World Heritage Nomination
Natural Heritage. China

Chengjiang Fossil Site

Ministry of Housing and Urban-Rural Development
of the People's Republic of China

January, 2011

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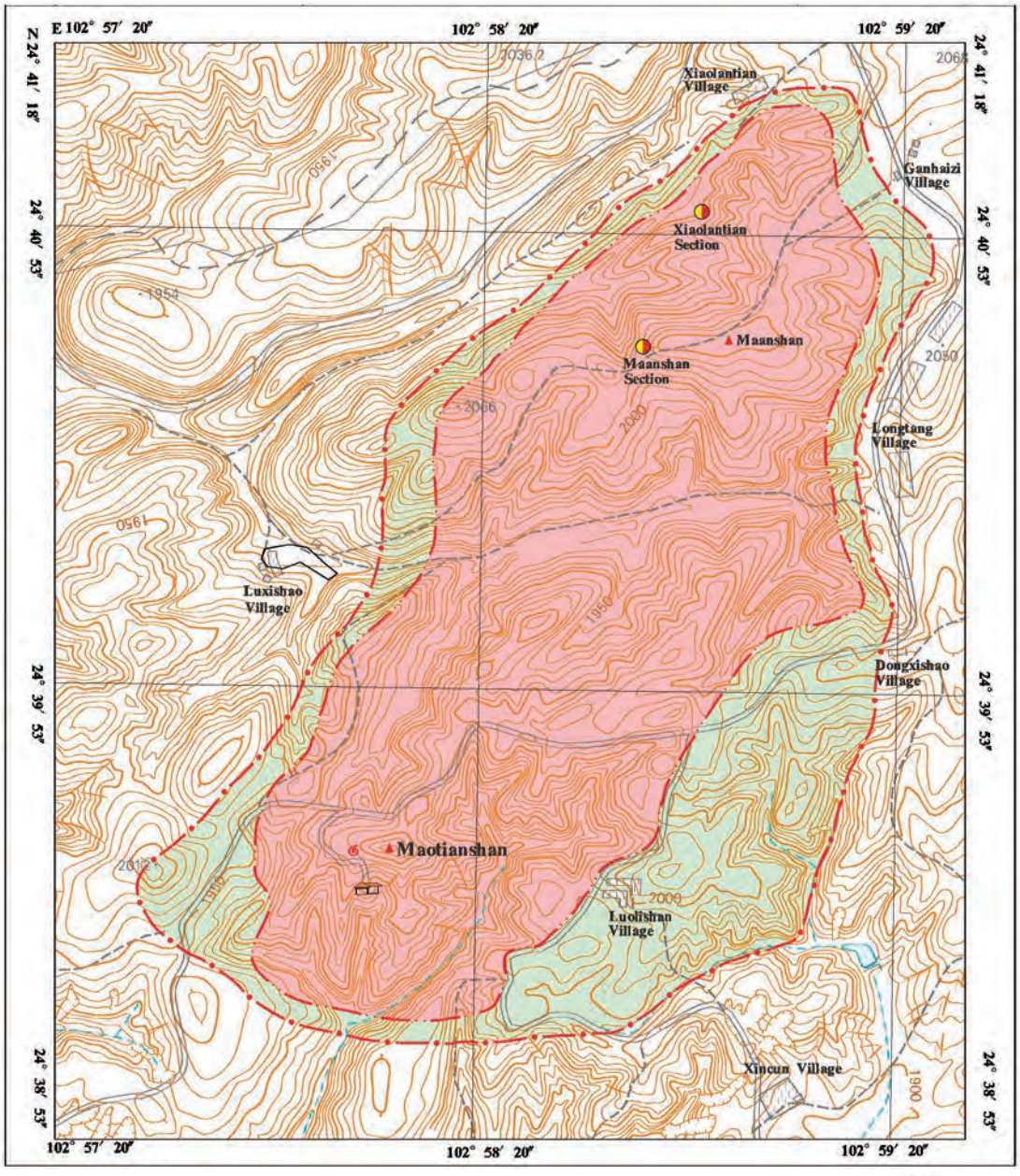
Executive Summary

State Party	The People's Republic of China
State, Province or Region	Chengjiang County, Yuxi City , Yunnan Province
Name of Property	Chengjiang Fossil Site
Geographical coordinates (central point)	**N 24°40'08" , E 102°58'38"**
Description of the boundary of the Nominated Property	The Nominated Property is a strip of land orientated northeast to southwest. It is 3,713m long, 2,555m wide and has a total area of 512 ha. The area consists of hilly land, with an elevation range of 156m. Based on the location of the fossil-bearing strata, fossil localities and local relief, the boundary of the Nominated Property is delineated as follows: **East side:** starts at the east end of the south valley of Xiaolantian Village, 100m west of the highway; extends southward via Haizi Village to Dongjishao Village, and ends south of Luolishan Village. **South side:** starts south of Luolishan Village; extends west to end west of the Maotianshan Management Station. **West side:** starts west of the Maotianshan Management Station; extends east of Luxishao Village and Ma'anshan, and ends west of Nandagou of Xiaolantian Village. **North side:** starts from the roadside at the west end of the south valley of Xiaolantian Village; extends east to the east end of the south valley. The nominated property includes a comprehensive sequence of exposed and unexposed strata and fossil horizons. It contains key stratigraphic sections and fossil localities, that are the most important and most representative of the Chengjiang Fossil Site. There is no permanent human residence or any industrial activity within the nominated property. The Buffer Zone surrounding the nominated property has a total area of 220 ha. The boundary of the Buffer Zone has been delineated by consideration of geological (structure; stratigraphy; fossil localities), topographical, human impact and other relevant factors. The Buffer Zone has one village and patches of farmland in valley bottoms and on gentle hill slopes but no industrial activity. The boundary of the Buffer Zone is delineated as follows: **East side:** starts from the east end of Nandagou of Xiaolantian Village; extends via Ganhaizi Village southward, and ends 800m east of Luolishan Village. **South side:** starts 800m south of Luolishan Village; extends west to 200m west of the reservoir and the Maotianshan Management Station. **West side:** starts 200m west of the reservoir and the Maotianshan Management Station; extends east of Luxishao Village, and ends at the west end of the south valley of Xiaolantian Village. **North side:** starts from the roadside at the west end of the south valley of Xiaolantian Village; extends east and ends at the east end of the south valley.
A4 size map of the Nominated Property, showing boundaries and Buffer Zone	Detailed map of the Chengjiang Fossil Site (overleaf)

Detailed Map of the Chengjiang Fossil Site



Justification Statement of Outstanding Universal Value	The nominated Chengjiang Fossil Site is a more than outstanding example of a major stage in the history of life on Earth. Of the three really major events in the evolutionary history of life on our planet – the origin of life, the Cambrian explosion and the end-Permian extinction event - the Chengjiang fossil Lagerstätte represents an unparalleled record of the fundamentally important rapid diversification of metazoan life in the early Cambrian (the Cambrian explosion) and of the primary establishment of a complex marine ecosystem. The major aspects of its importance are: • It provides direct evidence for the roots of animal biodiversity. • It presents by far the most complete record of an early Cambrian marine community. • It contains a prolific and exceptionally preserved biota, displaying the anatomy of hard and soft tissues of a very wide variety of organisms, invertebrate and vertebrate, in exquisite detail. • Its fossils bear upon fundamental questions regarding the design of animal body plans and the genetic generation of evolutionary novelty. • It records the early establishment of a complex marine ecosystem, with food webs capped by sophisticated predators. • The mode of preservation imparts a particular and rare beauty to the fossils, extending their value from the scientific to the aesthetic.
Criteria under which the property is nominated	*Criterion (viii): be outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features.* In relation to the "record of life" (Criterion (viii)), the nominated Chengjiang Fossil Site is of outstanding universal value because: • The Chengjiang fossil Lagerstätte, dated 530 million years before present, is the primary exemplifying biota of the early Cambrian explosion. It represents an unparalleled record of the fundamentally important rapid diversification of metazoan life in the early Cambrian, a geologically short interval during which almost all major groups of animals had their origins. It is an outstanding example of a major stage in the history of life, representing a palaeobiological window of exceptional significance. • The Chengjiang fossil Lagerstätte is unrivalled for its rich species diversity and fossil sites. To date at least 16 phyla, plus a variety of enigmatic groups, and about 200 species have been documented. Taxa recovered range from algae, through sponges and cnidarians to numerous bilaterian phyla, including the earliest known vertebrates. It is the most completely preserved early Cambrian community known. The Chengjiang fossil Lagerstätte contains early representatives of several major phylogenetic lineages. The earliest known specimens of several phyla such as cnidarians, ctenophores, sipunculans, priapulids, echinoderms and chordates occur here. Many of the taxa represent the stem groups to extant phyla and throw light on the pattern of acquisition of the characters that differentiate crown groups. • The Chengjiang fossil Lagerstätte is of truly exceptional preservation that the soft and hard tissues of skeletonized animals are preserved along with a wide array of organisms that were entirely soft bodied, and therefore normally unrepresented in the fossil record. It contains a wide variety of soft-bodied taxa, including many vermiform animals. Almost all of these soft-bodied species are unknown elsewhere. The quality and fidelity of

	preservation can be seen, for example, in the morphology of the proboscis and gut in nematomorph and priapulid worms such as Cricocosmia and Protopriapulites, the complex alimentary system in the arthropod *Naraoia*,and the delicacy of the gills in the enigmatic *Yunnanozoon*. The vertebrates, such as *Myllokunmingia*, preserve gills, serial structures interpreted as myomeres and gonads, and structures within the head. • The Chengjiang fossil Lagerstätte presents by far the most complete record of an early Cambrian marine community. It records the early establishment of a complex marine ecosystem, with food webs capped by sophisticated predators. It is the earliest record of a complex marine ecosystem. Moreover, it demonstrates that complex community structures had developed very early in the Cambrian diversification of animal life. There is evidence in the Chengjiang biota for the occupation of a wide range of ecological niches. The preserved biota enables palaeoecological investigation of a very early marine ecosystem. No other known site provides an equivalent window into the structure of early Cambrian communities.
Contact Information **of the official local** Institution/Agency	**Organization:** The Chengjiang Fossil National Geopark Management Committee **Address:** Chengjiang County, Yuxi City, Yunnan Province, P.R. China **Tel:** +86-0877-6913177 **Fax:** +86-0871-6913177 **E-mail:** dwq177@ 126.com

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1.a Country

The People's Republic of China

1.b State, Province or Region

Chengjiang County, Yuxi City, Yunnan Province

1.c Name of Property

Chengjiang Fossil Site

1.d Geographical coordinates (central point)

N 24°40'08", **E** 102°58'38"

1.e Maps of the boundaries of the Nominated Property and Buffer Zone

Map 1 Location of the Chengjiang Fossil Site in China

Map 2 Location of the Chengjiang Fossil Site in Yunnan Province

Map 3 Detailed Map of the Chengjiang Fossil Site

Map 4 Map showing relationship of the Chengjiang Fossil Site to the Chengjiang Fossil National Geopark

Map 5 Satellite image of the Chengjiang Fossil Site

1.f Area of the Property

Nominated Property: 512ha.

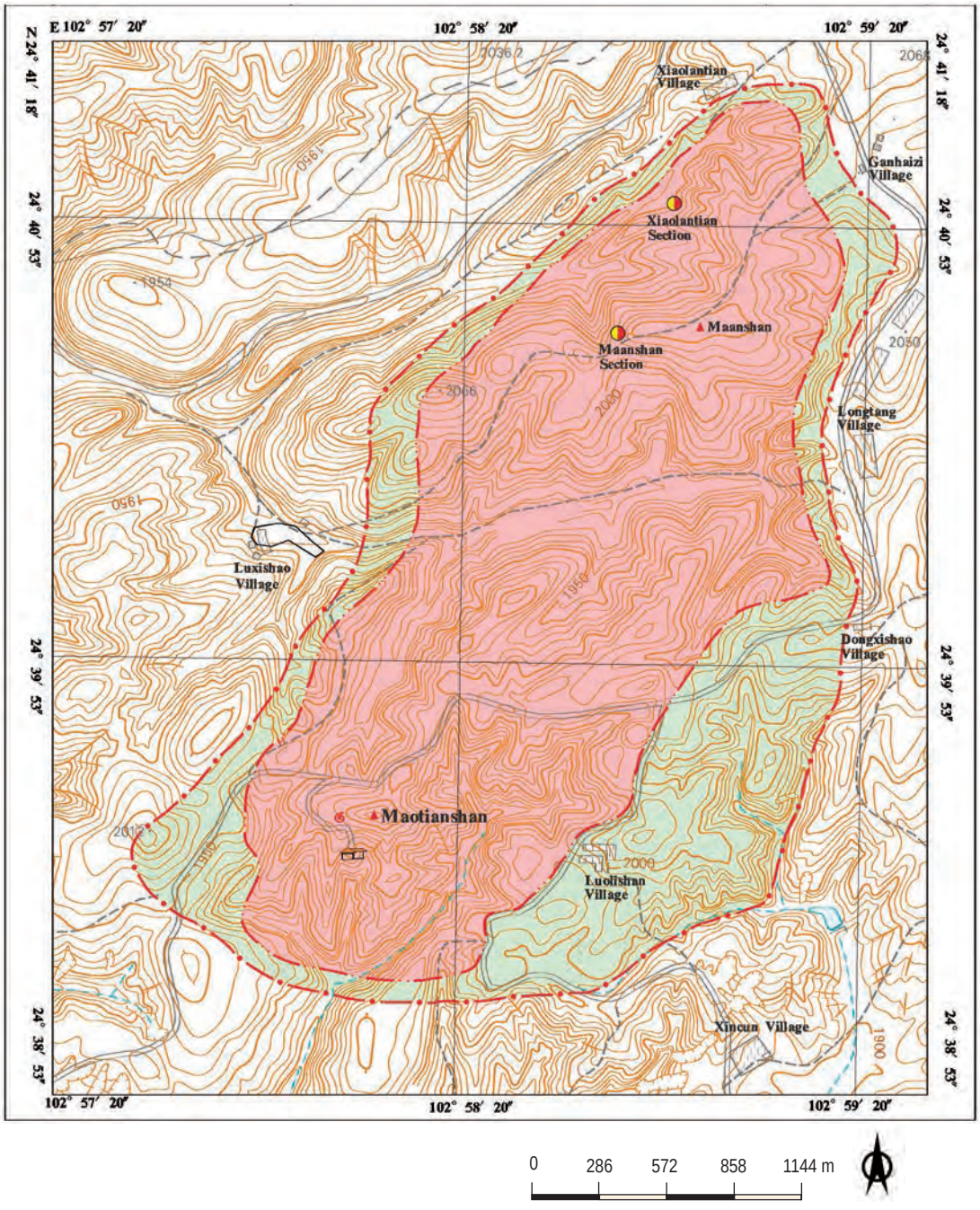
Buffer Zone: 220ha

Total area: 732ha.

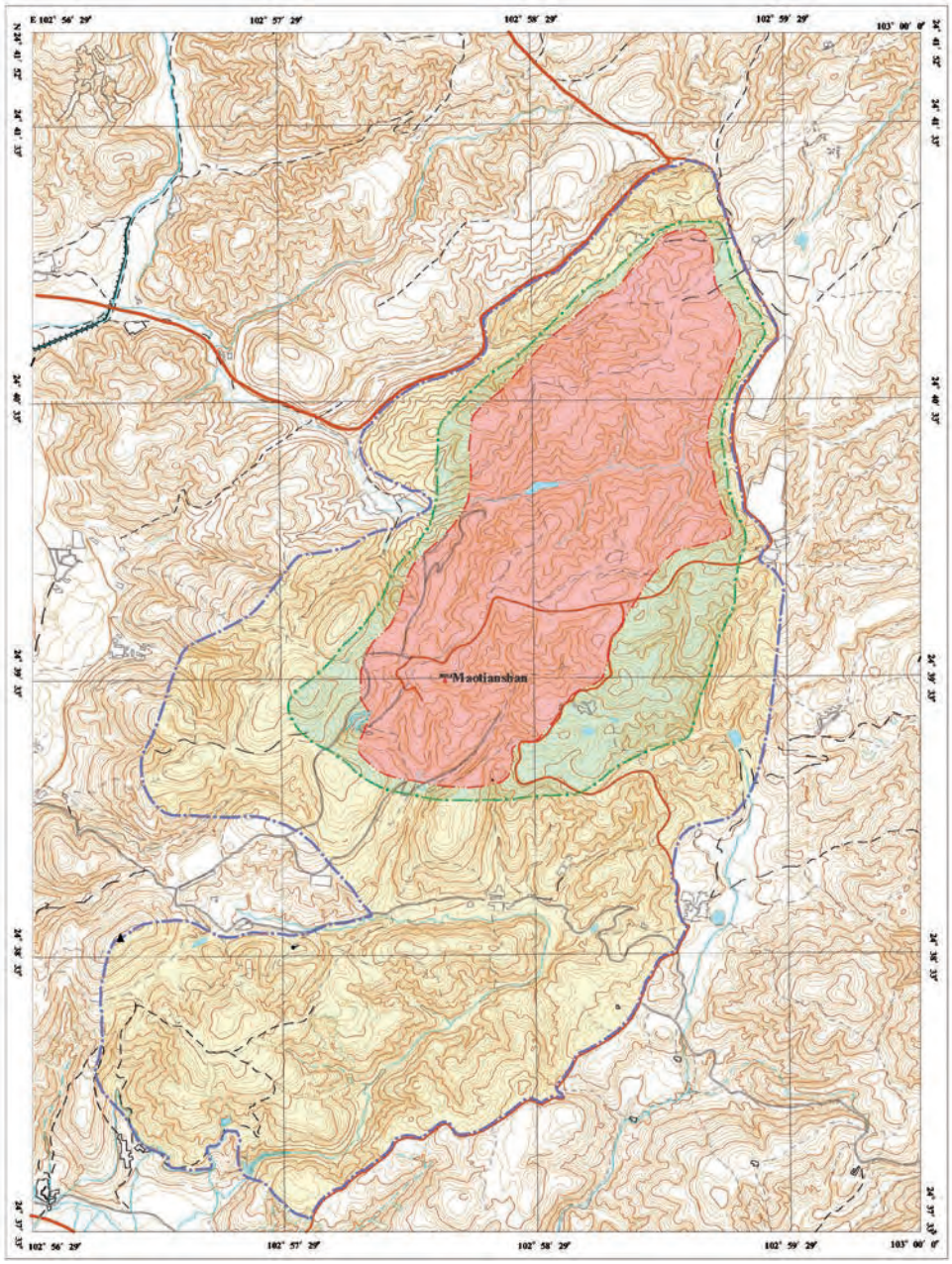
Map 1 Location of the Chengjiang Fossil Site in China

Map 2 Location of the Chengjiang Fossil Site in Yunnan Province

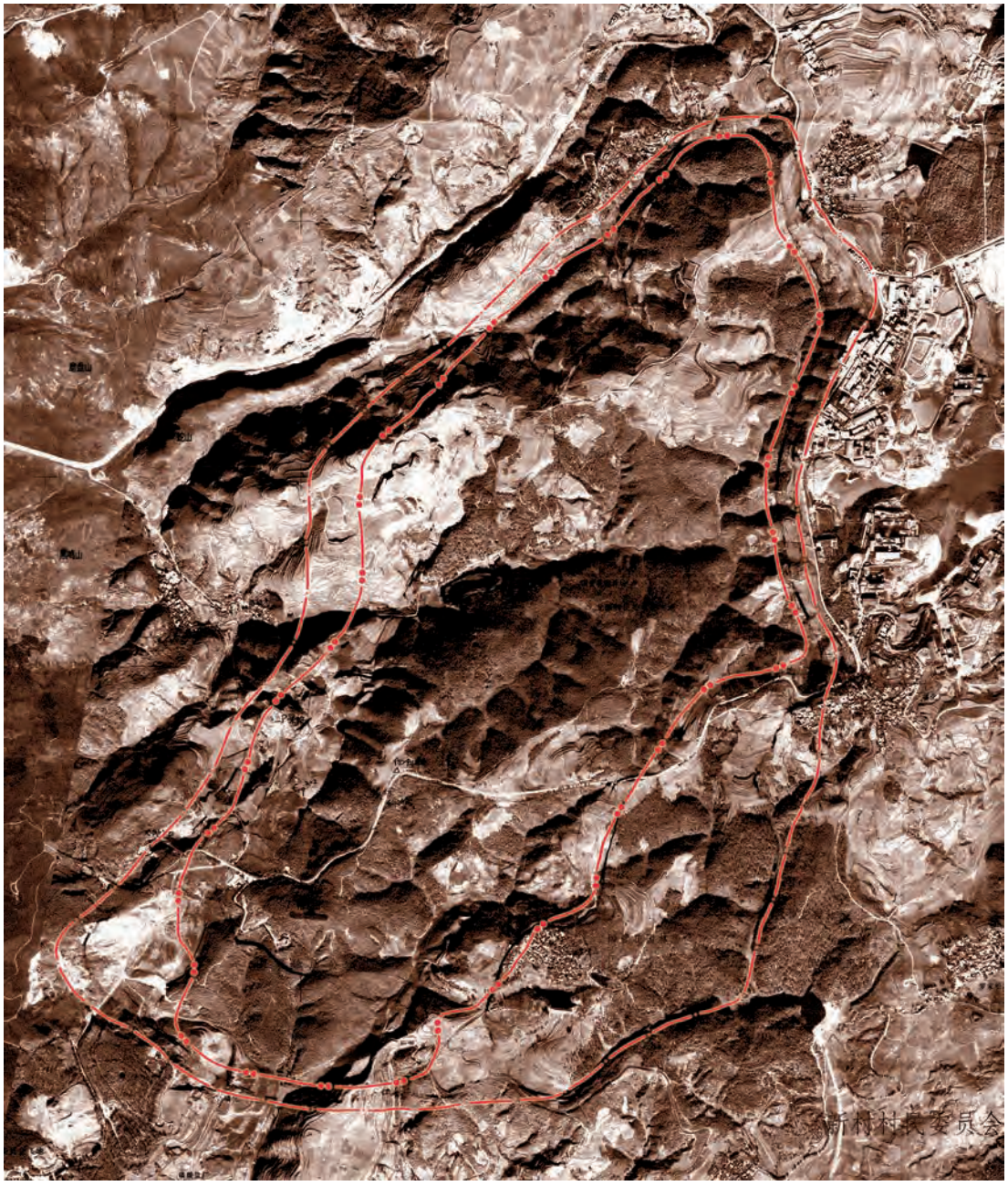
Map 3 Detailed Map of the Chengjiang Fossil Site

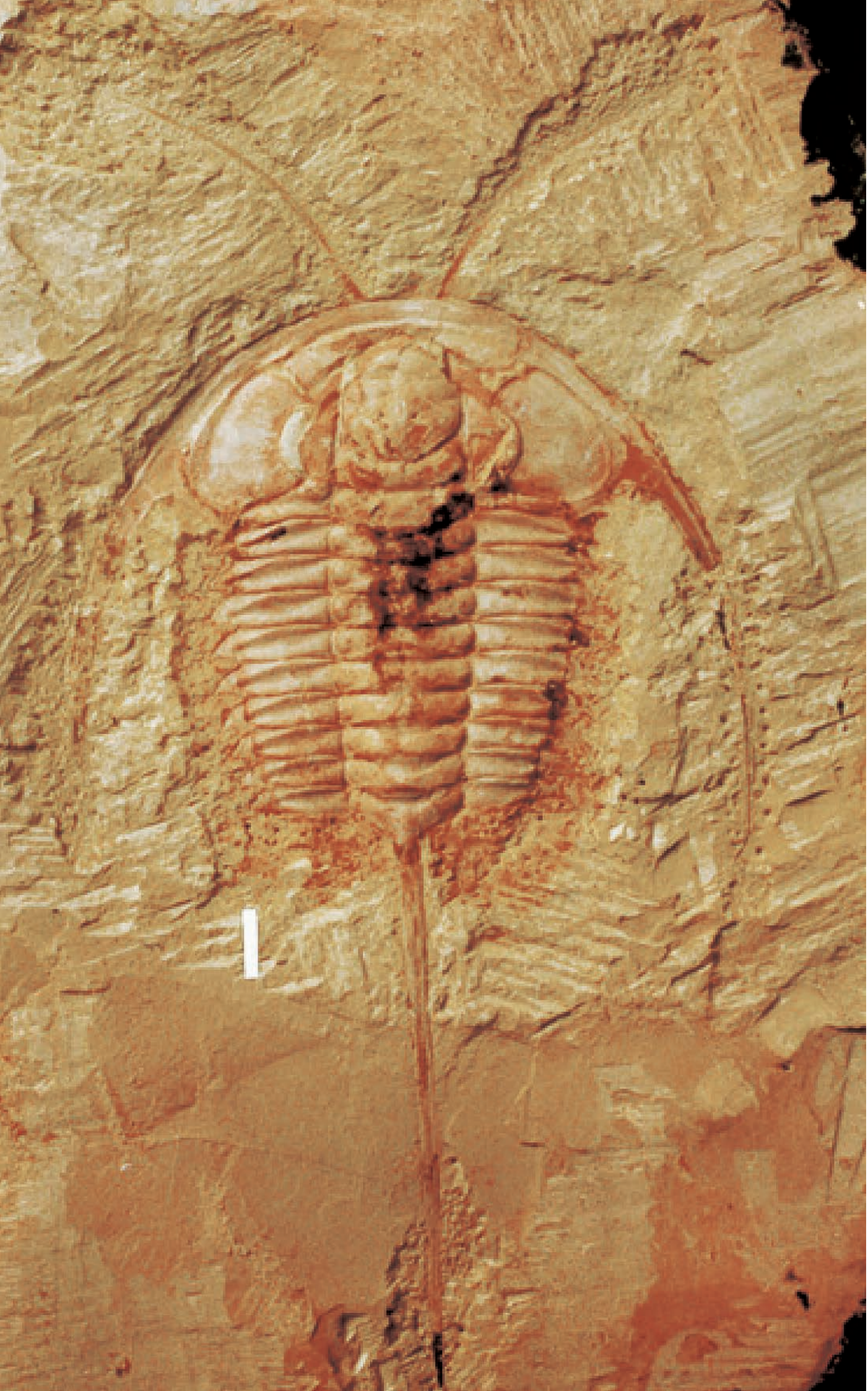


Map 4 Map showing relationship of the Chengjiang Fossil Site to the Chengjiang Fossil National Geopark



Map 5 Satellite image of the Chengjiang Fossil Site





2. Description

2.a Description of the Nominated Property

The term Chengjiang Fossil Site originated as a result of the discovery in 1984 of 530 Ma early Cambrian fossils at Maotianshan hill, Chengjiang County, Yunnan Province, China. This site is of outstanding global value because it provides the most compelling, geologically earliest evidence of the “Cambrian explosion” – the event that marked the first appearance in the fossil record of nearly all the major animal phyla. Sixteen phyla, more than 170 genera and about 200 species have been recorded in the Chengjiang Fossil Site to-date, including almost 150 new genera and about 160 new species. The site is not only rich in terms of the number and diversity of taxa present, but also the fossils are exceptionally preserved, with the very rare representation of soft tissues and entirely soft-bodied animals, thus providing as complete a picture of early Cambrian life as is possible. It is a most critical fossil site for our understanding of the origin, evolution, and diversification of early animal life. Without question, discovery of this site represents one of the most significant palaeontological discoveries of the 20th century.

2.a-1 Physical Geography

- Geographical location

The Chengjiang Fossil Site is located at Maotianshan hill in the eastern part of Chengjiang County, Yuxi City, Yunnan Province. The site is 5 km east of the county town of Chengjiang and 65 km south of the provincial capital of Kunming City (Fig. 2-1). Its central co-ordinate is N 24°40'08"， E 102°58'38".

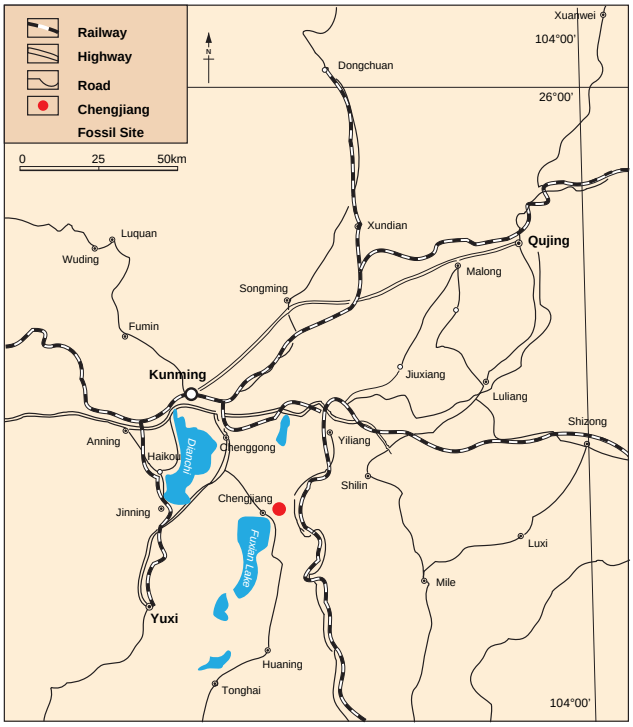


Fig. 2-1 Location of the Chengjiang Fossil Site

Relief and landform

The Chengjiang Fossil Site is located in the upland area of eastern Yunnan. Locally, the terraine is one of low mountains and hills cut by valleys and interspersed with lakes and fertile plains. Immediately to the south of the fossil site is Fuxian Lake, one of the deepest and most natural lakes in China (Fig.2-2). The relief locally is 1858 m to 2063 m above sea level, giving an altitude difference of about 200 metres.

Regionally, the Chengjiang Fossil Site is situated in the dissected erosional surface of the eastern Yunnan plateau, and locally the geological structure is that of a fault-blocked syncline. Maotianshan hill is located in the centre of the syncline, at an altitude of 2024 m. The middle and northern parts of the fossil site are made up of relatively high land, and the western and southern parts comprise low land. Throughout the site, erosional gullies expose the lower Cambrian and underlying Precambrian strata. Fuxian Lake serves as the local erosional base. The lake is 158 m deep, covers 212 square km, and was formed 3-4 Ma ago during the late Pliocene Himalayan Movement.

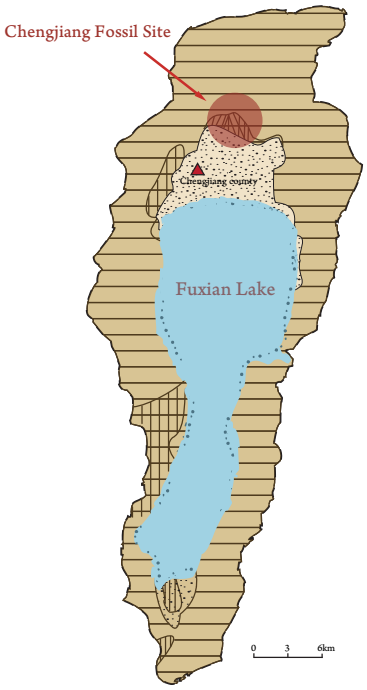


Fig. 2-2 Chengjiang Fossil Site and Fuxian Lake.

Climate

The nominated site lies under a monsoonal regime climate within the subtropical low latitude plateau area. Typically, a year is divided into two seasons: November to April is the dry season, and May to October is the wet season with 80% of the annual rainfall. The annual precipitation is some 964 mm and annual evaporation 1757 mm. The annual mean temperature is 15^0 with the highest daily temperature 31^0 and the lowest -5^0. Relative humidity is 74%, and the dominant winds are southerly and southwesterly with speeds of 1-2 m/s.

Hydrology

Regionally, the nominated site is within the catchment area of the Nanpanjiang River, a major tributary in the upper riches of the Pearl River. Locally, surface rivers or streams do not develop; mostly there are seasonal brooks. The main stream is the Luxishao, which is located in the northwest part of the site. This flows from east to west across Maotianshan hill before joining the Dongda River in the west of the site, with the fluvial course finally entering Fuxian Lake. The latter trends north to south, is 30 km long and 10 km wide, covers 212 square km, and lies 1,721 m above sea level.

Soil

The dominant soil of the nominated site is the plateau red earth type, followed by the purple earth type.

Vegetation

Primary forest has essentially disappeared, and the local vegetation now is largely warm and semi-humid evergreen forest. The Yunnan pine and the China Armand pine are typical floral elements, and there is also bush and planted woodland. Forest covers some 28% of the land.

2.a-2 Regional Geology

● Regional Geology

The Chengjiang Fossil Site belongs to the western part of the Yangtze Platform on the South China Plate, situated at tropical/subtropical latitudes. It is located at the southern end of the Xiaojiang Fault, a crustal fault of the Tethys-Himalaya tectonic regime, which extends in a north to south direction from Sichuan to Yunnan. The nominated site has experienced the major tectonic episodes associated with the South China crust: the Jinning (900 Ma), Chengjiang (800 Ma), and Caledonian and Hercynian (543 Ma to 250 Ma) movements; the Mesozoic uplift (250 Ma to 65 Ma); and the strong uplift and faulting of the Himalayan mountain building (from about 50 Ma ago). The geological structure of the Chengjiang area has also been influenced from about 4 Ma ago by movement along the Xiaojiang Fault. The dominant direction (strike) of the fossil-bearing lower Cambrian strata in this area is north-northeast to south-southwest (Fig. 2-3) .

● Strata

The strata in the nominated site are essentially of upper Sinian (late Proterozoic), lower Cambrian, middle and upper Devonian, Carboniferous, and Quaternary age. Lower Sinian and Permian strata occur at the margins of the site (Table 2-1).

The lithological features of the regional strata are as follows:

(11) Quaternary System (Q): slope eluvium and alluvial blanket of yellow-grey or purple-red sandy clay with abundant debris of dolomite, siltstone, phosphate rocks, mudstones and other siliceous rocks, mostly angular or subangular; about 15 m thick.

---------- disconformity ----------

(10) Neogene System (N_2): Medium to thick bedded conglomerate with subrounded debris mainly of dolomite, phosphate rock, sandstone and mudstone; about 15 m thick.

~~~~~~~ ~~~~ unconformity ~~ ~~~~~~~

(9) Permian System (P): The lower part is multi-coloured shale, grey and dark grey limestones and dolomitic limestone and dolomite; over 174 m thick. The upper part is basaltic tuff, volcanic breccia and basalts; about 176 m thick.

(8) Carboniferous System (C): Light grey and grey bioclastic limestones; 100 m thick.

(7) Middle and Upper Devonian (D_{2-3}): Light grey, thin and thick bedded dolomites; 75 m thick.

(6) Canglangpu Formation, lower Cambrian ($Є_{1c}$): Purple-red, grey, thin to medium bedded, micaceous fine quartz sandstone and grey-green thinly bedded silty mudstone, fossil-rich; 150 m thick.

——————— conformity ———————

(5) Qiongzhusi (= Heilinpu) Formation ($Є_{1q}$), lower Cambrian ($Є_{1q}$):
② Upper part (Yu'anshan Member ($Є_{1q^2}$))： Greyish-yellow and greyish-green shale and thin mudstone
~~~~~~~

interbedded with thin to medium beds of silty dolomite and calcareous siltstone. Repeated beds of fine quartz sandstone occur at 2-4 m intervals in the upper parts. Contains the Chengjiang Fauna. Grey-yellow thin bedded silty mudstone containing spherical calcite-dolomite nodules and phosphate silty dolomite at the base. 200 m thick.

① Lower part (Shiyantou Member ($Є_{1q}^{1}$): Dark grey, weathering yellow-grey, thin to medium bedded argillaceous siltstone with light grey, banded, micaceous dolomitic siltstone, grey-black thin to very thin bedded silty mudstone. Phosphate and pyrite nodules, greyish-green, thin to medium bedded, glauconitic sandstone with small shelly fossils. 80 m thick.

---------- disconformity ----------

(4) Yuhucun Formation, upper Sinian (Z_{2y}) : Consists of four parts:
Dahai Member (Z_{2y}^{4}) **:** Dark grey and bluish-grey phosphorite and phosphoric dolomite.
Xiaowaitou Member (Z_{2y}^{3}) **:** Greyish-yellow microbedded dolomite and brown silicolite, plus grey dolomite with black silicolitic fragments and black silicolite.
Baiyanshao Member (Z_{2y}^{2}) : Grey, brownish-grey and muddy dolomites.
Jiucheng Member (Z_{2y}^{1}) : Grey-green medium to thick bedded dolomite.
Over 800 m thick.

——————— conformity ———————

(3) Donglongtan Formation, upper Sinian(Z_{2dl})**:** Thick and massively bedded siliceous limestone and siliceous dolomite; over 150 m thick.

——————— conformity ———————

(2) Nantou Formation, upper Sinian (Z_{2n})**:** Red, green and variedness shale and silty shale, with moraine-breccia at the base; less than 40 m thick.

--- disconformity (Chengjiang Movement horizon) ---

(1) Chengjiang Formation, lower Sinian (Z_{1c})**:** Terrestrial purple-red feldspathic quartz sandstone and coarse sandstone with pyroclasts; 20 -110 m thick.

---------- disconformity ----------

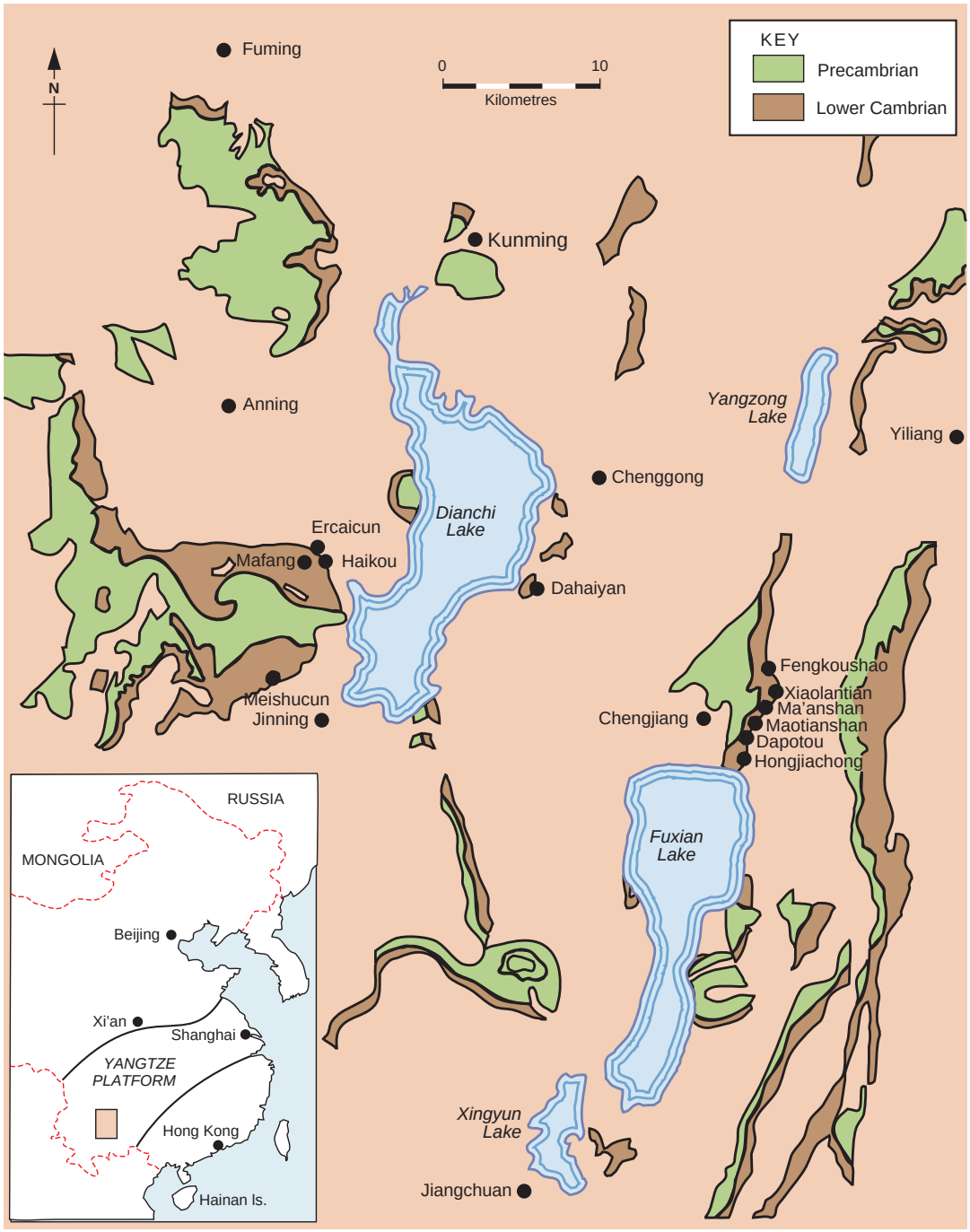


Fig. 2-3 Geological map with some of the localities that yield the Chengjiang Biota.

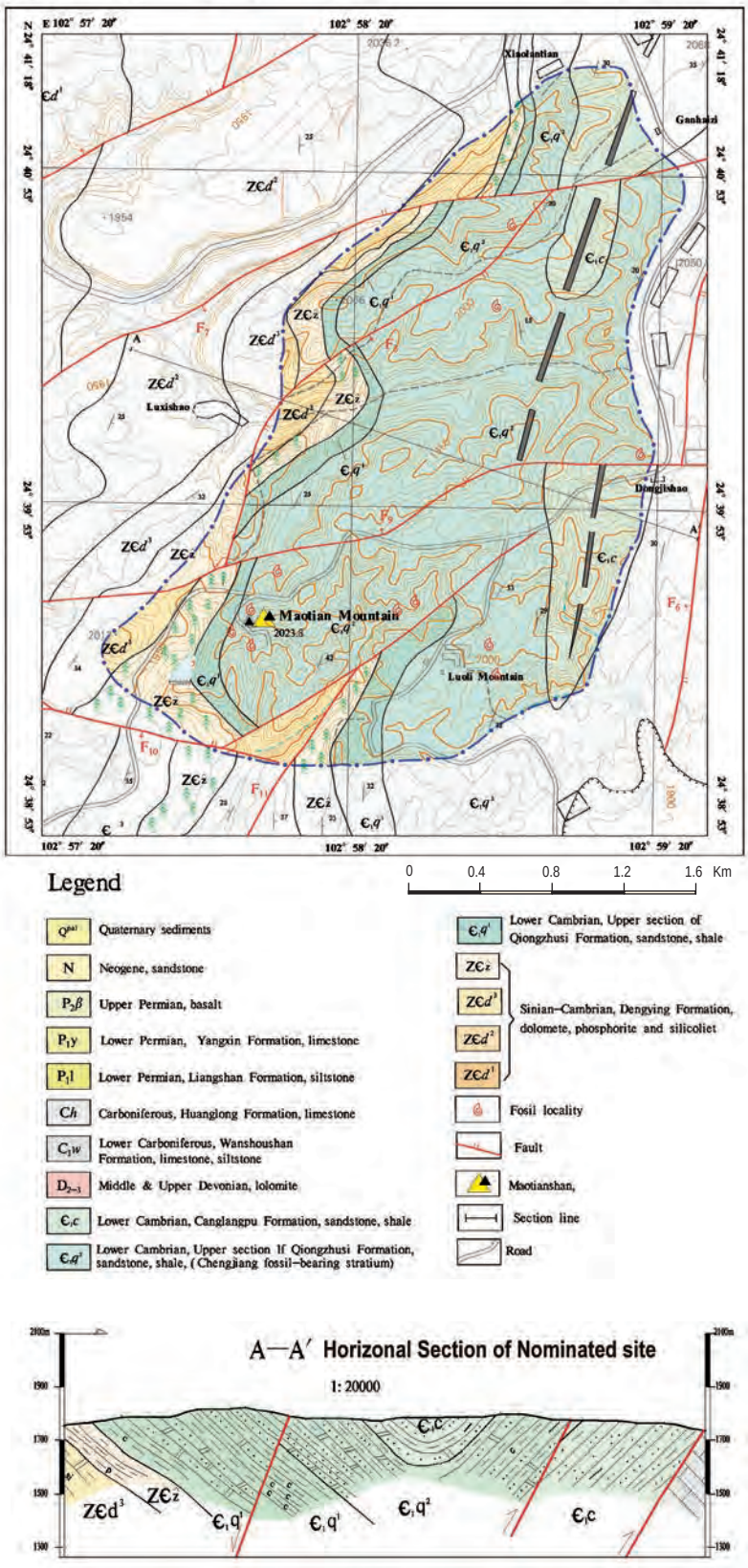


Fig. 2-4 Simplified geological map of the nominated Chengjiang Fossil Site

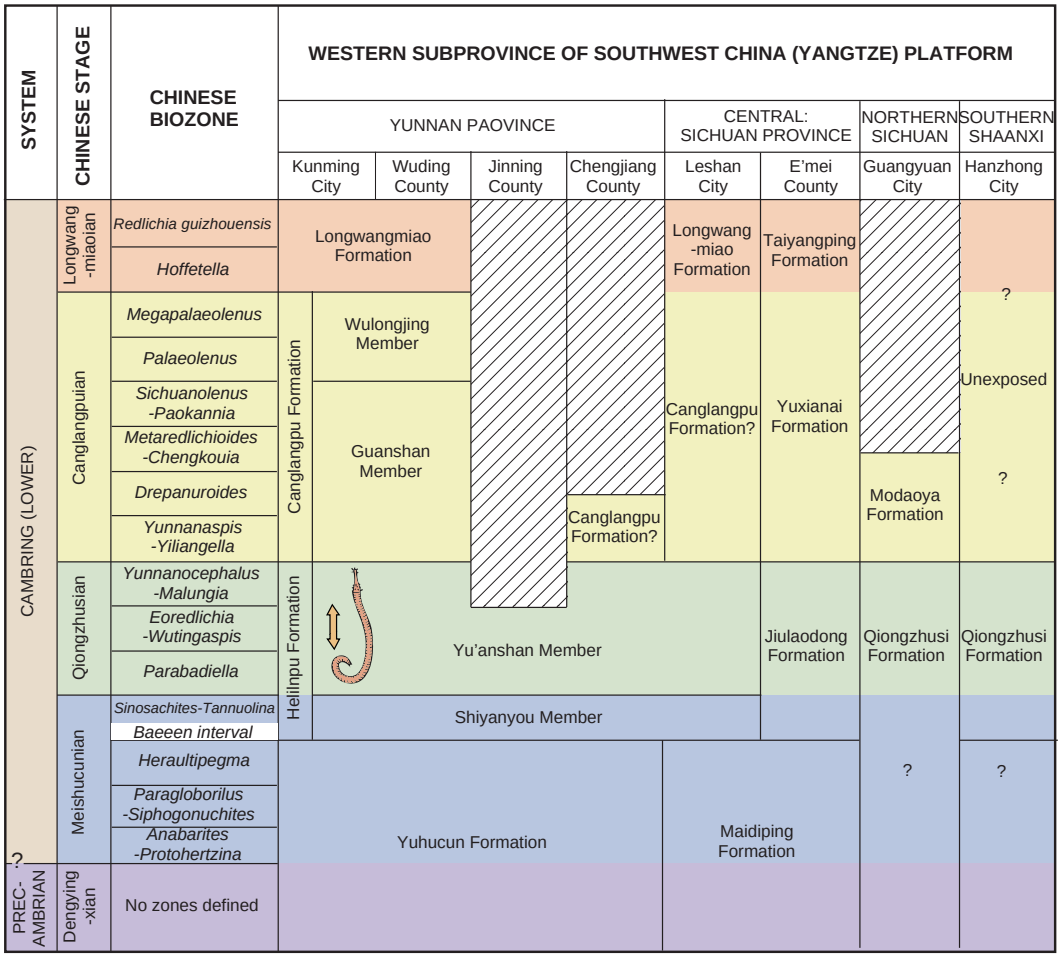


Fig. 2-5 Generalized stratigraphy of the upper Precambrian to lower Cambrian of the western subprovince of the Southwest China Platform (modified from Hou *et al.* 2002).

Table 2-1 Regional stratigraphic units of the Chengjiang Fossil Site

Chronostratigraphic unit				Lithostratigraphic unit		mark of chronostratigraphic units	Thichness(m)
erathem	system		Origin	Formation	menmber		
Cenozoic Erathem	Quaternary System		Lithostratigraphic unit	Heshangdong From.		Q^{pal}	4—15
	Neogene System			Ciyiong Form.		N	＞30
Paleozoic erathem	Permian System	upper		Emeishan Basalt Form.		P_3e	176
		lower		Yangxin Form.		P_1y	＞174
				Liangshan Form.		P_1l	10—24
	Carboniferous System	upper		Huanglong Form.		Ch	48—113
		lower		Wanshoushan Form.		C_1w	47.50
	Devonian System	Upper and middle		Huaning Form.		$D_{2\text{-}3}$	＞75
		lower		Cuifengshan Form.		D_1c	37—312
	Silurian System	middle		Guandi Form.		S_2	384
	Cambrian system	Middle		Douposi Form.		$\in_2 d$	70—95
		lower		Longwangmiao Form.		$\in_1 l$	50—150
				Canglongpu Form.		$\in_1 c$	>144.91
				Qiongzhusi Form.	Yuanshan Mem.	$\in_1 q2$	125.14
					ShiyantouMem.	$\in_1 q1$	20 76.55
Proterozoic Eonothem	Sinian	Upper		Yuhucun Form.	Dahai Mem.	$Z\in_{4\text{-}5}$	8.50—37.54
					ZhongyicunMem.		
					Xiaowaitou Mem.	Zy^3	25.23—140
					Baiyanshao Mem.	Zy^2	>77
					Jlucheng Mem.	Zy^1	>58.59
				Donglongtan Form		Z_2d	
				Nsntuo Form.		Z_1n	19.30—183.50
		Lower		Chengjiang Form.		Z_1c	616

Units				Histogram	thickness(m)	Lithodescription	Farna and Events	
	Formation	Member	Mark					
Lower Cambrian	Canglangpu Form	Wulongqing Mem.	$\epsilon_1 c^2$		85.15	Grey thin shale and quartz sandstone quartz sand stone in base,trilobite		
		Hongjingshao Mem.	$\epsilon_1 c^1$		59.76	Thin and middle bedding variedness shanle, silty sandstone trilobite		
	Qiongzhusi Form.	Yuanshan Mem. Upper	$\epsilon_1 q^{2-2}$		113.03	Yellowish green shale with sandstone,conglomerate, abundant fossils	Chengjiang Fauna	
		Yuanshan Mem. Lower	$\epsilon_1 q^{2-1}$		12.11	Black mudy shale,siltstone bioclast phosphoritein base	C-530Ma	
		Shiyantou Mem.	$\epsilon_1 q^1$		76.1	Dark grey siltstone blank mudstone, little shelly fossil,sandy dolomite	Meishucun little Shelly Fauna Fossil	Ⅲ
Upper Sinian	Yuhucun Form.	Dahai Mem.	$Z-\epsilon y^5$		5.9	grey middle and thick bedding phosphorous sandy dolomite		Ⅱ
		Zhongyicun Mem.	$Z-\epsilon y^4$		30.55	Thin and middle bedding phosphorite whth white chsydtonr		B−543Ma
		Xiaowaitou Mem.	Zy^3		45.59	Thin and middle bedding mudy Dolomite, thin bedding silicolite		Ⅰ
		Baiyanshao Mem.	Zy^2		105.4	Grey thin mudy dolomite, dolomite		A
		Jiucheng Mem.	Zy^1		58.59	purple thin mudstone, mudy dolomite with claysotone	Note: A:first appearance of little shelly fossils B:international horizon between Cambrian and Precambriam C:firstly apperancc of Triolobite fossils Ⅰ、Ⅱ、Ⅲ little shelly fossil associations	
	Donlongtan Form.	Upper Mem.	$Z_b d^2$		>750	light grey middlo and thick bedding Dlolmite, algae fossils		

Fig. 2-6 Stratigraphy, lithofacies, fauna and faunal events associated with the Chengjiang Fossil Site

- Geological structure

Tectonically, the Chengjiang Fossil Site falls into the eastern part of Kunming Platform fold belt, the structure of the site having been affected by the regionally active Xiaojiang Fault (see above).

The nominated site as a whole is underlain by an asymmetric syncline which has an axial trend of 30° E and the eastern limb of which is the steeper. Faults cut the synclinal axis and both limbs, and in the site as a whole they vary in length from several hundred metres to several kilometres. The faults can be grouped into two sets, one of which represent secondary faults of Xiaojiang Fault Belt, and the other is the result of neotectonic movements.

2.a-3 Chengjiang fossil-bearing strata and fossils

2.a-3-1 Chengjiang fossil-bearing strata

The fossils of the Chengjiang fauna occur in the yellowish mudstones and shales of the upper part of the Yu'anshan Member, Heilinpu (Qiongzhusi) Formation, *Eoredlichia* Biozone, of lower Cambrian age. The stratotype section of the Qiongzhusi Formation, the lateral equivalent of the Heilinpu Formation, is located in the Kunming area, and since 1941 it has also represented the national standard section for the *Eoredlichia* Biozone. The section also represents the stratotype for the Qiongzhusi Stage in South China. Lower Cambrian strata are well developed in eastern Yunnan, and the sediments of the Qiongzhusian Stage are extensively distributed, with over 30 sections being available. Mostly these sediments yield trilobites and other arthropods (of the Redlichiid biogeographical Realm). The discovery of the soft-bodied biota greatly enriched the fossils known from these sediments in the Chengjiang region. Moreover, as eastern Yunnan is one of the best regions in the world for showing a continuous sequence of lower Cambrian strata, it enables the Chengjiang soft-bodied fauna to be studied in stratigraphic, sedimentological and palaeoenvironmental context.

- **Strata bearing the Chengjiang Fossils:**

The upper part (ϵ_{1q}^{2-2}) of the Yu'anshan Member is divided into four parts, as follows (from top to bottom):

(4) Yellow silty sandstone. Contains a reduced Chengjiang Fauna, mainly trilobites such as *Eoredlichia and Yunnanocephalus*, less commonly *Chengjiangaspis*, and also the bradoriid crustaceans *Kuanyangia* and *Kunmingella,* and the brachiopods *Lingulella* and *Lingulepis*. 113 m thick.

(3) Yellowish green shale interbedded with thin to medium (10-20 cm) siltstones and sandstones. These represent the main beds yielding soft-bodied fossils, especially in the lower and middle parts of the member. There are diverse arthropods, such as *Naraoia, Leanchoilia, Isoxys*, *Kunmingella*, *Eoredlichia* and *Yunnanocephalus.* This part of the member is also rich in lobopodians, eldoniids, worms and sponges. 40–50 m thick.

(2) Black siltstone and shale beds. These sediments have yielded trilobites such as *Tsunyidiscus* and *Wutingaspis*, and the bradoriids *Hanchungella* and *Emeillopsis*. This horizon belongs to the *Parabadiella* Biozone, with trilobites and bradoriids being the main fossils; it lacks key fossils of the Chengjiang (soft-bodied) Fauna. The fauna lies between the Meishucun fauna and Chengjiang fauna.

(1) Black siltstone. This basal part of the member contains the oldest trilobites in China, for example *Parabadiella*, together with the bradoriids *Hanchiangella, Liangshanella, Nanchengella*, amongst others.

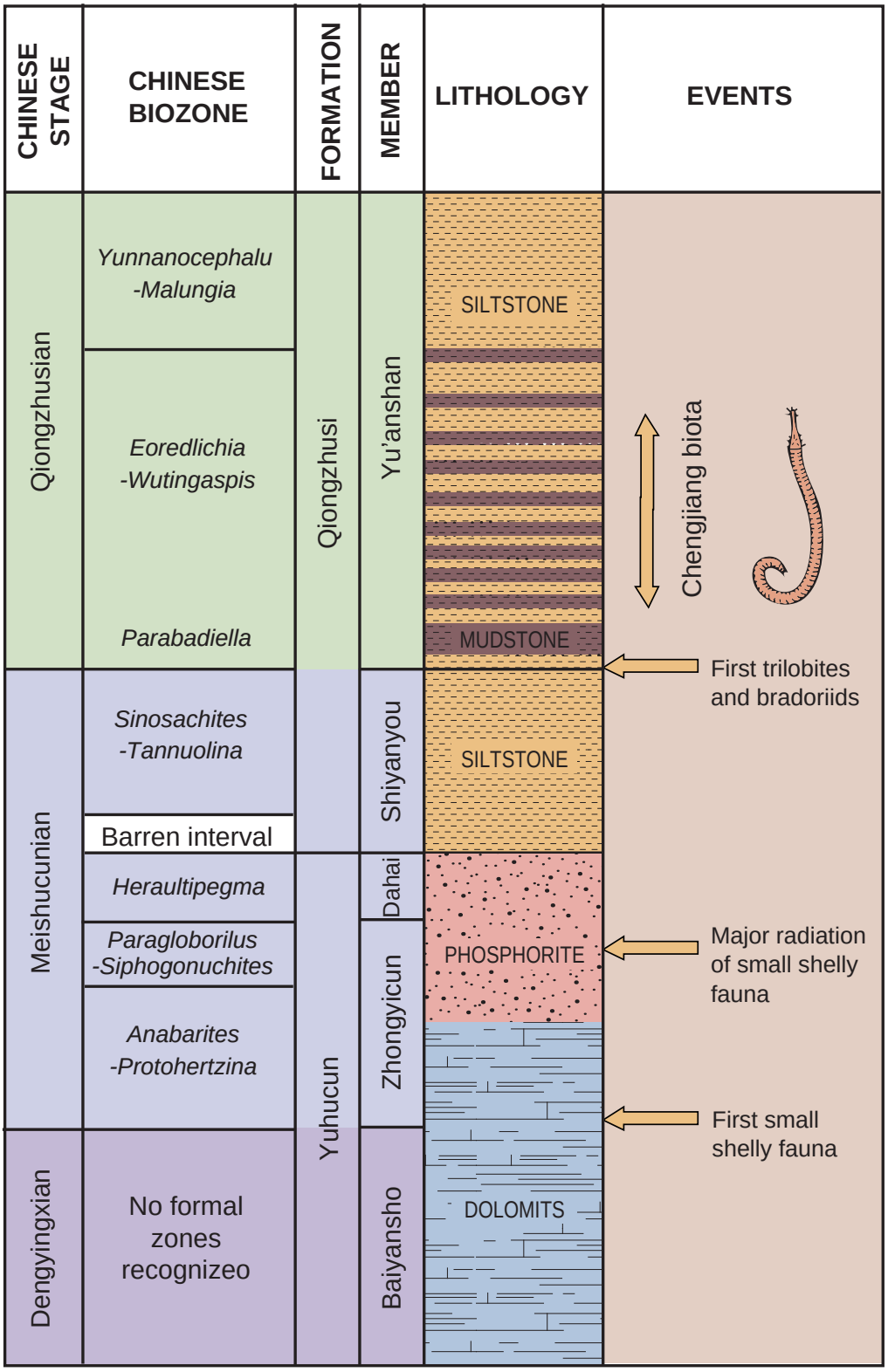


Fig. 2-7 Stratigraphic occurrence of the Chengjiang biota and other faunal events within the lower Cambrian of Chengjiang County, Yunnan Province.

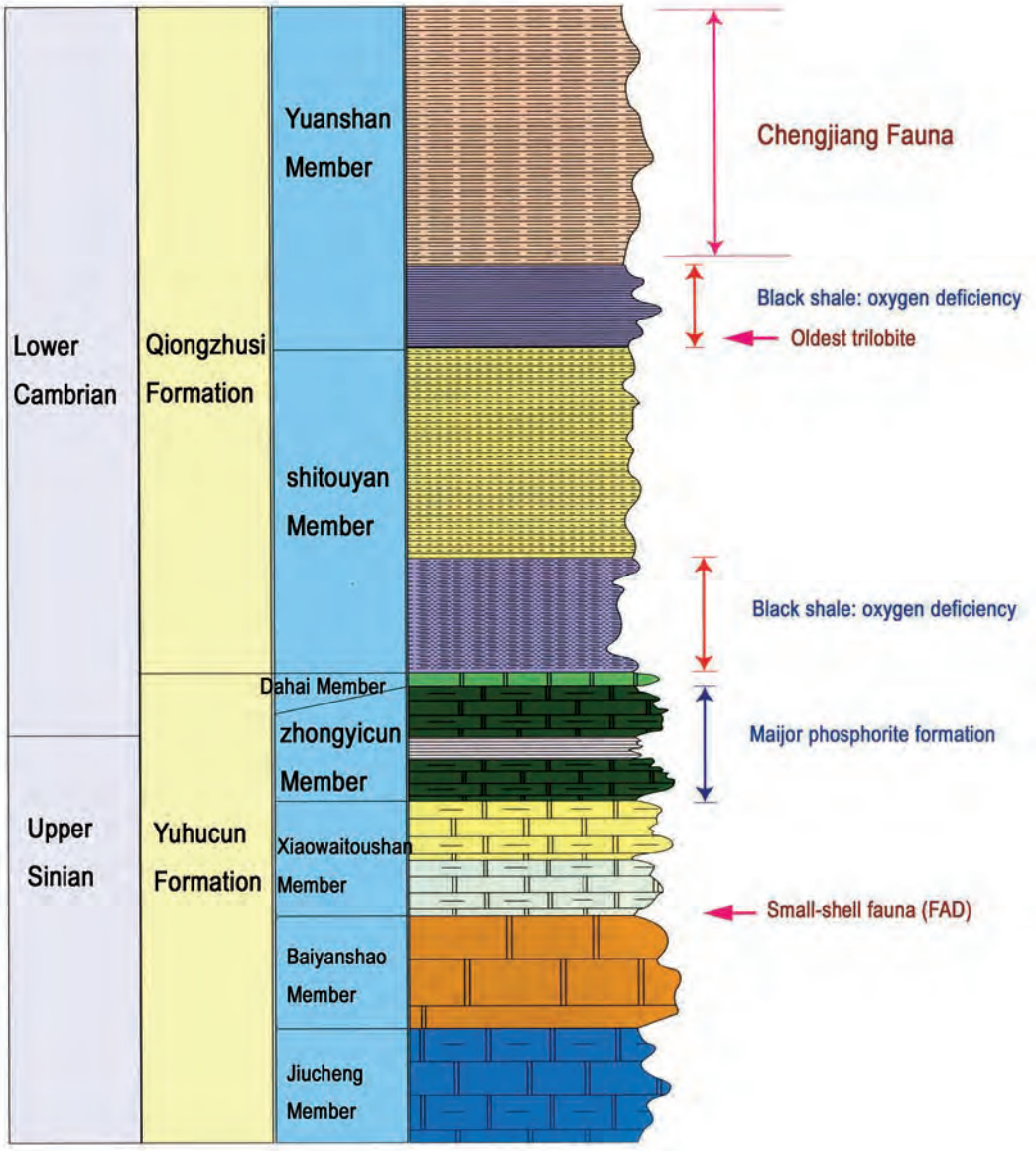


Fig. 2-8 Precambrian-Cambrian boundary stratotype, showing lithological features and major biological events

Fig. 2-9 Upper part of the Yu'anshan Member, Qiongzhusi Formation, the main Chengjiang fossil-bearing stratum

- Representative Stratigraphic Section (from top to bottom)

Yu'anshan Member ($Є_{1q}^{2}$) ＞110.38 m

(10) Red soil and yellowish-grey, thin and medium-bedded silty shale and silty mudstone with interbedded thin siltstone. 12.74 m thick. Two fossil horizons:

Upper part (Cg-f-10-2), arthropods: *Eoredlichia intermedia*, *Naraoia longicaudata*; brachiopods: *Lingulepis malongensis*; enigmatica: *Eldonia eumorpha*.

Lower part (Cg-f-10-1), arthropod: *Eoredlichia intermedia*; brachiopods: *Lingulella chengjiangensis*, *Lingulepis malongensis*.

(9) Yellowish-green, thin argillaceous shale and silty mudstone alternating with argillaceous siltstone (Cg-f-10-1), arthropods: *Eoredlichia intermedia*, *Yunnanocephalus yunnanensis*, *Waptia* sp., *Kunyangella cheni*; chancelloriid: *Chancelloria* sp.; brachiopod: *Lingulepis malongensis*. 9.65 m thick.

(8) Yellowish-green, medium-bedded argillaceous siltstone with interbeds of thin silty shale. Two fossil horizons, from upper to lower:
Upper part (Cg-f-8-2), arthropods: *Eoredlichia intermedia*, *Yunnanocephalus yunnanensis*, *Kunyangia pustulosa*, *Naraoia longicaudata*, *Kunyangella cheni*; brachiopod: *Lingulepis malongensis*; hyolithid: *Ambrolinevitus platypluteus*.

Lower part (Cg-f-8-1), arthropods: *Eoredlichia intermedia*, *Waptia ovata, Kunmingella maotianshanensis*; hyolithid: *Ambrolinevitus ventricosus*.

(7) Yellowish-green, thin argillaceous shale and silty shale with intercalations of very thin siltstone; the base is a yellowish-grey ferruginous and argillaceous sandstone. 0.35m thick. Three fossil horizons, from upper to lower as follows:

Fig. 2-10 Chengjiang fossil stratum, Yu'anshan Member, Qiongzhusi Formation, Ma'anshan

Fig. 2-11 Chengjiang fossil stratum, Yu'anshan Member, Qiongzhusi Formation, Xiaolantian

Upper part (Cg-f-7-3), arthropods: *Eoredlichia intermedia*, *Waptia ovata*, *Isoxys auritus*, *Kunmingella maotianshanensis*; nematomorph: *Maotianshania cylindrica*; brachiopod: *Heliomedusa orienta*; hyolithid*: Ambrolinevitus ventricosus*.

Middle part (Cg-f-7-2), arthropods: *Eoredlichia intermedia*, *Waptia ovata*, *Kunmingella maotianshanensis*; brachiopod: *Heliomedusa orienta*; hyolithid: *Ambrolinevitus ventricosus*.

Lower part (Cg-f-7-1), arthropods: *Eoredlichia intermedia*, *Naraoia longicaudata*, *Waptia ovata*; *Branchiocaris*? *yunnanensis*, *Ixoxys auritus*, *Kunmingella maotianshanensis*; sponge: *Leptomitus teretiusculus*; brachiopod: *Heliomedusa orienta*; hyolithid: *Ambrolinevitus ventricosus*; alga: *Yuknessia* sp.; enigmatica: *Vetulicola cuneatus*.

(6) Yellowish-green, thinly laminate silty shale with interbeds of thin to medium bedded argillaceous siltstone, with a 0.2-0.3 m argillaceous, fine ferruginous sandstone at the base. 21.6 m thick. Five fossiliferous horizons, from upper to lower as follows:

Uppermost part (Cg-f-6-5), arthropods: *Naraoia longicaudata*, *Waptia ovata*, *Isoxys auritus*, *Kunmingella maotianshanensis*.

Upper part (Cg-f-6-4), arthropods: *Eoredlichia intermedia*, *Naraoia longicaudata*, *Waptia ovata*, *Isoxys auritus*, *Kunmingella maotianshanensis*, *Peytoia* sp.; priapulid: *Selkirkia*? *elongata*; brachiopod: *Heliomedusa orienta*; hyolithid: *Ambrolinevitus platypluteus*.

Middle Part (Cg-f-6-3), arthropods: *Eoredlichia intermedia*, *Yunnanocephalus yunnanensis*, *Naraoia longicaudata*, *Parapalaeomerus sinensis*, *Waptia ovata*, *Isoxys auritus*, *Sunella grandis*, *Kunmingella maotianshanensis*, *Amplectobelua symbrachiata*; sponge: *Halichondites* sp.; brachiopod: *Heliomedusa orienta*.

Lower part (Cg-f-6-2), arthropods: *Eoredlichia intermedia*; *Naraoria longicaudata*, *Leanchoilia illecebrosa*, *Waptia ovata*, *Branchiocaris*? *yunnanensis*, *Isoxys auritus*, *Kunmingella maotianshanensis*; nematomorph: *Maotianshania cylindrical;* priapulid: *Acosmia maotianica*; sponge: *Leptomitella* sp.; brachiopods: *Heliomedusa orienta*, *Lingulepis malongensis*; enigmatica: *Vetulicola cuneatus*.

Bottom part (Cg-f-6-1), arthropods: *Eoredlichia intermedia*, *Yunnanocephalus yunnanensis*, *Naraoia longicaudata*, *Naraoia spinosa*, *Fuxianhuia protensa*, *Waptia ovata*, *Isoxys auritus*, *Kunmingella maotianshanensis*; sponges: *Triticispongia diagonata*; brachiopods: *Heliomedusa orienta*; enigmatica: *Heteromorphus longicaudatus*; alga: *Sinocylindra yunnanensis*.

(5) Yellowish-green shale and silty shale with interbeds of thin argillaceous siltstone. 12.06 m thick. Three fossil horizons, from upper to lower as follows:

Upper part (Cg-f-5-3), arthropods: *Yunnanocephalus yunnanensis*, *Naraoia longicaudata Naraoia spinosa*, *Isoxys auritus*, *Kunmingella maotianshanensis*; algae: *Fuxianospira gyrata*, *Yuknessia* sp.

Middle part (Cg-f-5-2), arthropods: *Yunnanocephalus yunnanensis*, *Naraoia longicaudata*, *Naraoia spinosa*, *Kunmingella* sp.; alga: *Sinocylindra yunnanensis*.

Lower part (Cg-f-5-1), arthropod: *Isoxys auritus*.

(4) Yellowish-grey silty shale alternating with thin siltstone, (Cg-f-4). nematomorph: *Maotianshania* sp.; algae: *Fuxianospira gyrata*, *Yuknessia* sp. 0.72 m thick.

(3) Yellowish-grey shale and a few interbeds of thin siltstone, with a 0.3 m thick fine, argillaceous, yellowish-grey, sandstone. 6.48 m thick. Two fossil horizons, from upper to lower as follows:

Upper part (Cg-f-3-2), arthropods: *Sunella* sp., *Spinokunmingella typica*; nematomorph: *Maotianshania*

sp.; sponge: *Saetaspongia densa*; alga: *Yuknessia* sp.

Lower part (Cg-f-3-1), arthropods: *Naraoia* sp., *Sunella* sp., *Kunmingella angustacostata*; algae: *Sinocylindra yunnanensis*, *Yuknessia* sp. etc.

(2) Grey-black shale with interbeds of silty shale and thin siltstone, (Cg-f-2). arthropods: *Naraoia spinosa*, *Leanchoilia illecebrosa*; sponge: *Saetaspongia densa*; alga: *Yuknessia* sp. 8.55 m thick.

(1) Black, weathering grey-white, thin carbonaceous shale, and silty carbonaceous shale, with spheroidal weathering, (Cg-f-1): arthropods: *Isoxys auritus*; sponges: *Saetaspongia densa*; brachiopod: *Heliomedusa orienta*. 7.02m thick (at outcrop).

The lower black shale is cut by a fault, and the yellowish-green shale appears repeatedly; abundant soft-bodied fossils (Cg-f-0): arthropods: *Eoredlichia intermedia*, *Naraoia longicaudata*, *Naraoia spinosa*, *Leanchoilia illecebrosa*, *Waptia* sp., *Branchiocaris*? *yunnanensis*, *Isoxys auritus*, *Kunmingella maotianshanensis*; brachiopods: *Heliomedusa orienta*, *Lingulepis malongensis*; alga: *Fuxianospira gyrata*; enigmatica: *Eldonia eumorpha*.

2.a-3-2 Palaeoenvironment and preservation of the Chengjiang Fossils

Palaeogeographical and lithofacies studies suggest that latitude, temperature, water-depth and salinity in the early tropical/subtropical Cambrian sea of eastern Yunnan were in part or in combination condusive for the preservation of the Chengjiang fauna (Figs 2-12, 2-13). Micro-ripples together with siltstone lenticles are present in the fine-grained argillaceous strata rich in this fauna. Also, geochemical studies of the sediments and the fossils indicate that there was a low-oxygen, near-reducing or reducing environment.

In the lower part of the member, siltstone material is predominant, and in the upper part, mudstone. Bed thickness in the upper part varies from 1-3 cm. The sum lithological characteristics of the upper part, with its abundant soft-bodied fossils, indicate that the sediments there formed as a result of short, episodic, micro-turbidity events (such horizons occur in about 95% of the member). It has been suggested amongst several explanations, that during catastrophic floods, fresh-water rapidly drained into the marine area, resulting in the death of much of the fauna. Fluctuations in the oxygen minimum zone, and also the affects of a high-density, sediment-laden nephaloid water mass have also been suggested as possible causes of death. Whatever the cause, many specimens remained entire, or largely so. The corpses were then apparently rapidly buried in the upper sedimentary layers before extensive decay could occur. Soft tissues of the Chengjiang fossils have been preserved through replacement by pyrite and subsequent weathering to iron oxides; some tissues are also preserved as carbon films (Gabbott *et al*., 2004).

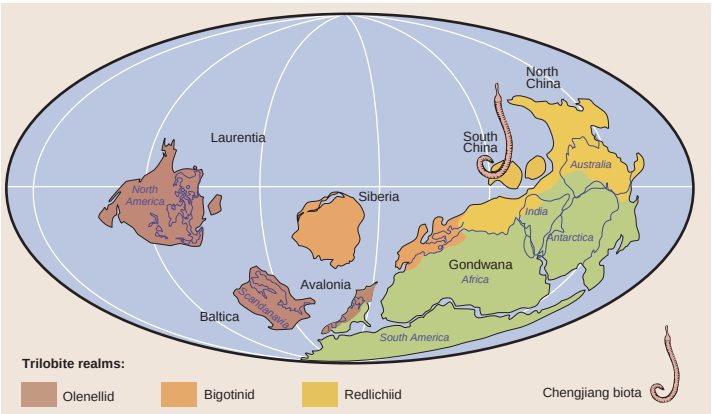


Fig. 2-12 Palaeogeographical map for the early Cambrian, showing trilobite faunal realms (after Mckerrow *et al*. 1992)

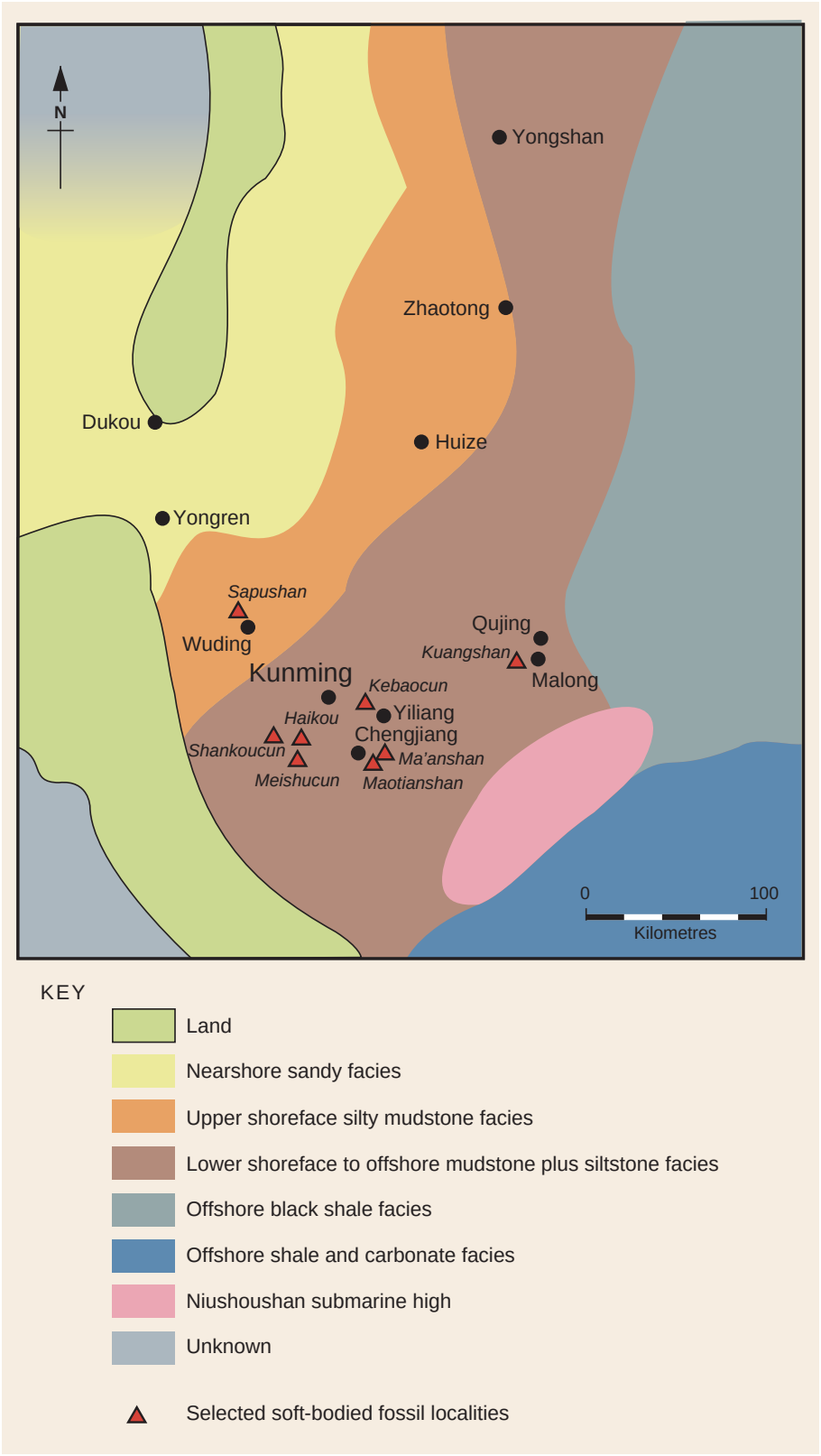


Fig. 2-13 Palaeogeographical and facies map of the eastern Yunnan area for Chengjiang Biota times (after Zhu *et al*. 2001)

2.a-3-3 The age of the Chengjiang Biota

Beds containing the Chengjiang fauna belong to the Qiongzhusi (regional Chinese) Stage of the lower Cambrian, which is the approximate equivalent of the Atdabadian Stage of Siberia and elsewhere (Qian & Bengtson 1989). Beds containing the Chengjiang fauna yield cambriid bradorid fossils, which occur in typical Atdabadian Stage faunas in eastern Siberia (Willliams *et al*. 2007). The beds containing the Chengjiang fauna can be correlated using acritarchs to those of the *Holmia* trilobite Biozone in Scandinavia (Vidal & Peel 1993), and to the *Nevadella* trilobite Biozone in North America. *Parabadiella* trilobites that occur below the fossils of the Chengjiang fauna are the earliest trilobites in China. The occurrence of *Eoredlichia* in Yunnan, to which biozone the Chengjiang fauna belongs, has been compared to that of *Fallotaspis* in North America and to the *Pararedlichia* and *Allotaspis* trilobite biozones in Morocco, all of which are belong to the early Atdabadian Stage (Brasier *et al*. 1994). Radiometric (^{40}Ar-^{39}Ar) dating of ilite from the lowest beds containing the Chengjiang Fauna, a yellowish-green shale horizon 1.5 km from Maotianshan hill, gives a date of 530 Ma, and the fauna is estimated to be of 2-3 Ma duration.

2.a-3-4 List of Fossils of the Chengjiang Fossil Site

From the discovery of the Chengjiang Lagerstatte in 1984 up to the end of 2009, more than 200 papers and 12 monographs have been published on various aspects of the biota and associated sediments. The fossils recorded include 16 phyla and more than 170 genera (almost 150 new) and about 200 species (about 160 new) spread across most of the animal phyla, either living or extinct, together with about 30 fossils of uncertain affinity.

Table 2-2 **List of fossils of the Chengjiang Fossil Site**

Phylum	Species
Algae	*Fuxianospira gyrata* Chen & Zhou, 1997* *Megaspirellus houi* Chen & Erdtmann, 1991* *Punctariopsis latifolia* Xu, 2001 *Punctariopsis simplex* Xu, 2001 *Sinocylindra yunnanensis* Chen & Erdtmann, 1991 *Yuknessia* sp. of Chen & Erdtmann, 1991* * Regarded as coprolites by Steiner *et al*., 2005
Phylum Porifera	*Allantospongia mica* Rigby & Hou, 1995 *Choia carteri* Walcott, 1920 *Choia xiaolantianensis* Hou *et al*., 1999 *Choiaella radiata* Rigby & Hou, 1995 *Crumillospongia biporosa* Rigby, 1986 *Halichondrites ellisa* Walcott, 1920 *Hazelia palmata* Walcott, 1920 *Leptomitella conica* Chen, Hou & Lu, 1989 *Leptomitella confusa* Chen, Hou & Lu, 1989 *Leptomitella metta* (Rigby, 1983) *Leptomitus teretiusculus* Chen, Hou & Lu, 1989 *Paraleptomitella dictyodroma* Chen, Hou & Lu, 1989 *Paraleptomitella globula* Chen, Hou & Lu, 1989 *Quadrolaminiella crassa* Chen, Hou & Li, 1990

	Quadrolaminiella diagonalis Chen, Hou & Li, 1990 *Saetaspongia densa* Mehl & Reitner *in* Steiner *et al*., 1993 *Takakkawia lineata* Walcott, 1920 *Triticispongia diagonata* Mehl & Reitner *in* Steiner *et al*., 1993
Phylum Cnidaria	*Archisaccophyllia kunmingensis* Hou *et al*., 2005 *Xianguangia sinica* Chen & Erdtmann, 1991
Phylum Ctenophora	*Maotianoascus octonarius* Chen & Zhou, 1997 *Sinoascus papillatus* Chen & Zhou, 1997 *Yunnanoascus haikouensis* Hu *et al*., 2007
Phylum Nematomorpha	*Cricocosmia jinningensis* Hou & Sun, 1988 *Maotianshania cylindrica* Sun & Hou, 1987 *Palaeoscolex sinensis* Hou & Sun, 1988 *Sabellidites yunnanensis* Luo & Zhang, 1986 *Tabelliscolex hexagonus* Han, Zhang & Shu, 2003 *Tylotites petiolaris* Luo & Hu *in* Luo *et al*., 1999 *Xiaoheiqingella peculiaris* Hu *in* Chen *et al*., 2002 *Xishania longiusula* Hu *in* Chen *et al*., 2002
Phylum Priapulida	*Acosmia maotiania* Chen & Zhou, 1997 *Anningvermis multispinosus* Huang, Vannier & Chen, 2004 *Archotuba conoidalis* Hou *et al*., 1999 (? =*Selkirkia*? *elongata* Luo & Hu in Luo *et al*., 1999) *Corynetis brevis* Luo & Hu *in* Luo *et al*., 1999 *Gangtoucunia aspera* Luo & Hu *in* Luo *et al*., 1999 *Lagenula striolata* Luo & Hu *in* Luo *et al*., 1999 *Oligonodus specialis* Luo & Hu *in* Luo *et al*., 1999 *Omnidens amplus* Hou, Bergström & Yang, 2006 *Palaeopriapulites parvus* Hou *et al*., 1999 *Paraselkirkia jinningensis* Hou *et al*., 1999 (? =*Selkirkia sinica* Luo & Hu *in* Luo *et al*., 1999) *Paratubiluchus bicaudatus* Han *et al*., 2004 *Protopriapulites haikouensis* Hou *et al*., 1999 (=*Sicyophorus rara* Luo & Hu *in* Luo *et al*., 1999) *Sandaokania latinodosa* Luo & Hu *in* Luo *et al*., 1999 *Yunnanpriapulus halteroformis* Huang, Vannier & Chen, 2004
Phylum Sipuncula	*Archaeogolfingia caudata* Huang *et al*., 2004 *Cambrosipunculus tentaculatus* Huang *et al*., 2004
Phylum Chaetognatha	*Protosagitta spinosa* Hu *in* Chen *et al*., 2002 (? =*Eognathacantha ercainella* Chen & Huang, 2002)
Phylum Annelida	*Maotianchaeta fuxianella* Chen, 2004
Phylum Hyolitha	*Ambrolinevitus maximus* Jiang, 1982 *Ambrolinevitus meishucunensis* Jiang, 1994 *Ambrolinevitus platypluteus* Qian, 1978 *Ambrolinevitus ventricosus* Qian, 1978

	Burithes yunnanensis Hou *et al*., 1999 (? =*Glossolites magnus* Luo & Hu *in* Luo *et al*., 1999) *Linevitus flabellaris* Qian, 1978 *Linevitus opimus* Yu, 1974
Phylum Mollusca	*Helcionella yunnanensis* Zhang & Babcock, 2002 *Petalilium latus* Luo & Hu *in* Luo *et al*., 1999
Phylum Lobopodia	*Cardiodictyon catenulum* Hou, Ramsköld & Bergström, 1991 *Hallucigenia fortis* Hou & Bergström, 1995 *Luolishania longicruris* Hou & Chen, 1989 *Megadictyon haikouensis* Luo & Hu *in* Luo *et al*., 1999 *Miraluolishania haikouensis* Liu & Shu *in* Liu *et al*., 2004 *Microdictyon sinicum* Chen, Hou & Lu, 1989 *Onychodictyon ferox* Hou, Ramsköld & Bergström, 1991 *Paucipodia haikouensis* Luo & Hu *in* Chen *et al*., 2002 *Paucipodia inermis* Chen, Zhou & Ramsköld, 1995
Phylum Arthropoda (including Anomalocarididae*)	*Acanthomeridion serratum* Hou, Chen & Lu, 1989 *Almenia spinosa* Hou & Bergström, 1997 *Amplectobelua symbrachiata* Hou, Bergström & Ahlberg, 1995* *Anomalocaris saron* Hou, Bergström & Ahlberg, 1995* *Anomalocaris* sp. of Hou, Bergström & Ahlberg, 1995* *Branchiocaris*? *yunnanensis* Hou, 1987 *Candaspis laevigata* (Hou & Bergström, 1991) (=*Canadaspis eucallus* Chen & Zhou, 1997; =*Perspicaris*? sp. of Hou 1987; ? =*Yiiangocaris ellipticus* Luo & Hu *in* Luo *et al*., 1999) *Chengjangocaris longiformis* Hou & Bergström, 1991 (*Cambrofengia yunnanensis* Hou *et al*., 1999 may be detached appendages) *Cindarella eucalla* Chen, Ramsköld, Edgecombe & Zhou *in* Chen *et al*., 1996 *Clypecaris pteroidea* Hou, 1999 (? =*Ercaicunia multinodosa* Luo & Hu *in* Luo *et al*., 1999) *Combinivalvula chengjiangensis* Hou, 1987 *Comptaluta inflata* (Zhang, 1974) *Comptaluta leshanensis* (Lee, 1975) *Cucumericrus decoratus* Hou, Bergström & Ahlberg, 1995 *Diplopyge forcipatus* Luo & Hu *in* Luo *et al*., 1999 *Diplopyge minutus* Luo & Hu *in* Luo *et al*., 1999 *Dongshanocaris foliiformis* (Hou & Bergström, 1998) *Eoredlichia intermedia* (Lu, 1940) *Ercaia minuscula* Chen, Vannier & Huang, 2001 *Forfexicaris valida* Hou, 1999 *Fortiforceps foliosa* Hou & Bergström, 1997 *Fuxianhuia protensa* Hou, 1987 *Haikoucaris ercaiensis* Chen, Waloszek & Maas, 2004 *Isoxys auritus* (Jiang, 1982) *Isoxys curvirostratus* Vannier & Chen, 2000

	Isoxys paradoxus Hou, 1987 (? = *Isoxys elongatus* Luo & Hu *in* Luo *et al.*, 1999) *Jianfengia multisegmentalis* Hou, 1987 *Jiucunella paulula* Hou & Bergström, 1991 *Kuamaia lata* Hou, 1987 *Kuamaia muricata* Hou & Bergström, 1997 *Kuanyangia pustulosa* (Lu, 1941) *Kunmingella douvillei* (Mansuy, 1912) *Kunmingocaris bispinosus* Luo & Hu *in* Luo *et al*., 1999 *Kunyangella cheni* Huo, 1965 *Kwanyinaspis maotianshanensis* Zhang & Shu, 2005 *Leanchoilia illecebrosa* (Hou, 1987) (=*Dianchia mirabilis* Luo & Hu *in* Luo *et al*., 1997; =*Leanchoilia asiatica* Luo & Hu *in* Luo *et al*., 1997; =*Yohoia sinensis* Luo & Hu *in* Luo *et al*., 1997; ? =*Zhongxinia speciosa* Luo & Hu *in* Luo *et al*., 1997; ?=*Apiocephalus elegans* Luo & Hu *in* Luo *et al*., 1999) *Liangshanella liangshanensis* Huo, 1956 *Mafangia subscalaria* Luo & Hu *in* Chen *et al*., 2002 *Mafangocaris multinodus* Luo & Hu *in* Chen *et al*., 2002 *Malongella bituberculata* Luo & Hu *in* Chen *et al*., 2002 *Naraoia longicaudata* Zhang & Hou, 1985 *Naraoia spinosa* Zhang & Hou, 1985 *Occacaris oviformis* Hou, 1999 *Odaraia*? *eurypetala* Hou & Sun, 1988 (? =*Glossocaris oculatus* Luo & Hu *in* Luo *et al*., 1999) *Ovalicephalus mirabilis* Luo & Hu *in* Chen *et al*., 2002 *Parapaleomerus sinensis* Hou *et al*., 1999 *Parapeytoia yunnanensis* Hou, Bergström & Ahlberg, 1995* *Pectocaris spatiosa* Hou, 1999 *Pisinnocaris subconigera* Hou & Bergström, 1998 (? =*Jianshania furcatus* Luo & Hu *in* Luo *et al*., 1999) *Primicaris larvaformis* Zhang *et al*., 2003 *Pseudoiulia cambriensis* Hou & Bergström, 1998 *Pterotrum triacanthus* Luo & Hu *in* Chen *et al*., 2002 *Pygmaclypeatus daziensis* Zhang, Han & Shu, 2000 *Retifacies abnormalis* Hou, Chen & Lu, 1989 (=*Retifacies longispinus* Luo & Hu *in* Luo *et al*., 1997; = *Tuzoia* sp. of Shu 1990) *Rhombicalvaria acantha* Hou, 1987 *Saperion glumaceum* Hou, Ramsköld & Bergström, 1991 *Sidneyia sinica* Zhang & Shu *in* Zhang, Han & Shu, 2002 *Sinoburius lunaris* Hou, Ramsköld & Bergström, 1991 *Skioldia aldna* Hou & Bergström, 1997 *Squamacula clypeata* Hou & Bergström, 1997 *Sunella* cf. *shensiensis* (Huo, 1965) *Synophalos xynos* Hou *et al*., 2009 *Syrrhaptis intestinalis* Luo & Hu *in* Luo *et al*., 1999 *Tanglangia longicaudata* Luo & Hu *in* Luo *et al*., 1999

	Tsunyidiscus aclis Zhou in Lee *et al*., 1975 *Tsunyidiscus niutitangensis* (Chang, 1964) *Tsunyiella diandongensis* Tong *in* Huo & Shu, 1985 ?*Tuzoia sinensis* Pan, 1957 (? =*Tuzoia limba* Shu, 1990) *Urokodia aequalis* Hou, Chen & Lu, 1989 *Waptia ovata* (Lee, 1975) *Wutingaspis tingi* Kobayashi, 1944 *Wutingella binodosa* Zhang, 1974 *Xandarella spectaculum* Hou, Ramsköld & Bergström, 1991 *Yunnanocaris megista* Hou, 1999 *Yunnanocephalus yunnanensis* (Mansuy, 1912)
Phylum Phoronida	*Eophoronis chengjiangensis* Chen, 2004 *Iotuba chengjiangensis* Chen & Zhou, 1997
Phylum Brachiopoda	*Diandongia pista* Rong, 1974 *Heliomedusa orienta* Sun & Hou, 1987 *Lingulella chengjiangensis* Jin, Hou & Wang, 1993 *Lingulellotreta malongensis* (Rong, 1974) *Longtancunella chengjiangensis* Hou *et al*., 1999 *Xianshanella haikouensis* Zhang, 2004
Phylum Echinodermata	*Dianchicystis jianshanensis* Shu *et al*., 2004 *Vetulocystis catenata* Shu *et al*., 2004
Phylum Chordata	*Cathaymyrus diadexus* Shu, Conway Morris & Zhang, 1996 ?*Cathaymyrus haikouensis* Luo & Hu *in* Luo *et al*., 2001 *Cheunkongella ancestralis* Shu *et al*., 2001 *Myllokunmingia fengjiaoa* Shu, Zhang & Han *in* Shu *et al*., 1999 (= *Haikouichthys ercaicunensis* Luo, Hu & Shu *in* Shu *et al*., 1999) *Shankouclava anningense* Chen *et al*., 2003 *Zhongjianichthys rostratus* Shu, 2003 ?*Zhongxiniscus intermedius* Luo & Hu *in* Luo *et al*., 2001
Uncertain systematic position	*Allonnia phrixothrix* Bengtson & Hou, 2001 (=*Allonnia junyuani* Janussen *et al.*, 2002) *Amiskwia sinica* Luo & Hu, 2002 *Anthotrum robustus* Luo & Hu *in* Luo *et al*., 1999 *Batofasciculus ramificans* Hou *et al*., 1999 *Beidazoon venustum* Shu, 2005 (= *Bullivetula variola* Aldridge *et al*., 2007) *Chancelloria eros* Walcott, 1920 *Conicula striata* Luo & Hu *in* Luo *et al*., 1999 *Cotyledion tylodes* Luo & Hu *in* Luo *et al*., 1999 (? = *Cambrotentacus sanwuia* Zhang & Shu *in* Zhang *et al*., 2001) *Didazoon haoae* Shu & Han *in* Shu *et al*., 2001 *Dinomischus venustus* Chen, Hou & Lu, 1989 *Discoides abnormis* Luo & Hu *in* Luo *et al*., 1999

	Eldonia eumorpha (Sun & Hou, 1987) (=*Yunnanomedusa eleganta* Sun & Hou, 1987) *Facivermis yunnanicus* Hou & Chen, 1989 *Heteromorphus confusus* (Chen & Zhou, 1997) (? =*Heteromorphus longicaudatus* Luo & Hu *in* Luo *et al*., 1999) *Hippotrum spinatus* Luo & Hu *in* Luo *et al*., 1999 *Jiucunia petalina* Hou *et al*., 1999 *Maanshania crusticeps* Hou *et al*., 1999 *Macrocephalus elongatus* Luo & Hu *in* Luo *et al*., 1999 *Parvulonoda dubia* Rigby & Hou, 1995 *Phacatrum tubifer* Luo & Hu *in* Luo *et al*., 1999 *Phasganula longa* Luo & Hu *in* Luo *et al*., 1999 *Phlogites longus* Luo & Hu *in* Luo *et al*., 1999 (= *Phlogites brevis* Luo & Hu *in* Luo *et al*., 1999; ? = *Calathites spinalis* Luo & Hu *in* Luo *et al*., 1999) *Pomatrum ventralis* Luo & Hu *in* Luo *et al*., 1999 (*Xidazoon stephanus* Shu, Conway Morris & Zhang *in* Shu *et al*., 1999) *Pristioites bifarius* Luo & Hu *in* Luo *et al*., 1999 *Rhipitrus clavifer* Luo & Hu *in* Luo *et al*., 1999 *Rotadiscus grandis* Sun & Hou, 1987 *Vetulicola cuneata* Hou, 1987 *Vetulicola monile* Aldridge *et al*., 2007 *Vetulicola rectangulata* Luo & Hu *in* Luo *et al*., 1999 *Yunnanozoon lividum* Hou, Ramsköld & Bergström, 1991 (=*Haikouella lanceolata* Chen *et al*., 1999) *Yuyuanozoon magnificissimi* Chen, Feng & Zhu *in* Chen *et al*., 2003

2.a-3-5 Representative Chengjiang fossils

The species illustrated and briefly described in this section are representative of the major groups that occur in the Chengjiang Lagerstätte. Almost all of them are confined to this deposit. Amongst other things, they reflect:

- The exceptional preservation of the biota, providing high-fidelity morphological details and in particular critical data on rare, soft-bodied material. This information is used to underpin important palaeobiological studies relating to early animal evolution.

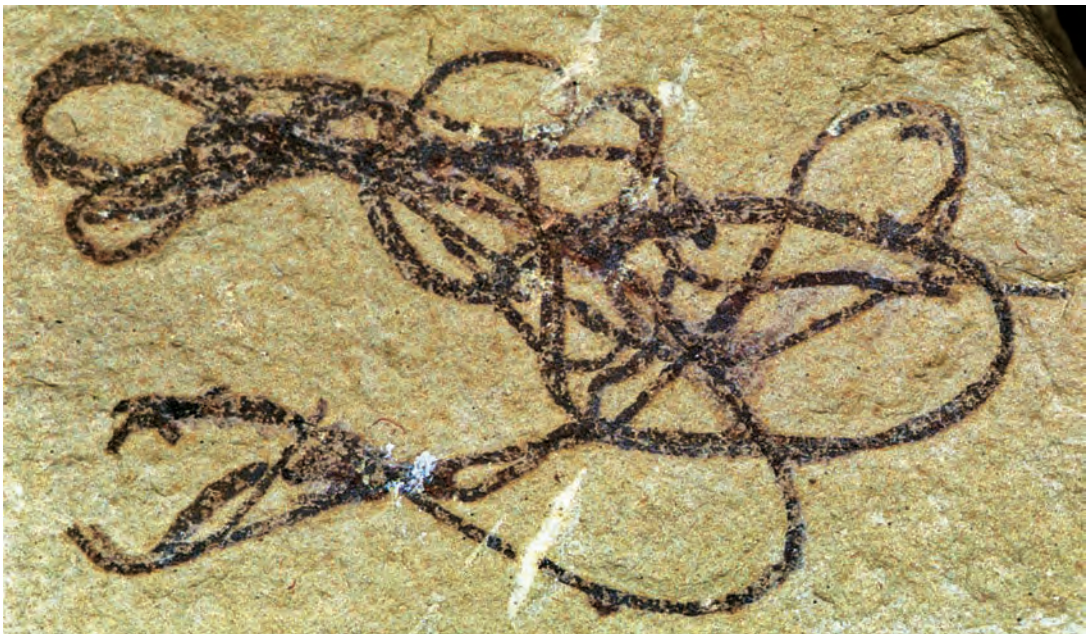
- The occurrence in the fauna of the earliest specimens from the fossil record of many of the major metazoan groups, thus helping determine their time of origin.

- The importance of the overall fauna for bearing witness to the Cambrian explosion event.

● Algae

Algae represent the base of the food chain with respect to the Chengjiang Biota, and their remains represent one of the most common fossil forms in the lagerstätte. They are all thread-like, though some taxa that were originally regarded as algae have recently been re-assessed to be strings of faecal material.

Sinocylindra yunnanensis **Chen & Erdtmann, 1991**



S. yunnanensis is one of the most common species in the Chengjiang biota. Its filament reaches about 0.3 mm in width and 20 mm in length; it is unbranched, and its surface is smooth. The macroscopic features of this species were thought to resemble those of membersa of the blue-green Oscillatoriaceae, but it was also recognized that its dimensions are too large for bacterial affinities. The relatively loose coiling indicates a certain rigidity of the filament comparable to that of the modern laminariacean *Chorda*, and the lack of branching is also a similarity with this group of brown algae, indicating a possible relationship.

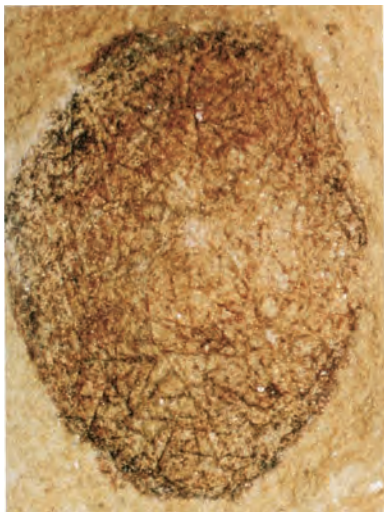
Phylum Porifera

Sponges (phylum Porifera) are the most primitive of the multicellular organisms. Their spicules have been recorded from Ediacaran age rocks, though they only become common as fossils from Cambrian times onwards. Sponges from the Chengjiang Lagerstätte are morphologically diverse and are second only to the arthropods in terms of the number of species (there are 19) from the deposit. Numerous complete specimens, not simply isolated spicules - the normal mode of preservation in the fossil record - have been recovered. Most are demosponges.

Allantospongia mica **Rigby & Hou, 1995**

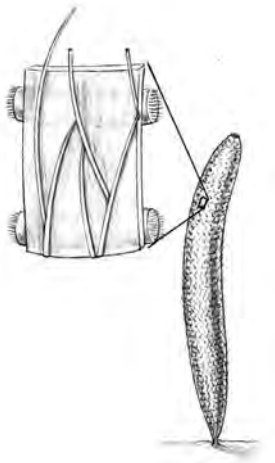
The body of the demosponge *T. mica* is relatively small, typically some 15 mm high by 10 mm wide, and elongate ovate to sausage-shaped in overall form. It consists mostly of a radiating thatch of small, single axis spicules that are clumped locally into tufts. In some specimens parts of the central area of the skeleton are more open-textured. Moderately larger spicules extend outwards from around the central thatched area.

Triticispongia diagonata **Mehl & Reitner, 1993**



T. diagonata has been referred to a second major sponge group - the hexactinellids. It is common within the biota, and specimens are typically 6-10 mm high. The oval to round skeleton has two moderately well organized series of small, delicate spicules with rectangular patterns. A basal root tuft anchored the individual to the sea floor.

Paraleptomitella dictyodroma **Chen, Hou & Lu, 1989**

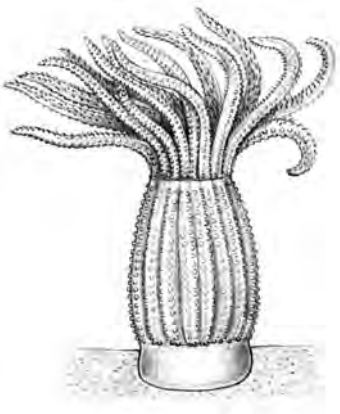


P. dictyodroma is a relatively common, tubular, thin-walled demosponge measuring up to about 100 mm long and 12 mm wide. The base of the sponge is narrow, and the opposing, oral margin, appears rounded. The double-layered skeleton is formed of single-axis spicules. The outer layer consists of coarse, slightly curved spicules that interlock with one another to form tapering, elongate areas filled with fine, vertically arranged spicules. Bundles of horizontally arranged spicules comprise the inner layer. Specimens were probably anchored to the sea floor.

● Phylum Cnidaria

Cnidarians, which include jellyfish, corals, sea anemones and sea pens, are rare in the Chengjiang Biota. Just two genera and two species have been described, and in total about 30 specimens collected.

Xianguangia sinica **Chen & Erdtmann, 1991**



This species consists entirely of the remains of soft tissues and has generally been allied to the sea anemones (Anthozoa). The animal is cylindrical, about 60 mm high and 30 mm wide at its base. The disc-like base supports longitudinal strips that extend into about 16 tentacle-like structures that surround the presumed mouth. The longitudinal strips may correspond to internal folds of the gut. Most specimens are preserved laterally collapsed; a few are compressed dorsoventrally, giving an flower-like appearance to the fossil.

● Phylum Ctenophora

Ctenophores ('comb jellies') have a delicate, gelatinous body and hence an exceedingly sparse fossil record. However, despite the fact that specimens are rare in the Chengjiang Lagerstätte (there are only about 20), three genera each with a single species are known from it, and these represent the earliest and most diverse fauna of fossil ctenophores.

Maotianoascus octonarius **Chen & Zhou, 1997**

The body of *M. octonarius* appears spherical in lateral outline. It is formed of eight petaloid lobes, which have a ring-like arrangement implying radial symmetry. Each lobe has a medial fold, along each face of which there is a strip of fine, transversely arranged ridge and furrow-like structures flanked by smooth longitudinal areas. These delicate features are the combs of the so-called comb rows. The lobes extend into a short, delicate, skirt-like membrane around the presumed site of a wide, centrally positioned mouth. At the opposing end, the lobes converge to meet in a small button-like dome.

● Phylum Nematomorpha

Nematomorphs ('horsehair worms') are one of the richest groups amongst the Chengjiang fossils: thousands of specimens have been collected and eight genera, each with a single species, recognised.

Cricocosmia jinningensis **Hou & Sun, 1988**

This worm is known from 1000s of specimens. Its body can reach at least 50 mm long and 2.5 mm wide. Anteriorly, there is a relatively long, retractable body region (proboscis) armed with spines. The anterior region of the trunk displays narrow, annulations, each bearing a pair of cone-shaped plates (sclerites). The gut is a dark, longitudinal, centrally positioned band. A curved spine projects from the posterior of the trunk. The rusty-brown colour of this specimen reflects the pyrite (altered to iron oxide) involved in its preservation; this is typical for Chengjiang specimens.

Maotianshania cylindrica **Sun & Hou, 1987**

M. cylindrica is known from about 1000 specimens, largest about 40 mm long and 2 mm wide. The relatively slender trunk has slightly convex, narrow annulations, each with many tiny irregularly distributed pits. The head and most of the trunk are typically fairly straight to gently curved, but in many specimens the posterior region is coiled through over 300°. The anterior retractable proboscis bears many papillae and rings of spines. The posterior normally terminates in a pair of tiny curved hooks. The intestine is narrow and sometimes preserved with slight relief.

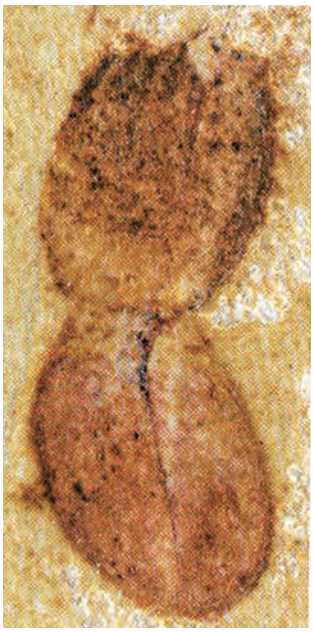
Palaeoscolex sinensis **Hou & Sun, 1988**

This worm is common in the Chengjiang biota. Several hundreds of specimens are known, many of them coiled. They may be up to 100 mm long and 4 mm wide, each with a proboscis anteriorly, and a curved spine posteriorly. Each annulation bears a double transverse row of tiny plates (30-45 um diameter, 40-50 per annulation), in between which there is a ridge bearing a double transverse row of smaller, more numerous pits (60-80 per annulation). The gut is preserved as a dark band and seemingly lacks mud infilling, suggesting a non-deposit feeding, possibly epifaunal and predatorial lifestyle.

Phylum Priapulida

Priapulids ('penis worms') are non-segmented worms. They are abundant in the Chengjiang Lagerstätte in terms of number of specimens (hundreds), genera (14) and species (14), and these represent the earliest examples from the fossil record. Priapulids were a relatively more significant faunal component in Cambrian seas compared to their importance in present-day marine environments. They range from shallow to deep water and are mostly burrowers though some are tube-dwellers, and they are typically predatory carnivores. Priapulids possess a retractable proboscis anteriorly, a trunk, and sometimes a tail (caudal) appendage.

Palaeopriapulites parvus Hou *et al*., **1999**



Specimens of *P. parvus* are less than 10 mm long. The proboscis and the trunk are approximately equal in size and oval-shaped in lateral view. The proboscis bears tiny spines arranged in about 20 longitudinal rows, and the trunk displays compressed, longitudinal wrinkles. The trunk was possibly encased in a f thick cuticle, as is the case in some Recent priapulid larvae. The gut is typically narrow and straight. There are hooks at the posterior end of the trunk.

Corynetis brevis **Luo & Hu, 1999**

This priapulid species is relatively rare in the Chengjiang Biota; some 25 specimens have been collected. The largest individuals are about 25 mm long. The proboscis bears an array of tiny spines arranged in about 25 longitudinal rows and its base is surrounded by long spines. In a few specimens the trunk displays a number of transverse rings and the posterior end bears a caudal appendage.

Protopriapulites haikouensis Hou *et al., 1999*

This worm is known from many tens of specimens, the largest of them about 10 mm long. The anterior proboscis and posterior trunk are of subequal size. The narrower, anterior part (pharynx) of the proboscis, and its broader posterior base, each bears a regular array of tiny spines. The trunk has 13-15 longitudinal external ridges, and internally it is occupied almost entirely by a multi-coiled gut. It is likely that *P. haikouensis* was a burrower but possibly not a predator. In some specimens the gut is apparently mud-filled, indicating that these individuals were perhaps digesting organic material from the sediment.

● Phylum Sipuncula

Two genera of sipunculids ('peanut worms'), each with a single species, are known from the Chengjiang Biota, these possibly being the only fossil representatives of the phylum (other proposed Silurian, Carboniferous and Jurassic body fossil examples are highly questionable).

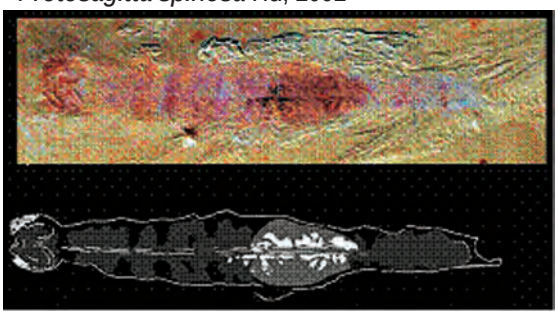
Cambrosipunculus tentaculatus Huang *et al.*, 2004

This species is about 40 mm long and 0.4 mm wide. It has a tapering body with no clear boundary between the retractible introvert region and the trunk. The anterior part of the introvert is armed with large hooks that form a ring sub-terminally, and moderately scattered hooks sited slightly more posteriorly. The introvert tip is crowned with at least ten short, tentacles. Fine papillae cover the trunk. The gut is U-shaped, with straight descending and ascending parts. A circle-like structure represents the anus.

● Phylum Chaetognatha

Chaetognaths ('arrow worms') number about 100 species present-day, they are common amongst the marine plankton, they provide a large proportion of the marine biomass, and they are an important part of the food web. Their relationship to other invertebrate phyla is uncertain. There is just one undoubted chaetognath species from the Chengjiang Lagerstätte, the single specimen of which represents the only unequivocal body fossil found in the Cambrian, and as such arguably the earliest record of the group (protoconodonts, known from the Cambrian, are considered by many to represent chaetognaths).

Protosagitta spinosa Hu, 2002



The only specimen of *P. spinosa* is about 35 mm long. The head is short and bears lateral grasping spines, and it is separated by a constriction from a cylindrical trunk, and then a more slender tail. The anus is located at the boundary of trunk and tail. Possible muscles, ovaries, and tail and lateral flaps are also preserved. It is presumed to have been a predator, like living chaetognaths.

● Phylum Annelida

Present-day the annelids, the segmented worms, include marine, freshwater and terrestrial forms, and there are over 16000 described species. The species assigned to Annelida from Chengjiang represents the earliest known record of the phylum.

Maotianchaeta fuxianella Chen, 2004

The single specimen of *M. fuxianella* is about 54 mm long by 6 mm wide. There are about 50 body segments, which become gradually narrower posteriorly. The lateral 'appendages' (parapodia) are elongate and taper to a point terminally, where they are spinose.

● Phylum Mollusca

Next to Arthropoda, Mollusca is the most diverse invertebrate phylum. Molluscs are one of the main components of modern ecosystems, and are widespread in marine, freshwater and terrestrial habitats. Molluscs from the Chengjiang Biota are very rare and of low diversity. However Mollusca is represented by *Helcionella*, a primitive mollusc, and also by *Petalilium*, a primitive cephalopod which is also the earliest from the fossil record.

Petalilium latus **Luo & Hu, 1999**

The morphology of this species has historically been compared to that of annelid worms, arthropods, flatworms, nemertine worms, and also molluscs, and it has even been suggested to represent a distinct, separate invertebrate group. However recently (2010) it was placed firmly in Mollusca as a stem cephalopod. It is known from some tens of specimens, up to 10 cm long. It has a small head with stalked eyes and a long pair of tentacles, a tubular gut and about 50 transverse bars in a flattened body, and lateral fins and lateral gills have also been recognised.

● Phylum Lobopodia

Lobopodians - small, soft-bodied marine fossils - are very closely related to the living, terrestrially based onychophorans (the 'velvet worms'). The Chengjiang Lagersätte has yielded numerous lobopodian specimens of exquisite morphological detail. They represent the richest lobopodian fauna in the fossil record (nine species representing eight genera), and best demonstrate the early radiation of the group. Lobopodians are significant for understanding the evolution of not only the onychophorans, but also the arthropods.

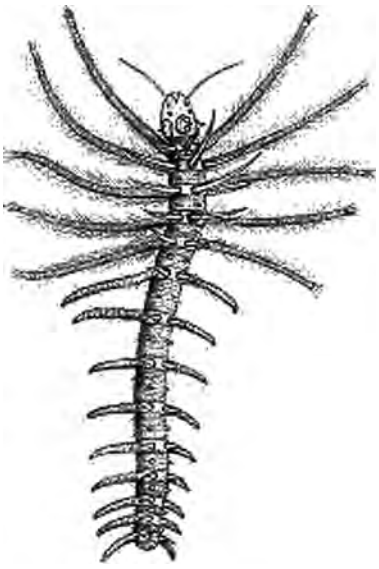
Cardiodictyon catenulum **Hou, Ramsköld & Bergström, 1991**

At least 100 specimens of this lobopodian have been collected from the Chengjiang Lagerstätte. Specimens can reach 30 mm in length. The head is elongate, rounded terminally, and bears two, or possibly three pairs of appendages. The long, slender trunk is annulated, and bears some 23 angular, paired plates (sclerites) with raised marginal ridges. Beneath each of the successive sclerite pairs, there is a pair of legs. Each leg has numerous, fine annuli and curved, pointed claws. The posterior trunk termination is blunt. A dark-coloured gut trace extends along the length of the trunk.

Hallucigenia fortis **Hou & Bergström, 1995**

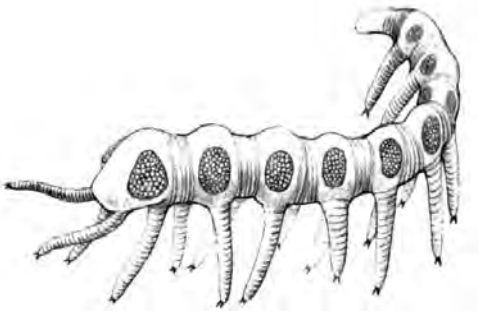
This species is relatively rare within the biota, a few dozen specimens having been collected. Complete specimens can reach 22 mm long. The head is ellipsoidal in shape and clearly differentiated from the trunk. Immediately behind the head there are two pairs of long, slender, annulated appendages. The trunk also displays annulations, and seven pairs of sclerites and annulated legs. A pair of curved claws is present on each leg. Each sclerite base supports a long spine. There is also an eighth leg pair without a corresponding sclerite pair. Traces of the gut are sometimes preserved. An epibenthic, crawling mode of life is envisaged for *Hallucigenia*, as for other Chengjiang lobopodians.

Luolishania longicruris **Hou & Chen, 1989**



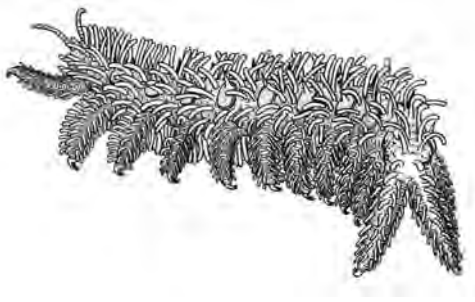
L. longicrurus is a relatively abundant Chengjiang species: over 200 specimens have been recovered. Specimens range from about 8.0 mm to 15 mm long. The head is slightly expanded relative to the posteriorly tapering trunk. There are 14 pairs of finely annulated legs, with four or five claws on each leg. The legs of the first five pairs are long, the length decreasing sharply in legs six and seven, and it is constantly short in legs eight to fourteen. There are 15 sets of trunk sclerites, each set comprising one dorsal and two lateral spines. One such set is on the head and the others are each above a leg pair. Up to 6-8 annuli are present mid-length in the trunk, and three in both theanterior and posterior regions. Gut are evident.

Microdictyon sinicum **Chen, Hou & Lu, 1989**



Over 100 specimens of *M. sinicum*, which can range up to almost 80 mm long, are known from the Chengjiang Biota. Interpretations differ as to which is the head end. A dark trace represents the gut. There are nine pairs of phosphatic trunk sclerites, the surface of each with hexagonal, cylindrical perforations and spiky nodes. *Microdictyon* was first established on the basis of isolated examples of these sclerites, which were recorded from many widespread Cambrian localities - for example the Lower Cambrian of Siberia. Not until such plates were found attached to the body of *M. sinicum* specimens from Chengjiang was their lobopodian identity recognised. The trunk areas that bear the sclerite pairs are smooth and dorsally swollen, and between them the body is annulated. There are ten pairs of annulated, terminally clawed legs.

Onychodictyon ferox **Hou, Ramsköld & Bergström, 1991**



This Chengjiang species is relatively rare: a few dozen specimens are known. It is a large lobopodian, reaching up to 70 mm long. The head morphology is unclear. There are ten pairs of trunk sclerites, with annulations between each pair. Each sclerite shows fine reticulate granulation and a spine-bearing outer ridge. Beneath each sclerite pair there is a pair of legs, and posteriorly there is an eleventh leg pair only. Each leg is annulated and bears two curved claws. In front of the leg pair associated with the first plate pair, there is another pair of similar legs, both of these pairs being slightly shorter than the others. Each trunk and leg annulation bears long tentacle-like structures.

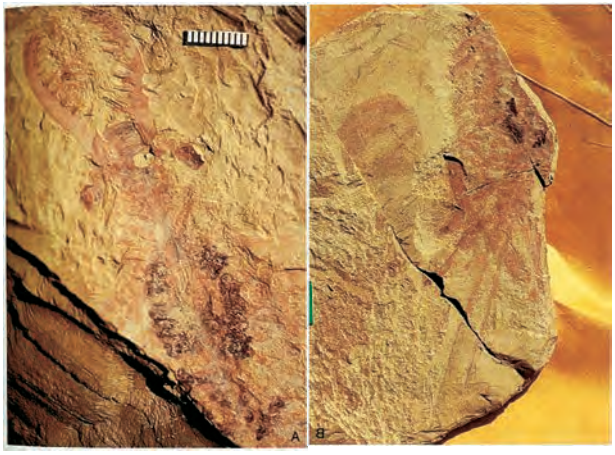
Paucipodia inermis **Chen, Zhou & Ramsköld, 1995**

The Chengjiang Lagerstätte has yielded a few dozen specimens of this relatively featureless lobopodian, which at over 100 mm long is also one of the largest in the fauna. The head is narrower than the tail, and the trunk tapers anteriorly and posteriorly, bears nine leg pairs, and lacks any dorsal plates or other major structures. Each leg is fairly long, tapers gradually, and ends with a claw pair. The body and legs show very fine annulations, about 4-5 per millimetre.

● Phylum Arthropoda (including anomalocaridids)

Arthropods form the dominant component of the Chengjiang Biota; they are documented in more than 100 species names that represent some 75 biological species (including 5 anomalocaridid species). Many Chengjiang species have been used in recent assessments of arthropod relationships, and they have been critical for understanding the evolution of this major invertebrate phylum. Forerunners of modern day crustaceans and also chelicerates have, for example, been thus identified amongst Chengjiang taxa. There are also other Chengjiang arthropods whose affinity and full evolutionary significance await determination. The remarkable preservation of Chengjiang arthrpodsl has allowed a wide range of habitats and sophisticated lifestyles and feeding types to be recognised for them, at this very early stage in the evolutionary radiation of animal phyla – for example the occupation by some arthropods of the pelagic niche.

Anomalocaris saron **Hou, Bergström & Ahlberg, 1995**



Anomalocaridids are a very distinctive, extinct group of animals that in several recent analyses have been resolved to a position in the lower part of the base of the arthropod lineage. Four anomalocaridid genera represented by five species – the earliest known members of the group – have been identified from the Chengjiang fauna. Individuals are estimated to have reached over a metre long, and all species are presumed to have been carnivorous predators living in the water column and at the top of the food chain. *A. saron* bears a pair of large, stalked eyes, and a pair of massive grasping appendages anteriorly that support well-developed multispinose projections along the inner side of each. Behind the grasping appendages there is a circular mouth made up of numerous plates. Eleven simple flaps project from the body. Posteriorly, there are three pairs of longer flaps, plus a pair of very long, trailing, streamer-like branches.

Canadaspis laevigata **(Hou & Bergström, 1991)**

Canadaspis is a relatively common Chengjiang arthropod species. Specimens are relatively common and can reach about 30 mm long. The unmineralized bivalved carapace covers the head and part of the trunk. There are stalked eyes and antennae, behind which are at least 10 pairs of biramous appendages. Each inner branch is stout and multi-segmented; each outer branch is a large, flat, ovoid blade. There is a tail unit is flanked by spines. The limb structure reflects a primitive level of organization, and *Canadaspis* has most recently been positioned in the upper part of the base of the arthropod lineage.

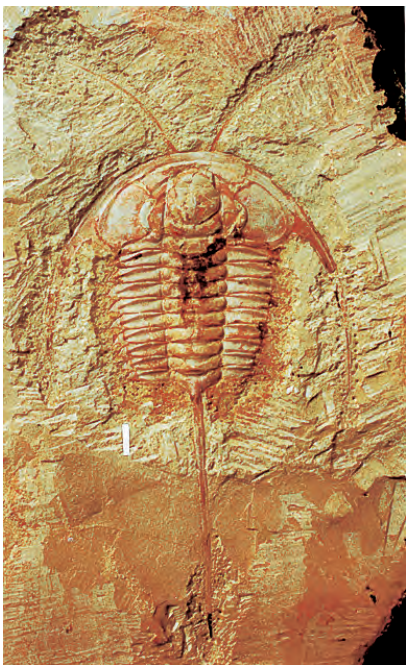
Chengjiangocaris longiformis **Hou & Bergström, 1991**

This species reaches up to 100 mm in length. Some five dorsal sclerites, the presumed thorax, are covered by the posterior part of the head shield. Behind are another 17 scerites representing the abdomen, then a small, triangular-shaped tail region. The inner branch of each biramous trunk appendage is simple, and consists of uniform segments and a small conical terminal piece. The exopod is a simple rounded flap, lacking setae or bristles. In the trunk, the appendages are much more closely spaced than the sclerites that cover them, resulting in a mismatch.

Cindarella eucalla **Chen, Ramsköld, Edgecombe & Zhou, 1996**

C. eucalla can be up to about 110 mm long. It has a large shield covering the head and part of the trunk. It shows long antennae and paired ventral eyes. The trunk has 15-17 dorsal sclerites in addition to those overlapped by the head shield, and posteriorly there is a median spine. *Cindarella* shows a decoupling of dorsal sclerites and segments in the trunk. In the anterior part of the trunk each sclerite corresponds to a segment and, like the post-antennal head segments, carries a biramous limb pair. Behind, the other trunk sclerites each covers more than one segment, increasing posteriorly from one to about four. *Cindarella* is a lamellipedian arthropod, that is, it bears lamellar setae on the outer branches of its biramous appendages.

Eoredlichia intermedia **(Lu, 1940)**

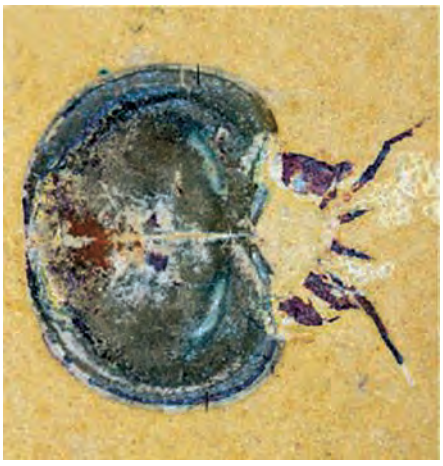


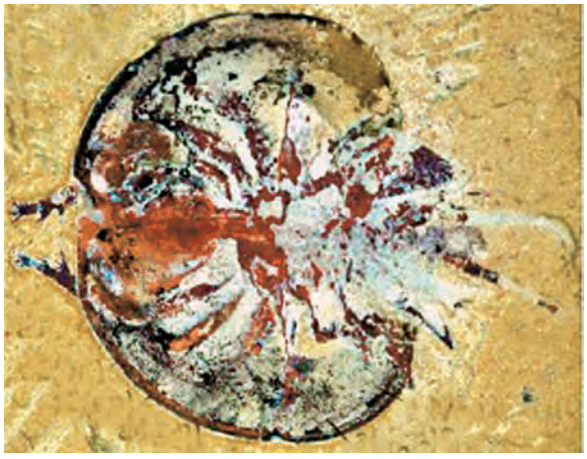
This species is a relatively common trilobite in the biota. It shows long, multi-segmented, setae-bearing antennae. The head shield has a forwardly tapering glabella centrally with 3 lateral furrows, large crescentic eyes, strongly divergent facial sutures, and long cheek spines. Fifteen laterally spinose segments make up the thorax, the ninth axial ring supporting a long spine. The tail shield is very small, elliptical in dorsal outline. Post-antennal appendages are biramous. The inner branch comprises seven segments, the first joining with a basal unit, and both together with the second segment having spines on their inner surfaces. The outer branch is a long, broad shaft with long setae, and a bristle-fringed lobe.

Fuxianhuia protensa **Hou, 1987**

F. protensa is known from hundreds of specimens, the largest about 110 mm long. The head shield extends posteriorly over three trunk segments. The head bears pairs of short, annulated antennae and eyes. There are about 31 dorsal trunk sclerites: the first three and the next 13-15 form the broad part; the narrow abdomen has about 13 sclerites and a medial terminal spine flanked by a pair of lateral spines. The broad trunk section has biramous legs each with a sturdy inner branch comprising about 20 similar segments lacking a terminal spine or claw, together with a thin, oval-shaped outer branch with smooth margins. There appears to be as many as 35-45 pairs of legs in total, with 2-3 pairs for each sclerite. The leg morphology is primitive, and *Fuxianhuia* has been positioned in the upper part of the base of the arthropod lineage.

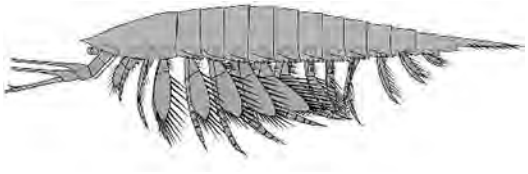
Kunmingella douvillei **(Mansuy, 1912)**





This is the most prolific Chengjiang species; countless 1000s of specimens are known, though specimens with soft parts are uncommon. Its valves are from 3.5-6 mm long, inside which the ten-segmented body bears ten pairs of limbs, five pairs each in the head and the trunk. Behind the antenna there are a series of biramous limbs, then two uniramous limbs. Based on this critical soft-part morphology, bradoriids have been determined to lie on the stem line leading to the true crustaceans. They possibly lived at the sediment-water interface, and the occurrence of supposed faecal material containing *Kunmingella* valves indicates that bradoriids were a food source for larger predators.

Leanchoilia illecebrosa **(Hou, 1987)**



This arthropod is a common element of the biota. The head shield is succeeded by 11 dorsal sclerites of the body, and a dagger-like tail bearing slender marginal spines. Stalked eyes are located near the front of the head shield. The most anterior, great appendage has three long flagellae, each longer than the body. There are three further pairs of appendages, biramous in form, in the head, and one such pair per body segment. The inner branch of each consists of a basal unit and nine simple cylindrical segments. The outer branch has a terminal part that is paddle-like with long, needle-like marginal setae. *Leanchoilia* is considered by some as a derivative from the base of the chelicerate lineage

Naraoia longicaudata **Zhang & Hou, 1985**

This arthropod, known from over 1,000 specimens, is a common Chengjiang species. Specimens can be over 60 mm long. The head shield is sub-semicircular and the trunk shield long and semi-elliptical; both are unmineralized. The head bears antennae, possible eyes ventrally, and at least three pairs of biramous appendages. There are some 22 other similar appendage pairs in the trunk. Each comprises a basal unit, an inner branch of seven segments including a terminal claw, and an outer branch. The basal unit and the first two segments of the inner branch bear inner marginal spines. A flexible stem attached to the basal unit enabled movement. The outer branch is a long slender shaft with long setae, and a narrow terminal lobe with bristles. The gut is relatively narrow, the intestinal branches on the cheek short and relatively simple. *N. longicaudata* was probably a scavenger, or possibly a deposit feeder. Naraoiids are considered to be trilobites by some researchers, though they resolve in the related nektaspid arthropod group in other analyses.

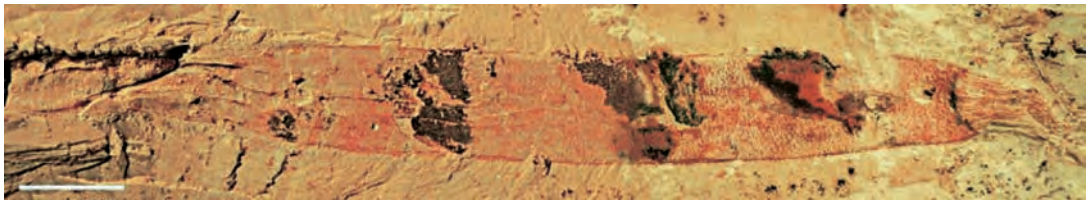
Synophalos xynos Hou, Siveter, Aldridge & Siveter, 2009

This Chengjang arthropod is known from a single individual about 24 mm long, together with a few tens of specimens that are attached to each other in several similar, chain-like associations. Its morphology includes a folded, unmineralized carapace, an abdomen of at least six segments, and a terminally bifurcate tail unit. The robustly integrated, linear configurations show all the specimens facing in the same direction in each chain. Such assemblies might, amongst other reasons, be due to migration-related, defence, feeding or reproduction activities. It has been suggested that the chains represent examples of a collective behavioural strategy associated with migration, either horizontally or vertically. In detail, the chains are unique for any arthropod, fossil or living.

● Phylum Phoronida

Phoronids are tube-dwelling sessile animals represented present-day by just two genera and some 20 species. They live either buried in soft sediment, or cemented to hard ground. Only two phoronid species, each belonging to a different genus, have been reported from the Chengjiang Lagerstätte. However these represent the only body fossil examples from the fossil record.

Eophoronis chengjiangensis Chen, 2004

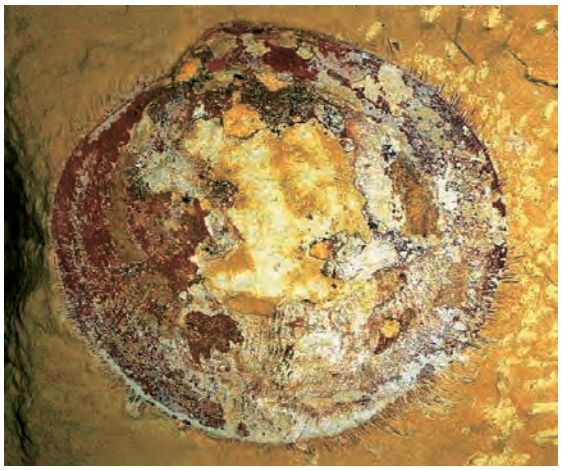


This very rare species is known from just a few specimens. The tube approaches 200 mm long, and its surface is densely covered with small, spinose projections. The alimentary canal is U-shaped, and the stomach relatively swollen. Tentacle-like structures are arranged in circle at the distal end of the body.

● Phylum Brachiopoda

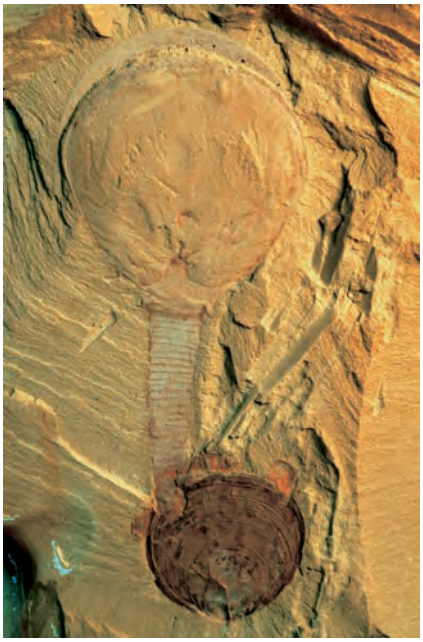
There are six brachiopod ('lamp shell') species assigned to six genera in the Chengjiang Biota, most of which are very common. Soft-bodied morphological features are extremely rarely preserved in fossil brachioods but such features, including delicate feeding apparatus and attachment stalks, are present in Chengjiang examples, and so provide significant data for our understanding of the early evolution of this geologically important phylum.

Heliomedusa orienta **Sun & Hou, 1987**



Thousands of specimens of *H. orienta* have been collected. The convex valves are from about 5-22 mm long. There is no original shell material remaining, and it appears to have been only weakly biomineralized. Valve surfaces show growth lines and fine, indictinct radial ridges. Preserved soft-tissues reported from *Heliomedusa* specimens include sensory marginal setae, the lophophore feeding apparatus, and traces of various canals. Muscle scars are often evident, with an elevated main, middle scar flanked by pairs of scars.

Longtancunella chengjiangensis **Hou et al., 1999**



This is a relatively rare Chengjiang species. Both valves are of similar size, thin, slightly convex, and subcircular in outline. The original shell has been dissolved away, and so neither ornament nor growth lines are apparent. Sparse, delicate setae are evident along the mantle margin. The attachment stalk is relatively short and robust - less than 10 mm long but 3mm wide – and sometimes clearly annulated. Specimens, remarkably, have been found associated in clusters

Lingulellotreta malongensis **Rong, 1974**

L. malongensis is known from hundreds of specimens. The shell reaches 7-10 mm long and 5 mm wide. The shape is basically ovoid, but the ventral valve is extended to a point at the narrow elongate pedicle opening. Both valves are covered with discontinuous radial ribs, which become spinose anetriorly. Both also show dense concentric growth lines. Internally, the dorsal valve shows fan-shaped muscle scars. The pedicle is remarkably long, reaching 50 mm in some specimens, and is annulated near its attachment end.

● Phylum Echinodermata

Echinoderms are extremely rare in Chengjiang. Just two species have been reported. However they represent the some of the earliest members of the phylum from the fossil record.

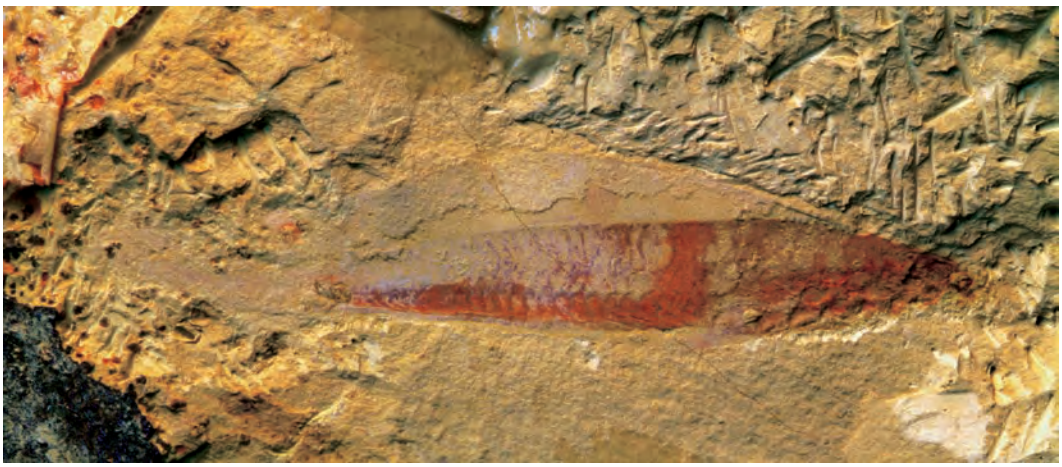
Vetulocystis catenata Shu *et al.*, 2004

V. catenata, together with *Dianchicystis jianshanensis*, also from Chengjiang, have been recognized as primitive, vetulicystid echinoderms. *V. catenata* displays a globose body and a tail. The body shows three main openings, including the mouth and the respiratory organ. The tail apparently comprises two segments, expands posteriorly, with a possible central intestine and a terminal anus. Vetulicystids are thought to have been sessile or semi-sessile suspension feeders.

● Phylum Chordata

Chordates comprise that most significant of deuterostome animal groups that includes the vertebrates, including man. The Chengjiang region has yielded, relatively, a considerable number and variety of fossil deuterostomes, and can lay claim to have provided the most significant insights into very early chordate and vertebrate evolution. There is some uncertainty regarding the exact affinity and placement of some of these species on the early deuterostome lineage. However, it is uncontested that the earliest true vertebrates in the fossil record, jawless fish, occur in the Chengjang Biota.

Myllokunmingia fengjiaoa **Shu, Zhang & Han 1999**

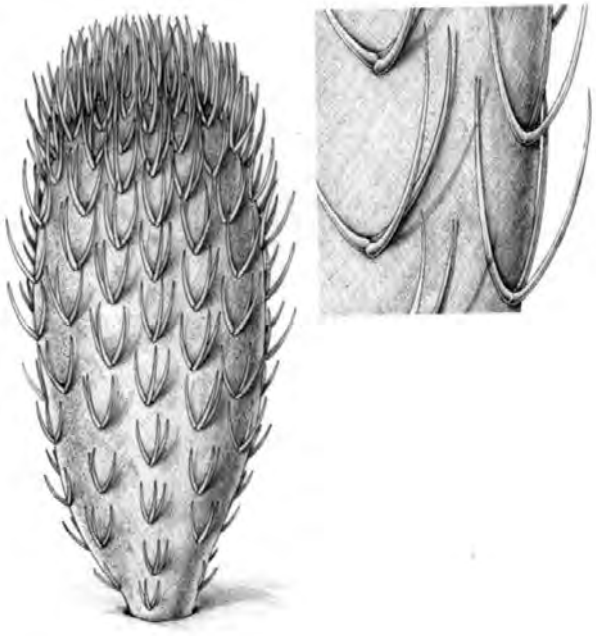


M. fengjiaoa is one of three jawless fish genera to have been identified from the Chengjiang Lagersätte. Over 500 specimens, typically some 25- 30 mm long, are now known. A distinct dorsal fin with ray-like supports, and a single or possibly paired narrower ventral fin are present. Traces of the gut and a putative anus have been identified. Anteriorly there is a set of six or seven gill pouches containing gill filaments. Muscle blocks are evident along the trunk, and also supposed gonads (at least 24) near the ventral margin. Arched structures, interpreted as notchord supports, extend from behind the head for over half the body length. A pericardial cavity may be present behind the gills. Eyes, other possible sensory structures, and cartlidges have been recognized in the head region.

● Uncertain systematic position

In addition to the species belonging to the 16 phyla mentioned above, there are at least 30 others in the Chengjiang Lagersätte the high-level systematic position of each of which is uncertain. The morphology or the body plan of these animals may be atypical with respect to known phyla, and possibly combine features characteristic of more than a single phylum. These enigmatic animals are peculiar to the Cambrian explosion event time interval. Further study of them, and/or the discovery of additional material, may shed light on their systematic position, and also lead to a better understanding of the origin and early evolution of the metazoans. Most of the enigmatic groups are relatively rare elements of the Chengjiang Biota, with the exception of the yunnanozoans, of which nearly 1000 specimens have been collected.

Allonnia phrixothrix **Bengtson & Hou, 2001**

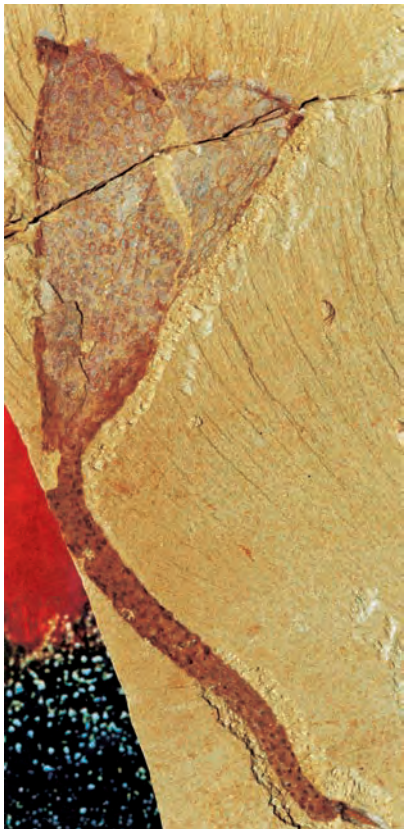


Several complete specimens of these chancelloriids are known from the Chengjiang biota. Individuals display a sac-like body up to 40 mm or more in length, with a flexible integument covered with spiny, tri-radiate sclerites. The sclerite wall was probably originally calcareous. The rays (spicules) of each sclerite are about 8 mm long. Two of the rays are positioned close to the body surface, with the third directed outwards; all rays point towards the end of the body in which a small opening is inferred. Chancelloriids look like sponges, but their sclerites attach outside the integument and each ray has a hollow core, unlike members of Porifera. Hollow rays also occur in halkieriid molluscs, but they show bilateral symmetry, while chancelloriids have radial symmetry. The similarity of sclerite form of chancelloriids and halkeriids may indicate that they are closely related, or alternatively it may simply reflect convergent evolution. Chancelloriids may have been suspension feeders, or possibly they were symbiotic with algae or bacteria.

Rotadiscus grandis **Sun & Hou, 1987**

R. grandis is known from several tens of species. Specimens display a discoidal body with little relief and 150 mm or more in diameter. The dorsal surface shows concentric lines and distinct radiating strands. The ventral surface exhibits numerous paired radial structures. A U-shaped or coiled structure surrounds the disc centre at about two-thirds the distance from the margin. This is considered to be the gut, with oral and anal ends close together. There are about 13 pairs of tentacular structures surrounding the mouth. *R. grandis* is one of two eldoniid species from the Chengjiang Lagerstätte; they represent the earliest record of this enigmatic animal group. Medusoid (jellyfish), holothurian (sea cucumber) and lophophorate (and thus brachiopod and bryozoan) affinities have all been proposed for eldoniids. In 2010 they were placed in a group informally identified as cambroernids, and tentatively regarded as primitive deuterostomes.

Cotyledion tylodes **Luo & Hu, 1999**



About a hundred specimens have been collected of this Chengjiang species. The body can be divided into three parts: a cup-shaped to conical calyx with a central cavity with a tentaculate upper opening; a slightly tapering, transversely conical to cylindrical stalk; and a distal holdfast characterized by a massive, knobbly structure. The body wall is thick and embeds rounded to elliptical/ flat plates that may be mineralized. The stalk is also plated, but more densely so. Specimens are usually attached to skeletal organisms such as trilobites.

Yunnanozoon lividum **Hou, Ramsköld & Bergström 1991**

Material of *Y. lividum* is abundant. Its body is typically 25-40 mm long. The dorsal part is divided into 24 segments that have been regarded by some as muscle blocks. An anterior opening is considered to be the mouth. Anteriorly located semicircular structures composed of small discs that support short spines have been interpreted bysome as branchial arches. Subcircular structures, putatively interpreted as gonads, occur ventrally. The gut is spiral in form. *Yunnanozoon*, an exclusively Chengjiang Lagerstätte animal, has been claimed as worm-like of unknown affinity, as a primitive deuterostome, as an ally of the enteropneust (acorn worm) hemichordates, and as a chordate. Ecologically, it is similarly enigmatic.

Vetulicola cuneata **Hou, 1987**

V. cuneata is a fairly common Chengjiang species. Like other vetulicolians it lacks eyes or appendages. Its large anterior body, which comprises six segmental rings, is 'closed' apart from a presumed mouth, and four or five putative gill pouches housing filamentous gills. Small, fin-like, marginal projections are variously present. The long posterior body comprises seven segments and a terminall tail unit. The gut spirals in the anterior part of the posterior body, but is straight elsewhere. Ten vetulicolian species belonging to seven genera have been recorded from the Chengjiang Lagerstätte, making it the richest fossil horizon for the group. Vetulicolians have been considered to represent unusual arthropods (possibly close to kinorhynchs), or primitive deuterostomes, or close relatives of the tunicate (urochordate) deuterostomes. *Vetulicola* could probably swim; both deposit and filter feeding have been suggested for it.

2.a-4 Biology and ecology

- Biogeographical zone (Province)

According to Udvardy's (1975) biogeographical system, the Nominated Property occurs within the Palaearctic Realm, Szechwan Highlands Province (2.39.12). The floral type of this biogeographical province is a mixed mountain and highland system with complex zonation.

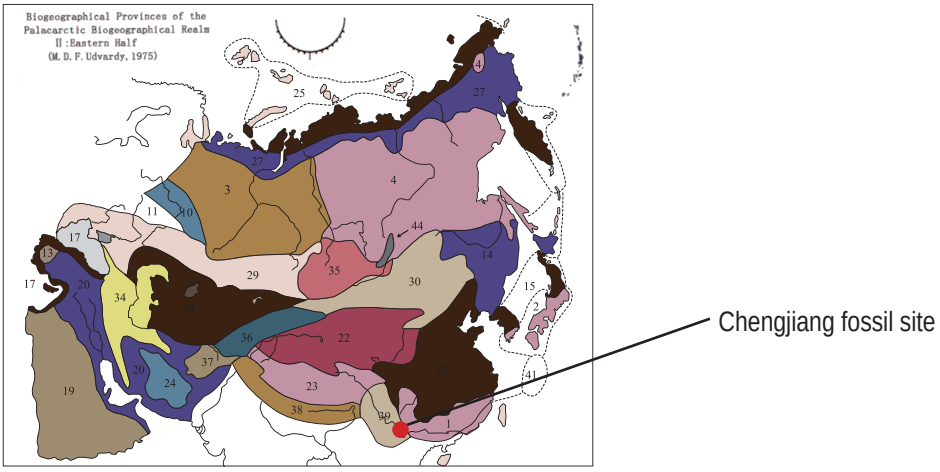


Fig. 2-14 Biogeographical provinces (Udvardy 1975) showing the position of the Chengjiang Fossil Site

- Plants

Before being officially protected (1987), the nominated site was used for traditional human activities, and most of the original vegetation was lost. The present vegetation is dominated by warm coniferous forest (either naturally recovered or planted), including Yunnan pine, armand pine, *Evelynia keteleevia*, *Anus nepalensis*, *Dodonaea viscose*, shrubs, chestnut plantation, cypress and eucalyptus.

Currently there is a total of 522 vascular plant species belonging to 389 genera and 124 families, of which 171 species and 128 genera are non-indigenous. The overall flora comprises 20 pteridophyte species (16 genera, 12 families), 6 gymnosperm species (5 genera, 3 families) and 486 angiosperm species (357 genera, 109 families).

Some of these species are nationally protected; for example, *Ranunculus sceleratua*, *Camellia reticulate, Dichotomanhyus tristaniaecarpa*. There are also some provincially protected species such as *Pistacia weinmannifolia, Michelia yunnanensis* and *Taxicodenda rongriffithii.*

Within the nominated site and surrounding area there are some remnant indigenous forest elements such as semi-humid evergreen broad-leaved species; for example, *Castanopsis orthacantha, Castanopsis delayvayi, Cyclobalanopsis glaucoides, Lithocarpus dealbatus, Olea yunnanensis* and *Evelynia keteleevia.*

Yunnan pine and armand pine not only dominate the nominated site but are also widely distributed in southwest China. The lower tier shrubs contain some endemic species that are important in the retoration of natural vegetation cover.

- Fauna

The fauna mainly comprises birds, reptiles and insects; for example, *Ciconia nigra, Platalea leucorodia, Aix galericulata, Anser indicus, Grus grus, Accipiter nisus, Chrysolophus amherstiae, Psilopsiagon aurifrons, Emberiza cia, Passer montanus, Prinia* spp.*, Manis pentadactyla, Trimeresurus stejnegeri yunnanensis* and *Dinodon septentrionale.*

2.a-5 Human activities

The nominated site is located in hilly country north of Fuxian Lake; there are no villages. There are many long established villages in the surrounding area: Zhedishao, Fengkoushao, Sanjiacun, Xiaolantian, Ganhaizi, Luoxishao, Dongxishao, Luolishan, XIncun, Zhebaicun, Xiaotuanpo, Dapotou and Gongjiachong. The total population of these villages is about 7,000, with a density of 60 persons/ km^2. Most are Han people, others are ethnic minorities such as Yi and Miao.

Agriculture activities of the villagers are mostly farming and herding: growing maize, potatoes, wheat, as well as raising sheep, cattle, pigs and fowl. Domestic fuels are electricity, biogas and firewood.

The earliest recorded geological study of the Chengjiang area dates to 1909/1910 by the French scientists J. Deprat and H. Mansuy, who conducted a detailed geological and palaeontological survey (Mansuy 1912).

Since 1938, phosphate mineral prospecting and exploration has been undertaken around the Fuxian Lake area. From the 1980s until 20004 the abundant phosphate resource around Maotianshan was also mined. Currently the land use structure of the nominated area is: forest land (55%), grassland slope (36%), cropland (15%) and restored mining sites (4%).

2.b History and development

2.b-1 Geological and palaeontological history

The Earth is about 4.6 billion years old. The oldest rocks are up to 4 billion years in age, and the record of life, perhaps, goes back nearly as far in time. Possible microfossils that resemble cyanobacteria occur in rocks about 3.5 billion years old, and there is geochemical evidence of organic fractionation processes occurring as long ago as 3.86 billion years. Fossils of more complex micro-organisms suggest that eukaryotes had appeared by about 2 billion years ago. Geochemical evidence suggests that oxygen had begun to form part of the armosphere at about the same time.

It was not until the late Precambrian, 600 - 570Ma ago, that eumetazoans appeared, These first multicellular fossils belong to the Ediacaran Biota and record an important biological radiation, but their evolutionary potential was limited (Seilacher,1989). During the early Cambrian (543 million years ago), oxygen in the atmosphere increased, while CO_2 decreased, and, at the same time, the remarkable diversification of animal life known as the Cambrian explosion began. The initial stages of this radiation are recognized in the appearance and diversification of various skeletonised animals, but from the exceptional preservation shown by the Chengjiang Biota it is evident that there was also a major diversification of soft-bodied animals.

The Jinning Orogeny, about 800 million years ago, generated the basement in south China, uplifting the crust and creating a landmass of varied topography. Additional deformation was caused by the subsequent

Chengjiang Orogeny. The rock record of the nominated area contains evidence of the local effects of the global ice age some 700 million years ago (the Sinian or Nantuo ice age). During the period 700-540 million years ago, the Chengjiang area experienced repeated crustal upheavals and long term erosion, finally being flooded by a shallow sea in which thick carbonate rock containing abundant small shelly animal fossils were deposited. 530 million years ago, the Chengjiang area was situated in a shallow gulf at a latitude of 11°S. With plenty of sunlight, sufficient oxygen and organic material, especially the flourishing algae, the conditions were perfect for the proliferation of consumers.

The Chengjiang fossils occur in laminated beds of the Yu'anshan Member. Bed thickness ranges from 1 cm to 3 cm and bedding planes are clear. The lower part of each bed is silty and the upper part muddy, characteristic of micro-turbidity deposition. Within these sediments, the animals were quickly buried, without decay or subsequent disturbance Soft tissues of the Chengjiang fossils have been preserved through replacement by pyrite in the early stages of decay; some tissues are also preserved as carbon films (Gabbott *et al*., 2004).

From the Cambrian to the late Permian (540-250 Ma), the Chengjiang area experienced several depositional episodes, resulting in the accumulation of a total of about 1,500 m of sedimentary rocks. Orogenic activity at the end of the Palaeozoic Era closed the ancient Tethys Ocean and ended the marine history of the Chengjiang region. Intracontinental volcanic activity at the end of the Permian Period also affected this area and a major regional fault, the Xiaojiang fault, became active and the fault-bounded syncline of Maotianshan started to take shape.

From 250 million years to 4 million years before present (early Triassic to late Neogene), the area experienced intermittent uplift, with Palaeozoic rocks being continually exposed and eroded. Topography levelled off and top soil developed to cover the underlying rock. More uplift occurred 3-4 million years ago, related to Himalayan mountain building and the area became a plateau, Fault-graben activity intensified, resulting in the development of a central basin in which water concentrated, beginning the formation of Fuxian Lake.

About 12,000 years ago (early Holocene), Fuxian Lake reached its maximum size ('big lake period'), exceeding 350 km^2 in area with a water surface 30 to 40 m higher than at present. The northern end of the lake extended to the north of Chengjiang County and spread to the southern foot of Maotianshan. In the middle of the Holocene, about 5,000 years ago, movement on the Xiaojiang fault intensified, accompanied by frequent earthquakes, creating increased relative relief and deepening Fuxian Lake.

About 3,000 years ago (late Holocene), human beings began to occupy the broadened northern bank of Fuxian Lake, living by fishing, hunting, breeding and deforestation. As a result, the primary thick semi-humid evergreen broad-leaved forest gradually disappeared, exposing the lower Cambrian strata.

2.b-2 History of human occupation

Yunnan boasts the earliest records of human occupation in China; the Chengjiang Fossil Site is just 300km away from the site of Yuanmou Man, the earliest human fossils in Yunnan. In the area around Chengjiang, counties such as Chenggong, Yiliang and Shilin contain evidence of human activitiy during the Paleolithic period, reachng back some 30,000 -100,000 years in history.

Chengjiang County is also rich in human history; there have been several Neolithic archeological discoveries in the area. From about the 12th century B.C. people started to inhabit this area in large numbers. The administrative regime began in the Warring States Period of Chinese history when Zhuang Qiao, an official

general of the Chu Kingdom, entered Yunnan with his army and took Chengjiang under his governance. In 106 B.C, during the West Han dynasty, the area became an administrative county with the name of Yuyuan County; it was not until 1913 that the county was renamed Chengjiang County.

Chengjiang County is multicultural, with ethnic groups including Han, Hui, Yi and Miao. People of the indigenous ethnic minority, Yi, are the descendents of the ancient Bo man, with an ancestry traceable through the Diqiang, Shou, Cuan men, Wuman and Luoluo people. The Yi, together with other ethnic minorities, developed a lakeshore culture. Subsequently, from the Qin dynasty (300 BC), an inland plain culture, known as the Han culture today, was developed. An Islamic culture entered in 1250 during the Yuan dynasty, and the Miao ethnic culture joined the ethnic mix after the 17th century, during the Qing dynasty.

The Chengjiang area enjoys a mild and pleasant climate, with bright sunshine and fertile soil. The earliest productive activities included fishing, hunting, animal breeding and farming. In places where the land is comparatively flat, the main crops are rice, broad beans, and potatoes. In hilly areas the products are mainly maize, potatoes and wheat. In the 1940s, tobacco was introduced to add a cash crop, allowing the locals to increase their income. The local fisherman have developed unique fishing techniques: the “fish hole catching” and “vanilla catching” methods.

Manual mills used to be the main local industry. Coal mining started in 1910 and phosphate mining in 1938, flourishing till the 1980s. Tourism has gradually risen in importance from the early 1990s. Today, the concept of ecological and sustainable development has been integrated into the agriculture, fishery, and mining and tourism industries.

Over time, the local people have raised their awareness of the importance of environment protection, including the protection of the forest and of Fuxian Lake. The discovery of the Chengjiang fossils at Maotianshan in 1984 not only increased the local people’s sense of pride but also enhanced their awareness of the need for geological heritage protection.

2.b-3 History of Geological Studies in the Chengjiang Area

● Early Geological Studies and the Discovery of the Chengjiang Lagerstätte

The Chengjiang Lagerstätte was discovered by Hou Xian-guang in 1984 and is now known from many localities of the Yu’anshan Member, Qiongzhusi (Heilinpu) Formation, over a wide area of eastern Yunnan Province. The first soft-bodied fossils to be found were from Maotianshan, about 6km east of the county town of Chengjiang. The Kunming-Chengjiang area of Yunnan Province is one of the best-known geological areas of China. From the pioneer days of geological exploration in China it had been appreciated that the Lower Cambrian of eastern Yunnan Province is richly fossiliferous. As early as the first decade of the twentieth century the Frenchmen Honore Lantenois (1907), Jaques Deprat (1912), and Henri Mansuy (1907, 1912) studied the geology and palaeontology of the region, resulting in publications that featured new fossils including trilobites and other arthropods. As part of mapping and other general geological survey work, the Lower Cambrian in this area was also extensively studied in the 1930s and 1940s (see Babcock & Zhang 2001, Hou *et al.* 2002). Indeed, the sequence has long been taken as a standard for the stratigraphic subdivision and correlation of the Cambrian, not only within the Southwest China (Yangtze) Platform but also throughout China and beyond.

Fig. 2-15 French geologists conducting research in the Chengjiang area in 1909

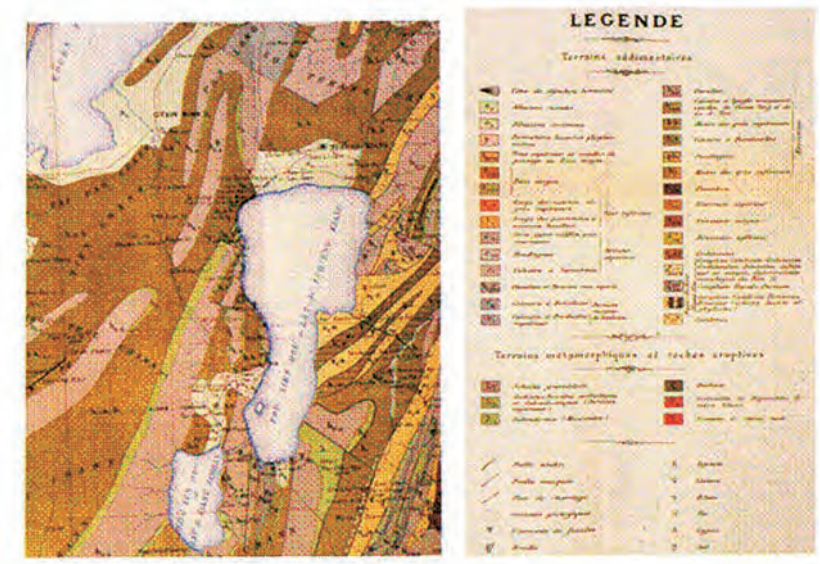


Fig. 2-16 The geology of the Chengjiang area (Deprat 1912)

In June 1984 Hou Xian-guang, then a member of the Nanjing Institute of Geology and Palaeontology of the Chinese Academy of Sciences, arrived in Kunming City to begin his second stint of fieldwork for his research on bradoriid arthropods (Hou *et al.* 2002). Already in 1980 he had systematically collected bradoriids at the Qiongzhusi section in Kunming City and from Sichuan Province. That the Kunming-Chengjiang area is especially rich in bradoriids was elucidated much earlier, by Professor Yang Zui-yi, during the 1930s. As a consequence of hostilities within China, Yang's Department of Geology at Zhongshan University had moved from Guangzhou City in Guangdong Province to the village of Donglongtan, situated about 55km southeast of Kunming and a mere 1.5km west of Maotianshan. Following fieldwork in Jinning County southwest of Kunming, Hou Xian-guang had travelled to Chengjiang town and then on by cart to the nearby small village of Dapotou, where a team from the Geological Bureau of Yunnan Province was living, prospecting for phosphorite deposits in the lower Cambrian. After reviewing the Qiongzhusi Formation at several nearby localities, systematic collection of bradoriids from near Hongjiachong village was undertaken with the help of a hired farm worker, but the sequence was demonstrably incomplete and a section on the west slope of Maotianshan was finally selected for detailed study.

The mudstone blocks that the farm worker dug out at Maotianshan were scoured for bradoriids. Work was notably easier than at Dapotou and Hongjiachong, because the rock was strongly weathered. At about three o'clock in the afternoon of Sunday July 1, a semicircular white film was discovered in a split slab, and was mistakenly thought to represent the valve of an unknown crustacean. With the realization that this and a second, subelliptical exoskeleton represented a previously unreported species, breaking of the rock in a search for additional fossils continued apace. With the find of another specimen, a 4-5 cm long animal with limbs preserved, it became apparent that here was nothing less than a softbodied biota. As recalled by Hou Xian-guang, the specimen with appendages (subsequently selected as the holotype of the arthropod *Naraoia longicaudata)* appeared as if it was alive on the wet surface of the mudstone. Elated by the discovery, the searchers increased their efforts and other new soft-bodied fossils were revealed one after another. Work on the section did not end until dark. Hou's field diary for that day signaled the significance of his discovery by alluding to the Burgess Shale fauna: "The discovery of fossils in the Phyllopod Bed".

Fig. 2-19 The Chengjiang Fossil Site: Maotianshan hill

Mr. Hou Xianguang at Maotianshan in 1984

Fig. 2-17 Hou Xian-guang, the discoverer of the Chengjiang Biota, at the discovery site

Fig. 2-18 The first discovered soft-bodied fossil of the Chengjiang Biota: *Naraoia longicaudata*

Members of the Geological Bureau team continued to provide Hou Xian-guang with valuable assistance in the field, not least by blasting the trackside exposures of the west slope of Maotianshan. Soft-bodied and other fossils were then collected on a large scale from three broad stratigraphic levels that were designated M2 (oldest), M3 and M4 (youngest) respectively. These terms were subsequently applied to three small quarries that were opened up for collecting. The three levels correspond to at least ten beds (Hou 1987), but in fact it is almost impossible to determine exactly how many beds of the blocky mudstone bear soft-bodied fossils. The mudstone of level M2 is 5 m thick and yields many species of the Chengjiang fauna; in general the number of taxa and specimens successively decreases through levels M3 and M4.

Hou Xian-guang also undertook a systematic search for bradoriids at several other sections in Yunnan Province, for example at Meishucun in Jinning County, Sapushan (Sapu Hill) and Shishan (Shi Hill) in Wuding County, and Kebaocun in Yiliang County, as well as at Hongjiachong and Dapotou in Chengjiang County. In addition to bradoriids, these sections yielded specimens of soft-bodied and lightly sclerotized and mineralized animals such as worms *(Cricocosmia),* large bivalved arthropods (e.g. *Isoxys),* a brachiopod *(Heliomedusa),* and an isolated sclerite of a lobopodian *(Microdictyori),* more specimens of which were subsequently obtained from Meishucun in 1986 (Hou & Sun 1988). These 10 weeks of fieldwork, ending on August 17, 1984, had

Fig. 2-20 Hou Xianguang and his colleagues excavate fossils at Maoatianshan

demonstrated that fossils with soft-part preservation are widely distributed in eastern Yunnan Province, and that in order to obtain reasonable numbers of specimens it is necessary to split large amounts of rock. Letters sent by Hou from the field, in 1984, informed the directors and others at his institute in Nanjing about the collection of abundant, well-preserved bradoriid specimens (in part treated in Hou 1987), his finds of the oldest trilobites at Chengjiang, Wuding and Jinning (some material reported by Zhang 1987) and other trilobites from Maotianshan (Zhang 1987), and the discovery and collection of many fossils with preserved soft parts (e.g. Zhang & Hou 1985, Hou 1987 papers, Sun & Hou 1987 papers).

Hou Xian-guang's subsequent fieldwork in the Chengjiang area was specifically aimed at collecting fossils with soft-part preservation. By the time of his next visit, from April to June 1985, logistics had changed. The team from the Geological Bureau of Yunnan Province resident in Dapotou village had new leaders; the

ground on both sides of the cart road leading from Dapotou to Maotianshan had been cleared to provide better access to two new phosphorite factories; and a drilling group of the Geological Bureau of Yunnan Province was living at the foot of Maotianshan and offered generous assistance, especially in providing provisions in the field.

With the support of the directors of the Nanjing Institute of Geology and Palaeontology, a third field season was undertaken throughout October to December 1985. For part of this period Hou Xian-guang was joined by Chen Luan-sheng, the custodian of fossils at the museum in the Nanjing Institute. From April to September 1987, further large-scale collecting took place, again supported by Academia Sinica, when work was concentrated mainly at Maotianshan and Jianbaobaoshan near Dapotou village. Hou's colleagues, Chen Jun-yuan, Zhou Gui-qing and Zhang Jun-ming, joined the field group at that time but they left in early May and June respectively for other duties. Additional collections were made by Hou Xian-guang in November 1989 and April-May 1990, especially from new sections such as those at nearby Fengkoushao, Xiaolantian and Ma'anshan.

The initial phase of collecting and describing the Chengjiang biota ended when Hou Xianguang left China for a lengthy period of research cooperation with Swedish scientists at the Natural History Museum in Stockholm, endeavours that resulted in papers on a wide range of Chengjiang animals (see Hou & Bergstrom 1997 and references therein). Subsequent to the early phase of study, Chengjiang fossils also engaged the attention of many Chinese and other palaeontologists worldwide, generating numerous research publications. In particular, Chen Jun-yuan (Nanjing Institute of Geology and Palaeontology) and Shu De-gan (North-west University, Xian) and other Chinese scientists and their collaborators have made considerable additions to the literature on the biota. The biota is documented in many scientific books, monographs and hundreds of papers (see 7.3 Bibliography), which have transformed our view and understanding of the early evolution of life.

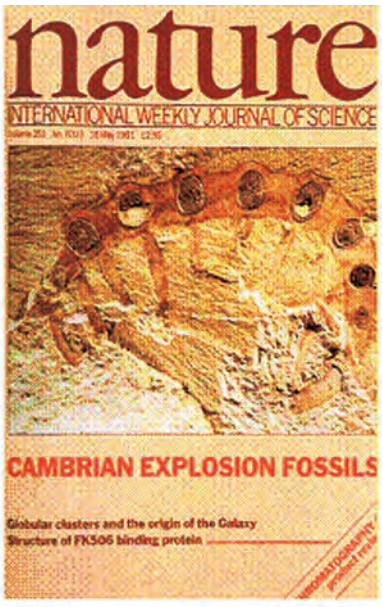


Fig. 2-21 A Chengjiang fossil on the front cover of the Journal *Nature*

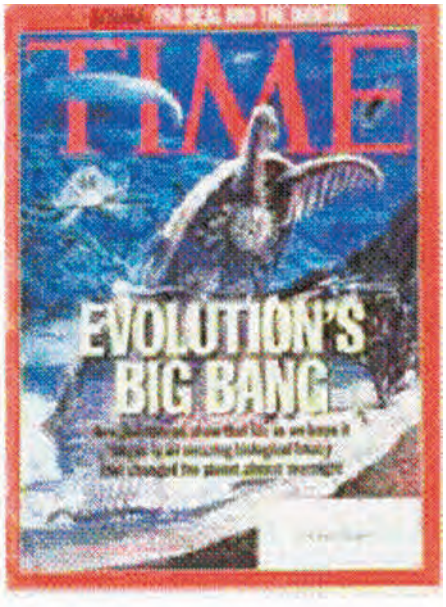


Fig. 2-22 Chengjiang fossils on the front cover of *TIME* magazine

- Protection of the Chengjiang Fossil Site and its fossils

1. On May 7, 1987 the County Government introduced “Interim Regulations for the Protection of the

Chengjiang Invertebrate Fauna" and also established a Management Group for the Protection of the Chengjiang Fauna. The County Government Office, the Science Committee, Cultural Bureau, Environment Protection Bureau and the Public Security Bureau were empowered to undertake the protection and management work.

2. On May 7, 1987 the "Short Term Implementation of Protection for the Chengjiang Fauna" was introduced, specifying the protection measures.

3. On January 1, 1988 the Chengjiang Fauna Exhibition Hall was officially opened in order to publicize the important scientific value and significance of Chengjiang fossils. Their protection was identified as a top priority.

4. On June 12, 1997 Yunnan Provincial Government officially approved the establishment of the "Chengjiang Fauna Provincial Nature Reserve".

5. On December 25, 1997 Yunnan Provincial Government introduced Order 51 to approve and make known "Yunnan Provincial Regulations on the Protection of the Chengjiang Fauna".

6. In March 2001 the Ministry of Land Resource approved the establishment of the "Chengjiang Fauna National Geopark".

Through the efforts of local and provincial governments in establishing relevant laws and regulations the Chengjiang fossil site and its fossils and fossil-bearing strata are now protected, effectively managed and publicized by a range of environmental rehabilitation measures, various management bodies, public education and scientific research.


a
c

3. Justification for inscription

3.a Criteria under which inscription is proposed

The Chengjiang Fossil Site is nominated under Criterion (viii):

> *Criterion (viii): be outstanding examples representing major stages of earth's history,* ***including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features.***

The nominated Chengjiang Fossil Site is a more than outstanding example of a major stage in the history of life on Earth. Of the three really major events in the evolutionary history of life on our planet – the origin of life, the Cambrian explosion and the end-Permian extinction event, the Chengjiang fossil Lagerstätte represents an unparalleled record of the fundamentally important rapid diversification of metazoan life in the early Cambrian ('the Cambrian explosion') and of the primary establishment of a complex marine ecosystem.
The major aspects of its importance are:

- It provides direct evidence for the roots of animal biodiversity.
- It presents by far the most complete record of an early Cambrian marine community.
- It contains a prolific and exceptionally preserved biota, displaying the anatomy of hard and soft tissues of a very wide variety of organisms, invertebrate and vertebrate, in exquisite detail.
- Its fossils bear upon fundamental questions regarding the design of animal body plans and the genetic generation of evolutionary novelty.
- It records the early establishment of a complex marine ecosystem, with food webs capped by sophisticated predators.
- The mode of preservation imparts a particular and rare beauty to the fossils, extending their value from the scientific to the aesthetic.

3.b Proposed Statement of Outstanding Universal Value

The Chengjiang fossil Lagerstätte preserves a marine community that developed shortly after the dawn of complex animal life. The truly exceptional preservation means that the soft and hard tissues of skeletonized animals are preserved along with a wide array of organisms that were entirely soft bodied, and therefore normally unrepresented in the fossil record. Through this, the biota provides by far the best evidence available for the origins and early evolution of the main animal groups, invertebrate and vertebrate, and for their evolutionary and ecological inter-relationships. Under the terms of criterion (viii) - *outstanding examples representing major stages of Earth's history, including the record of life,* - it is an outstanding example of a major stage in the history of life: it provides a unique and remarkable record of the development of the Cambrian explosion, a geologically short interval during which almost all major groups of animals had their origins.

- It provides direct evidence for the roots of animal biodiversity

  The Chengjiang fossil Lagerstätte contains early representatives of several major phylogenetic

lineages. The earliest known specimens of several phyla, for example cnidarians, ctenophores, sipunculans, priapulids, echinoderms and chordates occur here. Many of the taxa represent the stem groups to extant phyla (e.g. the anomalocaridids are regarded as stem group arthropods; at least some of the lobopodians appear to be stem group onychophorans) and throw light on the pattern of acquisition of the characters that differentiate crown groups. Additionally, many enigmatic taxa (e.g. vetulicolians, yunnanozoons, eldoniids) have affinities that are currently under debate, but have the potential to provide critical information on the nature of stem groups to many major clades (including those above

Fig. 3-1 An ecological reconstruction of the Chengjiang Biota, designed by Prof. Jan Bergstrom and drawn by Mr. Lennart Alex Andersson

Fig. 3-2 An artistic impression of the Chengjiang Biota, by Mr. Ma Xiang

phylum level) and the inter-relationships between phyla. This evidence can only be gained from the fossil record, and the Chengjiang biota is of prime importance in preserving diverse soft-bodied taxa at a key point in early animal evolution.

- It presents by far the most complete record of an early Cambrian marine community

  The remarkable diversity of the Chengjiang biota documented to date encompasses at least 16 phyla, plus a variety of enigmatic groups, and about 200 species. The community preserved (see Section 2.a) includes algae, a wide range of skeletonized and soft-bodied invertebrate phyla and the earliest known vertebrates (e.g. *Myllokunmingia*). The standard of preservation suggests that little, if anything, of the original living macrobiota has not been preserved. Thus, the preserved biota closely reflects the original living community and enables palaeoecological investigation of a very early marine ecosystem. No other known site provides an equivalent window into the structure of early Cambrian communities.

- **It contains a prolific and exceptionally preserved biota, displaying the anatomy of hard and soft tissues of a very wide variety of organisms, invertebrate and vertebrate, in exquisite detail**

  Evidence for the diversity of the biota and the quality of preservation is illustrated in Section 2.a. The quality and fidelity of preservation can be seen, for example, in the morphology of the proboscis and gut in nematomorph and priapulid worms such as *Cricocosmia* and *Protopriapulites*, the details of appendages in arthropods such as the bradoriid *Kunmingella*, the complex alimentary system in the arthropod *Naraoia*, and the delicacy of the gills in the enigmatic *Yunnanozoon*. The vertebrates, such as *Myllokunmingia*, preserve gills, serial structures interpreted as myomeres and gonads, and structures within the head. This quality of preservation enables us to investigate the anatomy of early animals on the basis of unrivalled evidence, and well over 200 papers and books have already been written, many in high-impact journals, to document the biota (see Bibliography).

- **Its fossils bear upon fundamental questions regarding the design of animal body plans and the** genetic generation of evolutionary novelty

  The fossils preserved at Chengjiang represent a wide variety of animal phyla and higher groups and include stem taxa to many major clades. They preserve evidence of the early radiation of metazoan body plans, and record the evolution of the anatomic features that characterize the phyla. Current evolutionary developmental research on extant animals is identifying the genetic basis for the development of various organ systems and recognising deep homologies that relate to the acquisition of major body features (e.g. segmentation, eyes) in separate groups. By combining the genetic evidence for developmental pathways with the evidence from the anatomy and phylogeny of actual fossils of early animals, scientists can begin to investigate the pattern and process of the origins of animal body plans. This integration of palaeontological and molecular evidence has, for example, been used to investigate arthropod phylogeny, incorporating evidence from Chengjiang fossils. It is also currently being used to inform the interpretation of some enigmatic Chengjiang fossils, including the vetulicolians and yunnanozoons.

- It records the early establishment of a complex marine ecosystem, with food webs capped by sophisticated predators

The Chengjiang Lagerstätte is the earliest record of a complex marine ecosystem. Moreover, it demonstrates that complex community structures had developed very early in the Cambrian diversification of animal life. There is evidence in the Chengjiang biota for the occupation of a wide range of ecological niches (e.g. Vannier 2007): pelagic (e.g. ctenophores), nektonic/nektobenthic (e.g. some arthropods, vertebrates, vetulicolians), epibenthic vagile (e.g. many arthropods, lobopodians, hyoliths), epibenthic sessile (e.g. sponges, the cnidarian *Xianguangia*, the chancelloriid *Allonia*), infaunal (e.g. priapulids, sipunculans, some linguliform brachiopods), and possible meiofaunal (e.g. the arthropod *Kunmingella*). Feeding strategies represented include probable planktonic and nektonic consumers (e.g. ctenophores, eldoniids, some arthropods, vetulicolians, vertebrates), suspension feeders (e.g. sponges), detritovores and scavengers (e.g. sipunculans, some arthropods, hyoliths), and carnivores (e.g. priapulids, anomalocaridids). The range of ecological strategies represented indicates the development of a sophisticated marine community with integrated food webs.

- The mode of preservation imparts a particular and rare beauty to the fossils, extending their **value from the scientific to the aesthetic**

  The quality and beauty of the fossils, preserved in red iron oxides and black carbon traces on a yellow shale background, has led to them being widely used as illustrations on the covers of palaeontological, evolutionary and general scientific journals, including the high-profile *Nature* and *Science*.

3.c Comparative analysis

The Chengjiang site is compared here with other non-hominid palaeontological sites that are already inscribed. Particular comparison is made with the Burgess Shale, which is also of Cambrian age (middle Cambrian rather than lower Cambrian) and contains exceptionally preserved fossils. The site is also compared with other significant Cambrian sites, both in terms of their palaeontological importance and their state of conservation, where known. Finally, comparison is made with sites on tentative World Heritage lists, and the potential for integration of the Chengjiang site with existing and tentative World Heritage sites to record the events of the Cambrian explosion is assessed.

3.c-1 Comparison with inscribed World Heritage fossil sites

Table 3-1: Non-hominid palaeontological sites on the World Heritage List

Name of property	Date of inscription	Criteria met	Geological period	Importance	Photo
Australian Fossil Mammal Sites (Riversleigh/ Naracoorte) (Australia)	1994	(viii), (ix)	Oligocene - Miocene	Rich mammal faunas and associated mid-Tertiary environmental changes	
Messel Pit Fossil Site (Germany)	1995	(viii)	Eocene	Understanding the Eocene palaeoenvironment and providing unique data on early mammal evolution	

Wadi Al-Hitan（Whale Valley）(Egypt)	2005	(viii)	Eocene	Whale fossils, their evolution, and their land to marine transition	
Dinosaur Provincial Park (Canada)	1979	(vii), (viii)	Cretaceous	Rich, diverse dinosaur fauna, including many complete specimens; also exceptional riparian features	
Dorset and East Devon Coast (UK)	2001	(viii)	Triassic, Jurassic, Cretaceous	Continuous sequence of mainly Jurassic rocks covering 185 million years of Earth history; associated fossil sites and coastal geomorphological features	
Ischigualasto-Talampaya Natural Parks (Argentina)	2000	(viii)	Triassic	Most complete Triassic continental fossil record, with mammals, dinosaurs and plants, and associated palaeoenvironments	
Monte San Giorgio (Switzerland/Italy)	2003/2010	(viii)	Triassic	Marine and land, reptiles, fish, numerous invertebrates, including soft-bodied preservation	
Grand Canyon National Park (USA)	1979	(vii),(viii) (ix), (x)	Permian	One of Earth's greatest geological spectacles; exceptional natural beauty and scenery; strata from Precambrian to Pleistocene; 5 faunal and floral life zones based on elevation; ecological refuge for dwindling ecosystems	
Joggins Fossils Cliffs (Canada)	2008	(viii)	Carboniferous	Wealth of Carboniferous fossils and associated palaeoenvironments; most complete record of Pennsylvanian terrestrial life and ecosystems	
Mammoth Cave National Park (USA)	1981	(vii),(viii) (ix), (x)	Carboniferous	World's longest network of natural caves, underground passageways and karst features; contains richest cave-dwelling wildlife known – over 130 species	

Miguasha National Park (Canada)	1999	(viii)	Devonian	Fish faunas, especially lobe-finned fishes, precursors of the first air- breathing terrestrial vertebrates – the tetrapods	
Burgess Shale (Canadian Rocky Mountain Parks) (Canada)	1980/ 1984/ 1990	(vii),(viii)	Cambrian	Middle Cambrian invertebrate community showing exceptional soft-bodied preservation	

3.c-1-1 Comparison with the Burgess Shale

The Burgess Shale is the most closely comparable site on the current World Heritage list to the Chengjiang fossil Lagerstätte. Because they are close in age (lower Cambrian and middle Cambrian) and because both contain exceptionally preserved fossils, specially detailed comparisons are presented below to demonstrate the importance of both sites and to emphasise the fundamentally different and essential record provided by the Chengjiang fossil Lagerstätte.

Table 3-2: Comparison of Chengjiang Fossils with Burgess Shale Fossils

	Chengjiang	Burgess
Discovery	1984, by Hou Xian-guang (Geologist, then of Nanjing Institute of Palaeontology and Stratigraphy)	1909, by Charles Walcott (Scientist; Smithsonian Institution, Washington)
Location	Chengjiang County, Yunnan Province, SW China	Near Banff, Rocky Mountains, British Columbia, Canada
Geographical Extent	A core area and Buffer Zone centred on Maotianshan, 7 km east of Chengjiang, forming part of a large sedimentary basin several 1000 km^2 in extent that contains numerous other localities yielding the Chengjiang biota	Walcott Quarry and some associated, adjacent sites, now forming part of the Rocky Mountains World Heritage site
Age and rock units	lower Cambrian (Series 2): Qiongzhusian Stage, Qiongzhusi Formation, Yu'anshan Member, *Eoredlichia-Wutingaspis* Biozone	Middle Cambrian (Series 3):Stephen Formation

Palaeogeographical setting	On South China Plate, situated in tropical/subtropical latitudes, off northern edge of Gondwana (supercontinent), eastern hemisphere	On NW margin of Laurentia, subtropical latitudes, western hemisphere
Local geological setting/ depositional environment; sediments	Lower shoreface to proximally offshore; fine, yellow-weathering grey mudstones	Seawards (in front) of a submarine escarpment which represents the platform margin; fine, dark grey to black shales
Major groups present; numbers of genera, species and specimens	Algae; invertebrates and vertebrates, representing at least 16 phyla, including Porifera, Cnidaria, Ctenophora, Nematomorpha, Priapulida, Sipuncula, Lobopodia, Arthropoda, Annelida, Brachiopoda, Phoronida, Hyolitha, Mollusca, Chaetognatha, Echinodermata, Chordata (including Vertebrata), and enigmatic animals (including yunannozoons, vetulicolians (banffozoans and vetulicolids), eldoniids); some 140 genera and 200 species, most species endemic; arthropods dominate, sponges also species-rich; over 100,000 specimens	Algae; invertebrates, representing at least 13 phyla, including Porifera, Cnidaria, Ctenophora, Priapulida, Lobopodia, Arthropoda, Annelida, Brachiopoda, Hyolitha, Mollusca, Chaetognatha, Echinodermata, Chordata, and enigmatic animals (including vetulicolians (banffozoans), eldoniids); some 140 genera and 170 species; most species endemic, arthropods dominate, sponges also species-rich; over 100, 000 specimens
Palaeoecology	Muddy, level bottom community. Indicates that, at this very early stage of metazoan radiation, a complex ecosystem was already developed, with occupation of all major marine biotopes except for the deep infaunal	Muddy, level bottom community. Indicates complex ecosystem, and occupation of all major marine biotopes except for the deep infaunal
Preservation of fossils	Flattened with some relief. Exceptional, soft-part and whole soft bodied preservation. Conservation of organic carbon, with widespread pyritisation, and subsequent oxidation through intense, recent, tropical weathering	Flattened with some relief. Exceptional, soft-part and whole soft bodied preservation. Conservation of organic carbon, with clay mineral replication and replacement, and subsequent greenschist stage metamorphism

Significance	Exceptional, soft-tissue preservation of a diverse fauna of invertebrates and vertebrates. Represents the earliest evidence in the fossil record of the metazoan radiation phase of the Cambrian explosion event. Provides critical information for palaeobiological and evolutionary studies	Exceptional, soft-tissue preservation of a diverse fauna of invertebrates. Represents an early stage of the appearance of metazoans in the fossil record, in the later part of the Cambrian explosion event. Provides critical information for palaeobiological and evolutionary studies
Repositories with significant holdings of material	Key Laboratory for Palaeobiology, Yunnan University, Kunming; Chengjiang County Museum and Maotianshan Museum/Field Station, Chengjiang; Nanjing Institute of Palaeontology and Stratigraphy, Nanjing; Early Life Centre, Northwest University, Xi'an	Smithsonian Institution, Washington; Royal Ontario Museum, Toronto

The Chengjiang site represents Cambrian life some 10 million years earlier than that at the Burgess Shale site; because of the rapidity of evolutionary changes during this interval, this time difference is highly significant. The fauna at the two sites shows some differences at phylum level: all phyla found in the Burgess Shale appear to be represented in the Chengjiang biota, which also contains sipunculans, nematomorphs, phoronids, yunnanozoans, vetulicolids and (the earliest) representatives of Vertebrata. The two faunas show a very considerable difference at generic level, and an almost complete difference in terms of species. A highly important aspect of the Chengjiang biota is that it contains fossils that shed major light on the early evolution and relationships of the deuterostomes, including the vertebrates. Different minerals are involved in the preservation of the two faunas: iron pyrite is important at Chengjiang, and clays are important at Burgess, so some of the anatomical information preserved may differ. Clearly, in many ways Chengjiang better represents the diversification of life during the Cambrian explosion than the Burgess Shale. However, and critically, the two faunas complement each other in providing two different windows in time on the Cambrian explosion, and both are essential for our understanding of this benchmark episode in the history of life.

3.c-1-2 Comparison with other non-hominid palaeontological sites on the World Heritage List

Here, the Chengjiang fossil Lagerstätte is compared with sites already inscribed that have palaeontological content (see list above). Apart from the Burgess Shale, the other palaeontological sites currently on the World Heritage List do not show a similar style of exceptional preservation to that of the Chengjiang fossil Lagerstätte.

Miguasha, **Ischigualasto-Talampaya**, Dinosaur Provincial Park, **Wadi Al-Hitan**, Messel, Riversleigh/ Naracoorte: these sites relate entirely or primarily to the evolutionary history of vertebrates and thereby

have a focussed importance that is not comparable with the much more comprehensive evolutionary significance of the Chengjiang biota. The Chengiang biota, however, does contain the earliest known vertebrate fossils, and so adds fundamentally to the unfolding story of vertebrate evolutionary history recorded in these sites.

Joggins: This site is of special significance for the Carboniferous Period. Like the Chengjiang site it records a palaeocommunity at a particular time in Earth history. The site preserves a terrestrial ecosystem, not comparable in content with the early marine ecosystem represented at Chengjiang.

Mammoth Cave National Park: This site is listed on the basis of the karst and cave geomorphology and the modern fauna and flora found there. Although the Carboniferous limestone in which the caves are developed does contain fossils, these do not have any universal significance. The site is not, therefore, comparable with Chengjiang.

Grand Canyon: This is a site of spectacular geomorphology. It displays strata from Precambrian to Pleistocene in age, and although several horizons do contain fossils, these in themselves do not have universal significance. The importance of the fossils in the Grand Canyon as part of a record of the history of life is not comparable with Chengjiang.

Monte San Giorgio: This site preserves a diverse vertebrate and invertebrate Triassic community, with some soft tissue preservation. It compares with Chengjiang in recording an important palaeocommunity at a point in geological time, in this case the early Mesozoic. Chengjiang preserves an even more complete community at an even more critical time in Earth history, the time of the Cambrian explosion.

Dorset/East Devon: This site preserves palaeocommunities through a long interval of geological time, spanning 185 million years of Mesozoic geological history and incorporating multiple distinct fossil localities. Very limited soft tissue preservation may occur at a few localities within the site, but none of the communities represented is nearly as fully preserved as at Chengjiang.

In summary, many of these sites contain important records of fossil communities or of the evolution of a particular clade, although in a few the fossils are of secondary or peripheral importance. The quality and significance of the Chengjiang site is at least the equal of every one of these sites.

3.c-2 Comparison with other important Cambrian sites

Here, the Chengjiang site is compared with other Cambrian sites that are producing important fossils but are not on the World Heritage inscribed list or the tentative list.

Sirius Passet, North Greenland: the Sirius Passet fauna was discovered in the 1980s. It, too, contains exceptionally preserved lower Cambrian fossils and it has yielded some important soft-bodied taxa that add to the story presented at Chengjiang. For example, specimens of halkeriids have added significant information pertaining to the early evolution of molluscs and related groups. Lobopodians, vetulicolians and other soft-bodied animals have also been recovered, but currently the known diversity of forms is low. The site has the potential to be complementary to the Chengjiang biota, but it is of limited known extent and there is no evidence that it will produce the diversity, richness and quality of fossils found at Chengjiang. The remoteness of the Sirius Passet locality means that it is intrinsically protected, but strict controls govern all collecting in Greenland.

Orsten fossils: These fossils are obtained from nodules of late Cambrian age in Sweden, and consist

of tiny (sub-millimetre) three-dimensional specimens preserved by phosphate replacement. They are recovered from calcareous rocks by dissolution in acid. The fossils preserve soft tissues and hard parts in exquisite anatomical detail, but the recovered fauna is almost exclusively restricted to panarthropod specimens, all presumed to be sub-adult growth stages. Although of high quality and of major importance for understanding early arthropods and the evolution of the phylum, the diversity of the fauna is clearly not comparable with that from the Chengjiang site.

Other Cambrian sites: There are many more known Konservat-Lagerstätten (sites with exceptional preservation of fossils) in Cambrian strata than in the other Lower Palaeozoic systems. Some of these (e.g. the Emu Bay Shale, Australia, and the Kaili biota, Guizhou Province, China) have a high diversity of well-preserved fossils that add to our understanding of Cambrian life and its evolution, but none match the diversity and significance of animals and quality of preservation displayed in the Chengjiang or Burgess Shale faunas.

3.c-3 Comparison with other tentative World Heritage sites

There are very few sites on the tentative World Heritage lists that have been proposed principally as palaeontological sites. Of these, the principal comparator is that at Mistaken Point (Southeast Newfoundland, Canada), which preserves Ediacaran (Late Precambrian) macrofossils. This assemblage comprises a soft-bodied biota that precedes the Cambrian explosion and demonstrates the nature of life before the radiation of the extant animal phyla. The kinds of organisms and the style of preservation at this site are very different from the Chengjiang fossil Lagerstätte, but the retention of anatomical detail is sometimes remarkable. This site is clearly complementary to, rather than competitive with, the Chengjiang fossil Lagerstätte. Indeed, it is possible to envisage a series of sites, including Mistaken Point, the Chengjiang site, the Burgess Shale and, perhaps, the Orsten localities that together present a stunning record of the evolution of life before, during and after the Cambrian explosion.

Summary

In conclusion, there are no known sites that present the quality and diversity of exceptionally preserved lower Cambrian fossils exhibited by the Chengjiang fossil Lagerstätte. The importance and quality of the Chengjiang site is at least equal to all other sites already on the inscribed list, and the Chengjiang fossil Lagerstätte records a marine community at a particularly critical time in the evolution of life. Other inscribed or tentative sites that are complementary to the Chengjiang fossil Lagerstätte are the Ediacaran site at Mistaken Point, Canada, and the middle Cambrian site of the Burgess Shale, within the Canadian Rocky Mountains. Together these three extraordinary sites record the rise of metazoan animals and the changes to marine communities that took place across one of the most important episodes in life history: the Cambrian explosion.

Inset 1:

Chengjiang Fossil Site and IUCN Site Evaluation Checklist

With respect to the IUCN World Heritage Fossil Site Evaluation Checklist, the attributes of the Chengjiang fossil Lagerstätte are as follows:

(1) Does the site provide fossils which cover an extended period of geological time? i.e. how wide is the geological window.

The Chengjiang Fossil Site presents a snapshot of biodiversity at a critical time in the early evolution of animal life. It represents a limited period of geological time but is a palaeobiological window of exceptional significance.

(2) Does the site provide specimens of a limited number of species or whole biotic assemblages? i.e. how rich is the species diversity?

The biota is extremely rich and diverse. Taxa recovered range from algae, through sponges and cnidarians to numerous bilaterian phyla, including the earliest known vertebrates (see Section 2.a). It is the most completely preserved early Cambrian community known.

(3) How unique is the site in yielding fossil specimens for that particular period of geological time? i.e. would this be the 'type locality' for study or are there similar areas that are alternatives?

The Chengjiang fossil Lagerstätte contains by far the most diverse and disparate fauna known from the lower Cambrian. As well as representatives of skeletonized groups (e.g. brachiopods, hyoliths, bradoriids, trilobites, echinoderms), it contains a wide variety of soft-bodied taxa, including many vermiform animals. Almost all of these soft-bodied species are unknown elsewhere, although a few genera are also found in other lower Cambrian sites around the world. However, the diversity and quality of preservation of the fauna at Chengjiang means that it would undoubtedly be regarded as the 'type locality' for early Cambrian life. There is no alternative.

(4) Are there comparable sites elsewhere that contribute to the understanding of the total 'story' of that point in time/space? i.e. is a single site nomination sufficient or should a serial nomination be considered?

There are one or two other lower Cambrian sites that display soft-tissue preservation, contain some additional taxa and, therefore, contribute to the total story of global early Cambrian biodiversity (e.g. Sirius Passet, North Greenland; Emu Bay Shale, Australia). There are also numerous lower Cambrian sites worldwide that preserve skeletonized remains only, but include taxa that are not present in the Chengjiang biota, again adding to our understanding of early Cambrian life. However, the Chengjiang area has an unrivalled diversity of forms and other sites are not remotely comparable in the completeness of their records of the palaeocommunity.

***(5) Is the site the only or main location where major scientific advances were (or are being) made** that have made a substantial contribution to the understanding of life on earth?*

The Chengjiang fossil Lagerstätte is one of the most important palaeontological sites in the world. No other locality has yielded as much information on the nature of early Cambrian representatives of extant phyla and on the structure of the earliest animal communities. The very fine scale anatomical detail preserved in the specimens renders them highly informative for the interpretation of early body plans, and numerous key fossils have been described that shed light on the early evolution of many major animal groups. The Chengjiang biota continues to make a highly significant contribution to developing fields of evolutionary biology.

(6) What are the prospects for ongoing discoveries at the site?

There is considerable potential for ongoing discoveries. Although many thousands of specimens have been collected, new major discoveries continue to be made every year. This is demonstrated by the continuing publication of papers in high-profile journals (see Bibliography). Existing collections contain numerous enigmatic specimens, some in very small numbers, whose true nature will only be determined when additional specimens are recovered.

(7) How international is the level of interest in the site?

The site is of the highest international interest. The fossils have been studied by many international teams, resulting in numerous publications (see Bibliography). An iconic temporary exhibition of Chengjiang fossils was held in the University of Oxford Museum in 2010, as part of the museum's 150th anniversary celebrations. At the International Palaeontological Congress 3 (London, 28 June – 3 July 2010), nine papers were presented specifically on fossils from the Chengjiang fossil Lagerstätte, far more than on any other individual deposit. The biota has attracted continual extensive coverage in global newspapers, radio and television.

(8) Are there other features of natural value (e.g. scenery, landform, vegetation) associated with the site? i.e. does there exist within the adjacent area modern geological or biological processes that relate to the fossil resource?

The prime importance of the site lies in its exceptional scientific value, but it is situated within a scenically attractive and unspoilt area of rural China, enhancing its appeal.

(9) What is the state of preservation of specimens yielded from the site?

The state of preservation of the fossils is truly exceptional, not just for the lower Cambrian, but for the entire fossil record. At Chengjiang, soft tissues such as gills, eyes and guts are commonly preserved, and there are numerous fossils of animals that were entirely soft-bodied.

(10) Do the fossils yielded provide an understanding of the conservation status of contemporary taxa and/or communities? i.e. how relevant is the site in documenting the consequences to modern biota of gradual change through time?

The Chengjiang fossil Lagerstätte records the original establishment of a marine ecosystem structure, with complex food chains, that persists to the present day. The maintenance of this basic structure through geological history provides a context within which to understand the consequences of human activity on modern marine ecosystems.

Inset 2:

Chengjiang Fossil Site and Recommendations of the Contextual Framework

With respect to the recommendations in Wells (1996) A contextual framework for assessment of World Heritage fossil site nominations, the following are relevant:

- ***RECOMMENDATION 1: Choose sites that contain well-preserved fossil accumulations of high species diversity which in combination best document the story of community and environmental change through time.***

  The Chengjiang fossil Lagerstätte is the best site in the world, in terms of diversity of fossils and their exceptional preservation, to represent the early Cambrian in any series of sites that are selected to document the story of community change through time.

- *RECOMMENDATION 2: The 'events ' to be represented in the history of life should, where possible, encompass the iconography of a tree of life not a ladder of progress.*

  The Chengjiang biota represents the diversification of animals close to the base of the tree of life.

- *RECOMMENDATION 3: Choose fossil Lagerstatten and make provision for expanding the List or substituting sites/fossils to better tell any chapter of the story.*

  The Chengjiang fossil Lagerstätte is one of the most important fossil sites in the world and is by far the best to illustrate the early Cambrian in the story of the history of life.

- *RECOMMENDATION 6: Phanerozoic sites should be chosen so as to be representative in time and space of both community structure and selected phylogenetic lineages.*

  The Chengjiang biota provides an outstanding representation of the early history of the phylogenetic lineages of many major phyla and is singularly representative of early Cambrian community structure.

- *RECOMMENDATION 7: Any fossil Lagerstatten chosen from the Phanerozoic should wherever possible be of high diversity and include significant invertebrate as well as vertebrate assemblages.*

  The Chengjiang biota is of very high diversity, representing a wide range of invertebrate phyla and containing the earliest known vertebrates.

- *RECOMMENDATION 8: A condition for granting World Heritage status should make provision for curation, study and display of any site/fossils.*

  Chengjiang fossils are widely displayed and available for study in China, including a public-access on-site field station with museum at Maotianshan and a purpose-built new museum in Chengjiang town. There are also museum displays in Yunnan University and at the Nanjing Institute of Palaeontology and Stratigraphy (NIGPAS, Academia Sinica). Curated collections are held at several Chinese institutions, including the Key Laboratory for Palaeobiology, Yunnan University, and NIGPAS.

3.d Integrity

3.d-1 Legal status

The Nominated Property is state-owned land, protected by the Constitution of PRC and by the Laws of the PRC on Environment Protection, Cultural Relic Protection, Regulations on Old Fossil Organism Administration and other laws of the state:

Constitution of the People's Republic of China (1982)

Article 9: All mineral resources, waters, forests, mountains, grassland, unreclaimed land, beaches and other natural resources are owned by the state, that is, by the whole people, with the exception of the forests, mountains, grasslands, unreclaimed land and beaches that are owned by collective in accordance with the law. The state ensures the rational use of natural resources and protects rare animals and plants. Appropriation or damaging of natural resources by any organization or individual by whatever means is prohibited.

Environmental Protection Law of the People's Republic of China (2002)

Article 17: The people's governments at all levels shall take measures to protect regions representing various types of natural ecological systems, regions with a natural distribution of rare and endangered wild animals and plants, regions where major sources of water are conserved, geological structures of major scientific and cultural value, famous regions where karst caves and fossil deposits are distributed, traces of glaciers, volcanoes and hot springs, traces of human history, and ancient and precious trees. Damage to the above shall be strictly forbidden.

Law of the People's Republic of China on Cultural Relic Protection (2002):

Article 2: Within the territory of the People's Republic of China, the following cultural relics are protected by the state; ……age-old vertebrate fossils and age-old human fossils with scientific value shall be protected as cultural relics by the state.

Regulations on Management of Palaeontological Specimens (Fossils) (Ministry of Land Resources 2002):

Article 5: The state shall implement key protection of the following fossil organisms and fossil-yielding areas: (I) Nominated type specimens of fossil species; (II) well-preserved and/or articulated vertebrate fossils; (III) fossils rare in China and fossils with special importance in biological evolution and classification; (IV) large or concentrated fossil-yielding areas. (Details see Appendix)

Regulations on Protection and Management of Geological Relics (1995)

Article 7: The following geological relics should be protected: First, typical stratotype sections, sections containing fossils groups, sections to illustrate lithological characters of formations, and sections as exemplars of geological formations, which are of great scientific research value in elucidating

geological history. Second, fossils and fossil localities of ancient humans, vertebrates and invertebrates, microfossils, trees and other plants, which are of great scientific and cultural research value in elucidating geological evolution and the evolution of life.. (Details see Appendix)

Regulations on Protection of Yunnan Chengjiang Fauna Fossils (1997):

Article 3: Conduct effective protection, proper scientific research and orderly development of Chengjiang Fauna Fossils.

Article 4: Establish Provincial Nature Conservation Area of Chengjiang Fauna Fossils (called Conservation Area hereafter) and implement special protection and management. The scope of the conservation area, the core area, the buffer area and the boundaries of the area should be determined by the Provincial People's Government. (Details see Appendix)

3.d-2 Boundary

- Principles and bases for boundary delineation

Since the Nominated Property is a fossil site, the principles and bases for boundary delineation have been assessed with consideration of the following aspects:

(1) The Nominated Property has geological consistency and coherence, with particular consideration given to the fossil horizon and its occurrence (strike and dip). The Nominated Property should include as much of the Chengjiang fossil-bearing horizon, i.e. the Yu'anshan Member, in both horizontal and vertical extensions as possible, and include important fossil-bearing stratigraphic sections and fossil localities (including the site where exceptionally preserved Chengjiang fossils were first found);

(2) The Nominated Property demonstrates the context and integrity of the stratigraphic and fossil sequences, by not only including the fossil-bearing horizon but also the immediately overlying and underlying strata;

(3) The scope and boundaries of the Nominated Property have been delineated with regard to the geological structure, which comprises a NE-SW asymmetrical syncline; the strata plunge eastwards, so the nominated site includes both the exposed fossil stratum in the west and its buried extension to the east;

(4) The boundaries of the Nominated Property are determined with consideration of natural topographical factors, such as hills, valleys and contour lines;

(5) The scope of the Nominated Property is part of the existing "National Geopark"; it covers the most natural and least human-impacted area;

(6) The Buffer Zone surrounds the Nominated Property and provides additional protection. Within the Buffer Zone there is no industrial activity.

- Description of boundary and scope

The Nominated Property is a strip of land orientated northeast to southwest. It is 3,713m long, 2,555m wide and has a total area of 512 ha. The area consists of hilly land, with an elevation range of 156m. Based

on the location of the fossil-bearing strata, fossil localities and local relief, the boundary of the Nominated Property is delineated as follows:

East side: starts at the east end of the south valley of Xiaolantian Village, 100m west of the highway; extends southward via Haizi Village to Dongjishao Village, and ends south of Luolishan Village.

South side: starts south of Luolishan Village; extends west to end west of the Maotianshan Management Station.

West side: starts west of the Maotianshan Management Station; extends east of Luxishao Village and Ma'anshan, and ends west of Nandagou of Xiaolantian Village.

North side: starts from the roadside at the west end of the south valley of Xiaolantian Village; extends east to the east end of the south valley.

The nominated property includes a comprehensive sequence of exposed and unexposed strata and fossil horizons. It contains key stratigraphic sections and fossil localities, that are the most important and most representative of the Chengjiang Fossil Site. There is no permanent human residence or any industrial activity within the nominated property.

The Buffer Zone surrounding the nominated property has a total area of 220 ha. The boundary of the Buffer Zone has been delineated by consideration of geological (structure; stratigraphy; fossil localities), topographical, human impact and other relevant factors. The Buffer Zone has one village and patches of farmland in valley bottoms and on gentle hill slopes but no industrial activity. The boundary of the Buffer Zone is delineated as follows:

East side: starts from the east end of Nandagou of Xiaolantian Village; extends via Ganhaizi Village southward, and ends 800m east of Luolishan Village.

South side: starts 800m south of Luolishan Village; extends west to 200m west of the reservoir and the Maotianshan Management Station.

West side: starts 200m west of the reservoir and the Maotianshan Management Station; extends east of Luxishao Village, and ends at the west end of the south valley of Xiaolantian Village.

North side: starts from the roadside at the west end of the south valley of Xiaolantian Village; extends east and ends at the east end of the south valley.

3.d-3 Area of site and related matters

The early Cambrian strata containing the Chengjiang fossils are found widely in eastern Yunnan with several tens of localities being identified. Of all these Chengjiang fossil sites, the nominated Maotianshan area is the most important and most representative. The nominated Maotianshan area covers an area of 512 ha with a Buffer Zone of 220 ha, totaling 732 ha. This area contains all the necessary exposures to display the outstanding universal value of the Chengjiang Biota.

• The nominated site includes not only the 125m thick Yuanshan Member, which contains the Chengjiang fossils, but also the overlying and underlying strata, to a total thickness of some 200m. The coherent stratigraphic sequence and fossils contained throughout provide a complete geological window displaying

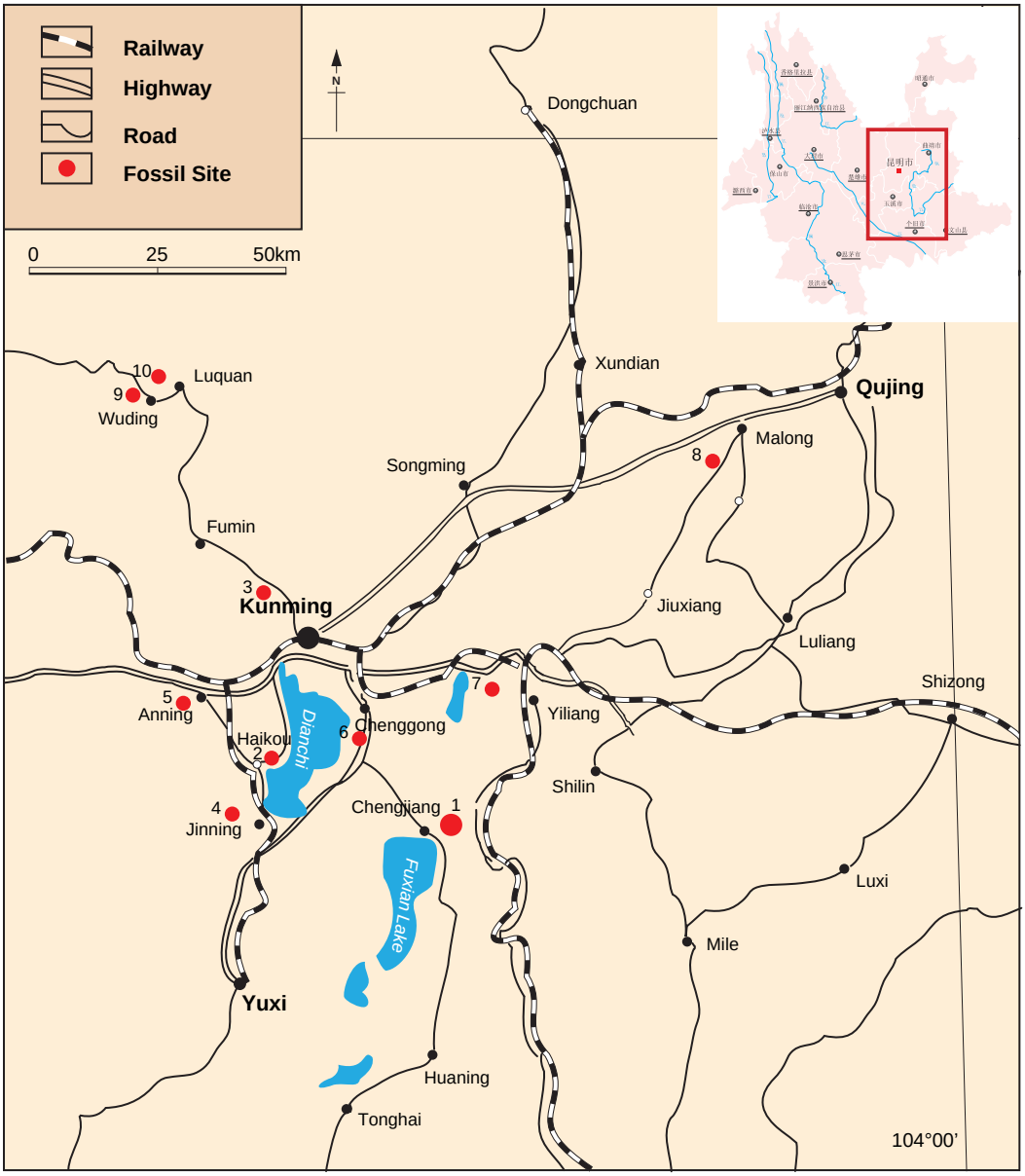
early Cambrian explosion of life.

• The nominated site contains several representative and well-studied fossil-bearing sections, such as Ma'anshan, Xiaolantian and others, as well as the site where the first Chengjiang soft-bodied fossil, *Naraoia longicaudata,* was discovered.

- Regional distribution of Chengjiang biota

The Lower Cambrian are widely distributed in central and eastern part of Yunnan Province, accordingly, the Chengjiang fossil-bearing strata (Yuanshan Member of Qiongzhusi Formation) and fossils also occurred in many places. Besides Chengjiang County, other notable places include Haikou of Kunming, Jinning County, Anning City, Chenggong County, Yiliang County, Malong County, Wuding County, etc. Fig. 3-3 and Table 3-3 show the important localities yielding Chengjiang biota.

Fig.3-3 Regional distribution of Chengjiang Biota



1. Maotianshan area, Chengjiang County
2. Ercai village, Haikou, Kunming City
3. Qiongzhusi, Kunming City
4. Meishucun, Jinning County
5. Shankou village, Anning City
6. Dayu village, Chenggong County
7. Kebao village, Yiliang County
8. Kuangshan, Malong County
9. Shishan, Wuding Coungy
10. Sapushan, Wuding Coungy

Table 3-3: Regional distribution of Chengjiang biota

No.	Locality	Location	**Exposure of Chengjiang fossil-bearing strata** (Yuanshan Member)	Discovery of Chengjiang fossils	Natural state
1	Chengjiang	Eastern Chengjiang County, Yuxi City	Fossil-bearing strata occur in a NS-trending area, covering some 25 square kilometers. Important fossil localities include Jiucun village, Xiaolantian, Maanshan, Maotianshan, Dapotou, Hongjiachong.	In 1984, the first soft-bodied fossil of the Chengjiang Biota was discovered at Maotianshan. Subsequent excavations make the Maotianshan area the most important Chengjiang fossil site; more than two thirds of the recorded Chengjiang biota species come from this area.	Since 1987 Maotianshan area was protected and fossil collection was largely prohibited since 1992. This area was designated as a provincial nature reserve in 1997 and a national geopark in 2001. As a result, the natural conditions have greatly recovered.
2	Haikou	Kunming City	Fossil-bearing strata occur widely in areas of Ercai village, Jianshan and Mafang, covering about 6 square kilometers.	First Soft-bodied Chengjiang fossil was found in 1993; also first Echinodermata and Chordata fossils as well as some uncertain species were found in this area. Nearly one third of the recorded new species come form this area.	A hilly land with dense residential buildings and heavily impacted by agricultural and industrial activities. It is a non-protected area.
3	Qiongzhusi	Kunming City	The stratigraphic units of Qiongzhusi Formation, Canglangpu Formation, Longwangmiao Formation of Lower Cambrian were defined from this place in 1942. The outcrop of Yuanshan Member is about 2 square kilometers.	Only 3-4 species of soft-bodied Chengjiang fossils were discovered since 1991.	A scenic area 7 kilometers northwest of Kunming City, close to the Qiongzhusi Temple, a national cultural relic protection units.
4	MeiShucun	Jinning County	It is the locality that the national/global boundary stratotype section of Precambrian and Cambrian is defined. The 120m thick Yuanshan Member of Qiongzhusi Formation is well exposed over some two square kilometers.	Soft-bodied Chengjiang fossils were found since 1986, and only about 10 or more species have been recorded.	A hilly area with well exposed strata of Yuanshan Member, Qiongzhusi Formation. It is a non-protected area.
5	Shankou village	Anning City	Strata of Yuanshan Member well exposed in Shankou village and Haoyi village areas, covering about five square kilometers.	Soft-bodied Chengjiang fossils were found since 1992, and only about 20 or more species have been recorded.	A hilly area largely in natural state, some lower slopes were cultivated for cropland. It is a non-protected area.

6	Dayu village	Chenggong County	Strata of Yuanshan Member occurr in Dayu village and Xiazhuang village area, totaling some five square kilometers.	Soft-bodied Chengjiang fossils were found since 1993, and only about 10 or more species have been found.	A hilly area basically in natural state, some lower slopes were cultivated for cropland. It is a non-protected area.
7	Kebao village	Yiliang County	Strata of Yuanshan Member crop out in around Kebao village and Caodian area, totaling some 15 square kilometers.	French geologists collected fossils of Lower Cambrian in this area in 1909. The soft-bodied Chengjiang fossils were found since August, 1984, and only about 10 or more species have been recorded.	A hilly area mostly occupied by cropland. It is a non-protected area.
8	Kuangshan	Malong County	Strata of Yuanshan Member expose in around Kuangshan and Nazhang areas, covering some 10 square kilometers.	Soft-bodied Chengjiang fossils were found since 1990, 17 species were recorded.	A hilly area, some lower slopes were cultivated for farmland. It is a non-protected area.
9 , 10	Sapushank, Shizishan	Wuding County	Strata of Yuanshan Member well exposed in Sapushank and Shizishan areas, covering some 5 square kilometers.	Soft-bodied Chengjiang fossils were found since 1997, 5 species were recorded.	Both are mountainous areas, Shizishan is a protected provincial scenic area. Sapushan retains its pristine natural state due to precipitous relief.

- Haikou fossil site

As shown in Table 3-3, next to Maotianshan area, Haikou, some 40 km northwest of the Maotianshan area, is the second most important fossil site from which many important specimens of the Chengjiang biota have been collected. The Haikou area has not been included in the Nominated Property because:

(1) Haikou is a dense industrial and residential area, with phosphate mining that has spoiled the natural setting. The human activity has caused disturbance to the fossil-bearing strata, and the area is below the standards required for integration into a world heritage site.

(2) To date, the Haikou site has no national protected area status.

(3) Most fossils collected from Haikou can also be found in the Maotianshan area. Since 1987, fossil excavation at Maotianshan has been controlled so that the most important Chengjiang fossil site is protected, so the focus of recent fossil collection has shifted to the outlying areas, with many specimens collected from Haikou.

However, due to the importance of the Haikou fossil site, it has been proposed that Haikou is given provincial protected area status in the near future. This will enable it to serve as a complementary protected site to the Chengjiang Fossil Site.

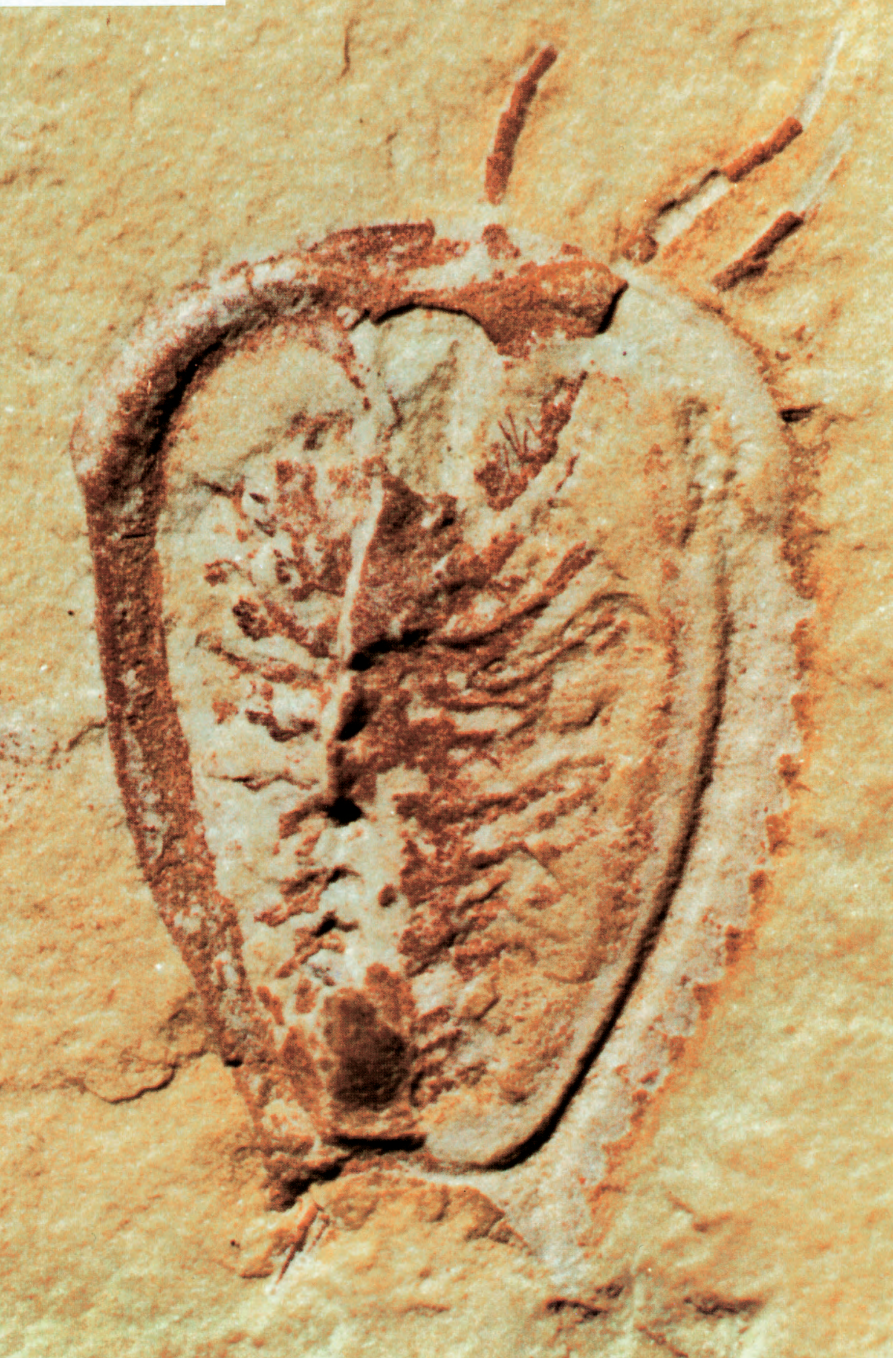
3.d-4 Negative impact

Before 1987, the nominated Chengjiang Fossil Site was subject to traditional human usage, with activities such as farming, grazing and logging. This led to the clearance of almost all of the primary forest, but, fortunately, most of these activities were confined to the surface, without serious disturbance to the buried fossils. Some localized phosphate mining did create some negative impacts on the fossil-bearing stratum and on the local topography.

In 1987, a protected area was established for the Chengjiang Fossil Site and, since then, human activities within the site have been controlled. After more than 20 years of natural recovery, the area has largely become covered by secondary forest and shrub. At present, there is no industry or permanent human residence within the Nominated Property and only some scattered traditional farm patches remain in the Buffer Zone.

3.d-5 Protection and management

At present, as a National Geopark and a Yunnan Provincial Nature Reserve, the Nominated Property is subject to multiple protection, covered by relevant laws and regulations. Specific management bodies have been established and are well staffed. A management plan and conservation measures have been set out and implemented. In addition, community involvement and traditional rural rules ensure that a sound and effective management system is in place. (Details see Chapter 5. Protection and Management)



4. State of Conservation and Factors Affecting the Property

4.a Present State of Conservation

With consideration of the various aspects of conservation (see 5.b-1), the Nominated Property of the Chengjiang Fossil Site is protected under a number of regulations: “Constitution of the Peoples Republic of China”, “Environmental Protection Law of the People’s Republic of China”, “Law of the Peoples Republic of China on Protection of Cultural Relics”, “Regulations on Geological Heritage Protection and Management”, “Regulations on Chengjiang Fauna Fossil Protection of Yunnan Province”, etc.; the present state of conservation is good.

The hierarchy of China’s national administrative system enables the emplacement of an effective central-to-local management structure, so that the nominated site can be protected according to relevant laws and regulations. There is a sound basis of conservation expertise that combines administrative and scientific management. Guided by the competent authority at a higher level, the Chengjiang Fossil National Geopark Management Committee (the Governing Body of the nominated site) is responsible for the management of the nature reserve area, and has launched environmental protection and rehabilitation work in the nominated site. Related resource management authorities and related enterprises have also established environmental protection agencies to control pollution, reduce noise, protect the ecological environment, and improve the quality of air, water and soil.

Boundaries of the Nominated Property have been delimited and a monitoring indicator (see 6.a) has also been set for timely monitoring/identification/settlement of problems. Personnel, agencies and funds are also available to safeguard the integrity and the outstanding universal value of the Nominated Property (covering important sections, fossil localities and the Buffer Zone).

The Nominated Property has been affected by natural factors and human activity to some extent. Natural factors include landslides and forest diseases. Human activities mainly relate to phosphate mining; there were several mining locations within the nominated area from 1989 to 2004. However, the regulatory agencies have taken effective measures to close mining activities within the nominated site and to carry out environmental rehabilitation, so that its outstanding universal value is now largely unaffected by natural factors or human activity.

4.b Factors Affecting the Property

4.b-1 Development Pressure

The biggest development pressures on the Nominated Property are phosphate mining and agricultural land utilization.

The Nominated Property is a phosphate ore resource area. From the 1980s to the end of the 1990s, the phosphorus chemical industry became one of the pillar industries of Chengjiang County. The annual production of phosphorus ore was about 1.2 million tons, with a considerable proportion coming from mining localities within the Nominated Property and Buffer Zone. The mineral layer is located beneath the Chengjiang fossil-bearing stratum, so removal of overburden has inevitably damaged the fossiliferous Qiongzhusi Formation. The phosphorite layer itself is also fossil bearing, so fossils from this level have been lost to mining. In addition, the existence of mines and the mining activity have seriously damaged

the vegetation and natural landscape in the Nominated Property. For these reasons, mining activities were gradually phased out in the nominated area after the "Provincial Nature Reserve for Chengjiang Fauna Fossil" was established in 1997. In September 2004, the Department of Land and Resources of Yunnan Province required closure of all mines in the Nominated Property; phosphate mining has now completely ceased within the Nominated Property and Buffer Zone.

The Nominated Property is a moderately eroded hilly terrain with a shortage of water. It is not a good place for agriculture development nor is it suitable for human habitation. The number of local residents has historically never been more than one thousand. The percentage of forest cover is 27.6%, and deforestation pressure is low due to the limited number of trees. Moreover, "The Overall Planning of National Geological Park of Yunnan Chengjiang Fauna" forbids deforestation in every protected area. Therefore, development pressure from agriculture and forestry in the Nominated Property is low; in the southeastern part of the Buffer Zone, towards Fuxian Lake, there are scattered villages that engender relatively more pressure for agricultural use of the land. Since the local agricultural activities are at subsistence levels, the impact caused by farming and grazing on the environment is limited, and there is no threat of agricultural encroachment onto the nominated fossil site.

4.b-2 Environmental Pressures

Since the establishment of the protected area, deforestation, vegetation destruction, ecological degradation and soil erosion have been controlled. As mining activities were not stopped until 2004, their impact on the landscape and environment has not yet been completely ameliorated.

There are two aspects to the current impact of the former mining activity: ① some waste debris remains from the mining and processing, including phosphorus slag, phosphogypsum, defluorinating slag and phosphorus sludge; these may cause leaching, pollution, soil erosion and geological hazards; ② waste water in the mining pits may pollute groundwater, although it has been treated in accord with national pollution discharge standards.

In addition, although gas emissions from the yellow phosphorus factories outside the Buffer Zone to the south and southwest are normally within required standards, as monitored by the Yuxi Environment Monitoring Station, there are times when dust, sulfur dioxide, etc. exceed the standard and cause air pollution.

4.b-3 Natural Disasters and Risk Preparedness

Risks of natural disasters mainly relate to problems generated in former mining areas. Where mining has altered topography there are localized landslides and creep deformation.

There are also risks from soil erosion and debris flows, especially in the Dongjishao--Dapotou area, in the southwestern part of the Buffer Zone. This area has low/medium vegetation cover and moderate soil erosion, exacerbated somewhat by mining activity and factory construction. In addition, piles of solid waste may become unstable and lead to debris flows.

The risk of forest fire is low, because the Nominated Property is situated in a low latitude, subtropical, plateau region with a monsoon climate. The western Liangwang Mountain acts as a natural barrier, while Fuxian Lake in the southwest and Yangzong Lake in the northeast also influence the climate, which is characterized by dry and wet seasons, although rain and heat occur in the same season.

Responses to risks of natural disaster:

- Training programs have been delivered on disaster prevention, to promote peoples' awareness and

capability;
- Warning signs and protective facilities have been set up in high risk places; these are checked regularly;
- A “government-community-enterprise-inhabitant” early-warning system for fire control has been set up and there is a forest fire brigade; use of fire in the fields for any purpose is forbidden during the forest fire prevention period;
- The percentage of forest cover has been increased to prevent soil erosion. In addition, farmers’ income has been improved, as has the quality of life of farmers who have returned farmland to forest, thereby promoting an adjustment to an eco-agriculture structure.

4.b-4 Illegal Fossil Excavation

The discovery of soft-bodied fossils at Chengjiang in 1984 generated national and international interest, and many researchers and fossil collectors were attracted to the Chengjiang area to excavate fossils. These activities led to many important discoveries, but they also meant that some fossils were lost to scientific research. Although a provincial protected area was established in the Maotianshan area in 1987, uncontrolled and illegal fossil excavations occurred sporadically until the early 1990s. This threatened the protection and management of the area to some extent, and compromised sustainable scientific research on the Maotianshan fossil site. Therefore, in 1997, the Yunnan provincial government strengthened protection of the Maotianshan fossil area, issuing the “Regulations on Protection of Chengjiang Fauna Fossil of Yunnan Province”. In 2001, the Maotianshan area was designated as a National Geopark, and protection and management were further improved. Since the restriction of fossil excavation in the Maotianshan area, most fossil excavations have shifted to other adjacent areas such as Haikou and Malong. Although illegal fossil excavation is now largely controlled, the enforcement of this prohibition remains a long-term consideration for the protection and management of this important fossil site.

4.b-5 Number of Inhabitants within the Property and the Buffer Zone

Nominated Property:	**0**
Buffer Zone:	**454**
Total:	**454**
Year:	**2010**

There are no inhabitants within the Nominated Property. Only a small number of inhabitants live in the Buffer Zone, and they cause no impact on the Nominated Property.

5. Protection and Management of the Property

5.a Ownership

The Nominated Property, the Chengjiang Fossil Site, is owned by the People's Republic of China.

The Constitution of the People's Republic of China

> *Article 9: All mineral resources, waters, forests, mountains, grassland, unreclaimed land, beaches and other natural resources are owned by the state, that is, by the whole people. The state ensures the rational use of natural resources and protects rare animals and plants.*

Regulations on the Management of Palaeontological specimens (fossils)

> *"… fossil specimens collected from fossil sites are owned by the People's Republic of China ".*

5.b Protective Designation

5.b-1 National Designation of the Nominated Property for Protection

Table 5-1 Protective Designation of the Chengjiang Fossil Site

Nominated Property	Protective Designation	Date
Chengjiang Fossil Site	Provincial Nature Reserve	June, 1997
	National Geopark	March, 2001
	National Natural Heritage	January, 2006

5.b-2 Articles and/or Clauses of Laws and Regulations concerning the Protection of the Nominated Property

Table 5-2 Relevant Laws and Regulations

No.	Title	Promulgation Date	Promulgated by
1	The Constitution of the P.R. China	March 15, 1999	The NPC, P.R. China
2	The Environmental Protection Law of the P.R. China	December 26, 1989	The NPC Standing Committee, P.R. China
3	The Decision of the State Council on Environmental Protection Issues	August 03, 1996	The State Council of P.R. China

4	The Forest Law of the P.R. China	September 20, 1984	The 7th session of the Standing Committee of The 6th National People's Congress
5	The Soil and Water Conservation Act of the P.R. China	June 29, 1991	The 20th session of the Standing Committee of The 7th National People's Congress
6	The Regulations of the P.R. China on Nature Reserves	December 01, 1994	The State Council of P.R. China
7	The Regulations on Land Management within Nature Reserves	July 24, 1995	The National Environmental Protection Agency, China Land Management Agency
8	The Mineral Resources Law of the P.R. China	August 29, 1996	The 21st session of the Standing Committee of The 8th National People's Congress
9	The Geological Environment Protection Law of Yunnan Province	January 01, 2002	The Standing Committee of Yunnan People's Congress
10	The Environmental Protection Regulations of Yunnan Province	December 03, 1997	The 31st session of the Standing Committee of The 8th Yunnan People's Congress
11	The Incentives and Penalties for the Implementation of the Environmental Protection Regulations of Yunnan Province	April 28, 1995	Yunnan Provincial Government
12	The Regulations of Yunnan Province on the Protection of Mines and Geological Environment	September 30, 1998	The People's Government of Yunnan Province
13	The Mineral Resources Management Regulations of Yunnan Province	December 03, 1997	The 31st session of the Standing Committee of The 8th Yunnan People's Congress
14	The Regulations of Yunnan Province on the Protection of Chengjiang Fauna Fossils	December 02, 1997	The 39th executive session of The People's Government of Yunnan Province
15	The Regulations on Management of Palaeontological specimens (Fossils)	July 29, 2002	Ministry of Land and Resources of P.R. China
16	The Regulations on Protection and Management of Geological features	May 04, 1995	Ministry of Geological Mineral Resources

The Constitution of the People's Republic of China

Article 9: All mineral resources, waters, forests, mountains, grassland, unreclaimed land, beaches and other natural resources are owned by the state, that is, by the whole people..... the state ensures the rational use of natural resources and protects rare animals and plants. Appropriation or damage of natural resources by any organization or individual by whatever means is prohibited.

Article 26: The state protects and improves the living environment and the ecological environment, and prevents and controls pollution and other public hazards. The state organizes and encourages afforestation and the protection of forests.

The Environmental Protection Law of the People's Republic of China

Article 17: The people's governments at various levels shall take measures to protect regions representing various types of natural ecological systems, regions with a natural distribution of rare and endangered wild animals and plants, regions where major sources of water are conserved, geological structures of major scientific and cultural value, famous regions where karst caves and fossil deposits are distributed, traces of glaciers, volcanoes and hot springs, traces of human history, and ancient and precious trees. Damage to the above shall be strictly forbidden.

Article 19: Measures must be taken to protect the ecological environment while natural resources are being developed or utilized.

Regulations on Protection and Management of Geological Relics

Article 7: The following geological relics should be protected: First, typical stratotype sections, sections containing fossils groups, sections to illustrate lithological characters of formations, and sections as exemplars of geological formations, which are of great scientific research value in elucidating geological history. Second, fossils and fossil localities of ancient humans, vertebrates and invertebrates, microfossils, trees and other plants, which are of great scientific and cultural research value in elucidating geological evolution and the evolution of life.

Regulations on Management of Palaeontological Specimens (Fossils)

Article 5: The state shall implement key protection of the following fossil organisms and fossil-yielding areas: (I) Nominated type specimens of fossil species; (II) well-preserved and/or articulated vertebrate fossils; (III) fossils rare in China and fossils with special importance in biological evolution and classification; (IV) large or concentrated fossil-yielding areas.

National Park Regulations

Article 3: National parks shall be subject to scientific planning, unified management and strict protection for sustainable utilization.

Article 4: The National Park administration agency, set up by the local government above the county level, shall take the responsibility for such protection, utilization and unified management of the National Park.

Article 5: The competent authority of the State Council for construction shall take the responsibility for the supervision and administration of the national parks. Other departments of the State Council shall fulfill their duties and responsibilities with respect to the supervision and administration of the national parks in accordance with their respective power as delegated by the State Council. The competent authority of the government of a province or an autonomous region as well as the competent authority of a municipality directly under the jurisdiction of the Central Government shall take the responsibility for the supervision and administration of the national parks within its administrative division. Other departments of the government of a province or an autonomous region as well as those of a municipality directly under the jurisdiction of the Central Government shall fulfill their duties and responsibilities with respect to the supervision and administration of the national parks in accordance with their respective power as delegated by the government.

Article 24: The landscape and natural environment within a National Park shall be under strict protection without damage or arbitrary alteration for sustainable development. The administration authority of a National Park shall establish and improve its administration systems and measures for the protection of the scenic resources. The inhabitants and visitors in a National Park shall protect the landscape, water body, vegetation, wildlife and other facilities therein.

Article 25: The administration authority of a National Park shall perform surveys and identify and draw up corresponding protection measures for the important landscapes within the park.

Article 26: The following activities are prohibited within a National Park:
(1) Any activity that will damage the landscape, vegetation, terrain or landform such as quarrying, mining, reclaiming, building a tomb or erecting a tombstone;
(2) construction of any facility for storage of explosives, inflammables and radioactive, toxic and corrosive materials etc;
(3) inscribing, scratching or painting on a scenic object or facility;
(4) littering.

The Mineral Resources Law of the People's Republic of China

Article 3: Mineral resources belong to the State. The right of state ownership in mineral resources is exercised by the State Council. State ownership of mineral resources, either near the Earth's surface or underground, shall not change with the alteration of ownership or right to the use of the land which the mineral resources are attached to.

The State safeguards the rational development and utilization of mineral resources. Seizing or damaging mineral resources by any means and by any organization or individual shall be prohibited. People's governments at various levels must make serious efforts to protect mineral resources. Anyone who wishes to explore or mine mineral resources shall separately make an application according to law and shall register after obtaining the right of exploration or mining upon approval.

Article 20: Unless otherwise approved by the competent departments authorized by the State Council, no one may mine mineral resources in the following places:
(5) Nature reserves and important scenic locations designated by the State, major sites of immovable historical relics and places of historical interest.

Regulations on Land Management within Nature Reserves

Article 4: Both an organization and an individual are prohibited from any activity that may cause damage to or endanger the land within a Nature Reserve. Both an organization and an individual

have the obligation to protect the land within a Nature Reserve, to report and/or charge any activity or behavior violating the Regulations on Land Management within the Nature Reserve.

Article 12: The requisition or acquisition of collectively-owned land or the assignment of state-owned land for construction or extension of a Nature Reserve shall be made in accordance with the Land Management Law.

Article 18: Unless otherwise provided in laws or administrative regulations, reclaiming, mining or quarrying (stone or sand) within a Nature Reserve is prohibited.

Regulations on the Implementation of the Land Administration Law of the P.R. China

Article 15: Unless otherwise provided in laws or regulations, any organization or individual who wishes to engage in mining or quarrying (stone, sand or soil) on any land shall submit an application to the competent land administration above county level for approval.

Interim Provisions on the Protection of Chengjiang Invertebrate Fossils (Chengjiang County **Government, Yunnan Province, May 07, 1987)**

Article 2: Large-scale construction or excavation is prohibited in the key areas where Chengjiang Fauna fossils occur, such as Maotianshan, Loulishan, Dapotou, Xiaolantian and Xiaotuanpo, and reclaiming or farming by local farmers shall be avoided where such fossils are concentrated.

Regulations of Yunnan Province on the Protection of Chengjiang Biota Fossils (the People's **Government of Yunnan Province, December 02, 1997)**

Article 4: Establish a Provincial Nature Reserve to bring Chengjiang Fauna Fossils under special protection and administration. The scope of the reserve as well as the boundaries of its core zones, experimental zones and buffer zone are delineated by the People's Government of Yunnan.

5.c Means of Implementing Protective Measures

5.c-1 Management Systems and Regulations

According to China's legal system, the legislative protection will be provided for and cover the use of land, geological heritage, ecological environment and fossils within the Nominated Property. In order to make the protection measures more feasible, operable and well-targeted, a corresponding management system and regulations are drawn up to ensure faithful implementation as well as a much more effective protection of the Nominated Property.

5.c-2 Management Systems

Accompanying its rapid economic development since the 1980s P.R. China has established a comprehensive management structure for ecological protection and geological and mineral resources development and utilization. In view of the concentration of fossils of great scientific value and associated geological features within the Nominated Property, the Government of Yunnan Province and the Yunnan World Heritage Management Committee will manage the Nominated Property in accordance with the Convention concerning the Protection of the World Cultural and Natural Heritage. The Management System is shown in Fig. 5-1:

Fig.5-1 Frame Diagram of Chengjiang Fossil Site Management System

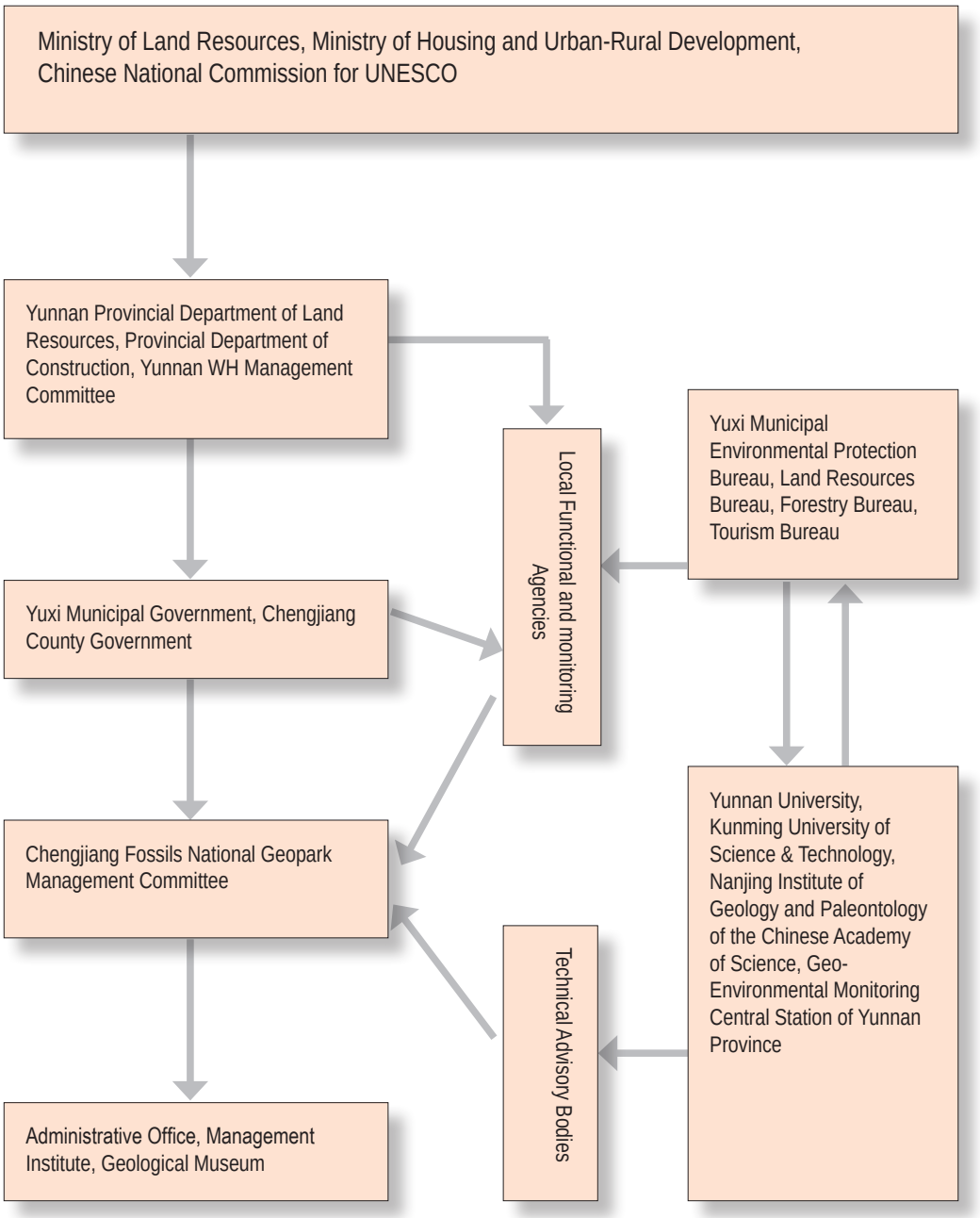


Table 5-3 Administration Agencies, Responsibilities and Persons Responsible

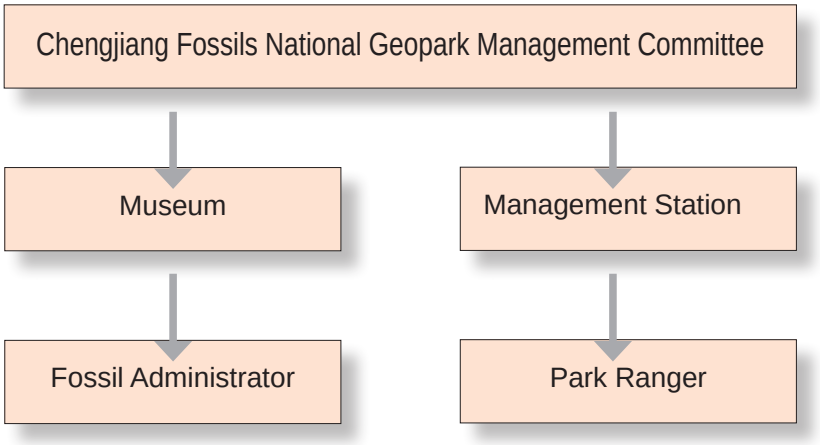
No.	Name	Legal Basis	Responsibilities & Duties	Address	Chief Person Responsible	Note
1	The Ministry of Housing and Urban-Rural Development of the P.R. China	1. National Park Regulations 2. The Programme of the State Council on Major Responsibilities, Internal Organs and Staffing	Coordination and leadership on the overall planning, protection, construction and management of the National Park	9 Sanlihe Road, Beijing, P.R. China 100835	Jiang Weixin	State-level governing authority
2	The Ministry of Land and Resources of the P.R. China	1. The Mineral Resources Law of the P.R. China 2. The Programme of the State Council on Major Responsibilities, Internal Organs and Staffing	Review, approval and coordination in connection with a National Nature Reserve within a National Park	115 Nanxiaojie, Xizhimennei, Beijing, P.R. China	Xu Shaoshi	State-level coordinating agency
3	State Administration of Cultural Heritage	1.The Cultural Objects Protection Law of the P.R. China 2. The Programme of the State Council on Major Responsibilities, Internal Organs and Staffing		10 Beidajie, Chaoyangmen, Beijing, P.R. China	Shan Jixiang	State-level coordinating agency
4	Yunnan World Heritage Management Committee	The Convention concerning the Protection of the World Cultural and Natural Heritage and relevant national/ provincial laws and regulations	Major decision-making and comprehensive guidance on Heritage Management	Kunming, Yunnan Province, P.R. China	Liu Ping	Sector's governing authority of Yunnan Province
5	The Department of Housing and Urban-Rural Development of Yunnan Province	Regulations of Yunnan Province on the Management of National Parks	Industrial management, daily protection and construction of national parks	Dianchi Road, Kunming, Yunnan Province, P.R. China	Luo Yingguang	Sector's governing authority of Yunnan Province
6	Yunnan Department of Land and Resources	1. The Mineral Resources Law of the P.R. China 2. Fossils Management Regulations	Protection and utilization of mineral resources within the Nominated Property	Baita Road, Kunming, Yunnan Province, P.R. China	He Zixing	Sector's governing authority of Yunnan Province

7	Office of Yunnan World Heritage Management Committee	The Convention concerning the Protection of the World Cultural and Natural Heritage and relevant national/ provincial laws and regulations	Management, protection and construction within the Nominated Property	Dianchi Road, Kunming, Yunnan Province, P.R. China	Ma Suhong	Governing agency of the Nominated Property
8	Chengjiang Fossil National Geopark Management Committee	The Regulations of Yunnan Province on the Protection of Chengjiang Fauna Fossils	Sectorial management within the administrative area of the Nominated Property	Fengxiang Road, Fenglu County, Chengjiang, Yunnan Province, P.R. China	Li Zhizhao	Grassroots administration agency of the Nominated Property

5.c-3 Administration Agencies

Established in January 1997, the Chengjiang Fossil Provincial Nature Reserve Management Committee, later also known as the Chengjiang Fossil National Geopark Management Committee with the designation of national geopark in 2010, is the management agency responsible for the management of the Nominated Property under the leadership and guidance of the governing authority. A management station undertakes the daily monitoring of the Nominated Property, and a museum has been built for exhibition, study and storage of fossil specimens. The Chengjiang Fossil National Geopark Management Committee currently has a staff of 62, comprising managerial personnel (19) and other personnel responsible for operations, research and services, and is fully capable of strict and orderly protection and management of the Nominated Property and its surrounding areas. The organization of the on-site management agency is shown in Fig. 5-2:

Fig. 5-2 On-site management structure



5.c-4 Protection Plans

Plans have been developed for the management and protection of the Nominated Property from different

perspectives and aspects. A protection and management plan with clear and effective measures has also been drawn up for the successful protection of the outstanding universal value of the Nominated Property (see 5.e for details).

5.c-5 Protection by Zonation

The nominated Chengjiang Fossil Site is part of the protected Yunnan Chengjiang Fossil National Geopark and is classified into protection zones according to the management plan.

The National Geopark is divided into: Special Protected Zone; Class I Protected Zone; Class II Protected Zone; and Class III Protected Zone.

Maotianshan, the heart of the Nominated Property, is the Special Protected Zone. It is the first place where exceptionally preserved fossils of the Chengjiang Biota were discovered and where the associated originally documented stratigraphic sections are concentrated. Class I Protected Zone lies outside the Special Protected Zone and includes strata and fossil localities of the Qiongzhusi (Heilinpu) Formation in the southern part of Ma'anshan to the north of the Nominated Property and north of Xiaotuanpo Village within the Buffer Zone to the south of the Nominated Property. Class II Protected Zone includes other key fossil localities in Qiongzhusi (Heilinpu) Formation strata; for example sections at Xiaolantian, Luolishan, Dapotou and Hongjiachong. Class III Protected Zone lies outside the other protected zones and facilitates the protection of additional fossil localities and stratigraphic sections of Qiongzhusi (Heilinpu) Formation strata.

No visitors, except those for the purpose of scientific research and having permission from the management authority, are allowed to enter the protected areas. In order to protect the landforms and landscapes within the protected zones, production activities have been stopped and banned in the Special, Class I and Class II protected zones. Furthermore, some 95ha of cropland has been returned to grassland to reduce human impact within the protected zones.

5.c-6 Monitoring

The renewal of the landscape from the effects of the former phosphate mining is scrutinized. The potential influence of the possible construction of roads/bridges and other similar activities is minimized and monitored. In order to maintain the integrity of the Nominated Property, its important stratigraphic sections and key fossil localities, especially Maotianshan, receive particular monitoring. Monitoring indicators and schedules (regular/irregular) have been set out (see 6.a for details) and checked by relevant authorities.

5.d Existing Plans Related to Municipality and Region in Which the Proposed Property Is Located

5.d-1 Approved Plans of the City and District of the Nominated Property

Plan	Prepared by	Approved on
The Eleventh Five-Year Plan of Chengjiang County for National Economic and Social Development	The People's Government of Chengjiang County	2005

5.d-2 Summary of Relevant Plans

Relevant plans pertaining to Chengjiang County are the most appropriate ones for the Chengjiang Fossil Site. These plans identify natural resources and their value and associated existing problems and issues of management and protection, rational utilization and tangible management measures etc. (see 7.b for excerpts)

5.e Property Management Plan or Other Management System

5.e-1 Management Plans Currently in Force in the Nominated Property

Management Plan	Prepared by	Approved on
Chengjiang Fossil Site Management Plan	Chengjiang Fossil National Geopark Management Committee	July 2010
General Management Plan of Yunnan Chengjiang Fauna National Geopark	Yunnan Geological and Environmental Monitoring Center, Yunnan Chengjiang Fossil Site/Provincial Nature Reserve Management Committee	March 2001
Plan for Ecological and Geological Control and Management for the Protection of Chengjiang Fauna Fossils in Surrounding Areas of Maotianshan	Yunnan Geological and Environmental Monitoring Center, Yunnan Fangcheng Planning and Design Firm	April 2005

5.e-2 Analysis and Explanation

- 《Chengjiang Fossil Site Management Plan》 **(2010)**

The copy of the plan is submitted as Appendix 3

Summary: This plan is prepared in particular for the management of the site nominated for world heritage status, it consists of seven parts:

Part 1: Statement of the management objectives and main goals, i.e. to safeguard the fossil site's outstanding scientific and aesthetic values, to incorporate the management and protection of the fossil site into the overall local social and economic development plan.

Part 2: Illustration of the bases for the preparation of the management plan, including 23 relevant national and local laws and regulations as well as world heritage management requirements (the Convention and Operational Guidelines).

Part 3: Summary the values of the Chengjiang fossil site, clarify its area (property zone and buffer zone), boundaries, inventory, and existing management challenges.

Part 4: Explanation of the management content, including the duration (2011-2015), zoning protection

plan, classified management plan, land-use and community control and involvement plan, environmental protection plan, scientific research and publicity plan, monitoring plan.

Part 5: Clarification of the executive bodies, supervision agencies, cooperate and technical advisory bodies. It is made clear that by law the Chengjiang Fossil National Geopark Management Committee is the executive body of the management plan.

Part 6: Illustration of capacity building, including the make-up of the managerial staff and the capacity needed for management, specific training programs on geology, paleontology and site management.

Part 7: Specification of concrete action plans, clarification of the finance budget and sources, and actions to be taken in the period 2011-2015 in relation to the management goals set out by the plan.

- 《Master Plan of Yunnan Chengjiang Fossil National Geopark》 **(2001, 2008)**

Summary: This plan was originally prepared in 2001 in the light of "Technical Regulations of the National Geopark Plan" when the Chengjiang fossil site was designated as a national geopark, it was revised in 2008 in response to the updated management requirements by the Ministry of Land Resources. The plan comprises 13 parts.

Part 1: Background of the geopark, clarification of its area (18km^2) and boundary, identification of management principles, and seven major management challenges.

Part 2: Clarification of major geological relics contained in the geopark and their distribution. Identification of scientific value, and analysis of regional geo-tourism resources and facilities.

Part 3: Clarification of the nature of the geopark: it is a geopark featuring important fossils of early Cambrian and providing important evidence to the history of life on earth. This part also defines the zonation of the park, divides the park into Specially Protected Zone, First Class Protected Zone, Second Class Protected Zone, and Third Class Protected Zone. Regarding functions, the park is composed of Protected Area, Tourism Area, and Service Area.

Part 4: Elaboration on protection and management objectives and goals, contents and measures. Illustrations of ecological improvement plan, geological environment improvement plan, and greening plan.

Part 5: Explanation of environmental capacity and tourism control. It is planed that the annual visitor volume is 15,000-200,000, and daily visitor number is under 2,000.

Part 6: Illustration of the displaying, interpretation and tourism control, suggestions on the establishment of the Museum of Chengjiang Fossils and tourism routes.

Part 7: Plan of tourism facilities, including the establishment of visitor center, interpretation signs, accommodations, security, education and publicity activities.

Part 8: Plan of scientific research, education and publicity.

Part 9: Infrastructure construction plan, mainly the road system (automobile road and foot path) within the park, as well as drainage projects.

Part 10: Projects and budgets, specification of the six major projects and their fund investments, the total

amount is 91,234 million yuan RMB.

Part 11: Efficiency analysis, including the social benefit, economic benefit and ecological benefit resulted from the implementation of the Master Plan.

Part 12: Management analysis, including clarification of the management system and management organs, make clear to establish a unified management, though the fossil site has several designations, the Chengjiang Fossil National Geopark Management committee is the daily and overarching management body, under which functional divisions set up.

Part 13: Safeguard measures, including concrete measures on law enforcement, government administration, personnel development, information system construction, fund raising, etc.

❖ Some detailed extracts of the plan see also *"7.b-3 Other extracts relating to planning*".

- 《**Plan for Ecological and Geological Control and Management for the Protection of** Chengjiang Fauna Fossils in Surrounding Areas of Maotianshan》 **(2005)**

Summary: This plan was jointly prepared by the Chengjiang county government, Yunnan Geo-Environmental Monitoring Central Station, and Yunnan Fangcheng Planning and Design Institute, aiming at rehabilitating the compromised natural environment in surrounding areas of Maotianshan. The plan comprises 7 parts.

Part 1: Introduction of the background, bases of the plan, general principles, duration and scope. The duration of the plan is 2005-2010, the scope is 153ha.

Part 2: Situation analysis, including the locations, natural conditions, major geological hazards, potential geological environmental problems, mining impacts, etc., and feasibility of controlling existing eco-geological environmental problems.

Part 3: Planning objectives, illustration of the general goal of protecting eco-system, rational utilization of natural resources and development of sustainable tourism. Clarification of short term and long term targets.

Part 4: Zoning control plan, in view of the existing problems, the 153ha planed area is divided into four subareas, each subarea with specific controlling measures.

Part 5: Fund budged, totally 20.55 million yuan RMB (short term 11.80 yuan RMB) is planed for engineering projects, greening projects, etc.

Part 6: Management plan, clarification of the organizing body, the monitoring body, the implementer of the plan.

Part 7: Benefit analysis, analysis of the social, economic and ecological benefits resulted from the implementation of the plan.

❖ Some detailed extracts of the plan see also *"7.b-3 Other extracts relating to planning*".

5.f Sources and Levels of Finance

In accordance with the principle of 'power-responsibility', the nominated Chengjiang Fossil Site has been financed by national investment together with local, provincial, municipal and county budgets. Meanwhile, other financial support from international organizations, non-government organizations, enterprises and private sources are also actively encouraged. Finances relating to the years 2000-2009 and onwards are as follows:

Table 5-4 Sources of Finance 2000-2009

	Source and Amount (in million RMB)				
Year	National Investment / Government Funds	Yunnan Province	City and County	Companies	Total
2000		0.12			0.12
2001			0.35		0.35
2002	0.05		0.26		0.34
2003			41		41
2004	2.00		1.30		3.30
2005	1.50		1.50		3.00
2006	1.90		1.30		3.20
2007	2.90		1.00		3.90
2008	3.00		1.90		4.90
2009	27.00		1.00		28.00

As shown in Table 5-4, the support from various governments has substantially increased the budget of the Nominated Property has since the year 2000. The current budget is set appropriately for the management and protection of an area the size of the nominated site.

5.g Sources of Expertise and Training in Conservation and Management Techniques

Over the past many years scientific and curatorial experts from the Maotianshan Station of the Nanjing Institute of Geology and Palaeontology (Chinese Academy of Sciences), the Yunnan Department of Geology and Mineral Resources and the Yunnan Institute of Geology have carried out training programmes for the curatorial staff that take care of the fossils, offering knowledge of geology, palaeontology, fossil identification, ecology and biology as well as foreign language tuition. The Chengjiang Fossil National Geopark Management Committee has established a training programme for relevant staff on the following key duties and tasks: patrol duties, law enforcement, monitoring of fossil sites, community involvement and public education, financial management, computer and GIS techniques and the establishment and use of databases.

After training, qualified personnel are certificated to take up their post. In this way the overall quality of the managerial staff is improved and the effective management of the property is ensured.

Table 5-5 List of Training Programmes

Date	Programme	Organizer
June 1998	The Protection and Conservation of valued objects	Yuxi Bureau of Cultural Affairs
Jan. 1999	Conservation, Management and Identification of Fossils	CAS Nanjing Institute of Geology and Palaeontology
Sept. 1999	Enforcement of Regulations Concerning the Protection and Management of Chengjiang Fauna Fossils	Yunnan Department of Land and Resources
Sept. 2004	Knowledge of World Heritage matters	Yunnan Department of Construction
Sept. 2007	Planning and Management of Heritage Site	Ministry of Construction
Sept. 2008	Museum Display and Interpretation	Yuxi Municipal Museum

5.h Visitor Facilities and Statistics

5.h-1 Statistics of Visitor Numbers

Some 4,000-5,000 people visited the nominated site each year during the period 2005-2009 (statistics of Chengjiang Fossil National Geopark Management Committee). The majority were local people and visitors from neighboring areas and cities. Foreign visitors came mainly to conduct scientific investigations and surveys.

Year	2005	2006	2007	2008	2009
Visitor numbers	3,000	3,600	4,000	4,200	5,000

5.h-2. Visitor Service Facilities

Table 5-6 Visitor facilities in the Nominated Property

Visitor Facilities		Number	Description
Type of facility	Roads	4	Two roads for vehicles and two foot trails
	Tour Guides	2	Museum narrator
	Signs and notices	112	Twenty-two boundary and site signs; Eighty zoning signs; ten interpretation notices
	Publications	7	Books and brochures
Museum		1	666.67m^2
Management Station within the Nominated Property		1	

Overnight Accommodation	N/A	No such facilities exist within the Nominated Property itself, but accommodation is readily available in the local county town of Chengjiang and also at nearby Fuxian Lake Provincial Scenic Area.
Restaurant or Rest Facilities		
Shop		
Parking Space	1	1,200 m^2
Washroom	3	120 m^2
Search and Rescue	1	One first-aid station. Other medical, search and rescue services are provided in the nearby county town of Chengjiang.

Fig. 5-3 Signs within the nominated site

Fig. 5-4 Maotianshan and its sign

Fig. 5-5 The Entrance to the Chengjiang Fossil National Geopark

5.i Policies and Programmes Related to the Presentation and Promotion of the Property

Chinese scholars and academic institutions have had close cooperation and exchanges with international experts and academic institutions since 1984 when the Chengjiang Biota was discovered. The administration agencies responsible for the Nominated Property have attached great importance to the promotion and dissemination of knowledge of the discoveries and importance of Chengjiang fossils. High priority has been given to publicising the scientific significance of the Chengjiang Fossil Fauna, especially to the general public.

- **Academic Exchanges**

Since the mid 1980s the management body of the Chengjiang Fossil Site and associated local authorities have undertaken wide international cooperation and academic exchanges relating to Chengjiang fossils, with international scientific bodies such as: the International Palaeontological Association; Royal Swedish Academy of Science; the Royal Society, UK; Oxford University; Cambridge University; National Geographic, US; University of California; Chinese Academy of Sciences; Yunnan University, China; Northwestern University China; and Yunnan Academy of Geological Research. Exchanges have taken place in the form of Joint Research Projects, International conferences, workshops and other forms of scientific meetings, resulting in a wealth of advances in scientific knowledge and insight into the Evolution of life.

Fig. 5-4 International scientists studying at the Chengjiang Fossil Site

- The Public Understanding of Science

As abundantly indicated by, for example, evidence on the World-Wide-Web, the Chengjiang Biota has attracted substantial and high profile media attention and publicity via National and International TV and Radio programmes and by feature and other articles in Newspapers and Magazines. Lectures by international scientists around the world and exhibitions in International museums have also served to display the significance of Chengjiang fossils. For example, in 2010 The University of Oxford, UK, chose to

have an Exhibition on Chengjiang fossils as a highlight to celebrate the 150th anniversary of its University Museum of Natural History.

Table 5-7 National and International Exhibitions of Chengjiang fossils

Item	**Location**	Date
Exhibition of Chengjiang fossils	Taizhung Museum, Taiwan	1997
Exhibition of Chengjiang fossils	Hong Kong	1998
Exhibition of Chengjiang fossils	Pu Tsu, Japan	2000
Exhibition of Chengjiang fossils	Toyohashi, Japan	2006
Exhibition of Chengjiang fossils	Guangzhou	2007
Exhibition of Chengjiang fossils	Oxford University, UK	2010

- Publications

To date at least 10 books and over 200 scientific papers have been published in key international and national academic journals. These include many papers in prestigious journals such as *Nature*, *Science*, *Proceedings of the National Academy of Sciences*, *Proceedings of the Royal Society* and *Geology*. The authorship of these papers include Prof. Hou Xianguang, the discoverer of Chengjiang Biota, and many other distinguished palaeontologists and evolutionary biologists from countries world-wide.

The Chengjiang Fossil National Geopark Management Committee has also published relevant materials on the nature and significance of the fossils. These include books and discs giving an Introduction to the Chengjiang Fauna Nature Reserve and others illustrating a range of Chengjiang fossils.

5.j Staffing Levels (professional, technical, maintenance)

Management Agency	Management Personnel	Professional & Technical Personnel	Part-time Community Management Personnel	Total
Chengjiang Fossil National Geopark Management Committee	**14**	4	**16**	**18** + **16**

The day-to-day management body of the Nominated Property, the Chengjiang Fossil National Geopark Management Committee, consists of thirteen members, of whom ten are qualified with Collage diplomas, two have Master's degrees and one has a Doctorate. In their education two of these staff specialized in Paleontology, two in Geology, two in Management and six in Museum studies. In addition, the Management Committee also employs sixteen local personnel as part-time rangers. The total number of current staff is deemed appropriate for the management of the size of the area of the Nominated Property.

6. Monitoring

6.a Key Indicators for Measuring State of Conservation

The Nominated Property is not just an important fossil site; it is also a natural landscape area. Thus, the measure of conservation monitoring not only relates to the fossils, their localities and associated geological features but also to wider aspects of hydrological, ecological and biological conditions and the impact of human activities within the nominated area as a whole.

The main aspects to be monitored of the nominated Chengjiang Fossil Site include:

- Geological heritage monitoring: of fossil-bearing strata, stratigraphic sections, fossil localities and associated excavations;
- Vegetation monitoring: of vegetation cover and exotic species;
- Air monitoring: of air quality;
- Hydrologic monitoring: of atmospheric precipitation, groundwater and water quality;
- Land use monitoring: of cropland, water bodies, mining, logging and infrastructure construction (road building etc.);
- Population monitoring: of population numbers within the Nominated Property and Buffer Zone;
- Visitor management monitoring: of visitor numbers, sightseeing, tourism service facilities and quality;
- Natural hazard monitoring: of potential meteorological hazards, fire, landslides, mud flows etc.

Table 6-1 Monitoring Indicators of Chengjiang fossil site

Indicator		Schedule	**Location of Records**
Geological Heritage	Stratigraphical section	Monthly	Chengjiang Fossil National Geopark Management Committee
	Key fossil locality		
	Type specimen	Irregular	Chengjiang Fossil National Geopark Management Committee
			Palaeontology Key Laboratory of Yunnan University
			Nanjing Palaeontology Institute of Chinese Academy of Sciences
Plant and animal species		Irregular	Forestry Bureau of Chengjiang County
Exotic species		Irregular	Forestry Bureau of Chengjiang County
Meteorological condition		Daily	Meteorological Bureau of Chengjiang County
Hydrologic regime and water quality		Irregular	Environmental Protection Agency of Chengjiang County
Village and population		Irregular	Statistical Bureau and Agricultural Bureau of Chengjiang County
Land use		Irregular	Land and Resources Bureau of Chengjiang County
Visitors and tourism facilities		Daily	Chengjiang Fossil National Geopark Management Committee
Forest fire		Real-time monitoring	Forestry Bureau of Chengjiang County

Natural hazards	Irregular	Land and Resources Bureau of Chengjiang County

6.b Administrative Arrangements for Monitoring Property

In order to ensure the long-term effective protection and management of the Nominated Property, especially to safeguard its integrity, the Chengjiang Fossil National Geopark Management Committee has established a comprehensive monitoring system with the involvement of a wide range of relevant administrative agencies. For example, the Chengjiang County Agriculture Bureau is responsible for the monitoring of land use, villages and population etc. within the nominated area; the Chengjiang County Forestry Bureau is in charge of the monitoring of exotic invasive species, deforestation, and fire control; and the Chengjiang County Land Resources Bureau is responsible for the monitoring of geological/natural hazards. All of the monitoring results and data are overseen by the National Geopark Management Committee, which checks and analyzes such information as the basis for decision-making. A quick response will be undertaken relating to any infringements of the Nominated Property.

As a result of the many and on-going improvements to the monitoring system and effective management of the nominated Chengjiang Fossil Site, it has been transformed from an area of much used human activity twenty years ago to a much more natural landscape today.

Table 6-2 Administrative bodies in charge of monitoring the Chengjiang Fossil Site

Monitoring bodies	Contact Information		
	Telephone	Address	Postcode
Chengjiang Fossil National Geopark Management Committee	0877-6913177	Chengjiang County, Yuxi City, Yunnan, P.R. China	652500
Chengjiang Forestry Bureau	0877-6911185	Chengjiang County, Yuxi City, Yunnan, P.R. China	
Chengjiang Environmental Protection Bureau	0877-6917528	Chengjiang County, Yuxi City, Yunnan, P.R. China	
Chengjiang Meteorological Bureau	0877-6911194	Chengjiang County, Yuxi City, Yunnan, P.R. China	
Chengjiang Water Conservancy Bureau	0877-6911115	Chengjiang County, Yuxi City, Yunnan, P.R. China	
Chengjiang Land Resources Bureau	0877-6913822	Chengjiang County, Yuxi City, Yunnan, P.R. China	
Chengjiang Agriculture Bureau	0877-6911139	Chengjiang County, Yuxi City, Yunnan, P.R. China	

6.c Results of Previous Reporting Exercises

Table 6-3 Results of Previous Monitoring Records

Record	Content	Achieved by	Archived in
Monitoring Report of Geological Heritage	Regular monitoring of key geological features: sections, fossil localities and associated excavations	Chengjiang Fossil National Geopark Management Committee	Chengjiang Fossil National Geopark Management Committee

Management Record of Type Specimen (of each fossil species)	Management record of type specimen	Chengjiang Fossil National Geopark Management Committee	
Annual Monitoring Report of Air Quality and Climate	Air quality, precipitation, evaporation and temperature	Chengjiang Meteorological Bureau	Chengjiang Meteorological Bureau
Annual Monitoring Report of Water Environmental Quality	Water quality change	Chengjiang Environmental Protection Bureau	Chengjiang Environmental Protection Bureau
Geological Maps of Chengjiang Fossil National Geopark	1. Geological background data: strata, geological structure and topographic features; 2. GPS located geological boundaries, fossil localities, hydrological features and roads in the Geopark. 3. Maps and relevant information: (1) 1:20000 scale Topographic and Geological Map of Chengjiang Fossil National Geopark (five copies); (2) 1:20000 scale Original Data Map of Chengjiang Fossil National Geopark (one original and one copy).	Yunnan Yuxi Taiyuan Mining Co., Ltd. (2006)	Chengjiang Fossil National Geopark Management Committee
Guidebook of Chengjiang Fossil National Geopark	Introduction to Chengjiang Fossil National Geopark, with up-to-date geological information	By Jiang Zhiwen & Chen Ailin; Published by Yunnan Nationalities Publishing House (2008)	Yunnan Nationalities Publishing House
Investigation Report of Chengjiang Forest Resources for Planning and Design	Survey report of current forest resources of Chengjiang County (including the nominated area)	Yunnan Provincial Institute of Forest Survey and Planning (2008)	Yunnan Provincial Institute of Forest Survey and Planning,

7. Documentation

7.a Photographs, Slides, Image Inventory, Authorization Table and Other Audiovisual Materials

The following materials are provided:

- Digital photographs of Chengjiang fossils (which can used on a webpage; 50 photographs, jpg format at 300 dpi resolution)
- 30 slides (35mm)
- One disk, introducing the Chengjiang Fossil Site (35 minutes)
- One atlas (picture album) of the Chengjiang Fossil Site
- Inventory of the Chengjiang Fossil Site (see Appendi 4)
- Authorization for photographs and audiovisual materials relating to the Chengjiang Fossil Site

Table 7-1 Authorization Form for photographs and audiovisual materials relating to the Chengjiang Fossil Site

Id.No	Format (slide/ print/ video)	Caption	Date of Image	Photographer/ Director of the Material	Copyright owner	Contact details of copyright owner	Non-exclusive cession of rights
1	30 slides, 35mm	Fossils of Chengjiang Fauna	2000~ 2010	Chengjiang Fossil National Geopark Management Committee	Chengjiang Fossil National Geopark Management Committee	Chengjiang Fossil National Geopark Management Committee dwq177@126.com	Use authorized
2	One disk introducing Chengjiang Fossil Site, 35 minutes	Chengjiang Fossil Site	2010	Chengjiang Fossil National Geopark Management Committee	Chengjiang Fossil National Geopark Management Committee	Chengjiang Fossil National Geopark Management Committee dwq177@126.com	Use authorized
3	One atlas (photographic album): the Chengjiang Fossil Site	Fossils of Chengjiang Fauna	2000~ 2010	Chengjiang Fossil National Geopark Management Committee	Chengjiang Fossil National Geopark Management Committee	Chengjiang Fossil National Geopark Management Committee dwq177@126.com	Use authorized
4	Digital photographs: Chengjiang fossils (50 photos, jpg format, 300 dpi)	Fossils of Chengjiang Fauna	2000~ 2010	Chengjiang Fossil National Geopark Management Committee	Chengjiang Fossil National Geopark Management Committee	Chengjiang Fossil National Geopark Management Committee dwq177@126.com	Use authorized

7.b Texts relating to Protective Designation, Copies of Property Management Plans or Documented Management Systems and Extracts of Other Plans Relevant to the Property

7.b-1 Texts relating to protective designation

Provincial Nature Reserve

This refers to a protected natural area that has value in terms of its landscape, culture or scientific significance, in which the natural landscape and human landscape co-occur, and which is available for sightseeing or scientific and cultural activities.

National Geopark

The National Geopark is identified as a unique geological area – a natural park in a region embracing both natural and man-made landscapes. It is used for various geological and geographic disciplines related to sustainable development education, environmental education, training and research. It also serves to promote the sustainable development of the society, economy and environment of the region. The National Geopark is approved and designated by the Ministry of Land and Resources.

National Natural Heritage

The establishment of China's 'National Natural Heritage' is to help facilitate the identification of sites that have potential for constituting China's World Heritage Tentative List. National Natural Heritage status stems from existing national protected areas that have recognized outstanding scientific and/or aesthetic value, such as national parks, national nature reserves and national geoparks. National Natural Heritage status is designated by the Ministry of Housing and Urban-Rural Development, after due evaluation procedure.

7.b-2 Copy of management planning

- 《Chengjiang Fossil Site Management Plan》 **(submited as Appendix 3)**

7.b-3 Other excerpts relating to planning

- **《Guidelines for Economic and Social Development of Chengjiang County during the 11th Five-year Plan Period》**

The advantages that Chengjiang County has in terms of natural resources and geography will be fully utilized. Tobacco cultivation and allied employment sectors will be supported, as will the phosphorous chemical industry. Tourism will be fostered and encouraged to grow, with special attention being paid to the conservation and lasting value of Maotianshan and nearby Fuxian Lake.

In accordance with the requirements of constructing a national eco-region demonstration area and following the important designation of "three protections" accorded for the Chengjiang Fossil Site, by the end of the 11th five-year plan period environmental degradation of the local area will have halted. Furthermore, socioeconomic development, preservation of the regional ecological environment and protection of both rural and urban environment will meet the requirements of a 2nd category eco-region demonstration area in accordance with national standards.

Chengjiang County will restore the natural environment of Maotianshan. It will undertake afforestation and allied ecological projects totaling an area of 16,869mu (1,124.60ha). Forest coverage of the Maotianshan Preservation Zone will exceed 80% by the end of 11th Five-year Plan period.

- 《Master Plan of the Chengjiang Fossil National Geopark》

(i) Background

On September 5, 2004 Chinese Premier Wen Jiabao made a landmark declaration concerning the preservation of the Chengjiang Fossil Site: "Protect the Chengjiang fossil site; protect the world fossil Lagerstätte; protect the natural heritage of great scientific importance." As a result, in order to effectively preserve the Chengjiang Fossil Site the Land and Resources Department of Yunnan Province have made dedicated arrangements for a master plan for the Chengjiang Fossil National Geopark.

(ii) Scope

The Chengjiang Fossil National Geopark centers on the Maotianshan area. It extends southward and northward respectively, embracing a natural landscape with geologic horizons and that includes fossil-bearing strata; the entire area is to be protected and managed. The Geopark covers 18 square kilometers. Its geographic center lies at: N 24°40'08", E 102°58'38".

(iii) Nature of the Plan

The Chengjiang Fossil National Geopark is a geologic heritage that contains outstanding evidence of Earth evolution and the evolution of life, as seen in important rock sections and their fossils. It is also an important stratigraphic site for the international correlation of strata of early Cambrian age. Important geological features of the Geopark include:

- Chengjiang Biota fossil-bearing strata

The fossil-bearing stratigraphic unit is essentially the mudstone of the Yu'anshan Member (Є1q2-2), Qiongzhusi Formation, of lower Cambrian age. The fossil-bearing unit is some 70m thick and extends laterally for more than 20km within the Geopark. In addition, the underlying stratigraphic unit, the Yuhucun Formation (Є1y), contains a rich fauna of so-called small-shelly fossils. These are taxonomically enigmatic species that provide important supplementary evidence for the Cambrian radiation of life.

- Key Stratigraphic Sections

In particular the Dapotou section, Kuama Village-Maotianshan section, Xiaolantian section and the Hongjiachong section are key Chengjiang fossil-bearing stratigraphic sections and therefore require protection.

- Notable fossiliferous localities

There are at least seven important localities that yield abundant fossils; each is to be protected. Of these, the Fengkoushao locality is especially suitable as a site for public education of the Chengjiang Biota.

(iv) Protection planning

The Geopark contains a wide range of important geological features such as key rock sections with abundant fossil-bearing horizons. In order to maintain the integrity of the area as a whole protection will be afforded to the landscape in its entirety, including the landform itself, the water system and the ecological system and associated wildlife.

- Protection by zonation

A four-tiered protection zone classification is adopted for the Geopark: namely, a special protection zone;

a first class protection zone; a second class protection zone; and a third class protection zone. The boundaries of these zones, and in particular those relating to the special protection zone and the outmost boundary of the Geopark will be demarcated on the ground.

• Ecological rehabilitation

Based on the results of a Feasibility Study ('*Report on the Maotianshan Forest Ecological Construction Project of Chengjiang County*'), the ecological rehabilitation plans for the Maotianshan area include: the return of scattered cropland to grassland; the afforestation of 19,700 mu (1,313ha), making the total forest coverage 72.9% of the Geopark.

• Rehabilitation of the environment

In accordance to Regulations relating to 'Ecological and Geological Improvement Planning for the Maotianshan Chengjiang Fossil Site', rehabilitation of the geological environment has included:

Short-term goal (2005-2007)**:** rehabilitation of the disturbed ground (that resulted mainly from mining activities) in and around the special protection zone, thus returning the area to its former natural landscape and relief.

Long-term goal (2007-2010)**:** rehabilitation of most of the Geopark area to its natural landscape. This programme has included retrieval of relief where necessary; afforestation; protection of important geological features; and the construction of visitor facilities as appropriate.

• Greening of the Landscape

The Geopark is located in the subtropics, and the predominant local vegetation is essentially evergreen broad-leaved forest that includes Yunnan pine, Armand pine, *Avelynia keteleevia*, *Anus nepalensis*, *Dodonaea viscose*, shrubs, chestnut plantations, cypress and eucalyptus. Planting renewal of the landscape should be mindful of the local natural vegetation and ecology by planting indigenous plant species. The aim is to endorse a natural vegetation system, comprising grass-bush-forest.

● 《Ecological and Geological Improvement Planning of the Maotianshan Fossil Site and Surrounding Areas》

(i) Background

As a key area of phosphorite deposits Chengjiang County boasts a gross reserve of 640 million tons, accounting for 21.8% of the total reserves of Yunnan Provence. Mining began in the area of what is now the Chengjiang Fossil Nature Reserve (established in 1997) in 1984, which contains about 66% of the total phosphorite reserves of Chengjiang County.

Immediately after the approval of the establishment of the Chengjiang Fossil Nature Reserve by the Yunnan Provincial Government, Chengjiang County began to regulate mining activities within the protected area. In the period 1997-2000, 48 small-scale mines were closed because they were damaging the natural environment. In 2003 nine unlicensed mines were also closed.

In 2004, Premier Wen Jiabao gave instructions to increase protection of the Chengjiang Fossil Site. Chengjiang County authorities closed fourteen further mines adjacent to the protected area and a law enforcement group was set up to promote and monitor environmental improvement of the former mining areas. All mines with the protected area were closed in 2004; as a result, the total output of phosphorite mines of Chengjiang County sharply reduced from 1.2 million tons to 100,000 tons.

A 2002 study showed that after nearly 20 years of phosphorite exploitation the total impacted area within the protected area was 3157.5 mu. Due to open pit mining and uncontrolled tailing, local relief of the effected area was disturbed, thereby to some extent compromising the Chengjiang fossil-bearing strata. Since the banning of mining in 2004, large-scale comprehensive environmental improvement has been conducted. Organized by the Yunnan Provincial Department of Land Resources and involving relevant government agencies and scientific institutes, a series of environment rehabilitation plans and projects have been undertaken. These include: Preliminary Guidelines to Protect Geologic Features; Improvement of the Geological Environment of Mining areas in Maotianshan and Surrounding Areas; Ecological and Geological Improvement Planning of the Maotianshan Fossil Site and Surrounding Areas; and the Feasibility Report of the Geological Environment Improvement Project of Phosphorite Mining Areas in the vicinity of Maotianshan (Phases Two and Three). In May 2005 the 'Ecological and Geological Improvement Planning of the Maotianshan Chengjiang Fossil Site' was adopted as the official document for planning.

(ii) Engineering Work

In accordance with the requirements of the planning laws engineering work for the mine-damaged areas are as follows:

Step One: To stabilize the disturbed mining areas.

Step Two: To restore the compromised relief, rebuilt the topsoil and facilitate the natural recovery of vegetation.

Step Three: With respect to the original ecosystem, carry out both artificial and natural recovery of vegetation.

The areas identified for environmental improvement are classified into two categories: a key improvement area; and an ordinary improvement area.

There are a total of twelve improvement areas, covering about 2,208 mu (147.2ha), which accounts for 69.93% of the total damaged surface area.

Table 7-2 Areas identified for Environmental Improvement within the Chengjiang Fossil Site

Site	Area (mu) **(1 mu= 1/15ha)**	Item
Kongxinfen Mining Area	255	Key Area: protect geological heritage features; restore vegetation; effect landslide control; stabilize waste disposal site and stockpile area; landfill as necessary; rebuild trails and set up signs
Luolishan	148	Key Area: protect geological features such as sections of strata; rehabilitate the mining surface; effect landslide control
Kongdongshan	474	Ordinary Area: Recover/re-excavate geological features; rehabilitate the mining surface and deal with any potential geological hazards
Guojiashan	283	Ordinary Area: Recover/re-excavate geological features; rehabilitate the mining surface and deal with any potential geological hazards
Mopanshan	260	Ordinary Area: Recover/re-excavate geological features; rehabilitate the mining surface and deal with any potential geological hazards
Hujiawanzi	130	Ordinary Area: Recover/re-excavate geological features; rehabilitate the mining surface and deal with any potential geological hazards
Hongjiachong	104	Ordinary Area: Recover/re-excavate geological features; rehabilitate the mining surface and deal with any potential geological hazards
Heimadi	83	Ordinary Area: Recover/re-excavate geological features; manage the mining surface and stabilize the side slope.
Pingtanzi	113	Ordinary Area: Recover/re-excavate geological features; rehabilitate the mining surface and deal with any potential geological hazards

Wenshuihe	112	Ordinary Area: Recover/re-excavate geological features; rehabilitate the mining surface and deal with any potential geological hazards
Dapotou	97	Ordinary Area: Recover/re-excavate geological features; rehabilitate the mining surface and deal with any potential geological hazards
Xiaotuanpo	52	Ordinary Area: Recover/re-excavate geological features; rehabilitate the mining surface and deal with any potential geological hazards
Total	**2208**	Key Area: 403 mu (about 26.87ha) Ordinary Area: 1805 mu (about 120.33 ha)

(iii) Recovery of the vegetation

According to the "Regional Vegetation of China", the nominated Chengjiang Fossil Site is within the subtropical evergreen broad-leaved forest region. The original vegetation is semi-humid evergreen broad-leaved forest characterized by plants of the Beech family. However, due to long-term human activities the original forest has largely disappeared, leaving mostly secondary vegetation that has appeared since the area was designated a protected area some 20 years ago.

As mentioned above, ecological recovery is one of the key aspects to improving the entire environment of the Chengjiang fossil protected area. Local relief and its vegetation are integral parts of the landscape as a whole. After one year's endeavor of environmental rehabilitation, the overall natural landscape of the Chengjiang Fossil Site has largely been recovered and bodes well for the future.

7.c Form and Date of Most Recent Records or Inventory of Property

7. c-1 Type and Date of Records

Table 7-3 Selective scientific inventory-type records about the Chengjiang Fossil Site

Nominated Property	Record	Date
Chengjiang Fossil Site	*The Cambrian System of the southwest region of China* (Volume)	1979
	The Sinian–Cambrian Boundary of Eastern Yunnan (Volume)	1982
	Chengjiang Fauna: the Witness of the Cambrian Explosion (Book)	1996
	Lower Cambrian Arthropods from Chengjiang, southwest China (Monograph)	1997
	Chengjiang Fossils: marine animals of 530 million years ago (Book)	1999
	Early Cambrian Chengjiang Fauna of Kunming area (Book)	1999
	Early Cambrian Chengjiang Fossils of Eastern Yunnan (Book)	2002
	The Flowering of Early Animal Life (Book)	2004
	The Dawn of the Animal Kingdom (Book)	2004
	Manual of Geological Map of the Chengjiang Fossil National Geopark of Yunnan Province	2006
	Guidebook of the Geology of the Chengjiang Fossil National Geopark	2005

7. c-2 Inventory of the Nominated Property

1. List of the Chengjiang Fossils

(See Appendix 4: Chengjiang fossil inventory list)

2. The main geological heritage features of the Chengjiang Fossil Site

Geological heritage features	Main features
Kuama Village - Dadiyakou - Maotianshan Section	**Location:** in the center of the nominated site; east of the Village Committee Office of Jihua Village and Kuama Village. **Stratigraphic sequence:** Longtan Formation, Upper Sinian System (Zb_2dn^3); Jiucheng Member of Yuhucun Formation (Zb_2y^1); Baiyanshao Member (Zb_2y^2), Xiaowaitoushan Member (Zb_2y^3), Zhongyicun Member ($Є_1y^4$), Dahai Member ($Є_1y^5$), Shiyantou Member ($Є_1q^1$) and Yu'anshan Member ($Є_1q^2$) of Qiongzhusi Formation. **Fossils:** Trace fossils of the Jiucheng Member; small-shelly fossils of the Meishucun Fauna (in Zhongyi Village) and Chengjiang Fauna fossils of the Yu'anshan Member.
Xiaolantian Section	**Location:** north of the nominated site; hillslope150 m south of the Village Committee Office of Longtan Village and Xiaolantian Village. **Stratigraphic sequence:** Shiyantou Member ($Є_1q^1$) – Yu'anshan Member ($Є_1q^2$) of the lower Cambrian Qiongzhusi Formation. **Fossils:** Chengjiang Fauna fossils.
Maotianshan Fossil Locality	**Location:** north, south and west slopes of Maotianshan hill. **Stratigraphic sequence:** Yu'anshan Member ($Є_1q^2$) of lower Cambrian Qiongzhusi Formation. **Fossils:** Chengjiang Fauna fossils. The west slope is the locality where the first soft-bodied fossils of the Chengjiang Fauna were discovered by Hou Xianguang in 1984.
Maanshan Fossil Locality	**Location:** west of the Ganhaizi Village, some 500m south of the Xiaolantian Section. **Stratigraphic sequence:** Yu'anshan Member ($Є_1q^2$) of lower Cambrian Qiongzhusi Formation. **Fossils:** Abundant Chengjiang Fauna fossils.
Xiaolantian Fossil Locality	**Location:** north part of the nominated site. **Stratigraphic sequence:** Yu'anshan Member ($Є_1q^2$) of lower Cambrian Qiongzhusi Formation. **Fossils:** Abundant Chengjiang Fauna fossils.
Luolishan Fossil Locality	**Location:** east side of Maotianshan hill, **Stratigraphic sequence:** Yu'anshan Member ($Є_1q^2$) of lower Cambrian Qiongzhusi Formation. **Fossils:** Chengjiang Fauna fossils

7.d Address where Inventory, Records and Archives are held

Addresses of Stakeholders of the Nominated Property

Nominated Property	Name of the Stakeholder	Address	Postcode
Chengjiang Fossil Site	Chengjiang Fossil National Geopark Management Committee	Chengjiang County, Yuxi City, Yunnan Province, P.R. China	652500
	Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences	39 Beijing Road East, Nanjing City, Jiangsu Province, P.R. China	210008
	Yunnan University	Kunming City, Yunnan Province, P. R. China	650031
	Northwest University	71 West Section, South Ring Road, Xi'an City, Shaanxi Province, P.R. China. North Campus: 229 Taibai North Road, Xi'an City 710069. 1 Xuefu Avenue, Guodu Education & Technology Industrial Park, Chang'an District, Xi'an City 710127.	710069
	Institute of Geology of Yunnan Province	Baita Road, Kunming City, Yunnan Province, P.R. China	650216

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Development of the People's Republic of China

World Heritage Nomination

Natural Property . China

Chengjiang Fossil Site

Appendix 1

Executive Summary

Ministry of Housing and Urban-Rural

Development of the People's Republic of China

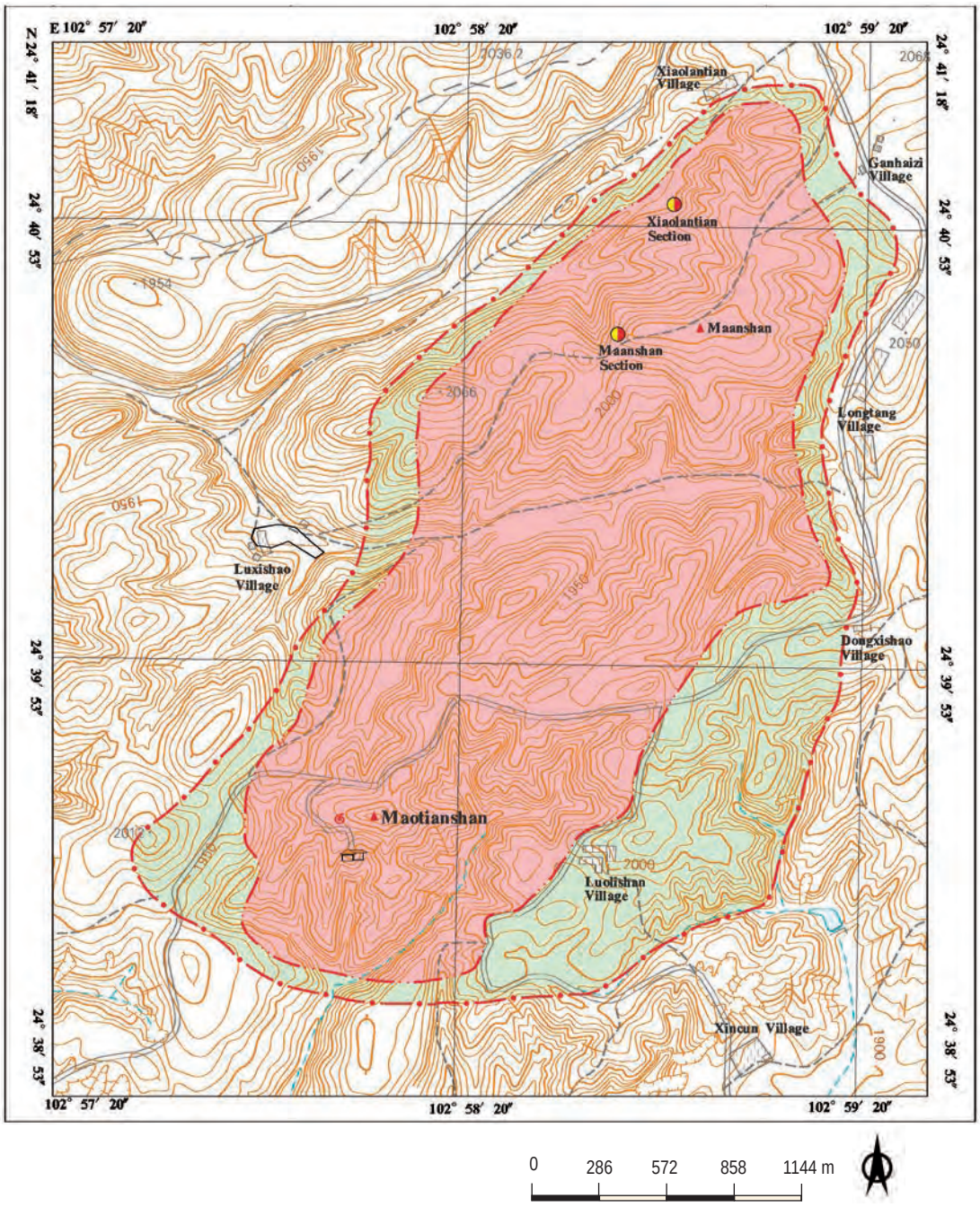
2011.1

Executive Summary

Executive Summary

State Party	The People's Republic of China
State, Province or Region	Chengjiang County, Yuxi City , Yunnan Province
Name of Property	Chengjiang Fossil Site
Geographical coordinates (central point)	**N 24°40'08" , E 102°58'38"**
Description of the boundary of the Nominated Property	The Nominated Property is a strip of land orientated northeast to southwest. It is 3,713m long, 2,555m wide and has a total area of 512 ha. The area consists of hilly land, with an elevation range of 156m. Based on the location of the fossil-bearing strata, fossil localities and local relief, the boundary of the Nominated Property is delineated as follows: **East side:** starts at the east end of the south valley of Xiaolantian Village, 100m west of the highway; extends southward via Haizi Village to Dongjishao Village, and ends south of Luolishan Village. **South side:** starts south of Luolishan Village; extends west to end west of the Maotianshan Management Station. **West side:** starts west of the Maotianshan Management Station; extends east of Luxishao Village and Ma'anshan, and ends west of Nandagou of Xiaolantian Village. **North side:** starts from the roadside at the west end of the south valley of Xiaolantian Village; extends east to the east end of the south valley. The nominated property includes a comprehensive sequence of exposed and unexposed strata and fossil horizons. It contains key stratigraphic sections and fossil localities, that are the most important and most representative of the Chengjiang Fossil Site. There is no permanent human residence or any industrial activity within the nominated property. The Buffer Zone surrounding the nominated property has a total area of 220 ha. The boundary of the Buffer Zone has been delineated by consideration of geological (structure; stratigraphy; fossil localities), topographical, human impact and other relevant factors. The Buffer Zone has one village and patches of farmland in valley bottoms and on gentle hill slopes but no industrial activity. The boundary of the Buffer Zone is delineated as follows: **East side:** starts from the east end of Nandagou of Xiaolantian Village; extends via Ganhaizi Village southward, and ends 800m east of Luolishan Village. **South side:** starts 800m south of Luolishan Village; extends west to 200m west of the reservoir and the Maotianshan Management Station. **West side:** starts 200m west of the reservoir and the Maotianshan Management Station; extends east of Luxishao Village, and ends at the west end of the south valley of Xiaolantian Village. **North side:** starts from the roadside at the west end of the south valley of Xiaolantian Village; extends east and ends at the east end of the south valley.
A4 size map of the Nominated Property, showing boundaries and Buffer Zone	Detailed map of the Chengjiang Fossil Site (overleaf)

Detailed Map of the Chengjiang Fossil Site

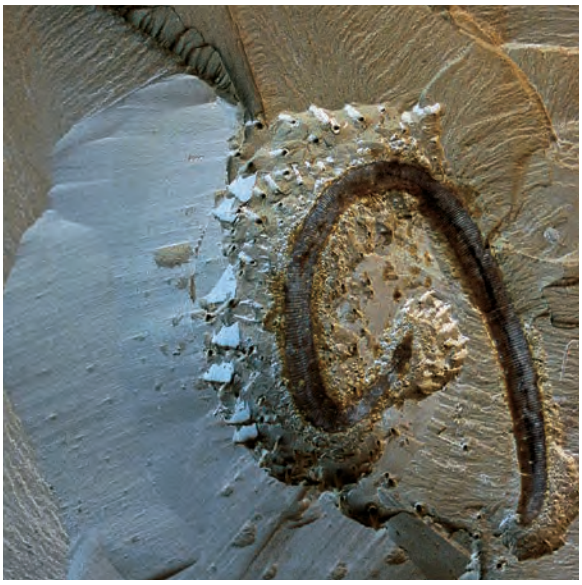


Legend

- Nominated Property
- Buffer Zone
- Hill
- Trail
- Road
- Initial discovery site of Chengjiang fossil
- Stratigraphic section
- Paleontology research station
- Village

Justification Statement of Outstanding Universal Value	The nominated Chengjiang Fossil Site is a more than outstanding example of a major stage in the history of life on Earth. Of the three really major events in the evolutionary history of life on our planet – the origin of life, the Cambrian explosion and the end-Permian extinction event - the Chengjiang fossil Lagerstätte represents an unparalleled record of the fundamentally important rapid diversification of metazoan life in the early Cambrian (the Cambrian explosion) and of the primary establishment of a complex marine ecosystem. The major aspects of its importance are: • It provides direct evidence for the roots of animal biodiversity. • It presents by far the most complete record of an early Cambrian marine community. • It contains a prolific and exceptionally preserved biota, displaying the anatomy of hard and soft tissues of a very wide variety of organisms, invertebrate and vertebrate, in exquisite detail. • Its fossils bear upon fundamental questions regarding the design of animal body plans and the genetic generation of evolutionary novelty. • It records the early establishment of a complex marine ecosystem, with food webs capped by sophisticated predators. • The mode of preservation imparts a particular and rare beauty to the fossils, extending their value from the scientific to the aesthetic.
Criteria under which the property is nominated	*Criterion (viii): be outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features.* In relation to the "record of life" (Criterion (viii)), the nominated Chengjiang Fossil Site is of outstanding universal value because: • The Chengjiang fossil Lagerstätte, dated 530 million years before present, is the primary exemplifying biota of the early Cambrian explosion. It represents an unparalleled record of the fundamentally important rapid diversification of metazoan life in the early Cambrian, a geologically short interval during which almost all major groups of animals had their origins. It is an outstanding example of a major stage in the history of life, representing a palaeobiological window of exceptional significance. • The Chengjiang fossil Lagerstätte is unrivalled for its rich species diversity and fossil sites. To date at least 16 phyla, plus a variety of enigmatic groups, and about 200 species have been documented. Taxa recovered range from algae, through sponges and cnidarians to numerous bilaterian phyla, including the earliest known vertebrates. It is the most completely preserved early Cambrian community known. The Chengjiang fossil Lagerstätte contains early representatives of several major phylogenetic lineages. The earliest known specimens of several phyla such as cnidarians, ctenophores, sipunculans, priapulids, echinoderms and chordates occur here. Many of the taxa represent the stem groups to extant phyla and throw light on the pattern of acquisition of the characters that differentiate crown groups. • The Chengjiang fossil Lagerstätte is of truly exceptional preservation that the soft and hard tissues of skeletonized animals are preserved along with a wide array of organisms that were entirely soft bodied, and therefore normally unrepresented in the fossil record. It contains a wide variety of soft-bodied taxa, including many vermiform animals. Almost all of these soft-bodied species are unknown elsewhere. The quality and fidelity of

	preservation can be seen, for example, in the morphology of the proboscis and gut in nematomorph and priapulid worms such as Cricocosmia and Protopriapulites, the complex alimentary system in the arthropod *Naraoia*,and the delicacy of the gills in the enigmatic *Yunnanozoon*. The vertebrates, such as *Myllokunmingia*, preserve gills, serial structures interpreted as myomeres and gonads, and structures within the head. • The Chengjiang fossil Lagerstätte presents by far the most complete record of an early Cambrian marine community. It records the early establishment of a complex marine ecosystem, with food webs capped by sophisticated predators. It is the earliest record of a complex marine ecosystem. Moreover, it demonstrates that complex community structures had developed very early in the Cambrian diversification of animal life. There is evidence in the Chengjiang biota for the occupation of a wide range of ecological niches. The preserved biota enables palaeoecological investigation of a very early marine ecosystem. No other known site provides an equivalent window into the structure of early Cambrian communities.
Contact Information **of the official local** Institution/Agency	**Organization:** The Chengjiang Fossil National Geopark Management Committee **Address:** Chengjiang County, Yuxi City, Yunnan Province, P.R. China **Tel:** +86-0877-6913177 **Fax:** +86-0871-6913177 **E-mail:** dwq177@ 126.com



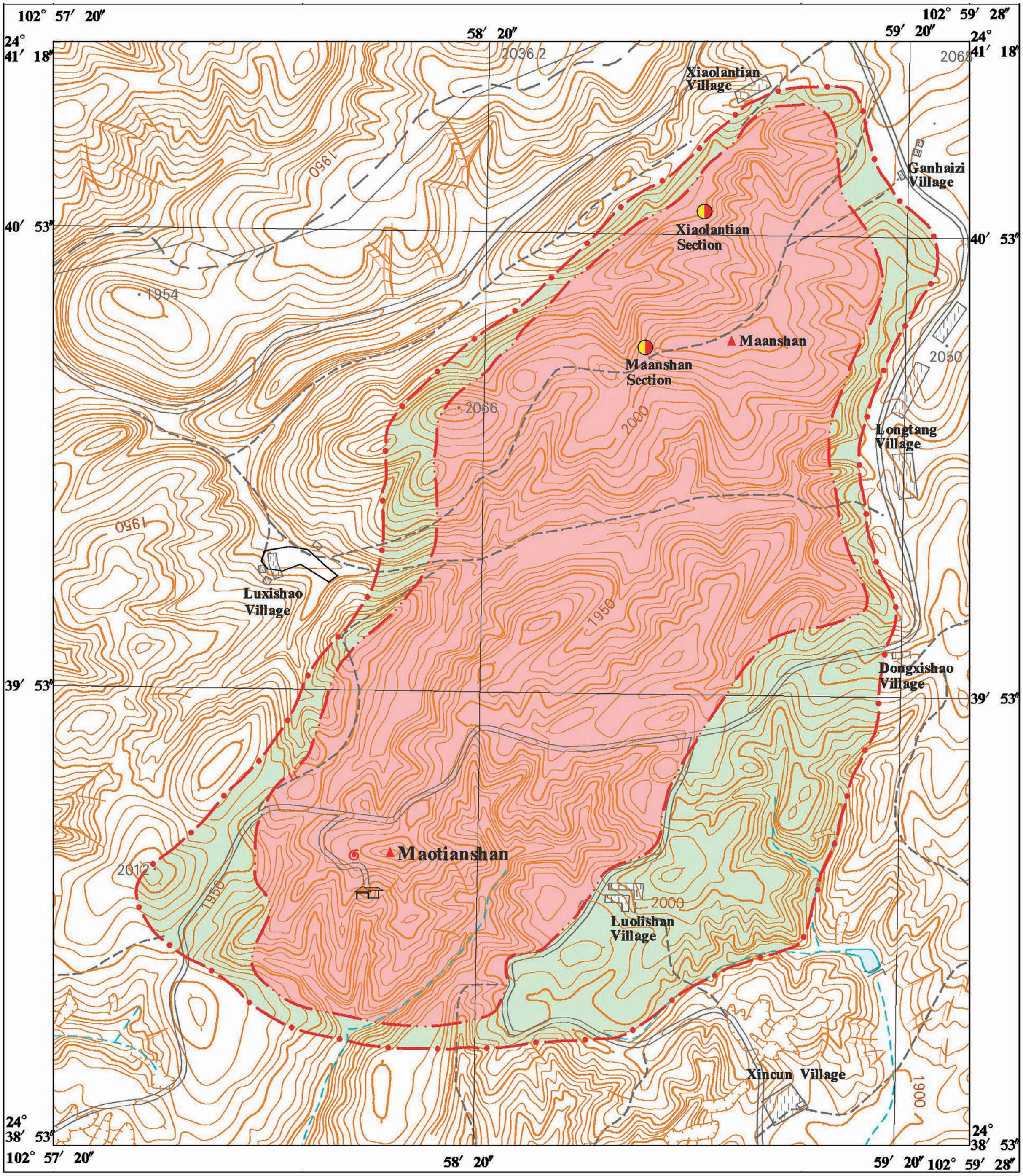
Map 1. Location of the Chengjiang Fossil Site in China

Legend

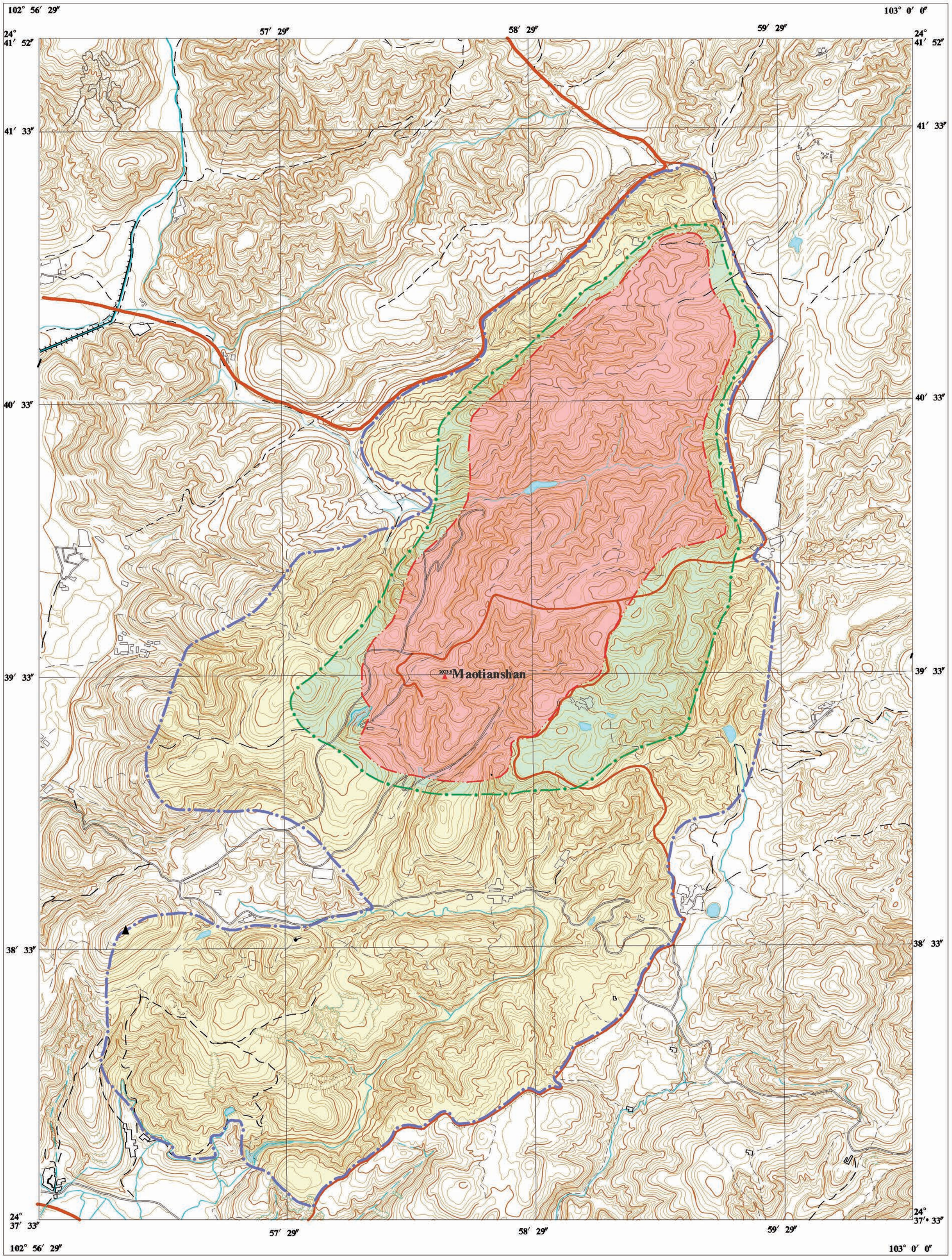
- Beijing
- Provincial Capital
- National Boundary
- Provincial Boundary
- River
- Lake
- Chengjiang Fossil Site

Map 2. Location of the Chengjiang Fossil Site in Yunnan Province

Map 3. Detailed Map of the Chengjiang Fossil Site



Map 4. Map showing relationship of the Chengjiang Fossil Site to the Chengjiang Fossil National Geopark



磨盘山

鹞山

黑鸣山

磷化

磷酸盐厂

新村村民委员会

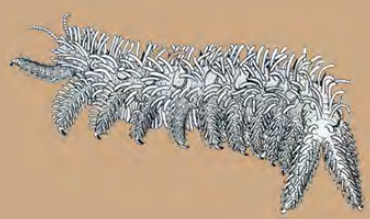
World Heritage Nomination

Natural Property . China

Chengjiang Fossil Site

Appendix 3

Chengjiang Fossil Site Management Plan



Ministry of Housing and Urban-Rural

Development of the People's Republic of China

2011.1

Chengjiang Fossil Site Management Plan

Table of Contents

1. Planning Goals and tasks

The request to nominate the Chengjiang Fossil Site in Yunnan into the List of World Heritage Sites aims to afford the common and global protection of its outstanding universal value, and endow it with the status of one of the world's natural treasures. In this regard, the People's Government of Yuxi City, through the advocacy of the People's Government of Yunnan Province and supported by the competent departments of the national government, and the world heritage management department, wishes to request that the Chengjiang Fossil Site be inscribed into the List of World Heritage Sites. These various levels of government within Yunnan and China are committed to carrying through the responsibilities and obligations for the protection of the Chengjiang Fossil Site, and to share the global rights and obligations for the common maintenance of it as a world heritage site. This Protection and Management Planning document will therefore enable:

- The Chengjiang Fossil Site to fulfill the requirements for a world heritage site;
- The permanent maintenance of the outstanding universal value identified for the site;
- Constant inquiry into the scientific, cultural and aesthetic values of the site;
- A substantial and active role in the nature conservation and sustainable social and economic development of the region.

1.1 Primary goals

1) To formulate the protection and management goals for the Chengjiang Fossil Site that comply with the requirements established in the laws and regulations of national and local government;

2) To develop tasks for the Chengjiang Fossil Site in order to achieve the goals for the protection and management of a world heritage site;

3) To develop protection and management action plans that incorporate the needs for the social and economic development of the region where the Chengjiang Fossil Site is located, and that play a constant and active role in the sustainable development of the local society and economy.

4) To propose the funding channels (sources) that will secure the implementation of the Protection and Management Planning objectives identified for the Chengjiang Fossil Site and its biota.

1.2 Primary tasks

1) To identify the conservation targets, their contents, as well as their spatial distribution with reference to the designated classes and categories, together

with the protection and management tasks at each stage, based on the outstanding universal value of the Chengjiang Fossil Site;

2) To identify the tasks for the protection of the Chengjiang Fossil Site and to formulate five-year planning and action plans for the site, based on the conservation laws and regulations of the national and local government;
3) To assess the status quo of the protection and management of Chengjiang Fossil Site, and to clarify the intrinsic values of the integrity of Chengjiang Fossil Site, so as to formulate action plans for the protection and restoration of the natural physiognomy;
4) To identify the elements for exhibition and education, and to develop the action plan accordingly, in accordance with the requirements for the exhibition of a world heritage site;
5) To identify a realistic protection system and secured funding support;
6) To identify the contents and formulate the action plans which are relevant to the outstanding universal value and integrity of the Chengjiang Fossil Site.

2. Bases for Formulating the Protection and Management Planning

The bases for formulating the protection and management planning for the nominated Chengjiang Fossil Site are the laws and regulations of the national and local government to which the protected attributes of the site are affiliated. The formulation process is guided by the Convention Concerning the Protection of the World Cultural and Natural Heritage and the Operational Guidelines for the Implementation of the World Heritage Convention.

2.1 List of key supportive state laws and regulations

No.	Title of the Laws and Policies	Time of Adoption	Adopting bodies
1	The Constitutions of the People's Republic of China	Adopted on Dec. 4, 1982, and amended on April 12, 1988, March 29, 1993, March 15, 1999 & March 14, 2004.	The Fifth National People's Congress
2	The Environmental Protection Law of the People's Republic of China	December 26, 1989	The Seventh Commission of the Standing Committee of the National People's Congress
3	The Law of the People's Republic of China on Environmental Impact Assessment (EIA)	October 28, 2002	The Ninth Commission of the Standing Committee of the National People's Congress
4	Land Management Law of the People's Republic of China	August 28, 2004	The Tenth Commission of the Standing Committee of the National People's Congress
5	Water Law of the People's Republic of China	August 29, 2002	The Ninth Commission of the Standing Committee of the National People's Congress
6	Law of the People's Republic of China on Water and Soil Conservation	June 29, 1991	The Seventh Commission of the Standing Committee of the National People's Congress
7	The People's Republic of China Law on the Prevention and Control of Water Pollution	Adopted on May 11, 1984, and amended on May 15, 1996 and February 28, 2008.	The Standing Committee of the National People's Congress

No.	Title of the Laws and Policies	Time of Adoption	Adopting bodies
8	Mineral Resources Law of the People's Republic of China	Adopted on March 19, 1986 and amended on August 29, 1996.	The Standing Committee of the National People's Congress
9	Law of the People's Republic of China on Wildlife Protection	August 28, 2004	The Tenth Commission of the Standing Committee of the National People's Congress
10	Law of the People's Republic of China on Prevention of Environmental Pollution Caused by Solid Waste	Adopted on October 30, 1995 and amended on December 29, 2004	The Standing Committee of the National People's Congress
11	Regulations of the People's Republic of China on Nature Reserves	October 9, 1994	The State Council of the People's Republic of China
12	Law of the People's Republic of China on Wild Plants Protection	October 30, 1996	The State Council of the People's Republic of China
13	The Regulations on the Protection of Fossils	August, 25, 2010	The State Council of the People's Republic of China
14	The Regulations of the People's Republic of China on the Protection and Management of Geological Heritage	May 4, 1995	Ministry of Geology and Mineral Resources of the People's Republic of China
15	The Technical Require-ments on the Formulation of Geoparks Planning	July 2010	Ministry of Land and Resources of the People's Republic of China

2.2 List of key supportive local laws and regulations

No.	Title of the Laws and Policies	Time of adoption	Adopting bodies
1	The Nature Reserve Management Regulations of Yunnan Province	December 3, 1997	The Standing Committee of the Yunnan Provincial People's Congress
2	The Regulations of Yunnan Province on the Protection of Geological Environment	July 28, 2001	The Standing Committee of the Yunnan Provincial People's Congress

No.	Title of the Laws and Policies	Time of adoption	Adopting bodies
3	The Environmental Protection Regulations of Yunnan Province	December 3, 1997	The Standing Committee of the Yunnan Provincial People's Congress
4	The Regulations of Yunnan Province on the Management of Mineral Resources	December 3, 1997	The Standing Committee of the Yunnan Provincial People's Congress
5	The Regulations of Yunnan Province on the Protection of Geological Environment in Mining Areas	September 30, 1998	The People's Government of Yunnan Province
6	The Regulations of Yunnan Province on the Protection of the Chengjiang Fossil Fauna	December 2, 1997	The People's Government of Yunnan Province
7	The Provisional Regulations on the Protection of Invertebrate Fossils in Chengjiang	May 7, 1987	The People's Government of Chengjiang County

2.3 Relevant Texts (and Articles), State Laws and Regulations

2.3.1 The Constitutions of the People's Republic of China

Article 9. Mineral resources, waters, forests, mountains, grassland, unclaimed land, beaches and other natural resources are owned by the state, that is, by the whole people. The state ensures the rational use of natural resources and protects rare animals and plants. The embezzlement or damage of natural resources by any organization or individual by whatever means is prohibited.

Article 10. Land in the rural and suburban areas is owned by collectives except for those areas that belong to the state as stipulated in the law; residential sites and private plots of cropland and hilly land are also owned by collectives.

The state may, in the public interest, take over land for its use in accordance with the law.

No organization or individual may appropriate, buy, sell or lease land, or unlawfully transfer land in other ways.

All organizations and individuals who use land must make rational use of the land.

Article 22. The state protects places of scenic and historical interest, valuable cultural

monuments and relics and other important items of China's historical and cultural heritage.

Article 26. The state protects and improves the living environment and the ecological environment, and prevents and controls pollution and other public hazards. The state organizes and encourages afforestation and forest protection.

2.3.2 Environmental Protection Law of the People's Republic of China

Article 2. "Environment as used in this Law refers to the entire body of all natural elements and artificially transformed natural elements affecting human existence and development, which includes the atmosphere, water, seas, land, minerals, forests, grasslands, wildlife, natural and humanistic remains, nature reserves, historic sites and scenic spots, as well as urban and rural areas.

Article 4. The plans for environmental protection formulated by the state must be incorporated into the national economic and social development plans; the state shall adopt economic and technological policies and measures favourable for environmental protection so as to coordinate the efforts for environmental protection with economic growth and social development.

Article 7. The competent departments of environmental protection administration of the local people's governments at or above the county level shall conduct unified supervision and management of the environmental protection work within territories under their jurisdiction.

Article 17. The people's governments at various levels shall take measures to protect regions representing various types of natural ecosystems, regions with a natural distribution of rare and endangered wild animals and plants, regions where major sources of water are conserved, geological structures of major scientific and cultural value, famous regions where karst caves and fossil deposits are distributed, traces of glaciers, volcanoes and hot springs, traces of human history, and ancient and precious trees. Damage to the above shall be strictly forbidden.

Article 19. Measures must be taken to protect the ecological environment where natural resources are being extracted or utilized.

Article 44. Whoever, in violation of this Law, causes damage to such natural resources as land, forests, grasslands, water, minerals, fish, wild animals and wild plants shall bear legal liability in accordance with the provisions of relevant laws.

2.3.3 The Law of the People's Republic of China on Environmental Impact Assessment (EIA)

Article 2. The term "appraising environmental impacts as mentioned in the present Law refers to the methods and institutions for analyzing, predicting and appraising the impacts of programmes and construction projects that might incur after they are carried out so as to propose countermeasures for preventing or mitigating the unfavorable impacts and make follow-up monitoring.

Article 8. With regard to the relevant special programmes of industry, agriculture, animal husbandry, forestry, energy, water conservancy, communications, municipal construction, tourism, and natural resources development (hereafter "special programmes), the relevant departments of the State Council and the local people's government of the cities with districts as well as the relevant departments thereof shall, prior to reporting the draft of the special programme for examination and approval, organize appraisals of environmental impacts, and submit a report of environmental impacts to the organ in charge of the examination and approval of the special program.

Article 16. The state practices classified management over the appraisals of the environmental impacts of construction projects according to the seriousness of the impacts.

The construction entities shall work out the report of environmental impacts, the report form of environmental impacts or the registration form of environmental impacts (hereafter "environmental impact appraisal documents) according to the following principles:

a. If the environmental impacts may be significant, it shall work out a report of environmental impacts so as to include an all-round appraisal of the environmental impacts;

b. If the environment impacts may be gentle, it shall work out a report form of environmental impacts so as to include an analysis or special appraisal of the environmental impacts;

c. If environment impacts may be very small so that it is not necessary to conduct an appraisal of the environmental impacts, it shall fill in a registration form of the environmental impacts.

The names of the construction projects subject to classified management of appraisal of environmental impacts shall be determined and published by the administrative department of the State Council in charge of environmental protection.

2.3.4 Land Administration Law of the People's Republic of China

Article 2 The People's Republic of China practices the socialist public ownership of land, namely ownership by the whole people and collective ownership by the workers.

...

The state may, out of necessity of public interest, requisition land collectively owned in accordance with law.

Article 12. Whoever changes land ownership and use in accordance with law should go through formalities of change in registration of land.

Article 15. Any organizations or individuals who dig sand, quarry, or mine or collect soil from the land must file an application with the land administration department of the people's government at and above the county level, and obtain permission from the approval of the government at and above the county level. In cases as stipulated in other laws and regulations, such applications shall be processed in accordance with relevant laws and regulations.

Article 47. For the requisition of land, compensation shall be given in accordance with the original use of the requisitioned land.

Article 54. Use of state-owned land for a construction project should be obtained in the form of paid-for use such as transfer; however, the following use of land for construction may be obtained in the form of appropriation subject to the approval of the people's government at or above the county level in accordance with law:

...

(2) land use for urban infrastructure and land use for non-profit undertakings;

Article 58. The right to the use of state-owned land may, subject to the approval of the people's government that originally approved the use of land or the people's government with authority of approval upon submission by the competent department of land administration of the people's government concerned, be withdrawn for any of the following circumstances:

...

(1) land use required for public interest;

2.3.5 Water Law of the People's Republic of China

Article 5. The state shall protect water resources and adopt effective measures to preserve natural vegetation, plant trees and grow grass, conserve water sources,

prevent and control soil erosion and improve the ecological environment.

2.3.6 Law of the People's Republic of China on Water and Soil Conservation

Article 2. As used in this Law, the term "water and soil conservation means preventative and rehabilitative measures taken against soil erosion that is caused by natural factors or human activities.

Article 8. Units and individuals engaged in production and construction activities that may cause soil erosion must adopt measures to protect the water and soil resources, and shall be responsible to take rehabilitative measures against the soil erosion resulting from their production and construction activities.

Article 13. The local people's governments at various levels shall, in the light of respective actual conditions, organize agricultural collective economic organizations as well as State-owned agricultural, forest and livestock farms to plant firewood forests, forage and green manure crops, and to conduct in a planned way the closing of hillsides for facilitating afforestation and growing grass and the rotation of closing and grazing periods, so as to check winds, fix drifting sand and preserve vegetation. Destroying forest or burning vegetation for land reclamation and stripping vegetation and digging up tree stumps on steep hillslopes or in arid regions shall be prohibited.

Article 27. Any enterprise or institution must, in the course of construction or production, adopt water and soil conservation measures, and shall be responsible for the rehabilitation of the soil eroded. If an enterprise or institution is unable to carry out the rehabilitation, the department of water administration shall undertake the task， and the cost thus entailed shall be borne by the enterprise or institution that has caused the soil erosion.

The expenses for the prevention and control of soil erosion arising in the course of construction shall be allocated from the capital construction investment; the expenses for the prevention and control of soil erosion arising in the course of production shall be allocated from the production cost.

2.3.7 Law of the People's Republic of China on Prevention and Control of Water Pollution

Article 9. The water pollutants discharged shall not exceed the limits set by the state or local authorities or the control quotes on total discharge of major water pollutants.

Article 40. The relevant departments of the State Council and the government at or

above the country level shall develop adequate industrial planning, and request those enterprises creating water pollution to renovate their technology and adopt integrative prevention and control measures to raise water re-use rate and reduce the volume of waste water and pollutant discharge.

2.3.8 Mineral Resources Law of the People's Republic of China

Article 3. Mineral resources shall be owned by the state. The state ownership of mineral resources, either near the earth's surface or underground, shall not change with the ownership or right to the use of the land which the mineral resources are attached to. The state shall safeguard the rational development and utilization of mineral resources. Seizing or damaging mineral resources by any means and by any organization or individual shall be forbidden. People's governments at all levels must make serious efforts to protect mineral resources. Anyone who wishes to explore mineral resources shall register according to the law. Anyone who wishes to exploit mineral resources shall apply for the right of mining.

Article 20. Unless approved by the competent department authorized by the State Council, no one may exploit mineral deposits in the following places:

(5) nature reserves and important scenic spots designated by the state, major sites of immovable historical relics and places of historical interest and scenic beauty that are under state protection;

(6) and other areas where mineral exploitation is forbidden by the state.

Article 22. If in the course of mineral exploration or exploitation, rare geologic phenomena or ancient cultural remains of major scientific and cultural value are discovered, they shall be protected and reported immediately to the relevant departments.

2.3.9 Law of the People’s Republic of China on the Protection of Wildlife

Article 12. If a construction project produces adverse effects on the environment for the survival of wildlife under special state or local protection, the construction unit shall submit a report on the environmental impact. The department of environmental protection shall, in examining and approving the report, seek the opinion of the department of wildlife administration at the same level.

Article 20. In nature reserves and areas closed to hunting, and during seasons closed to hunting, the hunting and catching of wildlife and other activities that are harmful to the living and breeding of wildlife shall be prohibited.

2.3.10. Law of the People's Republic of China on Prevention of Environmental Pollution Caused by Solid Waste

Article 29. Those units that produce industrial solid waste shall establish and amplify a responsibility system for the prevention of environmental pollution and take measures for preventing environmental pollution caused by industrial solid waste.

Article 30. Enterprises and institutions shall rationally choose and utilize raw materials, energy and other resources, apply advanced production technologies and equipment, and reduce the amount of industrial solid waste.

Article 33. Those who store smelting residue, chemical residue, coal ash residue, discarded ore, tail ore, or other industrial solid waste out-of-doors shall construct special facilities or sites for its storage.

Article 59. Those who violate the regulations of this Law by engaging in any one of the following actions shall be required to make rectifications within a specified period of time by the administrative department in charge of environmental protection under the local people's governments at the county level or above and shall be subject to a fine.

...

(6) constructing facilities or sites for the centralized storage or disposal of industrial solid waste or the burial sites for residential refuse in nature preserves, scenic spots, historic sites, drinking water sources, or other places which require special protection;

2.3.11 Regulations of the People's Republic of China on Nature Reserves

Article 2. The "nature reserve" as called herein is an area of terrestrial land and water bodies delineated in accordance with relevant laws by the national government at and above the county level for the purpose of nature conservation, and designated for special protection and management.

Article 9. Wherever one of the following conditions is met, a nature reserve should be established:

...

(4) possessing natural relics of geological structures, karst caves, fossil distribution areas, glaciers, volcanoes and hot springs that possess important scientific and cultural values

(5) other natural areas needing special protection.

Article 13. The scope and boundary of a nature reserve shall be identified and posted for public notification by the people's government who approves the establishment of the nature reserve.

The cancellation and changes in the nature, scope and boundary of a nature reserve must be approved by the people's government who has originally approved the establishment of the nature reserve.

Any organizations or individuals shall relocate the boundary markers of the nature reserve.

Article 14. The nature reserve can be demarked to include a core zone, buffer zone and experimental zone.

Access to the core zone is forbidden for any organizations and individuals. If indeed access is required for research purposes, approval must be obtained from the competent administrative department with the same level of the nature reserve. Facilities that are irrelevant to protection should be constructed.

Local residents living in the core zone should be resettled and given proper arrangement based on well-developed plans by the government at the county or above levels where the nature reserve is located.

Access to the buffer zone for research and observations is allowed if approved by the competent administrative authorities of the nature reserve. No facilities for production purposes shall be constructed.

Access to the experimental zone for study visit, tourism, acclimatization, breeding of rare and endangered wild animals and plants are allowed. No production facilities which may cause environmental pollution degrade the resources base or landscape shall be constructed.

Those nature reserves for which a zoning scheme is not developed, they will be managed in accordance with the regulations for the core zone and buffer zone.

Article 16. Environmental Impact Assessment must be carried out for development and construction projects in the experimental zone of a nature reserve. The EIA report (forms) must be formulated. The EIA report (forms) for projects with a total investment less than one million Yuan should be submitted to the competent environmental protection authorities of the county(city) for approval; The EIA report (forms) for projects with a total investment above

one million and below 10 million Yuan should be submitted to the competent environmental protection authorities of the prefecture for approval; The EIA report (forms) for projects with a total investment above 10 million Yuan, or such projects requiring access to nature reserves at or above provincial level, should be submitted to the competent environmental protection authorities of the province for review and approval;

Article 17. Funding sources for the construction and management of the nature reserves

(1) For nature reserves established at the approval of the government at or above the country level, the budget shall be listed into the financial budget of the people's government at the same level;

(2) Donation of social groups and individuals from home and abroad;

(3) Revenue of the nature reserve management institutions through implementing production and management activities that comply with the development of the nature reserve;

(4) Other income sources.

Article 18. Any of the following acts is forbidden in the nature reserves:

(1) Forest logging, quarrying, hunting, land reclamation, slash-and burn farming, mining and so on;

(2) Disposal of waste materials;

(3) Waste water discharge violating regulated environmental standards.

Article 23. In the case of the management institutions of a nature reserve violate this regulations with any of the following acts, the relevant competent authorities of nature reserve management shall charge the violator for correction, and to impose administrative penalties to the employer institution of the violators or its supervisory department.

…

(2) To carry out sightseeing, tourism and production activities in the nature reserve without appropriate approval.

2.3.12 Regulations of the People's Republic of China on Wild Plant Protection

Article 2. All activities in the territory of the People's Republic of China concerning the protection, development and utilization of wild plants must be conducted in conformity with these Regulations.

Wild plants protected under these Regulations refer to plants growing in natural conditions, which are specious or which are rare or near extinction and of important economic, scientific or cultural value.

As regards the protection of medicinal wild plants and wild plants within urban gardens, nature reserves and scenic spots, other relevant laws and regulations shall also apply.

Article 9. The state shall protect wild plants and the environment for their survival. All units and individuals shall be forbidden to illegally collect wild plants or damage the environment for their survival.

2.3.13 Regulations of the People's Republic of China on the Protection of Fossils

Article 2. Any excavation and collection activities of fossils (palaeontological specimens) in the territories and other marine jurisdictions of the People's Republic of China, as well as the import and export of fossil specimens shall observe these regulations.

The fossils referred to in the regulations are the body fossils and their trace fossils of animals and plants that are formed in past geological periods and buried in the earth's strata.

Article 3. The ownership of the fossils located within the territories and its marine jurisdictions of the People's Republic of China belong to the state.

Fossils collected by state-owned museums, research institutes, universities and colleges and other organizations, as well as those donated to the state by individuals and organizations belong to the state. Such ownership does not cease to exist regardless of terminated existence and changes of collection organization, nor will the ownership be changed.

Article 4. The state shall exercise the principles of categorized management, and protection priority, giving research the priority and rational use of the fossils.

Article 5. The competent land and resources authority of the State Council is charged with the protection in the country of fossils. The competent land and resources authorities of the people's government at or above the county levels are in charge of protecting the fossils in

their administrative jurisdiction.

Article 7. In accordance with their importance for biological evolution and biological taxonomy, fossils are classified into fossils for key protection and fossils for general protection.

Fossils with important scientific value or which are rare shall be listed as fossils for key protection, as specified below:

(1) The type specimens of fossils that have been identified and named at specific and generic level.

(2) Vertebrate fossils that are preserved complete.

(3) Macro-fossils of higher plants, trace fossils of invertebrates, footprints of vertebrates.

(4) Any other fossils identified by the competent land and resources authorities of the State Council as needing key protection.

The List of Key Protected Fossils will be reviewed and finalized by the National Expert Committee of Fossils and adopted by the competent land and resources authority of the State Council.

Article 8. National palaeontological (fossil) nature reserves should be established in areas with a concentrated distribution of key protected fossils. In areas with a concentrated distribution of common fossils and where fossils for key protection are also discovered, local level nature reserves for fossil protection should be established. The protocols established in the Regulations of the People's Republic of China on Nature Reserves apply in the establishment of nature reserves for protecting fossils.

Article 9. The people's government at or above the county level should strengthen the protection of fossils, and list the expenses for protecting fossils in the financial budget at the same government level.

Article 10. Only when they are needed for scientific research, teaching, popular science education, or for their protection/preservation purposes, can fossils be excavated. Whoever engages in excavating fossils must fulfill the qualifications established in Article 11 (2) of the regulations, and obtain approval in line with the protocols established therein.

"Excavation" as defined in the regulations refers to activities that engage a work surface, machine or other power tool to dig for fossils.

Article 11. The excavation of fossils for key protection in a national palaeontological (fossil) nature reserve, or in other areas, requires an application to be filed with the competent land and resources authority of the State Council and approval obtained. The excavation of fossils for general protection outside national fossil nature reserves, requires an application to be

filed with the competent land and resources authority of the province, autonomous region and municipal government in whose jurisdiction the fossil site(s) are located, and approval obtained.

Article 15. Organizations engaging in fossil excavation shall, within 30 days of the completion of the operation, or of scientific research and teaching activities, catalogue the recovered fossils, make corresponding descriptions and annotations, and transfer such records for storage to the collection institutions that are qualified and designated by the competent land and resources authorities that approved the excavation operations.

Article 16. In the case of research institutes that carry out any regional geological survey or scientific research, or a higher learning institute that needs to acquire a petty collection of fossils for teaching practice, then no approval is required. However, a written notification specifying the time, location and the quantity of the collection should be filed with the competent land and resources authorities of the provincial, autonomous region and municipal people's government in whose jurisdiction the fossils are located. The storage and keeping of such fossils shall observe the stipulations in the regulations.

"Petty collection" as defined in this regulation refers to the digging of minimal fossils with hand-held tools on the ground surface, without causing negative impacts to the ground surface and other resources.

Article 17. Foreigners and foreign organizations, out of research needs in international cooperation with Chinese partners, may excavate fossils in the territories of the People's Republic of China and its other marine justification areas.

Article 21. …
The competent land and resources authority of the people's government at or above the county level is responsible for compiling the archives and constructing databases for the key protected fossils in its administrative jurisdiction.

The collecting organization should set up its own archives of fossils, and furnish descriptions and annotations of the fossils collected.

Article 22. The state encourages organizations and individuals to donate the key protected fossils to the organization qualified for such storage tasks.

Any organizations and individuals should not buy and sell indiscriminately fossils listed for key protection.

Article 23. State-owned collecting organizations may not transfer, exchange and give as

gifts their collected fossils listed for key protection to non-state collecting organizations and individuals.

Any organizations and individuals may not transfer, exchange and give as gifts their collected fossils listed for key protection to foreigners or foreign organizations.

Article 24. The transfer, exchange and giving fossils as gifts listed for key protection between the collecting organizations must be approved by the competent land and resources authorities of the State Council.

Article 26. Unnamed fossils are not allowed to be exported out of the country. Fossils qualifying under any one of the following conditions, when the approval of the competent land and resources authorities of the State Council is obtained, can be exported out of the country:

(1) Cooperation with foreign research institutes necessary for scientific research.

(2) If exhibition in a foreign country is needed for scientific and cultural exchange.

Fossils listed for general protection can be exported out of the country only with the approval of the competent land and resources authorities of the provinces, autonomous region and municipal government in whose jurisdiction the fossils are located.

Article 30. The time validity of documents for the exportation of fossils is 90 days. Export beyond the approved validity period requires a reapplication to obtain export approval.

The length of stay for fossils listed for key protection in other countries and regions should not exceed six months. When extended stay in a foreign country is needed due to special reasons, an extended stay application should be filed with the competent land and resources authorities of the State Council 60 days prior to the expiration of the approved validity of stay. The extended stay shall not exceed six months.

Article 31. Regarding the re-entry of those fossils listed for key protection which have previously left the country with the appropriate approval, after re-entry customs procedures are cleared, the applicant (lending institution) should file an application within five days to the competent land and resources authority of the State Council, for re-entry verification.

2.3.14 The Regulations concerning the Protection of Geological Relics

Article 7. The following types of geological relics shall be protected:

2. Fossils of ancient humans, ancient vertebrates and invertebrates, ancient micro-organisms, ancient plants, etc., with important scientific and cultural value regarding geological and biological evolution, their excavation sites, as well as important relics demonstrating the

activities of ancient organisms.

Article 8. For geological relics having international, national and regional representation and significance, a protected section, protected site or a Geopark at the national, provincial and county levels should be established, as appropriate; this is generally referred to hereinafter as a geological relics nature reserve.

Article 9. Classification criteria for geological relics nature reserves:
National Level: (1). Geological relics which present important geological evidences of a major geological event or major evolutionary stages over a broad region or of the earth's evolutionary process. (2). Representative stratigraphic profiles, fossils and the occurrence of sites in a broad region with comparable significance at international or national scale. (3). Geological landscapes or phenomena that represent empirical geological significance at an international or national scale.

Article 11. Classification of protection significance: Class I, II and III protection shall apply for the geological relics in a nature reserve.
Class I Protection: This shall be exercised for geological relics with extremely rare and important scientific value at an international and national scale. No access to such areas shall be allowed without approval. Upon the approval of the competent authority for administering geological and mineral resources affairs of the people's government that has established the geological relics nature reserve, study visits, research or international exchange programs may be organized.

Class II Protection: This shall be exercised for geological relics with important scientific value for a broad region. Upon the approval of the competent authority for administering geological and mineral resources affairs of the people's government that has established the geological relics nature reserve, research, education, academic exchange and compatible tourism activities may be carried out.

Class III Protection: This shall be exercised for geological relics with substantial value. Upon the approval of the competent authority for administering geological and mineral resources affairs of the people's government that has established the geological relics nature reserve, tourism activities may be carried out.

Article 14. The scope and boundary of the geological relics nature reserve will be decided, boundary markers anchored and public notifications posted by the people's government that approves the establishment of the nature reserve. Without the approval of the original approval agencies, any organizations or individuals may not move and change the boundary tablets and markers.

2.3.15. Land Management Measures for Nature Reserves

Article 4. Encroachment into and damages to the land areas of nature reserves by any organizations and individuals are forbidden. It is the obligation of all organizations and individuals to protect the land use of nature reserves, and to report and testify to actions violating the land management of nature reserves.

Article 7. Land within the scope of a nature reserve is owned by the state or by collective communities in accordance with the laws and regulations.
Users of state-owned land and the owners of collective land in nature reserves should apply to the competent authority for land management of the local people's government at or above the county level for land registration and to obtain land certificates. The ownership rights and user's rights established in pertinent laws and regulations will not change as a result of delineating the scope of a nature reserve.

In the case of changing the land ownership and users' rights in accordance with the laws, application should be filed with the competent authority for land management of the local people's government at or above the country level to process the registration for land tenure change and renew the land certificate.

Article 9. The land use planning for the nature reserve and the surrounding protection zone, delineated in line with pertinent laws, shall be formulated by the competent authorities for land management and environmental protection of the local people's government at or above the country level, in consultation with other competent authorities. Upon review and approval by the government at the same level, the planning should be submitted to the immediate upper level of government for approval prior to implementation.

Article 12. If land acquisition is needed for establishing new nature reserves, expanding existing ones or delineating the core and buffer zones of nature reserves, relevant stipulations in the *Land Management Law* shall apply.

Article 13. The scope and boundary of the nature reserve will be delineated by the people's government that approves the establishment of the reserve, and they will also demarcate the boundary zones and signs for public notification.

Article 14. The nature reserve management agencies should install the boundary markers in accordance with the scope and boundary of the nature reserve delineated by the people's government that approves the establishment of the reserve.

Article 16. Organizations and individuals using the land in the nature reserve in accordance with pertinent laws should not expand the land use area without authorization. In exceptional

cases that a land use area needs to be expanded, and that the natural environment, natural resources and the conservation targets will not be impaired by such expansion, the nature reserve management agencies should make request to the competent authorities for approval. After qualifying the environmental impact assessment approved by the competent administrative authority for environmental protection, the request shall be scrutinized by the competent land administrative authority of the people's government at or above the county level, and then submitted to the people's government above the county level for final approval.

Article 17. Building infrastructures, which pollute, damage or endanger the natural environment and natural resources of the nature reserves in the nature reserve or its surrounding protection zones are strictly forbidden.

Article 18. Land reclamation for agriculture, mining, quarrying, digging sand, etc., is forbidden if otherwise stipulated by laws and administrative regulations. Tourism in the designated zone of the nature reserve shall secure that the original physiognomy and landscape will not be damaged or polluted. Local people may continue to live and engage in production activities in the surrounding protection zone of the nature reserve, but should not involve in activities that impair the functions of the nature reserve. If the land in the nature reserve is damaged but can be restored through land reclamation, relevant organizations and individuals shall be responsible for restoring the use of the land.

Article 19. In the case of constructing infrastructures within the nature reserve and in its surrounding protection zone, as needed in the development of the nature reserve and any other special needs, an environmental impact assessment report (form) must be formulated for approval by the competent environmental protection authority. For land use for building infrastructures, application must be filed for approval to the competent land management authority of the people's government at or above the county level. No production facilities of any kind shall be permitted in the Core Zone and Buffer Zone of nature reserves.

Article 20. It is forbidden for any organization and individual to damage, encroach into, buy and sell or transfer, in any other forms, the land in the nature reserve.

2.3.16 Technical requirements for formulating national Geopark planning

Geoparks fulfill three major tasks: firstly, they give protection to geological relics and the natural environment; secondly, they increase the awareness of, and quality of information regarding, the earth sciences to the general public; and thirdly, they enhance tourism activities and promote sustainable social and economic development in the region in question.

1. Principles to be observed in formulating national Geopark planning

- Fundamental principles for formulating the planning

The following fundamental principles shall be observed in formulating Geopark planning: (1) giving priority to conservation, science-based planning and rational use; (2) reflecting the missions of geoparks and stressing the features of the Geopark; (3) taking overall considerations to integrate and be compatible with other planning.

2. Foci and requirements for the planning efforts

(1) To appropriately delineate and define explicitly the scope of the Geopark

(2) Also the park areas and the functional zones of the Geopark

- Functional zoning

The functional zoning must be implemented within the scope of the park or its exclusive areas to delineate the following functional zones: entrance area, visitor service area, popular sciences education area, geological relics protection area, wilderness area, sightseeing area (including areas for the sightseeing of geological, human and cultural, ecological and special landscapes), park management area, as well as the area reserved for community residences, and so on.

Of these：

The geological heritage protection area:

Based on the importance of the protection targets, this area can be delineated into Special Protection Zone (site), Class I, II or III. For each protection zone, specific protection requirements need to be clarified: The Special Protection Zone (SPZ) belongs to the core protection area of the Geopark, and tourist access to this zone is not permitted. Only the research and the management staff who have obtained the required approval can access this zone, in order to carry out research and protection activities. No infrastructural facilities shall be constructed in this zone. In the Class I protection zone, necessary visitor trails and relevant facilities can only be installed if they are compatible and harmonious with the surrounding landscape and environment. Visits to this zone will be controlled and automobiles are not allowed there. Class II and Class III protection zones belong to the general protected area, where minimal geological service facilities can be installed. However constructions that are irrelevant to any appreciation of the geological landscape shall be restricted. All constructions and facilities should be in harmony with the landscape and the environment. In all the protection zones for geological relics, no infrastructural construction that is incompatible with the protection functions will be permitted. Nor will the exploration or the extraction of mineral resources be allowed. Large service facilities, such as hotels, guesthouses, training centers and sanatoria should not be built.

2.4 Relevant articles in the major laws and regulations concerning the protection of the Chengjiang Fossil Site

1. Regulations of Yunnan Province on the Protection of Nature Reserves

Article 2. The "nature reserve" as called herein refers to an area of terrestrial land and water bodies delineated in accordance with relevant laws by the national and local government at and above the county level for the purpose of nature conservation, and designated for special protection and management.

Article 5. The people's government at or above the county level shall incorporate the protection, construction and management of nature reserves into the national economic and social development plans, and they should list this as one of the key evaluation components in the target responsibility systems.

Article 9. Wherever one of the following conditions is met, a nature reserve should be established:

…

(4) Possessing natural relics of geological structures, karst caves, fossil distribution areas, glaciers, volcanoes and hot springs that possess important scientific and cultural values

(5) Other natural areas needing special protection.

Article 13. The scope and boundary of a nature reserve shall be identified and posted for public notification by the people's government who approves the establishment of the nature reserve.

The cancellation or change in the nature, scope or boundary of a nature reserve must be approved by the people's government that originally approved the establishment of the nature reserve.

Any organizations or individuals shall relocate the boundary markers of the nature reserve.

Article 14. The nature reserve can be demarked to include a Core Zone, Buffer Zone and Experimental Zone.

Access to the Core Zone is forbidden for any organizations or individuals. If access is required for research purposes, approval must be obtained from the administrative department that is appropriate to the level of the nature reserve. Facilities that are irrelevant to protection should not be constructed.

Those nature reserves for which a zoning scheme has not been developed, will be managed in accordance with the regulations for the Core Zone and the Buffer Zone.

Article 16. Environmental Impact Assessment must be carried out for development and construction projects in the Experimental Zone of a nature reserve. The EIA report (forms) must be formulated.

Article 17. Funding sources for the construction and management of the nature reserves

(1) For nature reserves established at the approval of the government at or above the county level, the budget shall be listed into the financial budget of the people's government at the same level;

(2) Donations from social groups and individuals at home and abroad;

(3) Revenue of the nature reserve management institutions through implementing production and management activities that comply with the development of the nature reserve;

(4) Other income sources.

Article 18. Any of the following acts is forbidden in the nature reserves:

(1) Forest logging, quarrying, hunting, land reclamation, slash-and-burn farming, mining, and so on;

(2) The disposal of waste materials;

(3) Waste water discharge violating regulated environmental standards.

2. Regulations of Yunnan Province on Geological Environmental Protection

Article 2. The principle of prevention comes first, and integrated with avoidance and integrated control. Whoever develops should protect and whoever potentially damages should have control mindful of geological environmental protection.

Article 4. The work for geological environmental protection includes geological environmental impact assessment, geological environmental monitoring, the prevention and control of geological disasters, the control of such geological environments relating to mining, engineering and hydrological sites, as well as the protection of geological heritage and fossil sites.

Article 16. For those geological relics that possess significant scientific or appreciable value, such as geological structures, stratigraphic profiles, fossils, karst caves, glaciers, volcanoes, hot springs and waterfalls, geological heritage nature reserves should be established based on the actual needs.

Relevant regulations of the national and provincial government should be observed in the establishment, construction and protection of geological heritage nature reserves.

Article 18. It is forbidden to embezzle and damage the equipment and facilities used for geological environmental monitoring and protection.

3. Regulations of Yunnan Province on the Protection of the fossils of the Chengjiang Fauna

Article 2. The fossils of the Chengjiang Fauna are owned by the state. Any organizations and individuals shall not damage them or illegally transfer them.

Article 4. The Chengjiang Fauna fossils provincial nature reserve (hereinafter referred to as "the Nature Reserve") is established to exercise special protection and management. The scope and boundary of the Core Zone, Buffer Zone and Experimental Zone of the Nature Reserve shall be delineated by the Provincial People's Government.

Article 6. Main mandates of the management agencies of the Nature Reserve:

(1) To enforce relevant laws, regulations, strategies and polices of the state concerning nature conservation and geological heritage protection;

(2) To carry out publicity and education activities for the protection of the geological heritage;

(3) To formulate various management mechanisms for the Nature Reserve, so as to exercise unified management of the Nature Reserve;

(4) To monitor the nature reserve, and set up and maintain archives;

(5) To assist relevant departments to carry out scientific research on the Nature Reserve;

(6) To organize orderly study visits and tourism activities under the conditions that protect the Nature Reserve and to see that its natural environment is not adversely affected;

(7) To collect, store and manage copies of the achievements made in scientific research, teaching practice and specimen collection activities by the various institutes in the Nature Reserve.

Article 8. The management expenses of the Nature Reserve shall be appropriated from the provincial budget, and the budget of the prefectures and counties in whose administrative jurisdiction the nature reserve is located.

Article 9. No access to the Core Zone of the Nature Reserve is allowed without proper approval. Upon the approval of the competent authorities of the provincial and prefecture government, non-damaging research and international cooperation and exchange activities can be engaged in, or study visits can be organized. However, for engagement in scientific research and international technological exchange and cooperation, such activities must be reviewed and endorsed by the provincial competent administrative authority in charge of science and technological affairs before approval can be granted.

It is forbidden to carry out tourism and production activities in the Buffer Zone of the Nature Reserve. With the approval of the Nature Reserve management agencies, scientific research, teaching practices, specimen collection and study visits can be carried out in the Buffer Zone.

With the approval of the Nature Reserve management agencies, scientific research, teaching practices, specimen collection and study visits can be carried out in the Experimental Zone.

Article 11. Organizations and individuals who are approved to access the Nature Reserve shall follow the management of the Nature Reserve management agencies.

Organizations and individuals who carry out scientific research, teaching practice and specimen collection should provide copies of their achievements to the Nature Reserve management agency for archiving.

Article 13. Any organizations and individuals should not damage or move the boundary markers that are identified and installed in accordance with established legislative protocols.

Article 14. It is forbidden to carry out logging, land reclamation for farming, quarrying, digging soil, mining or any other activities that may impair the conservation targets. If otherwise stipulated in other regulations, they will be observed as such.

Article 15. It is forbidden to construct any production facilities in the core and buffer zones of the Nature Reserve. In the Experimental Zone of the Nature Reserve, production facilities that pollute the environment and damage the geological relics cannot be constructed. In the construction of other necessary facilities, pollutant discharge shall not violate the national and provincial standards.

Article 16. Any organization and individuals may not collect, purchase, and trade fossil specimens in the Nature Reserve prior to the approval of the competent provincial administrative authority in charge of geology and mineral resources, or of the Nature Reserve management institutions.

4. The Provisional Regulations on Protecting Chengjiang Invertebrate Fossils (May 7, 1987, adopted and released by Chengjiang County Government of Yunnan Province)

Article 2. It is forbidden to implement large-scale operations and digging in the key distribution areas (Maotianshan, Luolishan, Dapotou, Xiaolantian and Xiaotuanpo) of fossils of the Chengjiang Fauna. The farming and cultivation activities of the local residents should avoid as much as possible the fossil sites.

2.5 Convention Concerning the Protection of the World Cultural and Natural Heritage and the Operational Guidelines for the Implementation of the World Heritage Convention

1. Justifications to nominate Chengjiang Fossil Site as a WHS Property pertaining to the criteria of World Heritage Sites.

WHS Criterion viii: The Nominated Property shall be outstanding examples representing major stages of the earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features;

2. Conditions for the integrity:

Article 88 of the Operational Guidelines: Integrity is a measure of the wholeness and intactness of the natural and/or cultural heritage and its attributes. Examining the conditions of integrity, therefore, requires assessing the extent to which the property:

(a) includes all elements necessary to express its outstanding universal value;

(b) is of adequate size to ensure the complete representation of the features and processes which convey the property's significance;

(c) suffers from adverse effects of development and/or neglect.

Article 90 stipulates: "for all properties nominated under criteria (vii) - (x), biophysical processes and landform features should be relatively intact. However, it is recognized that no area is totally pristine and that all natural areas are in a dynamic state, and to some extent involve contact with people. These activities may be consistent with the outstanding universal value of the area where they are ecologically sustainable."

Properties proposed under criterion (viii) should contain all or most of the key interrelated and interdependent elements in their natural relationships.

3. Protection and management of world heritage sites

Articles 96-99 of the Operational Guidelines stipulate that:

- Protection and management of World Heritage properties should ensure that the outstanding universal value, the conditions of integrity and/or authenticity at the time of inscription are maintained or enhanced in the future.

• All properties inscribed on the World Heritage List must have adequate long-term legislative, regulatory, institutional and/or traditional protection and management to ensure their safeguarding. This protection should include adequately delineated boundaries. Similarly States Parties should demonstrate adequate protection at the national, regional, municipal, and/or traditional level for the Nominated Property.

• Legislative and regulatory measures at national and local levels should assure the survival of the property and its protection against development and change that might negatively impact the outstanding universal value, or the integrity and/or authenticity of the property. States Parties should also assure the full and effective implementation of such measures.

4. Regulations concerning boundary

Articles 99, 101 and 102 of the Operational Guidelines stipulate that:
• The delineation of boundaries is an essential requirement in the establishment of effective protection of nominated properties.

• For properties nominated under criteria (vii) - (x), boundaries should reflect the spatial requirements of habitats, species, processes or phenomena that provide the basis for their inscription on the World Heritage List. The boundaries should include sufficient areas immediately adjacent to the area of outstanding universal value in order to protect the property's heritage values from direct effect of human encroachments and impacts of resource use outside of the nominated area.

• The boundaries of the Nominated Property may coincide with one or more existing or proposed protected areas, such as national parks or nature reserves, biosphere reserves or protected historic districts. While such established areas for protection may contain several management zones, only some of those zones may satisfy criteria for inscription.

5. Regulations concerning the Buffer Zone:

Articles 103 to 107 of the Operational Guidelines stipulate that:
• Wherever necessary for the proper conservation of the property, an adequate Buffer Zone should be provided.

• For the purposes of effective protection of the Nominated Property, a buffer zone is an area surrounding the Nominated Property which has complementary legal and/or customary restrictions placed on its use and development to give an added layer of protection to the property. This should include the immediate setting of the Nominated Property, important views and other areas or attributes that are functionally important as a support to the property and its protection. The area constituting the Buffer Zone should be determined in each case through

appropriate mechanisms. Details on the size, characteristics and authorized uses of a Buffer Zone, as well as a map indicating the precise boundaries of the property and its Buffer Zone, should be provided in the nomination.

• Where no Buffer Zone is proposed, the nomination should include a statement as to why a Buffer Zone is not required.

• Although buffer zones are not normally part of the Nominated Property, any modifications to the Buffer Zone subsequent to inscription of a property on the World Heritage List should be approved by the World Heritage Committee.

6. Requirements for sustainable use:

Article 119 of the Operational Guidelines stipulate that:

• World Heritage properties may support a variety of ongoing and proposed uses that are ecologically and culturally sustainable. The State Party and partners must ensure that such sustainable use does not adversely impact the outstanding universal value, integrity and/or authenticity of the property. Furthermore, any uses should be ecologically and culturally sustainable. For some properties, human use would not be appropriate.

2.6. Bases from relevant local planning and technical reports

1. The Outline of the Eleventh Five-Year Plan for the Economic and Social Development of Yunnan Province (The People's Government of Yunnan Province, 2006).

2. The Outline of the Eleventh Five-Year Plan for the Economic and Social Development of Yuxi City (The People's Government of Yuxi City, 2006).

3. The Outline of the Eleventh Five-Year Plan for the Economic and Social Development of Chengjiang County (The People's Government of Chengjiang County, 2006).

4. The Outline for the Industrial Development Planning of Chengjiang County for Year 2006 ~ 2015 (The People's Government of Chengjiang County, 2006).

5. The Planning for the Ecological Protection and Restoration of Huxian Lake (The Environmental Protection Bureau of Yuxi City, 2009).

6. The Master Plan of Yunnan Chengjiang Fossil National Geopark (Chengjiang Fossil National Geopark Management Committee, 2002).

7. A Preliminary Outline for Protection of the Heritage of Fossil Faunas in Maotianshan, Chengjiang, Yunnan Province, and Geological Environmental Control in the Adjacent Mining Areas (Division of Geological Environment, Yunnan Provincial Department of Land and Resources, 2004).

8. Geological Environmental Control Planning for the Adjacent Areas to the Maotianshan Fauna Fossil Site in Chengjiang (The People's Government of Chengjiang County, 2005).

9. Environmental Protection Planning (Outline) for the Maotianshan Fauna Fossil Nature Reserve, Chengjiang, Yunnan Province (The Environmental Protection Bureau of Yuxi City, 2005).

10. Protection and Development Planning for the Fossils of the Chengjiang Fauna in Yunnan (The People's Government of Chengjiang County, 2009).

11. Outline of the Master Plan for Fuxian Lake Tourist Holiday Resort, Yunnan Province (Kunming University of Science and Technology, December 2005).

12. Detailed Construction Plan for Xincun and Luolishan villages, Eastern Area of Chengjiang Maotianshan Fossil Nature Reserve, Yunnan Province (The People's Government of Chengjiang County, October 2010).

13. Chengjiang Fossil Site (A Report for the Nominated Property of Chengjiang Fossil Sites as a World Heritage Site, December 2010).

3. Protection Status of the Chengjiang Fossil Site

3.1 Value of the Chengjiang Fossil Site

The Chengjiang Fossil Site is named after the county town of Chengjiang County, Yunnan Province, where a 530 million year old biota was discovered in Cambrian rocks at Maotianshan in 1984. The Chengjiang Fossil Site has outstanding universal value because its fossils represent an unrivalled early record of the 'Cambrian Explosion' of the evolution of multicellular life. The fossils recorded include 16 phyla and more than 170 genera (almost 150 new) and about 200 species (about 160 new) spread across most of the animal phyla, living or extinct, together with algae and about 30 other fossils of uncertain affinity. The site is not only rich in terms of the number and diversity of species present, but also the fossils are exceptionally well preserved, with the representation of soft tissues and entirely soft-bodied animals, thus providing as complete a picture of early Cambrian life as is possible. It is a most critical fossil site for our understanding of the origin, evolution, and diversification of early animal life.

The site represents one of the most significant palaeontological discoveries of the 20th century. The major aspects of its importance are:

- It provides direct evidence for the roots of animal biodiversity that we know from today.
- It presents by far the most complete record of an early Cambrian marine community.
- It contains a prolific and exceptionally preserved biota, displaying the anatomy of hard and soft tissues of a very wide variety of organisms, invertebrate and vertebrate, in exquisite detail.
- Its fossils bear upon fundamental questions regarding the design of animal body plans and the genetic generation of evolutionary novelty.
- It records the early establishment (in the early Cambrian) of a complex marine ecosystem, with food webs capped by sophisticated predators.
- The mode of preservation imparts a particular and rare beauty to the fossils, extending their value from the scientific to the aesthetic.

The Chengjiang Fossil Site has outstanding universal value, and clearly meets the terms of World Heritage Site 'Criterion (viii)': "*be outstanding examples representing major stages of Earth's history (including the record of life*)."

3.2 Physical and socio-economic characteristics of the Chengjiang Fossil Site

The Chengjiang Fossil Site is located in the area of Maotianshan in the east of

Chengjiang County, Yuxi City. The site is five kilometers from the county town of Chengjiang and 65 km from the provincial capital city of Kunming. The center of the Chengjiang Fossil Site lies at coordinates N24º39'30" and E102º 57'30" (Figure 2-1).

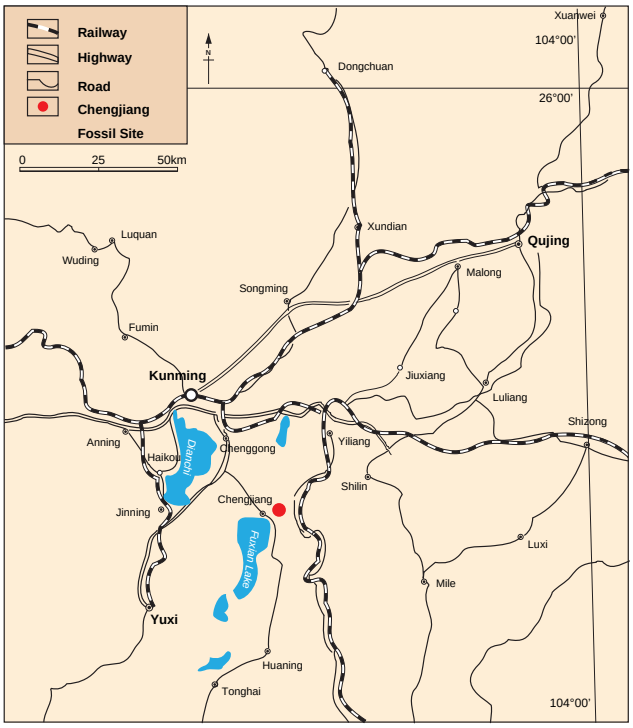


Fig. 2-1 Location of the Chengjiang Fossil Site

The Chengjiang Fossil Site is located on the eastern Yunnan plateau region and is partly a hilly area; it ranges in elevation from 1858.1m to 2063.5m. Geologically, the site lies on what is essentially a faulted and folded (synclinal) block. Maotianshan, the location of the initial discovery of fossils of the Chengjiang Biota, is at an elevation of 2024 m in the central part of the syncline. The fossil site is topographically higher in its central and northern parts, and lower to the west, south and southeast. Gullies resulting from erosion are well developed locally, exposing outcrops of early Cambrian and Pre-Cambrian strata. To the south of the fossil site, in a fault zone, is Fuxian Lake. Formed in the late Pliocene it covers 212 square km and at 158 m deep is the second deepest lake in China.

The nominated site experiences a monsoonal climatic regime within a subtropical low latitude plateau area. There are two seasons: November to April, the dry season; and May to October, the wet season with 80% of the annual rainfall. The annual precipitation is some 964 mm and annual evaporation 1757 mm. The annual mean temperature is 15^0 with the highest daily temperature 31^0 and the lowest -5^0. Relative humidity is 74%, and the dominant winds are southerly and southwesterly with speeds of 1-2 m/s.

The nominated site is within the catchment area of the Nanpanjiang River, a major tributary in the upper riches of the Pearl River. Locally, surface rivers or streams are not developed; mostly there are seasonal brooks. The dominant soil of the nominated site is the plateau red earth type, followed by the purple earth type. Primary forest has essentially disappeared, and the local vegetation now is largely warm and semi-humid evergreen forest. The Yunnan pine and the China Armand pine are typical floral elements, and there is also bush and planted woodland. Forest covers some 28% of the land。

The strata in the nominated site are essentially of upper Sinian (late Proterozoic), Cambrian, Devonian, Carboniferous and Quaternary age. Lower Sinian and Permian strata occur adjacent to the site. Fossils of the Chengjiang Fauna occur abundantly in the yellowish green sediments of the lower Cambrian Yu'anshan Member, Qiongzhusi (= Heilinpu) Formation, and cover a time span of 2-3 million years. Underlying these fossil-yielding deposits are rocks containing phosphorous ore reserves, extraction of which has been stopped with the nominated site.

The amicable climate and fertile soils in the area around Fuxian Lake have resulted in a long history of farming in the region. Early activities included fishing, hunting and the cultivation of the dominant crops of rice, broad beans and various types of potatoes in lowland areas, with maize, potatoes and wheat grown in the hilly areas. More recently, activities involving eco-agriculture, eco-fishing, forestry, eco-industry and eco-tourism have developed in Chengjiang County.

3.3 List of key properties in the Chengjiang Fossil Site

3.3.1 Strata bearing the Chengjiang Fossils

The upper part of the Yu'anshan Member is divided into four parts, as follows (from top to bottom):

(4) Yellow silty sandstone. Contains a reduced Chengjiang Fauna, mainly trilobites such as *Eoredlichia and Yunnanocephalus*, less commonly *Chengjiangaspis*, and also the bradoriid crustaceans *Kuanyangia* and *Kunmingella,* and the brachiopods *Lingulella* and *Lingulepis*.

(3) Yellowish green shale interbedded with thin to medium (10-20 cm) siltstones and sandstones. These represent the main beds yielding exquisitely preserved soft-bodied fossils. There are diverse arthropods, such as *Naraoia, Leanchoilia, Isoxys*, *Kunmingella*, *Eoredlichia* and *Yunnanocephalus.* This part of the member is also rich in lobopodians, eldoniids, worms and sponges.

(2) Black siltstone and shale beds. These sediments have yielded trilobites such as *Tsunyidiscus* and *Wutingaspis*, and the bradoriids *Hanchungella* and *Emeillopsis*. This horizon belongs to the *Parabadiella* Biozone, with trilobites and bradoriids being the main fossils; it lacks key fossils of the Chengjiang (soft-bodied) fauna. Stratigraphically the fauna

lies between the Meishucun fauna and Chengjiang fauna.

(1) Black siltstone. This basal part of the member contains the oldest trilobites in China, for example *Parabadiella*, together with the bradoriids *Hanchiangella, Liangshanella, Nanchengella*, amongst others.

3.3.2. Fossils of the Chengjiang Fauna

The Chengjiang fossil biota includes records of no less than 16 phyla and more than 170 genera (almost 150 new) and about 200 species (about 160 new) spread across most of the animal phyla, living or extinct, together with algae and about 30 other fossils of uncertain affinity. Many of the taxa represent the earliest record of their particular phylum. The fossils, which include both vertebrates and invertebrates, furnish unrivalled information on fundamental questions regarding the design of animal body plans, the genetic generation of evolutionary novelty and the evolution of animal groups at all taxonomic levels.

Algae

Fuxianospira gyrata Chen & Zhou, 1997*
Megaspirellus houi Chen & Erdtmann, 1991*
Punctariopsis latifolia Xu, 2001
Punctariopsis simplex Xu, 2001
Sinocylindra yunnanensis Chen & Erdtmann, 1991
Yuknessia sp. of Chen & Erdtmann, 1991*
* Regarded as coprolites by Steiner *et al*., 2005

Phylum Porifera

Allantospongia mica Rigby & Hou, 1995
Choia carteri Walcott, 1920
Choia xiaolantianensis Hou *et al*., 1999
Choiaella radiata Rigby & Hou, 1995
Crumillospongia biporosa Rigby, 1986
Halichondrites ellisa Walcott, 1920
Hazelia palmata Walcott, 1920
Leptomitella conica Chen, Hou & Lu, 1989
Leptomitella confusa Chen, Hou & Lu, 1989
Leptomitella metta (Rigby, 1983)
Leptomitus teretiusculus Chen, Hou & Lu, 1989
Paraleptomitella dictyodroma Chen, Hou & Lu, 1989
Paraleptomitella globula Chen, Hou & Lu, 1989
Quadrolaminiella crassa Chen, Hou & Li, 1990
Quadrolaminiella diagonalis Chen, Hou & Li, 1990

Saetaspongia densa Mehl & Reitner *in* Steiner *et al*., 1993
Takakkawia lineata Walcott, 1920
Triticispongia diagonata Mehl & Reitner *in* Steiner *et al*., 1993

Phylum Cnidaria

Archisaccophyllia kunmingensis Hou *et al*., 2005
Xianguangia sinica Chen & Erdtmann, 1991

Phylum Ctenophora

Maotianoascus octonarius Chen & Zhou, 1997
Sinoascus papillatus Chen & Zhou, 1997
Yunnanoascus haikouensis Hu *et al*., 2007

Phylum Nematomorpha

Cricocosmia jinningensis Hou & Sun, 1988
Maotianshania cylindrica Sun & Hou, 1987
Palaeoscolex sinensis Hou & Sun, 1988
Sabellidites yunnanensis Luo & Zhang, 1986
Tabelliscolex hexagonus Han, Zhang & Shu, 2003
Tylotites petiolaris Luo & Hu *in* Luo *et al*., 1999
Xiaoheiqingella peculiaris Hu *in* Chen *et al*., 2002
Xishania longiusula Hu *in* Chen *et al*., 2002

Phylum Priapulida

Acosmia maotiania Chen & Zhou, 1997
Anningvermis multispinosus Huang, Vannier & Chen, 2004
Archotuba conoidalis Hou *et al*., 1999 (? =*Selkirkia*? *elongata* Luo & Hu *in* Luo *et al*., 1999)
Corynetis brevis Luo & Hu *in* Luo *et al*., 1999
Gangtoucunia aspera Luo & Hu *in* Luo *et al*., 1999
Lagenula striolata Luo & Hu *in* Luo *et al*., 1999
Oligonodus specialis Luo & Hu *in* Luo *et al*., 1999
Omnidens amplus Hou, Bergström & Yang, 2006
Palaeopriapulites parvus Hou *et al*., 1999
Paraselkirkia jinningensis Hou *et al*., 1999 (? =*Selkirkia sinica* Luo & Hu *in* Luo *et al*., 1999)
Paratubiluchus bicaudatus Han *et al*., 2004
Protopriapulites haikouensis Hou *et al*., 1999 (=*Sicyophorus rara* Luo & Hu *in* Luo *et al*., 1999)
Sandaokania latinodosa Luo & Hu *in* Luo *et al*., 1999
Yunnanpriapulus halteroformis Huang, Vannier & Chen, 2004

Phylum Sipuncula

Archaeogolfingia caudata Huang *et al*., 2004

Cambrosipunculus tentaculatus Huang *et al*., 2004

Phylum Chaetognatha
Protosagitta spinosa Hu *in* Chen *et al*., 2002 (? = *Eognathacantha ercainella* Chen & Huang, 2002)

Phylum Annelida
Maotianchaeta fuxianella Chen, 2004

Phylum Hyolitha
Ambrolinevitus maximus Jiang, 1982
Ambrolinevitus meishucunensis Jiang, 1994
Ambrolinevitus platypluteus Qian, 1978
Ambrolinevitus ventricosus Qian, 1978
Burithes yunnanensis Hou *et al*., 1999 (? =*Glossolites magnus* Luo & Hu *in* Luo *et al*., 1999)
Linevitus flabellaris Qian, 1978
Linevitus opimus Yu, 1974

Phylum Mollusca
Helcionella yunnanensis Zhang & Babcock, 2002
Petalilium latus Luo & Hu *in* Luo *et al*., 1999

Phylum Lobopodia
Cardiodictyon catenulum Hou, Ramsköld & Bergström, 1991
Hallucigenia fortis Hou & Bergström, 1995
Luolishania longicruris Hou & Chen, 1989
Megadictyon haikouensis Luo & Hu *in* Luo *et al*., 1999
Miraluolishania haikouensis Liu & Shu *in* Liu *et al*., 2004
Microdictyon sinicum Chen, Hou & Lu, 1989
Onychodictyon ferox Hou, Ramsköld & Bergström, 1991
Paucipodia haikouensis Luo & Hu *in* Chen *et al*., 2002
Paucipodia inermis Chen, Zhou & Ramsköld, 1995

Phylum Arthropoda (including Anomalocarididae*)
Acanthomeridion serratum Hou, Chen & Lu, 1989
Almenia spinosa Hou & Bergström, 1997
Amplectobelua symbrachiata Hou, Bergström & Ahlberg, 1995*
Anomalocaris saron Hou, Bergström & Ahlberg, 1995*
Anomalocaris sp. of Hou, Bergström & Ahlberg, 1995*
Branchiocaris? *yunnanensis* Hou, 1987
Canadaspis laevigata (Hou & Bergström, 1991) (=*Canadaspis eucallus* Chen & Zhou, 1997;

=*Perspicaris*? sp. of Hou 1987; ? =*Yiliangocaris ellipticus* Luo & Hu *in* Luo *et al*., 1999)
Chengjiangocaris longiformis Hou & Bergström, 1991 (*Cambrofengia yunnanensis* Hou *et al*., 1999 may be detached appendages)
Cindarella eucalla Chen, Ramsköld, Edgecombe & Zhou *in* Chen *et al*., 1996
Clypecaris pteroidea Hou, 1999 (? =*Ercaicunia multinodosa* Luo & Hu *in* Luo *et al*., 1999)
Combinivalvula chengjiangensis Hou, 1987
Comptaluta inflata (Zhang, 1974)
Comptaluta leshanensis (Lee, 1975)
Cucumericrus decoratus Hou, Bergström & Ahlberg, 1995
Diplopyge forcipatus Luo & Hu in Luo *et al*., 1999
Diplopyge minutus Luo & Hu in Luo *et al*., 1999
Dongshanocaris foliiformis (Hou & Bergström, 1998)
Eoredlichia intermedia (Lu, 1940)
Ercaia minuscula Chen, Vannier & Huang, 2001
Forfexicaris valida Hou, 1999
Fortiforceps foliosa Hou &Bergström, 1997
Fuxianhuia protensa Hou, 1987
Haikoucaris ercaiensis Chen, Waloszek & Maas, 2004
Isoxys auritus (Jiang, 1982)
Isoxys curvirostratus Vannier & Chen, 2000
Isoxys paradoxus Hou, 1987 (? = *Isoxys elongatus* Luo & Hu *in* Luo *et al*., 1999)
Jianfengia multisegmentalis Hou, 1987
Jiucunella paulula Hou & Bergström, 1991
Kuamaia lata Hou, 1987
Kuamaia muricata Hou & Bergström, 1997
Kuanyangia pustulosa (Lu, 1941)
Kunmingella douvillei (Mansuy, 1912)
Kunmingocaris bispinosus Luo & Hu *in* Luo *et al*., 1999
Kunyangella cheni Huo, 1965
Kwanyinaspis maotianshanensis Zhang & Shu, 2005
Leanchoilia illecebrosa (Hou, 1987) (=*Dianchia mirabilis* Luo & Hu *in* Luo *et al*., 1997; =*Leanchoilia asiatica* Luo & Hu *in* Luo *et al*., 1997; =*Yohoia sinensis* Luo & Hu *in* Luo *et al*., 1997; ? =*Zhongxinia speciosa* Luo & Hu *in* Luo *et al*., 1997; ?=*Apiocephalus elegans* Luo & Hu *in* Luo *et al*., 1999)
Liangshanella liangshanensis Huo, 1956
Mafangia subscalaria Luo & Hu *in* Chen *et al*., 2002
Mafangocaris multinodus Luo & Hu *in* Chen *et al*., 2002
Malongella bituberculata Luo & Hu *in* Chen *et al*., 2002
Naraoia longicaudata Zhang & Hou, 1985
Naraoia spinosa Zhang & Hou, 1985
Occacaris oviformis Hou, 1999

Odaraia? *eurypetala* Hou & Sun, 1988 (? =*Glossocaris oculatus* Luo & Hu *in* Luo *et al*., 1999)
Ovalicephalus mirabilis Luo & Hu *in* Chen *et al*., 2002
Parapaleomerus sinensis Hou *et al*., 1999
Parapeytoia yunnanensis Hou, Bergström & Ahlberg, 1995*
Pectocaris spatiosa Hou, 1999
Pisinnocaris subconigera Hou & Bergström, 1998 (? =*Jianshania furcatus* Luo & Hu *in* Luo *et al*., 1999)
Primicaris larvaformis Zhang *et al*., 2003
Pseudoiulia cambriensis Hou & Bergström, 1998
Pterotrum triacanthus Luo & Hu *in* Chen *et al*., 2002
Pygmaclypeatus daziensis Zhang, Han & Shu, 2000
Retifacies abnormalis Hou, Chen & Lu, 1989 (=*Retifacies longispinus* Luo & Hu *in* Luo *et al*., 1997; = *Tuzoia* sp. of Shu 1990)
Rhombicalvaria acantha Hou, 1987
Saperion glumaceum Hou, Ramsköld & Bergström, 1991
Sidneyia sinica Zhang & Shu *in* Zhang, Han & Shu, 2002
Sinoburius lunaris Hou, Ramsköld & Bergström, 1991
Skioldia aldna Hou & Bergström, 1997
Squamacula clypeata Hou & Bergström, 1997
Sunella cf. *shenensis* (Huo, 1965)
Synophalos xynos Hou *et al*., 2009
Syrrhaptis intestinalis Luo & Hu *in* Luo *et al*., 1999
Tanglangia longicaudata Luo & Hu *in* Luo *et al*., 1999
Tsunyidiscus aclis Zhou *in* Lee *et al*., 1975
Tsunyidiscus niutitangensis (Chang, 1964)
Tsunyiella diandongensis Tong *in* Huo & Shu, 1985
?*Tuzoia sinensis* Pan, 1957 (? =*Tuzoia limba* Shu, 1990)
Urokodia aequalis Hou, Chen & Lu, 1989
Waptia ovata (Lee, 1975)
Wutingaspis tingi Kobayashi, 1944
Wutingella binodosa Zhang, 1974
Xandarella spectaculum Hou, Ramsköld & Bergström, 1991
Yunnanocaris megista Hou, 1999
Yunnanocephalus yunnanensis (Mansuy, 1912)

Phylum Phoronida

Eophoronis chengjiangensis Chen, 2004
Iotuba chengjiangensis Chen & Zhou, 1997

Phylum Brachiopoda

Diandongia pista Rong, 1974

Heliomedusa orienta Sun & Hou, 1987
Lingulella chengjiangensis Jin, Hou & Wang, 1993
Lingulellotreta malongensis (Rong, 1974)
Longtancunella chengjiangensis Hou *et al*., 1999
Xianshanella haikouensis Zhang, 2004

Phylum Echinodermata

Dianchicystis jianshanensis Shu *et al*., 2004
Vetulocystis catenata Shu *et al*., 2004

Phylum Chordata

Cathaymyrus diadexus Shu, Conway Morris & Zhang, 1996

?*Cathaymyrus haikouensis* Luo & Hu *in* Luo *et al*., 2001

Cheunkongella ancestralis Shu *et al*., 2001
Myllokunmingia fengjiaoa Shu, Zhang & Han *in* Shu *et al*., 1999 (= *Haikouichthys ercaicunensis* Luo, Hu & Shu *in* Shu *et al*., 1999)

Shankouclava anningense Chen *et al*., 2003
Zhongjianichthys rostratus Shu, 2003
?*Zhongxiniscus intermedius* Luo & Hu *in* Luo *et al*., 2001

Uncertain systematic position

Allonnia phrixothrix Bengtson & Hou, 2001 (=*Allonnia junyuani* Janussen *et al.,* 2002)
Amiskwia sinica Luo & Hu, 2002
Anthotrum robustus Luo & Hu *in* Luo *et al*., 1999
Batofasciculus ramificans Hou *et al*., 1999
Beidazoon venustum Shu, 2005 (= *Bullivetula variola* Aldridge *et al*., 2007)
Chancelloria eros Walcott, 1920
Conicula striata Luo & Hu *in* Luo *et al*., 1999
Cotyledion tylodes Luo & Hu *in* Luo *et al*., 1999 (? = *Cambrotentacus sanwuia* Zhang & Shu *in* Zhang *et al*., 2001)
Didazoon haoae Shu & Han *in* Shu *et al*., 2001
Dinomischus venustus Chen, Hou & Lu, 1989
Discoides abnormis Luo & Hu *in* Luo *et al*., 1999
Eldonia eumorpha (Sun & Hou, 1987) (=*Yunnanomedusa eleganta* Sun & Hou, 1987)

Facivermis yunnanicus Hou & Chen, 1989
Heteromorphus confusus (Chen & Zhou, 1997) (? =*Heteromorphus longicaudatus* Luo & Hu *in*

Luo *et al*., 1999)
Hippotrum spinatus Luo & Hu *in* Luo *et al*., 1999
Jiucunia petalina Hou *et al*., 1999
Maanshania crusticeps Hou *et al*., 1999
Macrocephalus elongatus Luo & Hu *in* Luo *et al*., 1999
Parvulonoda dubia Rigby & Hou, 1995
Phacatrum tubifer Luo & Hu *in* Luo *et al*., 1999
Phasganula longa Luo & Hu *in* Luo *et al*., 1999
Phlogites longus Luo & Hu *in* Luo *et al*., 1999 (= *Phlogites brevis* Luo & Hu *in* Luo *et al*., 1999; ? = *Calathites spinalis* Luo & Hu *in* Luo *et al*., 1999)
Pomatrum ventralis Luo & Hu *in* Luo *et al*., 1999 (*Xidazoon stephanus* Shu, Conway Morris & Zhang *in* Shu *et al*., 1999)
Pristioites bifarius Luo & Hu *in* Luo *et al*., 1999
Rhipitrus clavifer Luo & Hu *in* Luo *et al*., 1999
Rotadiscus grandis Sun & Hou, 1987
Vetulicola cuneata Hou, 1987

Vetulicola monile Aldridge *et al*., 2007

Vetulicola rectangulata Luo & Hu *in* Luo *et al*., 1999

Yunnanozoon lividum Hou, Ramsköld & Bergström, 1991 (=*Haikouella lanceolata* Chen *et al*., 1999)
Yuyuanozoon magnificissimi Chen, Feng & Zhu *in* Chen *et al*. 2003

3.4 Protective designations of the Chengjiang Fossil Site

3.4.1. Tentative List of World Heritage Sites in China

In accordance with the criteria and procedures established in No. [2005]-56 of the Ministry of Housing and Urban-Rural Development, the Nominated Property 'Chengjiang Fossil Site' meets the criterion "representing major stages of the Earth's history", and has fulfilled the request that "the surrounding environment should be rehabilitated and be harmonious with the history and current status of a world heritage site; and that the nominated property has formulated or promulgated laws, regulations and conservation planning for its overall protection and planning." Accordingly, the Chengjiang Faunal Site was inscribed into the Tentative List of World Heritage Sites in China on January 12, 2006 by the former Ministry of Construction (Chengjiang No. 5 [2006]).

3.4.2. National Geopark

National geological park status was obtained in accordance with the stipulations in the Notice on the Application for National Geopark Status (September 2000), issued by the Ministry of Land and Resources. By virtue of the fact that the Chengjiang Fossil Site "was an iconic site for exemplifying the 'Cambrian Explosion', containing abundant exceptionally preserved, and was in a plateau lakes area important for tourism", it fulfilled the requirements of "possessing major special national geo-scientific significance and geological heritages with high aesthetic value, and being integrated with other natural and cultural landscapes, and therefore constructing a type of unique natural area". Thus, in April, 2001 China's Ministry of Land and Resources ratified the Nominated Property to be in the first batch of China's geoparks, with the official name of "Yunnan Chengjiang Fossil National Geopark.

3.4.3 Yunnan Provincial Nature Reserve

In accordance with the stipulations established in the Regulations on Nature Reserve Management in Yunnan (Adopted on December 3rd, 1997), due to its unique early Cambrian biota the Chengjiang Fossil Site in Yunnan fulfills the criteria in Article 4 as "Possessing geological structures, karst caves, and areas with distribution of fossils, glaciers, volcanoes and hot springs." It was therefore designated, by the People's Government of Yunnan Province, as a provincial-level nature reserve in December 1997, with the title "Chengjiang Maotianshan Faunal Fossils Nature Reserve".

3.5 Scope of the Chengjiang Fossil Nominated Property

3.5.1 Area and boundary of the Nominated Property

The Nominated Property is part of the Yunnan Chengjiang Faunal Fossils National Geopark. The center of the Nominated Property lies at co-ordinates N 24°40'08", E 102°58'38". The Nominated Property is a strip of land orientated northeast - southwest. It is 3713m long, 2555m wide and has a total area of 512 ha (Figure 2-2). The nominated property includes a comprehensive sequence of exposed and unexposed strata and fossil horizons. It contains key stratigraphic sections and fossil localities that are the most important and most representative of the Chengjiang Fossil Site. The boundary of the nominated property is 100m from existing roads, so that potential interference by human activity is avoided. The boundary of the nominated property is drawn by reference to distinctive topographic features such as peaks and valleys.

3.5.2 Buffer Zone

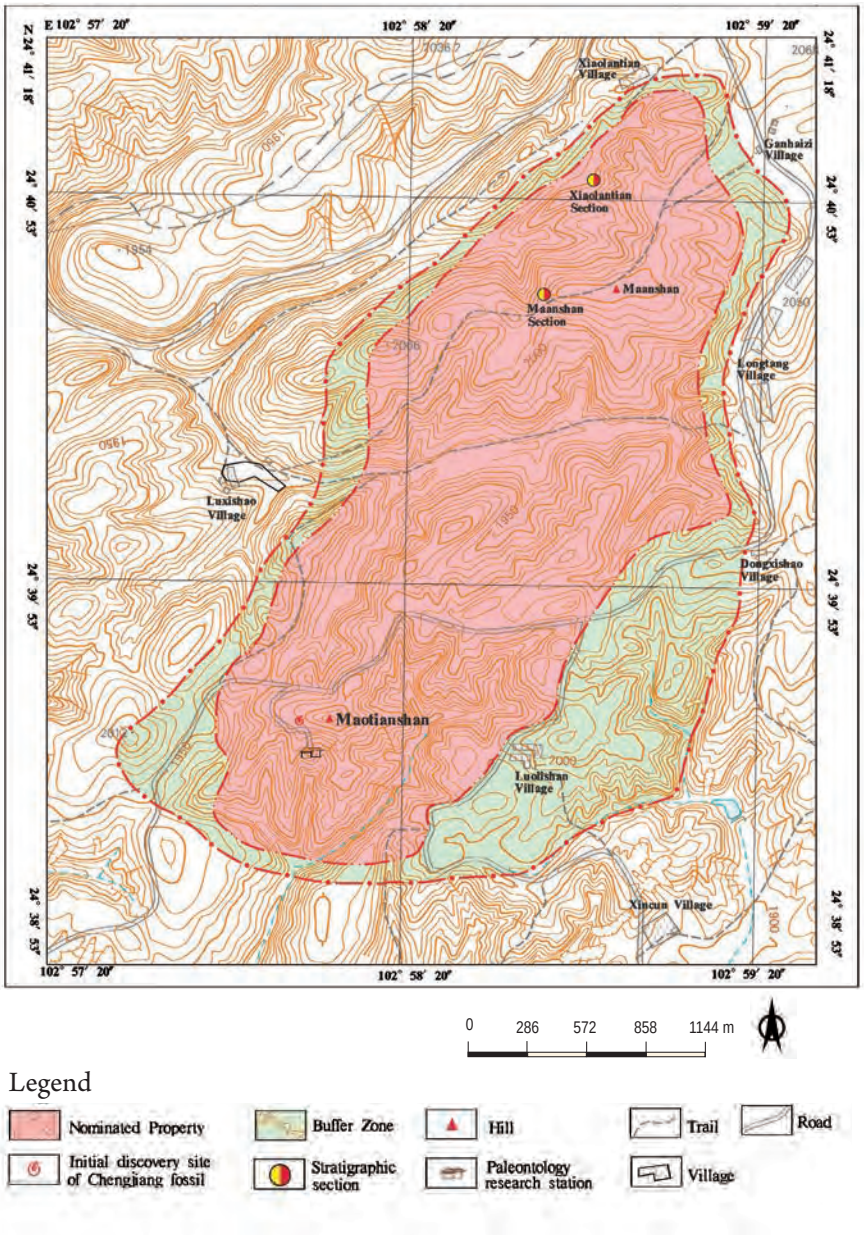


Figure 2-2. Map of Chengjiang Fossil Site

The Buffer Zone surrounding the Nominated Property has a total area of 220 ha. It has no permanent human residences or industrial activity. The boundary of the Buffer Zone ranges from 50-100 meters from existing roads and has been delineated by consideration of geological (structure; stratigraphy; Chengjiang fossil localities), topographical, human impact and other relevant factors.

3.6 Challenges confronting the protection of the Chengjiang Fossil Site

The Chengjiang Fossil Site is located in a region subject to the impact of human activity. In recent years the focus of regional economic activity has shifted from merely traditional endeavours such as fishing, hunting, animal husbandry and agriculture to also include mining and tourism. With ongoing rapid urbanization, conflicts have arisen from competing land-uses, including urban development, mining, nature conservation and the ecological restoration of blighted areas. Below the rock beds containing the fossils of the Chengjiang Biota there are famous phosphorite-bearing deposits in the Zhongyicun and Dahai members of the Meishucunian Stage. The rock strata succeeding the fossil-bearing beds form a plateau where the surface topography is flat and the top-soils are favorable for farming but which has suffered from the effects of long-term weathering.

Specifically, the major threats to the Chengjiang Fossil Site are:

- Abandoned phosphorous mining sites: Since the 1980s twelve mining sites have been abandoned in areas adjacent to the fossil site. Slopes of these abandoned sites are steep, resulting in potential ground collapses, landslides and debris flows. All of these natural hazards may exert considerable impact on the fossil-bearing beds, damage the natural landscape of the site and threaten the safety of humans and properties in the area.
- Phosphorous chemical industry: there are three phosphorous chemical plants in the adjacent area. Waste gas, dust and sands and waste water emitting from the phosphorous chemical production threaten the atmosphere and water quality of the fossil site.
- Road Transport: A road network (Class III rural transport roads) in the vicinity of the Chengjiang Fossil site connects the phosphorous chemical plant with the main urban areas including local towns. Traffic from vehicles and maintenance of the road network may trigger instability of the roadsides and increase water runoff, thus potentially resulting in greater erosion and consequent damage to the fossil-bearing and other strata of the Chengjiang Fossil Site and posing a threat to lives and properties.
- Expansion of agriculture, animal husbandry and residential land-use: Adjacent to the Chengjiang Fossil Site and its Buffer Zone there are thirteen residential areas, including villages, with a total population of 7,000 people Traditional farming and grazing land-use remain the main income sources for local people. Expansion of land areas for farming, grazing and residential sites may impact on the natural nature and integrity of the fossil site.
- Structure of land tenures: Land tenures relating to the Chengjiang Fossil Site and adjacent areas are of several types, including state-owned, collectively-owned, and contracted or leased to individuals and enterprises for various management purposes.

Such autonomous management of the land and forest areas brings about potential challenges to the designated and specific land use of these areas and the fossil site itself.

- Greening activities: Greening the fossil site is a double-edged sword: it should be expected that the fossil bearing beds are exposed and available for study, whereas maintaining the natural physiognomy demands the occurrence of natural (zonal) vegetation. Indiscriminant planting and the introduction of alien species will not benefit the maintenance and rehabilitation of the natural nature and integrity of the fossil site.
- Loss of fossils: Since the 1980s, when the Chengjiang Biota of soft-bodied fossils was discovered, it is estimated that a total of about 38,000 specimens has been collected. However, of these only some 5,000 are stored on site at the Chengjiang Fauna Fossil Geopark. Much of the fossil material has been disseminated to research institutes and museums worldwide or has been collected and retained by individuals. With further excavation the Geopark will have a potential on-going loss of Chengjiang Biota fossils.
- Protection of other sites in Yunnan that yield fossils of the Chengjiang Biota: Fossils of the Chengjiang Biota occur and have been collected at many sites in the eastern part of Yunnan Province in addition to those within the Geopark area itself. Such additional sites, many of which are based on extensive excavations, have yielded important representatives of the Chengjiang Biota; for example, the localities in the vicinity of Haikou, to the east of Dianchi Lake. Such sites are not located within the administrative jurisdiction of the Chengjiang Fossil Site itself and, yet, they are also confronted with threats from construction, mining, road construction and an expansion of farming activities. In recognizing this situation, from 2005 to 2009 the People's Government of Yunnan Province delegated special bodies to conduct thematic studies on the distribution of such sites and to propose strategies for their protection and management together with their fossils.

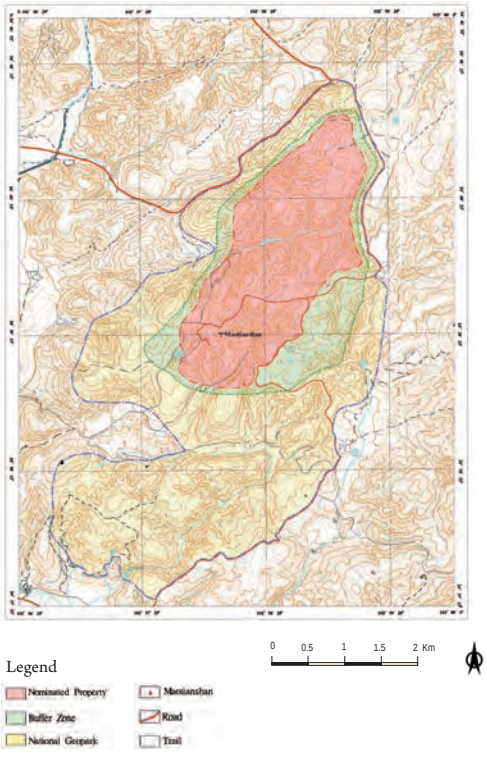
4. Thematic Protection and Management Planning of the Chengjiang Fossil Site

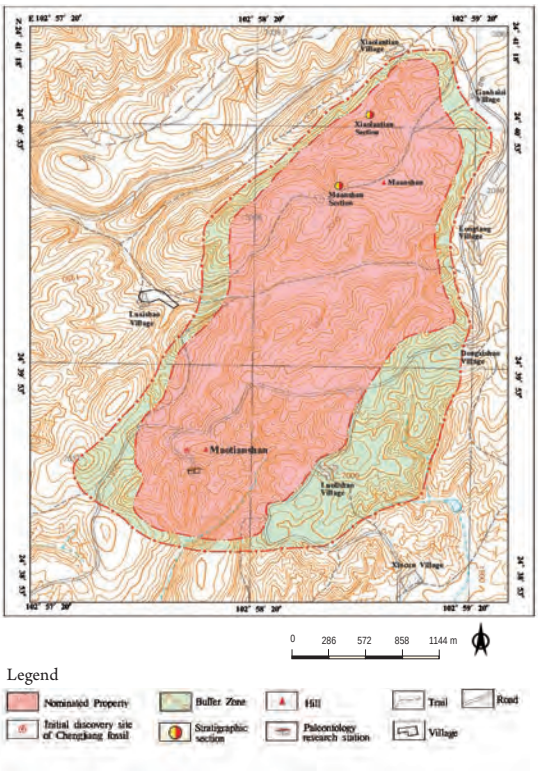
The executive period of this thematic protection and management planning lasts from 2011 to 2015.

4.1 Protection planning classes and zones

4.1.1 Scope of classification and zoning

Based on the protection attributes of the Chengjiang Fossil Site defined in the national and local legislation, the Chengjiang Fossil Site World Heritage Site Nominated Property is composed of two sections: the Nominated Property (512 ha) and the Buffer Zone (220 ha). Of these areas, the Nominated Property includes the special protection zone – Chengjiang Fossil National Geopark, a Class I protection zone and part of the Class II protection zone; the Buffer Zone covers the scope of the Class II protection zone and part of the Class III protection zone (See Figure 3).





4.1.2 Protection and management of the Nominated Property

(1) Protection and management goals

- To protect the strata and beds containing fossils of the Chengjiang Biota.
- To protect the integrity of the stratigraphic and paleogeographic context of the Chengjiang fossils.
- To protect the natural physiognomy of the Chengjiang Fossil Site.
- To provide well-managed conditions for fossil excavation and an interpretation system.
- To enforce a strict management system for the approval of fossil excavation and collection, and for registration and inventory-keeping of fossil specimens from the Chengjiang Fossil Site.

(2) Protection and management status

- The site has been surveyed and the distribution of the fossil-bearing strata identified. The strata containing Chengjiang fossils include yellowish green shale interbedded with minor conglomerates in the upper subsection ($\in_1 q^{2\text{-}2}$) of the Yu'anshan Member of the Lower Cambrian Qiongzhusi Formation ($\in_1 q^2$); underlying black shales (upper black stratum) of the lower subsection ($\in_1 q^2$) of the Yu'anshan Member of the Qiongzhusi Formation; fine-grained sandstone and glauconitic sandstone of the Shiyantou Member; phosphorite of the Dahai Member of the Qiongzhusi Formation; and phosphorus-bearing dolomite of the Yuhucun Formation. The overlying strata are shales, fine-grained sandstones and sandstones of the Lower Cambrian Langcangpu Formation and dolomitic mudstones of the Longwangmiao Formation.
- The boundary of the site has been delineated, but boundary markers and marking stakes or plates are lacking.
- A significant number of abandoned mining sites are present.
- A large number of pits from fossil excavation exist.
- Some rain-fed farmland areas occur within the site.
- Gully erosion is pervasive.
- Vegetation is mainly the result of human activity.

(3) Planned protection measures

- To construct a coordinate system for the major boundary points and to complete the construction of a management database for the Nominated Property.
- To conduct further surveys of the Chengjiang Fossil Site, in order to protect the excavated fossil strata and sites, and to identify potential fossil excavation sites; to

install a system of signs identifying the fossil-bearing strata and beds.

- To improve the boundary delineation by installing permanent boundary markers, and to improve the signage system along the boundary of the Nominated Property.
- To publicize the scope of the Nominated Property, the specific boundary location and the signage system.
- To organize a protection patrol team for the Nominated Property.
- To establish and enforce strictly a scrutiny and approval mechanism for scientific research and excavation in the Chengjiang Fossil Site.
- To rehabilitate the excavation sites of the Chengjiang fossils, and to provide or improve display panels describing the fossils, stratigraphy, paleogeography and geology.
- To address land-use management concerns for designated attributes that contribute to the naturalness and integrity of the scope of the Nominated Property, and to adjust the land-use structure and improve land tenure management.
- To enforce a strict ban on logging, land reclamation for farming, quarrying, soil removal, mining and any other operations that may impair the protection targets.
- No exploration for or extraction of mineral resources will be permitted. Large service facilities, such as hotels, guesthouses, training centers and sanatoria cannot be constructed.
- To undertake engineering measures to rehabilitate the ruins of abandoned mining sites based on the local geographic conditions, and to restore and promote native plant communities.

4.1.3 Protection and management of the Buffer Zone

(1) Protection and management goals

- To intercept potential impacts of human activity on the Nominated Property.
- To protect the strata hosting the fossils of the Chengjiang Biota, including the underlying and overlying strata and including the subsurface extension of the strata, from the impact of human activity (especially the mining and chemical industries).
- To protect the integrity and naturalness of the strata, stratigraphic sequence and extended palaeogeographic context of the Chengjiang Fossil Site.
- To protect the natural physiognomy of the Nominated Property.
- To provide a base for science education and public outreach, explaining the evolutionary importance of the Chengjiang fossils.
- To remediate the damage caused by the activities of the mining and chemical industries, and to rehabilitate the natural vegetation.

(2) Protection and management status

- The site has been surveyed and the distribution of the fossil-bearing strata identified.

- The remains of phosphorus mining sites have undergone preliminary rehabilitiation.
- A system of signs for scientific research and for public information has been set up for the Chengjiang fossil localities.
- Two communes, Xincun and Luolishan, with a total population of 2,500 people are located in the area. The total population of the villages in the Buffer Zone and its adjacent areas is 2,800.
- About 3,000 mu (200 ha) of rain-fed farmland is scattered in the area.
- Areas adjacent to the Buffer Zone are prone to the impact of phosphorus chemical production.
- The annual average per capita income of local residents is about 2,500 yuan (2010), which is lower than that of farmers in the country.
- The area is dominated by secondary vegetation and artificially established vegetation.

(3) Planned protection and management measures

- To construct a system of signs for the Buffer Zone and for the Chengjiang Fossil National Geopark, and to build a complete system of demarcation stakes for the Buffer Zone boundary
- To set up a patrol and checking mechanism for the protection and management of the area and to conduct regular patrolling and monitoring.
- To address the protection and restoration of the naturalness and integrity of the Buffer Zone by amending the land-use rights rationally and effectively.
- To mobilize local residents to restrict their industries and to support them to increase their economic income, so as to contribute to the development of conservation careers.
- To continue the rehabilitation and remediation measures on the ruins of the phosphorus mining sites; and to promote the rehabilitation of indigenous vegetation through strict scrutiny and approval of plant species selected for re-vegetation programs.
- To dismantle the industrial production facilities abandoned in the Buffer Zone.
- To exercise an approval and registration system for scientific research, sightseeing and fossil excavation in the Buffer Zone.
- To exercise a scrutiny mechanism for the records of fossil excavation activities.
- To control any expansion of residential housing toward the Buffer Zone.
- To control the flow of vehicles accessing the Buffer Zone, and to control the construction of roads in the Buffer Zone.

4.2 Classified protection and management planning

The Chengjiang Fossil Site is a WHS Nominated Property with the primary mission of protecting and exhibiting the fossils of the Chengjiang Biota. The major targets for protection and management include stratigraphic sections containing Chengjiang fossils, specimens of

Chengjiang fossils, other fossil specimens and geological relics, the natural physiognomy and indigenous plant communities of the Nominated Property.

4.2.1 Protection and management of stratigraphic sections containing Chengjiang fossils

(1) Protection and management goals

- To protect typical stratigraphic sections containing Chengjiang fossils.
- To protect the paleogeographic setting of the Chengjiang fossils.
- To protect the natural state and integrity of the upper and lower strata with Chengjiang fossils .
- To control excavation and research activities on Chengjiang fossils.
- To protect the natural physiognomy of the areas where strata with Chengjiang fossils are located.

(2) Protection and management status

- The area has been surveyed, typical stratigraphic sections with Chengjiang fossils identified and their distribution established.
- The upper and lower stratigraphic sequences with Chengjiang fossils and have been identified together with palaeogeographic features.
- Six stable fossil excavation sites/sections have been established (Maotianshan, Luolishan, Ma'anshan, Xiaolantian section, Xiaolantian fossil site, and Kuama village-Dadiyakou-Maotianshan section).
- A preliminary assessment and approval system for the excavation and collection of Chengjiang fossils has been established.
- A professional team for excavation of Chengjiang fossils has been preliminarily set up.

(3) Planned protection and management measures

- To publicize the stratigraphic setting of the Chengjiang fossils, the areas of distribution and the requirements for protection and management of stratigraphic sections, so as to mobilize the support of the community.
- To continue to improve the patrolling and monitoring system of the strata containing the Chengjiang fossils, and to organize a professional management team for patrol and inspection.
- To strictly forbid production activities in areas containing strata with Chengjiang fossils, including underground extraction.
- To maintain the natural physiognomy in the area with strata containing Chengjiang fossils, and to exercise a checking and management system for the

species selected for re-vegetation, and to promote the natural regeneration of the indigenous plant communities.

- To improve the management of fossil excavation and research activity involving Chengjiang fossils by implementing a system of public notifications, review and approval of the institute proposing excavation, the qualifications of excavators and their excavation plan. Any applicant institute and its palaeontological research team proposing fossil excavation will be required to produce evidence and certificates that meet the conditions below; the aims of the excavation project, excavation plan, plan for storing excavated specimens, and proposals for the restoration of the natural ecological conditions in the excavation area shall meet the following conditions:

- To establish a permit system for review and approval of scientific research and tourism activities in the Chengjiang Fossil Site, so that activities will be appropriately monitored. It is strictly forbidden for tourists to collect fossils.

- Any research team will include at least three staff members who hold a degree in paleontology or geology, or hold relevant technical qualifications or professional titles; they should have at least three years experience in excavating fossils. At least one of the team must hold s senior professional title or qualification in paleontology, and will act as the team leader for the excavation activities.

- The team must be equipped with appropriate equipment for professional fossil collection.

- The team must have the technology and skills appropriate for adequate protection of fossils during excavation.

- The team must have the facilities and equipment for protecting the fossils during transport and an appropriate repository for storing the fossils.

- To control all collection activities in the strata located in the Nominated Property and the Buffer Zone of the Chengjiang Fossil Site.
- To implement strict management in the restoration of the natural ecological condition of the excavation sites. Any institute undertaking excavation must record the status of natural physiognomy and natural vegetation before the fossil excavation operation begins, and complete the restoration of the natural physiognomy and natural vegetation within a given period of time after the excavation activities is completed. An institute will be designated to carry out a

quality check and, when satisfied, will produce a permit for withdrawal from the excavation sites.

- To improve the system for registration of the results of excavation of and scientific research on Chengjiang fossils, and to set up an archive of records of extraction activities in the strata bearing Chengjiang fossils in the Nominated Property and its Buffer Zone.

4.2.2 Protection and management of specimens of Chengjiang fossils

Many of the fossils discovered in the Chengjiang Fossil Site are new to science and have been named for the first time; the fossils include the type specimens of many genera and species. These are of the highest scientific importance of and possess outstanding universal value. Other specimens are of significance but of lower international importance; therefore, the management of specimens from the Chengjiang Fossil Site must be based on a categorization system.

(1) Categorization of the Chengjiang fossil specimens

Chengjiang fossils are assigned to one of two categories: fossils for key protection and fossils for general protection.

Fossils for key protection: all the Chengjiang fossils that have been or will be excavated, identified and named for the first time from the Chengjiang Fossil Site, principally the type specimens of fossils of the Chengjiang Biota but also all other key specimens, including (1) any vertebrate fossils; (2) other chordates, including cephalochordates and tunicates; (3) primitive chelicerates and other arthropods; (4) anomalocaridids (5) lobopodians; (6) primitive echinoderms; (7) stem taxa and enigmatic taxa, including vetulicolians, yunnanozoons and eldoniids; and (8) any other fossils of special scientific value.

Fossils for general protection: all fossil specimens other than those listed above, including fossils excavated from the black shale (upper black stratum) of the lower subsection (∈1q 2) of the Yu'anshan section of the Qiongzhusi Formation, from the fine-grained sandstone and glauconitic sandstone of the Shiyantou section, from the phosphorite of the Dahai section of the Qiongzhusi Formation, from the phosphorus-bearing dolomite of the Yuhucun Formation, from the shale, fine-grained sandstone and sandstone of the Langcangpu Formation and from the dolomite mudstone of the Longwangmiao Formation, as well as fossils from other strata within the Chengjiang Fossil Site.

(2) Protection and management status

- Most of the Chengjiang fossil specimens that have been excavated are registered and housed in research institutes. These include the Chengjiang Fossil National Geopark Management Committee, Yunnan University, Nanjing Institute of Geology and Paleontology of the Chinese Academy of Sciences (CAS), Northwest University, Yunnan Provincial Research Institute for Geological Sciences, Kunming University of Sciences and Technology.
- Type specimens of Chengjiang fossil taxa have been published formally in research papers. These published research papers form an archive of information on the Chengjiang Biota.
- There is currently no centrally-established archive with standard registration of key fossil specimens.
- There is currently no central registration system for recording fossil specimens excavated at the Chengjiang Fossil Site. There is also no system in place for inspection of specimens after identification.
- A list of key Chengjiang fossils has not been developed in the form of laws and regulations.

(3) Planned protection and management measures for key fossils

- To organize a professional evaluation committee to compile a list of fossils from the Chengjiang Biota.
- To evaluate and publicize the list of key fossils of the Chengjiang Biota.
- To ban strictly the indiscriminate buying and selling of key fossil specimens from the Chengjiang Biota.
- To improve the registration, inspection and validation of fossil specimens excavated from the Nominated Property.
- To set up and maintain an information database for Chengjiang fossils, and to construct lists of specimens of comparable fossils from throughout China (and the world).
- To improve museum facilities for curating, storing and displaying Chengjiang fossils. The National Geological Museum of Chengjiang Faunal Fossils will provide the basis for improving the systems for the collection of specimens, the preparation of photographs and documents, and the identification, documentation and publication of taxa. Electronic archives and an internet virtual museum for Chengjiang fossils will also be set up.
- To set up an exchange and collection mechanism for fossils of the Chengjiang Biota excavated in areas outside the Chengjiang Fossil Site. Professionals, amateurs and local people holding specimens/collections of Chengjiang fossils should be encouraged to donate these specimens to the museum of the Chengjiang Faunal Fossils National Geopark; a system should be established for issuing certificates acknowledging these donations.
- Personal and private borrowing of museum specimens for private exhibition

and collection will be banned. Any international exchange or trade of specimens discordant with management regulations, or without the approval of the competent department in charge, will also be strictly banned.

- To set up a criminal investigation and penalty system for damage to, destruction of and trade in specimens from the Chengjiang Biota.
- To improve exhibition and exchange activities for specimens from the Chengjiang Biota. Two exhibition and exchange programs will be implemented annually to enhance popular science education and to bring research activities to the attention of the general public.
- To publish newsletters when appropriate to publicize the research activities and advances on the Chengjiang Biota.

(4) Management of specimens under general protection

- To prepare and publicize a complete list of fossils from the strata in the Chengjiang Fossil Site.
- To identify and list the fossils held in the Chengjiang Faunal Fossils National Geological Museum, and to enrich the museum collection.
- To exhibit the fossil specimens from the various stratigraphic units in the Chengjiang Fossil Site.
- To encourage the donation of fossil specimens collected from all strata containing early Cambrian fossils in the Chengjiang region.
- To register all fossil specimens excavated in the Chengjiang Fossil Site.
- To ban the trade in fossil specimens from all strata containing early Cambrian fossils in the Chengjiang region.
-

(5) Management of fossil specimens of the Chengjiang Biota excavated from outside the Chengjiang Fossil Site.

- Specimens of the Chengjiang Biota include all those fossils that are found in the distribution zone of the exceptionally preserved fauna and its contiguous formations, i.e. all those discovered in the Lower Cambrian Qiongzhusi Formation in the eastern part of Yunnan Province.
- To encourage researchers on and excavators of any fossils of the Chengjiang Biota to provide lists of fossils discovered and copies of research outputs concerning Chengjiang fossils.
- To encourage the donation of excavated and collected specimens of Chengjiang fossils, with donators rewarded in accordance with relevant laws and regulations.
- To actively collect national and international research reports, papers and other information regarding Chengjiang fossils, so as to establish a complete archive of research information on Chengjiang fossils.
- To ban the trade in specimens of fossils from the Chengjiang Biota, and to

encourage the exchange and exhibition of newly excavated specimens.

- In accordance with the Regulations on the Protection of Fossils, to encourage fossil collectors (both individuals and organizations) to participate in exhibition and popular science education programs relating to the Chengjiang fossils, and to compose materials for publicity and popular science education regarding research investigations on Chengjiang fossils.
- To provide protection and management procedures to sites located outside the Chengjiang Fossil Site, relating especially to the excavation of fossils and the compilation of documentation concerning Chengjiang fossils.

4.2.3 Protection and management of other geological relics

(1) “Other geological relics” referred to herein are stratigraphic sections, fossil specimens, relics of geological structures, geological profiles of phosphorus ores and other geological features.

(2) Current status of protection and management

- Sections through the Lower Cambrian Canglangpu Formation and Longwangmiao Formation, and roadside exposures recording the effects of the Chengjiang Orogeny are present in the areas adjacent to the Chengjiang Fossil Site.
- Phosphate rock of the Dahai section and a phosphoritic dolomite section in the Yuhucun Formation were discovered during side slope stabilization in the abandoned phosphorus mining sites and along the roads in areas adjacent to the Chengjiang Fossil Site. They display characteristic features of the phosphoritic strata and contain some fossil specimens.
- Small-scale folds, fractures and other evidence of tectonic movements (including a tectonic unconformity) are present on the side slopes in the abandoned mining sites and along the roads in the areas adjacent to the Chengjiang Fossil Site.

(3) Planned protection and management measures

- To study and document the stratigraphic sections, geological structures, and profiles of phosphoritic strata, and to release to the public information on the locations, profile types and protection requirements.
- To establish and improve the interpretation and signage systems for the various types of geological relics.
- To ban strictly any damage to or destruction of exposed strata, geological structures, profiles of phosphoritic strata and interpretation signs.
- To prepare a database of geological relics and landscapes in the Chengjiang Fossil Site and adjacent areas.

- To set up a patrol and monitoring system for the geological relics and landscapes. The protection status of the geological relics and landscapes will be frequently checked, providing a basis for improvement of the protection and management measures.

4.2.4 Rehabilitation of natural physiognomy and natural vegetation

(1) The natural physiognomy and natural vegetation referred to herein are the natural status of the physical topography and natural vegetation in the Chengjiang Fossil Site. The abandoned phosphorus mining sites and the localities of gully erosion present a need for vegetation regeneration after engineering rehabilitation.

(2) Current status of protection and management

- Following remediation measures, a considerable area of vegetation has been restored on the side slopes and tailing piles of the abandoned phosphorus mining sites in the Buffer Zone of the Nominated Property.
- Rubble piles and erosion gullies exist in the pits left from fossil excavation.
- Engineering measures have been undertaken to stabilize the side slopes of the roads traversing the Buffer Zone of the Nominated Property.
- Rain-fed farmland exists in the Nominated Property; the area of farmland is significantly larger in the Buffer Zone.
- There is widespread erosion in the gullies in the Nominated Property and its Buffer Zone.
- A forest fire patrol team has been organized to implement the forest fire early warning and fire site patrol system.

(3) Planned protection and management measures

- To prepare and publicize a list of native species and vegetation types, as well as the protection requirements covering these for the Nominated Property.
- To organize a patrol team and patrol system for the geological and environmental risks in the Nominated Property and its Buffer Zone.
- To carry out engineering stabilization of the side slopes, abandoned phosphorus mines and gullies in the scope of the Nominated Property and the National Geopark in order to mitigate potential geological disasters.
- To protect existing vegetation and promote the natural regeneration of native vegetation, and to prepare a list of species to be used for re-vegetation of the Buffer Zone of the Nominated Property.
- To improve and enforce a rigorous early warning system for forest fire prevention in the geological park, and to perfect a patrol team and executive mechanism for forest fire prevention.
- Infrastructural projects that disturb the topography in the Buffer Zone of the

Nominated Property shall be strictly banned; and checking and approval of restoration activity on the natural physiognomy after completion of infrastructure projects shall be strictly enforced.

- To improve land-use management, and to ban strictly logging, forest clearing, grass cutting and slope land reclamation for farming.
- To ban strictly the refilling of natural gullies, and to treat the rubble accumulation on the side slopes of gullies, so as to protect existing vegetation and to promote regeneration of natural vegetation.
- To maintain the facilities for scientific research and tourism in the geopark, and to strictly enforce the checking and approval of restoration projects in the fossil excavation sites.

4.3 Land-use and community adjustment, community participation in planning and management

(1) Current status

The land tenure of the Chengjiang Faunal Fossil Nominated Property and its Buffer Zone, as well as the Chengjiang Faunal Fossils National Geopark, is under collective ownership, and the land is used through contracts and lease agreements with individuals and enterprises for their autonomous management, including forest land, barren mountains, farmland, and construction land-use. Agriculture and animal husbandry are the main production activities for community residents. The main sources for family income range from agricultural cultivation, rearing of animals, migratory labor and marketing of agricultural and husbandry products.

(2) Planned protection and management measures

- To verify land tenure and records of changes for the Chengjiang Faunal Fossils National Geopark.
- To prepare an inventory of land tenure within the Nominated Property and the Geopark and post for public notification.
- To improve the land-use archives of the Nominated Property and the Geopark.
- To maintain the natural physiognomy of the Nominated Property and the Geopark, and to protect and promote the natural vegetation, including forest, with regeneration where appropriate.
- To ban strictly land encroachment as a result of prospecting for mineral resources and to ban infrastructural projects in the scope of the Nominated Property.
- To ban residential land-use by local communities within the Nominated Property. Plans for the construction of residential houses in Luolishan and Xincun will be adjusted in accordance with the protection planning.
- In accordance with the authorized management rights and requirements for

the management and protection of the Nominated Property, to improve land-use adjustments, to exercise strict contract-based land-use, and to achieve harmoniously the protection of community residents' interests and the targets of the Nominated Property.

- The abandoned construction site in the Buffer Zone will be remediated to its natural physiognomy and will be managed as forest land, or land appropriate for reforestation to the purpose of restoring natural vegetation.
- The People's Government of Chengjiang County and the Chengjiang Fossil National Geopark Management Committee have the responsibility to assist the land management department to secure employment and allocate other land for those community residents whose land-use plans are affected for the purpose of protection of the Nominated Property.

4.4 Environmental protection planning

(1) Environmental protection refers herein to the atmospheric, water body, solid waste and ecological conditions in the Chengjiang Fossil World Heritage Site Nominated Property and its Buffer Zone, as well as in the Geopark.

(2) Current status of environmental protection

- The Chengjiang Faunal Fossils National Geopark belongs to the catchment area of Fuxian Lake – a regional (for Yunnan) plateau lake listed for key protection. The Nominated Property is the headwater area of a permanent river (Luxishao River) that flows into the lake. The headwater catchment of the Dapotou-Xiaotuanpo River is located in the southern part of the Geopark.
- There are phosphorus chemical enterprises in the areas adjacent to the Chengjiang Fossil Site. Waste gases, water discharge and accumulation of solid waste from these enterprises exist.
- There is severe ongoing erosion on the side slopes and surfaces of the simple roads that connect the Geopark, the factories and adjacent communities.
- There are abandoned phosphorus mining sites in the Geopark and its adjacent areas. The disturbed area totals 220 ha. Engineering treatment has been carried out on the side slopes and the deep pits in most of the sections. Tailing piles from the open mining of phosphorus ores are present.
- There are rubble piles, pits and trenches in the four fossil excavation sites.
- Natural communes, including Luolishan, Ganhaizi and Xiaolantian are located in the areas adjacent to the Nominated Property, and Xincun, Zhepocun and Dongxishao villages, and the Wild Duck Lake Industrial Zone are located in the adjacent areas of the Buffer Zone. Some of the families in the villages use firewood for energy.

(3) Planned protection and management measures

- To improve the system for the Chengjiang Fossil National Geopark Management Committee to review and verify whether various types of project plans and projects involving the National Geopark and its impact areas comply with the goals and requirements for the protection and management of the Geopark and the provincial nature reserve. The management committee's decisions on these matters will inform the decision of the local government.
- To publicize the environmental protection planning and management measures of the Geopark and of the headwater catchment of Fuxian Lake.
- To build bio-toilet facilities on the research and tourism sites of the Chengjiang Fossil Site.
- To supervise and inspect closely the "three wastes" treatment and discharge facilities of the phosphorus chemical enterprises in the areas, and to gradually close, phase out and relocate those enterprises that affect the environment of the Nominated Property.
- To improve and expedite the rural infrastructural development; specifically, to build facilities for the centralized treatment of household waste water and garbage, and to promote reduced waste water discharge and garbage disposal to meet environmental standards.
- To upgrade family energy facilities through extension of the use of firewood saving stoves, solar energy, biogas production, so as to reduce the overall firewood use.
- To continue the engineering treatment and re-vegetation of the abandoned phosphorus mining sites, phosphorus slag and chemical plants, and to publicize the appropriate species to promote natural regeneration of native vegetation.
- To monitor the volume of farm chemicals and pesticides in use and to extend ecological cultivation and rearing practices.
- To ban strictly any activities of logging and destruction of vegetation, and publicize the plans for rehabilitation of the barren mountains and for erosion control; to promote the rehabilitation of indigenous vegetation types through contracted reforestation in the barren mountains and gully areas.
- To promote measures for road surface hardening and for stabilizing the edge slopes of roads.
- To carry out engineering treatment and re-vegetation in the fossil excavation sites and rubble piles, while maintaining exposures of strata for fossil conservation.

4.5 Planning for research, exhibition, publicity, education and scientific exploration tourism in the Chengjiang Fossil Site

(1) The contents of this section include the plans for periods of research, for a detailed survey

of the fossil bearing strata and beds, for the establishment of scientific exploration tourism, with signage and an interpretation system, for the geological museum, and for posters and literature for public education concerning Chengjiang fossils.

(2) Current status of scientific research, exhibition, publicity and public education

- A team has been formed with the Chengjiang Fossil National Geopark Management Committee as the base and with participation of national andinternational scientists.
- The exhibition and signage at the entrance to the Chengjiang Faunal Fossils National Geopark and fossil excavation sites have been built.
- The Geopark Museum, where key fossils specimens are displayed from the Chengjiang Fossil Site and from adjacent areas, has been completed and opened to the public,.
- A series of reading materials for popular science education has been compiled and published, including *Chengjiang Faunal Fossils* and *Geological Exploration and Guidelines for the Basic Geology of Chengjiang Faunal Fossils National Geopark*.
- A number of exhibitions and public communication of science activities have been organized in cooperation with domestic and foreign institutes, as well as social groups. Poster exhibitions of Chengjiang fossils have been organized in six countries and regions outside Yunnan. Considerable experience has been gained for implementing publicity and popular science programs domestically and internationally.
- Routes have been constructed for scientific exploration, linking fossil excavation sites.
- Basic facilities for scientific exploration of Chengjiang faunal fossils have been equipped.
- Three sites demonstrating geological profiles of the Geopark have been established.
- The Geopark has been equipped with facilities that are capable of receiving an 100,000 annual visitors. Current visitation is about 5,000.
- Professional teams have been trained and are capable of guiding teaching practice, research training and exploration tourism for students from various types of school.

(3) Management planning for research, exhibition, popular science education and capacity building.

- To build a visitor service center based on the museum of the Chengjiang Faunal Fossils National Geopark.
- To complete a detailed mapping survey (Scale: 1:10,000) of the strata bearing the Chengjiang fossils, and to conduct periodic excavation research on

Chengjiang fossils.

- To actively mobilize support from both within and outside the Geopark to set up a Chengjiang fossils research fund; to collect research papers, works and monographs on fossils of the Chengjiang Biota; to publish occasional newsletters about the advancement of research on Chengjiang fossils; and to organize international conferences and seminars on Chengjiang fossils.
- To construct an information database on the Chengjiang Faunal Fossils National Geopark, to launch the construction of a digital Geopark, and to improve the database of geological relics of the Chengjiang Fossil Site.
- To compile a list and a photographic archive of fossils of the Chengjiang Biota, and to produce movie and TV programs about the protected Chengjiang Fossil Site so as to broaden popular science education and enhance the publicity and appeal of the Geopark.
- To improve the specimen display and interpretation system, and access to the museum; and to create interactive opportunities for audiences to participate in popular science education and publicity of the Geopark.
- To improve the signage and posters for the geological sites in the Geopark, and to complete the construction of routes for scientific exploration, including one linking “Southern entrance – Xincun – Luolishan – Maotiaoshan – the Service Center – Xiaotuanpo – Xincun – North entrance”.
- To open new sightseeing and scientific exploration routes demonstrating the natural history of the Chengjiang area and the Chengjiang Fossil Site; to include scientific explanations of the development and evolution of geological physiognomy, including the Chengjiang Orogeny, Nantou glacial period, Sinian phosphorus ores, Cambrian Explosion, Variscan Orogeny, Emeishan basalt eruptions, and the development of Fuxian Lake.
- To continue the cleaning up and rehabilitation of the scientific exploration sites on the tourism routes to eliminate safety risks and enhance the vegetation landscape on the exploration routes.
- To further integrate the linkages between scientific exploration in the Geopark and recreation around the Fuxian Lake tourism and holiday scenic resort; to enrich the facilities for popular science education for tourists in the areas; and to enhance the self-supporting capacity of the Geopark and to strengthen the capacity of the Geopark to contribute to local economic growth.
- To publicize the scientific knowledge of the Chengjiang Biota, and to build the capacity of tourist guides for the Geopark and the exploration and excavation sites; local community residents will be trained to work as tourist guides for the Geopark, and professional staff will also be encouraged to work as volunteer tour guides for the exploration and excavation sites.
- To design education posters regarding the protection and management of the Chengjiang Biota and distribute them to local villages and families, so as to

disseminate understanding of the Regulations on the Protection of Chengjiang Faunal Fossils in Yunnan, and rules on the protection and management of the Geopark and Chengjiang Fossil Site. This will contribute to fostering the capacity and willingness of local community residents to protect the resources of the Geopark.

- To develop ethnic tourism in the communities in the areas adjacent to the Geopark. This will contribute to broadening the channels for the local communities to participate in popular science education and increase their income opportunities.
- To recommend the Chengjiang Fossil Site to schools and universities at all levels, and to develop a full series of textbooks (teaching materials) for exploration and excavation, field practice, supplementary materials for research training, etc.; and to provide on-site guidance to student field parties and improve the services for student training.
- To improve the fire and disaster prevention and control system in the Geopark and the facilities for such purposes.

4.6 Monitoring planning

4.6.1 Monitoring contents

- Monitoring the protection of geological relics
- Monitoring the excavation of Chengjiang fossils
- Monitoring of the geological environment and geological risks
- Monitoring the regeneration of forest vegetation, the control of forest pests and diseases, and the control of the risk of forest fires
- Land-use monitoring
- Atmospheric monitoring
- Water quality monitoring
- Solid waste monitoring
- Survey of community residents

4.6.2 Current monitoring status

- Technical teams and equipment to implement monitoring of the Geopark are provisionally in place. However, the staff and equipment are not provided by the Geopark, but belong to respective competent departments of the government, or rely on the research institutes and universities in Yuxi City and Yunnan Province.
- Initial funding for implementing various monitoring tasks has been secured and a system for the regular monitoring of water quality, atmosphere, the geological environment, forest pests and diseases, forest fires and land usage has been established.

- Data have been accumulated over many years regarding land usage, land tenure, forest vegetation, atmosphere quality, water quality, solid waste, geological disasters and forest pests and diseases in the Geopark area.

4.6.3 Plans for monitoring

- To set up a real time monitoring network in the Geopark. This should cover the Chengjiang Fossil World Heritage Site Nominated Property, its Buffer Zone, strata containing Chengjiang fossils, fossil excavation sites, important sites of geological relics, the geological environment, forest vegetation, atmosphere, water quality, community residence and the river systems.
- To construct a Geographic Information System (GIS) for the Chengjiang Faunal Fossils National Geopark for regular and responsive updating of monitoring information.
- To establish a monitoring command center for the Geopark, to implement an annual reporting system, and to conduct training and education programs for the monitoring teams.
- To supplement and improve the equipment needed for field monitoring and surveying.
- To conduct episodic on-site inspections of the protection status of the fossil sites and geological relics in the Chengjiang Fossil Site.
- To conduct episodic inspection of the conservation status of specimens of Chengjiang fossils.
- To carry out on-site inspections twice annually of the geological environment and geological risks.
- To exercise an on-site monitoring and patrolling system for forest fire prevention in dry seasons, and to carry out regular checks and prevention measures in relation to forest pests and diseases.
- To monitor four times a year the ambient atmosphere in the Geopark. The standards of Class I of Category I (Atmospheric Environment Quality Standards (3095-1996) and Class I of the Integrated Emission Standards of Air Pollutants (GB16297-1996) shall apply in ambient atmosphere monitoring.
- To monitor the water bodies in the farmland, factories, mines and villages three to four times a year. Class III (Environmental Quality Standards for Surface Water, (GB3838-2002) Class III) and Class I Integrated Emission Standards of Pollutants (Class I, GB8978-4996) shall apply for monitoring rivers flowing into lakes. For water bodies flowing into Fuxian Lake, requirements for Class I (Environmental Quality Standards for Surface Water (GB3838-2002) Class I)

will be implemented. It is not permitted to build new pollutant discharge outlets, and discharge of all pollutants must meet required standards and must be treated with advanced purification.

- To monitor the storage facilities and sites for solid waste discharged from the phosphorus chemical enterprises on a regular and unannounced basis, including checking that the solid waste has been treated, and that effluent discharge meets the requirements of environmental management standards; to monitor periodically the progress of vegetation rehabilitation in the abandoned phosphorus mining sites; to monitor if the filtration-flow meets discharge standards to ensure that relevant enterprises practice management procedures that allow them to meet discharge standards.
- To check on a regular and unannounced basis the water quality in the farmland, to survey the volume of chemical fertilizers and pesticides applied by local farmers, and to check the piling and disposal of solid waste by the local villages.
- To carry out annual monitoring on the status of land tenure changes and on the progress of forest rehabilitation and re-vegetation activities.
- To carry out regular checking of the signage and interpretation system for scientific exploration and tourism, and to monitor the visitor service facilities in the Geopark.
- To implement an annual reporting mechanism for the monitoring and inspection activities in the Chengjiang Faunal Fossils National Geopark.

5. Management Institutions and Planning for Capacity Building and Training

5.1 Management executive agencies

The Chengjiang World Heritage Nominated Site builds on the three conservation designations: a national heritage site – the "Yunnan Chengjiang Faunal Fossils Protected Area", a national geopark – "Chengjiang Faunal Fossils" and a Yunnan provincial nature reserve – "Chengjiang County Maotianshan Faunal Fossils". The Chengjiang Fossil National Geopark Management Committee (hereinafter referred to as "the Committee"), a subsidiary of the Yuxi City People's Government, has a mandate to fulfill the responsibilities for the unified/overall management of all three conservation designations. The Committee is under the leadership of the Chengjiang County People's Government, which appropriates an administration budget for the daily management of the designations. Three branch offices have been set up under the Committee, as follows:

(1) The Chengjiang Faunal Fossils Management Office (The Management Office of Chengjiang Faunal Fossils National Geopark, MO) is responsible for on-site protection and management of the Geopark, and carries out patrolling and supervision responsibilities.

(2) The General Office (GO) is in charge of finances and accounting, personnel management and archives.

(3) The Museum is responsible for the fossil specimens, publicity and display, and research.

The daily management of the Chengjiang Faunal Fossil World Heritage Site Nominated Property is also the responsibility of the Committee. Its mandates are those established in the *Regulations of the Protection of Paleontological Fossils*, *Regulations of Yunnan Province on Nature Reserves* and *The Provisional Regulations on the Protection of Chengjiang Invertebrate Fossils*, and other relevant laws and regulations. These mandates specifically include:

- To exercise daily management of the Chengjiang Fossil Site.
- To organize the formulation of plans for the Chengjiang Fossil Site.
- To implement various plans approved by competent authorities.
- To organize research activities in the Chengjiang Fossil Site.
- To organize the display of specimens of Chenbgjiang fossils and related public science education activities.

- To be responsible for organizing exchange arrangements and research cooperation between the Chengjiang Fossil Site and external agencies and individuals.
- To be responsible for keeping Chengjiang fossil specimens.
- To organize various types of monitoring and protection patrols/checking in the Chengjiang Fossil Site.
- To prepare a budget for the protection of the Chengjiang Fossil Site.
- To raise conservation funds for the fossil site.
- To collaborate with the administrative townships/villages involved with the fossil site in order to implement the land-use plans, and to secure the land tenure for the protection of the Chengjiang Fossil Site.
- To organize and supervise the review of protection plans relating to the fossil site, and the implementation of relevant decisions.

5.2 Supervision and Guiding Agencies

The direct professional leadership, guidance and supervisory agencies of the Chengjiang Fossil National Geopark Management Committee: The Ministry of Land and Resources, the Ministry of Housing and Urban-Rural Development, the Ministry of Environmental Protection, the National Commission of the People's Republic of China for UNESCO, and the relevant functional departments of Yunnan Provincial People's Government, specifically, Yunnan Provincial Department of Housing and Urban-Rural Development, Department of Land and Resources, Department of Environmental Protection and Department of Forestry.

5.3 Institutes for technical cooperation and support

The management agency of the Chengjiang Fossil Site is the Chengjiang Fossil National Geopark Management Committee. Its partner institutes for technical cooperation and support include Yunnan University, Kunming University of Sciences and Technology, Nanjing Institute of Geology and Paleontology of the Chinese Academy of Sciences, Yunnan Provincial Headquarters for Geological Environment Monitoring, Yunnan Provincial Research Institute of Environmental Sciences. The United Kingdom, Germany, France, Sweden, the United States, Japan and other countries are also providing support for fossil research.

Figure 4 presents an overall diagram of the institutes and agencies involved in the management, leadership, supervision and technical guidance and support of the Chengjiang Fossil Site.

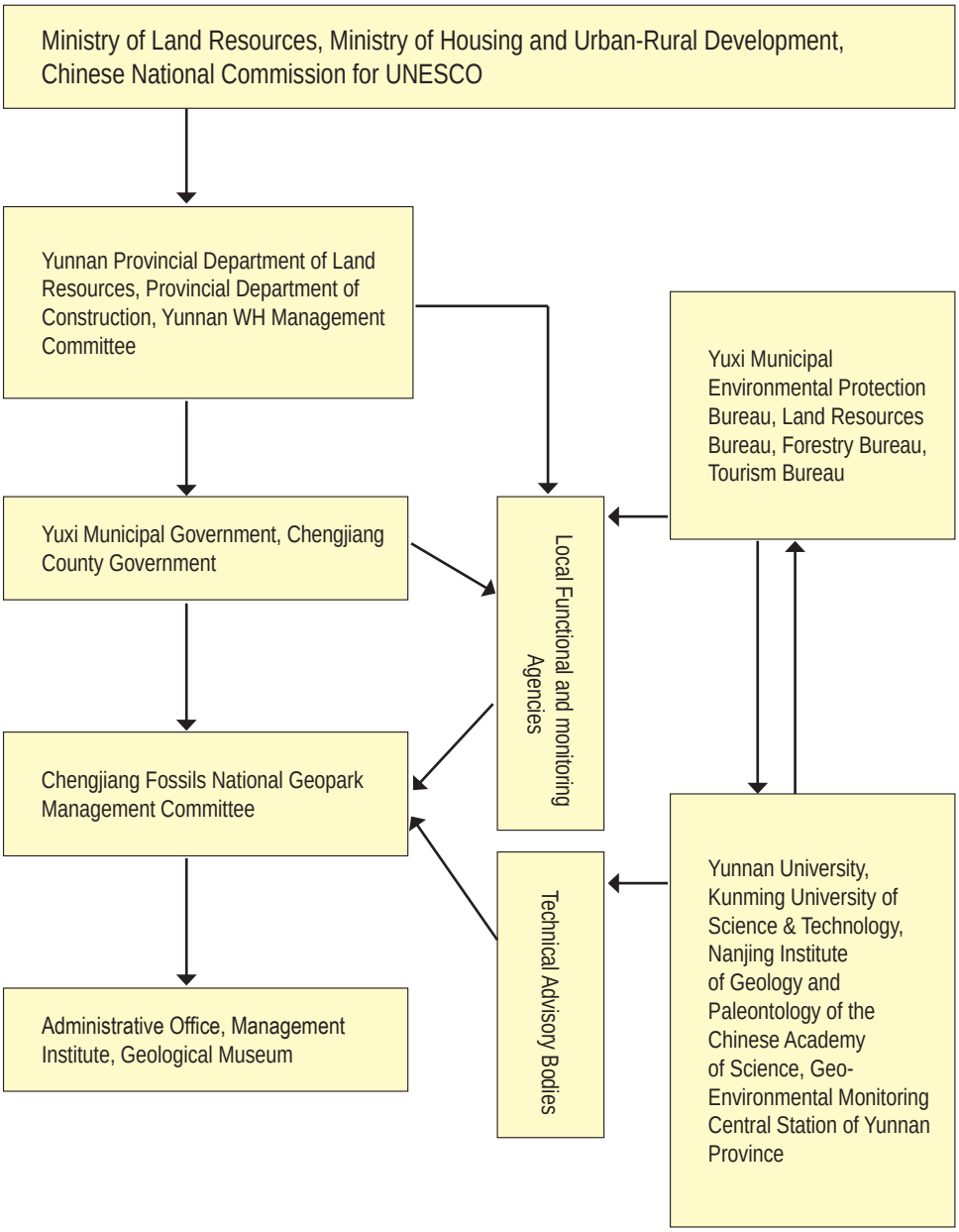


Figure 4. Organisational diagram for the Management, Leadership, Supervision, Administrative Management and Technical Support Institutions of the Chengjiang Fossil Site

6. Capacity Building of the Management Institutions

The components for the capacity building of the Chengjiang Fossil National Geopark Management Committee include human resources development and building the technical proficiency of the technical and professional staff members.

Table 3 shows the planning structure for institutional development and staff recruitment.

Table 3. The management institutions and staff composition for the Chengjiang Fossil Site

Management Institution	Professional management staff		Part-time staff from communities	
	Present	Future	Current	Future
The Management Committee	18	28	16	28

Table 4 shows the plans for technical capacity building and training of the management team for the years 2011-2012 in the Chengjiang Fossil Site.

Table 4. Capacity building and training

Contents of Training & Education	Time	Agencies in Charge
Essentials of geological and palaeontological relics; protection and management planning of the Chengjiang Fossil Site	2011.01	The Management Committee
Fundamentals of the world heritage site system; education concerning the nomination and inscription of the Chengjiang Fossil Site into the World Heritage Site list	2011.02	Chengjiang County Government
Protection and management regulations for nature reserves; protection and management of national geoparks	2011.03	The Management Committee
Training on environmental protection, environmental monitoring and ecological restoration	2011.03	Yuxi City Environmental Protection Bureau
Training on on-site patrol and inspection in the Chengjiang Fossil Site	2011.05	The Management Committee

Training of the tourist guides for popular science education and for explanation of the museum of Chengjiang fossils	2011.06	The Management Committee
Training on constructing a database of geological relics for the Chengjiang Fossil Site	2012	Yuxi City Land & Resources Bureau
Geological environment monitoring and prevention and control of geological disasters	2012	Yuxi City Land & Resources Bureau
Training on community management and community participation in the management the Geopark	2012	Chengjiang County Government

7. Action Planning and Resources Guarantee

The budget and sources of funding for the Protection Action Planning (Year 2011-2015) are presented in Table 5.

Table 5. Budget and sources of funding (Unit: yuan RMB)

Project activities	Fiscal year	Budget (in 10,000)	Funding sources
Daily patrol, monitoring and management of the Chengjiang Fossil Site	2011-2015	1,000	Chengjiang County Finance (CCF)
Boundary survey and marker installation for the Chengjiang Fossil Site	2011	150	CCF
Monitoring system for the Chengjiang Fossil Site	2010-2015	1,000	CCF and social donation
On-site display system for the Chengjiang Fossil Site	2010-2012	500	CCF, Yuxi City finance & govt. appropriation from the province
Exhibition system for the Chengjiang National Geopark	2010-2012	300	Appropriation from Yuxi City and Yunnan Prov. govt.
Sorting and cataloging of specimens of Chengjiang fossils	2010-2013	800	CCF and raising social capital
Improvement of the geological environment and landscape in the Chengjiang Fossil Site (including ecological restoration)	2010-2013	800	CCF and subsidies from the provincial and national government
Capacity building (knowledge and skills) of the management team and the production of a poster series for publicity and education regarding the Chengjiang Fossil Site	2009-2012	300	CCF and raising social capital
Community training in the Chengjiang Fossil Site	2010-2011	150	Raising social capital.

Research in the Chengjiang Fossil Site (periodic fossil excavation and detailed surveys of fossil-bearing strata and beds)	2010-2015	600	Government appropriation and raising social capital
External exchange	2011-2015	200	CCF and raising social capital
Infrastructure for the protection and management of the Chengjiang Fossil Site	2011-2015	1,500	CCF, govt. appropriation from the province and city, plus social fund raising
Grand total:	2010-2015	7,300	

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The Chengjiang Fossil National Geopark Management Committee
Yunnan Huakai Gardening Construction and Development Corp. Limited
Yunnan Provincial Geological Environment Monitoring Institute
Yunnan Fangcheng Planning Business Office
And other individuals and agencies who have provided various support and technical documents.

We would like to extend our special thanks to all of the above!

World Heritage Nomination

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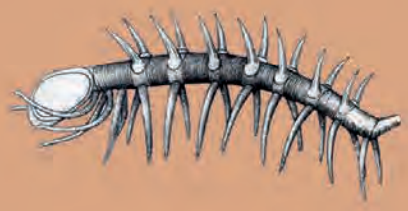
Chengjiang Fossil Site

Appendix 4

Inventory of Chengjiang Fossil Site



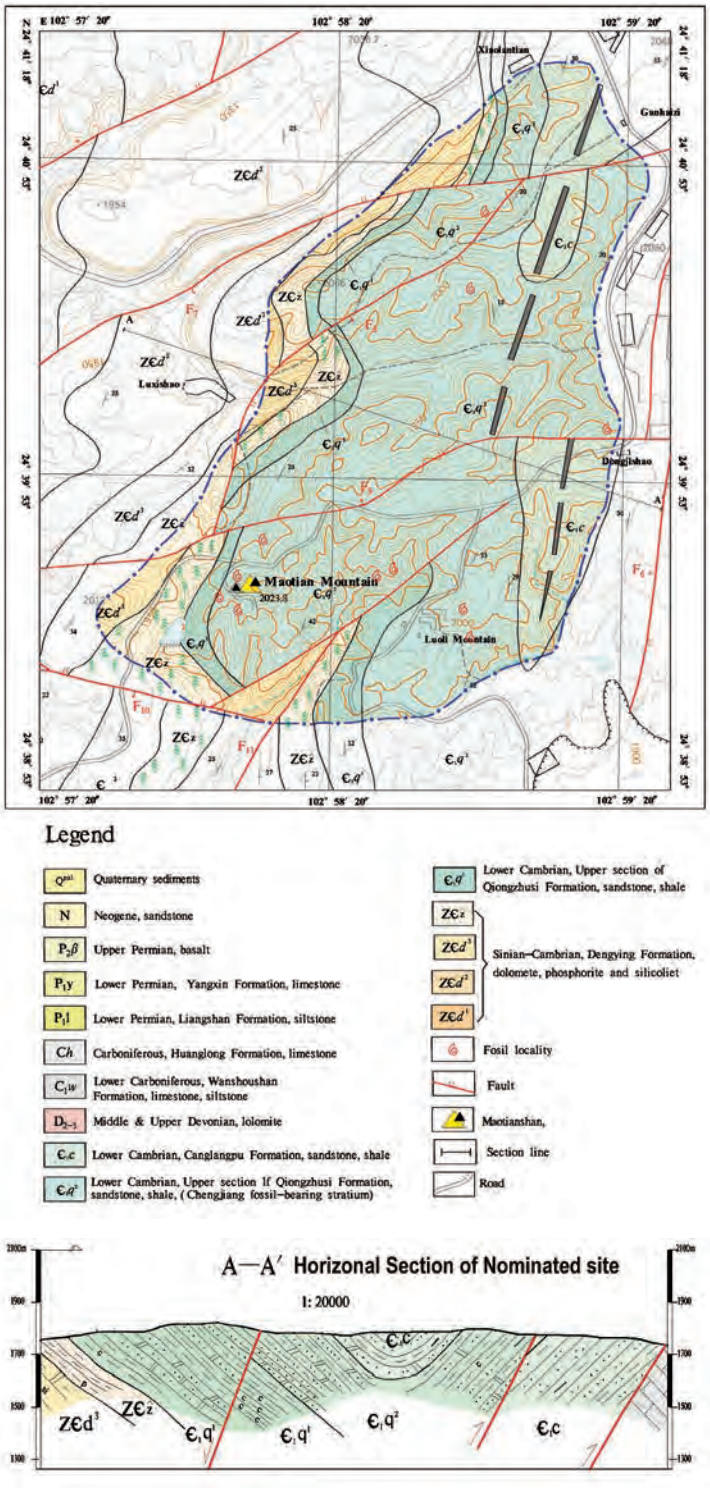
Ministry of Housing and Urban-Rural

Development of the People's Republic of China

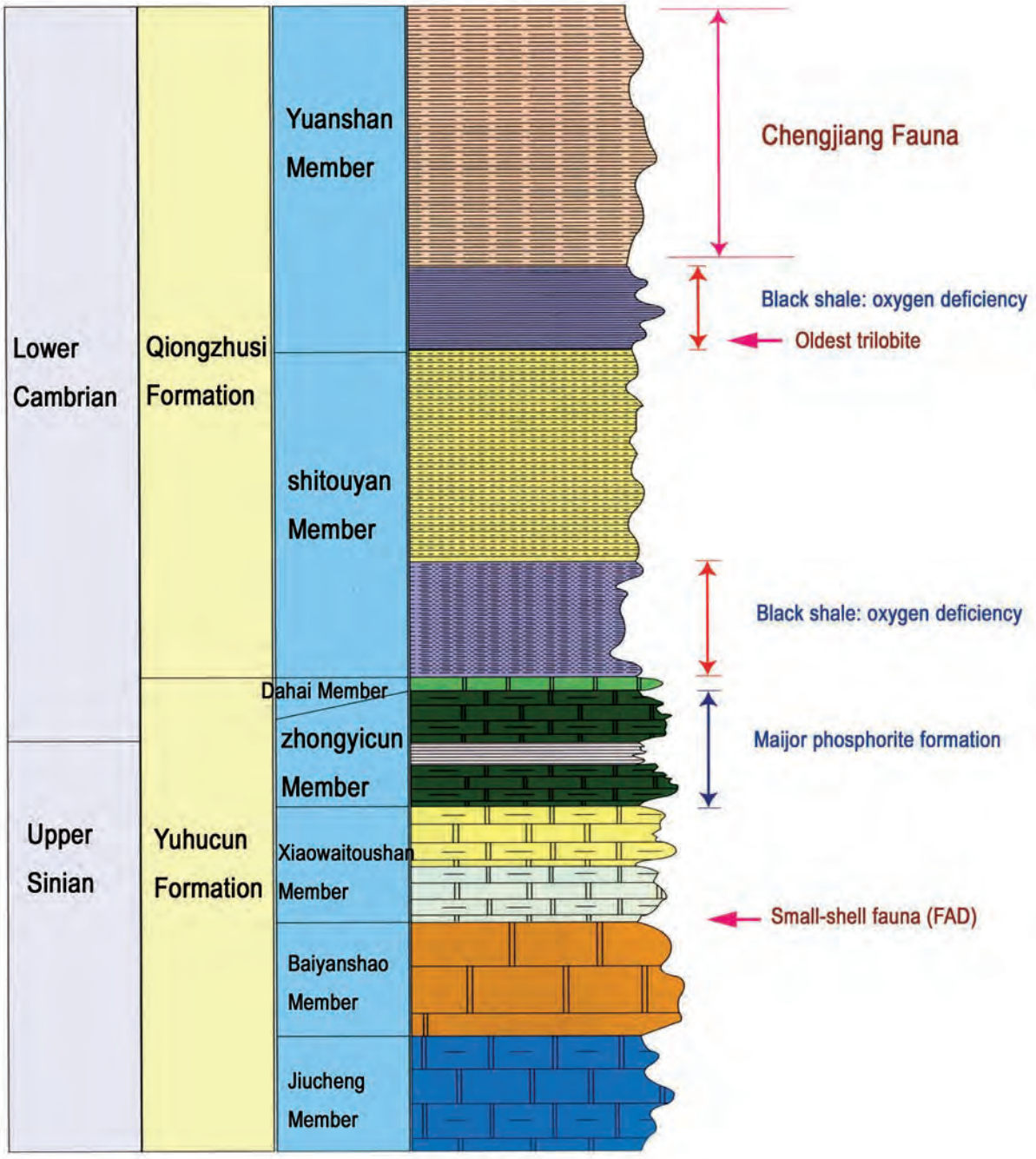
2011.1

Inventory of Chengjiang Fossil Site

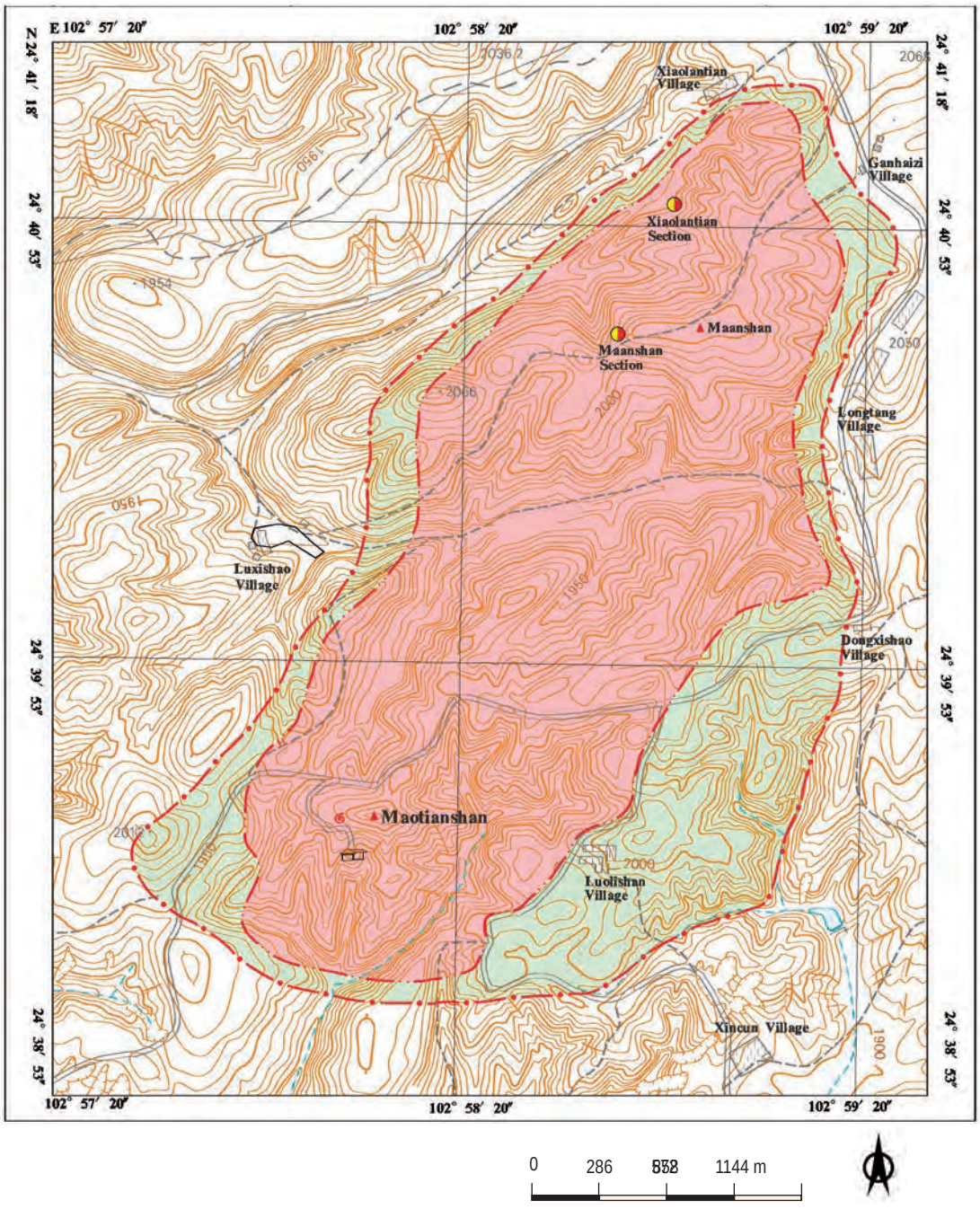
Contents



Geological map of the nominated Chengjiang Fossil Site



Precambrian-Cambrian boundary stratotype, showing lithological features and major biological events



Chengjiang fossil site, showing representative stratigraphic sections

Xiaolantian section

Ma’anshan Section

1. Representative Stratigraphic Section (from top to bottom)

● Yu'anshanϵ Member (ϵ_{1q}^{2}) ＞110.38m

(10) Red soil and yellowish-grey, thin and medium-bedded silty shale and silty mudstone with interbedded thin siltstone. 12.74m thick. Two fossil horizons:

Upper part (Cg-f-10-2), arthropods: *Eoredlichia intermedia*, *Naraoia longicaudata*; brachiopods: *Lingulepis malongensis*; enigmatica: *Eldonia eumorpha*.

Lower part (Cg-f-10-1), arthropod: *Eoredlichia intermedia*; brachiopods: *Lingulella chengjiangensis*, *Lingulepis malongensis*.

(9) Yellowish-green, thin argillaceous shale and silty mudstone alternating with argillaceous siltstone (Cg-f-10-1), arthropods: *Eoredlichia intermedia*, *Yunnanocephalus yunnanensis*, *Waptia* sp., *Kunyangella cheni*; chancelloriid: *Chancelloria* sp.; brachiopod: *Lingulepis malongensis*. 9.65m thick.

(8) Yellowish-green, medium-bedded argillaceous siltstone with interbeds of thin silty shale. Two fossil horizons, from upper to lower:
Upper part (Cg-f-8-2), arthropods: *Eoredlichia intermedia*, *Yunnanocephalus yunnanensis*, *Kunyangia pustulosa*, *Naraoia longicaudata*, *Kunyangella cheni*; brachiopod: *Lingulepis malongensis*; hyolithid: *Ambrolinevitus platypluteus*.

Lower part (Cg-f-8-1), arthropods: *Eoredlichia intermedia*, *Waptia ovata, Kunmingella maotianshanensis*; hyolithid: *Ambrolinevitus ventricosus*.

(7) Yellowish-green, thin argillaceous shale and silty shale with intercalations of very thin siltstone; the base is a yellowish-grey ferruginous and argillaceous sandstone. 0.35m thick. Three fossil horizons, from upper to lower as follows:

Upper part (Cg-f-7-3), arthropods: *Eoredlichia intermedia*, *Waptia ovata*, *Isoxys auritus*, *Kunmingella maotianshanensis*; nematomorph: *Maotianshania cylindrica*; brachiopod: *Heliomedusa orienta*; hyolithid*: Ambrolinevitus ventricosus*.

Middle part (Cg-f-7-2), arthropods: *Eoredlichia intermedia*, *Waptia ovata*, *Kunmingella maotianshanensis*; brachiopod: *Heliomedusa orienta*; hyolithid: *Ambrolinevitus ventricosus*.

Lower part (Cg-f-7-1), arthropods: *Eoredlichia intermedia*, *Naraoia longicaudata*, *Waptia ovata*; *Branchiocaris*? *yunnanensis*, *Ixoxys auritus*, *Kunmingella maotianshanensis*; sponge: *Leptomitus teretiusculus*; brachiopod: *Heliomedusa orienta*; hyolithid: *Ambrolinevitus ventricosus*; alga: *Yuknessia* sp.; enigmatica: *Vetulicola cuneatus*.

(6) Yellowish-green, thinly laminate silty shale with interbeds of thin to medium bedded argillaceous siltstone, with a 0.2-0.3m argillaceous, fine ferruginous sandstone at the base. 21.6m thick. Five fossiliferous horizons, from upper to lower as follows:

Uppermost part (Cg-f-6-5), arthropods: *Naraoia longicaudata*, *Waptia ovata*, *Isoxys auritus*, *Kunmingella maotianshanensis*.

Upper part (Cg-f-6-4), arthropods: *Eoredlichia intermedia*, *Naraoia longicaudata*, *Waptia ovata*, *Isoxys auritus*, *Kunmingella maotianshanensis*, *Peytoia* sp.; priapulid: *Selkirkia*? *elongata*; brachiopod: *Heliomedusa orienta*; hyolithid: *Ambrolinevitus platypluteus*.

Middle Part (Cg-f-6-3), arthropods: *Eoredlichia intermedia*, *Yunnanocephalus yunnanensis*, *Naraoia longicaudata*, *Parapalaeomerus sinensis*, *Waptia ovata*, *Isoxys auritus*, *Sunella grandis*, *Kunmingella maotianshanensis*, *Amplectobelua symbrachiata*; sponge: *Halichondites* sp.; brachiopod: *Heliomedusa orienta*.

Lower part (Cg-f-6-2), arthropods: *Eoredlichia intermedia*; *Naraoria longicaudata*, *Leanchoilia illecebrosa*, *Waptia ovata*, *Branchiocaris*? *yunnanensis*, *Isoxys auritus*, *Kunmingella maotianshanensis*; nematomorph: *Maotianshania cylindrical;* priapulid: *Acosmia maotianica*; sponge: *Leptomitella* sp.; brachiopods: *Heliomedusa orienta*, *Lingulepis malongensis*; enigmatica: *Vetulicola cuneatus*.

Bottom part (Cg-f-6-1), arthropods: *Eoredlichia intermedia*, *Yunnanocephalus yunnanensis*, *Naraoia longicaudata*, *Naraoia spinosa*, *Fuxianhuia protensa*, *Waptia ovata*, *Isoxys auritus*, *Kunmingella maotianshanensis*; sponges: *Triticispongia diagonata*; brachiopods: *Heliomedusa orienta*; enigmatica: *Heteromorphus longicaudatus*; alga: *Sinocylindra yunnanensis*.

(5) Yellowish-green shale and silty shale with interbeds of thin argillaceous siltstone. 12.06m thick. Three fossil horizons, from upper to lower as follows:

Upper part (Cg-f-5-3), arthropods: *Yunnanocephalus yunnanensis*, *Naraoia longicaudata Naraoia spinosa*, *Isoxys auritus*, *Kunmingella maotianshanensis*; algae: *Fuxianospira gyrata*, *Yuknessia* sp.

Middle part (Cg-f-5-2), arthropods: *Yunnanocephalus yunnanensis*, *Naraoia longicaudata*, *Naraoia spinosa*, *Kunmingella* sp.; alga: *Sinocylindra yunnanensis*.

Lower part (Cg-f-5-1), arthropod: *Isoxys auritus*.

(4) Yellowish-grey silty shale alternating with thin siltstone, (Cg-f-4). nematomorph: *Maotianshania* sp.; algae: *Fuxianospira gyrata*, *Yuknessia* sp. 0.72m thick.

(3) Yellowish-grey shale and a few interbeds of thin siltstone, with a 0.3m thick fine, argillaceous, yellowish-grey, sandstone. 6.48m thick. Two fossil horizons, from upper to lower as follows:

Upper part (Cg-f-3-2), arthropods: *Sunella* sp., *Spinokunmingella typica*; nematomorph: *Maotianshania* sp.; sponge: *Saetaspongia densa*; alga: *Yuknessia* sp.

Lower part (Cg-f-3-1), arthropods: *Naraoia* sp., *Sunella* sp., *Kunmingella angustacostata*; algae: *Sinocylindra yunnanensis*, *Yuknessia* sp. etc.

(2) Grey-black shale with interbeds of silty shale and thin siltstone, (Cg-f-2). arthropods: *Naraoia spinosa*, *Leanchoilia illecebrosa*; sponge: *Saetaspongia densa*; alga: *Yuknessia* sp. 8.55m thick.

(1) Black, weathering grey-white, thin carbonaceous shale, and silty carbonaceous shale, with spheroidal weathering, (Cg-f-1): arthropods: *Isoxys auritus*; sponges: *Saetaspongia densa*; brachiopod: *Heliomedusa orienta*. 7.02m thick (at outcrop).

The lower black shale is cut by a fault, and the yellowish-green shale appears repeatedly; abundant soft-bodied fossils (Cg-f-0): arthropods: *Eoredlichia intermedia*, *Naraoia longicaudata*, *Naraoia spinosa*, *Leanchoilia illecebrosa*, *Waptia* sp., *Branchiocaris*? *yunnanensis*, *Isoxys auritus*, *Kunmingella maotianshanensis*; brachiopods: *Heliomedusa orienta*, *Lingulepis malongensis*; alga: *Fuxianospira gyrata*; enigmatica: *Eldonia eumorpha*.

2. List of species of the Chengjiang biota

As of 2009, over 200 species of the Chengjiang biota have been recorded.

Phylum	Species
Algae	*Fuxianospira gyrata* Chen & Zhou, 1997 *Megaspirellus houi* Chen & Erdtmann, 1991 *Punctariopsis latifolia* Xu, 2001 *Punctariopsis simplex* Xu, 2001 *Sinocylindra yunnanensis* Chen & Erdtmann, 1991 *Yuknessia* sp. of Chen & Erdtmann, 1991 *Enteromophites intestinalis* Xu,2001 *Vendotaenia cf. antiquaGnilovskaya* Xu,2001 *Longfengshania cordata* Xu,2002 *Plantulaformis sinensis* Xu,2002 *Paradelesseria sanguinea* Xu,2004
Phylum Porifera	*Allantospongia mica* Rigby & Hou, 1995 *Choia carteri* Walcott, 1920 *Choia xiaolantianensis* Hou *et al*., 1999 *Choiaella radiata* Rigby & Hou, 1995 *Crumillospongia biporosa* Rigby, 1986 *Halichondrites ellisa* Walcott, 1920 *Hazelia palmata* Walcott, 1920 *Leptomitella conica* Chen, Hou & Lu, 1989 *Leptomitella confusa* Chen, Hou & Lu, 1989 *Leptomitella metta* (Rigby, 1983) *Leptomitus teretiusculus* Chen, Hou & Lu, 1989 *Paraleptomitella dictyodroma* Chen, Hou & Lu, 1989 *Paraleptomitella globula* Chen, Hou & Lu, 1989 *Quadrolaminiella crassa* Chen, Hou & Li, 1990 *Quadrolaminiella diagonalis* Chen, Hou & Li, 1990 *Saetaspongia densa* Mehl & Reitner *in* Steiner *et al*., 1993 *Takakkawia lineata* Walcott, 1920 *Triticispongia diagonata* Mehl & Reitner *in* Steiner *et al*., 1993
Phylum Cnidaria	*Archisaccophyllia kunmingensis* Hou *et al*., 2005 *Xianguangia sinica* Chen & Erdtmann, 1991
Phylum Ctenophora	*Maotianoascus octonarius* Chen & Zhou, 1997 *Sinoascus papillatus* Chen & Zhou, 1997 *Yunnanoascus haikouensis* Hu *et al*., 2007

Phylum Nematomorpha	*Cricocosmia jinningensis* Hou & Sun, 1988 *Maotianshania cylindrica* Sun & Hou, 1987 *Palaeoscolex sinensis* Hou & Sun, 1988 *Sabellidites yunnanensis* Luo & Zhang, 1986 *Tabelliscolex hexagonus* Han, Zhang & Shu, 2003 *Xiaoheiqingella peculiaris* Hu *in* Chen *et al*., 2002 *Xishania longiusula* Hu *in* Chen *et al*., 2002
Phylum Priapulida	*Acosmia maotiania* Chen & Zhou, 1997 *Anningvermis multispinosus* Huang, Vannier & Chen, 2004 *Archotuba conoidalis* Hou *et al*., 1999 (? =*Selkirkia*? *elongata* Luo & Hu *in* Luo *et al*., 1999) *Corynetis brevis* Luo & Hu *in* Luo *et al*., 1999 *Gangtoucunia aspera* Luo & Hu in Luo *et al*., 1999 *Lagenula striolata* Luo & Hu *in* Luo *et al*., 1999 *Oligonodus specialis* Luo & Hu in Luo *et al*., 1999 *Omnidens amplus* Hou, Bergström & Yang, 2006 *Palaeopriapulites parvus* Hou *et al*., 1999 *Paraselkirkia jinningensis* Hou *et al*., 1999 (? =*Selkirkia sinica* Luo & Hu *in* Luo *et al*., 1999) *Paratubiluchus bicaudatus* Han *et al*., 2004 *Protopriapulites haikouensis* Hou *et al*., 1999 (=*Sicyophorus rara* Luo & Hu *in* Luo *et al*., 1999) *Sandaokania latinodosa* Luo & Hu in Luo *et al*., 1999 *Yunnanpriapulus halteroformis* Huang, Vannier & Chen,
Phylum Sipuncula	*Archaeogolfingia caudata* Huang *et al*., 2004 *Cambrosipunculus tentaculatus* Huang *et al*., 2004
Phylum Chaetognatha	*Protosagitta spinosa* Hu *in* Chen *et al*., 2002 (? =*Eognathacantha ercainella* Chen & Huang, 2002)
Phylum Annelida	*Maotianchaeta fuxianella* Chen, 2004
Phylum Hyolitha	*Ambrolinevitus maximus* Jiang, 1982 *Ambrolinevitus meishucunensis* Jiang, 1994 *Ambrolinevitus platypluteus* Qian, 1978 *Ambrolinevitus ventricosus* Qian, 1978 *Burithes yunnanensis* Hou *et al.,* 1999 (? =*Glossolites magnus* Luo & Hu *in* Luo *et al*., 1999) *Linevitus flabellaris* Qian, 1978 *Linevitus opimus* Yu, 1974
Phylum Mollusca	*Helcionella yunnanensis* Zhang & Babcock, 2002 *Petalilium latus* Luo & Hu *in* Luo *et al*., 1999

Phylum Lobopodia	*Cardiodictyon catenulum* Hou, Ramsköld & Bergström, 1991 *Hallucigenia fortis* Hou & Bergström, 1995 *Luolishania longicruris* Hou & Chen, 1989 *Megadictyon haikouensis* Luo & Hu *in* Luo *et al*., 1999 *Miraluolishania haikouensis* Liu & Shu *in* Liu *et al*., 2004 *Microdictyon sinicum* Chen, Hou & Lu, 1989 *Onychodictyon ferox* Hou, Ramsköld & Bergström, 1991 *Paucipodia haikouensis* Luo & Hu *in* Chen *et al*., 2002 *Paucipodia inermis* Chen, Zhou & Ramsköld, 1995 *Tylotites petiolaris* Luo & Hu in Luo *et al*., 1999
Phylum Arthropoda (including Anomalocarididae*)	*Acanthomeridion serratum* Hou, Chen & Lu, 1989 *Almenia spinosa* Hou & Bergström, 1997 *Amplectobelua symbrachiata* Hou, Bergström & Ahlberg, 1995* *Anomalocaris saron* Hou, Bergström & Ahlberg, 1995* *Anomalocaris* sp. of Hou, Bergström & Ahlberg, 1995* *Branchiocaris*? *yunnanensis* Hou, 1987 *Candaspis laevigata* (Hou & Bergström, 1991) (=*Canadaspis eucallus* Chen & Zhou, 1997; =*Perspicaris*? sp. of Hou 1987; ? =*Yiiangocaris ellipticus* Luo & Hu *in* Luo *et al*., 1999) *Chengjangocaris longiformis* Hou & Bergström, 1991 (*Cambrofengia yunnanensis* Hou *et al*., 1999 may be detached appendages) *Cindarella eucalla* Chen, Ramsköld, Edgecombe & Zhou *in* Chen *et al*., 1996 *Clypecaris pteroidea* Hou, 1999 (? =*Ercaicunia multinodosa* Luo & Hu *in* Luo *et al*., 1999) *Combinivalvula chengjiangensis* Hou, 1987 *Comptaluta inflata* (Zhang, 1974) *Comptaluta leshanensis* (Lee, 1975) *Diplopyge forcipatus* Luo & Hu *in* Luo *et al*., 1999 *Diplopyge minutus* Luo & Hu *in* Luo *et al*., 1999 *Dongshanocaris foliiformis* (Hou & Bergström, 1998) *Eoredlichia intermedia* (Lu, 1940) *Ercaia minuscula* Chen, Vannier & Huang, 2001 *Forfexicaris valida* Hou, 1999 *Fortiforceps foliosa* Hou & Bergström, 1997 *Fuxianhuia protensa* Hou, 1987 *Haikoucaris ercaiensis* Chen, Waloszek & Maas, 2004 *Isoxys auritus* (Jiang, 1982) *Isoxys curvirostratus* Vannier & Chen, 2000 *Isoxys paradoxus* Hou, 1987 (? = *Isoxys elongatus* Luo & Hu *in* Luo *et al.*, 1999) *Jianfengia multisegmentalis* Hou, 1987 *Jiucunella paulula* Hou & Bergström, 1991 *Kuamaia lata* Hou, 1987 *Kuamaia muricata* Hou & Bergström, 1997

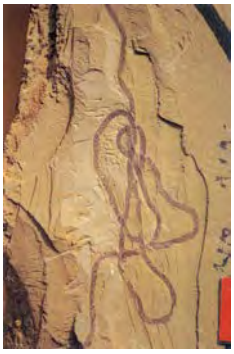
Phylum Arthropoda (including Anomalocarididae*)	*Kuanyangia pustulosa* (Lu, 1941) *Kunmingella douvillei* (Mansuy, 1912) *Kunmingocaris bispinosus* Luo & Hu *in* Luo *et al*., 1999 *Kunyangella cheni* Huo, 1965 *Kwanyinaspis maotianshanensis* Zhang & Shu, 2005 *Leanchoilia illecebrosa* (Hou, 1987) (=*Dianchia mirabilis* Luo & Hu *in* Luo *et al*., 1997; =*Leanchoilia asiatica* Luo & Hu *in* Luo *et al*., 1997; =*Yohoia sinensis* Luo & Hu *in* Luo *et al*., 1997; ? =*Zhongxinia speciosa* Luo & Hu *in* Luo *et al*., 1997; ?=*Apiocephalus elegans* Luo & Hu *in* Luo *et al*., 1999) *Liangshanella liangshanensis* Huo, 1956 *Mafangia subscalaria* Luo & Hu *in* Chen *et al*., 2002 *Mafangocaris multinodus* Luo & Hu *in* Chen *et al*., 2002 *Malongella bituberculata* Luo & Hu *in* Chen *et al*., 2002 *Naraoia longicaudata* Zhang & Hou, 1985 *Naraoia spinosa* Zhang & Hou, 1985 *Occacaris oviformis* Hou, 1999 *Odaraia*? *eurypetala* Hou & Sun, 1988 (? =*Glossocaris oculatus* Luo & Hu *in* Luo *et al*., 1999) *Ovalicephalus mirabilis* Luo & Hu *in* Chen *et al*., 2002 *Parapaleomerus sinensis* Hou *et al*., 1999 *Parapeytoia yunnanensis* Hou, Bergström & Ahlberg, 1995* *Pectocaris spatiosa* Hou, 1999 *Pisinnocaris subconigera* Hou & Bergström, 1998 (? =*Jianshania furcatus* Luo & Hu *in* Luo *et al*., 1999) *Primicaris larvaformis* Zhang *et al*., 2003 *Pseudoiulia cambriensis* Hou & Bergström, 1998 *Pterotrum triacanthus* Luo & Hu *in* Chen *et al*., 2002 *Pygmaclypeatus daziensis* Zhang, Han & Shu, 2000 *Retifacies abnormalis* Hou, Chen & Lu, 1989 (=*Retifacies longispinus* Luo & Hu *in* Luo *et al*., 1997; = *Tuzoia* sp. of Shu 1990) *Rhombicalvaria acantha* Hou, 1987 *Saperion glumaceum* Hou, Ramsköld & Bergström, 1991 *Sidneyia sinica* Zhang & Shu *in* Zhang, Han & Shu, 2002 *Sinoburius lunaris* Hou, Ramsköld & Bergström, 1991 *Skioldia aldna* Hou & Bergström, 1997 *Squamacula clypeata* Hou & Bergström, 1997 *Sunella* cf. *shensiensis* (Huo, 1965) *Synophalos xynos* Hou *et al*., 2009 *Syrrhaptis intestinalis* Luo & Hu *in* Luo *et al*., 1999 *Tanglangia longicaudata* Luo & Hu *in* Luo *et al*., 1999 *Tsunyidiscus aclis* Zhou in Lee *et al*., 1975 *Tsunyidiscus niutitangensis* (Chang, 1964) *Tsunyiella diandongensis* Tong *in* Huo & Shu, 1985

Phylum Arthropoda (including Anomalocarididae*)	?*Tuzoia sinensis* Pan, 1957 (? =*Tuzoia limba* Shu, 1990) *Urokodia aequalis* Hou, Chen & Lu, 1989 *Waptia ovata* (Lee, 1975) *Wutingaspis tingi* Kobayashi, 1944 *Wutingella binodosa* Zhang, 1974 *Xandarella spectaculum* Hou, Ramsköld & Bergström, 1991 *Yunnanocaris megista* Hou, 1999 *Yunnanocephalus yunnanensis* (Mansuy, 1912)
Phylum Phoronida	*Eophoronis chengjiangensis* Chen, 2004 *Iotuba chengjiangensis* Chen & Zhou, 1997
Phylum Brachiopoda	*Diandongia pista* Rong, 1974 *Heliomedusa orienta* Sun & Hou, 1987 *Lingulella chengjiangensis* Jin, Hou & Wang, 1993 *Lingulellotreta malongensis* (Rong, 1974) *Longtancunella chengjiangensis* Hou *et al*., 1999 *Xianshanella haikouensis* Zhang, 2004
Phylum Echinodermata	*Dianchicystis jianshanensis* Shu *et al*., 2004 *Vetulocystis catenata* Shu *et al*., 2004
Phylum Chordata	*Cathaymyrus diadexus* Shu, Conway Morris & Zhang, 1996 ?*Cathaymyrus haikouensis* Luo & Hu *in* Luo *et al*., 2001 *Cheunkongella ancestralis* Shu *et al*., 2001 *Myllokunmingia fengjiaoa* Shu, Zhang & Han *in* Shu *et al*., 1999 (= *Haikouichthys ercaicunensis* Luo, Hu & Shu *in* Shu *et al*., 1999) *Shankouclava anningense* Chen *et al*., 2003 *Zhongjianichthys rostratus* Shu, 2003 ?*Zhongxiniscus intermedius* Luo & Hu *in* Luo *et al*., 2001

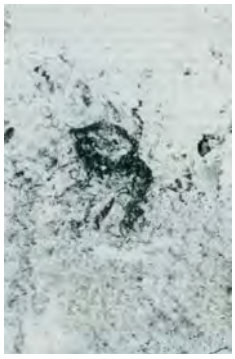
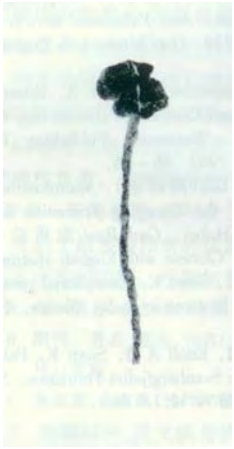
Uncertain **systematic position**	*Allonnia phrixothrix* Bengtson & Hou, 2001 (=*Allonnia junyuani* Janussen *et al.*, 2002) *Amiskwia sinica* Luo & Hu, 2002 *Anthotrum robustus* Luo & Hu *in* Luo *et al*., 1999 *Batofasciculus ramificans* Hou *et al*., 1999 *Beidazoon venustum* Shu, 2005 (= *Bullivetula variola* Aldridge *et al*., 2007) *Chancelloria eros* Walcott, 1920 *Conicula striata* Luo & Hu *in* Luo *et al*., 1999 *Cotyledion tylodes* Luo & Hu *in* Luo *et al*., 1999 (? = *Cambrotentacus sanwuia* Zhang & Shu *in* Zhang *et al*., 2001) *Didazoon haoae* Shu & Han *in* Shu *et al*., 2001 *Dinomischus venustus* Chen, Hou & Lu, 1989 *Discoides abnormis* Luo & Hu *in* Luo *et al*., 1999 *Eldonia eumorpha* (Sun & Hou, 1987) (=*Yunnanomedusa eleganta* Sun & Hou, 1987) *Facivermis yunnanicus* Hou & Chen, 1989 *Heteromorphus confusus* (Chen & Zhou, 1997) (? =*Heteromorphus longicaudatus* Luo & Hu *in* Luo *et al*., 1999) *Hippotrum spinatus* Luo & Hu *in* Luo *et al*., 1999 *Jiucunia petalina* Hou *et al*., 1999 *Maanshania crusticeps* Hou *et al*., 1999 *Macrocephalus elongatus* Luo & Hu *in* Luo *et al*., 1999 *Parvulonoda dubia* Rigby & Hou, 1995 *Phacatrum tubifer* Luo & Hu *in* Luo *et al*., 1999 *Phasganula longa* Luo & Hu *in* Luo *et al*., 1999 *Phlogites longus* Luo & Hu *in* Luo *et al*., 1999 (= *Phlogites brevis* Luo & Hu *in* Luo *et al*., 1999; ? = *Calathites spinalis* Luo & Hu *in* Luo *et al*., 1999) *Pomatrum ventralis* Luo & Hu *in* Luo *et al*., 1999 (*Xidazoon stephanus* Shu, Conway Morris & Zhang *in* Shu *et al*., 1999) *Pristioites bifarius* Luo & Hu *in* Luo *et al*., 1999 *Rhipitrus clavifer* Luo & Hu *in* Luo *et al*., 1999 *Rotadiscus grandis* Sun & Hou, 1987 *Vetulicola cuneata* Hou, 1987 *Vetulicola monile* Aldridge *et al*., 2007 *Vetulicola rectangulata* Luo & Hu *in* Luo *et al*., 1999 *Yunnanozoon lividum* Hou, Ramsköld & Bergström, 1991 (=*Haikouella lanceolata* Chen *et al*., 1999) *Yuyuanozoon magnificissimi* Chen, Feng & Zhu *in* Chen *et al*., 2003

Vendobiont	*Stromatoveris psygmoglena* Shu et al., 2006
Coprolites	*Regarded as coprolites by* Steiner et al., 2005

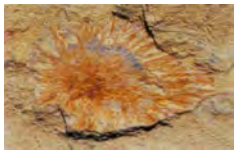
1.Algae

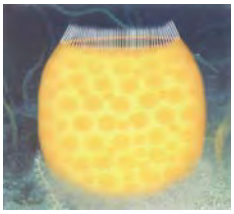
No	Species	Photo
1-1	*Fuxianospira gyrata* Chen & Zhou, 1997 Locality: Maotianshan	
1-2	*Megaspirellus houi* Chen & Erdtmann, 1991 Locality: Maotianshan	
1-3	*Punctariopsis latifolia* Xu, 2001 Locality: Haikou	
1-4	*Punctariopsis simplex* Xu, 2001 Locality: Haikou	

No	Species	Photo
1-5	*Sinocylindra yunnanensis* Chen & Erdtmann, 1991 Locality: Maotianshan	
1-6	*Yuknessia sp.* of Chen & Erdtmann, 1991 Locality: Maotianshan	
1-7	*Enteromophites intestinalis* Xu,2001 Locality: Haikou	
1-8	*Vendotaeniacf.antiquaGnilovskaya* Xu,2001 Locality: Haikou	

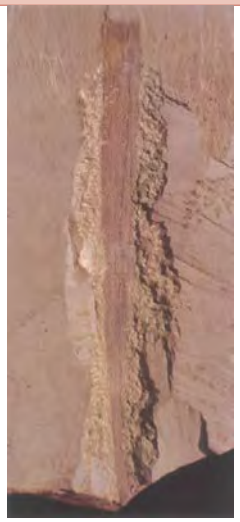
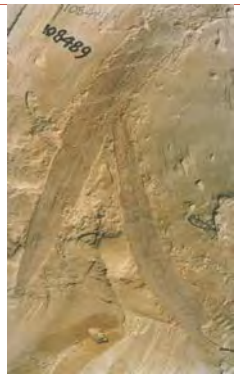
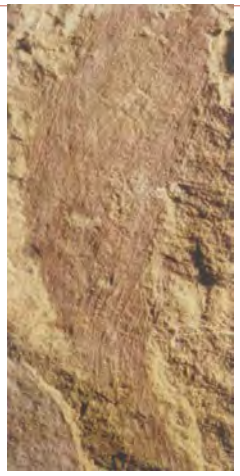
No	Species	Photo
1-9	*Longfengshaniacordata* Xu,2002 Locality: Haikou	
1-10	P*lantulaformis sinensis* Xu,2002 Locality: Haikou	
1-11	*Paradelesseriasanguinea* Xu,2004 Locality: Haikou	

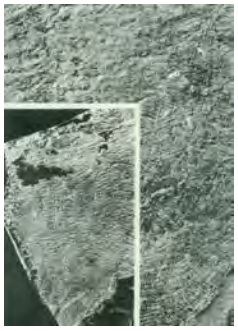
2. Phylum Porifera

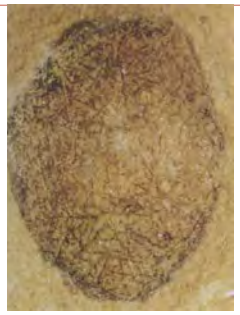
No	Species	Photo
2-1	*Allantospongia mica* Rigby & Hou, 1995 Locality: Xiaolantian	
2-2	*Choia carteri* Walcott, 1920 Locality: Maotianshan	
2-3	*Choia xiaolantianensis* Hou et al., 1999 Locality: Xiaolantian	 
2-4	*Choiaella radiata* Rigby & Hou, 1995 Locality: Maotianshan	 

No	Species	Photo
2-5	*Crumillospongia biporosa* Rigby, 1986 Locality: Maotianshan	 
2-6	*Halichondrites ellisa* Walcott, 1920 Locality: Maotianshan	
2-7	*Hazelia palmata* Walcott, 1920 Locality: Maotianshan	 

No	Species	Photo
2-8	*Leptomitella conica* Chen, Hou & Lu, 1989 Locality: Maotianshan	
2-9	*Leptomitella confusa* Chen, Hou & Lu, 1989 Locality: Maotianshan	
2-10	*Leptomitella metta* (Rigby, 1983) Locality: Maotianshan	

No	Species	Photo
2-11	*Leptomitus teretiusculus* Chen, Hou & Lu, 1989 Locality: Maotianshan	
2-12	*Paraleptomitella dictyodroma* Chen, Hou & Lu,1989 Locality: Maotianshan	
2-13	*Paraleptomitella globula* Chen, Hou & Lu, 1989 Locality: Maotianshan	

No	Species	Photo
2-14	*Quadrolaminiella crassa* Chen, Hou & Li, 1990 Locality: Maotianshan	
2-15	*Quadrolaminiella diagonalis* Chen, Hou & Li, 1990 Locality: Maotianshan	
2-16	*Saetaspongia densa* Mehl & Reitner in Steiner et al., 1993 Locality: Maotianshan	

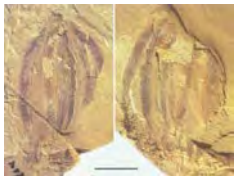
No	Species	Photo
2-17	*Takakkawia lineata* Walcott, 1920 Locality: Maotianshan	
2-18	*Triticispongia diagonata* Mehl & Reitner in Steiner et al., 1993 Locality: Xiaolantian	

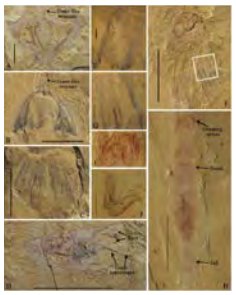
3.Phylum Cnidaria

No	Species	Photo
3-1	*Archisaccophyllia kunmingensis* Hou et al., 2005 Locality: Haikou	

No	Species	Photo
3-2	*Xianguangia sinica* Chen & Erdtmann, 1991 Locality: Maotianshan	

4.Phylum Ctenophora

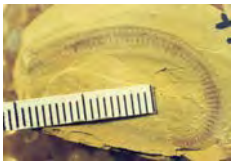
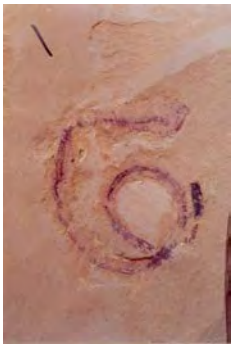
No	Species	Photo
4-1	*Maotianoascus octonarius* Chen & Zhou, 1997 Locality: Maotianshan	
4-2	*Sinoascus papillatus* Chen & Zhou, 1997 Locality: Maotianshan	

No	Species	Photo
4-3	*Yunnanoascus haikouensis* Hu et al., 2007 Locality: Haikou	

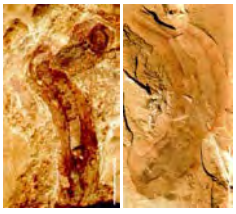
5.Phylum Nematomorpha

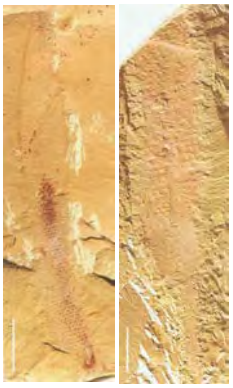
No	Species	Photo
5-1	*Cricocosmia jinningensis* Hou & Sun, 1988 Locality: Meishucun	

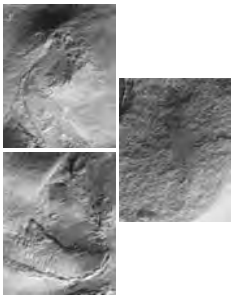
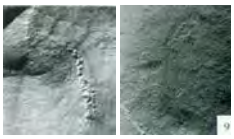
No	Species	Photo
5-2	*Maotianshania cylindrica* Sun & Hou, 1987 Locality: Maotianshan	
5-3	*Palaeoscolex sinensis* Hou & Sun, 1988 Locality: Maanshan	
5-4	*Sabellidites yunnanensis* Luo & Zhang, 1986 Locality: Meishucun	

No	Species	Photo
5-5	*Tabelliscolex hexagonus* Han, Zhang & Shu, 2003 Locality: Maotianshan	
5-6	*Xiaoheiqingella peculiaris* Hu in Chen et al., 2002 Locality: Haikou	
5-7	*Xishania longiusula* Hu in Chen et al., 2002 Locality: Haikou	

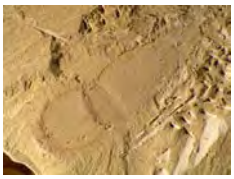
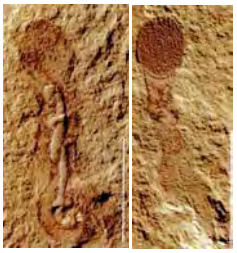
6.Phylum Priapulida

No	Species	Photo
6-1	*Acosmia maotiania* Chen & Zhou, 1997 Locality: Maotianshan	

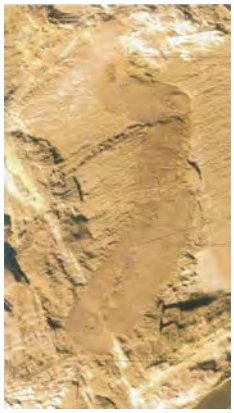
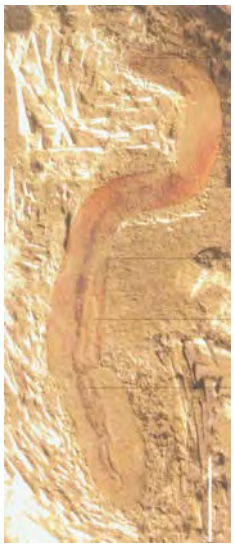
No	Species	Photo
6-2	*Anningvermis multispinosus* Huang, Vannier & Chen, 2004 Locality: Anning	
6-3	*Archotuba conoidalis* Hou et al., 1999 (? =Selkirkia? elongata Luo & Hu in Luo et al., 1999) Locality: Maanshan	
6-4	*Corynetis brevis* Luo & Hu in Luo et al., 1999 Locality: Haikou	

No	Species	Photo
6-5	*Gangtoucunia aspera* Luo & Hu in Luo et al., 1999 Locality: Gangtoucun	
6-6	*Lagenula striolata* Luo & Hu in Luo et al., 1999 Locality: Haikou	
6-7	*Oligonodus specialis* Luo & Hu in Luo et al., 1999 Locality: Haikou	
6-8	*Omnidens amplus* Hou, Bergström & Yang, 2006 Locality: Haikou	

No	Species	Photo
6-9	*Palaeopriapulites parvus* Hou et al., 1999 Locality: Maotianshan	
6-10	*Paraselkirkia jinningensis* Hou et al., 1999 (? =Selkirkia sinica Luo & Hu in Luo et al., 1999) Locality: Haikou	

No	Species	Photo
6-11	*Paratubiluchus bicaudatus* Han et al., 2004 Locality: Haikou	
6-12	*Protopriapulites haikouensis* Hou et al., 1999 (=Sicyophorus rara Luo & Hu in Luo et al., 1999) Locality: Haikou	
6-13	*Sandaokania latinodosa* Luo & Hu in Luo et al., 1999 Locality: Haikou	
6-14	*Yunnanpriapulus halteroformis* Huang, Vannier & Chen, 2004 Locality: Haikou	

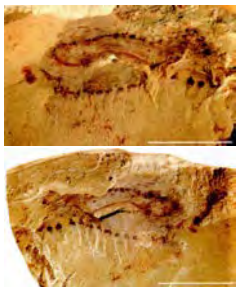
7.Phylum Sipuncula

No	Species	Photo
7-1	*Archaeogolfingia caudata* Huang et al., 2004 Locality: Anning	
7-2	*Cambrosipunculus tentaculatus* Huang et al., 2004 Locality: Anning	

8.Phylum Chaetognatha

No	Species	Photo
8-1	*Protosagitta spinosa* Hu in Chen et al., 2002 (= Eognathacantha ercainella Chen & Huang, 2002) Locality: Haikou	

9.Phylum Annelida

No	Species	Photo
9-1	*Maotianchaeta fuxianella* Chen, 2004 Locality: Maotianshan	

10.Phylum Hyolitha

No	Species	Photo
10-1	*Ambrolinevitus maximus* Jiang, 1982 Locality: Maotianshan	
10-2	*Ambrolinevitus meishucunensis* Jiang, 1994 Locality: Maotianshan	
10-3	*Ambrolinevitus platypluteus* Qian, 1978 Locality: Maotianshan	

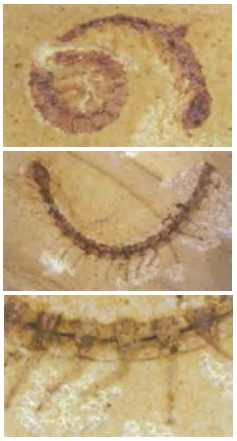
No	Species	Photo
10-4	*Ambrolinevitus ventricosus* Qian, 1978 Locality: Maotianshan	
10-5	*Burithes yunnanensis* Hou et al., 1999 (? =Glossolites magnus Luo & Hu in Luo et al., 1999) Locality: Maotianshan	
10-6	*Linevitus flabellaris* Qian, 1978 Locality: Maotianshan	

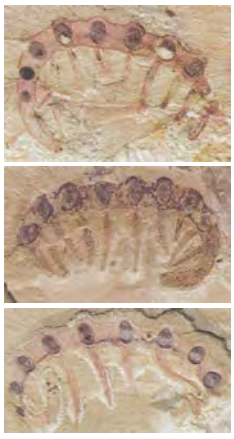
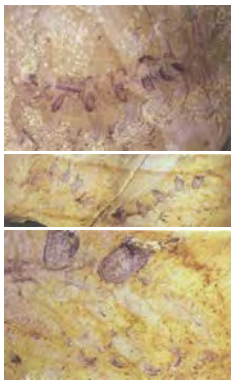
No	Species	Photo
10-7	*Linevitus opimus* Yu, 1974 Locality: Maotianshan	

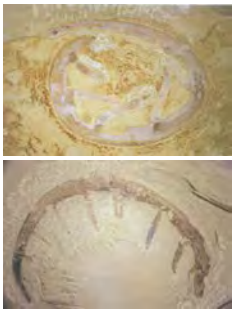
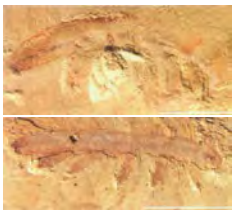
11.Phylum Mollusca

No	Species	Photo
11-1	*Helcionella yunnanensis* Zhang & Babcock, 2002 Locality: Maotianshan	
11-2	*Petalilium latus* Luo & Hu in Luo et al., 1999 Locality: Haikou	

12.Phylum Lobopodia

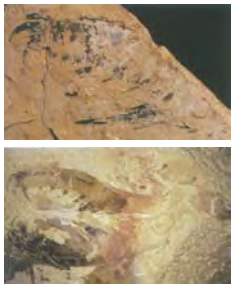
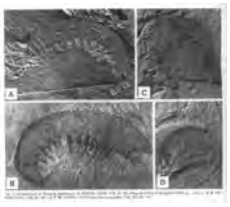
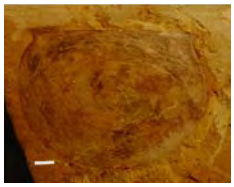
No	Species	Photo
12-1	*Cardiodictyon catenulum* Hou, Ramsköld & Bergström, 1991 Locality: Maotianshan	
12-2	*Hallucigenia fortis* Hou & Bergström, 1995 Locality: Maotianshan	
12-3	*Luolishania longicruris* Hou & Chen, 1989 Locality: Maotianshan	
12-4	*Megadictyon haikouensis* Luo & Hu in Luo et al., 1999 Locality: Haikou	

No	Species	Photo
12-5	*Miraluolishania haikouensis* Liu & Shu in Liu et al., 2004 Locality: Haikou	
12-6	*Microdictyon sinicum Chen*, Hou & Lu, 1989 Locality: Maotianshan	
12-7	*Onychodictyon ferox* Hou, Ramsköld & Bergström, 1991 Locality: Maotianshan	

No	Species	Photo
12-8	*Paucipodia haikouensis* Luo & Hu in Chen et al., 2002 Locality: Haikou	
12-9	*Paucipodia inermis* Chen, Zhou & Ramsköld, 1995 Locality: Maotianshan	
12-10	*Tylotites petiolaris* Luo & Hu in Luo et al., 1999 Locality: Haikou	

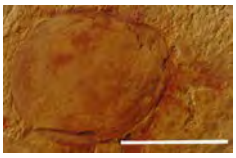
13.Phylum Arthropoda (including Anomalocarididae*)

No	Species	Photo
13-1	*Acanthomeridion serratum* Hou, Chen & Lu, 1989 Locality: Maotianshan	

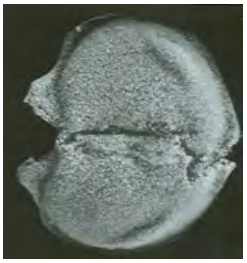
No	Species	Photo
13-2	*Almenia spinosa* Hou & Bergström, 1997	
13-3	*Amplectobelua symbrachiata* Hou, Bergström & Ahlberg, 1995* Locality: Maotianshan	
13-4	*Anomalocaris saron* Hou, Bergström & Ahlberg, 1995*	
13-5	*Anomalocaris* sp. of Hou, Bergström & Ahlberg, 1995 Locality: Maotianshan	
13-6	*Branchiocaris? yunnanensis* Hou, 1987 Locality: Maotianshan	

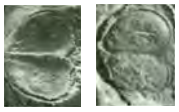
No	Species	Photo
13-7	*Canadaspis laevigata* (Hou & Bergström, 1991) (=*Canadaspis eucallus* Chen & Zhou, 1997; =*Perspicaris?* sp. of Hou 1987; ? =*Yiliangocaris ellipticus* Luo & Hu *in* Luo *et al*., 1999) Locality: Maotianshan	
13-8	*Chengjiangocaris longiformis* Hou & Bergström, 1991 (*Cambrofengia yunnanensis* Hou et al., 1999 may be detached appendages) Locality: Maotianshan	
13-9	*Cindarella eucalla* Chen, Ramsköld, Edgecombe & Zhou in Chen *et al*., 1996 Locality: Maotianshan	
13-10	*Clypecaris pteroidea* Hou, 1999 (? =*Ercaicunia multinodosa* Luo & Hu *in* Luo *et al*., 1999) Locality: Xiaolantian	
13-11	*Combinivalvula chengjiangensis* Hou, 1987 Locality: Maotianshan	

No	Species	Photo
13-12	*Comptaluta inflata* (Zhang, 1974) Locality: Maotianshan	
13-13	*Cucumericrus decoratus* Hou, Bergström & Ahlberg, 1995 Locality: Maotianshan	
13-14	*Comptaluta leshanensis* (Lee, 1975) Locality: Maotianshan	
13-15	*Diplopyge forcipatus* Luo & Hu in Luo et al., 1999 Locality: Haikou	

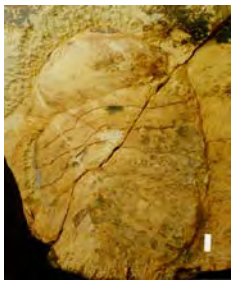
No	Species	Photo
13-16	*Diplopyge minutus* Luo & Hu in Luo *et al*., 1999 Locality: Haikou	
13-17	*Dongshanocaris foliiformis* (Hou & Bergström, 1998) Locality: Maotianshan	
13-18	*Eoredlichia intermedia* (Lu, 1940) Locality: Maotianshan	
13-19	*Ercaia minuscula* Chen, Vannier & Huang, 2001 Locality: Haikou	
13-20	*Forfexicaris valida* Hou, 1999 Locality: Maotianshan	

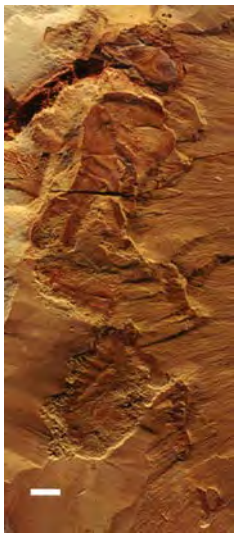
No	Species	Photo
13-21	*Fortiforceps foliosa* Hou &Bergström, 1997 Locality: Maotianshan	
13-22	*Fuxianhuia protensa* Hou, 1987 Locality: Maotianshan	
13-23	*Haikoucaris ercaiensis* Chen, Waloszek & Maas, 2004 Locality: Haikou	
13-24	*Isoxys auritus* (Jiang, 1982) Locality: Maotianshan	
13-25	*Isoxys curvirostratus* Vannier & Chen, 2000 Locality: Maotianshan	
13-26	*Isoxys paradoxus* Hou, 1987 (? = *Isoxys elongatus* Luo & Hu *in* Luo *et al*., 1999) Locality: Maotianshan	

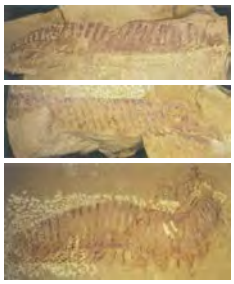
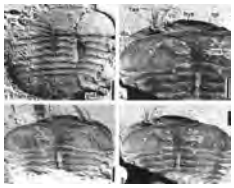
No	Species	Photo
13-27	*Jianfengia multisegmentalis* Hou, 1987 Locality: Maotianshan	
13-28	*Jiucunella paulula* Hou & Bergström, 1991 Locality: Xiaolantian	
13-29	*Kuamaia lata* Hou, 1987 Locality: Maotianshan	
13-30	*Kuamaia muricata* Hou & Bergström, 1997 Locality: Maotianshan	
13-31	*Kuanyangia pustulosa* (Lu, 1941) Locality: Maotianshan	

No	Species	Photo
13-32	*Kunmingella douvillei* (Mansuy, 1912) Locality: Maotianshan	
13-33	*Kunmingocaris bispinosus* Luo & Hu in Luo et al., 1999 Locality: Haikou	
13-34	*Kunyangella cheni* Huo, 1965 Locality: Maotianshan	
13-35	*Kwanyinaspis maotianshanensis* Zhang & Shu, 2005 Locality: Maotianshan	
13-36	*Leanchoilia illecebrosa* (Hou, 1987) (=*Dianchia mirabilis* Luo & Hu *in* Luo *et al*., 1997; =*Leanchoilia asiatica* Luo & Hu *in* Luo *et al*., 1997; =*Yohoia sinensis* Luo & Hu *in* Luo *et al*., 1997; ? =*Zhongxinia speciosa* Luo & Hu *in* Luo *et al*., 1997; ?=*Apiocephalus elegans* Luo & Hu *in* Luo *et al*., 1999) Locality: Maotianshan	
13-37	*Liangshanella liangshanensis* Huo, 1956 Locality: Maotianshan	

No	Species	Photo
13-38	*Mafangia subscalaria* Luo & Hu *in* Chen *et al*., 2002 Locality: Haikou	
13-39	*Mafangocaris multinodus* Luo & Hu *in* Chen *et al*., 2002 Locality: Haikou	
13-40	*Malongella bituberculata* Luo & Hu *in* Chen *et al*., 2002 Locality: Malong	
13-41	*Naraoia longicaudata* Zhang & Hou, 1985 Locality: Maotianshan	
13-42	*Naraoia spinosa* Zhang & Hou, 1985 Locality: Maotianshan	

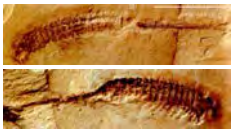
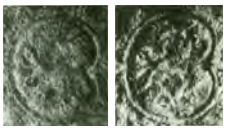
No	Species	Photo
13-43	*Occacaris oviformis* Hou, 1999 Locality: Maotianshan	
13-44	*Odaraia? eurypetala* Hou & Sun, 1988 (? =*Glossocaris oculatus* Luo & Hu *in* Luo *et al*., 1999) Locality: Maotianshan	
13-45	*Ovalicephalus mirabilis* Luo & Hu *in* Chen *et al*., 2002 Locality: Haikou	
13-46	*Parapaleomerus sinensis* Hou *et al*., 1999 Locality: Maotianshan	

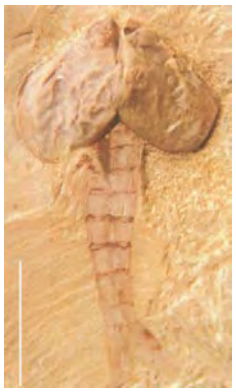
No	Species	Photo
13-47	*Parapeytoia yunnanensis* Hou, Bergström & Ahlberg, 1995* Locality: Maotianshan	
13-48	*Pectocaris spatiosa* Hou, 1999 Locality: Xiaolantian	
13-49	*Pisinnocaris subconigera* Hou & Bergström, 1998 (?=*Jianshania furcatus* Luo & Hu *in* Luo *et al*., 1999) Locality: Maotianshan	

No	Species	Photo
13-50	*Primicaris larvaformis* Zhang *et al*., 2003 Locality: Haikou	
13-51	*Pseudoiulia cambriensis* Hou & Bergström, 1998 Locality: Maotianshan	
13-52	*Pterotrum triacanthus* Luo & Hu *in* Chen *et al*., 2002 Locality: Haikou	
13-53	*Pygmaclypeatus daziensis* Zhang, Han & Shu, 2000 Locality: Haikou	

No	Species	Photo
13-54	*Retifacies abnormalis* Hou, Chen & Lu, 1989 (=*Retifacies longispinus* Luo & Hu *in* Luo *et al*., 1997; = *Tuzoia* sp. of Shu 1990) Locality: Maotianshan	
13-55	*Rhombicalvaria acantha* Hou, 1987 Locality: Maotianshan	
13-56	*Saperion glumaceum* Hou, Ramsköld & Bergström, 1991 Locality: Dapotou	
13-57	*Sidneyia sinica* Zhang & Shu *in* Zhang, Han & Shu, 2002 Locality: Maotianshan	
13-58	*Sinoburius lunaris* Hou, Ramsköld & Bergström, 1991 Locality: Maotianshan	

No	Species	Photo
13-59	*Skioldia aldna* Hou & Bergström, 1997 Locality: Maotianshan	
13-60	*Squamacula clypeata* Hou & Bergström, 1997 Locality: Xiaolantian	
13-61	*Sunella cf. shensiensis* (Huo, 1965) Locality: Maotianshan	
13-62	*Synophalos xynos* Hou *et al*., 2009 Locality: Haikou	
13-63	*Syrrhaptis intestinalis* Luo & Hu *in* Luo *et al*., 1999 Locality: Haikou	

No	Species	Photo
13-64	*Tanglangia longicaudata* Luo & Hu *in* Luo *et al*., 1999 Locality: Haikou	
13-65	*Tsunyidiscus aclis* Zhou *in* Lee *et al*., 1975 Locality: Haikou	
13-66	*Tsunyidiscus niutitangensis* (Chang, 1964) Locality: Haikou	
13-67	*Tsunyiella diandongensis* Tong *in* Huo & Shu, 1985 Locality: Haikou	
13-68	?*Tuzoia sinensis* Pan, 1957 (? =*Tuzoia limba* Shu, 1990) Locality: Haikou	
13-69	*Urokodia aequalis* Hou, Chen & Lu, 1989 Locality: Maotianshan	

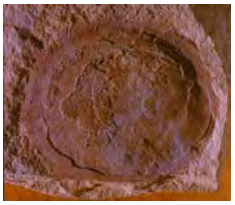
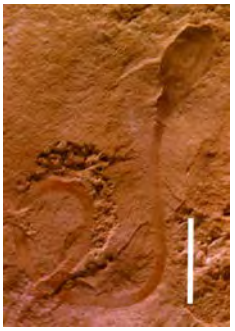
No	Species	Photo
13-70	*Waptia ovata* (Lee, 1975) Locality: Maotianshan	
13-71	*Wutingaspis tingi* Kobayashi, 1944 Locality: Maotianshan	
13-72	*Wutingella binodosa* Zhang, 1974 Locality: Maotianshan	
13-73	*Xandarella spectaculum* Hou, Ramsköld & Bergström, 1991 Locality: Dapotou	

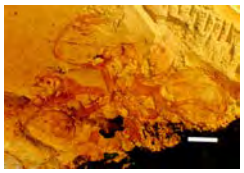
No	Species	Photo
13-74	*Yunnanocaris megista* Hou, 1999 Locality: Maotianshan	
13-75	*Yunnanocephalus yunnanensis* (Mansuy, 1912) Locality: Maotianshan	

14.Phylum Phoronida

No	Species	Photo
14-1	*Eophoronis chengjiangensis* Chen, 2004 Locality: Maotianshan	
14-2	*Iotuba chengjiangensis* Chen & Zhou, 1997 Locality: Maotianshan	

15.Phylum Brachiopoda

No	Species	Photo
15-1	*Diandongia pista* Rong, 1974 Locality: Maotianshan	
15-2	*Heliomedusa orienta* Sun & Hou, 1987 Locality: Maotianshan	
15-3	*Lingulella chengjiangensis* Jin, Hou & Wang, 1993 Locality: Maotianshan	
15-4	*Lingulellotreta malongensis* (Rong, 1974) Locality: Maotianshan	

No	Species	Photo
15-5	*Longtancunella chengjiangensis* Hou et al., 1999 Locality: Maotianshan	
15-6	*Xianshanella haikouensis* Zhang, 2004 Locality: Haikou	

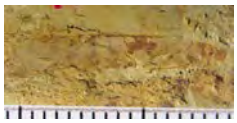
16.Phylum Echinodermata

No	Species	Photo
16-1	*Dianchicystis jianshanensis* Shu et al., 2004 Locality: Anning	

No	Species	Photo
16-2	*Vetulocystis catenata* Shu *et al*., 2004 Locality: Anning	

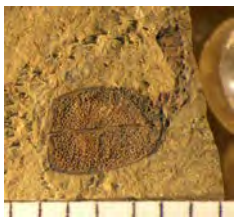
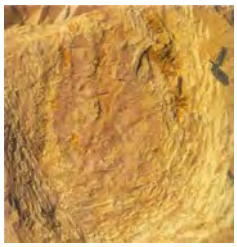
17.Phylum Chordata

No	Species	Photo
17-1	*Cathaymyrus diadexus* Shu, Conway Morris & Zhang, 1996 Locality: Maanshan	
17-2	?*Cathaymyrus haikouensis* Luo & Hu *in* Luo *et al*., 2001 Locality: Haikou	

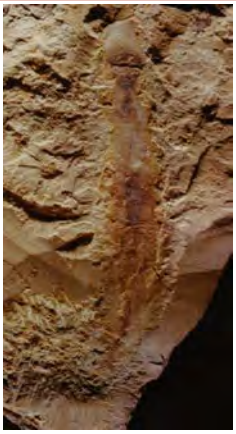
No	Species	Photo
17-3	*Cheunkongella ancestralis* Shu et al., 2001 Locality: Haikou	
17-4	*Myllokunmingia fengjiaoa* Shu, Zhang & Han *in* Shu *et al., 1999 (= Haikouichthys ercaicunensis* Luo, Hu & Shu *in* Shu *et al*., 1999) Locality: Haikou	
17-5	*Shankouclava anningense* Chen et al., 2003 Locality: Anning	
17-6	*Zhongjianichthys rostratus* Shu, 2003 Locality: Haikou	
17-7	*?Zhongxiniscus intermedius* Luo & Hu *in* Luo *et al*., 2001 Locality: Haikou	

18.Uncertain systematic position

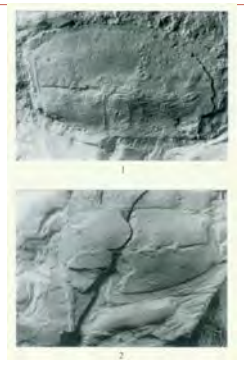
No	Species	Photo
18-1	*Allonnia phrixothrix* Bengtson & Hou, 2001 (=*Allonnia* junyuani Janussen *et al*., 2002) Locality: Maotianshan	
18-2	*Amiskwia sinica* Luo & Hu, 2002 Locality: Haikou	
18-3	*Anthotrum robustus* Luo & Hu *in* Luo *et al*., 1999 Locality: Haikou	
18-4	*Batofasciculus ramificans* Hou *et al*., 1999 Locality: Maotianshan	

No	Species	Photo
18-5	*Beidazoon venustum* Shu, 2005 (= *Bullivetula variola* Aldridge *et al*., 2007) Locality: Haikou	
18-6	*Chancelloria eros* Walcott, 1920 Locality: Maotianshan	
18-7	*Conicula striata* Luo & Hu *in* Luo *et al*., 1999 Locality: Haikou	
18-8	*Cotyledion tylodes* Luo & Hu *in* Luo *et al*., 1999 (? = *Cambrotentacus sanwuia* Zhang & Shu *in* Zhang *et al*., 2001) Locality: Haikou	
18-9	*Didazoon haoae* Shu & Han *in* Shu *et al*., 2001 Locality: Dabanqiao	

No	Species	Photo
18-10	*Dinomischus venustus* Chen, Hou & Lu, 1989 Locality: Maotianshan	
18-11	*Discoides abnormis* Luo & Hu *in* Luo *et al*., 1999 Locality: Haikou	
18-12	*Eldonia eumorpha* (Sun & Hou, 1987) (=*Yunnanomedusa eleganta* Sun & Hou 1987) Locality: Maotianshan	
18-13	*Facivermis yunnanicus* Hou & Chen, 1989 Locality: Maotianshan	

No	Species	Photo
18-14	*Heteromorphus confusus* (Chen & Zhou, 1997) (? =*Heteromorphus longicaudatus* Luo & Hu *in* Luo *et al*., 1999) Locality: Haikou	
18-15	*Hippotrum spinatus* Luo & Hu *in* Luo *et al*., 1999 Locality: Haikou	
18-16	*Jiucunia petalina* Hou *et al*., 1999 Locality: Maotianshan	
18-17	*Maanshania crusticeps* Hou et al., 1999 Locality: Maanshan	
18-18	*Macrocephalus elongatus* Luo & Hu *in* Luo *et al*., 1999 Locality: Haikou	

No	Species	Photo
18-19	*Parvulonoda dubia* Rigby & Hou, 1995 Locality: Maotianshan	
18-20	*Phacatrum tubifer* Luo & Hu *in* Luo *et al*., 1999 Locality: Haikou	
18-21	*Phasganula longa* Luo & Hu *in* Luo *et al*., 1999 Locality: Haikou	
18-22	*Phlogites longus* Luo & Hu *in* Luo *et al*., 1999 (= *Phlogites brevis* Luo & Hu *in* Luo *et al*., 1999; ? = *Calathites spinalis* Luo & Hu *in* Luo *et al*., 1999) Locality: Haikou	
18-23	*Pomatrum ventralis* Luo & Hu *in* Luo *et al*., 1999 (*Xidazoon stephanus* Shu, Conway Morris & Zhang *in* Shu *et al*., 1999) Locality: Haikou	
18-24	*Pristioites bifarius* Luo & Hu *in* Luo *et al*., 1999 Locality: Haikou	

No	Species	Photo
18-25	*Rhipitrus clavifer* Luo & Hu *in* Luo *et al*., 1999 Locality: Haikou	
18-26	*Rotadiscus grandis* Sun & Hou, 1987 Locality: Maotianshan	
18-27	*Vetulicola cuneata* Hou, 1987 Locality: Maotianshan	
18-28	Vetulicola monile Aldridge et al., 2007 Locality: Haikou	
18-29	*Vetulicola rectangulata* Luo & Hu *in* Luo *et al*., 1999 Locality: Maotianshan	

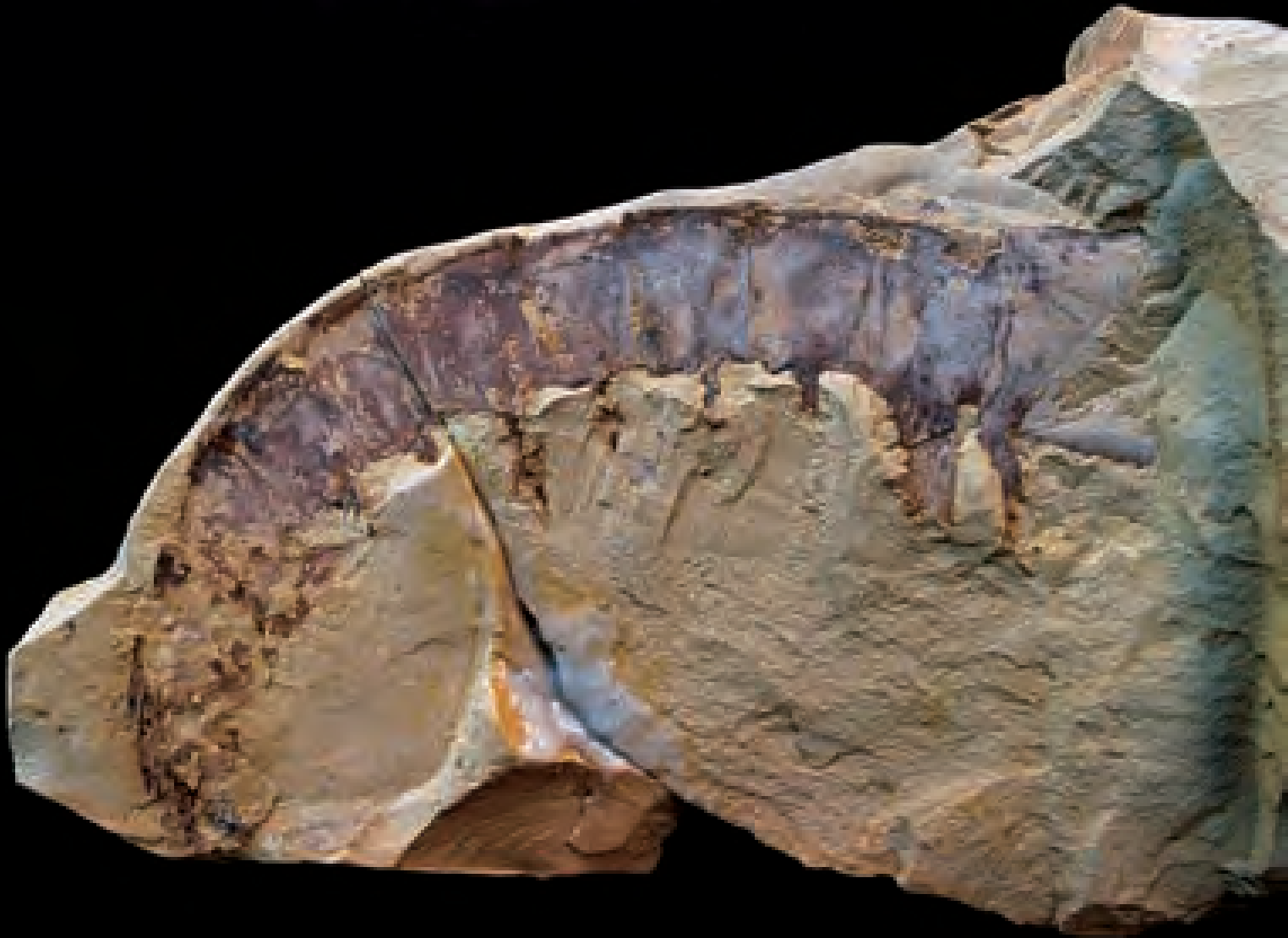
No	Species	Photo
18-30	*Yunnanozoon lividum* Hou, Ramsköld & Bergström, 1991 (=*Haikouella lanceolata* Chen *et al*., 1999) Locality: Maotianshan	
18-31	*Yuyuanozoon magnificissimi* Chen, Feng & Zhu *in* Chen *et al*. 2003 Locality: Maotianshan	

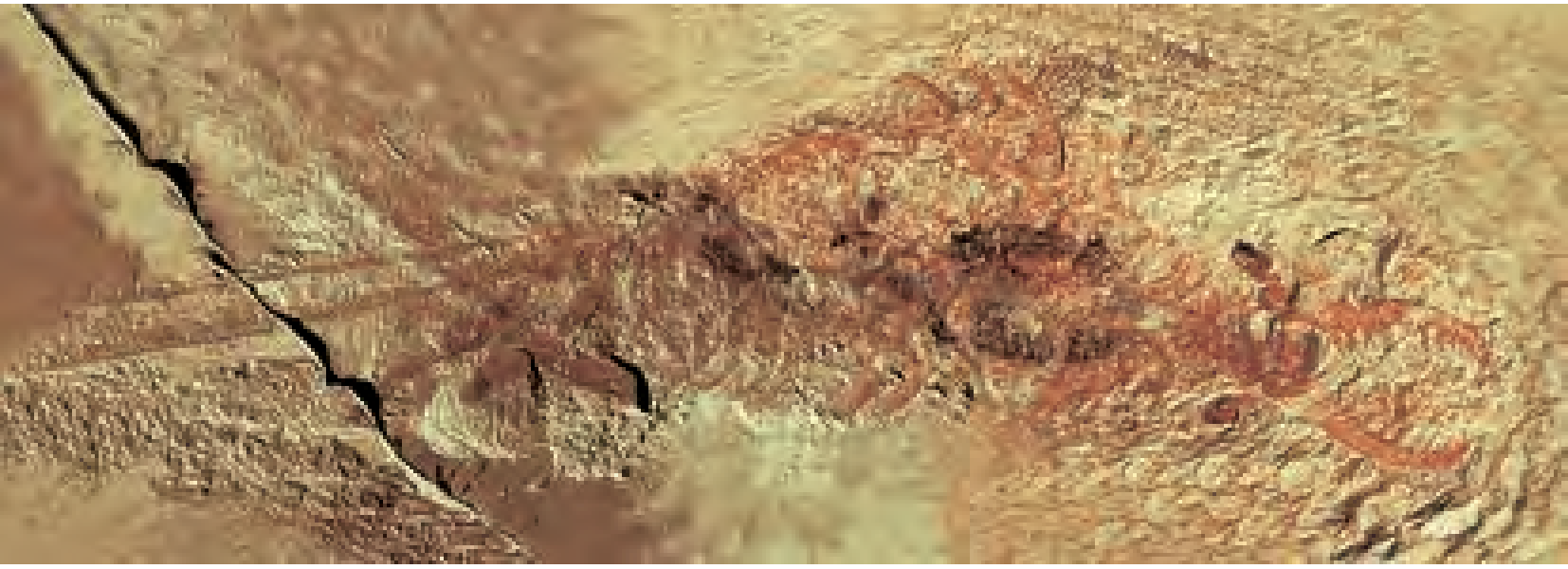
19.Vendobiont

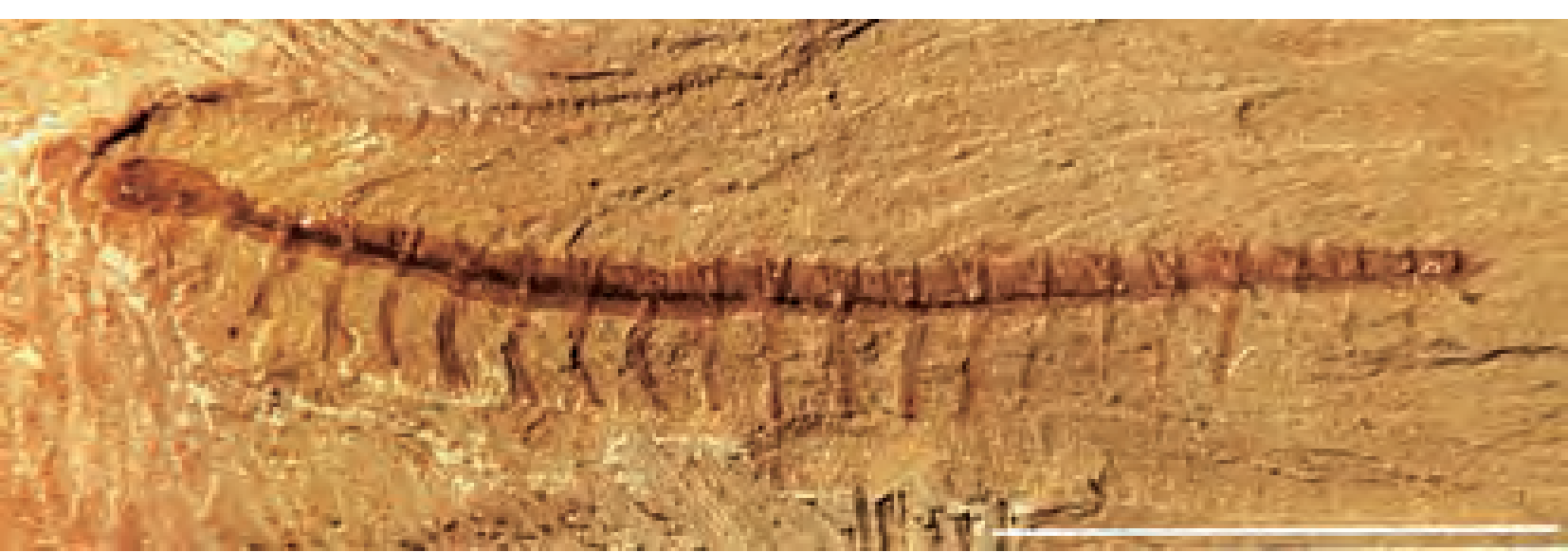
No	Species	Photo
19-1	*Stromatoveris psygmoglena* Shu *et al*., 2006 Locality: Haikou	

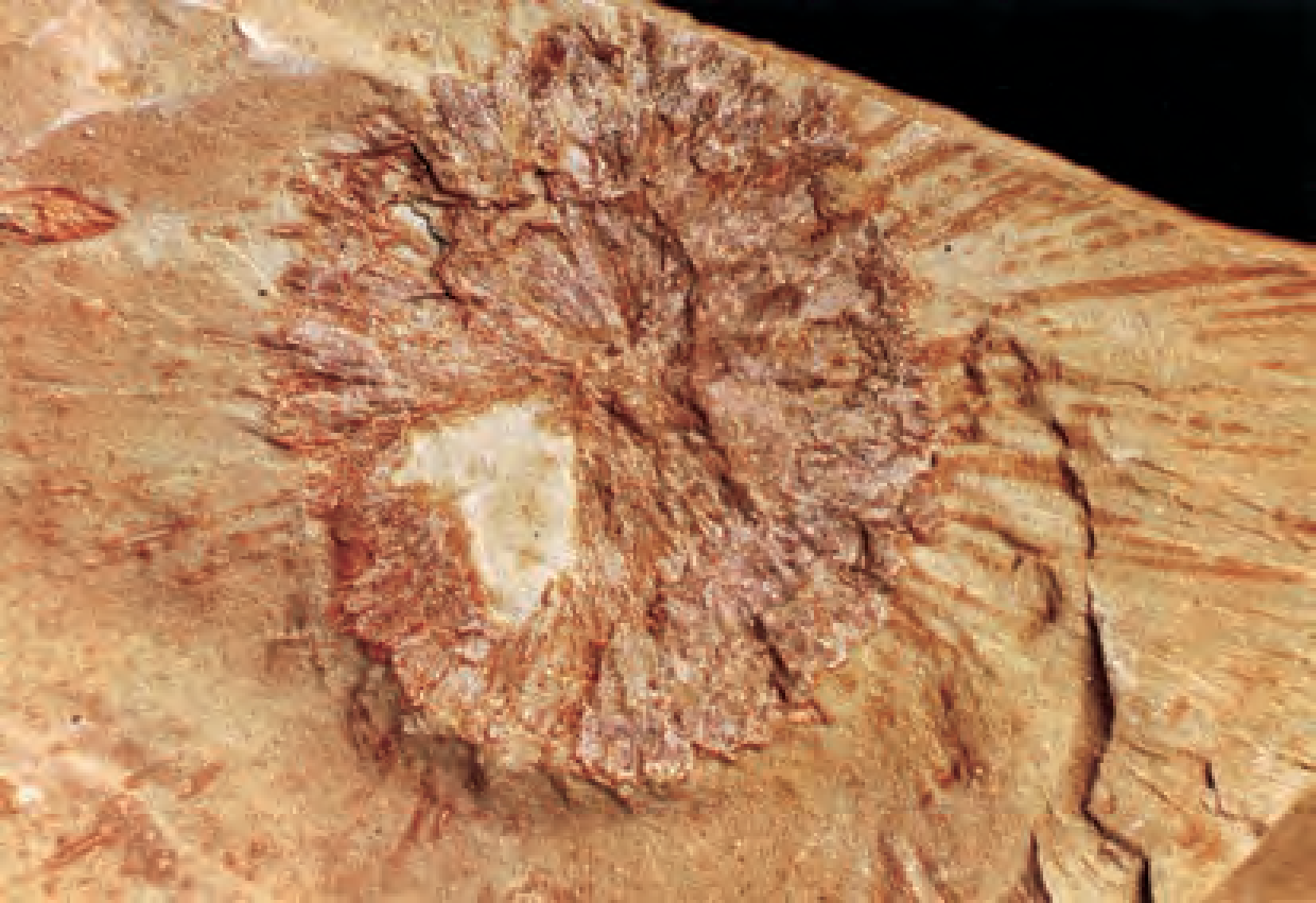
20. Coprolites

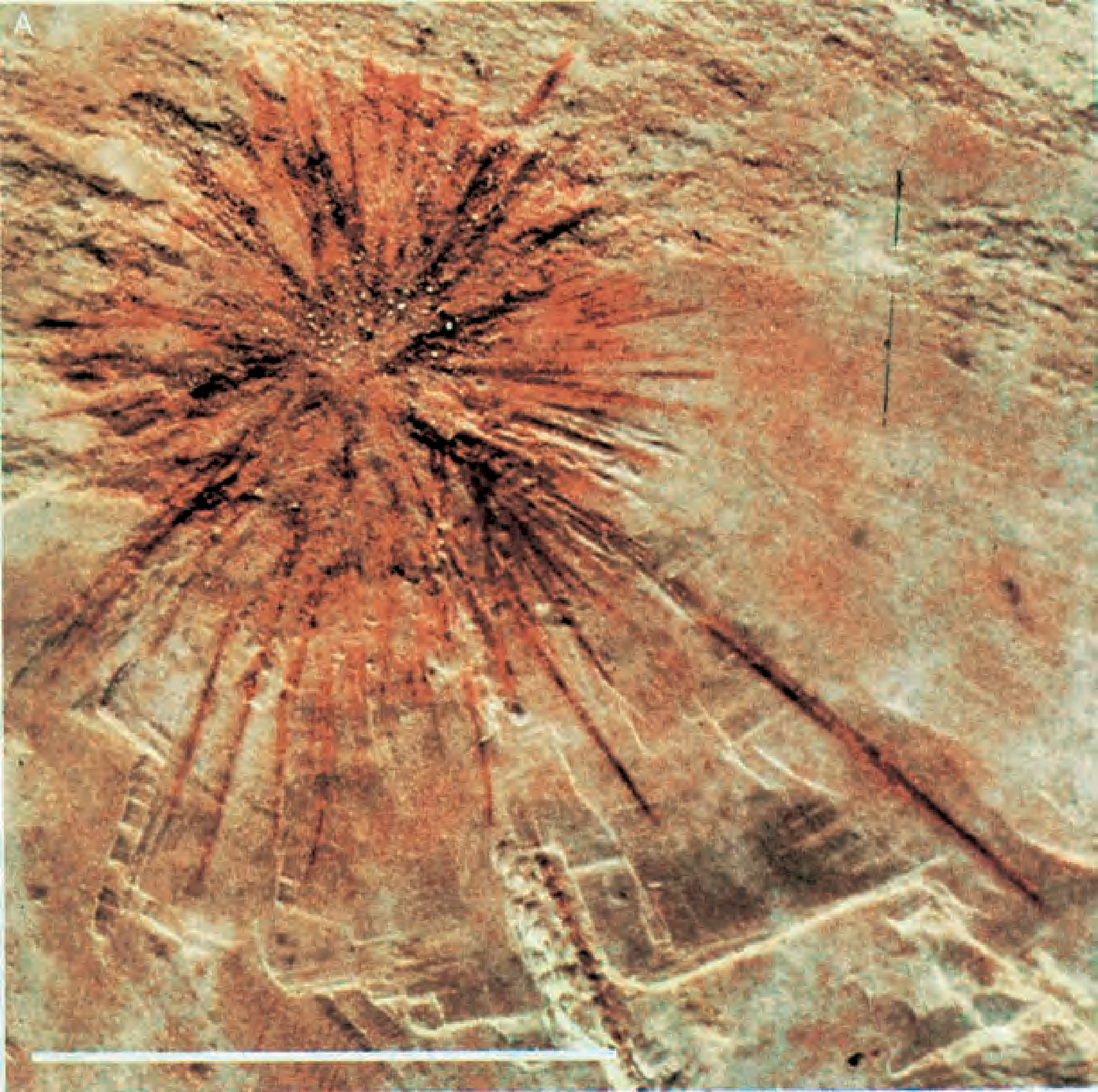
No	Species	Photo
20-1	Regarded as coprolites by Steiner et al.,2005 Locality: Maotianshan	







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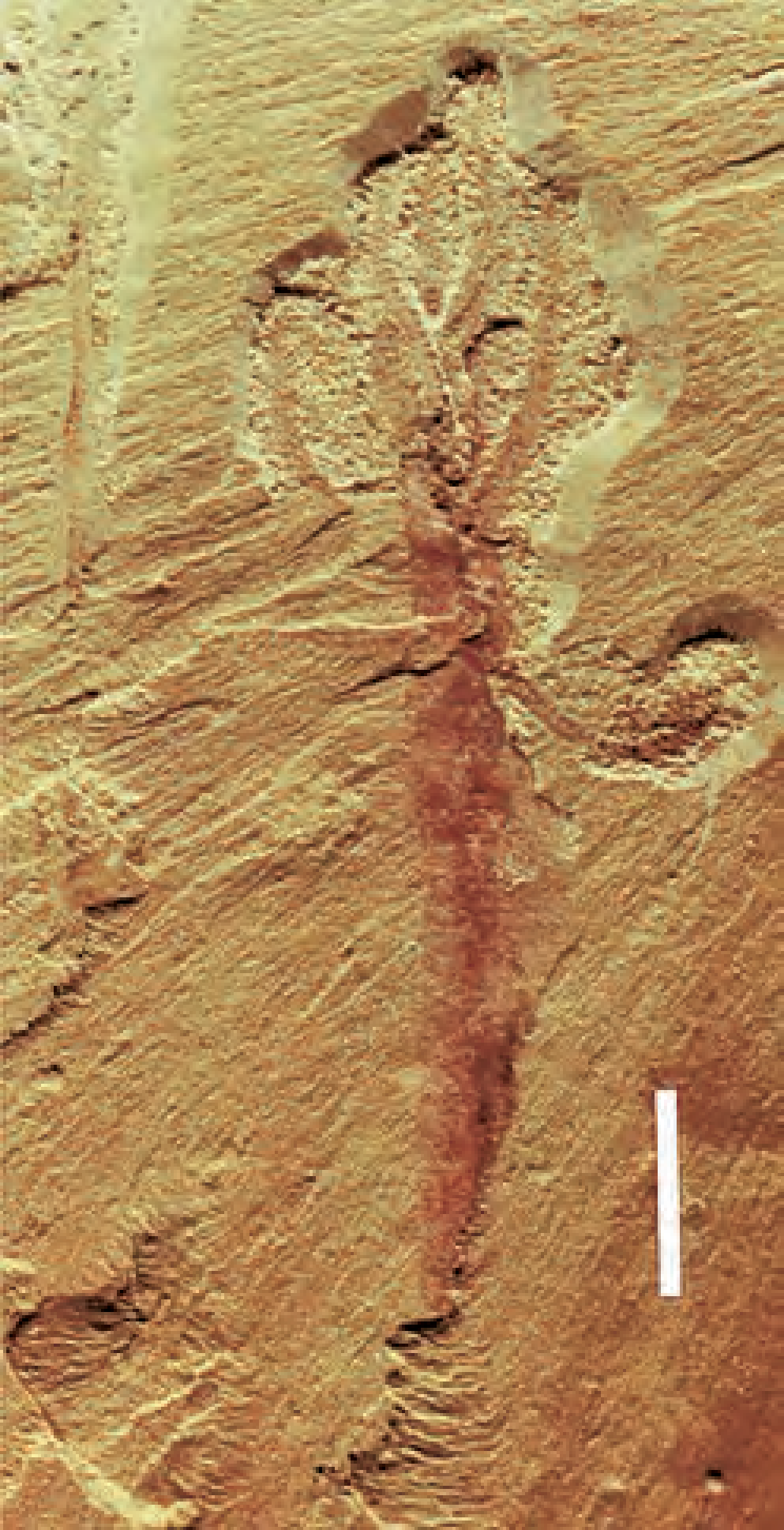

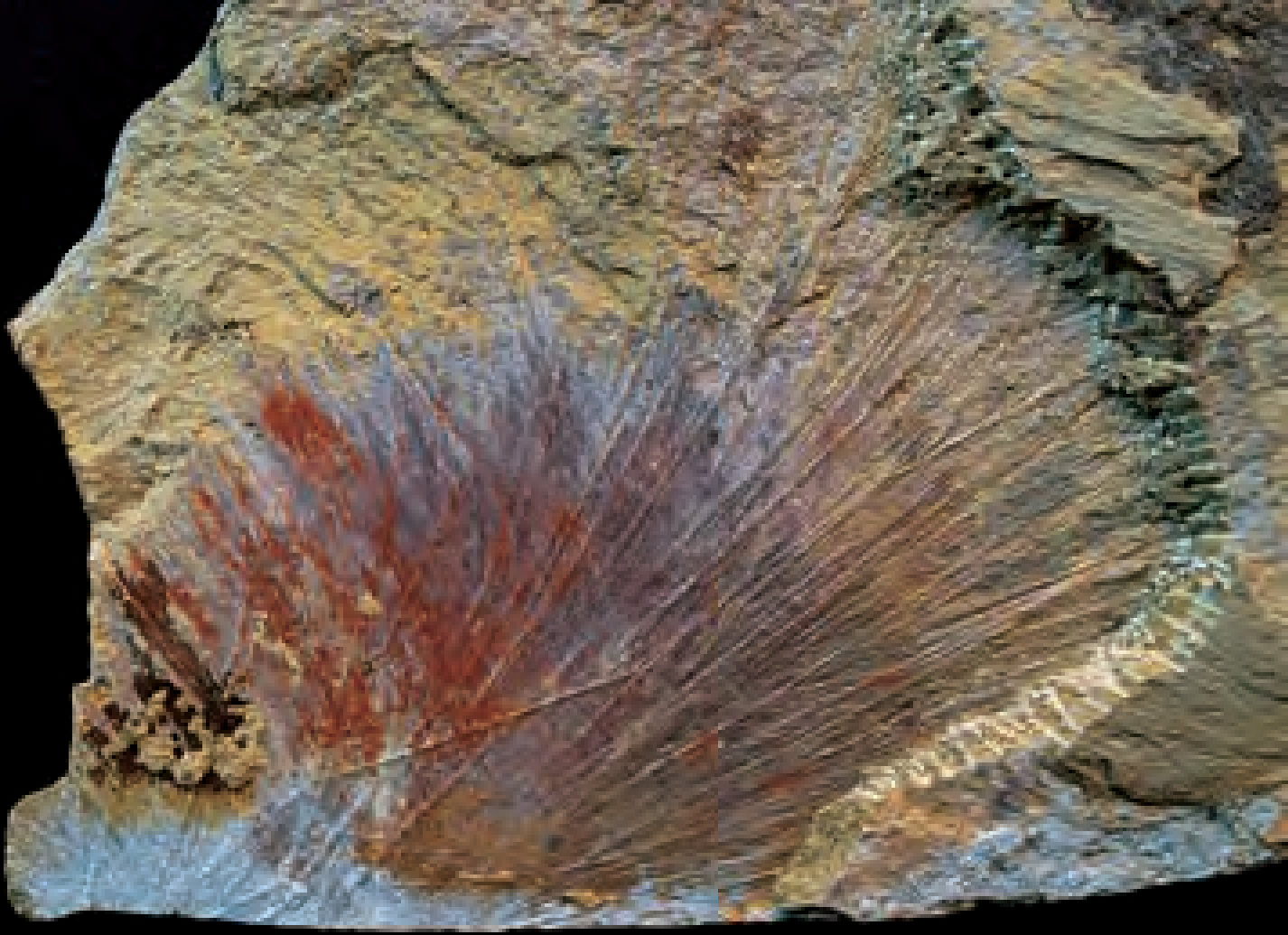

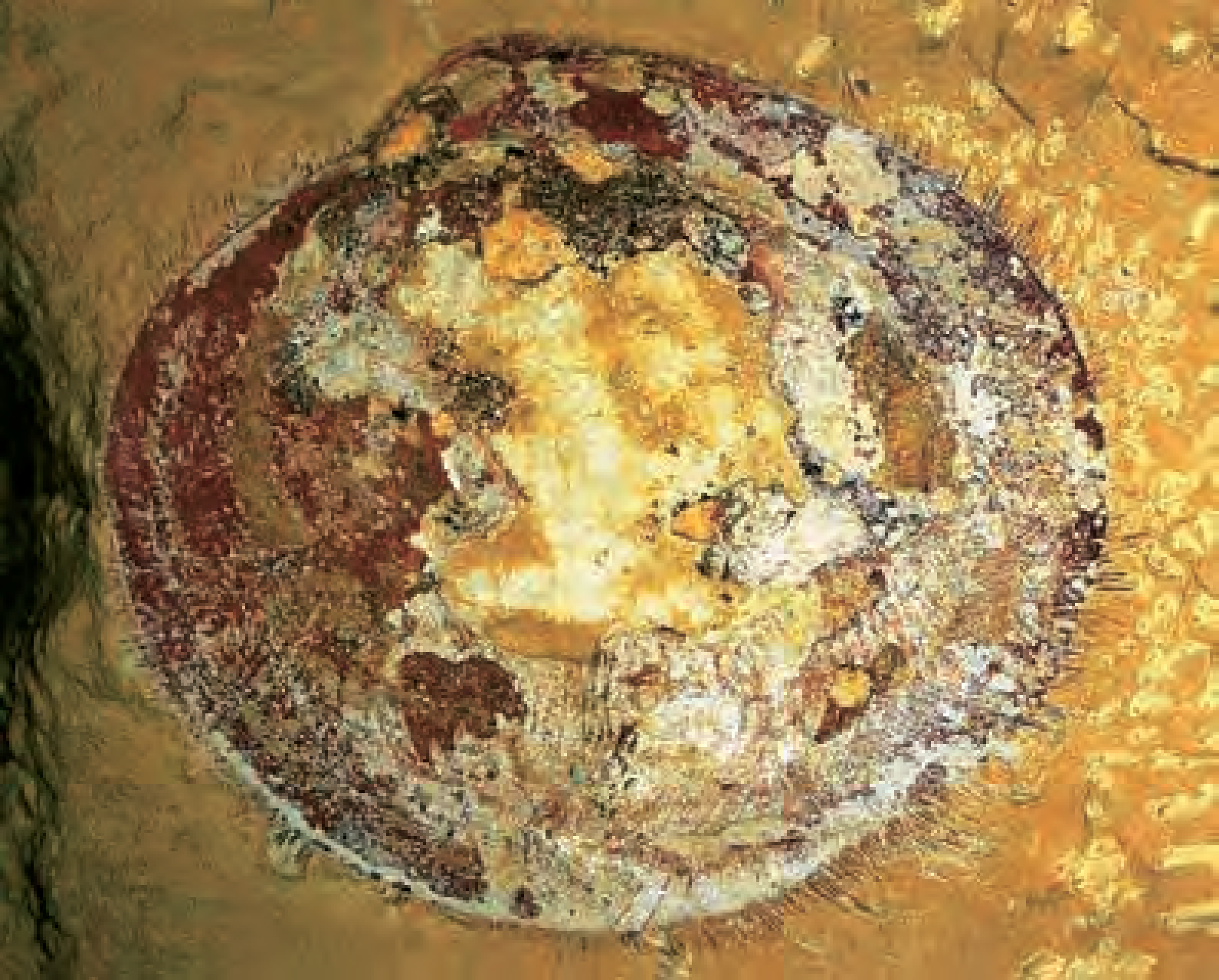

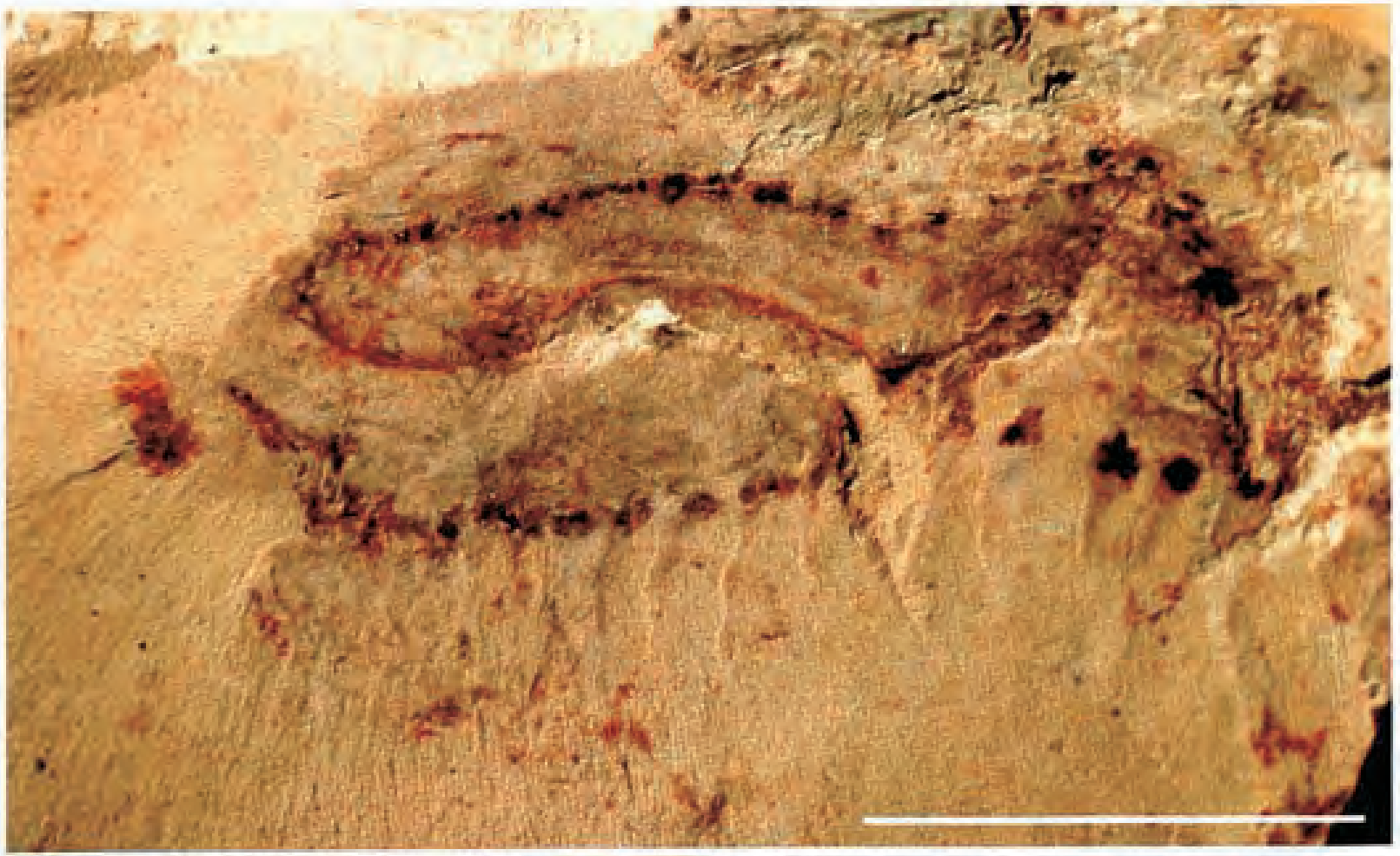

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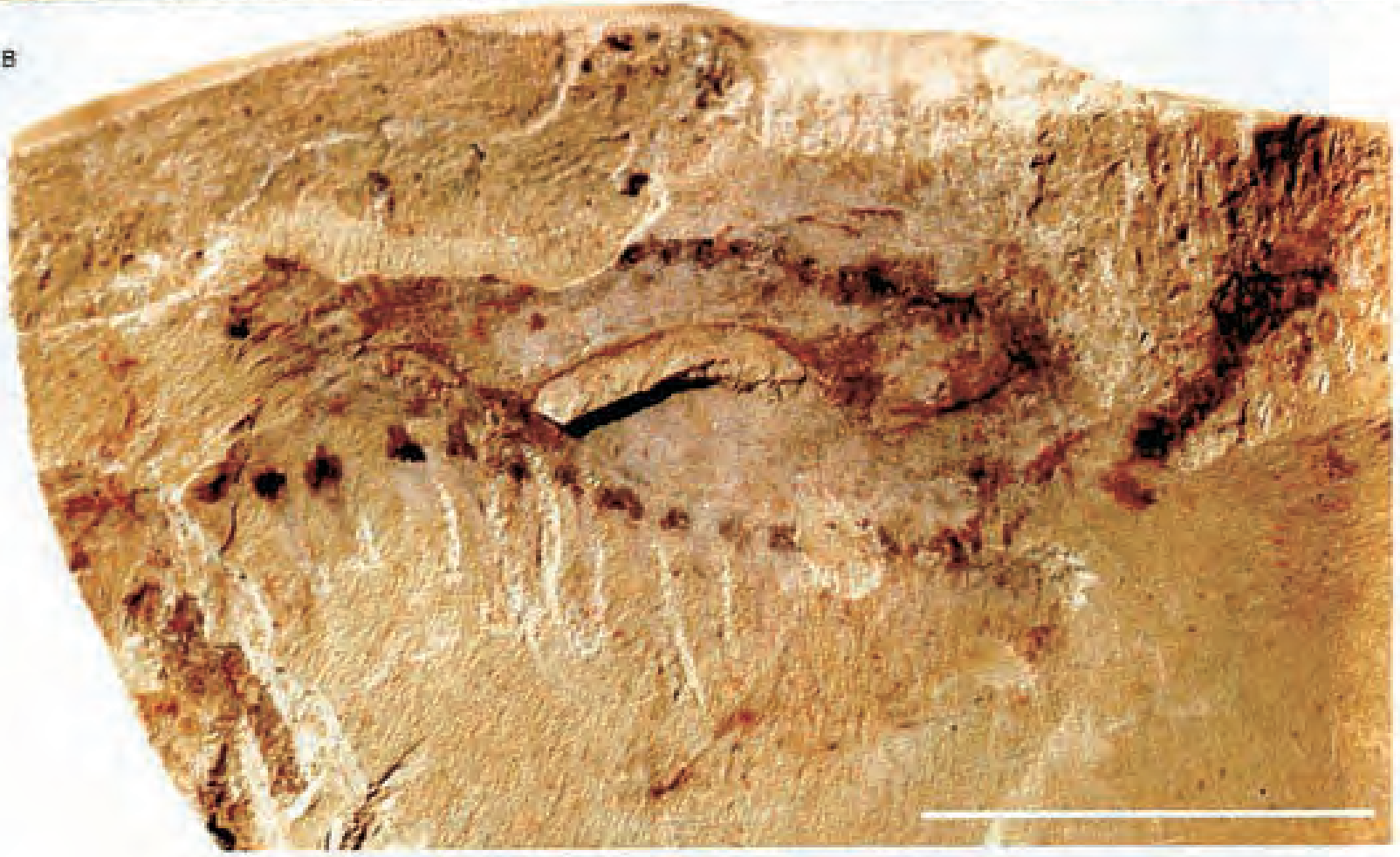

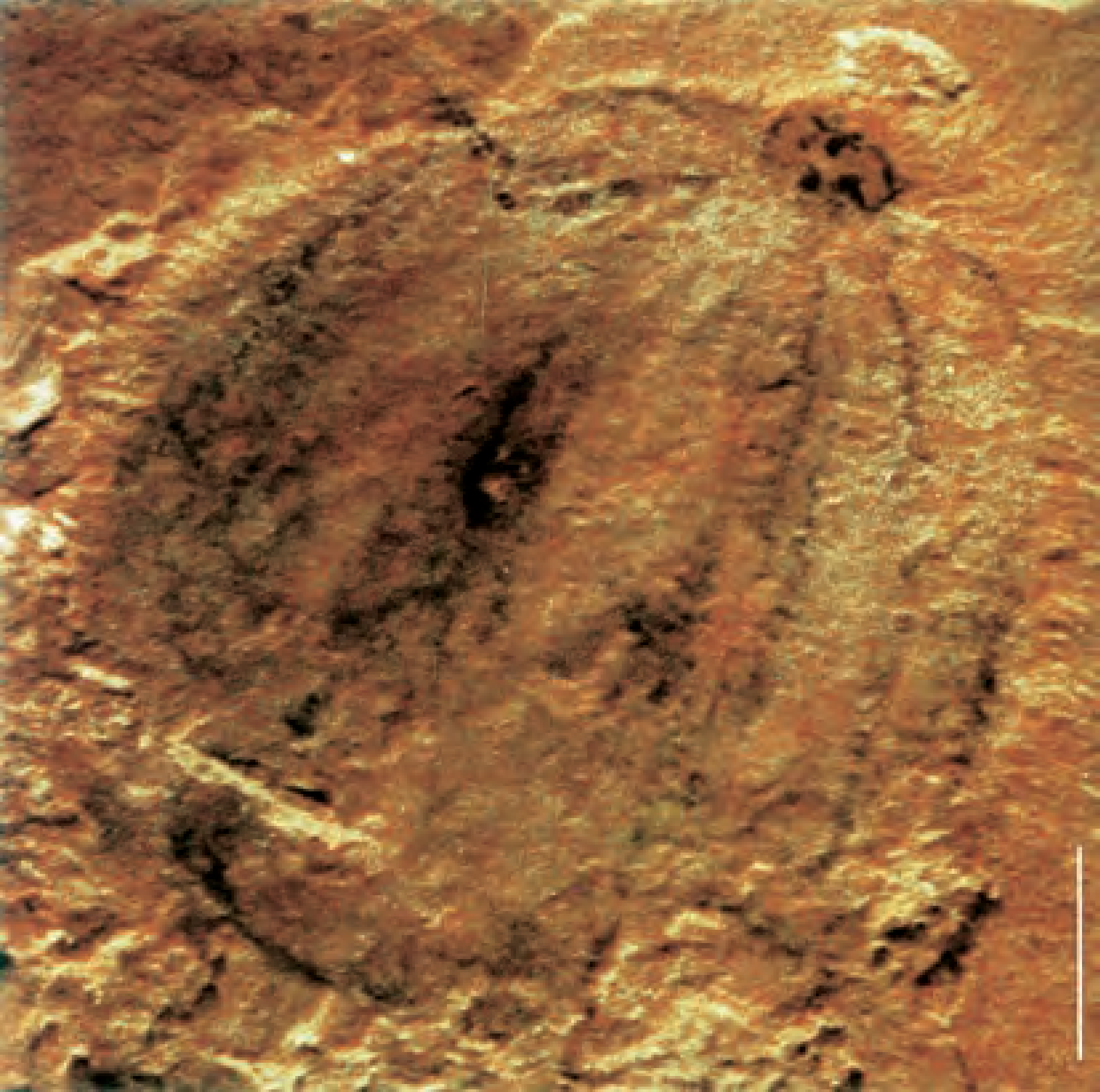

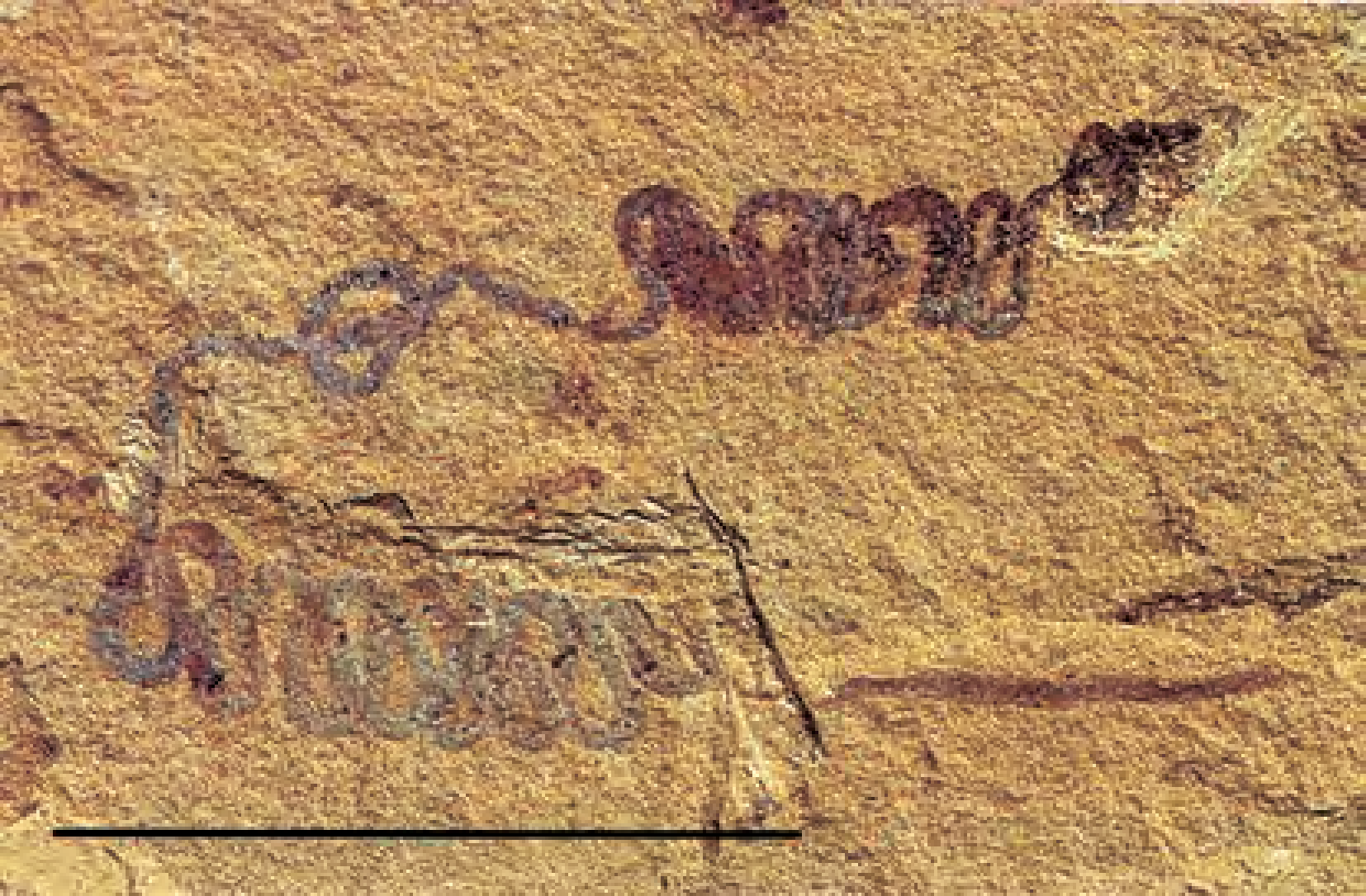


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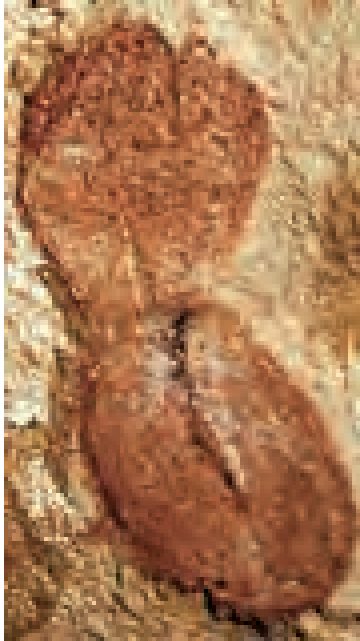

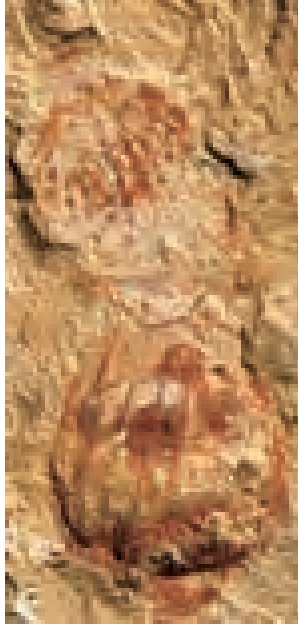

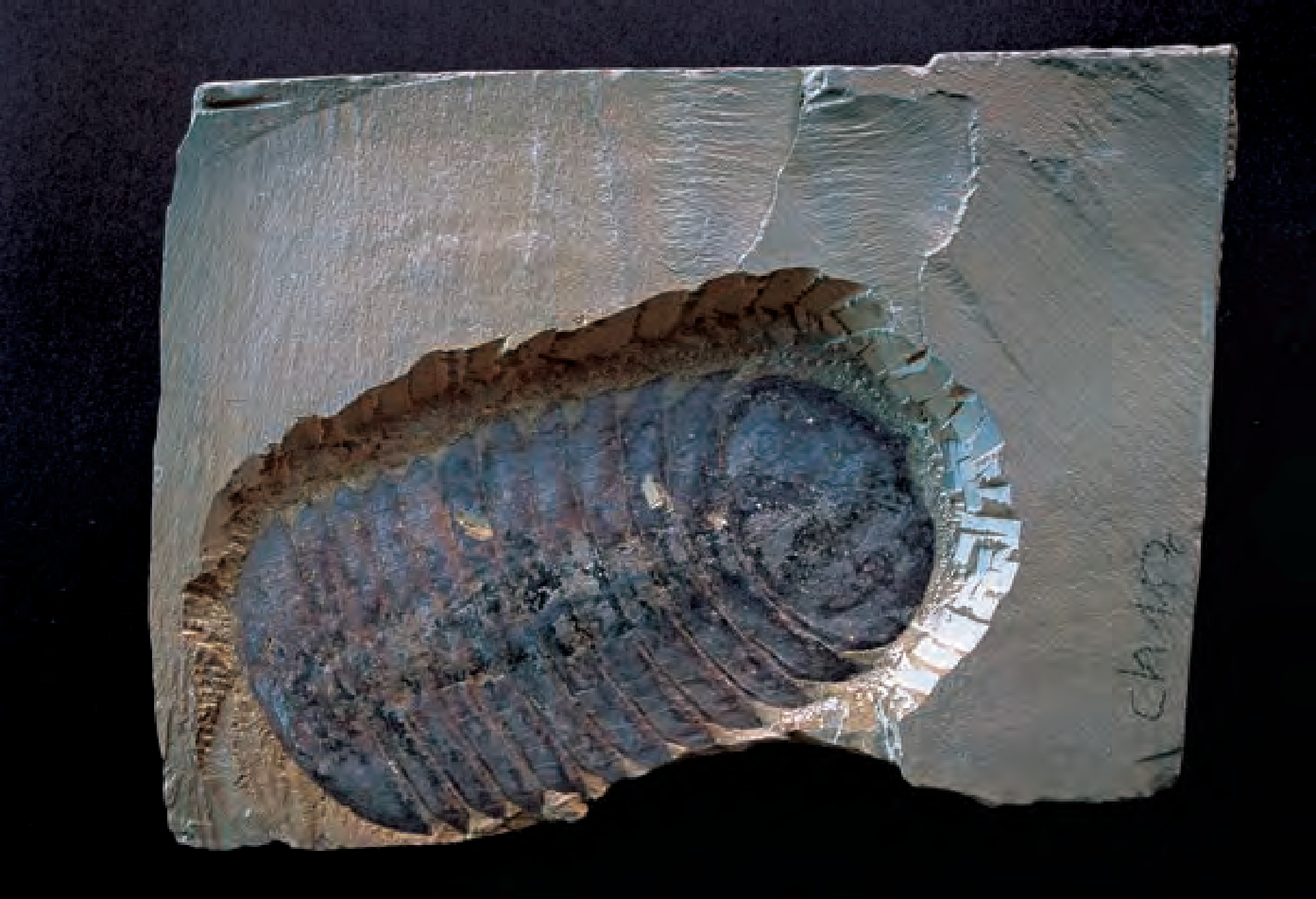

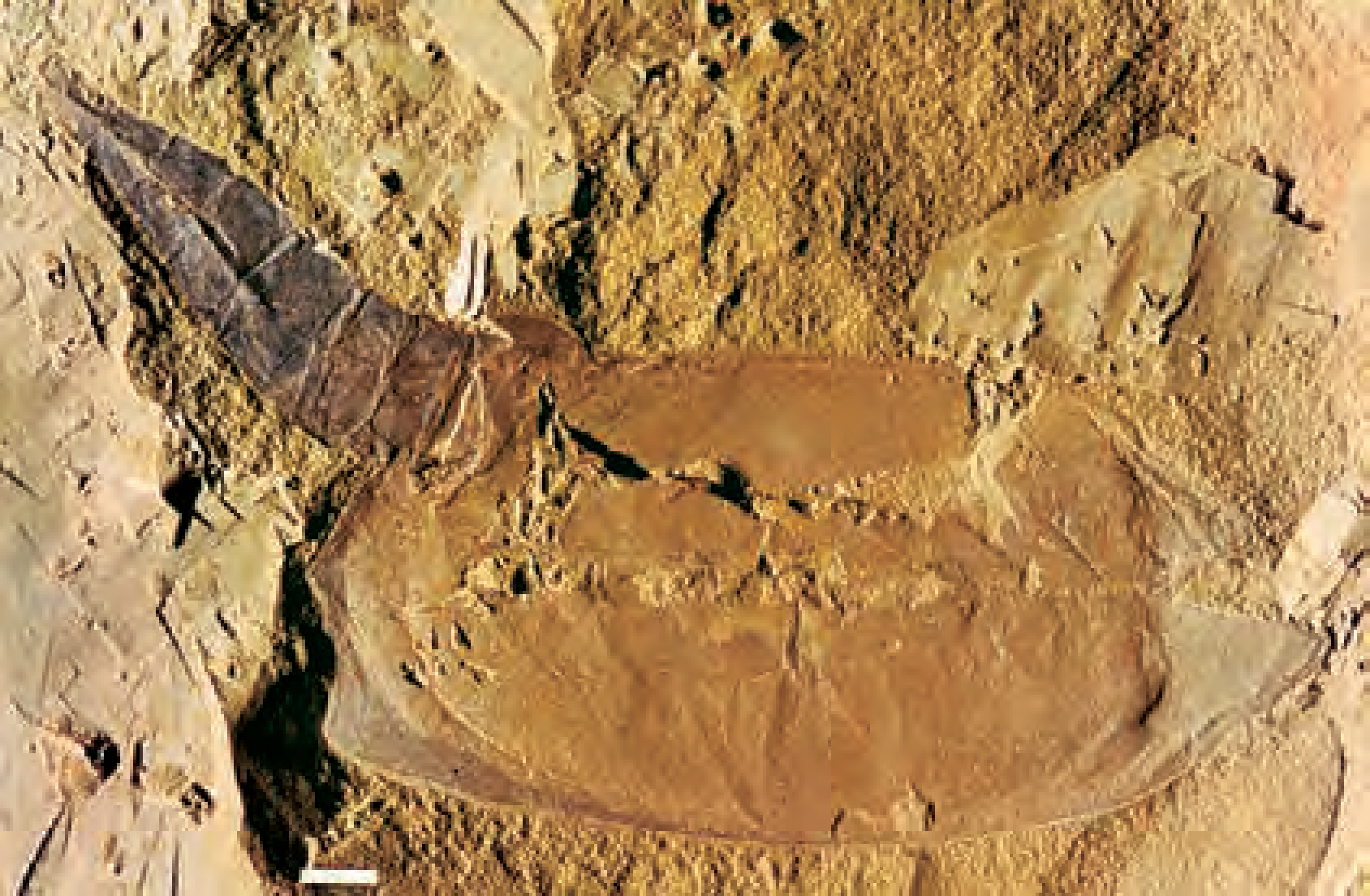


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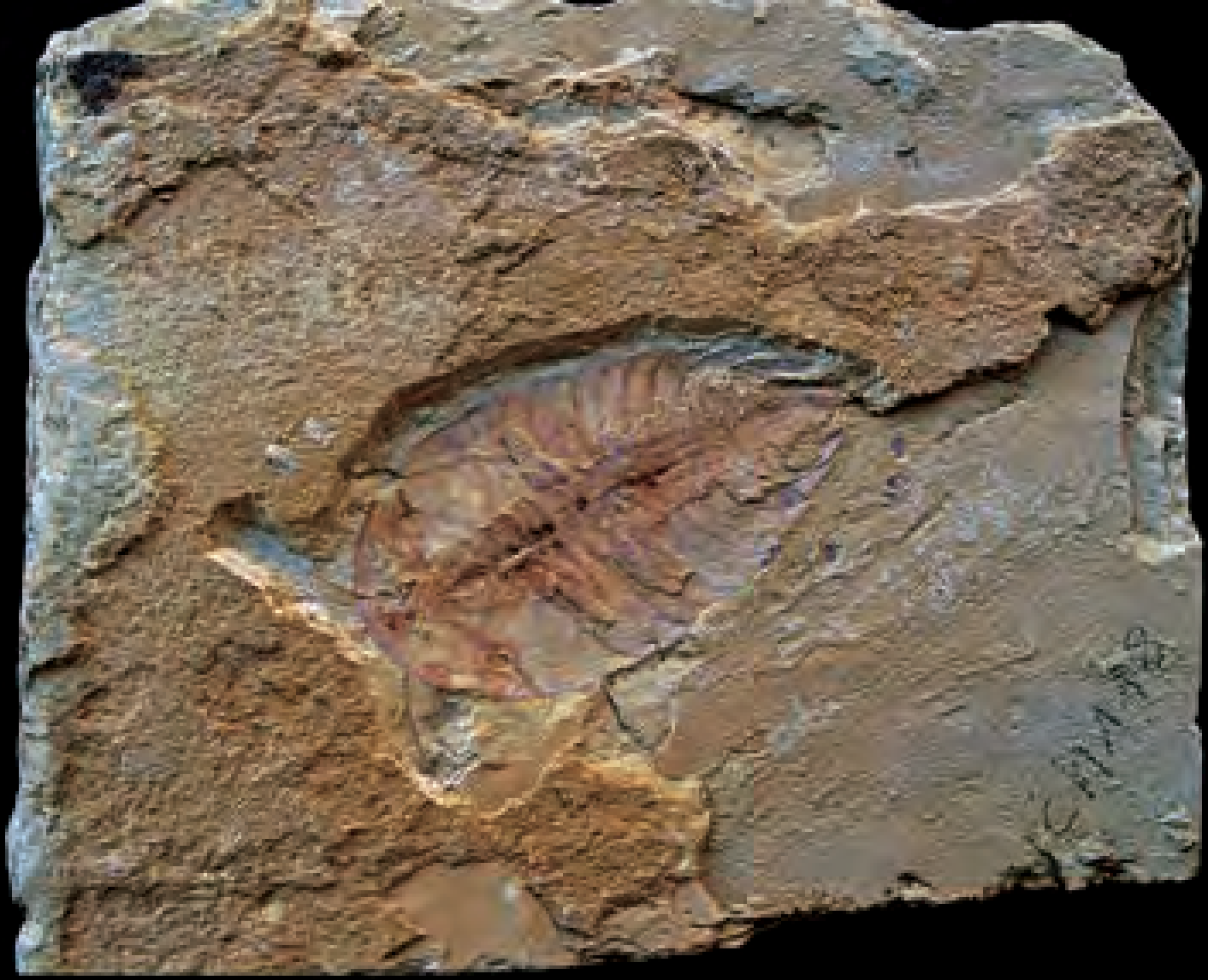


World Heritage Nomination

Natural Property . China

Chengjiang Fossil Site

Appendix 8

Excerpts of Relevant Laws and Regulations

Ministry of Housing and Urban-Rural

Development of the People's Republic of China

2011.1

Excerpts of Relevant Laws and Regulations

Contents

The Constitution of the PRC

Article 9: Mineral resources, waters, forests, mountains, grassland, unreclaimed land, beaches and other natural resources are owned by the state, that is, by the whole people..... the state ensures the rational use of natural resources and protects rare animals and plants. The appropriation or damage of natural resources by any organization or individual by whatever means is prohibited.

Article 26: The state protects and improves the living environment and the ecological environment, and prevents and controls pollution and other public hazards. The state organizes and encourages afforestation and the protection of forests.

The Environmental Protection Law of the PRC

Article 17: The people's governments at various levels shall take measures to protect regions representing various types of natural ecological systems, regions with a natural distribution of rare and endangered wild animals and plants, regions where major sources of water are conserved, geological structures of major scientific and cultural value, famous regions where karst caves and fossil deposits are distributed, traces of glaciers, volcanos and hot springs, traces of human history, and ancient and precious trees. Damage to the above shall be strictly forbidden.

Article 19: Measures must be taken to protect the ecological environment while natural resources are being developed or utilized.

The Mineral Resources Law of the PRC

Article 3: Mineral resources belong to the State. The rights of State ownership in mineral resources is exercised by the State Council. State ownership of mineral resources, either near the earth's surface or underground, shall not change with the alteration of ownership or right to the use of the land which the

mineral resources are attached to.

Article 20: Unless otherwise approved by the competent departments authorized by the State Council, no one may mine mineral resources in the following places:

(5) Natural reserves and important scenic spots designated by the State, major sites of immovable historical relics and places of historical interest and scenic beauty that are under State protection;

The Regulations on the Protection and Management of Geological Heritage

Article 7: The following geological heritage shall be protected:

A. Typical stratotype sections (incl. parastratotype sections), stratigraphic sections where fossil assemblages are discovered, lithology-lithofacies sections, typical geological structural sections and features etc. that are of great scientific value in tracing geologic history.

B. Fossils of ancient human, vertebrates and invertebrates, microfossils, plant fossils, places of origin as well as paleontological remains that are of great scientific and cultural value in the study of earth and biological evolution.

A protected area, section, point or geopark can be established and demarcated at the state-, province- or county-level for geological heritage or remains of worldwide, nationwide or regionwide significance. Such areas, sections, points or geoparks are hereinafter referred to as The Geological Reserve.

Article 10: Application, Examination and Approval of A Geological Reserve:

For a national geological reserve, the application shall be filed by the Ministry of Geology and Mineral Resources or by the people's government of the province, autonomous prefecture or city directly under the central government where the geological heritage is located, assessed by the Commission on Assessment of A National Natural Reserve, reviewed and signed by the Ministry of Environmental Protection, and approved and announced by the State Council.

For a national geological reserve to be nominated for inscription on World Natural Heritage List, the application shall be filed by the Ministry of Geology and Mineral Resources to the governing ministry of the State Council.

Article 11: Classification of Protection.

The protection of geological heritage or remains within a geological reserve can be classified into

Class A Protection, Class B Protection and Class C Protection.

Class A Protection: for extremely rare heritage or remains of important scientific value in the world or China. Access prohibited unless approved. Any visit, scientific research or international exchange in the reserve shall be subject to the approval of the local Department of Geology and Mineral Resources establishing the reserve.

Class B Protection: for geological heritage or remains of important scientific value over a large area. Any scientific activities, educational activities, academic exchanges or limited tourism activities to be done in the reserve shall be subject to the approval of the local Department of Geology and Mineral Resources establishing the reserve.

Class C Protection: for geological heritage or remains of general significance. Limited tourism activities in the reserve shall be subject to the approval of the local Department of Geology and Mineral Resources establishing the reserve.

Article 14: A geological reserve shall be demarcated (by erecting boundary markers or stones) and announced by the people's government approving the establishment of the reserve only. These markers or stones shall not be moved or altered without the approval of the original approving authority.

Article 17: No activity having an impact on the protected heritage, e.g. quarrying, borrowing, mining, grazing or cutting etc., shall be allowed within a reasonable area. Collecting specimen and/or fossils within the reserve without the prior approval of the responsible authority is expressly prohibited.

Article 18: No new factory building or other structures that have nothing to do with the protection of the geological heritage shall be allowed within the reserve, and the existing ones (if any) that will cause pollution or damage to the heritage shall be improved to the standard, stopped, or moved out of the reserve within a time limit.

Article 19: Any scientific activities, educational activities or tourism activities in the reserve shall be subject to the approval of the administrative authority according to the classification of the protection of the geological heritage. A duplicate copy of outcomes resulting from such scientific research shall be submitted to the authority responsible for the protection and administration of the geological heritage.

The Geological Environment Protection Law of Yunnan Province

Article 4: The protection of geological environment includes: environment impact assessment, environmental monitoring, geological disaster prevention and control, mines, engineering and hydrological projects, protection of geological heritage and fossils etc.

Article 9: A geological environment impact assessment shall be carried out and detailed in a separate chapter of an EIA Report if:

C. development and utilization of geological heritage and geological resources

The dedicated chapter of the above-mentioned EIA Report shall be evaluated by an expert panel organized by the Ministry of Land and Resources, which shall present its conclusion in twenty days from the date of acceptance.

Article 16: A geological reserve shall be established and demarcated for geological heritage of great value, including: geological structures, sections, fossils, caves, glaciers, volcanoes, hot springs, waterfalls etc.

Such geological reserve shall be established, built and protected in accordance with relevant national and/or provincial regulations.

The Regulations of the PRC on Nature Reserves

Article 2: The natural reserve under this article means a protected area where the representative natural ecosystem exists, where rare and endangered wildlife/species are distributed, or land, terrestrial water body or sea area where a natural heritage of special significance is located.

Article 10: A natural reserve shall be established and demarcated for:

D. Natural heritage of great scientific and cultural value e.g. geological structures, famous caves, fossil-concentrated areas, glaciers, volcanoes, hot springs etc.

Article 18: A natural reserve can be further divided into core zone, buffer zone and experimental zone.

Any part of a natural reserve where the natural ecosystem is well preserved in a good condition and rare and endangered species are concentrated shall be designated as the core zone to which the access

is prohibited and no scientific activity is allowed within the core zone with the exception of those approved according to Article 27.

A buffer zone covering a specified area shall be demarcated around/outside the core zone for scientific activities or observation only.

An experimental zone shall be demarcated outside the buffer zone for scientific experiments, education, visiting, study tour, sightseeing, domestication and breeding of rare and endangered wildlife etc.

If necessary, the people's government approving the establishment of a natural reserve shall demarcate the peripheral areas of a natural reserve for the purpose of better protection.

Article 27: Access to the core zone of a natural reserve is prohibited. Any scientific activity, observation or survey that has to be done in the core zone must be approved by the Provincial Department of Natural Reserve by submitting an application accompanied by an activity plan, and in case of a national natural reserve, such application must be approved by the Ministry of Natural Reserves.

If the native residents living in the core zone of a natural reserve have to be resettled, such resettlement must be arranged properly by the people's government where the natural reserve is located.

Article 28: Tourism, production or commercial activities are prohibited in the buffer zone of a natural reserve. Any non-destructive scientific activity, educational activity or specimen collection that has to be done in the buffer zone of a natural reserve must be approved by the administrative authority of the natural reserve by submitting an application accompanied by an activity plan.

Article 32: No production facility shall be built in the core zone or buffer zone of a natural reserve. No production facility that will cause pollution or damage to the environment or resources or landscape shall be built in the experimental zone of a natural reserve. And other facilities shall be in compliance with the national or local emission standards. The existing facilities that are within the experimental zone of a natural reserve and that have an emission exceeding the national or local criteria shall be improved to standards within a time limit, and the damage, if any, shall be remedied.

The peripheral facilities around a natural reserve shall be kept free of any damage to the environment within the natural reserve, And the damage, if any, shall be remedied within a time limit.

Such improvement or remedy shall be determined and ordered by the authority as designated in the

law or regulations. The company or organization receiving such order shall complete all the works within the time limit and in the manner as specified.

Regulations on Land Management within natural reserve

Article 4: Both an organization and an individual are prohibited from any activity that may cause damage to or endanger the land within a natural reserve.

Both an organization and an individual have the obligation to protect the land within a natural reserve, to report and/or charge any activity or behavior violating the Regulations on Land Management within the natural reserve.

Article 13: A natural reserve shall be demarcated (by erecting boundary markers or stones) and announced by the people's government approving the establishment of the reserve only.

Article 14: The administrative authority in charge of a nature reserve shall erect the boundary markers for the nature reserve according to the boundaries and scope as demarcated by the people's government approving the establishment of the nature reserve.

Such boundary markers or stones shall not be moved without prior approval.

Article 18: Unless otherwise provided in laws or administrative regulations, reclaiming, mining or quarrying (stone or sand) within a natural reserve is prohibited.

The Regulations of the PRC on National and Provincial Parks

Article 8: Parks can be further divided into national parks and provincial parks.

A national park means an area that is representative of a nation and that is well preserved or kept as it was thousands of years ago and that can represent important natural, human, cultural and historical evolution, similarly, a provincial park means an area that is just representative of a region.

Article 26: the following activities are prohibited within a national or provincial park:

(1) any activity that will damage the landscape, vegetation, terrain or landform, such as quarrying,

mining, reclaiming, building a tomb or erecting a tombstone;

Article 30: Any construction project or work in a national or provincial park shall be in compliance and in agreement with the plan for the park and in harmony with the landscape without causing any damage, pollution or inconvenience.

The employer of and contractor for such project or work shall work out plan(s) and measures for pollution prevention and control, water and soil conservation, protection of surrounding landscape, water bodies, vegetation, wildlife, landform and other topographical features.

Regulations on Protection of Fossils

Article 2: The fossils under these regulations means the body fossils and trace fossils of animals and plants that have been formed during geologic history and occur in strata.

Article 3: Any fossil discovered in the territory of the People's Republic of China or other sea area under the jurisdiction of the People's Republic of China belongs to the People's Republic of China.

Article 8: A natural fossil reserve shall be established where fossils requiring special protection are concentrated, and a local natural fossil reserve shall be established where fossils requiring general protection are concentrated and where fossils requiring special protection are also discovered. Such natural fossil reserve shall be established following the procedures as specified in the Regulations of the P.R.C. on Nature Reserves.

Article 11: Fossil excavation in a national natural fossil reserve or excavation of fossils under special protection in other areas shall be approved by the Ministry of Land and Resources by filing an application. And excavation of fossils requiring general protection shall be approved by the competent department of the people's government of the province, autonomous prefecture or city directly under the central government where the fossils are located by filing an application.

The application for fossil excavation shall meet the following criteria and shall be accompanied by the evidencing documents, general information of the excavation, excavation plan, specimen or sample preservation plan, natural and ecological conditions of the area where excavation is to take place as well as restoration plan etc.

A. availability of at least 3 technical staff each with a professional title in paleontology or related field as well as at least 3 years' experiences in fossil excavation (at least one staff shall have a senior title in paleontology and act as the team leader);

B. availability of facilities and equipment that are suitable for fossil excavation;

C. availability of processing technology and process that are suitable for fossil protection;

D. availability of facilities, equipment and houses that are suitable for fossil storage;

Article 15: All the excavated fossils shall be registered with corresponding description and label and handed over to the organization designated by the Ministry of Land and Resources approving the fossil excavation in 30 days from the completion of such excavation or scientific or educational activities.

Article 22: Fossils under special protection shall not be traded by any individual or organization. Fossils under general protection can only be traded in the place designated by the people's government above the county level. The procedures for such trading shall be drawn up by the people's government of the province, autonomous prefecture or city directly under the central government.

Article 26: Unnamed fossils shall not leave the country.

The fossils under special protection can only leave the country with the approval of the Ministry of Land and Resources and for one of the following purposes:

A. scientific cooperation with overseas research organizations;

B. overseas exhibition for scientific and cultural exchange.

The fossils under general protection can only leave the country with the approval of the Department of Land and Resources of the people's government of the province, autonomous prefecture or city directly under the central government where the fossils are located.

Article 34: The state has the recourse for any fossil leaving the country illegally.

The Ministry of Land and Resources is the authority exercising the recourse on behalf of the state. Ministry of Foreign Affairs, Ministry of Public Security and General Administration of Customs shall assist Ministry of Land and Resources in exercising the recourse for fossils leaving the country illegally.

Regulations on Management of Fossils

Article 2: The fossils under these regulations means the body fossils and trace fossils of animals and plants that have been formed during geologic history and occur in strata.

Article 5: The following fossils and the place of origin thereof shall be under special protection:

A. named fossil specimens of specific species and genera;

B. perfectly or well preserved fossils of rare ancient vertebrates;

C. fossils that are rare in China or are of special value in biological evolution and classification;

D. place or site where large-size fossils are located or where other important fossils are concentrated.

Article 8: A fossil reserve shall be established and demarcated in accordance with the Regulations of the P.R.C. on Nature Reserves as well as a fossil protection plan for the place or site where large-size fossils are located or other important fossils are concentrated.

The fossil reserves can be further divided into national fossil reserve and provincial fossil reserve.

The fossil reserve shall be managed in accordance with the national regulations regarding the management of a nature reserve.

Article 9: Fossil excavation by any individual or organization is prohibited.

Fossil excavation in a national fossil reserve by a scientific research institution, university or college for the purpose of scientific research, education or science promotion shall be subject to the assessment made by an expert panel organized by the Ministry of Land and Resources. And the excavation of fossils under special protection outside a provincial fossil reserve shall be subject to the assessment by an expert panel organized by the Department of Mineral Resources of the people's government of the province, autonomous prefecture or city directly under the central government.

The procedures and methods for such excavation and assessment shall be drawn up by the Ministry of Land and Resources.

Article 17: Any one of the following activities, actions or conducts in violation of these regulations shall be fined 30,000 CNY and be ordered to rectify within a time limit, and if such activity, action or conduct constitutes a crime, the criminal responsibilities shall be imposed according to the law.

A. fossil excavation without prior assessment by a fossil expert panel;

B. fossil excavation not following the excavation plan;

C. failure to submit the excavation report for reference;

D. failure to submit the list of excavated fossils or submission of a false list;

E. use of excavated fossils in commercial activities;

F. intentional damage to or destruction of fossils, place of origin or excavation site under special protection.

The Regulations of Yunnan Province on the Protection of Chengjiang Fauna Fossils

Article 2: Chengjiang Fossil-Lagerstatte belongs to China and any illegal transferring or assigning by any organization or individual is prohibited.

Article 4: A provincial nature reserve is established for Chengjiang Fossil-Lagerstatte for special protection and administration (hereinafter referred to as the Reserve). The Reserve as well as its core zone, buffer zone and experimental zone shall be approved and demarcated by the People's Government of Yunnan.

Article 5: The Board of Management is established jointly by the People's Government of Yunnan and Chinese Academy of Sciences for coordination on material matters regarding the management of the Reserve. Under the Board of Management is a general office shared by the administrative agency of the Reserve.

Article 6: The duties and responsibilities of the administrative agency of the Reserve are as follows:

A. implementation of national laws, regulations, guidelines and policies regarding the protection of the natural reserve and geological heritage;

B. information dissemination and educational activities on the protection of geological heritage;

C. devising systems for centralized management of the Reserve;

D. monitoring and maintenance of the Reserve as well as maintenance of associated records/files;

E. assisting other departments in their research activities to be done in the Reserve;

F. orderly organization of visits or other tourism activities on condition that no impact will be caused by such activities on the Reserve and its natural environment.

G. collection, storage and management of duplicates of outcomes and fossil specimens resulting from research activities, educational activities and specimen collecting etc. done in the reserve.

Article 9: Access to the core zone within the Reserve without prior approval is prohibited. Any non-destructive scientific research, international scientific cooperation/exchange or visiting that has to be done in the Reserve shall be subject to the approval of the Yunnan Department of Geology and Mineral Resources or subject to the review and approval of the Yunnan Department of Science and Technology in case of

scientific research or international scientific cooperation/exchange.

Tourism, production or other commercial activities are prohibited in the buffer zone of a nature reserve. Scientific research, educational activities, specimen collecting or visiting shall be subject to the prior approval of the administrative agency of the reserve.

Visiting or other tourism activities to be done in the experimental zone within the Reserve shall be subject to the prior approval of the administrative agency of the Reserve.

Article 13: The boundary markers erected around the Reserve following legal procedures shall not be damaged or moved by any individual or organization.

Article 14: No activity having an impact on the protected heritage, e.g. quarrying, borrowing, mining, reclaiming or cutting etc., shall be allowed in the Reserve with the exception of those allowed according to laws and/or regulations.

Article 15: no production facility shall be built in the core zone or buffer zone of the Reserve. No production facility that will cause pollution or damage to the environment or resources or landscape shall be built in the experimental zone of the Reserve. And other facilities shall be in compliance with the national or provincial emission standards.

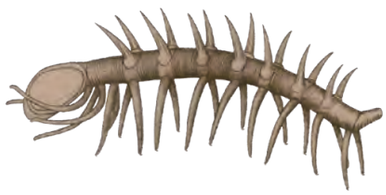
Article 16: Collecting fossil specimens in the Reserve without the prior approval of the Provincial Department of Geology and Mineral Resources or the administrative agency of the Reserve as well as trading in fossil specimens are strictly prohibited.

World Heritage Nomination

Natural Heritage. China

Supplementary Information on the Nominated World Natural Heritage:

Chengjiang Fossil Site



Ministry of Housing and Urban-Rural Development

of the People's Republic of China

November, 2011

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12 October 2011

IUCN Evaluation of Chengjiang Fossil Site (China) – Nominated for inclusion on the World Heritage List

Dear Ambassador,

The IUCN World Heritage technical evaluation mission to the Chengjiang Fossil Site, China, was undertaken by Prof. Dr. Patrick McKeever and Prof. Dr. Mohd Shafeea Leman from 23 to 27 September 2011. The evaluators greatly appreciated the excellent support and co-operation provided by you and your colleagues in the preparation and implementation of the mission, and the kind welcome by the State Party throughout the mission. Please convey our sincere thanks to all of the officials, scientists and contributors that assisted the evaluators in undertaking the mission.

The IUCN World Heritage Panel will meet in Gland, Switzerland, in late November / early December 2011 to examine World Heritage nominations for natural and mixed properties, and cultural landscapes. The IUCN Panel will examine in detail each nomination dossier from the State Party, reports and desktop reviews of field evaluators and external reviewers, and other references regarding the nominated properties.

As noted in previous correspondence, IUCN seeks to develop and maintain a dialogue with States Parties during the evaluation process. To help the IUCN World Heritage Panel's discussions, following the discussions held during the mission, we would like to kindly ask for clarification of the four points listed hereafter.

1. Location of important fossil finds: We would appreciate clarification on the actual palaeontological content of the nominated site. Following discussions during the mission, it appears that at least some of the fossils listed in the nomination dossier were not identified within its boundary, but rather from sites that are some distance from the nominated property. Most notably, some of the key fossils noted come from Haikou (some 60km away at least). Haikou was noted as an area of very active mining and therefore it is not possible to include this area in a World Heritage nomination. We would be grateful if the State Party would clarify which of the important fossils listed in the nomination actually come from the nominated property itself according to the current state of their knowledge (noting many fossils collected from the nominated property have not yet been studied and, therefore, have not yet been identified). Once this is done, we would also be grateful for the State Party comments on whether a revised comparative analysis would need to be prepared, considering only the fossil values included within the nominated property.

2. Trackway construction at Xiaolantian: At the main Xiaolantian section, it was noted that a wide trackway has been excavated into the section had been constructed recently. It would appear that this trackway may have damaged the geological significance of the site, and notably the possibility of being able to find fossils in-situ in an undisturbed geological setting. The path may also create a risk that during periods of heavy rainfall it could act as a channel for rainfall and may cause excessive erosion. We would be grateful for the assessment of the State Party regarding this path, the extent to which it has damaged the exposures, and how further damage might be avoided. We recommend careful assessment of any further interventions in the site, prior to their implementation.

3. Museum Building at Maotianshan: The mission also noted a concern of possible damage at the Maotianshan site, the site of the important fossil find back in 1984. Here a small museum has been built over part of the site, but it is inevitable that during the building of this structure will have impacted much of the rock section. We would be grateful for the comment of the State Party regarding the extent to which the geological values of this exposure have been impacted by this building.

4. Protection status of the nominated property: We would be grateful for clarification regarding the protection the nominated property actually has. The mission noted that the nominated property sites entirely within a national Chinese geopark. Under the national geopark system in China, it is understood that geoparks are zoned into areas of complete protection, areas of some less protection, areas suitable for tourism development etc. In the case of Chengjiang Fossil National Park, the area of highest level protection does not appear to coincide with the nominated property, which instead appears to have a lower level of protection. We would be grateful for confirmation from the State Party of the current protection status of the property, and in particular to confirm if the highest level of protection status could be provided to the nominated property.

Supplementary information should be submitted officially in three copies to the UNESCO World Heritage Centre in order for it to be registered as part of the nomination. An electronic copy of any supplementary information to both the UNESCO World Heritage Centre and IUCN Headquarters would also be helpful.

We would appreciate your response to the above points as soon as possible. In order to facilitate the evaluation process **it would be most useful to have your response before the IUCN Word Heritage Panel convenes (28 November - 02 December 2011), but no later than the 28 February 2012**, as per paragraph 148 of the Operational Guidelines. Please note that any information submitted after this date may not be considered by IUCN in its evaluation for the World Heritage Committee. It should be noted, however, that while IUCN will carefully consider any supplementary information submitted, it cannot properly evaluate a completely revised nomination or large amounts of new information submitted at the last minute. So we request to keep your response concise and respond only to the above requests.

Taking into account your response, IUCN will formulate its final recommendation to the World Heritage Committee which will meet from 25 June to 5 July 2012 in St. Petersburg, Russian Federation.

Please do not hesitate to contact Mr. Tilman Jaeger, World Heritage Programme Officer, if you have any questions with respect to this request for supplementary information (Tel: + 41 22 999 0158; Fax: +41 22 999 0002; Email: tilman.jaeger@iucn.org).

Let me again reiterate our thanks for your support of the World Heritage Convention and for the conduct of IUCN's recent mission. We look forward to your kind cooperation in furnishing responses to the abovementioned points.

Yours sincerely,

Tim Badman
Director - World Heritage Programme

Cc. Chinese National Commission for UNESCO, Mr Fang Maotian, Secretary-General
Ms Zuo Xiaoping, MoHURD
UNESCO World Heritage Centre, Mr Jing Feng and Mr Alessandro Balsamo
Ms Aban Marker Kabraji, IUCN Asia Regional Office, Regional Director
Prof. Dr. Patrick McKeever and Prof. Dr. Mohd Shafeea Leman

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1. Location of important fossil finds: We would appreciate clarification on the actual palaeontological content of the nominated site. Following discussions during the mission, it appears that at least some of the fossils listed in the nomination dossier were not identified within its boundary, but rather from sites that are some distance from the nominated property. Most notably, some of the key fossils noted come from Haikou (some 60 km away at least). Haikou was noted as an area of very active mining and therefore it is not possible to include this area in a World Heritage nomination. We would be grateful if the State Party would clarify which of the important fossils listed in the nomination actually come from the nominated property itself according to current state of their knowledge (noting many fossils collected from the nominated property have not yet been studied and, therefore, have not yet been identified). Once this is done, we would also be grateful for the State Party comments on whether a revised comparative analysis would need to be prepared, considering only the fossil values included within the nominated property.

1. Concerning the location of important fossil finds

- **Clarified fossil list of the Nominated Chengjiang Fossil Site**

As described in the nomination text, from the discovery of the Chengjiang Lagerstätte in 1984 up to 2010, the fossils recorded in the biota comprise at least 200 species (about 160 new) of 170 genera (almost 150 new) of 16 phyla; some 32 of these species are enigmatic and cannot yet be assigned to a phylum. A full fossil list of the biota is given in the submitted nomination text: Table 2-2; and Appendix 4: Inventory.

As indicated in the nomination text, these 200 species of the Chengjiang biota have come from about 10 localities in eastern Yunnan Province (nomination text: 3.d-3： Area of site and related matters). A clarification of the fossil species actually found in the Nominated Chengjiang Fossil Site is presented below (Table 1); this list has been compiled through collaborative work between Chinese and international experts.

- **Of the 200 species, at least 152 species (of which 100 are new and have their type localities within the nominated site) of 132 genera (about 80 new) representing more than 13 phyla have been found at the Nominated Chengjiang Fossil Site (Table 1).**

Table 1. Fossils of the Nominated Chengjiang Fossil Site

(★= TYPE LOCALITY IS WITHIN THE NOMINATED CHENGJIANG FOSSIL SITE)

No.	Algae
001	*Fuxianospira gyrata* Chen & Zhou, 1997 ★
002	*Megaspirellus houi* Chen & Erdtmann, 1991 ★
003	*Punctariopsis latifolia* Xu, 2001
004	*Punctariopsis simplex* Xu, 2001
005	*Sinocylindra yunnanensis* Chen & Erdtmann, 1991★
006	*Yuknessia* sp. of Chen & Erdtmann, 1991 Regarded as coprolites by Steiner *et al.*, 2005
	Phylum Porifera
007	*Allantospongia mica* Rigby & Hou, 1995★
008	*Choia carteri* Walcott, 1920
009	*Choia xiaolantianensis* Hou *et al.*, 1999★
010	*Choiaella radiata* Rigby & Hou, 1995★
011	*Crumillospongia biporosa* Rigby, 1986★
012	*Halichondrites ellisa* Walcott, 1920
013	*Hazelia palmata* Walcott, 1920
014	*Leptomitella conica* Chen, Hou & Lu, 1989★
015	*Leptomitella confusa* Chen, Hou & Lu, 1989★
016	*Leptomitella metta* (Rigby, 1983)
017	*Leptomitus teretiusculus* Chen, Hou & Lu, 1989★
018	*Paraleptomitella dictyodroma* Chen, Hou & Lu, 1989★
019	*Paraleptomitella globula* Chen, Hou & Lu, 1989★
020	*Quadrolaminiella crassa* Chen, Hou & Li, 1990★
021	*Quadrolaminiella diagonalis* Chen, Hou & Li, 1990★
022	*Saetaspongia densa* Mehl & Reitner *in* Steiner *et al.*, 1993★
023	*Takakkawia lineata* Walcott, 1920
024	*Triticispongia diagonata* Mehl & Reitner *in* Steiner *et al.*, 1993★
	Phylum Cnidaria
025	*Xianguangia sinica* Chen & Erdtmann, 1991★
	Phylum Ctenophora
026	*Maotianoascus octonarius* Chen & Zhou, 1997★
027	*Sinoascus papillatus* Chen & Zhou, 1997★
028	*Yunnanoascus haikouensis* Hu *et al.*, 2007

	Phylum Nematomorpha
029	*Cricocosmia jinningensis* Hou & Sun, 1988
030	*Maotianshania cylindrica* Sun & Hou, 1987★
031	*Palaeoscolex sinensis* Hou & Sun, 1988★
032	*Sabellidites yunnanensis* Luo & Zhang, 1986
033	*Tabelliscolex hexagonus* Han, Zhang & Shu, 2003★
	Phylum Priapulida
034	*Acosmia maotiania* Chen & Zhou, 1997★
035	*Archotuba conoidalis* Hou *et al*., 1999★(? = *Selkirkia*? *elongata* Luo & Hu *in* Luo *et al*., 1999)
036	*Omnidens amplus* Hou, Bergström & Yang, 2006★
037	*Palaeopriapulites parvus* Hou *et al*., 1999★
038	*Paraselkirkia jinningensis* Hou *et al*., 1999 (? = *Selkirkia sinica* Luo & Hu *in* Luo *et al*., 1999)
039	*Protopriapulites haikouensis* Hou *et al*., 1999 (= *Sicyophorus rara* Luo & Hu *in* Luo *et al*., 1999)
	Phylum Annelida
040	*Maotianchaeta fuxianella* Chen, 2004★
	Phylum Hyolitha
041	*Ambrolinevitus maximus* Jiang, 1982
042	*Ambrolinevitus meishucunensis* Jiang, 1994★
043	*Ambrolinevitus platypluteus* Qian, 1978
044	*Ambrolinevitus ventricosus* Qian, 1978
045	*Burithes yunnanensis* Hou *et al*., 1999★(? = *Glossolites magnus* Luo & Hu *in* Luo *et al*., 1999)
046	*Linevitus flabellaris* Qian, 1978
047	*Linevitus opimus* Yu, 1974
	Phylum Mollusca
048	*Helcionella yunnanensis* Zhang & Babcock, 2002★
049	*Petalilium latus* Luo & Hu in Luo *et al*., 1999
	Phylum Lobopodia
050	*Cardiodictyon catenulum* Hou, Ramsköld & Bergström, 1991★
051	*Hallucigenia fortis* Hou & Bergström, 1995★
052	*Luolishania longicruris* Hou & Chen, 1989★
053	*Microdictyon sinicum* Chen, Hou & Lu, 1989★
054	*Onychodictyon ferox* Hou, Ramsköld & Bergström, 1991★
055	*Paucipodia inermis* Chen, Zhou & Ramsköld, 1995★
	Phylum Arthropoda (including Anomalocarididae♦)
056	*Acanthomeridion serratum* Hou, Chen & Lu, 1989★
057	*Almenia spinosa* Hou & Bergström, 1997★
058	*Amplectobelua symbrachiata* Hou, Bergström & Ahlberg, 1995♦★
059	*Anomalocaris saron* Hou, Bergström & Ahlberg, 1995♦★

060	*Anomalocaris* sp. of Hou, Bergström & Ahlberg, 1995♦
061	*Branchiocaris*? *yunnanensis* Hou, 1987★
062	*Canadaspis laevigata* (Hou & Bergström, 1991)★(=*Canadaspis eucallus* Chen & Zhou, 1997; =*Perspicaris*? sp. of Hou 1987; ? = *Yiliangocaris ellipticus* Luo & Hu *in* Luo *et al*., 1999)
063	*Chengjiangocaris longiformis* Hou & Bergström, 1991★(*Cambrofengia yunnanensis* Hou *et al*., 1999 may be detached appendages)
064	*Cindarella eucalla* Chen, Ramsköld, Edgecombe & Zhou *in* Chen *et al*., 1996★
065	*Clypecaris pteroidea* Hou, 1999★(? =*Ercaicunia multinodosa* Luo & Hu *in* Luo *et al*., 1999)
066	*Combinivalvula chengjiangensis* Hou, 1987★
067	*Comptaluta inflata* (Zhang, 1974)
068	*Comptaluta leshanensis* (Lee, 1975)
069	*Cucumericrus decoratus* Hou, Bergström & Ahlberg, 1995♦★
070	*Diplopyge forcipatus* Luo & Hu in Luo *et al*., 1999
071	*Diplopyge minutus* Luo & Hu in Luo *et al*., 1999
072	*Dongshanocaris foliiformis* (Hou & Bergström, 1998)★
073	*Eoredlichia intermedia* (Lu, 1940)
074	*Forfexicaris valida* Hou, 1999★
075	*Fortiforceps foliosa* Hou & Bergström, 1997★
076	*Fuxianhuia protensa* Hou, 1987★
077	*Isoxys auritus* (Jiang, 1982)
078	*Isoxys curvirostratus* Vannier & Chen, 2000★
079	*Isoxys paradoxus* Hou, 1987★(? = *Isoxys elongatus* Luo & Hu *in* Luo *et al*., 1999)
080	*Jianfengia multisegmentalis* Hou, 1987★
081	*Jiucunella paulula* Hou & Bergström, 1991★
082	*Kuamaia lata* Hou, 1987★
083	*Kuamaia muricata* Hou & Bergström, 1997★
084	*Kuanyangia pustulosa* (Lu, 1941)
085	*Kunmingella douvillei* (Mansuy, 1912)
086	*Kunmingella typica* Huo & Shu, 1985★
087	*Kunyangella cheni* Huo, 1965
088	*Kwanyinaspis maotianshanensis* Zhang & Shu, 2005★
089	*Leanchoilia illecebrosa* (Hou, 1987)★(=*Dianchia mirabilis* Luo & Hu *in* Luo *et al*., 1997; =*Leanchoilia asiatica* Luo & Hu *in* Luo *et al*., 1997; =*Yohoia sinensis* Luo & Hu *in* Luo *et al*., 1997; ? =*Zhongxinia speciosa* Luo & Hu *in* Luo *et al*., 1997; ?=*Apiocephalus elegans* Luo & Hu *in* Luo *et al*., 1999)
090	*Liangshanella liangshanensis* Huo, 1956
091	*Naraoia longicaudata* Zhang & Hou, 1985★
092	*Naraoia spinosa* Zhang & Hou, 1985★
093	*Occacaris oviformis* Hou, 1999★
094	*Odaraia*? *eurypetala* Hou & Sun, 1988★(? =*Glossocaris oculatus* Luo & Hu *in* Luo *et al*., 1999)
095	*Ovalicephalus mirabilis* Luo & Hu *in* Chen *et al*., 2002
096	*Parapaleomerus sinensis* Hou *et al*., 1999★
097	*Parapeytoia yunnanensis* Hou, Bergström & Ahlberg, 1995♦★
098	*Pectocaris spatiosa* Hou, 1999★

099	*Pisinnocaris subconigera* Hou & Bergström, 1998★(? = *Jianshania furcatus* Luo & Hu *et al.* 1999)
100	*Primicaris larvaformis* Zhang *et al.*, 2003★
101	*Pseudoiulia cambriensis* Hou & Bergström, 1998★
102	*Pygmaclypeatus daziensis* Zhang, Han & Shu, 2000
103	*Retifacies abnormalis* Hou, Chen & Lu, 1989★(= *Retifacies longispinus* Luo & Hu *in* Luo *et al.*, 1997; = *Tuzoia* sp. of Shu 1990)
104	*Rhombicalvaria acantha* Hou, 1987★
105	*Saperion glumaceum* Hou, Ramsköld & Bergström, 1991★
106	*Shankouia zhenghei* Chen *et al.*, 2004
107	*Sidneyia sinica* Zhang & Shu *in* Zhang, Han & Shu, 2002★
108	*Sinoburius lunaris* Hou, Ramsköld & Bergström, 1991★
109	*Skioldia aldna* Hou & Bergström, 1997★
110	*Squamacula clypeata* Hou & Bergström, 1997★
111	*Sunella* cf. *shenensis* (Huo, 1965)
112	*Synophalos xynos* Hou *et al.*, 2009
113	*Syrrhaptis intestinalis* Luo & Hu in Luo *et al.*, 1999
114	*Tanglangia longicaudata* Luo & Hu *in* Luo *et al.*, 1999
115	*Tsunyidiscus aclis* Zhou *in* Lee *et al.*, 1975
116	*Tsunyidiscus niutitangensis* (Chang, 1964)
117	*Tsunyiella diandongensis* Tong *in* Huo & Shu, 1985★
118	? *Tuzoia sinensis* Pan, 1957 (? = *Tuzoia limba* Shu, 1990)
119	*Urokodia aequalis* Hou, Chen & Lu, 1989★
120	*Waptia ovata* (Lee, 1975)
121	*Wutingaspis tingi* Kobayashi, 1944
122	*Wutingella binodosa* Zhang, 1974
123	*Xandarella spectaculum* Hou, Ramsköld & Bergström, 1991★
124	*Yunnanocaris megista* Hou, 1999★
125	*Yunnanocephalus yunnanensis* (Mansuy, 1912) ★
	Phylum Phoronida
126	*Eophoronis chengjiangensis* Chen, 2004★
127	*Iotuba chengjiangensis* Chen & Zhou, 1997★
	Phylum Brachiopoda
128	*Diandongia pista* Rong, 1974
129	*Heliomedusa orienta* Sun & Hou, 1987★
130	*Lingulella chengjiangensis* Jin, Hou & Wang, 1993★
131	*Lingulellotreta malongensis* (Rong, 1974)
132	*Longtancunella chengjiangensis* Hou *et al.*, 1999★
	Phylum Chordata
133	*Cathaymyrus diadexus* Shu, Conway Morris & Zhang, 1996★
134	? *Zhongxiniscus intermedius* Luo & Hu *in* Luo *et al.*, 2001

	Uncertain systematic position
135	*Allonnia phrixothrix* Bengtson & Hou, 2001★(=*Allonnia junyuani* Janussen *et al.,* 2002)
136	*Batofasciculus ramificans* Hou *et al*., 1999★
137	*Chancelloria eros* Walcott, 1920
138	*Cotyledion tylodes* Luo & Hu *in* Luo *et al*., 1999★(? = *Cambrotentacus sanwuia* Zhang & Shu *in* Zhang *et al*., 2001)
139	*Dinomischus venustus* Chen, Hou & Lu, 1989★
140	*Eldonia eumorpha* (Sun & Hou, 1987) ★(= *Yunnanomedusa eleganta* Sun & Hou, 1987)
141	*Facivermis yunnanicus* Hou & Chen, 1989★
142	*Heteromorphus confusus* (Chen & Zhou, 1997)★(? =*Heteromorphus longicaudatus* Luo & Hu *in* Luo *et al*., 1999)
143	*Jiucunia petalina* Hou *et al*., 1999★
144	*Maanshania crusticeps* Hou *et al*., 1999★
145	*Parvulonoda dubia* Rigby & Hou, 1995★
146	*Pomatrum ventralis* Luo & Hu *in* Luo *et al*., 1999 (*Xidazoon stephanus* Shu, Conway Morris & Zhang *in* Shu *et al*., 1999)
147	*Rotadiscus grandis* Sun & Hou, 1987★
148	*Stromatoveris psygmogien* Shu et al., 2006
149	*Vetulicola cuneata* Hou, 1987★
150	*Vetulicola rectangulata* Luo & Hu *in* Luo *et al*., 1999
151	*Yunnanozoon lividum* Hou, Ramsköld & Bergström, 1991 (=*Haikouella lanceolata* Chen *et al*., 1999) ★
152	*Yuyuanozoon magnificissimi* Chen, Feng & Zhu in Chen et al. 2003★

● Comparative analysis

This comparative analysis is based on taxa reported from within the boundaries of the Nominated Site (see Table 1). The Chengjiang biota is also represented outside the site boundaries, both in the immediate area and at localities further afield in southern Yunnan, such as those at Haikou, Jinning and Anning. Several important fossils have been found in the Haikou region, from strata in the lower part of the Yu'anshan Member; the middle and upper parts of the member are not present at Haikou. The strata that have been studied in the Nominated Chengjjiang Site are predominantly stratigraphically higher than those at Haikou. However, strata equivalent to those at Haikou, representing the lower Yu'anshan Member, are present at the Nominated Site. The clearances in 2011 at the Xiaolantian locality, undertaken as part of the conservation improvements in the area, display these strata well. Fossil collections have not yet been made in these lower strata within the Chengjiang site, because collecting there was terminated in 1997 for conservation reasons. Some 20 species that were first reported from the Chengjiang biota outside the Nominated Site have subsequently

been identified in collections made within the Nominated Site before 1997. It is, therefore, highly probable that additional taxa (including vertebrates) currently known only from outside the Nominated Site boundaries are present in strata within the site.

In the nomination text, extensive comparative analyses have been made between the Chengjiang Fossil Site and other palaeontological sites in the world (3.c Comparative analysis). Restriction of the fossil list to species found to date within the Nominated Chengjiang Fossil Site does not affect the comparative analyses already made with all of these other sites except the Burgess Shale, as these sites are very different in both geological period and fossil content. Following the clarification of the fossil list, it is valuable to present a more detailed comparative analysis with the most similar site, the Burgess Shale, which also has great significance in preserving a complementary record of the Cambrian Explosion.

● Detailed comparative analysis with the Burgess Shale

Table 2. Comparison of fossils of the Chengjiang and Burgess Shale sites

	Nominated Chengjiang Site	**Burgess Shale Site**
Discovery	1984, by Hou Xian-guang (Geologist, then of Nanjing Institute of Palaeontology and Stratigraphy)	1909, by Charles Walcott (Scientist; Smithsonian Institution, Washington)
Location	Chengjiang County, Yunnan Province, SW China	Near Banff, Rocky Mountains, British Columbia, Canada
Geographical Extent	A core area and buffer zone centred on Maotianshan, 7 km east of Chengjiang, forming part of a large sedimentary basin several 1000 km^2 in extent that contains numerous other localities yielding the Chengjiang biota	Walcott Quarry and some associated, adjacent sites, now forming part of the Rocky Mountains World Heritage site
Age and rock units	Lower Cambrian (Series 2): Qiongzhusian Stage, Qiongzhusi Formation, Yu'anshan Member, *Eoredlichia-Wutingaspis* Biozone	Middle Cambrian (Series 3):Stephen Formation
Palaeogeographical setting	On South China Plate, situated in tropical/subtropical latitudes, off northern edge of Gondwana	On NW margin of Laurentia, subtropical latitudes, western hemisphere

	(supercontinent), eastern hemisphere	
Local geological setting/depositional environment; sediments	Lower shoreface to proximally offshore; fine, yellow-weathering grey mudstones	Seawards (in front) of a submarine escarpment which represents the platform margin; fine, dark grey to black shales
Major groups present; numbers of genera, species and specimens	Algae; invertebrates and chordates, representing at least 13 phyla, including Porifera, Cnidaria, Ctenophora, Nematomorpha, Priapulida, Lobopodia, Arthropoda, Annelida, Brachiopoda, Phoronida, Hyolitha, Mollusca, Chordata (including Vertebrata at Haikou), and enigmatic animals (including yunannozoons, vetulicolians (banffozoans and vetulicolids), eldoniids); more than 130 genera and 150 species, nearly all species endemic; arthropods dominate, sponges also species-rich; over 100,000 specimens	Algae; invertebrates and chordates, representing at least 13 phyla, including Porifera, Cnidaria, Ctenophora, Priapulida, Lobopodia, Arthropoda, Annelida, Brachiopoda, Hyolitha, Mollusca, Chaetognatha, Echinodermata, Chordata, and enigmatic animals (including vetulicolians (banffozoans), eldoniids); some 140 genera and 170 species; nearly all species endemic, arthropods dominate, sponges also species-rich; over 100, 000 specimens
Palaeoecology	Muddy, level bottom community. Indicates that, at this very early stage of metazoan radiation, a complex ecosystem was already developed, with occupation of all major marine biotopes except for the deep infaunal	Muddy, level bottom community. Indicates complex ecosystem, and occupation of all major marine biotopes except for the deep infaunal
Preservation of fossils	Flattened with some relief. Exceptional, soft-part and whole soft bodied preservation. Conservation of organic carbon, with widespread pyritisation, and subsequent oxidation through recent, tropical weathering	Flattened with some relief. Exceptional, soft-part and whole soft bodied preservation. Conservation of organic carbon, with clay mineral replication and replacement, and subsequent greenschist stage metamorphism
Significance	Exceptional, soft-tissue preservation of a diverse fauna of invertebrates and of vertebrates (at Haikou). Represents the earliest evidence in the fossil record of the metazoan radiation phase of the Cambrian explosion	Exceptional, soft-tissue preservation of a diverse fauna of invertebrates. Represents an early stage of the appearance of metazoans in the fossil record, in the later part of the Cambrian explosion event.

	event. Provides critical information for palaeobiological and evolutionary studies	Provides critical information for palaeobiological and evolutionary studies
Repositories with significant holdings of material	Key Laboratory for Palaeobiology, Yunnan University, Kunming; Chengjiang County Museum and Maotianshan Museum/Field Station, Chengjiang; Nanjing Institute of Palaeontology and Stratigraphy, Nanjing; Early Life Centre, Northwest University, Xi'an	Smithsonian Institution, Washington; Royal Ontario Museum, Toronto

The Nominated Chengjiang Site and the Burgess Shale site are close in age (early Cambrian and mid-Cambrian, respectively) and both contain exceptionally preserved fossils. Detailed comparisons are presented below to demonstrate the importance of both sites and to emphasise the fundamentally different and essential record provided by the fossils from the Nominated Chengjiang Site.

- The biotas represented at the Chengjiang and Burgess sites are virtually mutally exclusive at species level. Of the 152 species listed here from the Nominated Chengjiang Site, only six (five sponges and a chancelloriid) have also been found in the Burgess Shale. Most of the enigmatic animals characteristic of the Chengjiang site (e.g. *Vetulicola, Yunnanozoon*, *Dinomischus*, *Batofasciculus*, *Facivermis*), which have the potential to elucidate the stem-group evolution of major higher taxa, have no counterparts in the Burgess Shale biota.

- The Nominated Chengjiang Site represents Cambrian life some 10 million years earlier than that at the Burgess Shale site; this was an interval of unparalleled ('explosive') evolutionary change, so this time difference is exceedingly significant. The fauna at the two sites show similarities at phylum level: all phyla found in the Burgess Shale appear to be represented in the Chengjiang biota, which also contains nematomorphs, phoronids, yunnanozoans, vetulicolids and, at Haikou, sipunculans and (the earliest) representatives of Vertebrata. However, the Chengjiang site records an earlier stage in the development of all these major groups, and has yielded many key fossils that provide evidence for the pattern and process of the acquisition of the diagnostic characters of phyla and of supra-phylum groupings. A highly

important aspect of the Chengjiang biota is that it contains fossils that shed major light on the early evolution and relationships of the deuterostomes, including evidence from the earliest known chordates and from putatively related groups (vetulicolians, yunnanozoons). Additionally, there are many more lobopod and non-trilobite arthropod species recorded from the Nominated Chengjiang Site than at the Burgess Shale; these Chengjiang taxa are crucial in resolving basal arthropod inter-relationships and in elucidating the origin and evolution of the arthropod body plan. Some of the lobopods provide fundamental evidence bearing on the question of the origin and relationships of the phylum Onycophora.

- The Chengjiang biota also differs from the Burgess Shale biota in the almost total absence of polychaete (annelid) worms (one species based on a single specimen). At Burgess they are relatively numerous and are assigned to at least five species. This difference may be related to evolution rather than ecology, and putatively provides an illustration of the importance of the time difference between the two biotas.

- Palaeoecologically, the biota of the Nominated Chengjiang Site occupied a shallow-water environment, and there was little post-mortem transport or decomposition of the animals. It provides the earliest representation in the fossil record of a complex animal community. Some specimens are clearly preserved in life position, for example brachiopods attached by pedicles to other animals and *Cotyledion* epibionts on *Vetulicola*. Arthropods from the Nominated Chengjiang Site and Haikou have, furthermore, furnished the earliest known example of collective behaviour in the animal kingdom. Similar specimens have not been recorded from the Burgess Shale.

- Different minerals are involved in the preservation of the two faunas: iron pyrite and organic carbon are important at Chengjiang, whereas clays with organic carbon are important at Burgess, so some of the anatomical information preserved differs. For example, pedicles of brachiopods are commonly well preserved in the fossils from the Nominated Chengjiang Site, but not in the Burgess Shale. Similarly, the unique preservation of appendages in species of bradoriids from the Nominated Chengjiang Site has allowed phylogenetic resolution of this globally common group of Cambrian arthropods as stem Crustacea.

Clearly, in many ways the Nominated Chengjiang Site better represents the diversification of life during the Cambrian explosion than the Burgess Shale site. However, and critically, the two faunas complement each other in providing two different windows in time on the Cambrian explosion, with two different biotas, and both are essential for our understanding of this benchmark episode in the history of life.

2. Trackway construction at Xiaolantian: At the main Xiaolantian section, it was noted that a wide trackway has been excavated into the section had been constructed recently. It would appear that this trackway may have damaged the geological significance of the site, and notably the possibility of being able to find fossils in-situ in an undisturbed geological setting. The path may also create a risk that during periods of heavy rainfall it could act as a channel for rainfall and may cause excessive erosion. We would be grateful for the assessment of the State Party regarding this path, the extent to which it has damaged the exposures, and how further damage might be avoided. We recommend careful assessment of any further interventions in the site, prior to their implementation.

2. The trackway at Xiaolantian

● **Background**

The Xiaolantian section is located in the northern part of both the Nominated Property and also the Chengjiang Fauna Geopark (Fig. 1). The section is well known because nearly 40 species have been discovered there between the late 1980s and early 1990s. Since 1997, fossil collecting has been prohibited in the Xiaolantian area due to strengthened conservation regulations in the Geopark as a whole.

Fig. 1. Location of the Xiaolantian section in the nominated property.

Following indication from the World Heritage Center of the intended IUCN field visit, in order to display a complete rock section for evaluation within the nominated site, and also to establish a representative section for the Geopark, the park management body began (March 2011) to prepare the section at Xiaolantian.

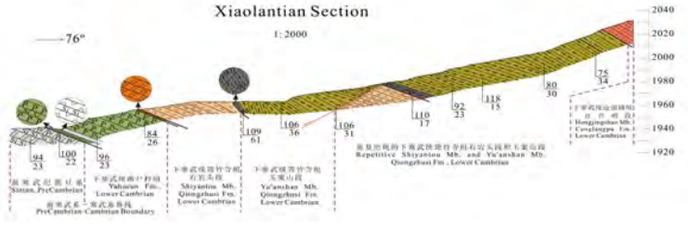


Fig. 2. Geology of the section at Xiaolantian.

Fig. 3. Panoramic view of the cleared section (near-middle distance)

The cleared section, stretching along the north side of the Xiaolantian valley, is 485 m long (Figs 2, 3). A 1-1.5 m wide trackway was cleaned along the route of the previous track. In addition, the arable land in the valley bottom was returned to grassland.

● Impact on the rock exposure

In order to assess the impact of the improved trackway in exposing the geology of the Xiaolantian area, it is necessary to indicate the situation before cleaning took place. Prior to 2010, the Xiaolantian section was a shallow, abandoned fossil quarry mostly covered by rock debris and topsoil; nearby were patches of farmland (Figs 4, 5).

Fig. 4. Xiaolantian section in 1994, showing (far distance) the fossil quarry, and in the upper part of the hillside the track.

Fig. 5. Xiaolantian valley in 2010, showing the section and nearby farmland.

The Xiaolantian section can be divided into three parts:

- The upper part (22 m) comprises siltstones of the Hongjingshao Member, Canglangpu Formation (ϵ_{1c}). They are well exposed due to their resistance to weathering (Fig. 6).

Fig. 6. Upper part of the Xiaolantian section.

- The middle part (260 m) consists of mudstones of the Yu'anshan Member, Qiongzhusi Formation (ϵ_{1q}^{2}). These were previously largely covered by rock debris 1-2 m thick, and cut into by a shallow gully representing the remains of the fossil quarry (Fig. 7).

Fig. 7. Middle part of the Xiaolantian section.

• The lower part (203 m) comprises siltstones of the Shiyantou Member, Qiongzhusi Formation (ϵ_{1q}^{1}) and phosphorite of the Zhongyicun Member, Yuhucun Formation (ϵ_{1y}^{4}). This part was covered by topsoil and grass (Fig. 8).

Fig. 8. Lower part of the Xiaolantian section.

The purpose of the section renovation was to remove overlying topsoil and debris and expose bedrock.

- **Results**

• The upper part (22 m) remains relatively untouched in comparison with other parts of the section, as the rock is naturally exposed (Figs 9, 10).

• The middle part (260 m) was made available by removing overlying debris (Figs 11, 12).

• The lower part (203 m) was made available by stripping off the topsoil on the side-slope along the existing Xiaolantian track (Figs 13, 14).

Fig. 9. Upper part of the Xiaolantian section before cleaning (March 2011).

Fig. 10. Upper part of the Xiaolantian section after cleaning (September 2011).

Fig. 11. Middle part of the Xiaolantian section before cleaning (March 2011).

Fig. 12. Middle part of the Xiaolantian section after cleaning (September 2011).

Fig. 13. Lower part of the Xiaolantian section before cleaning (March 2011).

Fig. 14. Lower part of the Xiaolantian section after cleaning (September 2011).

Fig. 15. Distant view of the Xiaolantian valley prior to renovation work (2010).

Fig. 16. Distant view of the Xiaolantian valley after the section was cleaned (September 2011).

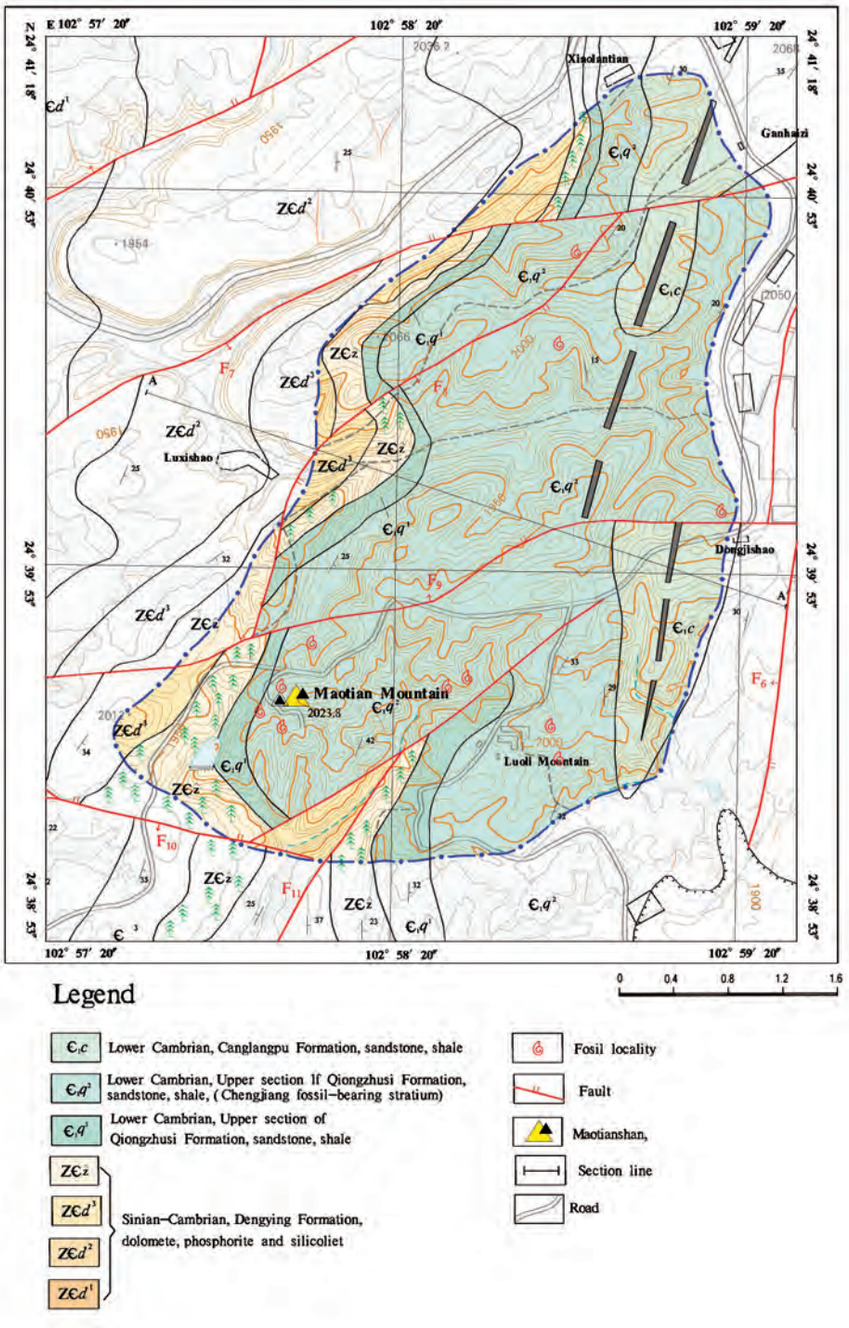
During the cleaning process some parts of the trackway were made slightly wider, but overall essentially little or no bedrock was removed. The fossil-bearing stratum, the Yu'anshan Member, covers 414 ha, or 81 % of the nominated site (Fig. 17). The Xiaolantian trackway exposes about 0.039 ha (260 m × 1.5 m), or 390 m^2 of this member, which accounts for 0.0076 % of the nominated site, and 0.0094 % of the fossil-bearing area. The impact of the trackway, either to the Xiaolantian area or the entire nominated site, is very localized and limited. The integrity of the nominated site remains intact.

We therefore consider that any concerns that the new trackway has damaged the geological significance of the site are unfounded. The trackway has, in fact, enhanced the utility of the site, making available a section from the late Precambrian to the lower Cambrian Canglangpu Formation, exposing the Precambrian/Cambrian boundary and spanning all the soft-bodied fossil horizons. Importantly, it clearly exposes for the first time a continuous section in the nominated site through the lower Yu'anshan Member with potential new horizons with soft-bodied fossils.

Concerns that fossils might now not be found in situ, in an undisturbed geological setting, are also unfounded. On the contrary, considerably more undisturbed rock, including the fossiliferous and potentially

fossiliferous horizons, has been made available for study by the clearance. Moreover identical and completely undisturbed sections are still available in the nominated site, adjacent and parallel to the trackway.

Fig. 17 Geological Map of the Nominated Chenggiang Fossil Site



● Protecting the site

The average annual rainfall on the gentle, hilly landscape of the nominated site is 963.83 mm/year. There are no perennial streams, and in the rainy season (May-October) there is occasional drainage in the large gullies, but never any flood. The Xiaolantian section and trackway are located in the middle and upper slopes of the Xiaolantian valley, near the hilltop, with limited risk of excessive, run-off erosion. Additionally, existing vegetation up-slope of the section provides protection against run-off, and down-slope of the section newly planted vegetation will combat erosional undercutting; extra planting could be undertaken, as necessary. The section will now be allowed to weather naturally, and any possible future human intervention will be strictly assessed, limited, and governed.

● Summary

Located in the northern part of the nominated site, the Xiaolantian section was previously represented by an abandoned fossil quarry largely covered by rock debris and topsoil. In order to display a clear rock sequence for IUCN evaluation, and to establish a representative rock section for scientific and educational use, the park management body cleaned the section, and it created a 1-1.5 m wide trackway along section, together with associated explanatory signs. A minimum amount of bedrock was excavated during the process, and the original nature of the site remains essentially intact. In the future, any changes to the site will be left largely to natural processes. The state party fully accepts the advice of the IUCN evaluators, however, that any future man-made intervention should be preceded by a full assessment of the proposed measures.

3. Museum Building at Maotianshan: The mission also had concern regarding the possible impact that the building of small museum may have had on the geological section at the Maotianshan locality. "We would be grateful for the comment of the State Party regarding the extent to which the geological values of this exposure have been impacted by this building."

3. The Museum Building at Maotianshan

● **Background**

The west slope of Maotianshan hill in the southern part of the Chengjiang nominated site is where the first soft-bodied Chengjiang fossils were discovered in 1984 by Hou Xianguang (Figs 18, 19). Subsequent work yielded more than 80 fossil species. Since 1997 fossil collecting has been prohibited at the Maotianshan locality.

This locality has great palaeontological and historical significance. In order to enhance protection of the site, while also attempting to widen public understanding of its scientific importance, in 2010 a small arch-shaped exhibition hall was built over the strata where the first Chengjiang soft-bodied fossils were found (Fig. 20).

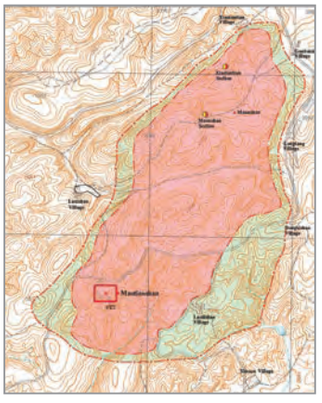


Fig. 18. Location of the Maotianshan section in the nominated property.

Fig. 19. The section at Maotianshan (2010).

Fig. 20. The museum at Maotianshan (2011).

The museum is 36 m long, 9-12 m wide and 9-13.5 m high. It comprises an exhibition room displaying specimens and illustrations of Chengjiang fossils (Fig. 21) and a sheltered exposure (9 m × 32 m) of fossil-bearing mudstones of the Yu'anshan Member (Fig. 22).

Fig. 21. Front part of the museum at Maotianshan.

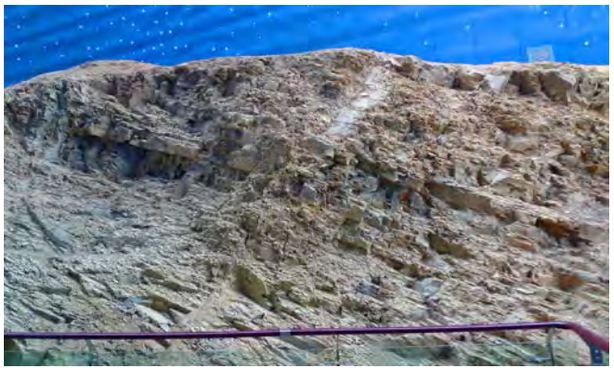


Fig. 22. Rear part of the museum at Maotianshan.

● **Impact of the Museum on the rock exposure**

The museum occupies some 360 square meters. During its construction about 126 cubic meters of earth and rock were cleared for site grading, but the building of the museum has not altered the geological integrity or scientific value of the locality. The horizons where the soft-bodied fossils were initially discovered are still fully available for study and are now sheltered and protected by the museum covering; they have not been lost by its construction. Moreover, many of the same stratigraphic levels are also exposed immediately outside the museum confines.

● **Summary**

In order to better shelter and preserve the key Maotianshan rock section a small on-site museum was built in 2010. The museum also serves to widen public appreciation of the importance of the Chengjiang biota. The impact that the building has on the environment at the Maotianshan locality is limited and the geological integrity and value of the original section remains intact. The museum was

established for well-intentioned reasons but the management body accepts that, when considering its construction in principle, it could have been more aware of commonly accepted guidelines relating to the protection of geologically significant sites. Bearing in mind the general principle that the best strategy for protecting such sites is to retain their natural state, the management body has agreed that in future such building projects will not be allowed to occur within the nominated site.

4. Protection status of the nominated property: We would be grateful for clarification regarding the protection the nominated property actually has. The mission noted that the nominated property sites entirely within a national Chinese geopark. Under the national geopark system in China, it is understood that geoparks are zoned into areas of complete protection, areas of some less protection, areas suitable for tourism development etc. In the case of Chengjiang Fossil National Park, the area of highest level protection does not appear to coincide with the nominated property, which instead appears to have a lower level of protection. We would be grateful for confirmation from the State Party of the current protection status of the property, and in particular to confirm if the highest level of protection status could be provided to the nominated property.

4. The protection status of the Nominated Property

● **Background**

When the Chengjiang Fauna Geopark was established in 2001, functional zoning was developed in relation to the Technical Requirements for Geopark Planning. The 1,800 ha Chengjiang Fauna Geopark was classified into four zones (Fig. 23):

- **Special Protection Zone:** 120 ha (red on Fig. 23). This is the core protection area of the Geopark and tourist access is not permitted. Only approved research and management staff can access this zone, in order to carry out research and protection activities. No infrastructural facilities may be constructed in this zone.

- **Class I Protection Zone:** 215 ha (pink on Fig. 23). Only appropriate visitor trails and relevant facilities can be installed, as long as they are compatible and harmonious with the surrounding landscape and environment. Visits to this zone are controlled and automobiles are not permitted.

- **Class II and Class III Protection Zones:** Class II 587 ha (green on Fig. 23); Class III 878 ha (yellow on Fig. 23). These zones comprise the general protected area, where minimal geological service facilities can be installed. Constructions that are irrelevant to any appreciation of the geological landscape are restricted. All constructions and facilities should be in harmony with the landscape and the environment.

Fig. 23. Map showing the zoning of the Chengjiang Geopark and the relationship to the Nominated Property.

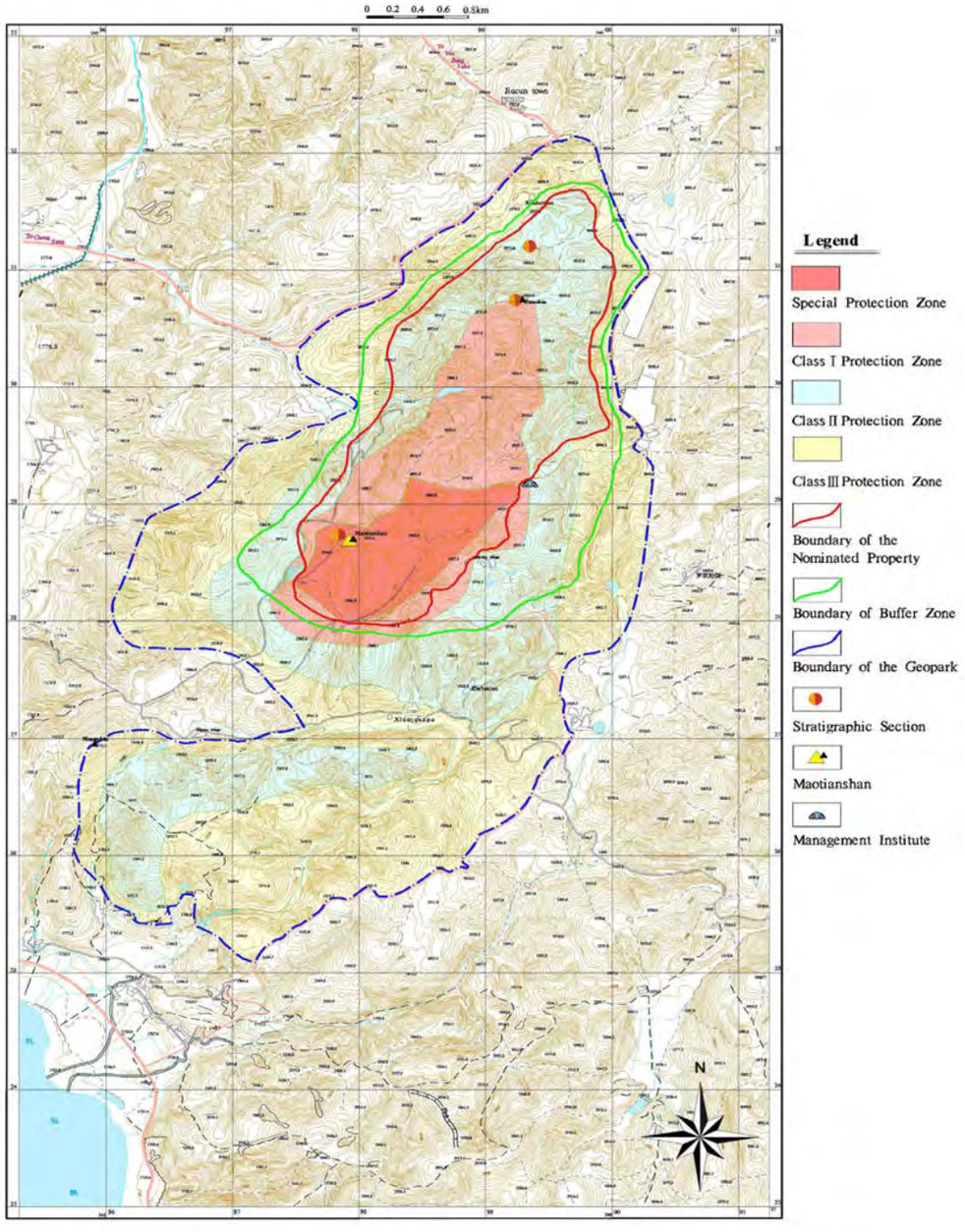


Figure 23 indicates that the Nominated Property covers:

- all of the Special Protection Zone (120 ha).
- almost all of the Class I Protection Zone (110 ha), with the exception of a narrow strip in the south and southeast where there is a road and mining activities have occurred.
- part of the Class II Protection Zone (182 ha) in the northern part of the Geopark.

● Revised protection requirements

When the Geopark was established in 2001, the Maotianshan site was considered to be of primary importance, because the first exceptionally preserved Chengjiang fossils were found there; the fossil-bearing strata are well exposed at this site and the natural features of the area are well represented. For these reasons, the Special Protection Zone and the Class I Protection Zone were limited to the area centered on Maotianshan.

The integrity conditions for nominated World Heritage properties, as set out in paragraphs 87-88 of the Operational Guidelines, impose different requirements. In this respect, the area centered on Maotiianshan is not of “adequate size to ensure the complete representation of the features and processes which convey the property’s significance”. In order to include “all elements necessary to express its outstanding universal value” such as a complete rock sequence, all important local fossil sites, the geological structure, and the nature of the landscape, the Nominated Property has been defined to include a larger area, ranging from Maotianshan to Xiaolantian (see nomination text: 3d-2). This area includes some land originally within the Class II protection zone.

It is recognized that the original zoning of the Geopark requires revision to coincide with the scope of the Nominated Property.

● Revised zoning

The Nominated Property is currently the area of the Geopark displaying the least effects of human impact (nomination text 3d-2). Since the launch of the World Heritage nomination in 2010, the entire Nominated Property has, in practice, been afforded the highest levels of protection and management.

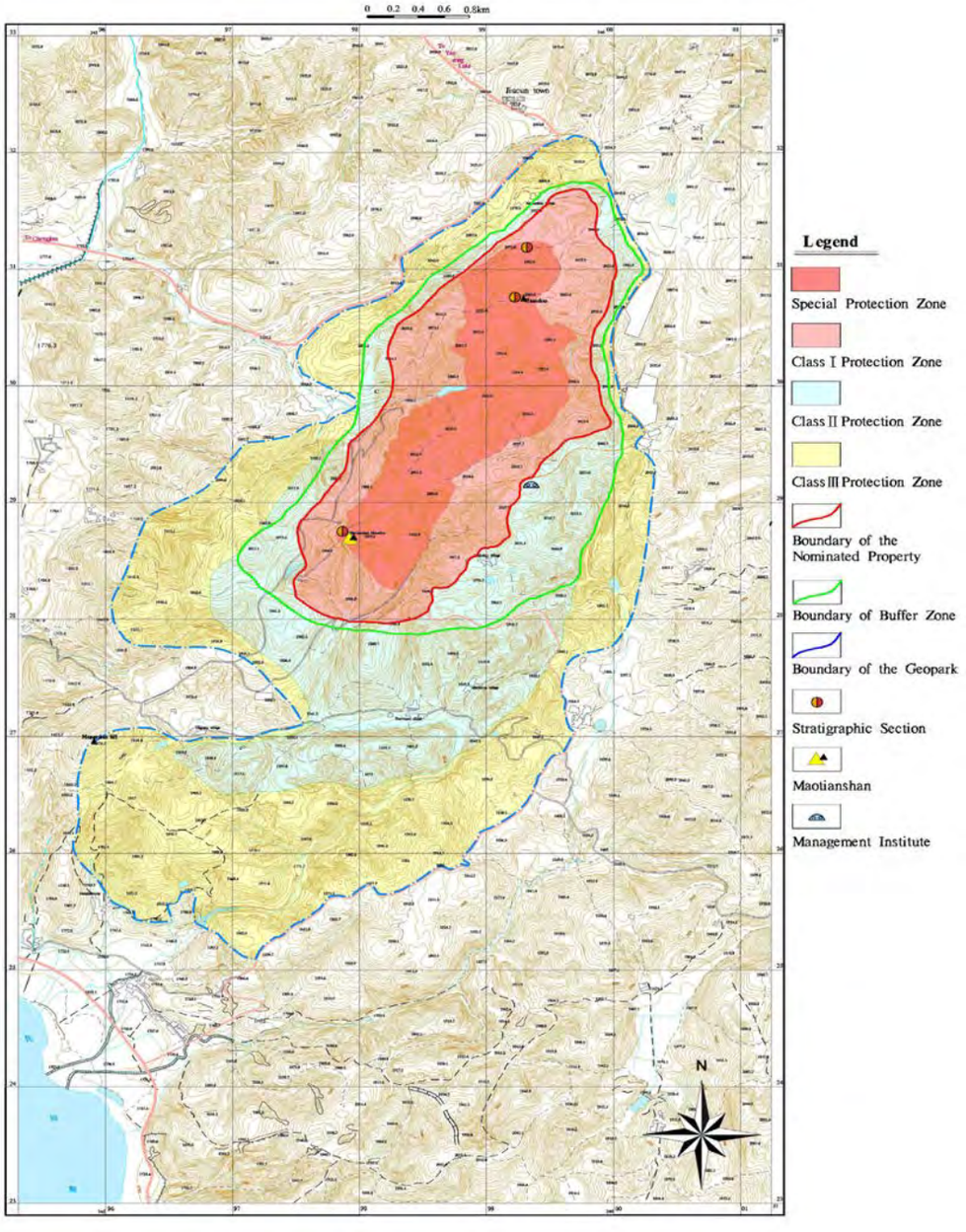
A revision of the zoning to reflect the protection requirements of the Nominated Property has now been implemented and approved by the Yunnan Provincial Department of Land and Resources (Annex 1).

The revised zoning is as follows (Fig. 24):

- the Special Protection Zone is enlarged to 215 ha;
- the Class I Protection Zone is enlarged to 297 ha, including the Ma'anshan and Xiaolantian areas in the north;
- the Class II Protection Zone is 587ha, and the Class III protection zone is 701 ha.

Figure 24 shows the relationship of the revised zoning of the Geopark to the Nominated Property, indicating that the area of the Special Protection Zone plus the Class I Protection Zone corresponds to the nominated property. The boundary of the Class I Protection Zone coincides with the boundary of the Nominated Property. The buffer zone is entirely within the Class II Protection Zone of the Geopark. This revised zoning guarantees the highest protection status for the Nominated Property.

Fig. 24. Map Showing the revised zoning of the Geopark and its relationship to the Nominated Property.



Annex: Approval document for the revision of the zoning of the Chengjiang Fauna Geopark.

云南省国土资源厅文件

云国土资〔2011〕282号

云南省国土资源厅关于澄江动物群古生物国家地质公园功能分区调整的意见

澄江动物化石群省级自然保护区管理委员会：

你委《关于调整澄江动物群古生物国家地质公园功能分区的请示》（澂管字〔2011〕23号）收悉，经我厅研究，意见如下：

一、澄江动物群国家地质公园功能分区于2002年划定，随着该区域研究程度不断提高，原有的功能分区已不适应保护与管理的需要，有必要根据2010年国土资源部颁布的《国家地质公园规划编制技术要求》进行调整。

二、经我厅组织专家论证，同意地质公园功能分区调整方案，即：特级保护区从原来的1.2平方千米变更为2.15平

方千米；一级保护区从原来的 2.15 平方千米变更为 2.97 平方千米；二级保护区范围调整后，面积仍为 5.87 平方千米；三级保护区从原来的 8.78 平方千米变更为 7.01 平方千米。调整后，地质公园的外围边界不变，总面积不变，仍为 18 平方千米。

三、调整后的功能分区中，特级保护区和一级保护区的总面积为 5.12 平方千米，其范围与世界遗产提名地一致。该区域是整个地质公园最重要的区域，要按规定给予高级别的保护。

四、你委要继续认真做好澄江动物群古生物化石的保护工作，维护其重要价值，保障其完整性，同时，进一步加强国家地质公园的管理。

二〇一一年十一月十日

主题词：国土资源　地质公园　区划　调整　意见

云南省国土资源厅办公室　　2011 年 11 月 11 日印制

打印：肖丽云　　校对：刁成宝　　共印 5 份

Document of Yunnan Provincial Department of Land and Resources

File No: [2011] 282,
Yunnan Provincial Department of Land and Resources

Opinion of Yunnan Provincial Department of Land and Resources on the Revision of the Functional Zoning of the Chengjiang Fauna National Geopark

Chengjiang Fauna National Geopark Management Committee:

The "Report on the Revision of the Functional Zoning of the Chengjiang Fauna National Geopark"（File No: [2011] 23,Chengjiang Geopark Management Committee）has been reviewed by the Yunnan Provincial Department of Land and Resources and the opinion is as follows:

1. The existing zoning of the Chengjiang Fauna Geopark was developed in 2002, studies in recent years indicates that the original zoning is incompatible with the protection and management requirement. In relation to the "Technical Requirements of General Planning Revision of National Geopark " issued by the Ministry of Land and Resources in 2010, it is necessary to revise the existing zoning of the Chengjiang geopark.

2. Base on the reviewing conclusion of expert penal, the department agrees with the revised zoning of the geopark, i.e. Special Protection Zone is changed from 120ha to 215ha; Class I Protection Zone is changed from 215ha to 297ha; Class II Protection Zone is changed in scope, its area is still 587ha; Class III Protection Zone is changed from 878ha to 701ha; After the revision, the outer boundary of the geopark remains unchanged, and the total area of the geopark remains unchanged, it is still 1800ha.

3. After the revision, the total area of the Special Protection Zone and the Class I Protection Zone is 512ha, which coincides with the scope nominated for world heritage status, this area is the most important area of the whole geopark and must be of highest protection.
4. Requires the Chengjiang Geopark Management Committee, taking the revision of functional zoning as an

opportunity, to better the protection of the geological relics, to maintain the park's important value, to safeguard its integrity and further strengthen the management.

Seal of the Yunnan Provincial Department of Land and Resources

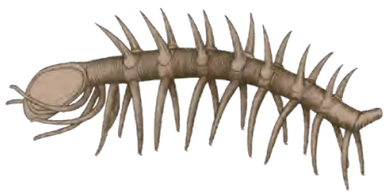
2011.11.10

World Heritage Nomination

Natural Heritage. China

Supplementary Information on the Nominated World Natural Heritage:

Chengjiang Fossil Site



Ministry of Housing and Urban-Rural Development

of the People's Republic of China

November, 2011

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12 October 2011

IUCN Evaluation of Chengjiang Fossil Site (China) – Nominated for inclusion on the World Heritage List

Dear Ambassador,

The IUCN World Heritage technical evaluation mission to the Chengjiang Fossil Site, China, was undertaken by Prof. Dr. Patrick McKeever and Prof. Dr. Mohd Shafeea Leman from 23 to 27 September 2011. The evaluators greatly appreciated the excellent support and co-operation provided by you and your colleagues in the preparation and implementation of the mission, and the kind welcome by the State Party throughout the mission. Please convey our sincere thanks to all of the officials, scientists and contributors that assisted the evaluators in undertaking the mission.

The IUCN World Heritage Panel will meet in Gland, Switzerland, in late November / early December 2011 to examine World Heritage nominations for natural and mixed properties, and cultural landscapes. The IUCN Panel will examine in detail each nomination dossier from the State Party, reports and desktop reviews of field evaluators and external reviewers, and other references regarding the nominated properties.

As noted in previous correspondence, IUCN seeks to develop and maintain a dialogue with States Parties during the evaluation process. To help the IUCN World Heritage Panel's discussions, following the discussions held during the mission, we would like to kindly ask for clarification of the four points listed hereafter.

1. Location of important fossil finds: We would appreciate clarification on the actual palaeontological content of the nominated site. Following discussions during the mission, it appears that at least some of the fossils listed in the nomination dossier were not identified within its boundary, but rather from sites that are some distance from the nominated property. Most notably, some of the key fossils noted come from Haikou (some 60km away at least). Haikou was noted as an area of very active mining and therefore it is not possible to include this area in a World Heritage nomination. We would be grateful if the State Party would clarify which of the important fossils listed in the nomination actually come from the nominated property itself according to the current state of their knowledge (noting many fossils collected from the nominated property have not yet been studied and, therefore, have not yet been identified). Once this is done, we would also be grateful for the State Party comments on whether a revised comparative analysis would need to be prepared, considering only the fossil values included within the nominated property.

2. Trackway construction at Xiaolantian: At the main Xiaolantian section, it was noted that a wide trackway has been excavated into the section had been constructed recently. It would appear that this trackway may have damaged the geological significance of the site, and notably the possibility of being able to find fossils in-situ in an undisturbed geological setting. The path may also create a risk that during periods of heavy rainfall it could act as a channel for rainfall and may cause excessive erosion. We would be grateful for the assessment of the State Party regarding this path, the extent to which it has damaged the exposures, and how further damage might be avoided. We recommend careful assessment of any further interventions in the site, prior to their implementation.

3. Museum Building at Maotianshan: The mission also noted a concern of possible damage at the Maotianshan site, the site of the important fossil find back in 1984. Here a small museum has been built over part of the site, but it is inevitable that during the building of this structure will have impacted much of the rock section. We would be grateful for the comment of the State Party regarding the extent to which the geological values of this exposure have been impacted by this building.

4. Protection status of the nominated property: We would be grateful for clarification regarding the protection the nominated property actually has. The mission noted that the nominated property sites entirely within a national Chinese geopark. Under the national geopark system in China, it is understood that geoparks are zoned into areas of complete protection, areas of some less protection, areas suitable for tourism development etc. In the case of Chengjiang Fossil National Park, the area of highest level protection does not appear to coincide with the nominated property, which instead appears to have a lower level of protection. We would be grateful for confirmation from the State Party of the current protection status of the property, and in particular to confirm if the highest level of protection status could be provided to the nominated property.

Supplementary information should be submitted officially in three copies to the UNESCO World Heritage Centre in order for it to be registered as part of the nomination. An electronic copy of any supplementary information to both the UNESCO World Heritage Centre and IUCN Headquarters would also be helpful.

We would appreciate your response to the above points as soon as possible. In order to facilitate the evaluation process **it would be most useful to have your response before the IUCN Word Heritage Panel convenes (28 November - 02 December 2011), but no later than the 28 February 2012**, as per paragraph 148 of the Operational Guidelines. Please note that any information submitted after this date may not be considered by IUCN in its evaluation for the World Heritage Committee. It should be noted, however, that while IUCN will carefully consider any supplementary information submitted, it cannot properly evaluate a completely revised nomination or large amounts of new information submitted at the last minute. So we request to keep your response concise and respond only to the above requests.

Taking into account your response, IUCN will formulate its final recommendation to the World Heritage Committee which will meet from 25 June to 5 July 2012 in St. Petersburg, Russian Federation.

Please do not hesitate to contact Mr. Tilman Jaeger, World Heritage Programme Officer, if you have any questions with respect to this request for supplementary information (Tel: + 41 22 999 0158; Fax: +41 22 999 0002; Email: tilman.jaeger@iucn.org).

Let me again reiterate our thanks for your support of the World Heritage Convention and for the conduct of IUCN's recent mission. We look forward to your kind cooperation in furnishing responses to the abovementioned points.

Yours sincerely,

Tim Badman
Director - World Heritage Programme

Cc. Chinese National Commission for UNESCO, Mr Fang Maotian, Secretary-General
Ms Zuo Xiaoping, MoHURD
UNESCO World Heritage Centre, Mr Jing Feng and Mr Alessandro Balsamo
Ms Aban Marker Kabraji, IUCN Asia Regional Office, Regional Director
Prof. Dr. Patrick McKeever and Prof. Dr. Mohd Shafeea Leman

Contents

Supplementary information on the Nominated World Natural Heritage: Chengjiang Fossil Site

1. Location of important fossil finds: We would appreciate clarification on the actual palaeontological content of the nominated site. Following discussions during the mission, it appears that at least some of the fossils listed in the nomination dossier were not identified within its boundary, but rather from sites that are some distance from the nominated property. Most notably, some of the key fossils noted come from Haikou (some 60 km away at least). Haikou was noted as an area of very active mining and therefore it is not possible to include this area in a World Heritage nomination. We would be grateful if the State Party would clarify which of the important fossils listed in the nomination actually come from the nominated property itself according to current state of their knowledge (noting many fossils collected from the nominated property have not yet been studied and, therefore, have not yet been identified). Once this is done, we would also be grateful for the State Party comments on whether a revised comparative analysis would need to be prepared, considering only the fossil values included within the nominated property.

1. Concerning the location of important fossil finds

- **Clarified fossil list of the Nominated Chengjiang Fossil Site**

As described in the nomination text, from the discovery of the Chengjiang Lagerstätte in 1984 up to 2010, the fossils recorded in the biota comprise at least 200 species (about 160 new) of 170 genera (almost 150 new) of 16 phyla; some 32 of these species are enigmatic and cannot yet be assigned to a phylum. A full fossil list of the biota is given in the submitted nomination text: Table 2-2; and Appendix 4: Inventory.

As indicated in the nomination text, these 200 species of the Chengjiang biota have come from about 10 localities in eastern Yunnan Province (nomination text: 3.d-3： Area of site and related matters). A clarification of the fossil species actually found in the Nominated Chengjiang Fossil Site is presented below (Table 1); this list has been compiled through collaborative work between Chinese and international experts.

- **Of the 200 species, at least 152 species (of which 100 are new and have their type localities within the nominated site) of 132 genera (about 80 new) representing more than 13 phyla have been found at the Nominated Chengjiang Fossil Site (Table 1).**

Table 1. Fossils of the Nominated Chengjiang Fossil Site

(★= TYPE LOCALITY IS WITHIN THE NOMINATED CHENGJIANG FOSSIL SITE)

No.	Algae
001	*Fuxianospira gyrata* Chen & Zhou, 1997 ★
002	*Megaspirellus houi* Chen & Erdtmann, 1991 ★
003	*Punctariopsis latifolia* Xu, 2001
004	*Punctariopsis simplex* Xu, 2001
005	*Sinocylindra yunnanensis* Chen & Erdtmann, 1991★
006	*Yuknessia* sp. of Chen & Erdtmann, 1991 Regarded as coprolites by Steiner *et al.*, 2005
	Phylum Porifera
007	*Allantospongia mica* Rigby & Hou, 1995★
008	*Choia carteri* Walcott, 1920
009	*Choia xiaolantianensis* Hou *et al.*, 1999★
010	*Choiaella radiata* Rigby & Hou, 1995★
011	*Crumillospongia biporosa* Rigby, 1986★
012	*Halichondrites ellisa* Walcott, 1920
013	*Hazelia palmata* Walcott, 1920
014	*Leptomitella conica* Chen, Hou & Lu, 1989★
015	*Leptomitella confusa* Chen, Hou & Lu, 1989★
016	*Leptomitella metta* (Rigby, 1983)
017	*Leptomitus teretiusculus* Chen, Hou & Lu, 1989★
018	*Paraleptomitella dictyodroma* Chen, Hou & Lu, 1989★
019	*Paraleptomitella globula* Chen, Hou & Lu, 1989★
020	*Quadrolaminiella crassa* Chen, Hou & Li, 1990★
021	*Quadrolaminiella diagonalis* Chen, Hou & Li, 1990★
022	*Saetaspongia densa* Mehl & Reitner *in* Steiner *et al.*, 1993★
023	*Takakkawia lineata* Walcott, 1920
024	*Triticispongia diagonata* Mehl & Reitner *in* Steiner *et al.*, 1993★
	Phylum Cnidaria
025	*Xianguangia sinica* Chen & Erdtmann, 1991★
	Phylum Ctenophora
026	*Maotianoascus octonarius* Chen & Zhou, 1997★
027	*Sinoascus papillatus* Chen & Zhou, 1997★
028	*Yunnanoascus haikouensis* Hu *et al.*, 2007

	Phylum Nematomorpha
029	*Cricocosmia jinningensis* Hou & Sun, 1988
030	*Maotianshania cylindrica* Sun & Hou, 1987★
031	*Palaeoscolex sinensis* Hou & Sun, 1988★
032	*Sabellidites yunnanensis* Luo & Zhang, 1986
033	*Tabelliscolex hexagonus* Han, Zhang & Shu, 2003★
	Phylum Priapulida
034	*Acosmia maotiania* Chen & Zhou, 1997★
035	*Archotuba conoidalis* Hou *et al*., 1999★(? = *Selkirkia*? *elongata* Luo & Hu *in* Luo *et al*., 1999)
036	*Omnidens amplus* Hou, Bergström & Yang, 2006★
037	*Palaeopriapulites parvus* Hou *et al*., 1999★
038	*Paraselkirkia jinningensis* Hou *et al*., 1999 (? = *Selkirkia sinica* Luo & Hu *in* Luo *et al*., 1999)
039	*Protopriapulites haikouensis* Hou *et al*., 1999 (= *Sicyophorus rara* Luo & Hu *in* Luo *et al*., 1999)
	Phylum Annelida
040	*Maotianchaeta fuxianella* Chen, 2004★
	Phylum Hyolitha
041	*Ambrolinevitus maximus* Jiang, 1982
042	*Ambrolinevitus meishucunensis* Jiang, 1994★
043	*Ambrolinevitus platypluteus* Qian, 1978
044	*Ambrolinevitus ventricosus* Qian, 1978
045	*Burithes yunnanensis* Hou *et al*., 1999★(? = *Glossolites magnus* Luo & Hu *in* Luo *et al*., 1999)
046	*Linevitus flabellaris* Qian, 1978
047	*Linevitus opimus* Yu, 1974
	Phylum Mollusca
048	*Helcionella yunnanensis* Zhang & Babcock, 2002★
049	*Petalilium latus* Luo & Hu in Luo *et al*., 1999
	Phylum Lobopodia
050	*Cardiodictyon catenulum* Hou, Ramsköld & Bergström, 1991★
051	*Hallucigenia fortis* Hou & Bergström, 1995★
052	*Luolishania longicruris* Hou & Chen, 1989★
053	*Microdictyon sinicum* Chen, Hou & Lu, 1989★
054	*Onychodictyon ferox* Hou, Ramsköld & Bergström, 1991★
055	*Paucipodia inermis* Chen, Zhou & Ramsköld, 1995★
	Phylum Arthropoda (including Anomalocarididae♦)
056	*Acanthomeridion serratum* Hou, Chen & Lu, 1989★
057	*Almenia spinosa* Hou & Bergström, 1997★
058	*Amplectobelua symbrachiata* Hou, Bergström & Ahlberg, 1995♦★
059	*Anomalocaris saron* Hou, Bergström & Ahlberg, 1995♦★

060	*Anomalocaris* sp. of Hou, Bergström & Ahlberg, 1995♦
061	*Branchiocaris*? *yunnanensis* Hou, 1987★
062	*Canadaspis laevigata* (Hou & Bergström, 1991)★(=*Canadaspis eucallus* Chen & Zhou, 1997; =*Perspicaris*? sp. of Hou 1987; ? = *Yiliangocaris ellipticus* Luo & Hu *in* Luo *et al*., 1999)
063	*Chengjiangocaris longiformis* Hou & Bergström, 1991★(*Cambrofengia yunnanensis* Hou *et al*., 1999 may be detached appendages)
064	*Cindarella eucalla* Chen, Ramsköld, Edgecombe & Zhou *in* Chen *et al*., 1996★
065	*Clypecaris pteroidea* Hou, 1999★(? =*Ercaicunia multinodosa* Luo & Hu *in* Luo *et al*., 1999)
066	*Combinivalvula chengjiangensis* Hou, 1987★
067	*Comptaluta inflata* (Zhang, 1974)
068	*Comptaluta leshanensis* (Lee, 1975)
069	*Cucumericrus decoratus* Hou, Bergström & Ahlberg, 1995♦★
070	*Diplopyge forcipatus* Luo & Hu in Luo *et al*., 1999
071	*Diplopyge minutus* Luo & Hu in Luo *et al*., 1999
072	*Dongshanocaris foliiformis* (Hou & Bergström, 1998)★
073	*Eoredlichia intermedia* (Lu, 1940)
074	*Forfexicaris valida* Hou, 1999★
075	*Fortiforceps foliosa* Hou & Bergström, 1997★
076	*Fuxianhuia protensa* Hou, 1987★
077	*Isoxys auritus* (Jiang, 1982)
078	*Isoxys curvirostratus* Vannier & Chen, 2000★
079	*Isoxys paradoxus* Hou, 1987★(? = *Isoxys elongatus* Luo & Hu *in* Luo *et al*., 1999)
080	*Jianfengia multisegmentalis* Hou, 1987★
081	*Jiucunella paulula* Hou & Bergström, 1991★
082	*Kuamaia lata* Hou, 1987★
083	*Kuamaia muricata* Hou & Bergström, 1997★
084	*Kuanyangia pustulosa* (Lu, 1941)
085	*Kunmingella douvillei* (Mansuy, 1912)
086	*Kunmingella typica* Huo & Shu, 1985★
087	*Kunyangella cheni* Huo, 1965
088	*Kwanyinaspis maotianshanensis* Zhang & Shu, 2005★
089	*Leanchoilia illecebrosa* (Hou, 1987)★(=*Dianchia mirabilis* Luo & Hu *in* Luo *et al*., 1997; =*Leanchoilia asiatica* Luo & Hu *in* Luo *et al*., 1997; =*Yohoia sinensis* Luo & Hu *in* Luo *et al*., 1997; ? =*Zhongxinia speciosa* Luo & Hu *in* Luo *et al*., 1997; ?=*Apiocephalus elegans* Luo & Hu *in* Luo *et al*., 1999)
090	*Liangshanella liangshanensis* Huo, 1956
091	*Naraoia longicaudata* Zhang & Hou, 1985★
092	*Naraoia spinosa* Zhang & Hou, 1985★
093	*Occacaris oviformis* Hou, 1999★
094	*Odaraia*? *eurypetala* Hou & Sun, 1988★(? =*Glossocaris oculatus* Luo & Hu *in* Luo *et al*., 1999)
095	*Ovalicephalus mirabilis* Luo & Hu *in* Chen *et al*., 2002
096	*Parapaleomerus sinensis* Hou *et al*., 1999★
097	*Parapeytoia yunnanensis* Hou, Bergström & Ahlberg, 1995♦★
098	*Pectocaris spatiosa* Hou, 1999★

099	*Pisinnocaris subconigera* Hou & Bergström, 1998★(? = *Jianshania furcatus* Luo & Hu *et al.* 1999)
100	*Primicaris larvaformis* Zhang *et al.*, 2003★
101	*Pseudoiulia cambriensis* Hou & Bergström, 1998★
102	*Pygmaclypeatus daziensis* Zhang, Han & Shu, 2000
103	*Retifacies abnormalis* Hou, Chen & Lu, 1989★(= *Retifacies longispinus* Luo & Hu *in* Luo *et al.*, 1997; = *Tuzoia* sp. of Shu 1990)
104	*Rhombicalvaria acantha* Hou, 1987★
105	*Saperion glumaceum* Hou, Ramsköld & Bergström, 1991★
106	*Shankouia zhenghei* Chen *et al.*, 2004
107	*Sidneyia sinica* Zhang & Shu *in* Zhang, Han & Shu, 2002★
108	*Sinoburius lunaris* Hou, Ramsköld & Bergström, 1991★
109	*Skioldia aldna* Hou & Bergström, 1997★
110	*Squamacula clypeata* Hou & Bergström, 1997★
111	*Sunella* cf. *shenensis* (Huo, 1965)
112	*Synophalos xynos* Hou *et al.*, 2009
113	*Syrrhaptis intestinalis* Luo & Hu in Luo *et al.*, 1999
114	*Tanglangia longicaudata* Luo & Hu *in* Luo *et al.*, 1999
115	*Tsunyidiscus aclis* Zhou *in* Lee *et al.*, 1975
116	*Tsunyidiscus niutitangensis* (Chang, 1964)
117	*Tsunyiella diandongensis* Tong *in* Huo & Shu, 1985★
118	? *Tuzoia sinensis* Pan, 1957 (? = *Tuzoia limba* Shu, 1990)
119	*Urokodia aequalis* Hou, Chen & Lu, 1989★
120	*Waptia ovata* (Lee, 1975)
121	*Wutingaspis tingi* Kobayashi, 1944
122	*Wutingella binodosa* Zhang, 1974
123	*Xandarella spectaculum* Hou, Ramsköld & Bergström, 1991★
124	*Yunnanocaris megista* Hou, 1999★
125	*Yunnanocephalus yunnanensis* (Mansuy, 1912) ★
	Phylum Phoronida
126	*Eophoronis chengjiangensis* Chen, 2004★
127	*Iotuba chengjiangensis* Chen & Zhou, 1997★
	Phylum Brachiopoda
128	*Diandongia pista* Rong, 1974
129	*Heliomedusa orienta* Sun & Hou, 1987★
130	*Lingulella chengjiangensis* Jin, Hou & Wang, 1993★
131	*Lingulellotreta malongensis* (Rong, 1974)
132	*Longtancunella chengjiangensis* Hou *et al.*, 1999★
	Phylum Chordata
133	*Cathaymyrus diadexus* Shu, Conway Morris & Zhang, 1996★
134	? *Zhongxiniscus intermedius* Luo & Hu *in* Luo *et al.*, 2001

	Uncertain systematic position
135	*Allonnia phrixothrix* Bengtson & Hou, 2001★(=*Allonnia junyuani* Janussen *et al.,* 2002)
136	*Batofasciculus ramificans* Hou *et al*., 1999★
137	*Chancelloria eros* Walcott, 1920
138	*Cotyledion tylodes* Luo & Hu *in* Luo *et al*., 1999★(? = *Cambrotentacus sanwuia* Zhang & Shu *in* Zhang *et al*., 2001)
139	*Dinomischus venustus* Chen, Hou & Lu, 1989★
140	*Eldonia eumorpha* (Sun & Hou, 1987) ★(= *Yunnanomedusa eleganta* Sun & Hou, 1987)
141	*Facivermis yunnanicus* Hou & Chen, 1989★
142	*Heteromorphus confusus* (Chen & Zhou, 1997)★(? =*Heteromorphus longicaudatus* Luo & Hu *in* Luo *et al*., 1999)
143	*Jiucunia petalina* Hou *et al*., 1999★
144	*Maanshania crusticeps* Hou *et al*., 1999★
145	*Parvulonoda dubia* Rigby & Hou, 1995★
146	*Pomatrum ventralis* Luo & Hu *in* Luo *et al*., 1999 (*Xidazoon stephanus* Shu, Conway Morris & Zhang *in* Shu *et al*., 1999)
147	*Rotadiscus grandis* Sun & Hou, 1987★
148	*Stromatoveris psygmogien* Shu et al., 2006
149	*Vetulicola cuneata* Hou, 1987★
150	*Vetulicola rectangulata* Luo & Hu *in* Luo *et al*., 1999
151	*Yunnanozoon lividum* Hou, Ramsköld & Bergström, 1991 (=*Haikouella lanceolata* Chen *et al*., 1999) ★
152	*Yuyuanozoon magnificissimi* Chen, Feng & Zhu in Chen et al. 2003★

● Comparative analysis

This comparative analysis is based on taxa reported from within the boundaries of the Nominated Site (see Table 1). The Chengjiang biota is also represented outside the site boundaries, both in the immediate area and at localities further afield in southern Yunnan, such as those at Haikou, Jinning and Anning. Several important fossils have been found in the Haikou region, from strata in the lower part of the Yu'anshan Member; the middle and upper parts of the member are not present at Haikou. The strata that have been studied in the Nominated Chengjjiang Site are predominantly stratigraphically higher than those at Haikou. However, strata equivalent to those at Haikou, representing the lower Yu'anshan Member, are present at the Nominated Site. The clearances in 2011 at the Xiaolantian locality, undertaken as part of the conservation improvements in the area, display these strata well. Fossil collections have not yet been made in these lower strata within the Chengjiang site, because collecting there was terminated in 1997 for conservation reasons. Some 20 species that were first reported from the Chengjiang biota outside the Nominated Site have subsequently

been identified in collections made within the Nominated Site before 1997. It is, therefore, highly probable that additional taxa (including vertebrates) currently known only from outside the Nominated Site boundaries are present in strata within the site.

In the nomination text, extensive comparative analyses have been made between the Chengjiang Fossil Site and other palaeontological sites in the world (3.c Comparative analysis). Restriction of the fossil list to species found to date within the Nominated Chengjiang Fossil Site does not affect the comparative analyses already made with all of these other sites except the Burgess Shale, as these sites are very different in both geological period and fossil content. Following the clarification of the fossil list, it is valuable to present a more detailed comparative analysis with the most similar site, the Burgess Shale, which also has great significance in preserving a complementary record of the Cambrian Explosion.

● Detailed comparative analysis with the Burgess Shale

Table 2. Comparison of fossils of the Chengjiang and Burgess Shale sites

	Nominated Chengjiang Site	**Burgess Shale Site**
Discovery	1984, by Hou Xian-guang (Geologist, then of Nanjing Institute of Palaeontology and Stratigraphy)	1909, by Charles Walcott (Scientist; Smithsonian Institution, Washington)
Location	Chengjiang County, Yunnan Province, SW China	Near Banff, Rocky Mountains, British Columbia, Canada
Geographical Extent	A core area and buffer zone centred on Maotianshan, 7 km east of Chengjiang, forming part of a large sedimentary basin several 1000 km^2 in extent that contains numerous other localities yielding the Chengjiang biota	Walcott Quarry and some associated, adjacent sites, now forming part of the Rocky Mountains World Heritage site
Age and rock units	Lower Cambrian (Series 2): Qiongzhusian Stage, Qiongzhusi Formation, Yu'anshan Member, *Eoredlichia-Wutingaspis* Biozone	Middle Cambrian (Series 3):Stephen Formation
Palaeogeographical setting	On South China Plate, situated in tropical/subtropical latitudes, off northern edge of Gondwana	On NW margin of Laurentia, subtropical latitudes, western hemisphere

	(supercontinent), eastern hemisphere	
Local geological setting/depositional environment; sediments	Lower shoreface to proximally offshore; fine, yellow-weathering grey mudstones	Seawards (in front) of a submarine escarpment which represents the platform margin; fine, dark grey to black shales
Major groups present; numbers of genera, species and specimens	Algae; invertebrates and chordates, representing at least 13 phyla, including Porifera, Cnidaria, Ctenophora, Nematomorpha, Priapulida, Lobopodia, Arthropoda, Annelida, Brachiopoda, Phoronida, Hyolitha, Mollusca, Chordata (including Vertebrata at Haikou), and enigmatic animals (including yunannozoons, vetulicolians (banffozoans and vetulicolids), eldoniids); more than 130 genera and 150 species, nearly all species endemic; arthropods dominate, sponges also species-rich; over 100,000 specimens	Algae; invertebrates and chordates, representing at least 13 phyla, including Porifera, Cnidaria, Ctenophora, Priapulida, Lobopodia, Arthropoda, Annelida, Brachiopoda, Hyolitha, Mollusca, Chaetognatha, Echinodermata, Chordata, and enigmatic animals (including vetulicolians (banffozoans), eldoniids); some 140 genera and 170 species; nearly all species endemic, arthropods dominate, sponges also species-rich; over 100, 000 specimens
Palaeoecology	Muddy, level bottom community. Indicates that, at this very early stage of metazoan radiation, a complex ecosystem was already developed, with occupation of all major marine biotopes except for the deep infaunal	Muddy, level bottom community. Indicates complex ecosystem, and occupation of all major marine biotopes except for the deep infaunal
Preservation of fossils	Flattened with some relief. Exceptional, soft-part and whole soft bodied preservation. Conservation of organic carbon, with widespread pyritisation, and subsequent oxidation through recent, tropical weathering	Flattened with some relief. Exceptional, soft-part and whole soft bodied preservation. Conservation of organic carbon, with clay mineral replication and replacement, and subsequent greenschist stage metamorphism
Significance	Exceptional, soft-tissue preservation of a diverse fauna of invertebrates and of vertebrates (at Haikou). Represents the earliest evidence in the fossil record of the metazoan radiation phase of the Cambrian explosion	Exceptional, soft-tissue preservation of a diverse fauna of invertebrates. Represents an early stage of the appearance of metazoans in the fossil record, in the later part of the Cambrian explosion event.

	event. Provides critical information for palaeobiological and evolutionary studies	Provides critical information for palaeobiological and evolutionary studies
Repositories with significant holdings of material	Key Laboratory for Palaeobiology, Yunnan University, Kunming; Chengjiang County Museum and Maotianshan Museum/Field Station, Chengjiang; Nanjing Institute of Palaeontology and Stratigraphy, Nanjing; Early Life Centre, Northwest University, Xi'an	Smithsonian Institution, Washington; Royal Ontario Museum, Toronto

The Nominated Chengjiang Site and the Burgess Shale site are close in age (early Cambrian and mid-Cambrian, respectively) and both contain exceptionally preserved fossils. Detailed comparisons are presented below to demonstrate the importance of both sites and to emphasise the fundamentally different and essential record provided by the fossils from the Nominated Chengjiang Site.

- The biotas represented at the Chengjiang and Burgess sites are virtually mutally exclusive at species level. Of the 152 species listed here from the Nominated Chengjiang Site, only six (five sponges and a chancelloriid) have also been found in the Burgess Shale. Most of the enigmatic animals characteristic of the Chengjiang site (e.g. *Vetulicola, Yunnanozoon*, *Dinomischus*, *Batofasciculus*, *Facivermis*), which have the potential to elucidate the stem-group evolution of major higher taxa, have no counterparts in the Burgess Shale biota.

- The Nominated Chengjiang Site represents Cambrian life some 10 million years earlier than that at the Burgess Shale site; this was an interval of unparalleled ('explosive') evolutionary change, so this time difference is exceedingly significant. The fauna at the two sites show similarities at phylum level: all phyla found in the Burgess Shale appear to be represented in the Chengjiang biota, which also contains nematomorphs, phoronids, yunnanozoans, vetulicolids and, at Haikou, sipunculans and (the earliest) representatives of Vertebrata. However, the Chengjiang site records an earlier stage in the development of all these major groups, and has yielded many key fossils that provide evidence for the pattern and process of the acquisition of the diagnostic characters of phyla and of supra-phylum groupings. A highly

important aspect of the Chengjiang biota is that it contains fossils that shed major light on the early evolution and relationships of the deuterostomes, including evidence from the earliest known chordates and from putatively related groups (vetulicolians, yunnanozoons). Additionally, there are many more lobopod and non-trilobite arthropod species recorded from the Nominated Chengjiang Site than at the Burgess Shale; these Chengjiang taxa are crucial in resolving basal arthropod inter-relationships and in elucidating the origin and evolution of the arthropod body plan. Some of the lobopods provide fundamental evidence bearing on the question of the origin and relationships of the phylum Onycophora.

- The Chengjiang biota also differs from the Burgess Shale biota in the almost total absence of polychaete (annelid) worms (one species based on a single specimen). At Burgess they are relatively numerous and are assigned to at least five species. This difference may be related to evolution rather than ecology, and putatively provides an illustration of the importance of the time difference between the two biotas.

- Palaeoecologically, the biota of the Nominated Chengjiang Site occupied a shallow-water environment, and there was little post-mortem transport or decomposition of the animals. It provides the earliest representation in the fossil record of a complex animal community. Some specimens are clearly preserved in life position, for example brachiopods attached by pedicles to other animals and *Cotyledion* epibionts on *Vetulicola*. Arthropods from the Nominated Chengjiang Site and Haikou have, furthermore, furnished the earliest known example of collective behaviour in the animal kingdom. Similar specimens have not been recorded from the Burgess Shale.

- Different minerals are involved in the preservation of the two faunas: iron pyrite and organic carbon are important at Chengjiang, whereas clays with organic carbon are important at Burgess, so some of the anatomical information preserved differs. For example, pedicles of brachiopods are commonly well preserved in the fossils from the Nominated Chengjiang Site, but not in the Burgess Shale. Similarly, the unique preservation of appendages in species of bradoriids from the Nominated Chengjiang Site has allowed phylogenetic resolution of this globally common group of Cambrian arthropods as stem Crustacea.

Clearly, in many ways the Nominated Chengjiang Site better represents the diversification of life during the Cambrian explosion than the Burgess Shale site. However, and critically, the two faunas complement each other in providing two different windows in time on the Cambrian explosion, with two different biotas, and both are essential for our understanding of this benchmark episode in the history of life.

2. Trackway construction at Xiaolantian: At the main Xiaolantian section, it was noted that a wide trackway has been excavated into the section had been constructed recently. It would appear that this trackway may have damaged the geological significance of the site, and notably the possibility of being able to find fossils in-situ in an undisturbed geological setting. The path may also create a risk that during periods of heavy rainfall it could act as a channel for rainfall and may cause excessive erosion. We would be grateful for the assessment of the State Party regarding this path, the extent to which it has damaged the exposures, and how further damage might be avoided. We recommend careful assessment of any further interventions in the site, prior to their implementation.

2. The trackway at Xiaolantian

● **Background**

The Xiaolantian section is located in the northern part of both the Nominated Property and also the Chengjiang Fauna Geopark (Fig. 1). The section is well known because nearly 40 species have been discovered there between the late 1980s and early 1990s. Since 1997, fossil collecting has been prohibited in the Xiaolantian area due to strengthened conservation regulations in the Geopark as a whole.

Fig. 1. Location of the Xiaolantian section in the nominated property.

Following indication from the World Heritage Center of the intended IUCN field visit, in order to display a complete rock section for evaluation within the nominated site, and also to establish a representative section for the Geopark, the park management body began (March 2011) to prepare the section at Xiaolantian.

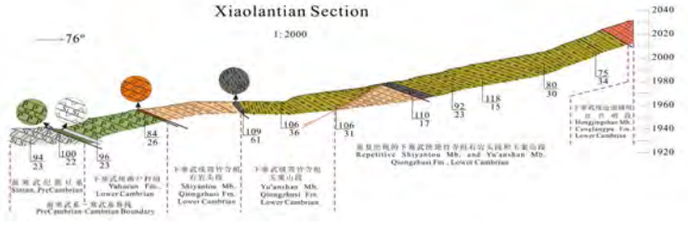


Fig. 2. Geology of the section at Xiaolantian.

Fig. 3. Panoramic view of the cleared section (near-middle distance)

The cleared section, stretching along the north side of the Xiaolantian valley, is 485 m long (Figs 2, 3). A 1-1.5 m wide trackway was cleaned along the route of the previous track. In addition, the arable land in the valley bottom was returned to grassland.

● Impact on the rock exposure

In order to assess the impact of the improved trackway in exposing the geology of the Xiaolantian area, it is necessary to indicate the situation before cleaning took place. Prior to 2010, the Xiaolantian section was a shallow, abandoned fossil quarry mostly covered by rock debris and topsoil; nearby were patches of farmland (Figs 4, 5).

Fig. 4. Xiaolantian section in 1994, showing (far distance) the fossil quarry, and in the upper part of the hillside the track.

Fig. 5. Xiaolantian valley in 2010, showing the section and nearby farmland.

The Xiaolantian section can be divided into three parts:

- The upper part (22 m) comprises siltstones of the Hongjingshao Member, Canglangpu Formation (ϵ_{1c}). They are well exposed due to their resistance to weathering (Fig. 6).

Fig. 6. Upper part of the Xiaolantian section.

- The middle part (260 m) consists of mudstones of the Yu'anshan Member, Qiongzhusi Formation (ϵ_{1q}^{2}). These were previously largely covered by rock debris 1-2 m thick, and cut into by a shallow gully representing the remains of the fossil quarry (Fig. 7).

Fig. 7. Middle part of the Xiaolantian section.

• The lower part (203 m) comprises siltstones of the Shiyantou Member, Qiongzhusi Formation (ϵ_{1q}^{1}) and phosphorite of the Zhongyicun Member, Yuhucun Formation (ϵ_{1y}^{4}). This part was covered by topsoil and grass (Fig. 8).

Fig. 8. Lower part of the Xiaolantian section.

The purpose of the section renovation was to remove overlying topsoil and debris and expose bedrock.

- **Results**

• The upper part (22 m) remains relatively untouched in comparison with other parts of the section, as the rock is naturally exposed (Figs 9, 10).

• The middle part (260 m) was made available by removing overlying debris (Figs 11, 12).

• The lower part (203 m) was made available by stripping off the topsoil on the side-slope along the existing Xiaolantian track (Figs 13, 14).

Fig. 9. Upper part of the Xiaolantian section before cleaning (March 2011).

Fig. 10. Upper part of the Xiaolantian section after cleaning (September 2011).

Fig. 11. Middle part of the Xiaolantian section before cleaning (March 2011).

Fig. 12. Middle part of the Xiaolantian section after cleaning (September 2011).

Fig. 13. Lower part of the Xiaolantian section before cleaning (March 2011).

Fig. 14. Lower part of the Xiaolantian section after cleaning (September 2011).

Fig. 15. Distant view of the Xiaolantian valley prior to renovation work (2010).

Fig. 16. Distant view of the Xiaolantian valley after the section was cleaned (September 2011).

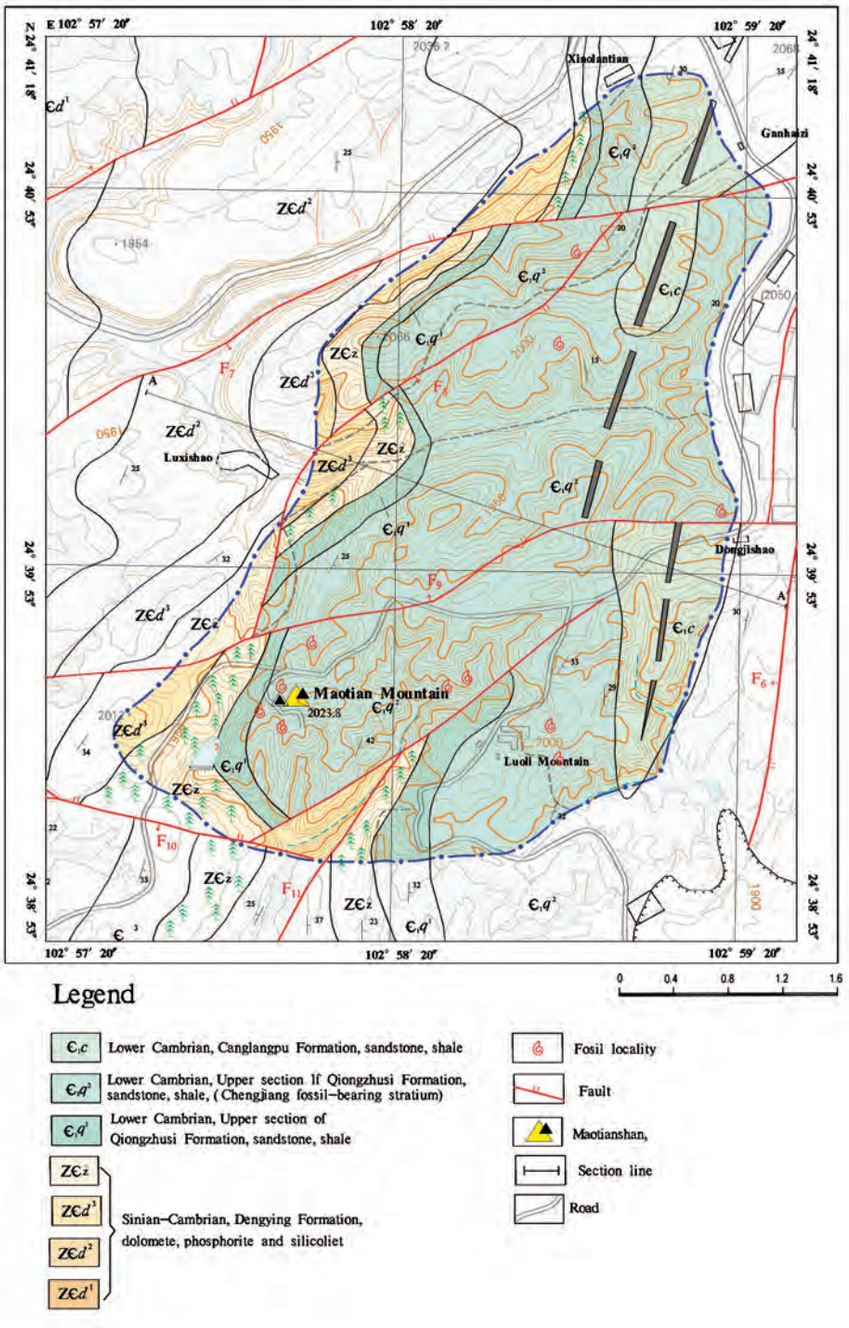
During the cleaning process some parts of the trackway were made slightly wider, but overall essentially little or no bedrock was removed. The fossil-bearing stratum, the Yu'anshan Member, covers 414 ha, or 81 % of the nominated site (Fig. 17). The Xiaolantian trackway exposes about 0.039 ha (260 m × 1.5 m), or 390 m^2 of this member, which accounts for 0.0076 % of the nominated site, and 0.0094 % of the fossil-bearing area. The impact of the trackway, either to the Xiaolantian area or the entire nominated site, is very localized and limited. The integrity of the nominated site remains intact.

We therefore consider that any concerns that the new trackway has damaged the geological significance of the site are unfounded. The trackway has, in fact, enhanced the utility of the site, making available a section from the late Precambrian to the lower Cambrian Canglangpu Formation, exposing the Precambrian/Cambrian boundary and spanning all the soft-bodied fossil horizons. Importantly, it clearly exposes for the first time a continuous section in the nominated site through the lower Yu'anshan Member with potential new horizons with soft-bodied fossils.

Concerns that fossils might now not be found in situ, in an undisturbed geological setting, are also unfounded. On the contrary, considerably more undisturbed rock, including the fossiliferous and potentially

fossiliferous horizons, has been made available for study by the clearance. Moreover identical and completely undisturbed sections are still available in the nominated site, adjacent and parallel to the trackway.

Fig. 17 Geological Map of the Nominated Chenggiang Fossil Site



● Protecting the site

The average annual rainfall on the gentle, hilly landscape of the nominated site is 963.83 mm/year. There are no perennial streams, and in the rainy season (May-October) there is occasional drainage in the large gullies, but never any flood. The Xiaolantian section and trackway are located in the middle and upper slopes of the Xiaolantian valley, near the hilltop, with limited risk of excessive, run-off erosion. Additionally, existing vegetation up-slope of the section provides protection against run-off, and down-slope of the section newly planted vegetation will combat erosional undercutting; extra planting could be undertaken, as necessary. The section will now be allowed to weather naturally, and any possible future human intervention will be strictly assessed, limited, and governed.

● Summary

Located in the northern part of the nominated site, the Xiaolantian section was previously represented by an abandoned fossil quarry largely covered by rock debris and topsoil. In order to display a clear rock sequence for IUCN evaluation, and to establish a representative rock section for scientific and educational use, the park management body cleaned the section, and it created a 1-1.5 m wide trackway along section, together with associated explanatory signs. A minimum amount of bedrock was excavated during the process, and the original nature of the site remains essentially intact. In the future, any changes to the site will be left largely to natural processes. The state party fully accepts the advice of the IUCN evaluators, however, that any future man-made intervention should be preceded by a full assessment of the proposed measures.

3. Museum Building at Maotianshan: The mission also had concern regarding the possible impact that the building of small museum may have had on the geological section at the Maotianshan locality. "We would be grateful for the comment of the State Party regarding the extent to which the geological values of this exposure have been impacted by this building."

3. The Museum Building at Maotianshan

● **Background**

The west slope of Maotianshan hill in the southern part of the Chengjiang nominated site is where the first soft-bodied Chengjiang fossils were discovered in 1984 by Hou Xianguang (Figs 18, 19). Subsequent work yielded more than 80 fossil species. Since 1997 fossil collecting has been prohibited at the Maotianshan locality.

This locality has great palaeontological and historical significance. In order to enhance protection of the site, while also attempting to widen public understanding of its scientific importance, in 2010 a small arch-shaped exhibition hall was built over the strata where the first Chengjiang soft-bodied fossils were found (Fig. 20).

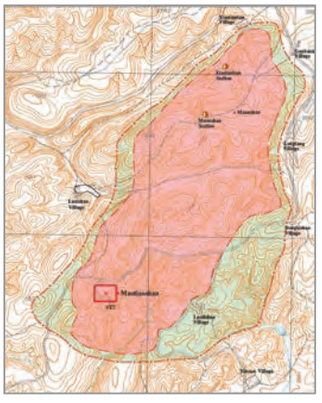


Fig. 18. Location of the Maotianshan section in the nominated property.

Fig. 19. The section at Maotianshan (2010).

Fig. 20. The museum at Maotianshan (2011).

The museum is 36 m long, 9-12 m wide and 9-13.5 m high. It comprises an exhibition room displaying specimens and illustrations of Chengjiang fossils (Fig. 21) and a sheltered exposure (9 m × 32 m) of fossil-bearing mudstones of the Yu'anshan Member (Fig. 22).

Fig. 21. Front part of the museum at Maotianshan.

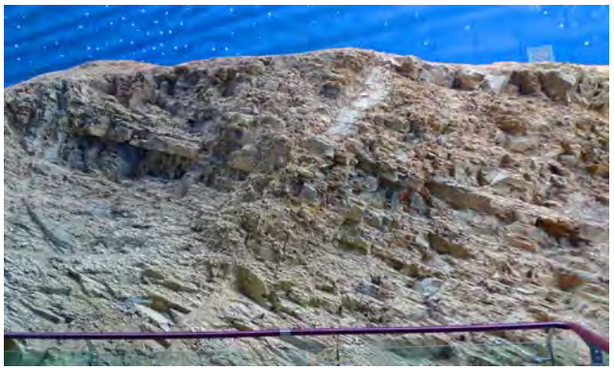


Fig. 22. Rear part of the museum at Maotianshan.

● **Impact of the Museum on the rock exposure**

The museum occupies some 360 square meters. During its construction about 126 cubic meters of earth and rock were cleared for site grading, but the building of the museum has not altered the geological integrity or scientific value of the locality. The horizons where the soft-bodied fossils were initially discovered are still fully available for study and are now sheltered and protected by the museum covering; they have not been lost by its construction. Moreover, many of the same stratigraphic levels are also exposed immediately outside the museum confines.

● **Summary**

In order to better shelter and preserve the key Maotianshan rock section a small on-site museum was built in 2010. The museum also serves to widen public appreciation of the importance of the Chengjiang biota. The impact that the building has on the environment at the Maotianshan locality is limited and the geological integrity and value of the original section remains intact. The museum was

established for well-intentioned reasons but the management body accepts that, when considering its construction in principle, it could have been more aware of commonly accepted guidelines relating to the protection of geologically significant sites. Bearing in mind the general principle that the best strategy for protecting such sites is to retain their natural state, the management body has agreed that in future such building projects will not be allowed to occur within the nominated site.

4. Protection status of the nominated property: We would be grateful for clarification regarding the protection the nominated property actually has. The mission noted that the nominated property sites entirely within a national Chinese geopark. Under the national geopark system in China, it is understood that geoparks are zoned into areas of complete protection, areas of some less protection, areas suitable for tourism development etc. In the case of Chengjiang Fossil National Park, the area of highest level protection does not appear to coincide with the nominated property, which instead appears to have a lower level of protection. We would be grateful for confirmation from the State Party of the current protection status of the property, and in particular to confirm if the highest level of protection status could be provided to the nominated property.

4. The protection status of the Nominated Property

● **Background**

When the Chengjiang Fauna Geopark was established in 2001, functional zoning was developed in relation to the Technical Requirements for Geopark Planning. The 1,800 ha Chengjiang Fauna Geopark was classified into four zones (Fig. 23):

- **Special Protection Zone:** 120 ha (red on Fig. 23). This is the core protection area of the Geopark and tourist access is not permitted. Only approved research and management staff can access this zone, in order to carry out research and protection activities. No infrastructural facilities may be constructed in this zone.

- **Class I Protection Zone:** 215 ha (pink on Fig. 23). Only appropriate visitor trails and relevant facilities can be installed, as long as they are compatible and harmonious with the surrounding landscape and environment. Visits to this zone are controlled and automobiles are not permitted.

- **Class II and Class III Protection Zones:** Class II 587 ha (green on Fig. 23); Class III 878 ha (yellow on Fig. 23). These zones comprise the general protected area, where minimal geological service facilities can be installed. Constructions that are irrelevant to any appreciation of the geological landscape are restricted. All constructions and facilities should be in harmony with the landscape and the environment.

Fig. 23. Map showing the zoning of the Chengjiang Geopark and the relationship to the Nominated Property.

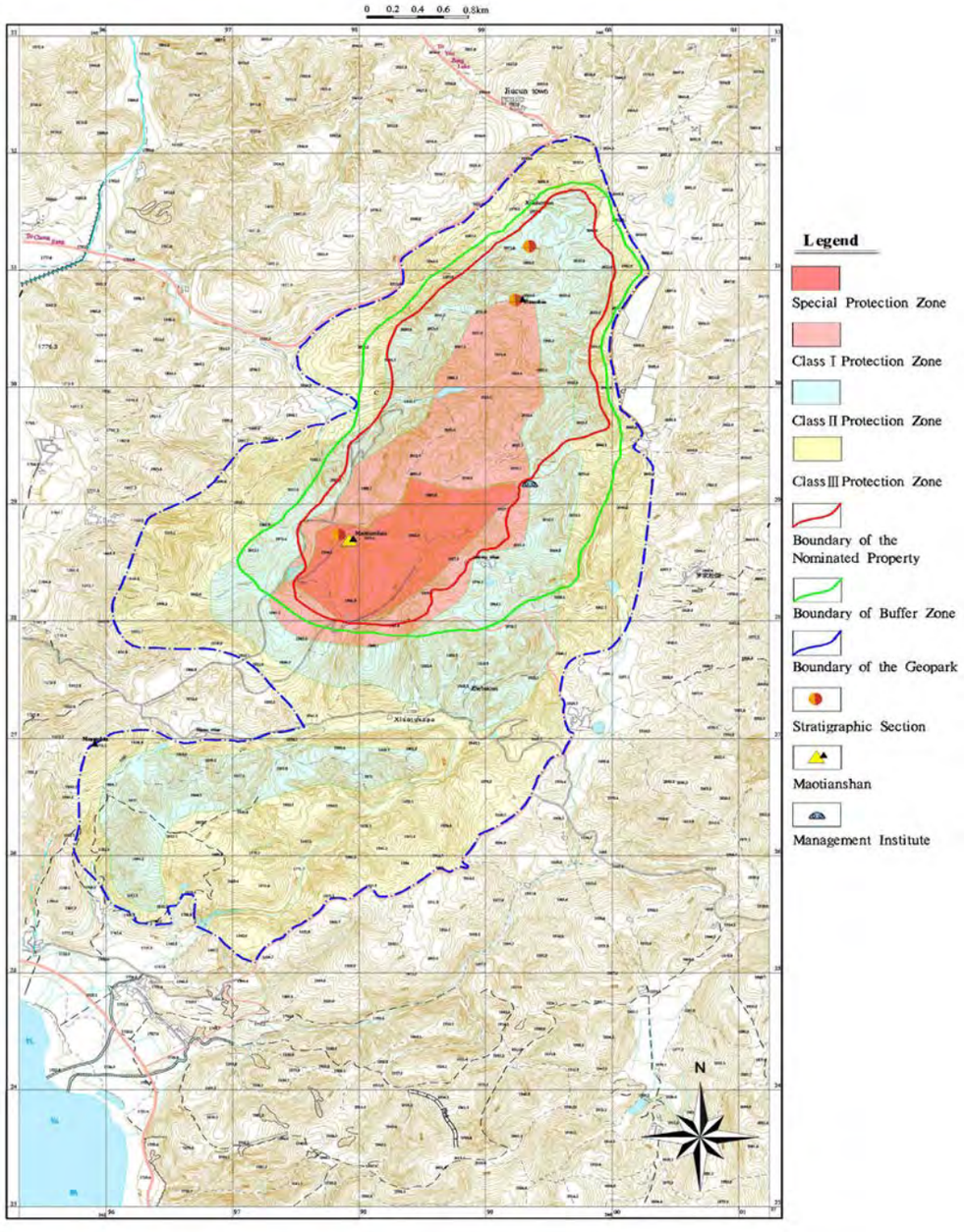


Figure 23 indicates that the Nominated Property covers:

- all of the Special Protection Zone (120 ha).
- almost all of the Class I Protection Zone (110 ha), with the exception of a narrow strip in the south and southeast where there is a road and mining activities have occurred.
- part of the Class II Protection Zone (182 ha) in the northern part of the Geopark.

● Revised protection requirements

When the Geopark was established in 2001, the Maotianshan site was considered to be of primary importance, because the first exceptionally preserved Chengjiang fossils were found there; the fossil-bearing strata are well exposed at this site and the natural features of the area are well represented. For these reasons, the Special Protection Zone and the Class I Protection Zone were limited to the area centered on Maotianshan.

The integrity conditions for nominated World Heritage properties, as set out in paragraphs 87-88 of the Operational Guidelines, impose different requirements. In this respect, the area centered on Maotiianshan is not of “adequate size to ensure the complete representation of the features and processes which convey the property’s significance”. In order to include “all elements necessary to express its outstanding universal value” such as a complete rock sequence, all important local fossil sites, the geological structure, and the nature of the landscape, the Nominated Property has been defined to include a larger area, ranging from Maotianshan to Xiaolantian (see nomination text: 3d-2). This area includes some land originally within the Class II protection zone.

It is recognized that the original zoning of the Geopark requires revision to coincide with the scope of the Nominated Property.

● Revised zoning

The Nominated Property is currently the area of the Geopark displaying the least effects of human impact (nomination text 3d-2). Since the launch of the World Heritage nomination in 2010, the entire Nominated Property has, in practice, been afforded the highest levels of protection and management.

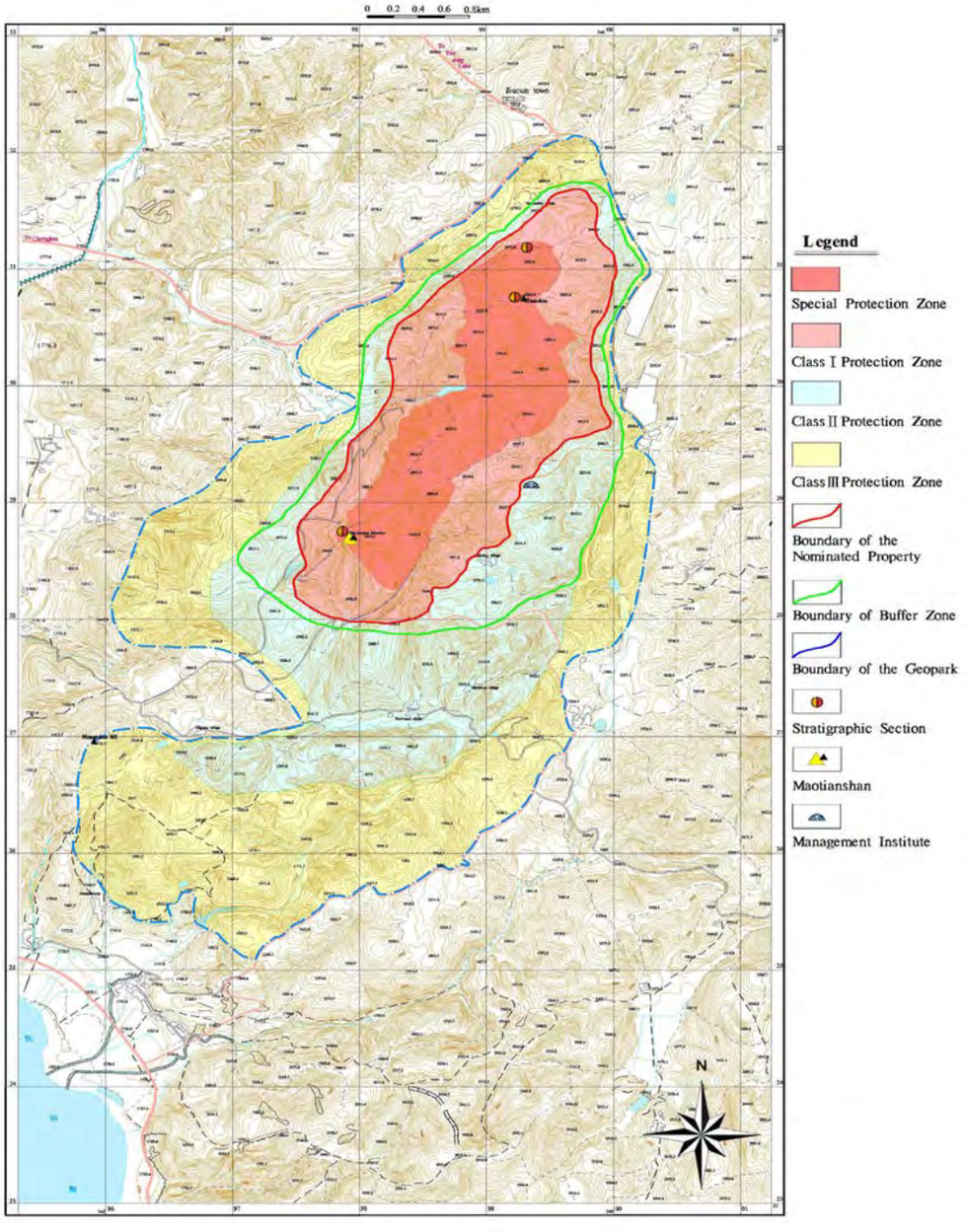
A revision of the zoning to reflect the protection requirements of the Nominated Property has now been implemented and approved by the Yunnan Provincial Department of Land and Resources (Annex 1).

The revised zoning is as follows (Fig. 24):

- the Special Protection Zone is enlarged to 215 ha;
- the Class I Protection Zone is enlarged to 297 ha, including the Ma'anshan and Xiaolantian areas in the north;
- the Class II Protection Zone is 587ha, and the Class III protection zone is 701 ha.

Figure 24 shows the relationship of the revised zoning of the Geopark to the Nominated Property, indicating that the area of the Special Protection Zone plus the Class I Protection Zone corresponds to the nominated property. The boundary of the Class I Protection Zone coincides with the boundary of the Nominated Property. The buffer zone is entirely within the Class II Protection Zone of the Geopark. This revised zoning guarantees the highest protection status for the Nominated Property.

Fig. 24. Map Showing the revised zoning of the Geopark and its relationship to the Nominated Property.



Annex: Approval document for the revision of the zoning of the Chengjiang Fauna Geopark.

云南省国土资源厅文件

云国土资〔2011〕282号

云南省国土资源厅关于澄江动物群古生物国家地质公园功能分区调整的意见

澄江动物化石群省级自然保护区管理委员会：

你委《关于调整澄江动物群古生物国家地质公园功能分区的请示》（澂管字〔2011〕23号）收悉，经我厅研究，意见如下：

一、澄江动物群国家地质公园功能分区于2002年划定，随着该区域研究程度不断提高，原有的功能分区已不适应保护与管理的需要，有必要根据2010年国土资源部颁布的《国家地质公园规划编制技术要求》进行调整。

二、经我厅组织专家论证，同意地质公园功能分区调整方案，即：特级保护区从原来的1.2平方千米变更为2.15平

方千米；一级保护区从原来的 2.15 平方千米变更为 2.97 平方千米；二级保护区范围调整后，面积仍为 5.87 平方千米；三级保护区从原来的 8.78 平方千米变更为 7.01 平方千米。调整后，地质公园的外围边界不变，总面积不变，仍为 18 平方千米。

三、调整后的功能分区中，特级保护区和一级保护区的总面积为 5.12 平方千米，其范围与世界遗产提名地一致。该区域是整个地质公园最重要的区域，要按规定给予高级别的保护。

四、你委要继续认真做好澄江动物群古生物化石的保护工作，维护其重要价值，保障其完整性，同时，进一步加强国家地质公园的管理。

二〇一一年十一月十日

主题词：国土资源　地质公园　区划　调整　意见

云南省国土资源厅办公室　　2011 年 11 月 11 日印制

打印：肖丽云　　校对：刁成宝　　共印 5 份

Document of Yunnan Provincial Department of Land and Resources

File No: [2011] 282,
Yunnan Provincial Department of Land and Resources

Opinion of Yunnan Provincial Department of Land and Resources on the Revision of the Functional Zoning of the Chengjiang Fauna National Geopark

Chengjiang Fauna National Geopark Management Committee:

The "Report on the Revision of the Functional Zoning of the Chengjiang Fauna National Geopark"（File No: [2011] 23,Chengjiang Geopark Management Committee）has been reviewed by the Yunnan Provincial Department of Land and Resources and the opinion is as follows:

1. The existing zoning of the Chengjiang Fauna Geopark was developed in 2002, studies in recent years indicates that the original zoning is incompatible with the protection and management requirement. In relation to the "Technical Requirements of General Planning Revision of National Geopark " issued by the Ministry of Land and Resources in 2010, it is necessary to revise the existing zoning of the Chengjiang geopark.

2. Base on the reviewing conclusion of expert penal, the department agrees with the revised zoning of the geopark, i.e. Special Protection Zone is changed from 120ha to 215ha; Class I Protection Zone is changed from 215ha to 297ha; Class II Protection Zone is changed in scope, its area is still 587ha; Class III Protection Zone is changed from 878ha to 701ha; After the revision, the outer boundary of the geopark remains unchanged, and the total area of the geopark remains unchanged, it is still 1800ha.

3. After the revision, the total area of the Special Protection Zone and the Class I Protection Zone is 512ha, which coincides with the scope nominated for world heritage status, this area is the most important area of the whole geopark and must be of highest protection.
4. Requires the Chengjiang Geopark Management Committee, taking the revision of functional zoning as an

opportunity, to better the protection of the geological relics, to maintain the park's important value, to safeguard its integrity and further strengthen the management.

Seal of the Yunnan Provincial Department of Land and Resources

2011.11.10

World Heritage Nomination

Natural Heritage. China

Further Supplementary Information on the Nominated World Natural Heritage:

Chengjiang Fossil Site

Ministry of Housing and Urban-Rural Development

of the People’s Republic of China

January, 2012

World Heritage Nomination

Natural Heritage. China

Further Supplementary Information on the Nominated World Natural Heritage:

Chengjiang Fossil Site

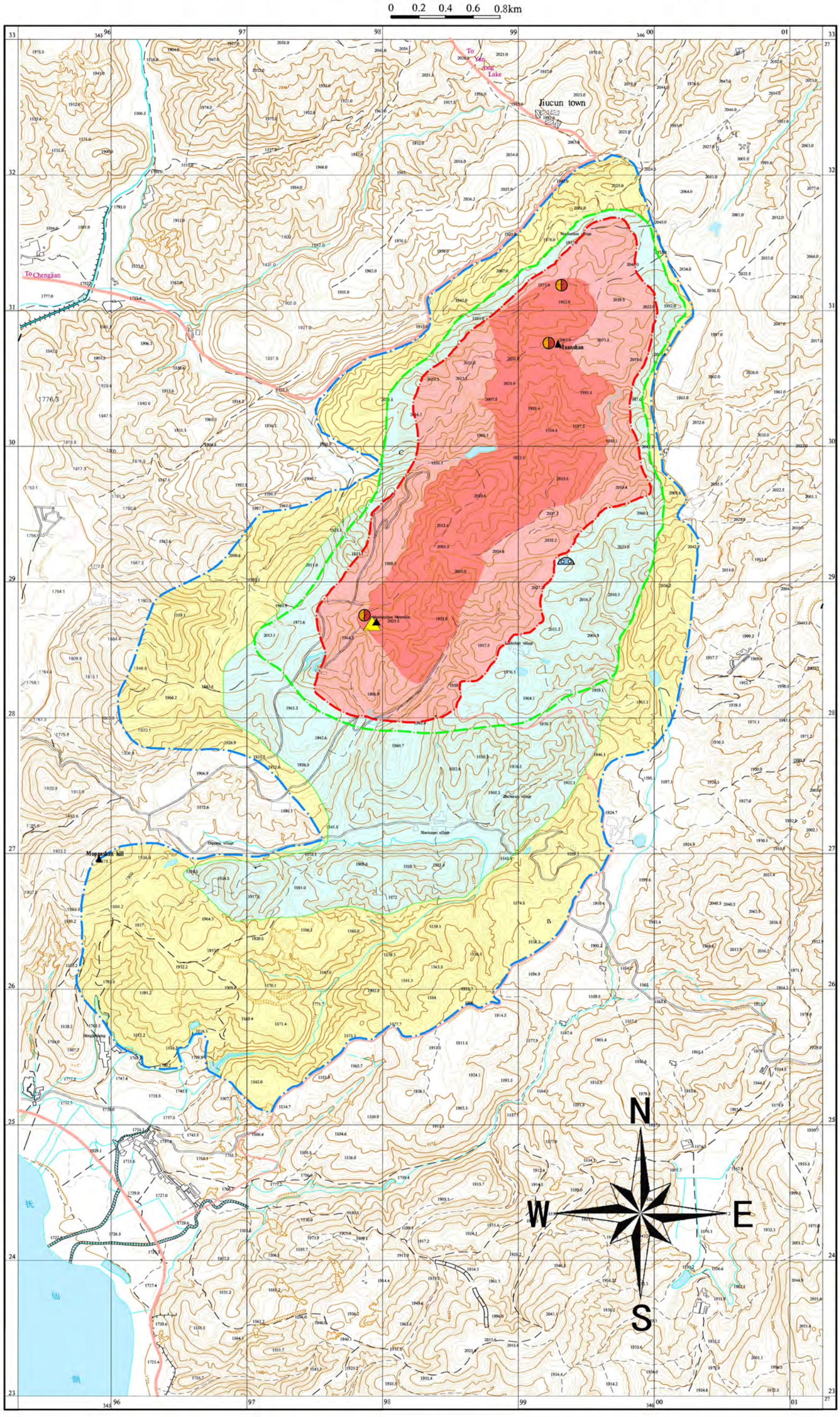
Ministry of Housing and Urban-Rural Development

of the People's Republic of China

January, 2012

Annex:

Map showing the re-zoning of the Geopark and its relationship with the Nominated Property



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5 December 2011

IUCN Evaluation of Chengjiang Fossil Site (China) – Request for Supplementary Information

Dear Ambassador,

The IUCN World Heritage Panel has meet in Gland, Switzerland, the week of November 28 2011 to examine World Heritage nominations for natural and mixed properties, and cultural landscapes. The IUCN Panel has examined in detail each nomination dossier from the State Party, reports and desktop reviews of field evaluators and external reviewers, other references regarding the nominated properties, as well as the supplementary information that have reached us on Tuesday November 29th 2011.

As noted in previous correspondence, IUCN seeks to develop and maintain a dialogue with States Parties during the evaluation process. The Panel was very grateful for the information already received from teh State Party following my earlier letter, which we have fully considered. Following the panel's discussions, we would like to kindly ask for further clarification of the points listed hereafter.

Monitoring of the nominated property
The World Heritage Convention requires State Parties to report on the state of conservation of World Heritage properties under their administration on a six-year cycle. It is requested that State Party provide supplementary information related to a monitoring program with indicators of the protection, presentation and promotion of paleontological values. We consider it important that this information address indicators related to the integrity of the fossil bearing strata, the ongoing promotion of the scientific interest in the site, and the conservation of the record of biodiversity,

Boundaries
Although the supplementary information provided indicates a positive re-zoning of the property for further protection the nominated property, the delineation of the proposed boundaries of the property, buffer and protection zones do not necessarily appear to be coincident with the geological formations that bear important fossil biota and nor are all easily identifiable on the ground. IUCN requests that the State Party provides further information related to the rationale for delineation of property, buffer and zoning boundaries to ensure that important fossil bearing strata are protected and that the boundaries can be easily identified on the ground for management purposes. We would be grateful if a final definitive copy of the map of the nominated property showing clearing the boundary of the nominated property, the buffer zone of the property, as well as the finally agreed zoning of the property would be provided.

Funding
The State Party indicates in the Management Plan (Appendix 3: Page 64) that a budget is to be prepared for the protection of the nominated property and that the management organization is responsible for raising conservation funds for the site. Further information is requested to clarify the expected budget, and confirmation that this will be sufficient to ensure long term and stable funding for furthering scientific research and management to protect, promote and present the values of the site.

Visitor numbers to the nominated property
The IUCN Panel would welcome specific information regarding any anticipated change in visitor numbers at the nominated property, following possible inscription on the World Heritage List, and the plans that the State Party has to ensure any increase in numbers will not create negative impacts on the property.

Impacts – Integrity
Further information is requested to provide for a clear inventory of the impacts of human development (including but not limited to past mining and access and transportation routes) at the nominated property. In addition to this inventory, it is further requested that the State Party provide information on any plans for remediation (if necessary) it intends to undertake regarding any identified damage to strata. Furthermore it is requested that the State Party outline the specific policies and procedure it will follow prior to undertaking any further infrastructure development at the property, to avoid any possibility of impacts on site integrity.

Conservation of other important fossil sites for the Chengjiang biota, outside the boundaries of the property.
As evident in the original nomination documentation, fossils of scientific importance have been excavated and collected outside the proposed boundaries of the nominated property. The State Party is requested to consider the how important fossil sites (strata) bearing Chengjiang biota in the wider region can be managed and protected to ensure that important heritage located outside of the boundaries of the nominated property can continue to contribute to understanding of this significant stage of Earth history.

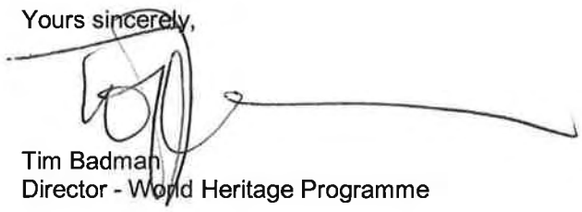
As per paragraph 148 of the Operational Guidelines the formal deadline for submission of supplementary information is **28 February 2012** and therefore any information submitted after this date may not be considered by IUCN in its evaluation for the World Heritage Committee. It should be noted, however, that while IUCN will carefully consider any supplementary information submitted, it cannot properly evaluate a completely revised nomination or large amounts of new information submitted at the last minute. So we request to keep your response concise and respond only to the above requests.

Supplementary information should be submitted officially in three copies to the UNESCO World Heritage Centre in order for it to be registered as part of the nomination. An electronic copy of any supplementary information to both the UNESCO World Heritage Centre and IUCN Headquarters would also be helpful.

Taking into account your response, IUCN will formulate its final recommendation to the World Heritage Committee which will meet from 24 June to 6 July 2012 in St. Petersburg, Russian Federation.

Let me again reiterate our thanks for your support of the World Heritage Convention and for the conduct of IUCN's recent mission, and also for the supplementary information already provided. We look forward to your kind cooperation in furnishing responses to the abovementioned points.

Yours sincerely,



Tim Badman
Director - World Heritage Programme

Cc. Chinese National Commission for UNESCO, Mr Fang Maotian, Secretary-General
Ms Zuo Xiaoping, MoHURD
UNESCO World Heritage Centre, Mr Jing Feng and Mr Alessandro Balsamo
Ms Aban Marker Kabraji, IUCN Asia Regional Office, Regional Director

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Monitoring of the nominated property

The World Heritage Convention requires State Parties to report on the state of conservation of World Heritage properties under their administration on a six-year cycle. It is requested that State Party provide supplementary information related to a monitoring program with indicators of the protection, presentation and promotion of palaeontological values. We consider it important that this information address indicators related to the integrity of the fossil bearing strata, the ongoing promotion of the scientific interest in the site, and the conservation of the record of biodiversity.

1. Monitoring of the Nominated Property

According to the monitoring requests set out in the Operational Guidelines (Chapter IV, Chapter V, Annex 7) and based on the practice of periodic reporting on the state of conservation of World Heritage sites, the comprehensive monitoring programmes of the nominated Chengjiang Fossil Site have previously been described in the nomination text (Chapter 6. Monitoring).

More detailed monitoring programmes, with indicators of the protection, presentation and promotion of palaeontological values of the nominated Chengjiang Fossil Site, are further clarified as follows:

1.1 Protection

Monitoring programme	Key indicator	Explanation	Periodicity	Location of Records
Integrity of fossil sites/ strata	Mining	The monitoring objectives are to secure against any mining activities occurring in the Nominated Property and its buffer areas. Monitoring measures include daily field patrol, assisted with GPS and analysis of remote sensing images.	Monitored daily and documented monthly	Chengjiang Fauna National Geopark Management Committee

	Quarrying	The same measures as for monitoring mining activities.		
	Stratigraphical section	The monitoring objectives are to secure the three fossil sections against man-made damage, or severe erosion damage. The means of monitoring is by on-site patrol.		
	Key fossil locality	The monitoring objective is to secure the six key fossil localities against damage by man-made activities. The means of monitoring is by on-site patrol.		
	Illegal fossil excavation	The monitoring objective is to secure against illegal fossil excavation in the Nominated Property and its buffer areas. The means of monitoring is by daily on-site patrol.		
	Farmland encroachment	The monitoring objective is to secure against the cultivation of new farmland in the Nominated Property. The means of monitoring is on-site patrol, assisted with farmland distribution maps, GPS and remote sensing images.		
	Infrastructure	The monitoring objective is to secure against the construction of new infrastructure. The means of monitoring is on-site patrol, assisted with maps, GPS and remote sensing images.		

	Forest	The monitoring objectives are to secure against damage to forestry vegetation by man-made activities, and against fires, in the Nominated Property and its buffer areas. The means of monitoring is by on-site patrol assisted with GPS and remote sensing images.		
	Geological hazard	The monitoring objective is to secure against geological hazards that would damage the stratigraphic sections and fossil localities. The means of monitoring is by on-site patrol, assisted with maps, GPS and geological and geographical maps.		
	Boundary	The monitoring objective is to secure against deterioration or damage to the boundary pillars and signboards of the Nominated Property and its buffer areas. The means of monitoring is on-site patrol.		

* For other environmental monitoring programmes see the original nomination text: 6. Monitoring.

1.2 Presentation

Monitoring program	Key indicator	Explanation	Periodicity	Location of Records
Presentation	Museums	Monitoring the facilities, items on display, records of opening hours and visitor numbers, at Chengjiang County Museum and Chengjiang Maotianshan Museum.	Monitored daily and documented monthly	Chengjiang Fauna National Geopark Management Committee Chengjiang Fauna Museum
	Onsite signage boards	The monitoring objective is to secure the intactness of all types of signage boards at the Chengjiang Fossil Site. The means of monitoring is by on-site patrol.	Monitored monthly	
	Information service	Document the information services for popular sciences and visitors at the Chengjiang Fossil Site, such as visitor guides to the site, introductions to the museum, tourist handbooks, maps and video stream playbacks, etc.	Monitored quarterly	
	Thematic Activities	Document the domestic and international presentation activities of Chengjiang fossils, such as fossil exhibitions and academic conferences, etc.	Monitored quarterly	

1.3 Promotion

Monitoring program	Key indicator	Explanation	Periodicity	Location of Records
	List of fossil records	Record new fossil species discovered at the Chengjiang Fossil Site and its adjacent areas (time, locality and discoverer); update the list of fossil records for the site.	Recorded and documented yearly	Chengjiang Fauna National Geopark Management Committee

	Research projects	Document research projects for Chengjiang fossils, such as the project title, research elements, research institute and participating scientists, research duration and funding, etc.		
	Publications	Document the publications concerning the Chengjiang fauna, including monographs, research papers, videos and images, etc.		
	Academic conferences	Document the academic conferences involving the Chengjiang fauna, e.g. name of conference, location, contents and participants, etc.		
	Training	Document the training sessions for the Chengjiang Fossil Site, e.g. contents, training target, time and location.		
	Thematic publicity	Document thematic publicity activities for the Chengjiang Fossil Site, e.g. contents, target group, time and location, etc.		
	Community participation	Document the participatory activities of local communities and residents at the Chengjiang Fossil Site, e.g. local residents participating in conservation management, policy promulgation and defence of the interests of local residents.		

Boundaries

Although the supplementary information provided indicates a positive re-zoning of the property for further protection the nominated property the delineation of the proposed boundaries of the property, buffer and protection zones do not necessarily appear to be coincident with the geological formations that bear important fossil biota and nor are all easily identifiable on the ground. IUCN requests that the State Party provides further information related to the rationale for delineation of property, buffer and zoning boundaries to ensure that important fossil bearing strata are protected and that the boundaries can be easily identified on the ground for management purposes. We would be grateful if a final definitive copy of the map of the nominated property showing clearing the boundary of the nominated property, the buffer zone of the property, as well as the finally agreed zoning of the property would be provided.

2. Boundaries

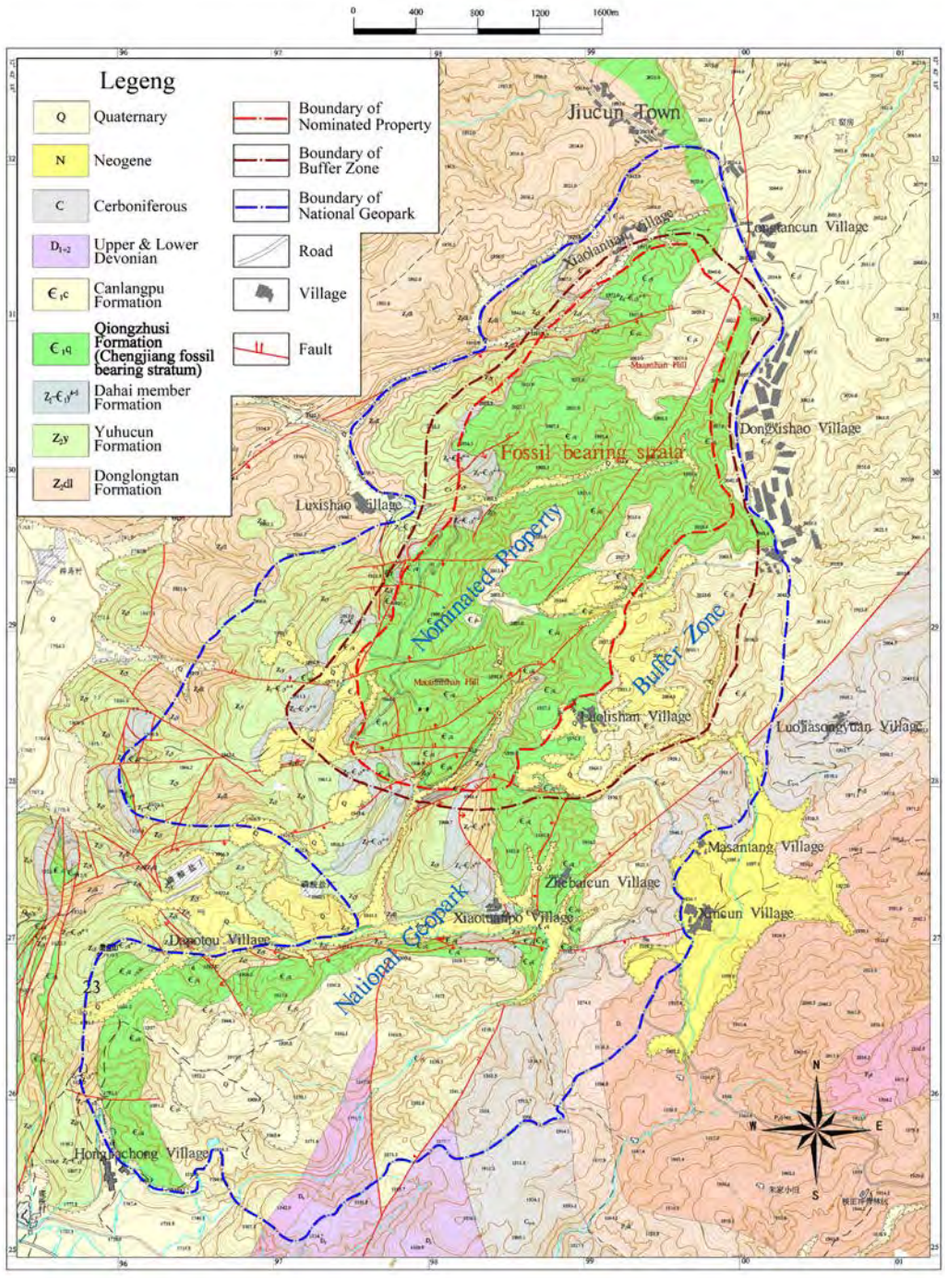
2.1 Boundary identification

As described in the nomination texts, the Maotianshan area where the Nominated Property is situated is a hilly area with moderate relief. Before the Chengjiang Fossil Lagerstätte was discovered in 1984, and during the many years after fossils were first found, the area had been used for traditional human habitation, and did not belong to any type of protected area. Various types of anthropogenic activities have therefore left behind obvious signs and traces.

Regional geological surveys show that early Cambrian strata, including the fossil beds (clays and shales) of the Qiongzhusi Formation containing the Chengjiang fauna, are distributed in a N-S belt in the Maotianshan area in the east of Chengjiang County. The outcrop area with fossil beds to the north of the Jiucun town boundary had historically been used intensively for anthropogenic activities, and includes a number of residential towns and villages, and large parcels of land used for mining and industrial production. The physical quality of the strata containing the Chengjiang Fauna was therefore seriously affected in this region. However in the outcrop area with the Chengjiang fossil horizons to the south of the Jiucun town boundary, the physical nature of the strata is relatively better and this part of the outcrop area has undergone relatively little impact from human activity. Therefore, when the national geopark was established in 2001, the area totaling 180 hectares to the south of Jiucun, where the fossil horizons and related geological formations are of better physical quality and could be well maintained and protected, was delineated as the scope of the geopark (Fig. 1.).

The initial nomination of the Chengjiang Fossil Site dates back to 2005. In order to ensure the high natural quality of the Nominated Property, only 120 hectares in Maotianshan and its surrounding areas was identified as the Nominated Property in the nomination texts compiled in 2006-2009. In the technical consultations and defending that followed, it was believed that the

Fig 1. Map indicating the relationship between the regional geology and the geopark



initial identified area of 120 hectares would seem to be unable to fulfill the integrity criteria for a Nominated Property. Based on the requirements for integrity criteria in the Operational Guidelines and taking into account the local situation, the expert group consulted with the local management institutions at the Chengjiang Fossil Site, so as to adjust the scope and boundary of the Nominated Property and its buffer zones. In the adjustment process, it was recognized that the most important guiding principles are: 1. The Nominated Property has an adequate size to ensure the complete representation of the geological and palaeontological features and

processes which convey the property's significance; 2. the Nominated Property includes all elements necessary to represent its outstanding universal value; 3. the Nominated Property suffers least adverse development impact.

Regarding the geological formations of the geopark:

- The early Cambrian strata and fossiliferous horizons (Qiongzhusi Formation) occur in a N-S belt east of Chengjiang, and are concentrated in the Xiaolantian-Maotianshan area in the north of the geopark (Fig. 1). In the main, they form in this area a NNE-SSW oriented syncline, the core of which is also located there. Therefore, both in terms of the development and the outcrop of the fossiliferous beds, the Xiaolantian-Maotianshan area is the most important and most representative area.

- Over the past two decades and more, although collections have been made in other scattered areas, nearly all the important fossils have been discovered in the Xiaolantian-Maotianshan area.

- From a land-use point of view, as shown from satellite imagery, the fossiliferous beds/horizons in the central and southern part of the geopark (south of Maotianshan Hill) have obviously been affected by the activities from three villages, the farming of large tracts of land, and from past mining operations. As indicated in the integrity criteria, the physical quality of this area does not, apparently, fulfill the criteria for a nominated site, and therefore it has not been delineated into the scope of the Nominated Property.

Through prudent on-site investigation and consultations, at the beginning of 2010, the total area of the Nominated Property was increased from 120 to 512 hectares and its scope was extended from the original Maotianshan area to include the Xiaolantian area in the north (Fig. 2, Fig. 3).

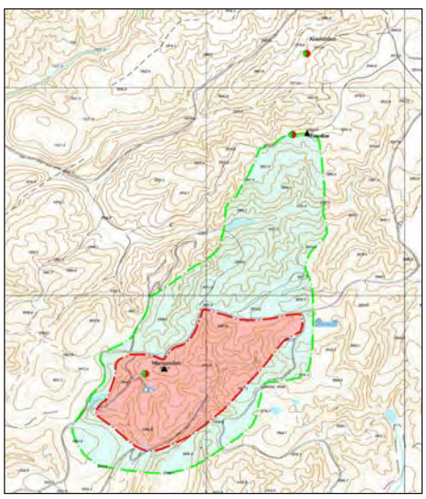


Fig 2. The area of 120 hectares delineated as the Nominated Property in 2005-2009

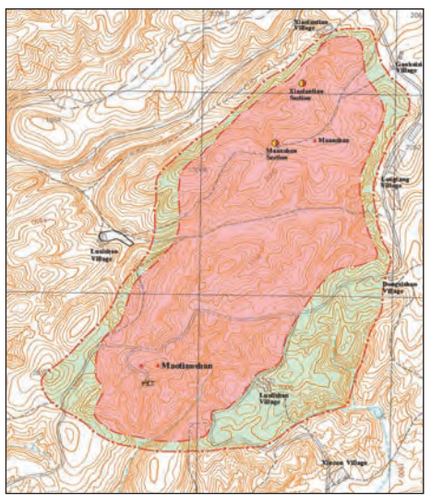


Fig 3. In 2010, the total area of the Nominated Property was increased to 512 hectares

The current scope of the Nominated Property is considered to be the optimal choice that both fulfills the integrity criteria of a world heritage site and that also meets local criteria, as:

- In terms of the scope of the geopark and assessing it from a broader perspective, the Nominated Property is the most important and representative area for the Chengjiang Fauna in its geological context. It encompasses all the necessary geological and palaeontological elements that exhibit the outstanding universal value of the Chengjiang Fossil Site - for example, a complete stratigraphic sequence of Precambrian and lower Cambrian strata, with the Xiaolantian section representing the most complete and contiguous stratigraphic section regionally. Moreover, as the Nominated Property is located at the core of the syncline, the development and outcrop of the fossil-bearing beds (particularly the Yu'anshan member of Qiongzhusi Formation), the outcrop covering an area of 141 hectares, are relatively intact. The Nominated Property not only includes the most important stratigraphic sections, but also extremely significant fossil localities, for example Maotianshan, Ma'anshan and Xiaolantian. In other words, all the palaeontological and stratigraphic discoveries are represented, or can be potentially represented, at the Nominated Property.

- The Nominated Property represents an area least disturbed by human activities and one that throughout the entire fossil-bearing region has maintained good natural quality. There are no permanent human habitation sites, for example villages, it was least affected by past mining operations, nor are there any industrial or commercial facilities. Farmland is restricted to relatively small areas. The vegetation and physical landscape is also much better maintained in this area.

- The Nominated Property is an area that has been best managed and protected. Since the establishment of the geopark, the local government and the management departments have implemented many projects for environmental management and protection as part of efforts to protect the Chengjiang Fossil Site. These include restoration of the areas damaged by previous mining operations, the introduction in appropriate places of vegetation to stabilize the land surface and counter erosion, the dismantling of incompatible infrastructures, the anchoring of boundary pegs, the erection of signage boards, and the setting up of on-site protection stations. All these projects were implemented mostly within the scope of the Nominated Property and its buffer zones.

2.2 Boundary of the Nominated Property and ground identification

As indicated above, the Nominated Property is located in the northern part of the geopark. When implementing on-site boundary delineation, in addition to considering the inclusion of necessary elements of geological formations and least negative impacts, we must also take into account the compatibility between the boundary of the Nominated Property and natural features, such as topographic peaks, valleys and roads to allow easy ground identification and management. Specifically:

- The northeast boundary of the Nominated Property adjoins the geopark boundary, which at this location is the highway. In this case, the boundary is delineated along the valleys and hilltops located 100-150 m west of the highway, which serves as an obvious landmark reference for ground identification (Fig. 4).

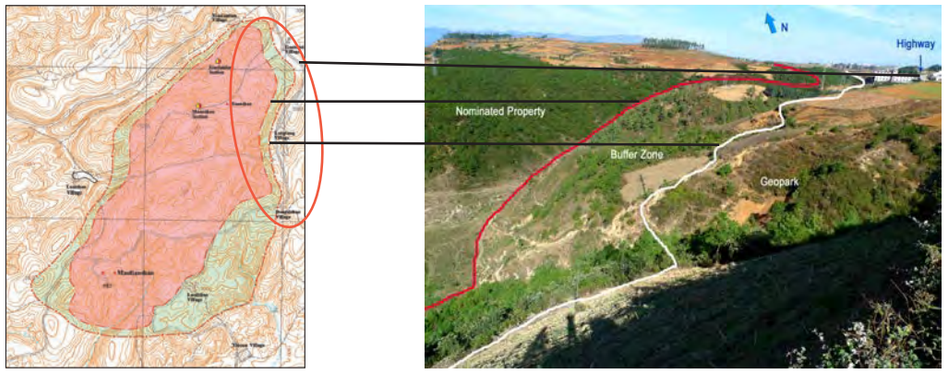


Fig. 4. Northeast boundary of the nominated property and ground identification

- The southeast boundary is delineated along the highway. In other words, the Nominated Property is on the west side, and the buffer zone on the east side, of the highway (Fig. 5)

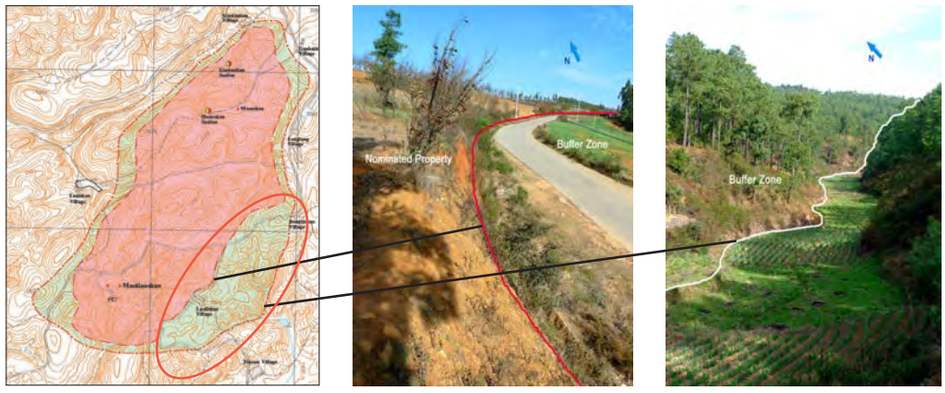


Fig. 5. Southeast boundary of the Nominated Property and ground identification

- The south boundary of the Nominated Property is delineated from a ground landmark – the conjunction of the two valleys 700 m to the south of Maotianshan, and it then extends along the hillsides to both the east and the west (Fig. 6). The justifications for the boundary delineation at these locations are : 1. Due to the effect of a fault, the fossiliferous beds (Qiongzhusi Formation) are dislocated at this location and their outcrop decreases; 2. Further to the south are large tracts of farmland, villages and previously damaged mining areas. For ground identification, the valley conjunction serves as the best landmark.

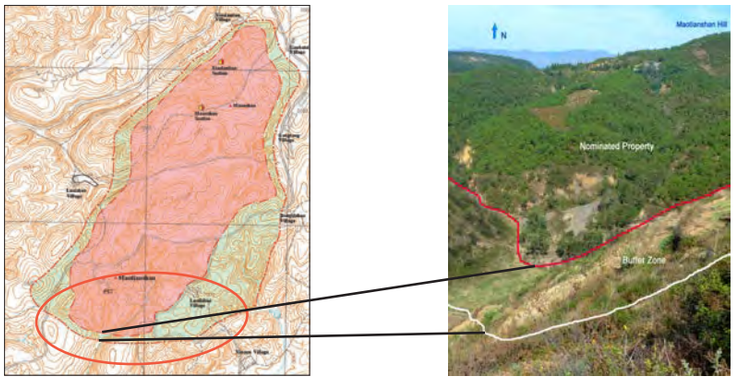


Fig. 6. South boundary of the Nominated Property and ground identification

- The southwest boundary of the Nominated Property (to the south of Luxishao village) is delineated along the valley and hills to the west of the line of the fossiliferous beds (Qiongzhusi Formation) (Fig. 7).

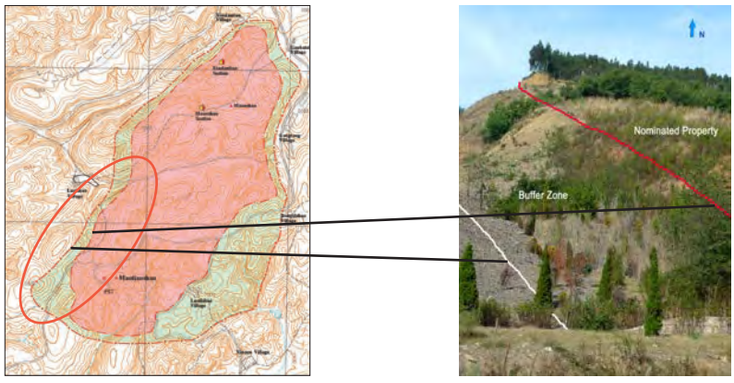


Fig. 7. Southwest boundary of the nominated property and ground identification

- The northwest boundary runs approximately parallel to the highway, due to its proximity with the boundary of the geopark (to the north of Luxishao village) which was delineated along the highway, and is delineated along the hills and valleys 500-600 m to the southeast of it. Luxishao village and the hills and valleys in the north serve as the ground references (Fig. 8).

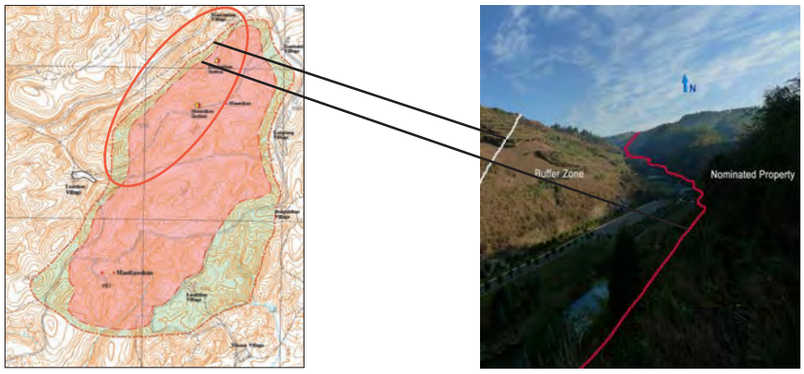


Fig 8. Northwest boundary of the nominated property and ground identification

- The north boundary of the Nominated Property is delineated along the valley on the south side of Xiaolantian village. The boundary is located on the tip of the geopark, and so extends for only a short distance, and is easily identifiable on the ground by Xiaolantian and this valley (Fig. 9).

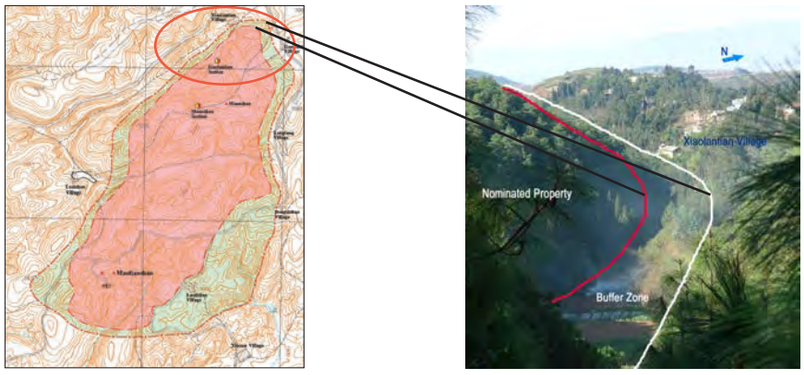


Fig. 9. North boundary of the nominated property and ground identification

2.3 Boundary of the buffer zone and ground identification

The buffer zone is located on the periphery of the Nominated Property and provides extra protection to it. The zone is about 50-800m wide and has a total area of 220 hectares. In identifying the buffer zone boundary, considerations were taken of the continuity of geological composition, landform and topography, and the impact of human activities, etc. It can be seen (Fig. 5) that the buffer zone has variable widths. Specifically:

- As the northeast and northwest boundaries run close to the geopark boundary, this segment of the buffer zone is narrower. The highway, village and valleys are the distinctive

landmarks for ground identification.

- The south and southwest boundaries are close to areas of human activities; the hills, valleys, vegetation and farmland are the clear landmark references.

- The buffer zone adjoining the southeast boundary is the widest, reaching 800 m, mainly because of the extensive outcrop of fossiliferous beds in this area. However due to the fact that Luolishan (a traditional village) and associated farmland is also located in this area, the area is delineated as a buffer zone. The valley on the east side of Luolishan provides the ground reference (Fig. 5).

2.4 Re-zoning and map

As outlined in the supplementary information submitted in November 2011, in order to fulfill the requirements for protecting the Nominated Property, the necessary adjustments were made to the original zoning of the geopark. The adjustment plan was subsequently approved by the appropriate authorities of Yunnan Province. After re-zoning, the size of the Special Protection Zone increased from 120 hectares to 215 hectares and that of Class I protection zone from 215 hectares to 297 hectares. After the boundary adjustment, the size of the special protection zone plus the Class I protection zone is equivalent to the size of the Nominated Property (512 hectares). The boundary of the Class I protection zone coincides with that of the Nominated Property. This ensures that the Nominated Property enjoys the highest level of protection.

A detailed map showing the re-zoning of the geopark and its relationship with the Nominated Property is annexed (See annex: Map showing the re-zoning of the Geopark and its relationship with the Nominated Property).

2.5 Demarcation on the ground

Although the boundaries of the Nominated Property and its buffer zone and functional zones have been clearly specified and displayed on maps, some segments of these boundaries are still not easily identifiable on the ground. This is because the overall physiognomy of the Nominated Property is an undulating hilly area, and because not only complete geological components should be **included** in the process of boundary identification, but also those areas obviously disturbed by human activities should be **excluded** from it. Recognising this, the local government and the park management departments have committed that, at such time that the nominated Chengjiang Fossil Site is granted World Heritage status, they will work promptly to demarcate the boundary of the Nominated Property and its buffer zones on the ground, using environmentally friendly measures, to benefit easy boundary identification and its protection and management.

Funding

The State Party indicates in the Management Plan (Appendix 3: Page 64) that a budget is to be prepared for the protection of the nominated property and that the management organization is responsible for raising conservation funds for the site. Further information is requested to clarify the expected budget, and confirmation that this will be sufficient to ensure long term and stable funding for furthering scientific research and management to protect, promote and present the values of the site.

3. Funding

3.1 Overview of Management fund

Since the establishment of the Chengjiang Fauna National Geopark in 2001, the source of park management funds mainly comprises two major categories: the stable management fund and the special fund for conservation and management.

3.1.1 Stable management fund

The stable management fund is appropriated from the financial budget of the governments of Chengjiang County and Yuxi Municipality. From 2001 to 2011, the annual management fund was some 5 to 6 million Chinese yuan (approximately US $900,000). The stable management fund is spent mainly on the daily protection and management of the Chengjiang Fossil Site.

3.1.2 Special fund for conservation and management

Special funds are those that the management institutions of the Chengjiang Fossil Site request from the Chengjiang County government, Yuxi municipal government and relevant authorities of Yunnan Province and the Central government, based on the need for the protection, promotion, presentation and environmental management of the Chengjiang Fossil Site and research on the fossils themselves. From 2001 to 2010 such funding supported 17 special programs totaling 58.50 million Chinese yuan (approximately US $9.30 million); for example:

- In 2002 the Yunnan Provincial Development and Reform Commission invested five million Chinese yuan for the construction of a museum repository for fossils of the Chengjiang biota;

- In 2005 the Ministry of Land and Resources invested three million Chinese yuan for the management of the geological environment in the areas at and adjacent to Maotianshan;

- In 2008 the Ministry of Land and Resources gave three million Chinese yuan specifically for the protection of the geological sites and fossils of the Chengjiang biota;

- In 2009 the State Development and Reform Commission invested 19 million Chinese yuan on the development of infrastructure for the protection of the Chengjiang biota;

- In 2009 the Yunnan Provincial Development and Reform Commission funded 3.5 million Chinese yuan for the protection of the Chengjiang biota;

- In 2011 the Ministry of Land and Resources invested 9.3 million Chinese yuan for the construction of management stations for the Chengjiang Geopark.

3.2 Expected budget

3.2.1 Stable management fund

In accordance with the Twelfth Five Year Plan (2011~2015) for the National Economic and Social Development of Chengjiang County and Yuxi Municipality, these authorities will further strengthen the protection of the Chengjiang Fossil Site and its environment. From the municipal and county government budgets, an annual allocation of at least 6.5 million Chinese yuan (approximately one million US dollars) will be set aside as the stable management fund for the Chengjiang Fossil Site (Table 1).

Table 1. Breakdown of the annual budgetary plan for the stable management fund for the Chengjiang Fossil Site (in 10,000 Chinese yuan)

	Project	Budget	Funding source
Protection	Onsite patrol	35	Chengjiang County finance
	Monitoring	100	
	Sorting and cataloging of fossils in museums	40	
	Museum maintenance	25	
	Staff stipend	120	
Promotion	Fossil excavation and research	100	Yuxi municipal finance
	Capacity building of the management team	20	
	Community training	20	
	Publicity and public understanding and education of popular science	40	
	External/International exchange and cooperation	40	

Presentation	An on-site presentation system	50	As above
	Presentation system in the geological museum	60	
Grand total: 650			

3.2.2 Special fund

The appropriate management institutions of the Chengjiang Fossil Site have detailed a 2011-2015 year plan to request special funds from Yuxi Municipality, Yunnan Provincial government and the Central government in order to ensure the future protection of the fossil site. Two special funding programs have been approved by the Yuxi municipal government for 2012:

(1) an investment of 10 million Chinese yuan for building capacity for the collecting and research of Chengjiang fossils;
(2) a fund of three million Chinese yuan for the presentation and educational promotion of fossils of the Chengjiang biota.

In addition, other special funds have also been requested from the State Development and Reform Commission, the Ministry of Land and Resources and the Ministry of Housing and Urban-Rural Development (MOHURD). It is expected that more funding support will be mobilized.

Summary

Since the establishment of the Chengjiang Geopark in 2001 the Chinese government at all levels has addressed special attention to the conservation and management of the Geopark. Moreover, ample funding support has been provided via a stable management fund and a special fund.

As the size of both the Chengjiang Geopark and the Nominated Property are relatively small, in practice the stable management fund can secure the daily management of the Geopark and the Nominated Property, including the need for conservation, promotion and presentation. By contrast the special fund enables support for projects demanding high input, such as mine management, museum construction, infrastructure development and monitoring, in which areas outstanding achievements have been made. In January 2011 the State Party formally nominated the Chengjiang Fossil Site for World Heritage status. The Chinese government at all levels is therefore paying even greater attention to the conservation and management of the Chengjiang Fossil Site and funding support is also growing appropriately. In the future, in compliance with the requirements in the Convention Concerning the Protection of the World Cultural and Natural Heritage and the Operational Guidelines, ample funding support will be assured for the protection, promotion and presentation of the Chengjiang Fossil Site.

Visitor numbers to the nominated property

The IUCN Panel would welcome specific information regarding any anticipated change in visitor numbers at the nominated property, following possible inscription on the World Heritage List, and the plans that the State Party has to ensure any increase in numbers will not create negative impacts on the property.

4. Visitors and their potential impact on the Nominated Property

4.1 Statistics of visitor numbers

From 2005 to 2009 there were some 4,000-5,000 visitors annually to the Nominated Property (see the nomination text; 5h-1). In the last two years visitor numbers have increased moderately, totalling about 7,200 in 2010 and 10,307 in 2011. Since the establishment of the Geopark in 2001, visitor numbers to the Chengjiang Fossil Site have been at relatively low levels. Contributing factors for this include the fact that despite its outstanding importance as a world-class scientific (/fossil) site, the lack of special local scenic features does not particularly encourage casual tourist visitors. Furthermore, the relatively small size of the fossils, albeit that they are visible in hand specimen, does not give them the wider popular public appeal of, say, dinosaurs.

4.2 Expected changes in visitor numbers

If the Chengjiang Fossil Site is inscribed on the World Heritage List, it is expected that visitor numbers will grow reasonably significantly. It is projected that annual visitor numbers will increase from the current 10,000 to some 30,000-40,000 in the coming five years. Relative to other national parks or geoparks, such visitor numbers are still on the relatively low side.

4.3 Mitigating potential negative impact

To counter possible negative impact on the site as a result of the increase in visitors, we will adopt the technical guidelines and advice given in the World Heritage Manuals: Managing Tourism at World Heritage Sites. With respect to the nominated Chengjiang Fossil Site the main goals relative to tourism development are to enable visitors to understand the nature of:

1. the outstanding universal scientific value of the Chengjiang fossil Lagerstätte;
2. the Cambrian explosion and its paleontological and evolutionary context;
3. the appearance and basic morphological form of typical Chengjiang fossils;
4. the environment of the area yielding the Chengjiang fossils;
5. the rock strata containing Chengjiang fossils;
6. the importance of protecting and conserving the Chengjiang Fossil Site and its fossils.

For tourist visitors to the Chengjiang Fossil Site it will be important to have a dedicated guided

route/area and to produce allied informative literature, all to professional standards. In order to mitigate the negative impact of tourism the local management departments responsible for the site have already adopted measures to protect the physical environment and fossil-bearing strata.

- **Area designated for tourist visitors**

An area for tourist visitors has been demarcated, on the west slope of Maotianshan. It covers about three hectares and occupies 0.6% area of the Nominated Property (Fig. 10). Tourist visitors enter the designated route-way from a newly-built management station and take a single roadway to arrive at the dedicated tourist area. Tourists will be able to view Chengjiang fossil-bearing strata, including the site of the initial discoveries. They are also able to visit the museum to view typical Chengjiang fossils and learn about their scientific context and importance. The tour lasts for about two hours in total.

For a few professional scientists and appropriate students (e.g., those reading Geology degrees) it will also be possible to visit the geological section at Xiaolantian in the northern part of the Nominated Property (Fig. 10). The Xiaolantian section covers about two hectares, which is 0.4% of the Nominated Property area. The tour time is about 90 minutes.

- **Tourist carrying capacity**

Thanks to convenient accessibility to the dedicated tourist area and the relatively short visiting time needed, the estimated tourist carrying capacity is about 100,000 visits per year (see Management Planning: 4.5.2). Visitor numbers are thus projected to be within the visiting capacity of the site well into in the future.

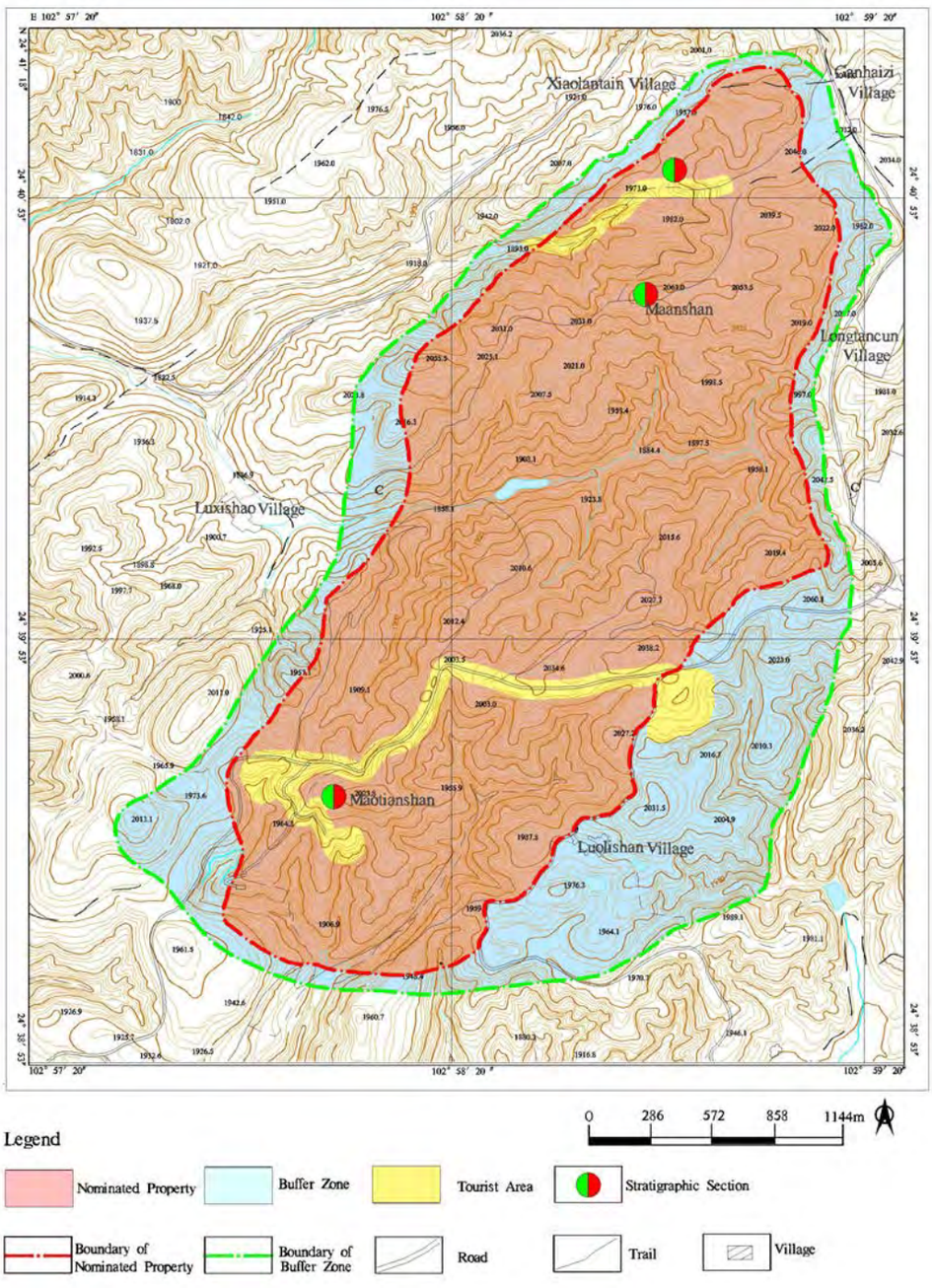
- **Mitigating impact on the fossil-bearing strata**

Key measures will aim to strengthen general education and publicity relating to the Chengjang biota, for the benefit of the wider public; to strictly enforce the boundaries of the area dedicated for tourists; to prohibit tourists from collecting fossils; and to prevent the building of any additional facilities for tourism in the area of the Chengjiang fossil-bearing horizons.

- **Environmental impact**

Potential environmental impact/pollution on vegetation, soil, water resources and wildlife resulting from the forecast increased visitors will not be substantial. The total area dedicated for tourism is relatively small, as is the estimated number of tourists. In addition there is an absence of hotels, restaurants and other recreational facilities and none will be planned for in the future. Measures will also be taken to control and minimize littering the environment.

Fig. 10. Area designated for tourist visitors



Impacts-Integrity

Further information is requested to provide for a clear inventory of the impacts of human development (including but not limited to past mining and access and transportation routes) at the nominated property. In addition to this inventory, it is further requested that the State Party provide information on any plans for remediation (if necessary) it intends to undertake regarding any identified damage to strata. Furthermore it is requested that the State Party outline the specific policies and procedure it will follow prior to undertaking any further infrastructure development at the property , to avoid any possibility of impacts on site integrity.

5. Impacts-Integrity

5.1 List of impacts of human development

The impacts of human development in the Nominated Property and its buffer zone are principally the effects of past mining activities and the development of farmland, roads and infrastructures. Table 2 gives a list of these impacts. Fig. 11 shows farmland distribution and the localities of past mining sites; Fig. 12 indicates the distribution of highways and the locations of buildings.

Table 2. List of impacts of human development

Impact of human development	Nominated Property		Buffer zone	
Past mining	A total of 22 hectares was disturbed by past mining operations. This area is located on the western boundary of the Nominated Property (southern side of Luxishao village). The mines were closed down in 2004 and the damaged area remediated. Vegetation is undergoing gradual natural rehabilitation.		A total of 18 hectares was disturbed by past mining operations. These were located mainly in the buffer zone on the western and southern boundary. The mines were closed down between 2004 and 2007 and most of the damaged area has been remediated. Vegetation is undergoing gradual natural rehabilitation.	
Farmland	Existing farmland	114 hectares	Existing farmland	73 hectares
	Abandoned farmland	27 hectares	Abandoned farmland	/
Roads	Paved road	2186m	Paved road	4500m
	Road	7500m	Road	2760m
	Trail	6300m	Trail	2400m

Buildings	Onsite management station	465 m^2	Onsite management station	1,100 m^2
	Parking lot	1 parking lot; area: 1,687 m^2	Parking lot	1 parking lot, area: 3,250 m^2
	Toilet	1 Toilet, size: 133 m^2	Toilet	2 Toilets, area: 198 m^2
	Museum	380 m^2	Luolishan village	Village size: 12,210 m^2
	Palaeontological research station	900 m^2		

Fig 11. Location of farmland and past mining sites

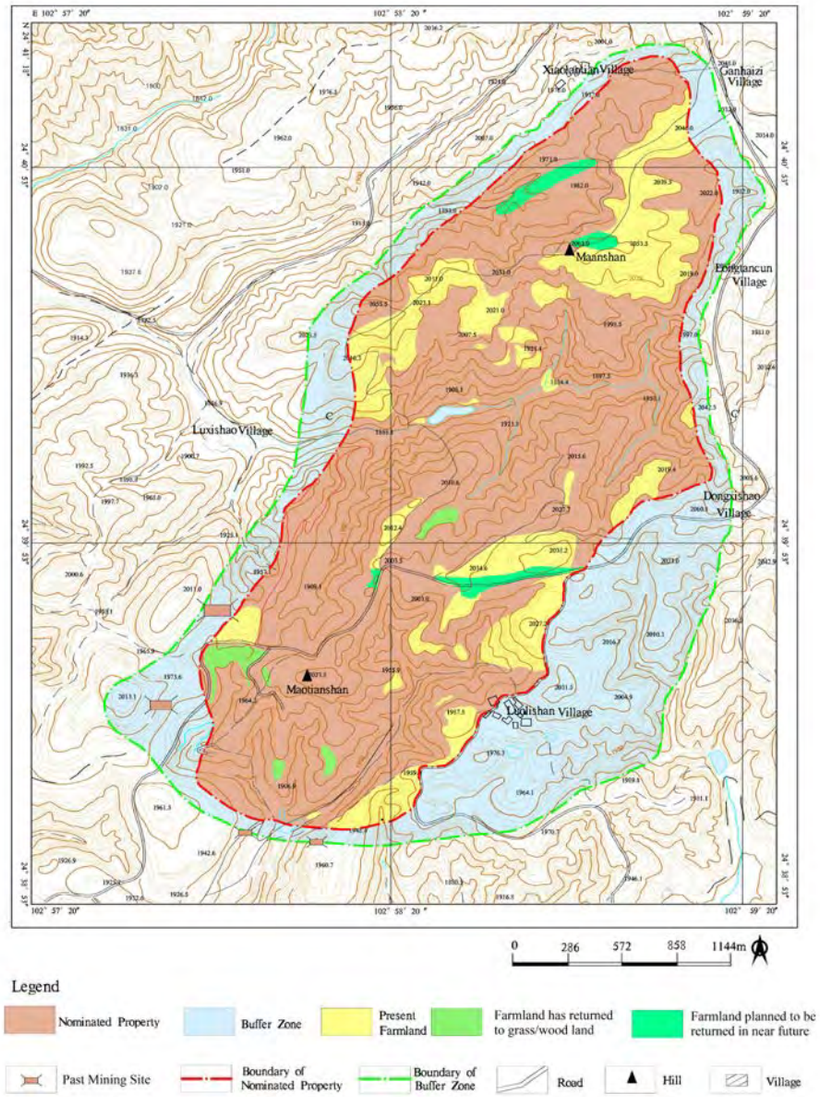
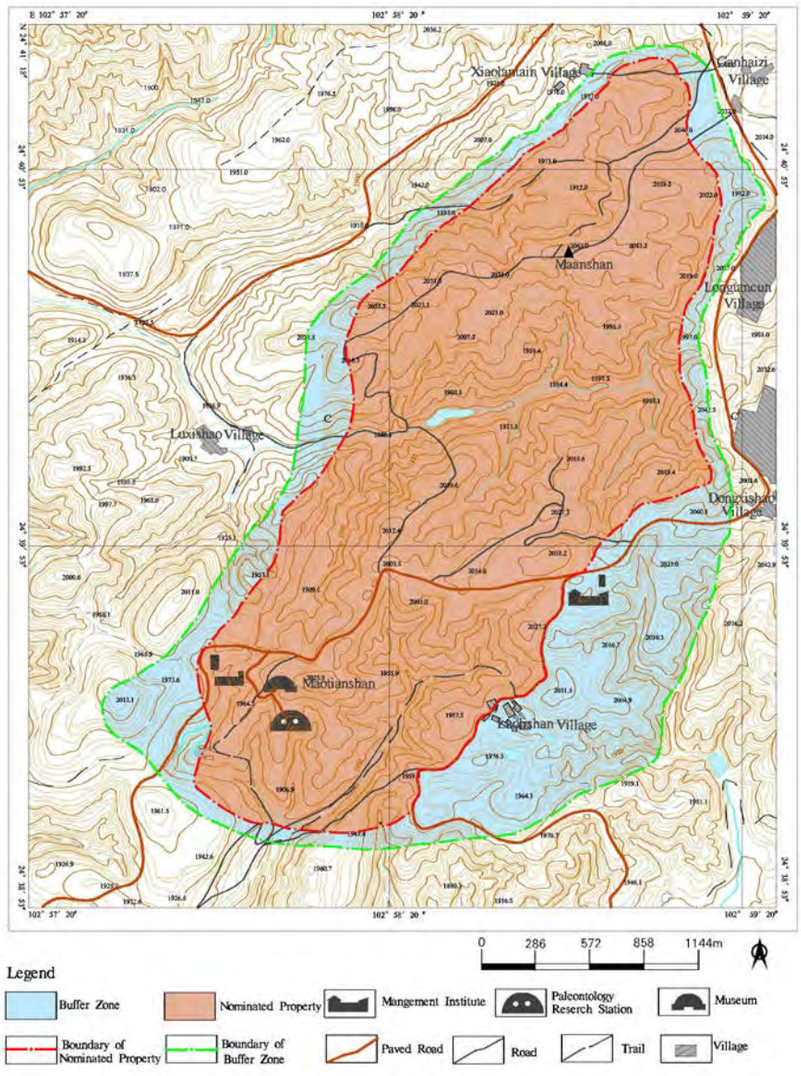


Fig. 12. Distribution of highways and buildings



5.2 Remediation plan for damaged strata

As environment rehabilitation programmes in the past have achieved remarkable achievement within the nominated property and its buffer zone, so far there are no stratigraphic sections in the Nominated Property that retain damage caused by past mining operations, nor are there any buildings incompatible with the environment that need to be dismantled. Mining operations have ceased in the buffer zone, and there is no identified damage to strata requiring remediation. From 2012 to 2015, the environmental remediation plan for the Chengjiang Fossil Site therefore comprises:

1. Forest/grass reclamation on approximately 20 hectares of farmland near Maotianshan and Ma'anshan;

2. Remediation and rehabilitation of the small amount of impact remaining from mining operations in some localities;

3. Development of plans and guidance regarding the architectural/construction style the only village located in the buffer zone, Luolishan, with a view to harmonizing the appearance of the village with the surrounding environment;

4. Ecological restoration in the Nominated Property and its buffer zone by gradually replacing alien plants with indigenous species.

5.3 Policies and protocols prior to undertaking infrastructure development

5.3.1 Policies governing infrastructure development at the Nominated Property

The Chengjiang Fossil Site has been designated as a "National geopark" (2001), a "National natural heritage" (2006) and a "Yunnan provincial nature reserve" (1997). Hence, it is protected by relevant laws and regulations (See 5.b-1, 5.b-2 in the nomination text).

The policies concerning infrastructure development include:

"Access of any organization or individuals to the core zone is forbidden. In case such access is indeed needed for research purposes, prior approval should be obtained from the competent administrative department for nature reserves at the same level; No infrastructure irrelevant to protection shall be built in the nature reserve."

The Regulations on Nature Reserve Management of Yunnan Province (1998)

"No production facility shall be built in the core zone and buffer zone of the protected area."

The Regulations of Yunnan Province on the Protection of Chengjiang Fauna Fossils (1997)

"The Special Protection Zone belongs to the core protection area of the Geopark, and tourist access to this zone is not permitted. Only the research and the management staff who have obtained the required approval can access this zone, in order to carry out research and protection activities. No infrastructural facilities shall be constructed in this zone. In the Class I protection zone, necessary visitor trails and relevant facilities can only be installed if they are compatible and harmonious with the surrounding landscape and environment. Visits to this zone will be controlled and automobiles are not allowed there."

The Technical Requirements for Formulating National Geopark Planning (2010)

"The following activities that violate the planning for national parks are forbidden: to establish various development zones in national parks and build hotels, rest houses, training centers, nursing homes as well as other constructions that have no bearing on the protection of national parks resources in core zones. Such buildings that have been in existence shall be moved out of the national parks according to the planning."

The Regulations on National Parks (2006)

5.3.2 Procedure for infrastructure development at the Nominated Property

The Chengjiang Fossil Site belongs to a national geopark in the national-level protected area system of the State Party. The Ministry of Land and Resources and the Land and Resources Department of Yunnan Province are the competent administrative departments for the site. In this respect, the following protocols are to be observed for any request to undertake infrastructure development in the Chengjiang National Geopark:

1. The Chengjiang County government and Yuxi municipal government must review and approve the proposed infrastructure development plans;
2. The Land and Resources Department of Yunnan Province must review and approve the proposed infrastructure development plans;
3. The Ministry of Land and Resources must review and approve the proposed infrastructure development plans.

In the above approval protocols, the competent administrative departments shall call for an expert panel to review and evaluate the proposed infrastructure development plan, focusing on whether the proposed plans comply with the relevant laws and regulations for the protection of the Chengjiang Fossil Site, whether they comply with the management planning, and whether an Environmental Impact Assessment (EIA) has been undertaken. Failure in the approval of any of the three protocols already prohibits the proposed infrastructure development plan from implementation.

In 2011, the State Party made a decision to submit the Chengjiang Fossil Site for inscription on the World Heritage List. In the administration system of the State Party, the Ministry of Housing and Urban-Rural Development (MOHURD) administers the inscription and management of world heritage sites. Because of this decision, since 2011 additional protocols have been added to the approval process for any infrastructure development in the Chengjiang Fossil Site:

1. The Department of Housing and Urban-Rural Development of Yunnan Province and the World Heritage Management Committee of Yunnan Province must review and approve the proposed infrastructure development plans;
2. The Ministry of Housing and Urban-Rural Development must review and approve the proposed infrastructure development plans.

Failure in the approval of any protocols means that the infrastructure development projects cannot be undertaken. Infrastructure development projects must now go through a strict system of multiple review and approval processes.

In addition to these protocols it must be stressed that, as the Nominated Property is an area of limited size (512 hectares), the management institutions of the Chengjiang Fossil Site and the local government have made a decision that, in order to protect the integrity of the fossil-bearing strata and to better protect the natural environment, in principle, no future infrastructure development will be permitted at the Nominated Chengjiang Fossil Site.

Conservation of other important fossil sites for the Chengjiang biota, outside the boundaries of the property.

As evident in the original nomination documentation, fossils of scientific importance have been excavated and collected outside the proposed boundaries of the nominated property. The State Party is requested to consider the how important fossil sites (strata) bearing Chengjiang biota in the wider region can be managed and protected to ensure that important heritage located outside of the boundaries of the nominated property can continue to contribute to understanding of this significant stage of Earth history.

6. Conservation of other important fossil sites for the Chengjiang biota outside the boundaries of the property

6.1 Management and protection of fossil sites (strata) in the Chengjiang region

As illustrated in Fig. 1 and described above in the boundary delineation section, fossil sites (strata) in the Chengjiang area are mainly exposed to the east of Chengjiang County seat, distributed in an elongated N-S oriented zone. In 2001 when the national geopark was established, those areas where fossil sites and strata are best and most naturally exposed (to the south of Jiucun Town) were incorporated within the scope of the geopark.

To date, most of the fossil discoveries in the Chengjiang region have been concentrated in the Xiaolantian-Maotianshan area. The major known fossil sites outside the boundary of the Nominated Property are the following three (Fig. 13):

i. Dapotou village section

Dapotou village is located about 1.2 km outside the southwestern edge of the Nominated Property. Fossiliferous strata outcrop on the southern and southwestern sides of the village (Fig. 13), but poor exposures and light weathering make it difficult to excavate fossils. From 1987 to 1989 some fossils were collected at this location, and the following arthropods have been published:

1. *Urokodia aequalis* Hou, Chen & Lu, 1989
2. *Xandarella spectaculum* Hou, Ramsköld & Bergström, 1991
3. *Saperion glumaceum* Hou, Ramsköld & Bergström, 1991

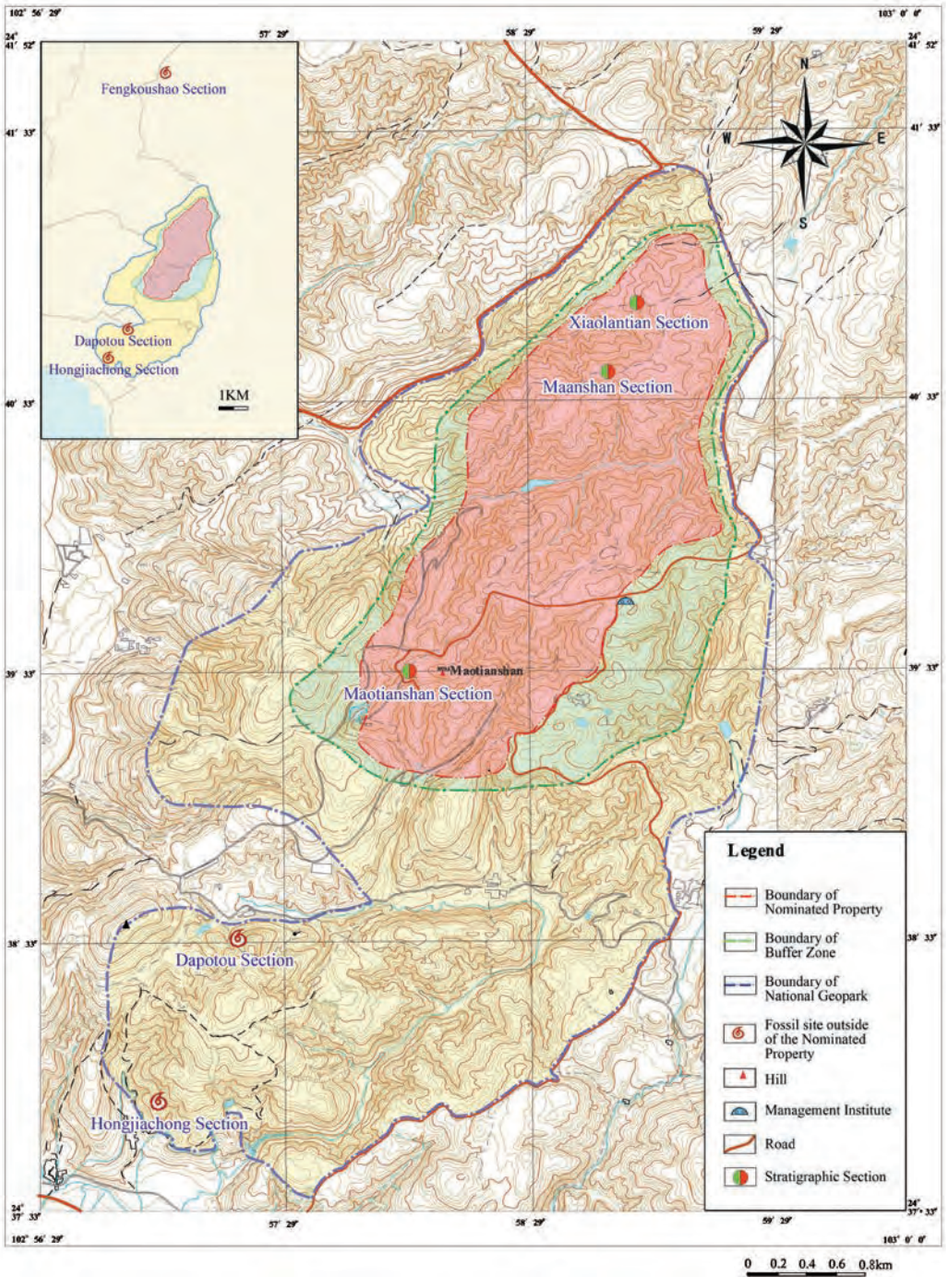
ii. Hongjiachong village section

Hongjiachong village is located about 2.5 km outside the southwestern edge of the Nominated Property. Fossiliferous strata outcrop about 100 m north of the village (Fig. 13), where fossil collection started in 1984. Due to the presence of a fault, some strata are absent. No fossils collected from Hongjiachong village have appeared in published papers.

iii. Fengkoushao village section

Fengkoushao village is located about 10 km outside the northern edge of the Nominated Property. Fossiliferous strata outcrop about 50 ~ 100 m to the south of the village (Fig. 13). In 1990, two weeks of fossil collecting were carried out here. To date, only one arthropod species, *Chengjiangocaris longiformis* Hou & Bergström, 1991, has been described and published from this locality.

Fig 13. Fossil sites outside the boundary of the Nominated Property



The Dapotou village section and the Hongjiachong village section are located outside the Nominated Property but inside the Chengjiang National Geopark. They are, therefore, effectively managed and protected in line with the relevant regulations for national geopark management.

The Fengkoushao section is located outside the Chengjiang National Geopark, so it does not benefit from any conservation regulations. However, activities such as fossil excavation and collection are protected by The Regulations on Management of Fossils (2002), The Regulations on Protection of Fossils (2009) and The Regulations of Yunnan Province on the Protection of Chengjiang Fauna Fossils (1997) of the State Party (See Annex 8 of the original nomination text).

6.2 Conservation of other important fossil sites (strata) outside the boundaries of the Nominated Property

As indicated in the original nomination text (3.d-3, Fig 3-3, Table 3-3), early Cambrian strata are extensively distributed in the eastern part of Yunnan Province. In addition to the fossil sites/strata in Chengjiang County, fossil sites/strata containing the Chengjiang biota (Yu'anshan member of Qiongzhusi Formation) have also been discovered in a dozen counties and cities, including Haikou, Jin'ning County, An'ning City, Chenggong, Yiliang, Malong and Wuding counties. Years of fossil excavation, collection and research have shown that, with the exception of Haikou, the abundance and diversity of fossils found in other areas are relatively low. At present, although no protected areas have been designated for these fossil sites, they are managed and protected under national and Yunnan provincial laws and regulations, such as:

The Regulations of Yunnan Province on the Protection of Chengjiang Fauna Fossils) (1997)

"Article 2: Chengjiang Fossil-Lagerstatte belongs to China and any illegal transferring or assigning by any organization or individual is prohibited."

The Regulations on Management of Fossils (2002)

"Article 9: Fossil excavation by any individual or organization is prohibited."

The Regulations on the Protection of Fossils (2010)

Article 3: Any fossil discovered in the territory of the People's Republic of China or other sea area under the jurisdiction of the People's Republic of China belongs to the People's Republic of China.

Article 11: ... And excavation of fossils ***outside the national protected fossil sites*** *shall be approved by the competent department of the people's government of the province, autonomous prefecture or city directly under the central government where the fossils are located by filing an application.*

Article 15: All the excavated fossils shall be registered with corresponding description and label and handed over to the organization designated by the Ministry of Land and Resources approving the fossil excavation in 30 days from the completion of such excavation or scientific or educational activities.

Thus, applications must be submitted to the competent administrative departments of the local government and approval obtained prior to fossil excavation at any of these sites, including Haikou. All fossils collected must be properly recorded and registered.

Although it would not be possible to set up protected areas at every site where fossils of the Chengjiang biota are discovered, establishment of a protected area at a relevant level will be considered where the importance of a particular site is scientifically recognized. For example, it has been suggested that the Haikou site be designated as a provincial protected area.

All Chengjiang biota fossils discovered outside Chengjiang County contribute to the understanding of the fauna, of the Cambrian Explosion and of the early Cambrian evolutionary environment. In this regard, Yunnan Province will, in line with pertinent laws and regulations, register, approve and check fossil excavations at different sites, and ban illegal fossil excavation. All Chengjiang biota fossils found will be recorded with the catalogue updated annually.

United Nations
Educational, Scientific and
Cultural Organization

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Organización
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منظمة الأمم المتحدة
للتربية والعلم والثقافة

联合国教育、
科学及文化组织

The Culture Sector
World Heritage Centre

H. E. Mr You Shaozhong
Ambassador
Permanent Delegation of China to
UNESCO
UNESCO House

Ref: CLT/WHC/PSM/12/LJ/APA/221 16 August 2012

Subject: **Inscription of *Chengjiang Fossil Site* (N 1388), China, on the World Heritage List**

Dear Ambassador,

I have the pleasure to inform you that the World Heritage Committee, at its 36th session (Saint Petersburg, Russian Federation, 24 June – 6 July 2012), examined the nomination of the ***Chengjiang Fossil Site*** and decided to **inscribe** the property on the World Heritage List. The decision of the Committee concerning the inscription is attached.

I am confident that your government will take the necessary measures for the effective conservation of this new World Heritage property. The World Heritage Committee and its Secretariat, the World Heritage Centre, will do everything possible to collaborate with you in these efforts.

The *Operational Guidelines for the Implementation of the World Heritage Convention* (paragraph 168), request the Secretariat to send to each State Party with a newly inscribed property a map of the area(s) inscribed. Please examine the attached map and inform us of any discrepancies in the information by **1 December 2012**.

The inscription of the property on the World Heritage List is an excellent opportunity to draw the attention of visitors to, and remind local residents of, the *World Heritage Convention* and the outstanding universal value of the property. To this effect, you may wish to place a plaque displaying the World Heritage emblem and the UNESCO logo at the property. You will find suggestions on this subject in the *Operational Guidelines for the Implementation of the World Heritage Convention.*

In many cases States Parties decide to hold a ceremony to commemorate the inscription of a property on the World Heritage List. Upon request to the World Heritage Centre by the State Party, a World Heritage Certificate can be prepared for such an occasion.

I would be grateful if you could provide me with the name, address, telephone and fax numbers and e-mail address of the person or institution responsible for the management of the property so that we may send them World Heritage publications.

Please find attached the brief descriptions of your site, prepared by IUCN and the World Heritage Centre, in both English and French. As these brief descriptions will be used in later publications, as well as on the World Heritage

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website, we would like to have your full concurrence with their wording. Please examine these descriptions and inform us, by **1 December 2012** at the latest, if there are changes that should be made. If we do not hear from you by this date, we will assume that you are in agreement with the text as prepared.

Furthermore, as you may know, the World Heritage Centre maintains a website at http://whc.unesco.org/, where standard information about each property on the World Heritage List can be found. Since we can only provide a limited amount of information about each property, we try to link our pages to those maintained by your World Heritage property or office, so as to provide the public with the most reliable and up-to-date information. If there is a website for the newly inscribed property, please send us its web address.

All the Decisions adopted by the 36th session of the World Heritage Committee are available at the following web address of the World Heritage Centre: http://whc.unesco.org/archive/2012/whc12-36com-19e.pdf.

As you know, according to paragraph 172 of the *Operational Guidelines for the Implementation of the World Heritage Convention*, the World Heritage Committee invites the States Parties to the *Convention* to inform the Committee, through the World Heritage Centre, of their intention to undertake or to authorize in the area protected under the *Convention* major restorations or new constructions which may affect the outstanding universal value of the property.

May I take this opportunity to thank you for your co-operation and for your support in the implementation of the *World Heritage Convention.*

Please accept, dear Ambassador, the assurances of my highest consideration.

Kishore Rao
Director

cc: National Commission of China for UNESCO
IUCN

Extract of the Decisions adopted by the 36th session of the World Heritage Committee (Saint Petersburg, 2012)

Decision: 36 COM 8B.9

The World Heritage Committee,

1. Having examined Documents WHC-12/36.COM/8B and WHC-12/36.COM/INF.8B2,

2. Inscribes the **Chengjiang Fossil Site**, **China**, on the World Heritage List on the basis of **criterion (viii)**;

3. Adopts the following Statement of Outstanding Universal Value:

Brief synthesis

The Chengjiang Fossil Site, located in the Province of Yunnan, China, conserves fossil remains which are of exceptional significance. The rocks and fossils of the Chengjiang Fossil Site present an outstanding and extraordinarily preserved record that testifies to the rapid diversification of life on Earth during the early Cambrian period, 530 million years before present. In this geologically short interval, almost all major groups of animals had their origins. The diverse geological evidence from the Chengjiang Fossil Site presents fossil remains of the highest quality of preservation and conveys a complete record of an early Cambrian marine community. It is one of the earliest records of a complex marine ecosystem and a unique window of understanding into the structure of early Cambrian communities.

Criterion (viii): The Chengjiang Fossil Site presents an exceptional record of the rapid diversification of life on Earth during the early Cambrian period, 530 million years before present. In this geologically short interval almost all major groups of animals had their origins. The property is a globally outstanding example of a major stage in the history of life, representing a palaeobiological window of great significance.

The exceptional palaeontological evidence of the Chengjiang Fossil Site is unrivalled for its rich species diversity. To date at least 16 phyla, plus a variety of enigmatic groups, and about 196 species have been documented. Taxa recovered range from algae, through sponges and cnidarians to numerous bilaterian phyla, including the earliest known chordates. The earliest known specimens of several phyla such as cnidarians, ctenophores, priapulids, and vertebrates occur here. Many of the taxa represent the stem groups to extant phyla and throw light on characteristics that distinguish major taxonomic groups.

The property displays excellent quality of fossil preservation including the soft and hard tissues of animals with hard skeletons, along with a wide array of organisms that were entirely soft-bodied, and therefore relatively unrepresented in the fossil record. Almost all of the soft-bodied species are unknown elsewhere. Fine-scale detailed preservation includes features as the alimentary systems of animals, for example of the arthropod Naraoia, and the delicate gills of the enigmatic Yunnanozoon. The sediments of Chengjiang provide what are currently the oldest known fossil chordates, the phylum to which all vertebrates belong.

The fossils and rocks of the Chengjiang Fossil Site, together, present a complete record of an early Cambrian marine community. It is one of the earliest records of a complex marine ecosystem, with food webs capped by sophisticated predators. Moreover, it demonstrates that complex community structures had developed very early in the Cambrian diversification of animal life, and provides evidence of a wide range of ecological niches. The property thus provides a unique window of understanding into the structure of early Cambrian communities.

Integrity

The property has clear boundaries including the most significant rock exposures of the region, and has a buffer zone that provides wider protection to the property. It is noted that fossil evidence is provided in some sites that lie outside the property boundaries and its buffer zone,

and these areas need to receive appropriate wider protection and are important to provide context for the property.

Prior to 2004, 14 phosphate mining operations occurred in the buffer zone of the property. Since 2008 they have all been closed down. The process of rehabilitating these former mining sites is ongoing and will take some considerable time. No mining activities have actually impacted on the property itself and the ongoing commitment of County and Provincial governments to not open or re-open mines within the property or its buffer zone are critical to protect the values of the property.

Various excavations have occurred within the property in relation to the two key fossil sites. At the key stratigraphic section of Xiaolantian, a deep excavation has been made to create a walkway. Additionally, a museum has been built at Miaotanshan, over the site of the first Chengjiang Fauna fossil discovery. Both the path and museum construction have had impacts on the integrity of the site. The State Party has introduced a process for systematic review and approval for any development which may impact on the site. Moreover, the management authority has completely restricted future infrastructure development in the property.

Protection and management requirements

The Chengjiang Fossil Site is state-owned and protected under the Article 9 of the constitution of the People's Republic of China and by various laws including the Environmental Protection Law of the People's Republic of China (2002), the Law of the People's Republic of China on Cultural Relic Protection (2002), the regulations on the management of paleontological specimens (Ministry of Land and Resources, 2002), regulations on the protection and management of geological relics (1995) and the regulation on the protection of Yunnan Chengjiang Fauna Fossil (1997).

The property is designated as a protected area ensuring that potentially damaging human activities within the site can be prevented. The area is largely covered with secondary forest and shrub and there is no industrial activity or permanent human habitation within the boundary. The property lies entirely within a Chinese National Geopark.

There is an effective management plan, supported by a dedicated and adequately staffed and resourced management body. The Chengjiang Fossil Site Management Institute is responsible for coordinating on-site management of the protected area. The property protection strategy includes a National Geopark zoning plan which affords adequate protection to key fossil sites, supported by staffing for implementation. The finances of the Chengjiang Fossil Site come largely from national sources and are supplemented by smaller contributions at the City and County levels. Stable and special funding for the ongoing management of the property is adequate to address ongoing protection, promotion and presentation of the property. The property has an established monitoring programme including defined indicators for the conservation of this property, and which needs to be integrated with monitoring of the protection of the wider surroundings of the property. The need for ongoing and effective curation of fossil specimens collected from the property, to the highest international standards, is fully recognised and provided for by the State Party.

Visitor numbers are anticipated to increase from a few thousand (4-5,000) individuals in 2012, most of whom are locals or individuals from neighbouring areas and visiting scientists. Increased visitation to the property requires effective management strategies and the provision of guides, designation of restricted areas, and strict restrictions on fossil collecting. It will be essential to carefully regulate visitor numbers within the capacity of the property. The anticipated maximum numbers at the time of inscription were estimated at c.30-40,000 people. There is a need to assure effective land-use planning in areas surrounding the property in order to secure its long-term conservation, including the conservation of fossil sites in the surrounding area that provide context for understanding the value of the property.

4. Commends the State Party on its continued and responsive efforts to improve protection and management of the property and on increasing conservation investments;

5. Requests the State Party to:

   a) Continue to strengthen and enhance land-use planning to avoid further impacts to the values and integrity of the property and its buffer zones,

   b) Ensure proactive tourism management in anticipation of increased future visitation, and to ensure that visitation remains within the capacity of the property,

   c) Ensure any proposed infrastructure development and excavations are sympathetic to the site's values and are subject to rigorous prior impact assessments, to determine if they are appropriate, including via reporting to the World Heritage Committee in line with paragraph 172 of the *Operational Guidelines*;

6. Strongly encourages strengthened management and protection of important fossil sites and strata bearing Chengjiang biota in the wider region to complement research and further the understanding of this significant stage of Earth's history. Enhanced land-use planning as well as management and protection through national and provincial laws is imperative to ensure that the fossil record in the wider landscape is protected, as it provides important context for the comprehension of the property.

Surface and coordinates of the property inscribed on the World Heritage List by the 36th session of the World Heritage Committee (Saint Petersburg, 2012), in accordance with the *Operational Guidelines*.

State Party	Property	ID N	Area	Buffer zone	Centre point coordinates
China	Chengjiang Fossil Site	1388	512	220	N24 40 08 E102 58 38

Brief Description in English

A hilly 512 ha site in Yunnan province, Chengjiang's fossils present the most complete record of an early Cambrian marine community with exceptionally preserved biota, displaying the anatomy of hard and soft tissues in a very wide variety of organisms, invertebrate and vertebrate. They record the early establishment of a complex marine ecosystem. The site documents at least sixteen phyla and a variety of enigmatic groups as well as about 196 species, presenting exceptional testimony to the rapid diversification of life on Earth 530 million years ago, when almost all of today's major animal groups emerged. It opens a palaeobiological window of great significance to scholarship.

Brief Description in French

Ce site de 512 hectares de collines, situé dans la province du Yunnan, offre les archives les plus complètes d'une communauté marine du Cambrien inférieur, avec un biote exceptionnellement préservé où l'anatomie des tissus durs et mous d'une très grande variété d'organismes, invertébrés et vertébrés, apparaît avec un maximum de détails. Le site témoigne de l'établissement ancien d'un écosystème marin complexe. On y trouve au moins 16 phyla, ainsi qu'une variété de groupes énigmatiques et environ 196 espèces, le tout témoignant de façon exceptionnelle de la rapide diversification de la vie sur terre il y a 530 millions d'années, au moment où sont apparus presque tous les principaux groupes d'animaux d'aujourd'hui. Le site représente une fenêtre paléobiologique de grande importance pour la science.

Detailed Map of the Chengjiang Fossil Site