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The Courier

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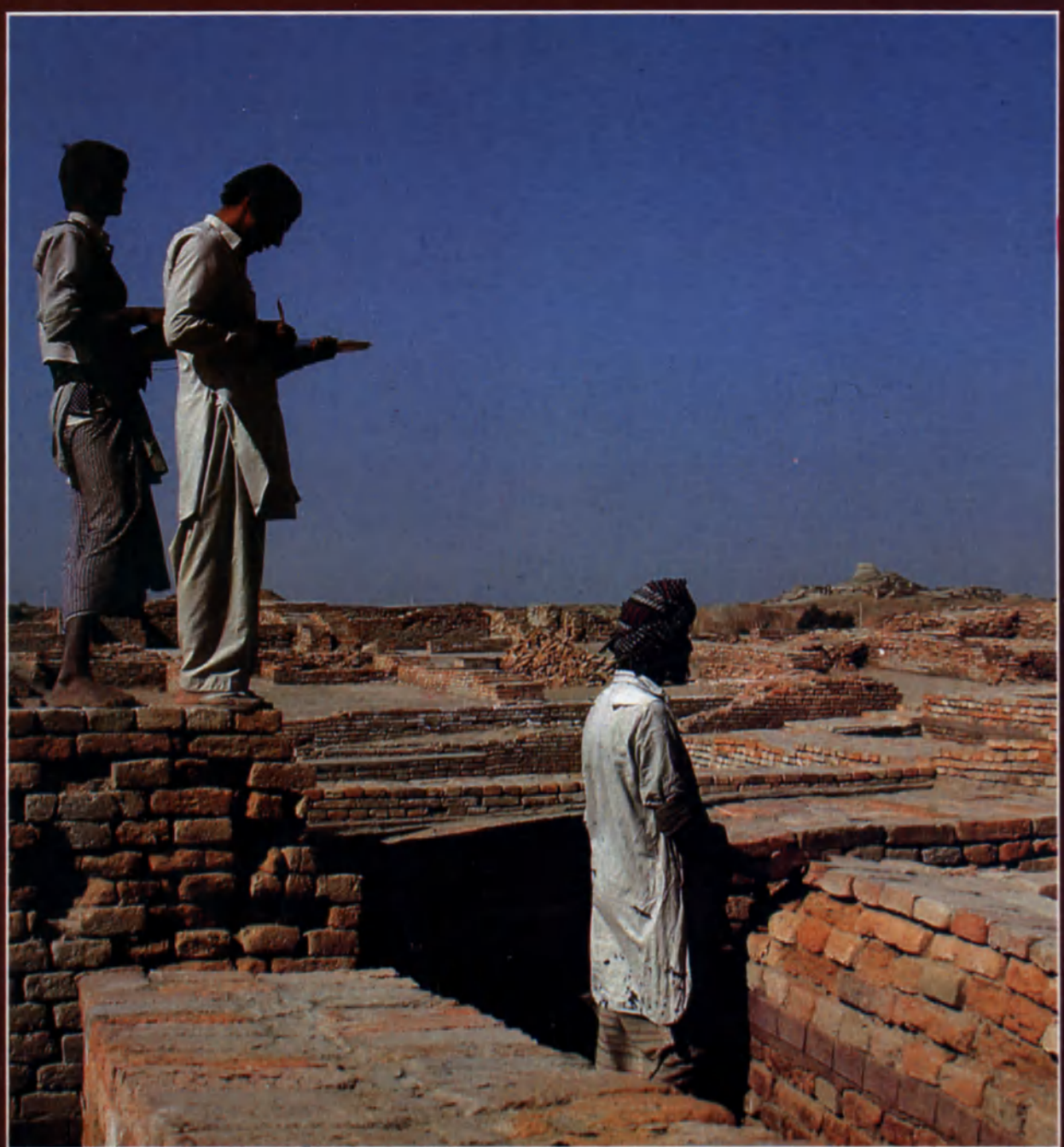
What's new in archaeology?



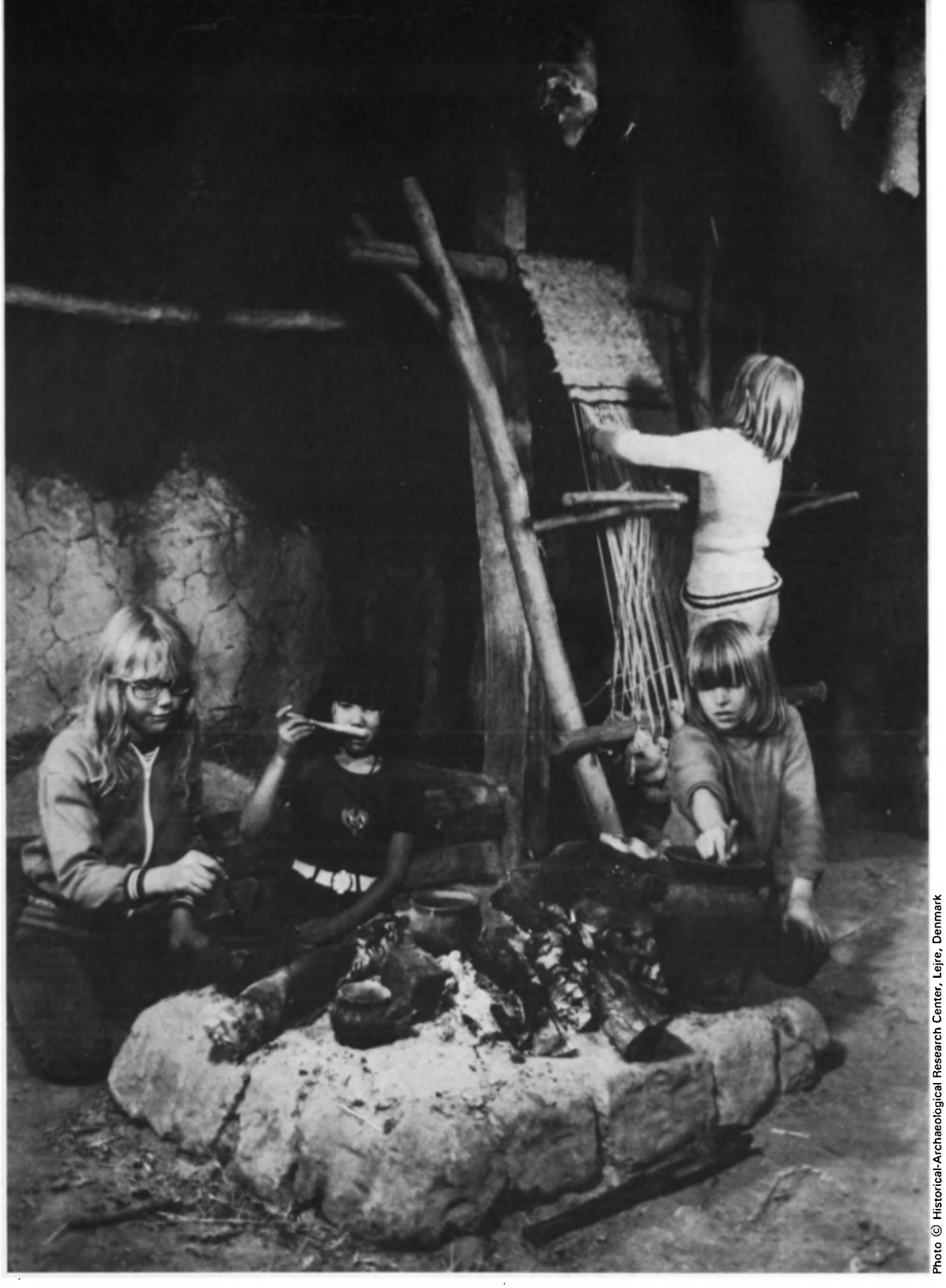


Photo © Historical-Archaeological Research Center, Lejre, Denmark

A time to live...

36 Denmark

Tender cooks, Iron Age broth

Children who visit the Historical-Archaeological Research Center at Lejre in Denmark have an opportunity to live, eat and work as they might have done in the Iron Age. The Center, which was founded to bring children and young people nearer to their past through practical activities, has a weaving workshop, 19th-century farm cottages and a potters' workshop as well as a school and a cluster of Iron Age houses. Here, three young pupils are busy preparing and tasting an Iron Age meal while a fourth works at the loom. Autopsies performed on the bodies of Iron Age men, remarkably preserved in the peat bogs of Denmark, have yielded information about their last meals before they died, up to 2,000 years ago.

UNESCO
The Courier
A window open on the world

Editorial

ARCHAEOLOGY, the study of man's past through the material remains of human activity, has come a long way since it originated among the leisured connoisseurs of sixteenth-century Europe. Whereas the early excavators, it has been said, "were little better than grave-robbers", today's archaeologists are specialists who investigate the past using forensic skills buttressed by a formidable array of scientific and technological expertise.

At the same time, in the late twentieth century the material remains of the past are more than ever impossible to ignore. They are uncovered every day by urban development projects and large-scale engineering works. New nations seeking to establish their own identity feel the importance of a heritage which not only defines the past cultural achievements of their peoples but is also an essential factor in national development. Paradoxically, an age bent on change has come face to face with its past.

In this changing climate archaeology has assumed a new importance and is itself changing. Its activities are expanding into new fields (urban archaeology, industrial archaeology, seismological archaeology...). New theoretical approaches are being developed, and new scientific techniques have made it possible to chart the past of every country more reliably than ever before. The traditional picture of the spade-wielding archaeologist is undergoing drastic modification. A modern archaeologist is part of a multidisciplinary team and may call on teledetection from space as a means of prospection, use a computer for such varied tasks as making a three-dimensional site-map or getting access to the latest archaeological data, and rely on nuclear physics to analyse his finds, as well as appealing to sciences as varied as botany, entomology and even the study of pollen, diatoms and fishbones.

All the same archaeology still means spadework, and to prove it we have chosen to present two major recent excavations in Latin America and Central Asia. The uncovering in the heart of Mexico City of the Great Temple levelled by the Spanish after the conquest in the sixteenth century is one of the most exciting recent events in Latin American archaeology. Equally enthralling is the discovery by Soviet archaeologists of a fabulous Bactrian treasure in the heart of central Asia.

If archaeology today is interdisciplinary it is also, and increasingly, international. Here Unesco has played a leading role for many years, largely as a result of international campaigns to save the world cultural heritage, symbolized in this issue by Moenjodaro in Pakistan.

Last but not least, in International Youth Year, archaeology can tap the enthusiasm of a host of amateurs, many of them young people, whose very existence is a challenge to modern archaeologists wishing to give real meaning to the phrase "democratization of the past".

Cover : At work on the site of Moenjodaro
Photo © Raoul Zamora, Paris

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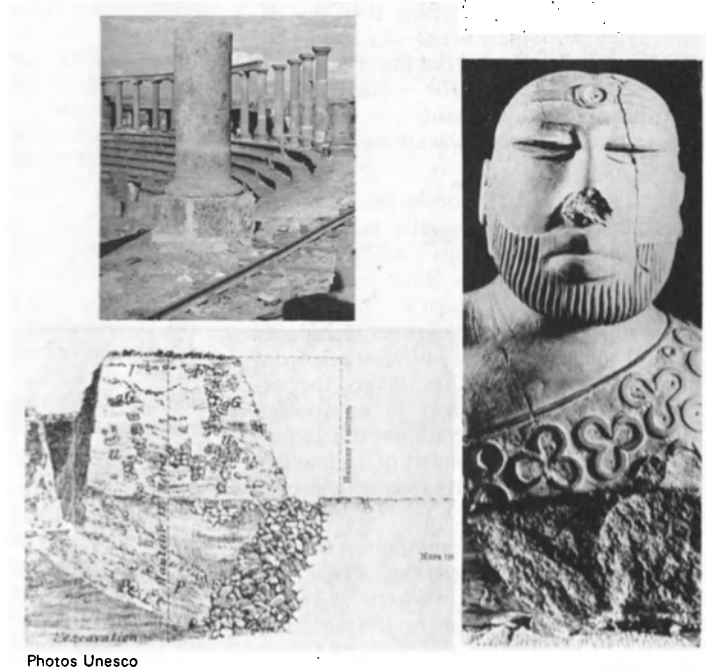
July 1985
38th year



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What's new in archaeology?

by Colin Renfrew

OVER the past two or three decades, archaeology—the study of the human past through the material remains of human activity—has changed profoundly in nature. Archaeology was once widely regarded as some sort of backward extension of recorded history. For times when written records were available it was seen as a useful addition, as simply some sort of illustration of the written narrative. For the prehistoric period, prior to the availability of written testimony, it offered some kind of shadowy reconstruction of the past, an illiterate substitute for a proper historical record.

Today, rather suddenly, archaeology, seems *relevant* and relevant in a very international way. Every continent has its own rich archaeological record, whether or not it has its own written records into the remote past. Moreover we can see more clearly that what happened in the Americas, for instance, or in Africa two or three thousand years ago is just as relevant to our general understanding of human history as events occurring at that time in Asia or in Europe, areas with a longer written record.

Several developments have come together to create a new awareness that the archaeology of all these areas—and let us not leave out Australia and the Pacific—is part of *our* archaeology, the record of the history and achievements of our own species, and a part of the cultural heritage of *our* world.

In the first place, the development of new dating techniques, especially radiocarbon dating, has allowed the archaeological finds from every part of the globe to be dated reliably, without recourse to written history. The application of other techniques from the sciences, along with more rigorous excavation methods, has given the archaeologist a whole array of approaches which he or she can use to investigate past economies, the development of technology and early social systems (see article page 12).

Secondly, with the development of what has come to be called the "New Archaeology", research workers have redefined their aims. We are no longer simply seeking to reconstruct the past, and form some simple narrative of what happened in early times. We are trying in addition to understand *why* things changed and why they became what they are. This aim requires the development of a clearer theoretical framework for archaeology and involves the questioning of old beliefs. And if our goal is to understand how and why things change, the study of the processes at work in one part of the world may give us very valuable insights into those operating in another. The New Archaeology is therefore not ethnocentric, or at least it tries not to be.

Thirdly, with the increased pace of development in many parts of the world, both in towns and in the countryside through the mechanization and intensification of agriculture, many components of the archaeological record are under threat. The awareness that this is so has given rise to "rescue archaeology" as a national policy in many countries, sometimes referred to as Culture Resource Management. This implies both the effort to protect important sites against damage, and an acknowledgement of the need to conduct systematic excavations at those whose destruction cannot be prevented, so as to learn what we can from them before the site has been destroyed. Along with the national, public investment in rescue archaeology has come a deeper awareness of the significance of the early past for each nation's own identity. Our past matters: it is a fundamental part of what we have become. And archaeology is the only way we can find out about our early origins.

Up until a century ago, no-one had any very clear idea of how old the world was, and very little notion of the antiquity of humankind. In most countries there were creation stories, often suggesting that the first appearance of humankind was the act of god, or of the gods. But no one could say with any precision how long ago this occurred.

It was not until 1859, the same year in which Charles Darwin published *The Origin of Species,* that the antiquity of man was established. Flint tools were then shown to have been found together with the bones of extinct animals, and it was demonstrated that the animals and the humans who made the tools must have lived many thousands of years ago.

Work over the century following these revelations made many things clear. It was shown that our species had first emerged in Africa and that most of the globe had first been peopled during what is termed the Old Stone Age, well before 10000 BC. Evidence for the local origins of farming was found in several parts of the world. In some of these areas, early cities developed for the first time and writing was invented.

But when? To give a precise date to these developments was extremely difficult. It was not until the 1950s that progress in atomic physics allowed new analytical techniques to come to the aid of archaeology. From the application of potassium-argon dating applied to these two elements found in rocks of volcanic origin, we know that the first tool-making hominids emerged in Africa around two million years ago. They were not, of course, very much like modern humans. But even the earliest hominids, of the genus *Australopithecus,* had the human ability of walking upright, of using the hand to hold things in a prehensile grasp, of binocular vision, and other abilities distinguishing them from many other species.

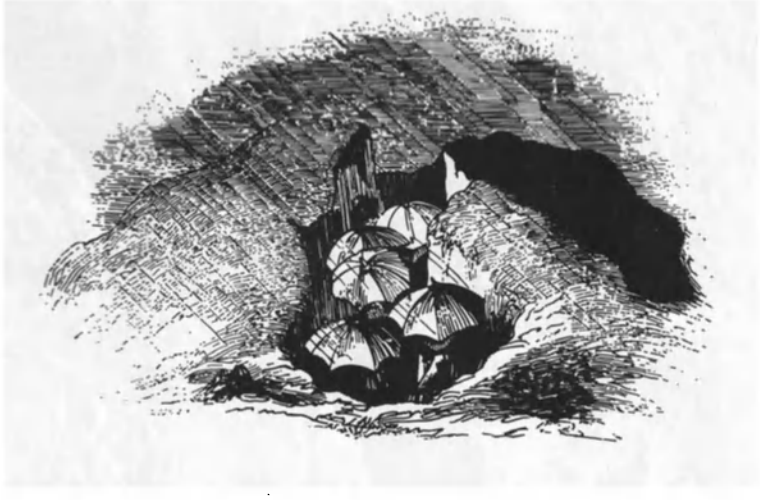
By 35,000 years ago, the first members of our own species, *Homo sapiens sapiens* are seen. Modern humankind dates from then and this date for the appearance of modern humankind is given to us by radiocarbon analysis. This technique of radiocarbon dating is another spin-off from atomic physics, and it allows any piece of organic matter (that is to say, material derived from once living things, whether animal or plant, and which contains carbon) to be dated in the laboratory, so long as it is not more than about 40,000 years old.

For prehistoric Europe, these results have produced a revolution in our thinking. They showed that many of the very early European developments were not derived from the east Mediterranean area, as had once been thought. For instance it is no longer true that the pyramids of Egypt are the earliest stone-built monuments in the world. Some of the stone-built tombs of Europe are earlier, and Stonehenge in England or the temples of Malta are now the contemporaries of the pyramids not their younger relatives.

The broader significance of radiocarbon dating is much wider even than this. It means that for the first time, those areas which did not have an early written history can have their own secure chronology. We know now, for instance, that Australia had a human population, the ancestors of the modern aborigines, as early as 25,000 years ago. We can now date properly the early developments in the Americas, to take another example. It has been shown that the origins of the Maya civilization of Mexico and neighbouring countries date back as early as 2000 BC. We can now begin to understand the African iron age, and recognize properly the true originality of the terracotta and the bronze sculptures of Nigeria, some of them dating back to around 600 BC. ▶

Photo © John Reader, London

An extraordinary combination of climatic and geological conditions has preserved these footprints of a hominid in petrified volcanic ash at Laetoli, Tanzania, for some 3,600,000 years.



Above, excavating a tumulus in fair weather and foul, as depicted in the* Gentleman's Magazine, *1852. Below, a modern scientific excavation being carried out at a Palaeolithic site in the Oise, France.

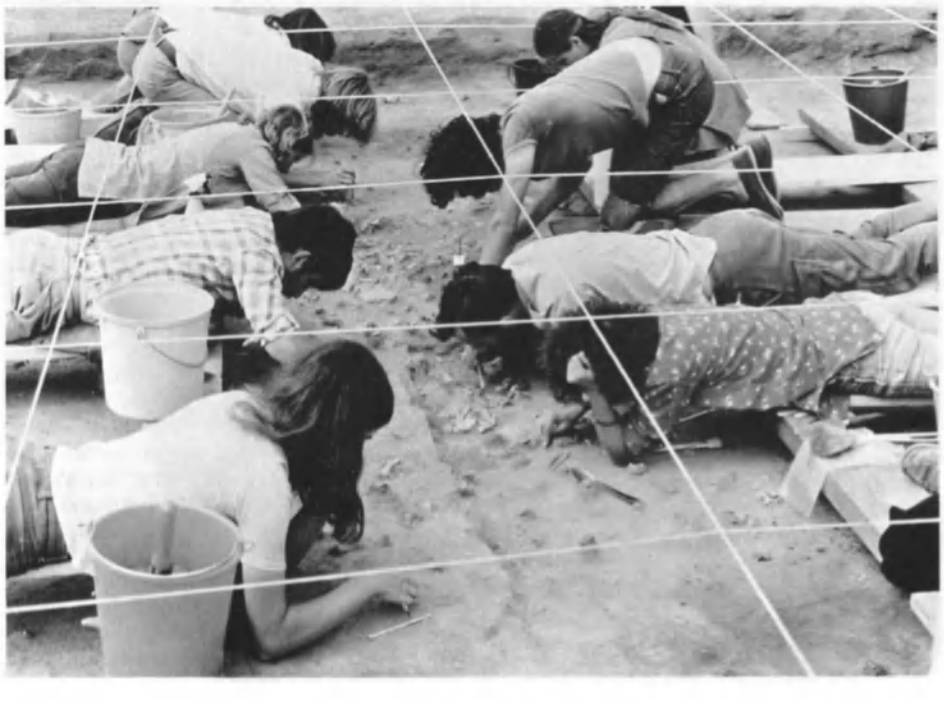


Photo © Roger Agache, Abbeville, France

These are just a few examples of the many which could be brought forward from each area of the globe. All of this means then, that it is now possible to speak in terms of a world prehistory. For each area the long sequence of human development can be built up. As a result of this dating revolution, each country can have its own, well-dated prehistory.

Dating techniques represent, however, only one group of the techniques of archaeological science, even though they are probably the most important. Another line of investigation is the laboratory analysis of artefacts—stone tools, for instance, or pottery—which can often give clear indications of the original source of the material used. This allows us to learn something of the trade and exchange of goods among the early populations and of the system of distribution of the goods to the areas where they were used, buried and later discovered by the archaeologist.

The life sciences too have made their contribution. From the study of the rubbish of early societies it is now possible to build up a very clear picture of their diet, and hence of their subsistence economy. For instance, carbonized seeds from rubbish dumps, when studied by a specialist, can reveal precisely what food crops were being cultivated by early farmers. Investigations of animal bones can indicate which wild animals were being hunted, and whether or not domestic animals were being kept and in what numbers and proportions.

Modern archaeology, it has been said, is sometimes just the study of poor man's rubbish. This is often quite true! For by studying these rather modest remains we can build up a whole picture of the developing economy of early societies which may tell us more about life in them than the most precious objects of gold or jade.

In many ways, however, the most exciting recent developments in archaeology have not been those achieved in the laboratory, in the perfection of dating methods or the study of the early environment. They have come rather, from a change in outlook, and of philosophy. The "New Archaeology" began in the 1960s, in the United States and in Britain, arising from a dissatisfaction with the assumption and outlook of the traditional archaeology, which often seemed to reach conclusions framed in very simplified historical terms. Its leading exponent has been Professor Lewis R. Binford of the University of New Mexico at Albuquerque, and his great achievement has been to show that in order to understand the past it is not sufficient just to dig up the artefacts of past ages and to write some intuitive story based on one's impressions of them.

Instead, our concern should be the study of culture process—that is to say how and why human cultures change. We have to ask much more carefully what is the explanation for all the differences, the variability which we see in the archaeological record. This means that we have to develop a better theory, a better methodology for archaeological interpretation.

Processual archaeologists, then, seek to understand why things changed, and this means developing explanations through a willingness to generalize. It implies the con-

Photo Alexis Vorontzoff, Unesco

Prehistoric megalithic temple complex at Ggantija, on the island of Gozo, Republic of Malta. Modern scientific dating techniques have shown that some of Malta's prehistoric stone temples, characterized by a very skilful use of local materials, were built before 3000 BC, much earlier than was once thought. Unesco is co-operating with the Maltese Government on the preservation and presentation of Malta's important monuments and sites.

struction of theories in the same sort of way that the scientist works when understanding the world of nature. These theories can then be assessed, and sometimes they can be tested against new archaeological findings.

To take an example, we may want to understand how a particular city came to be built, and how civilization emerged in an area—whether we are talking of ancient Rome, or of Moenjodaro in Pakistan, or whatever. To do this properly we need to seek some more general understanding of the processes which lead to increasing growth and complexity in different human cultures. We can then study how far the case of Rome or Moenjodaro fits into the general picture, and try to examine the special features of each.

The "New Archaeology" is more optimistic than the traditional approach. It does not accept the assertion that we cannot learn through archaeology about the social organization or the religious life of past societies as many traditional archaeologists have asserted. Rather we have to try and develop sound arguments which will allow us to interpret the data about these aspects of society, as well as about diet and about technology and so forth.

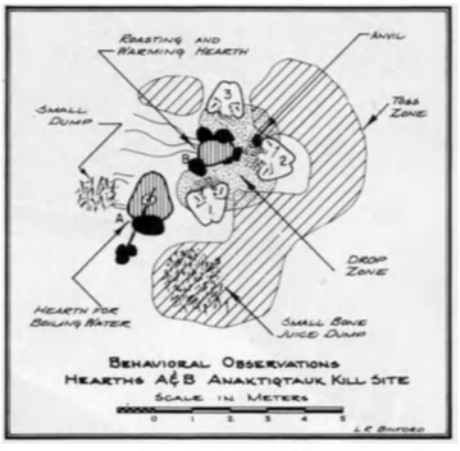
Processual archaeology is very concerned also to think more carefully about how the archaeological record itself is formed—about exactly how the sites which we dig up, and the objects which we find in them, come to be found where they are. The new field of ethnoarchaeology has developed in order to investigate these issues. It involves going out to live in a suitable contemporary community, which has a way of life that is in some respects similar to the prehistoric or historic one that one seeks to understand. The ethnoarchaeologist studies how the modern archaeological record in that contemporary society comes about.

Lewis Binford was one of the first archaeologists to go and do this. His interest was in the hunter-gatherers of the Mousterian period, 40,000 years ago. He saw clearly that the best way to understand the archaeological record of those long-dead hunter-gatherers was to go out and study in detail the archaeological record of a living community of hunter-gatherers. He chose the Nunamiut eskimos of Alaska. He lived in a suitable community, taking part in hunting expeditions. And because he was not a very good hunter, he did the butchery for the group. This gave him the opportunity of studying how rubbish is discarded in such a community, and his work has contributed greatly to the study of early hunter-gatherers.

The same techniques of study can be applied to urban communities also. In Tucson, Arizona, the "Garbage Project" under the direction of Professor William J. Rathje has studied the rubbish discarded by families in different districts of the city. Since they do not simply throw rubbish away, but deposit it in trash cans, the Garbage Project has had to turn itself into a rubbish-disposal squad, collecting the garbage from the trash cans and studying it in the laboratory. It may sound odd, but the results are very interesting.

This project illustrates the point that the techniques of archaeology are relevant to the material culture of human societies at all times and places, ancient and modern. The contemporary archaeologist no longer thinks in terms of "primitive" and "advanced" cultures. The hunter-gatherer of today or yesterday is as interesting as the city-dweller: both are part of the rich variety of human culture—although it must be admitted that hunter-gatherers have contributed to it for a hundred times as long as city-dwellers!

There is another reason why modern archaeology really does deserve its place in the modern world. The traditional archaeology often explained things in terms of the "diffusion" of culture. The assumption was ▶



Drawing © L.R. Binford. Taken from *In Pursuit of the Past*, Thames and Hudson Ltd.

To help him unravel the archaeological record left by the hunter-gatherers of the Mousterian period, 40,000 years ago, the U.S. archaeologist Lewis Binford decided to study the archaeological record of a modern community of hunter-gatherers, the Nunamiut eskimos of Alaska. In seeking to understand how hunters perceive and use their landscape and the kind of archaeology they create by their actions, Binford mapped the life of the Nunamiut community in every detail. Above, line drawing by Binford of activities he observed at a Nunamiut killing and butchering site. Bone splinters discarded by 2 men (nos. 2 and 3) entered the drop zone. Larger bones were thrown behind them in the toss zone.

▶ made that the major advances came about only in one or two areas, and were transmitted to the barbarian fringe by the "diffusion" of culture. In recent years, researchers have come to realize that this was sometimes a rather colonialist viewpoint, implying that the interesting developments came about only in a few crucial, privileged centres.

Today we see that, to understand the changes taking place, you have to understand the processes that are operating locally in the area under study. It is necessary to study the changes in social structure, the developing population, the economy and technology. Exchanges with other areas, and the importation of new ideas can admittedly play and do play a part in that process, but they are not necessarily of dominant importance.

To take one example, it was assumed for many years that the ruins of Great Zimbabwe, in the country which today takes its name from that monument, must have been the work of skilled immigrants from the north, or perhaps the result of contacts with Arab traders. It simply was not accepted that they could be the work of the local inhabitants, that is to say, of the African population. Yet today all the evidence (including the radiocarbon evidence) goes to show that this was in fact the case. We don't need immigrants, or a trading mission, to account for the monument, which we can explain better in terms of the local working of the society of the time. Just the same is true of Stonehenge in England which used to be thought of as the product of contacts and skills of the Mediterranean world. Today we think of it in local terms. We don't need Mediterranean colonists to explain it.

This does not mean that we should always think of each land in isolation. But it does encourage us to believe that every nation should encourage the investigation by archaeological means of its own past. Today most countries are proud of their own cultural heritage, and some of them have remarkable museums, like those in Mexico City and in Cairo, to display it.

There is also a growing concern for the conservation of the cultural heritage. Unesco is sponsoring a number of projects, such as its major campaign to save the remains of the great early city of Moenjodaro in Pakistan (see article page 32); and most nations have their own programme for safeguarding monuments. These are now seen as international problems. Some of them will be discussed at the World Archaeological Congress, to be held in September 1986 in Southampton and London (see note page 38). The U.K. national secretary, Professor Peter Ucko of Southampton University, is expecting that representatives from most countries in the world will attend. They will discuss problems of conservation and of interpretation, in the light of the newly-emerging international consciousness about our early past.

Archaeology used to be the pursuit of a few leisured amateurs, often based in the more prosperous centres of the industrial west. Today it is a field of great interest to many people in every country in the world. This is partly because it gives each of us an opportunity to understand more fully our own national history. But to focus on one's own nation alone is mere chauvinism. Archaeology also offers us the opportunity to see the early history of each land as one part of the broader history of the human species as a whole. And processual archaeology invites us to try to understand better the greater diversity of human culture, now and in the past. This has been made easier both by the battery of techniques made available by the sciences, and the rigour and the self-awareness which have been part of the "New Archaeology". ■

The Tucson Garbage Project

The brainchild of a group of anthropologists at the University of Arizona, the Tucson Garbage Project was launched in 1973 in order to study the material culture of a modern city by "excavating" its garbage, considered as evidence of its residents' way of life. In the words of the Project's director, Professor William L. Rathje, "we believed that assumptions about the way material culture is related to behaviour in past civilizations can be tested in a familiar, on-going society. Second, we felt that applying archaeological methods to such a society can produce valuable insights into that society itself." Below, Rathje's student workers carefully sort, record and weigh household garbage for evidence of what contemporary society buys and how it lives. This attempt to take a systematic look at modern society in the United States from the archaeological viewpoint is the prototype of similar studies conducted elsewhere in the United States as well as in Mexico city and Sydney, Australia.

Photo © W.L. Rathje, Tucson, Arizona

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Let the past serve the future

by Osaga Odak

"Pick it up. Feel it. Take it to pieces. Can you find this? This is the message that the children in Kenya are given these days when they visit one of the national museums." This statement in a Nairobi newspaper highlights the main objective of the Nairobi Museum's education services—to show that learning can be an active and enjoyable process. Below, students handle a cast of early man at the National Museum, Nairobi.

IN the Third World, application of development theory is directed primarily towards alleviating human suffering and enabling people to live relatively comfortable lives. This implies the provision of better health services, adequate educational opportunities and proper communications systems as well as improving agriculture and moving towards industrialization.

The role of culture (and of archaeology which is concerned with an aspect of culture) in development has, however, generally been neglected. Yet if development is to be meaningful, it has to embrace all spheres of human activity, including culture. Cultural intervention in development, it must be stressed, is fundamental to the stability of the development effort.

Archaeology evolved as a discipline in Europe. But at the time when it was developing into a truly scientific discipline the continent of Africa was in the process of being colonized. The colonists were preceded by explorers and missionaries who saw ▶

Photo © National Museum, Nairobi

▶ Africa as a continent inhabited by primitive peoples who needed to be rescued from barbarism and brought to civilization basically through the Christian religion.

To the missionaries, African religions and values were not worthy of preservation and development. Furthermore, the religious systems the missionaries imposed were based on alien cultural systems which were incompatible with African cultures. The whole fabric of African culture was undermined. Shrines were replaced by churches, mosques and temples, sites sacred to the Africans were defiled and artefacts that bore witness to the continent's pre-colonial technological achievements were replaced by industrially produced items.

This was the context in which European and American archaeologists came to Africa. They came not to save African culture and history from destruction, but primarily for their own personal aims and ambitions. Nevertheless, there were some positive side-effects since their work, oriented as it was towards reconstruction of cultural successions and the development of general archaeological methodologies and theories, not only revealed numerous past cultural achievements and laid the foundations for future work, but also led to an upward reassessment of the African cultural profile.

Cultural consciousness based on traditional culture among the colonized was not encouraged during colonial times even in countries where the colonists established organizations dealing with antiquities and archaeological programmes.

After independence, however, there was a movement towards what might be termed a "cultural renaissance". Study of traditional culture systems and elements of cultural disciplines such as archaeology found their way piecemeal into syllabuses. However, the lack of a sufficient number of trained local educationists and the almost total reliance on foreign experts in the preparation of educational programmes resulted, to some extent, in a continuation of colonial programmes.

As the African countries moved towards self-sufficiency in manpower, the position began gradually to change. Efforts were made to intensify investigation of the history of Africa, but since there were few written records in which that history was reflected, African historians turned to other sources. Archaeology in particular gained new popularity as a tool of historical research and was introduced as an auxiliary discipline in the history departments of several African universities.

Nevertheless, the appeal of archaeology remains limited. This is in part because excavation, an essential element in archaeology, involves dealing with burial-grounds, skeletal remains and other sites and objects associated with certain taboos. Hence, in ordinary people's minds, to be an archaeologist is to be a "grave-digger" and to practise an abnormal profession.

Modernization has also had a negative influence. Modern developments in agriculture, road building and the construction of dams and hydro-electric power plants have destroyed sites once regarded with reverence and this in turn has encouraged vandals to destroy other formerly sacred places either in the hope of finding treasure or even just for fun. All this has created a climate of general disrespect for traditional culture that has extended to include disciplines such as archaeology and anthropology which study traditional culture.

During the International year of Disabled Persons, 1981, the Tunisian National Committee of the International Council of Museums (ICOM) designed a scheme to use museum facilities to help mentally handicapped children. Right, during their first experimental visit to an archaeological museum, the National Museum of the Bardo, Tunis, a group of handicapped children examine a massive foot from a statue of Jupiter. Above, a drawing made after the visit by one of the children, Khaled Zarrouq. The scheme proved that the mentally handicapped could benefit from the stimulus of regular visits to museums.

Students' quarters at the Centre for Museum Studies, Jos, Nigeria.

Photo © National Museum, Jos

Since independence the influence of foreign archaeologists and of foreign foundations funding archaeological projects has continued to display both negative and positive aspects. Recent advances in the study of human origins, especially in east Africa, have, for example, focused world attention on Africa's distant past. They have also given outsiders the impression that African archaeology has no problems and that work is going ahead smoothly.

The fact is, however, that these studies refer to periods before the emergence of modern man. It may be asked, for example, to what extent the study of human origins contributes to the understanding of the history and culture of the modern populations of Africa. A government which is conscious of the need to understand the overall past of its peoples cannot rely almost exclusively on one aspect of human history, however important, which is of little direct relevance to its peoples, whilst ignoring those areas vital to the promotion of their consciousness of their cultural identity.

A further problem is that, due to the shortage of funds from internal sources, African archaeologists seek and receive

Photos © National Museum of the Bardo, Tunis

financial assistance from foreign foundations and financing agencies. Although in a number of cases this has led to archaeological work being carried out which would not otherwise have been done, it also involves two major negative side-effects. Firstly, it tends to encourage local authorities not to provide for archaeological work in their development planning on the grounds that funds will be available from foreign sources. Secondly, these foreign foundations and agencies usually assist only projects they themselves have selected. As a result local archaeologists find themselves obliged to design their research proposals to fit in with the dictates of the funding agencies. In this way foreign foundations may influence the development of archaeological work in a country without necessarily involving foreign researchers.

All this highlights the need for coherent, clear-cut national policies for archaeology backed by legislation and adequate financial resources. Such policies should include clear guidelines concerning the relationships between archaeology and other cultural organizations and disciplines as well as an element of manpower planning.

An archaeological organization manned by a sufficient number of local archaeologists and inspired by a well-formulated policy could play a very positive role. By co-ordinating the efforts of local and foreign researchers it could prevent duplication of effort and ensure proper distribution of research over the different time periods and different aspects of archaeology.

Armed with a sound policy and a knowledge of national priorities, a local archaeological organization could relate archaeological efforts to national development needs and provide up-to-date information on the country's archaeological potential. It would also be expected to have at its disposal detailed documentation on the country's cultural resources, including an inventory of archaeological sites and monuments based on work undertaken previously together with the relevant data (field notes, reports, publications and other unpublished materials) retained at its documentation centre.

The public has yet to recognize the role archaeology has to play in modern development and few Africans are attracted to it. It is not unusual for African countries to have no more than a handful of professional archaeologists, or even just one. The battle for recognition has not been won even within academic circles. The problem is to remove archaeology from the dark corners of academic élitism and throw it open to the public.

Young people are currently in the majority in Third World countries and, just as the ultimate solution to illiteracy lies in free and compulsory education for youth, so also, if the battle for the recognition of archaeology is to be won, it has to start with them. There is therefore an urgent need to stimulate interest in archaeology among the young, to enhance its status within academic circles and to develop interest in it among the public at large.

Archaeology provides data which contribute to the reconstruction of the history of peoples whose past is not or is only little reflected in written records. Relics unearthed at archaeological sites mirror the origin and development of a people's culture. Some of the sites excavated could be developed into on-the-spot museums or cultural parks.

Archaeological sites, treasures and artefacts can become symbols which intensify a people's sense of belonging to a locality and to a historical and cultural tradition. A sense of cultural identity is the basis for self-awareness and self-realization which opens up vast opportunities for individual or group creativity. Accordingly, archaeology can play an important role in any nation's development. ■

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How science unlocks the secrets of the past

by Tony Hackens

ARCHAEOLOGY was born in sixteenth-century Europe as an offshoot of the scholarly pleasures of the Renaissance. Many early archaeologists were collectors motivated by an aesthetic interest in Antiquity and a desire to reconstitute the background of events described by ancient writers.

Until the beginning of the twentieth century, generations of archaeologists set out to rediscover and excavate great sites, to record the evolution of styles and to retrace the interplay of cultural influences according to aesthetic criteria and typology—the study of objects by types.

Today's archaeologist usually lives in a world which is far from the preoccupations of scholarly collectors or prestige excavations. He or she is at the centre of a group of specialists from different scientific disciplines. Working with these specialists and profiting from methods used in the natural sciences, modern archaeologists attempt to decipher the messages stored in the

Tell-tale tree rings

In the late 15th century Leonardo da Vinci discovered seasonal growth patterns in trees. In this century *tree-ring dating (dendrochronology)* has become a science. Each ring produced in a tree's trunk during its yearly growth is unique. The rings are wide or narrow depending on the prevailing growth conditions, and precisely the same long-term sequence of wide and narrow rings is never repeated, because year-to-year variations in climate are never the same. By putting together tree-ring patterns from overlapping living trees and dead wood (see diagram) scientists construct a *tree-ring chronology*. Samples of wood from objects discovered by archaeologists can be dated by being matched, either visually or using a computer, to such master chronologies, established region by region.

Because they live to such a great age, the bristlecone pines which grow in the White Mountains of California have served as a unique tool in tree-ring dating. Using them, Dr. C.W. Ferguson of Arizona University has established a continuous tree-ring sequence which stretches back over 8,500 years into the past (see back cover). Ferguson hopes that this sequence will eventually reach back at least 10,000 years. This sequence and others developed in other parts of the world have been used to "calibrate", or cross-check, dates established using *radiocarbon* or *carbon 14*, another important scientific dating method used by archaeologists.

Developed in the late 1940s, radiocarbon dating is based on the fact that living organisms absorb radiocarbon from the atmosphere. When they die the carbon disintegrates at a known rate, and by measuring the amount of it left in a sample of organic material such as charcoal or bone, it is possible to determine how long ago the plant or animal died. However, when scientists analysed the carbon 14 content of tree rings of known age they found that although the carbon 14 age and the tree-ring age should have been the same, there were actually considerable discrepancies. Earlier than 1000 BC the carbon 14 dates give a progressively greater underestimate of the true calendar date. Why is this so? The reason is that radiocarbon dating was based on the assumption that the cosmic rays that created carbon 14 had bombarded the atmosphere at a fixed intensity, but in fact carbon 14 has fluctuated. Today, tree-ring calibration charts have been established which convert radiocarbon years into calendar years. It is amazing to think that some Swiss lake-villages of the 4th millennium BC can be dated not by millennia or centuries but down to the year in which the trees used to build them were felled.

This development had far-reaching consequences for archaeology. Many European prehistoric monuments and sites were shown to be centuries older than previously thought. The classical theory whereby their origin was due to skills and motivations which were diffused into Europe from the east was no longer tenable in the light of tree-ring calibration.

Left, section of an oak felled in the Forest of Fontainebleau in 1952. By counting the tree-rings it was possible to establish the age of the tree which, because it began to grow around the time of the Massacre of St. Bartholomew in Paris, in 1572, is known as the oak of St. Bartholomew.

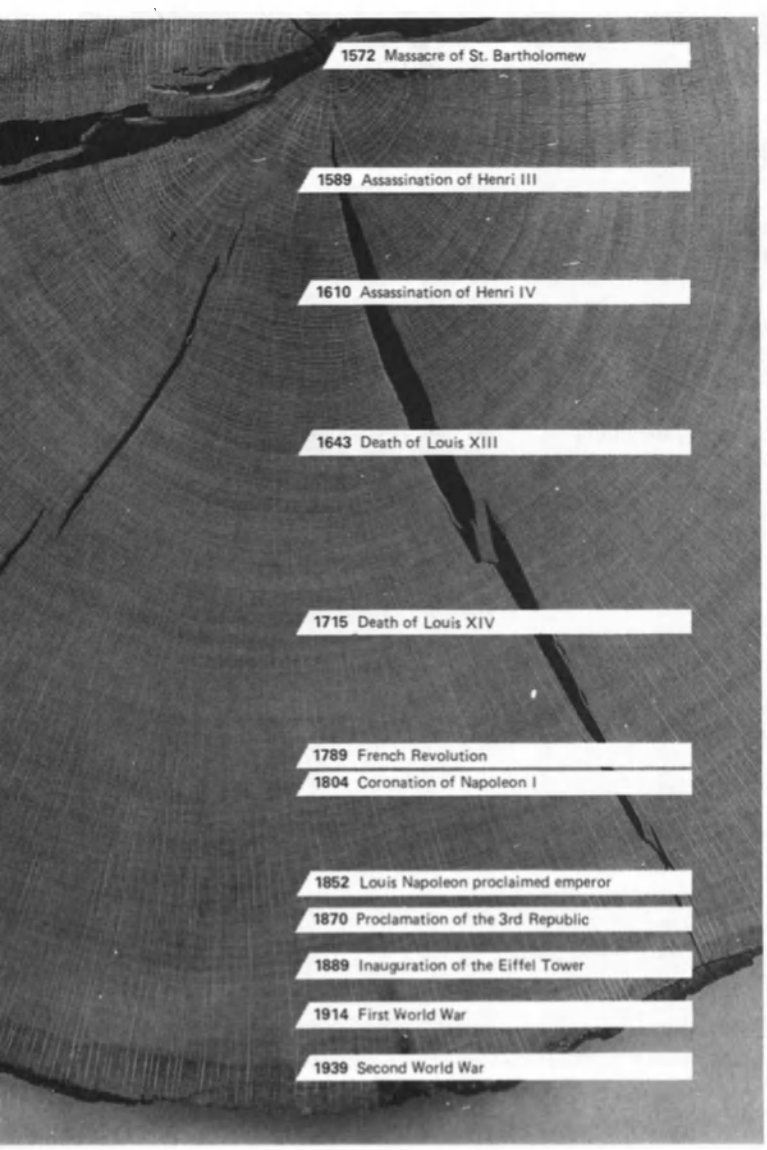
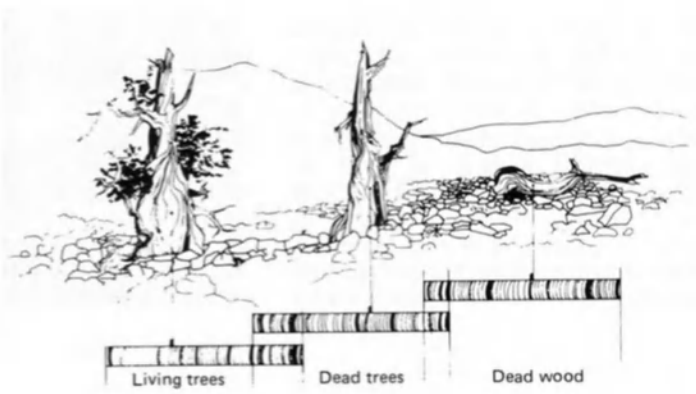


Photo © Centre Technique du Bois, Paris



Drawing Bob Kinmont © Eastern Sierra Interpretive Association, Bishop, California

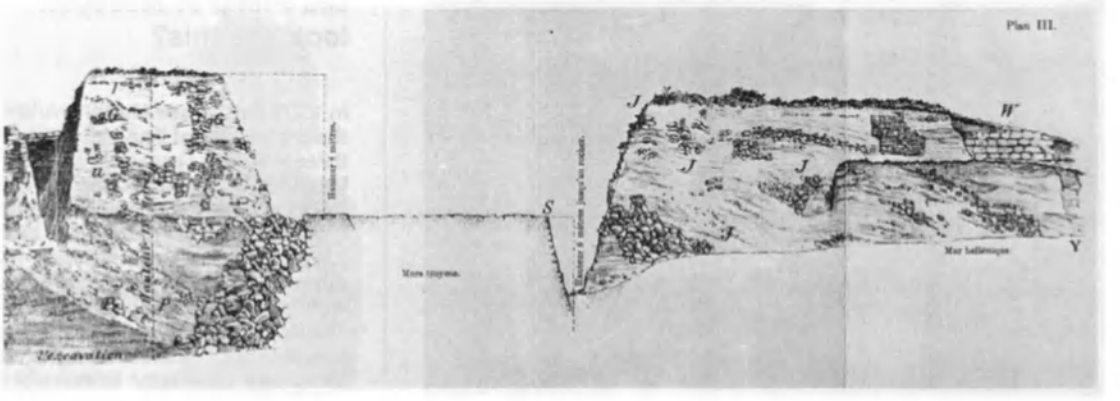
material archives of human activity in the form of multifarious traces left on a wide variety of materials. Although they may not tread in the footsteps of Schliemann at Troy and Mycenae, or those of Lord Carnarvon in Egypt, nor experience the excitement of discovering tombs overflowing with precious objects and jewellery, they perform an equally valid humanist task as they use the latest scientific techniques to recapture aspects of the life, environment, landscape, economy or technology of the past.

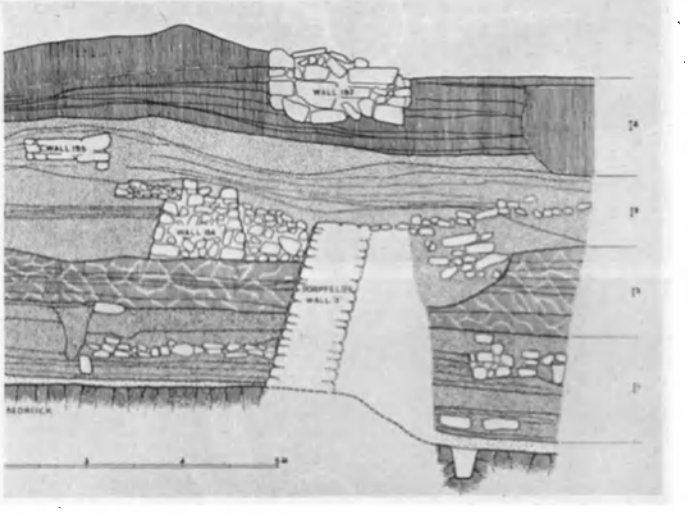
To excavate is to destroy, and once destroyed the archaeological heritage—unlike nature—cannot grow again. These seemingly commonplace observations underlie the mission of the archaeologist, who must identify the slightest hint of past human activity, analyse every facet of the information it can yield by using every available method, and evaluate his or her interpretation through reasoning which may later be tested with the computer.

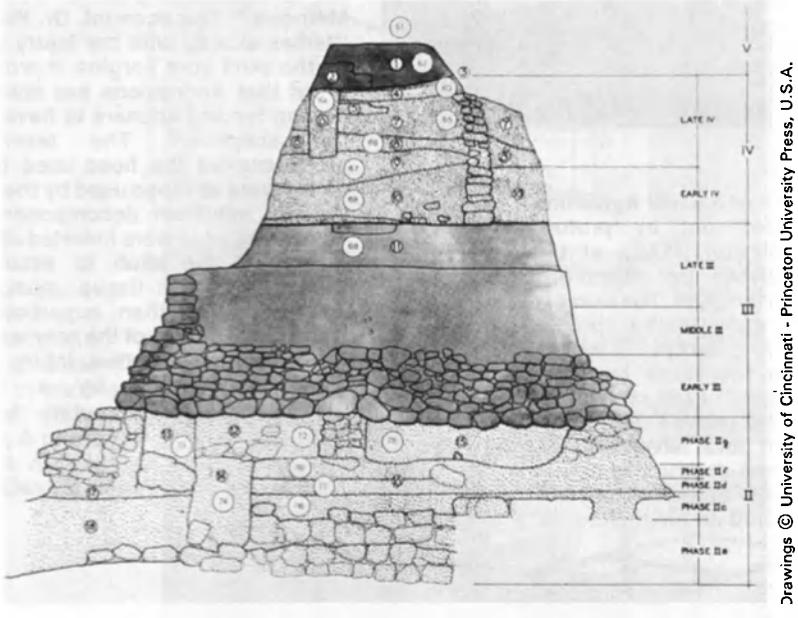
The following text, with accompanying boxes and illustrations, attempts to provide a highly simplified and selective account of some of the complex scientific techniques being used today by archaeologists in prospection, excavation, analysis, dating and preservation.

WHERE TO EXCAVATE. One problem a field archaeologist faces is that of knowing where to dig. Sometimes the study of old documents and literature is helpful: in other cases clues must be found from the air or on the ground. The use of *aerial photography* in archaeology (see page 18) goes back to the beginning of the century, when photos were taken from a balloon above Ostia, the port of Rome. Its systematic application has made it possible to study the layout of towns before beginning to excavate, to locate traces of Roman roads and villas and to observe systems of land management. More recently *teledetection from satellites* has vastly expanded the scale of possibilities for aerial prospection.

On the ground, the use of *electrical resistivity* to detect buried walls and ditches is now widespread. In making a resistivity survey, an electrical current is passed through the ground to mea- ▶







These 3 drawings of the site of ancient Troy reflect some of the changing techniques and approaches in field archaeology since the last century. Top, a cross-section drawn in 1879 and published by Heinrich Schliemann. It shows the accumulation of debris to which the great German archaeologist often referred as a major obstacle to his search for Homeric Troy. Middle drawing is a diagrammatic section of a deposit at Troy by Carl Blegen, who directed the University of Cincinnati's research at Troy from 1932 to 1938. Blegen's major interest was the analysis of stratigraphical sequences in different parts of the artificial hill of Troy. Bottom drawing is a recently published section showing not only stratigraphy but the sampling of soil in the different layers. This is done to help reconstruct the environment at different periods.

Drawings © University of Cincinnati - Princeton University Press, U.S.A.

▶ sure the resistance of the soil, which is affected by moisture. Metal detectors are being widely used by treasure hunters in some countries where, when used indiscriminately and irresponsibly, they have caused havoc to the archaeological heritage. Recently US and Swedish technicians have developed a radar-truck capable of recording structures buried to a depth of four metres in certain terrain such as peat.

EXCAVATION. When they come to excavate, the most important method used by modern archaeologists is to study the *stratigraphy* of a site, the arrangement of archaeological deposits in superimposed layers or strata. The earliest excavations at Rome in the sixteenth century and at Pompei and Herculaneum in 1717 were above all a harvest of objects from the soil, and Schliemann himself admitted that he had dug through (and destroyed) many recent levels before reaching the "interesting" Trojan levels. He was not alone in acting in this way. His drawings give some idea of the superposition of strata and remains, but he made no precise visual records which can be interpreted without reference to his reports.

The next generation of archaeologists made abundant records, drew vertical and horizontal sections, and covered the site with a grid of squares of standard size in order to "read" the way in which the strata were superimposed, to analyse their relationship with the levels of soil on which people had lived, and with layers of building and destruction. A meticulous description was made of every trace revealed during the methodical removal of earth, often using precision instruments to locate the exact position of each vestige.

The present generation of archaeologists takes large numbers of samples while excavating—samples of earth, pollen, and charcoal. In this way it is possible to deduce from the ruins of a building what the building was actually like, to reconstitute its environment, and to identify the occupation of those who lived in it. Analysis of the isotope Carbon 13 in bones and tissue can provide evidence of the diet of prehistoric men, and the study of insect finds can help indirectly to identify their occupations. Stratigraphy now makes use of a range of scientific disciplines, among which the earth sciences play an increasing part.

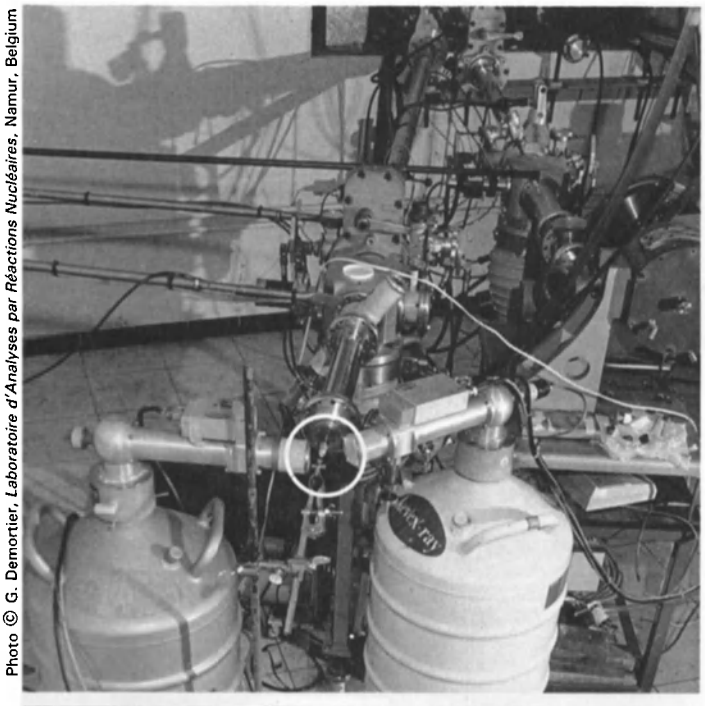


Photo © G. Demortier, *Laboratoire d'Analyses par Réactions Nucléaires*, Namur, Belgium

Photo © G. Deconnick, Laboratoire d'Analyses par Réactions Nucléaires, Namur

Top photo: analysis of a small Byzantine cross being carried out by proton-induced X-ray emission (PIXE), at the Laboratoire d'Analyses par Réactions Nucléaires, Namur, Belgium. The cross is bombarded with protons from a "proton gun", inducing X-rays whose characteristics are measured by X-ray detectors at each side of the cross. The analysis showed the relative content of gold, copper, iron and silver. Photo, above, shows the non-destructive nature of this test : a member of the Namur team uses the same method on his own teeth.

Did Philip of Macedon look like this?

In 1977 Professor Manolis Andronicos of the University of Thessaloniki discovered three royal graves at Vergina in Macedonia (see *Unesco Courier,* June 1979). It seemed possible that King Philip II of Macedon (382-336 BC), the father of Alexander the Great, might have been buried in the biggest tomb, but proof was lacking. In 1981 Richard Neave of Manchester University, Dr. John Prag of the Manchester Museum and Dr. J.H. Musgrave of Bristol University began to co-operate with Professor Andronicos in examining the skull in question and reconstructing the dead man's appearance. Casts were taken of the bones of the skull, in fragments after cremation. It proved difficult to fit the bones together, and study showed that this difficulty was largely due to injury and congenital deformity. "In short," Dr. Prag has written, "the left side of the dead man's face was markedly underdeveloped and the right side overdeveloped, to compensate for this." Plastic surgeons also noted injuries to the right eye-socket which, they concluded, could only have been caused by a missile from above. Portrait heads of Philip show an injury to the right eye which was apparently sightless, and a 1st century BC author noted that "he had his right eye cut out when he was struck by an arrow while inspecting the siege engines and the protective sheds at the siege of Methone." This account, Dr. Prag notes, "tallies exactly with the injury we noted on the skull from Vergina. It provided the proof that Andronicos has always been hoping for and appears to have silenced the sceptics." The team which reconstructed the head used the same techniques as those used by the police to identify unknown decomposed bodies. Measuring pegs were inserted at different points on the skull to establish the thickness of soft tissue, muscles were modelled, and then superficial layers added. The details of the scar were based on an almost identical injury received some years ago by a Canadian lumberjack.

1

2

3

Photos © Department of Medical Illustration, Royal Infirmary, Manchester, UK

1. Reconstructed skull showing injury to right eye
2. Plaster cast of the finished head
3. Wax cast of the reconstructed head with hair, beard and skin colour

THE ANALYSIS OF ARCHAEOLOGICAL FINDS. Since the end of the Second World War great strides have been made in the analytical techniques used by archaeologists. Objects may be analysed to discover how they were made, what they were made of, and where those materials were obtained. The Lydian stone or *touchstone* was the earliest method used to determine the proportion of precious metal contained in an object. It provides remarkably precise results. The metal to be assayed is rubbed on the touchstone which is then exposed to a reactive agent whose colour changes are evaluated.

In the third century BC, Archimedes used the concept known today as *specific gravity* to solve the problem of whether or not King Hieron of Syracuse's crown was made of gold or of an alloy of gold and silver. According to the story, it occurred to him one day as he stepped into his bath and saw the water overflow that the excess of bulk caused by the introduction of alloy could be measured by putting the crown and equal weights of gold and silver separately into a vessel of water and measuring the differences of overflow. Each of these techniques is still used today.

In *chemical analysis* techniques a sample has to be taken from the object being analysed, and in the case of precious objects this is often undesirable. *Spectrographic analysis,* which succeeded "wet chemistry", investigates the chemical nature of a material by examination of its spectrum. Using this technique only a single point may be examined in each object, and if a sample is taken it is destroyed and the experiment cannot be repeated. The ideal remained a method of analysis which did not destroy the object being analysed.

The next step towards *non-destructive analysis* was to bombard objects with *X-rays* which cause no damage and simply provoke other rays whose diffraction or energy levels are characteristic of different materials. This analysis is confined to a microscopic layer of atoms on the surface of an object. A specimen which is not homogenous will thus deceive the analyst as to its true nature. The X-ray method requires a profound knowledge of series of objects so as to avoid hasty generalizations made from surface analyses. ▶

In an experimental study which could open up fascinating possibilities for future work on human evolution and archaeology, Swedish scientist Svante Pääbo recently succeeded in extracting and cloning (reproducing identical copies of) a DNA sample from the 4,500-year-old mummy (right) of an ancient Egyptian boy who died at the age of one. DNA (deoxyribonucleic acid) is the master molecule of life and carries the hereditary instructions that determine the nature of a living organism, and information on DNA sequences can give us a clear picture of a population's genetic identity. Information on the DNA sequences of ancient Egyptian mummies could, therefore, tell us not only about the relationships between members of the Egyptian royal families, but also about population movements in ancient Egypt. It should be pointed out that, despite sensational rumours, it is not possible using these techniques to reconstitute a functional gene, and even less a living human being, from such DNA sequences.

Photo Svante Pääbo © *Das Altertum, Berlin, German Dem.*

Dating prehistoric sites

Methods	Materials	Range of time	Comments
Dendrochronology	Wood	0 to 7,000	
Carbon 14	Organic remains (wood, bones) shells	0 to 40,000	
Uranium-thorium ratio	Stalagmites bones shells	10,000 to 250,000	
Thermoluminescence	Ceramics burned rocks (silex, sandstone, granite) stalagmites	0 to several hundreds of thousands of years	
Electron spin resonance	Stalagmites bones	1,000 to several million years	under development
Fission tracks	Volcanic glass, minerals rich in uranium	0 to several hundred thousand years	
Potassium-argon	volcanic larva	1,000 to 1,000 million years	
Amino-acids	Bones		under development

Chart © *Centre des Faibles Radioactivités, Centre mixte* CNRS-CEA, Gif-sur-Yvette, France

Certain dating methods are more appropriate than others, depending on the approximate age of the site and the materials available. Whenever possible it is advisable to use several methods and to compare results.

Rome has embarked on a far-reaching project in which the conservation of the antiquities in its historic centre is an integral part of the wider canvas of modern city planning. The protection of marble and bronze monuments and statues disfigured by air pollution was a priority step. Right, statue of Marcus Aurelius undergoing treatment at the Central Institute of Restoration.

Photo © *Istituto Centrale del Restauro, Rome*

▶ The use of more penetrating rays has made it possible to eliminate both the disadvantages of destructive analysis and the superficial character of X-ray analysis.

Nuclear analysis using neutrons either produced from a reactor or an accelerator has greatly extended our knowledge of ancient metalwork, as well as helping to identify recent forgeries, through establishing the respective content of certain elements and identifying the sources of metals in ancient coinage by what are called the "geological fingerprints" of their original mines. But one field of nuclear analysis is particularly fruitful: that of the proportion of isotopes of certain bodies determined by mass spectrography. The proportions of Oxygen 16 and Oxygen 18 in ancient marble are characteristic of different deposits, and it is much safer to identify the origins of Greek marble artefacts using this method rather than by an "experienced" judgment of the grain and the colouring of the veins. The application of this method to lead is even more widespread, since lead is so extensively used in building and glass. It has been possible to identify deposits of lead from ancient Spain to Iran with considerable certainty.

Finally, analyses are carried out to find out more about the nature of ancient technologies. The *electron probe microanalyser* provides an enlarged image on a screen of responses recorded when electron beams bombard a surface. This method has been used to determine whether gilding was done with mercury. Detailed and repeated analyses can be carried out, even on cumbersome objects, using *Proton Induced X-ray Emission (PIXE)* apparatus in which protons strike a small area of the object and provoke X-rays whose characteristics are measured by X-ray detectors.

DATING. The *Carbon 14* dating method invented by Willard F. Libby is today part of the dating arsenal of many archaeologists. An accurate measurement of the proportion of Carbon 14 contained by a given sample makes it possible to estimate its age "BP" (Before Present, i.e. before 1950). Extensive research revealed that Carbon 14 dates were in some cases erroneous

Photo Cherville © Fotogram, Paris

In many countries today treasure hunting using metal detectors is a popular outdoor hobby. Archaeologists preoccupied with the problem of the erosion of the archaeological heritage and damage to sites have strongly criticized treasure hunters on the grounds that they are only interested in objects and that by removing objects from their context they destroy valuable information about the past. At the same time many archaeologists are also aware of the danger of a "comprehension gap" between them and the public and feel that it is important to try to mobilize the enthusiasm of treasure hunters for the buried heritage and reconcile their hobby interests with the scientific investigation of the past.

Georadar is an electromagnetic method of site investigation which has been developed to map geological structures and which also has applications for archaeology. Electromagnetic energy is transmitted into the ground from a unit on the surface. On its way through the soil part of the energy is reflected when it meets an interface between two materials of differing electrical properties (such as soil and bedrock, or soil and an archaeological object) while the rest proceeds to greater depths (see diagram). By measuring the time between the transmitted and reflected signals it is possible to survey the different layers of soil and rock and the location of buried objects. The reflected signals are displayed on a cathode ray tube and on a graphic recorder, providing a continuous profile of the subsurface. Below, the radar system in field operation. The antenna is mounted on a boom which can be raised or lowered by a winch inside the vehicle. The graphic record of the reflected signals is a close approximation to the interfaces that would be seen in the wall of a trench dug along the path taken by the radar apparatus. Below, "radargram" of a Bronze Age road in a Danish bog. The oak road, slightly inclined, was based on sand. The depth of the road surface was approximately half a metre.

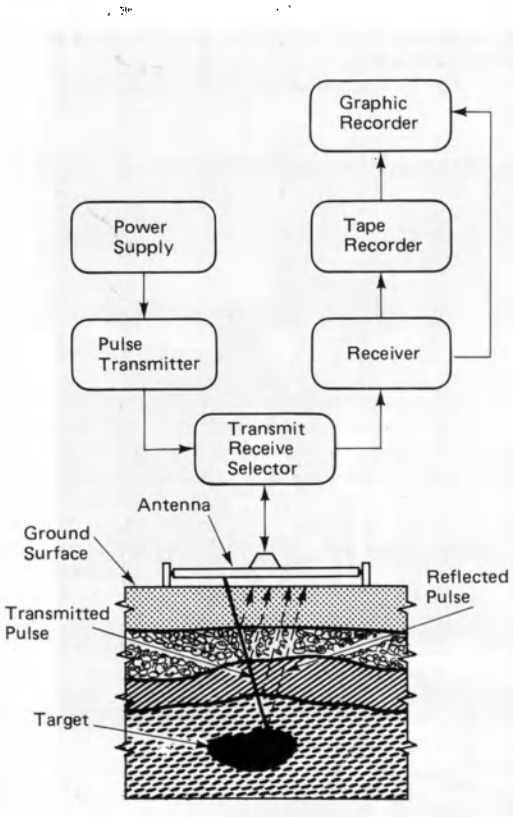


Photo © H. Bruch – Skanrad, Växjö, Sweden

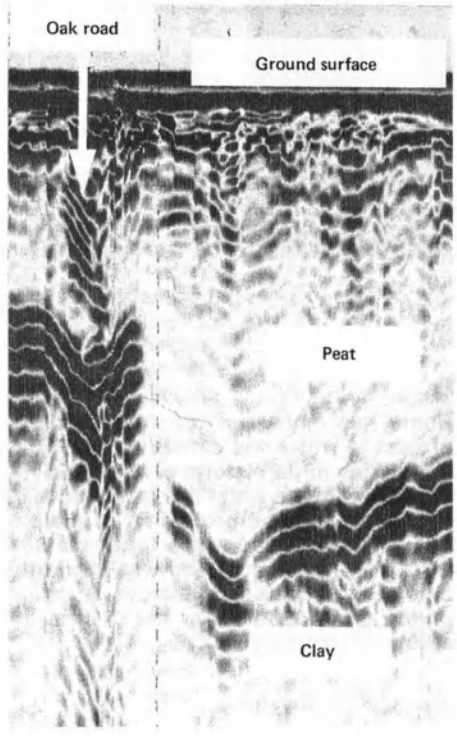


Photo © Skanrad – The Danish National Museum, M.S. Jorgenson

because of wide fluctuations of cosmic rays in the past. Carbon 14 dates have been adjusted after confrontation with dates provided by other methods such as *thermoluminescence* and *dendrochronology* (see box page 12).

Thermoluminescence is based on the phenomenon that rays from radioactive elements in the soil and cosmic rays accumulate in the crystalline materials of pottery and that when the materials are heated this energy is liberated and emitted in the form of light. The quantity of energy and thus of light is proportional to the length of time during which they have been accumulated. The system acts as a kind of clock which starts at zero when the material is heated to a certain temperature. (In the case of pottery this is when the pottery was baked.) The quantities of light involved are infinitely small, and photomultipliers are needed to make them visible and measure them. Nevertheless, the accumulation is significant for long periods of over 1,000 years, and this method is of inestimable value above all for periods earlier than 50,000 years. In very ancient civilizations lacking any written or typological references, such as the prehistory of Brazil, or the Jomo culture of Japan, or the oldest cultures of West Africa, thermoluminescence has become accepted as a pioneer dating method. For space reasons it is not possible to include all dating methods such as magnetic dating and new nuclear methods now being developed (see chart page 15).

COMPUTERS AND MATHEMATICAL TECHNIQUES. The possibilities opened up to archaeologists by access to big archaeological data banks are virtually limitless. This would replace cumbersome paper files and the consultation of annual bibliographies which often inevitably appear with delay. We should have literally at our fingertips information about objects and monuments, sites and current research which we could call up at will. But the danger is that of the tower of Babel. Computer languages and software must be compatible, yet even in a field with a concise and international language such as numismatics different teams have different aims and equipment. Views and experiences are being exchanged but not yet, automatically at ▶

Photo © British Museum, London

The preservation of Pete Marsh

The body of a man was discovered in a peat bog at Lindow Moss south of Manchester (UK) in August 1984 and taken to the British Museum for analysis and preservation. The body had been mutilated by an excavating machine but its upper half, including part of the digestive tract and much skin and hair, were still intact after preservation in peat, partly decayed plant matter that gives off a preservative acid, absorbs moisture and excludes oxygen. Radio-carbon dating showed that the corpse of "Pete Marsh", as the man was nicknamed, was about 2,500 years old. A team of scientists including specialists in forensic science, dermatology, anatomy, microbiology and botany immediately began to investigate the remains and a portrait of Pete Marsh emerged. He is estimated to have been 167 cm tall, aged between 20 and 30, with mousey-coloured hair, red moustache, beard and sideburns, and immaculately trimmed fingernails. He had come to a violent end by garrotting. Further study of the body has been carried out by X-ray, and computerized images of its insides have been taken with a nuclear magnetic resonance scanner. Using newly developed genetic engineering techniques, researchers are also proposing to extract genes from the corpse and "grow" them in the laboratory. Before being put on public display, Pete Marsh is being "freeze-dried" (lyophilized) using a technique which involves freezing the water content of the body which is then placed in a vacuum chamber where its ice crystals vaporize.

any rate, information and data themselves. Too many data banks are closed systems reserved for the privileged who have access to them. Distance questioning is rarely possible. However, tens of thousands of images can already be recorded on a video disc, and theoretically the major photo libraries could become accessible like those museums which have published illustrated microfiches of their holdings.

Computerization has also made it possible to carry out complex reasoning through simulation in short spaces of time, and to catalogue, record and relate masses of data at great speed.

Interdisciplinarity is thus a keynote of archaeology today. It should not be limited to the use of costly new methods. Archaeologists also call increasingly on the expertise of geologists, soil scientists, botanists and others working in long-established disciplines. It is not possible here to make a complete list of the sciences nowadays involved in the reconstruction of the past, but such a list would include the study of shells, diatoms and fishbones, mining and ore processing techniques, the study of glass and paper, not to mention the whole field of underwater archaeology. ■

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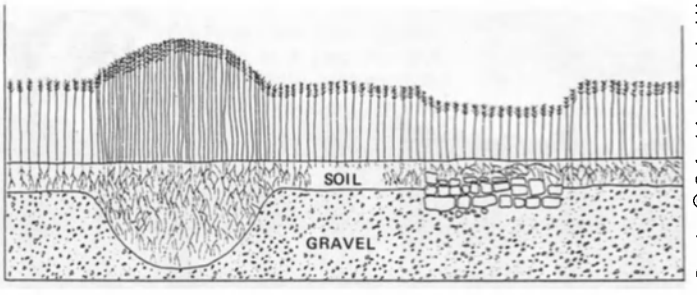
Archaeology from the air

Photo © Ashmolean Museum, Oxford



Drawing © Oxford Archaeological Unit

Aerial photography has become a major tool of modern archaeology and each year leads to the discovery of large numbers of new sites which are often invisible at ground level. Buried traces of human activity can affect plant growth for thousands of years, and these differences in vegetation can be observed from the air. Interpreting aerial photos is a highly specialized task; the image changes as the light changes at different times of day and at different seasons, and varies with the state of the vegetation and other factors. Buried sites may be revealed as soil-marks (traces of differently coloured or textured soil) or crop-marks. Drawing above shows how crop-marks develop. The vegetation is taller over the buried ditch but stunted above the stone foundations. Photo gives a rare opportunity to see why crop-marks appear. The dark soil of a silted up Iron Age ditch can be seen at the edge of this gravel pit. The barley above it is taller as a result of the extra depth of soil and moisture. Remote sensing technology using devices mounted on spacecraft and aircraft which can "sense" on wavelengths that cannot be detected by the human eye or by conventional photography seems bound to affect radically the way in which archaeological reconnaissance is planned and carried out. As yet the potential of this technology for archaeological research has only begun to be tapped.

The Nazca enigma

Immense patterns made of furrows or ditches are etched into the barren Nazca desert almost 500 km southeast of Lima, the capital of Peru. They are so vast that they cannot be seen from ground level, but when viewed from the air they unfold into a fantastic bestiary of semi-naturalistic monkeys, long-necked birds, a spider, a lizard, dogs, fish and whales, surrounded by zigzags, spirals, star-shapes, rectangles and trapezoids. The lines, scored by moving aside lines of rocks to expose the lighter alluvial soil beneath, are named after and widely attributed to the Nazca culture which flourished in the area from around 200 BC to 600 AD.

What was their purpose? Ever since the discovery of the Nazca display over 40 years ago by Dr. Paul Kosok, this has been a perplexing archaeological mystery. Many theories have been put forward, some far-fetched. Did the lines indicate a space-port built by or for extra-terrestrial beings? Did they have a ritual significance, with torchlight processions winding along the pictograms on ritual days? Were they a star map of the ancient heavens, "the world's largest astronomy book," in Dr. Kosok's phrase? Did they contain symbolic information for transmission to later generations? Although many different interpretations have been made of the individual components of the Nazca display, today many scholars agree that it has social, political, economic and religious implications of some kind.

Ever since the Nazca lines were discovered, astronomer-mathematician Dr. Maria Reiche has devoted her life to studying them and attempting to establish correlations between them and astronomical occurrences. She has specially recorded some of her conclusions for the Unesco Courier. "The perfect proportions of these figures, some of them 200 or 300 metres long, suggest that they might have been made in order to be seen from the air. They could represent constellations which, as in other ancient cultures, were considered to be divinities. These constellations characterize the different epochs of the year according to their visibility at night. The most important time of the year was always December because it was then that water was expected to flow in the drier rivers and people prepared for this event by making ploughs... In Nazca this water-announcing constellation was the Big Dipper. When afraid the water would not appear, the people would draw on the ground an image of the water-bringing divinity, that is the constellation which always appeared at the same time as the water, so big that the divinity could see itself from high up and be reminded to send water again. For several reasons the Big Dipper is depicted as a monkey. The spider can be considered to represent Orion."

Not all archaeologists agree with Dr. Reiche's theories, but they pay tribute to her determination to preserve the fragile Nazca lines for posterity, so that even if their mystery is never fully explained they will remain among the most beautiful creations of human ingenuity.

Right, 90-metre-long Nazca humming bird seen from the air.

Photo Georg Gerster © Rapho, Paris

Centre colour pages

Top left: ***Archaeological digs carried out in China from 1974 to 1979 at a number of sites of the ancient kingdom of Zhongshan, in present-day Hebei Province, south-east of Beijing, have made a major contribution to our knowledge of this period of Chinese civilization (from the 6th to the beginning of the 3rd century BC). Some 20,000 objects were recovered, most of them from two great royal tombs. Several musical instruments testify to the importance accorded to music during this period. Kongfuzi (Confucius) considered music to be essential to the good government of a State. King Cuo of Zhongshan (died 314 BC) seems to have shared this view. A carillon of musical stones and a complete carillon of 14 bronze bells (our photo) were discovered in his tomb. Hung in descending order on a lacquered wood frame, the bells had no tongues but were struck by a small mallet. This is one of the very few complete carillons that have ever been found.***

Photo ©Foreign Affairs Bureau of the Ministry of Culture, Beijing

Bottom left: ***Coloured frieze from the Temple of the Eagles, part of the Great Temple complex in Mexico City (see article this page).***

Photo Alex Webb © Magnum, Paris

Top right: ***Ruins of Moenjodaro in Pakistan. Advanced concepts of city planning were used in this centre of a brilliant culture that flowered in the Indus Valley 5,000 years ago.***

Photo © Raoul Zamora, Paris

Bottom right: ***Masterpiece of micro-jewellery from a Scythian kurgan (burial mound) in the Ukraine depicts a griffon with a pendant in the form of a bunch of grapes.***

Photo © Institute of Oriental Studies of the USSR Academy of Sciences, Moscow

Opposite page

Above: ***Charged with expressive power, this extremely rare miniature ivory bust of Alexander the Great wearing a lion helmet dates from the 3rd century BC. It was unearthed in a monumental temple excavated by Soviet archaeologists in the Tajik SSR (see article page 28).***

Photo © Institute of Oriental Studies of the USSR Academy of Sciences, Moscow

Below: ***Bearded head in the style of the Nok civilization of Nigeria. Since most objects of the Nok civilization were found at alluvial sites in which stratigraphy is impossible because of landslides, there is little certain archaeological data about them. The use of carbon 14 and thermoluminescence dating techniques (see article page 12) proposed a period for the Nok civilization ranging from 500 BC to ± 500 AD.***

Photo © Université Catholique de Louvain. De Grunne Collection

El Templo Mayor

The Great Temple of the Aztecs in the heart of Mexico City

by Eduardo Matos Moctezuma

ON the night of 21 February 1978, workers of the Light and Power Company were digging on the corner of Guatemala and Argentina Streets in the centre of Mexico City. After breaking the thick concrete surface and penetrating about two metres down, they encountered a hard stone which put a stop to further progress. On removing the clay adhering to it they found that the stone was covered with a series of reliefs, and decided to suspend operations until the next day. A telephone call to the Office of Salvage Archaeology of the National Institute of Anthropology and History led to the despatch of a team of archaeologists to identify the find. On 23 February it was established that on part of the stone was a piece of sculpture showing a face in profile with adornments on the head.

Salvage operations continued until the 27th under the supervision of the archaeologists. An enormous monolith, 3.25 metres in diameter, was uncovered. Its upper surface bore a sculptured representation of a decapitated, naked woman, whose arms and legs were separated from the torso. Clearly this was Coyolxauhqui, a lunar deity and sister of Huitzilopochtli, the Aztec god of war who, according to legend, killed his sister in single combat on the hill of Coatepec.

This discovery marked the start of the Great Temple Project. From the outset it was planned in three principal phases. This enabled us to apply the theory and methods that would give us a clearer picture of the chief temple of the Aztecs or Mexicas, who settled on the little islands in the lake of Texcoco around 1325 and later became subject to the lordship of Azcapotzalco, before achieving independence around 1428. They then became an expansionist community and conquered large areas of central America, until in 1521 they succumbed to the dominion of the Spaniards who under Hernán Cortés conquered Mexico during the sixteenth century and destroyed the Aztec city of Tenochtitlán, and with it the city's Great Temple—*el Templo Mayor.*

The project was carried out in three ▶ phases.

Below, the Coyolxauhqui Stone, 3.25 metres in diameter, whose accidental discovery in 1978, in the heart of Mexico City, was to lead to the comprehensive excavation of the ancient Aztec Great Temple of Tenochtitlán. The stone depicts the dismembered body of the goddess Coyolxauhqui, a moon goddess, who, according to myth, was defeated in battle, slain and dismembered by her brother Huitzilopochtli, god of war and of the sun.

Photo © Raoul Zamora, Paris

▶ The first phase consisted in assembling all available information about the Great Temple, both from historical sources and from reports of previous archaeological investigations, either on the site or on nearby sites. On the basis of this information, a general plan covering both theoretical and practical aspects was drawn up.

The second phase consisted of the excavations proper, which were begun on 20 March 1978 and completed in November 1982. Suitable techniques were employed to ensure adequate control of the excavation process, the area being divided up into 2-metre-square grids. The site was also divided into three sections, each supervised by an archaeologist and his assistants. Support units included a team of restorers with a field laboratory, as well as biologists, chemists, geologists and other specialists from the Department of Prehistory. There were also photographic laboratories, a design section and a section for controlling the excavated material.

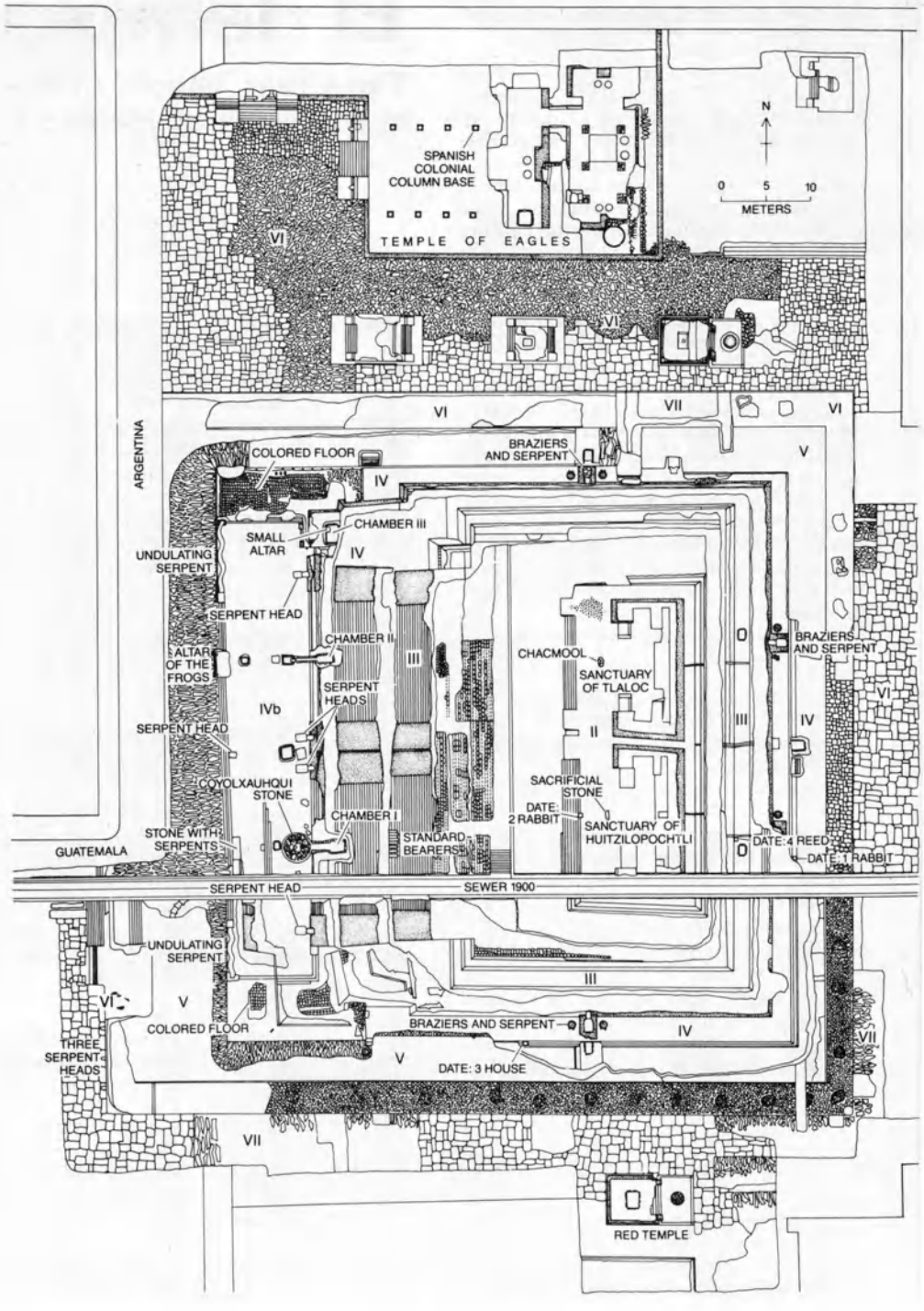
The third phase comprises the study and analysis of the material recovered in the preceding phase. After four years' continuous work, the first two phases have been completed, and we are now engaged on the third phase which will take longer.

We shall now summarize the results of nearly five years of excavations and of the investigations currently being carried out.

Architecture — Until a few years ago the chief sources of information about the Great Temple were the accounts of sixteenth-century chroniclers. Now, thanks to archaeology, we have the temple before our eyes, and we can see that in fact the chroniclers' descriptions correspond very closely to what they saw or to what the indigenous people told them. Thanks to archaeology we have also been able to learn about very early periods in the temple's history, of which even the last generations of Mexicas knew nothing.

The main façade faced west. The temple stood on a vast platform, with a base of four elements, including two stairways leading up to two sanctuaries—one on the south side dedicated to the tutelary war god Huitzilopochtli, and another on the north side to Tlaloc, the god of water, rain and fertility.

For various reasons the temple was repeatedly enlarged. For instance, the city of Tenochtitlán suffered from flooding, which made it necessary to raise the level of its buildings, as well as from structural faults due to the instability of the terrain. Again we know from historical sources that certain rulers ordered a new temple to be raised on top of the existing one, so that different construction Epochs are



Plan © *Scientific American*, New York

superimposed upon each other. We now know that the temple was enlarged on all four sides at least seven times. There were also four enlargements of the main façade.

We shall now briefly describe each of these construction Epochs, except for Epoch I, which was located inside Epoch II and was in a state of such deterioration that it would be pointless to describe it. The Roman figures indicate total enlargements on all four sides and, if followed by a letter, enlargements of the main façade only.

Epoch II — This structure is notable for the fact that its upper part is remarkably complete. We can see remains of the two stone sanctuaries with some of the stucco (mixture of sand and lime) which covered them. Facing the entrance to the sanctuary of Huitzilopochtli is the sacrificial stone. On the top step, in line with this stone, is a head with a glyph, or carved pictograph, of two rabbits above it, corresponding to the year 1390.

Inside the sanctuary a platform runs from north to south, in the middle of which there is a small altar on which an image of the deity must have been placed. On the Tlaloc (north) side there is a *chacmool*—a polychrome stone sculpture of the divine messenger responsible for carrying the offering into the sanctuary. The pillars at the entrance to the sanctuary are still decorated with mural paintings of black and white circles (perhaps depicting the god's eyes) on blue and red bands. Below these are alternating vertical black and white bands. Inside can be seen the plat- ▶

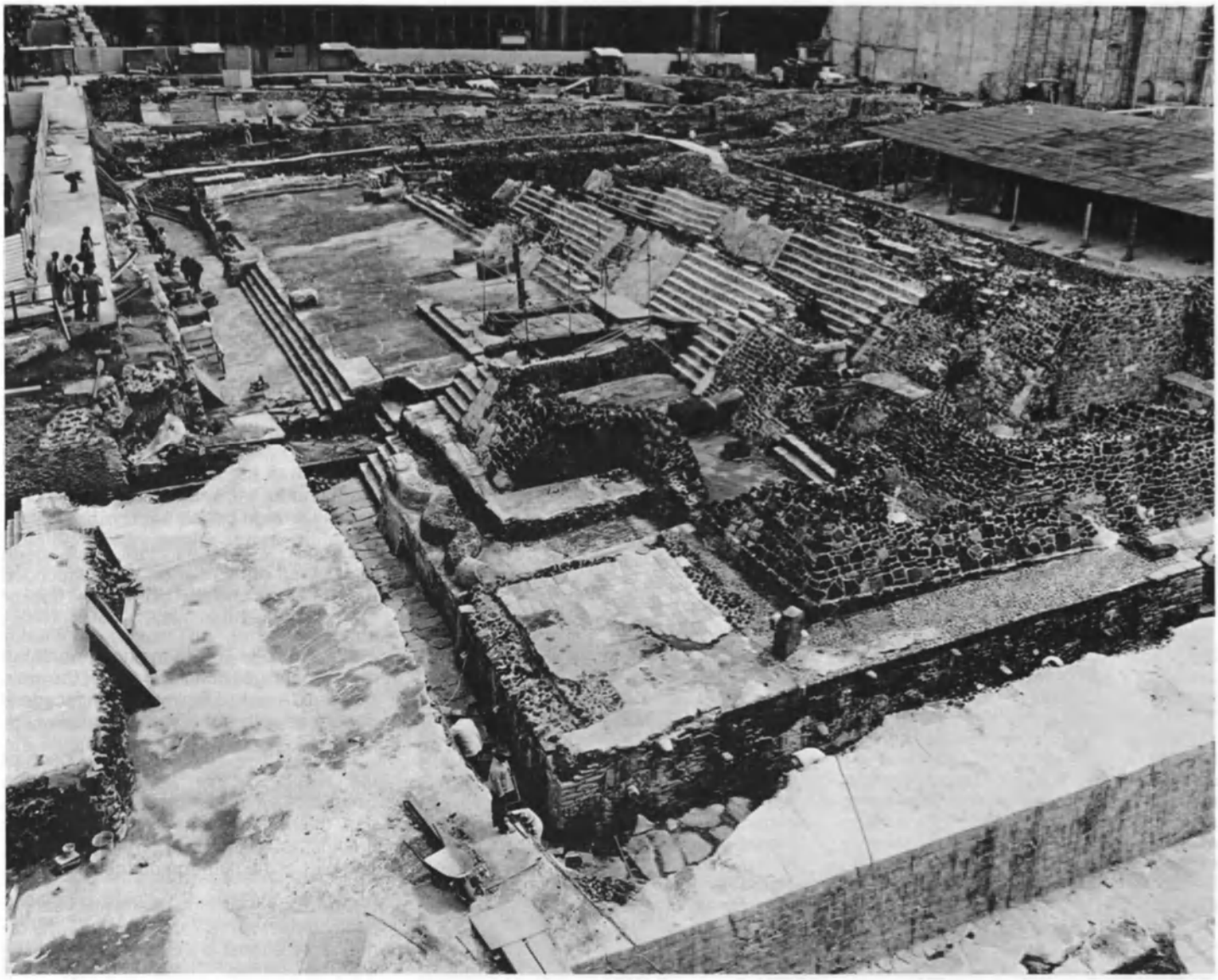
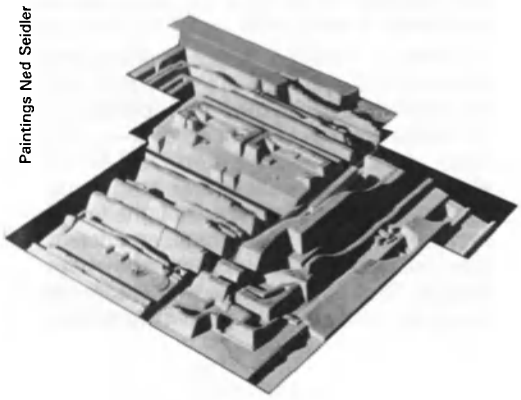


Photo Salvador Guillem Arroyo © National Anthropological Institute of Mexico

The great temple of Tenochtitlán



Paintings Ned Seidler © National Geographic, Washington, D.C.

The Templo Mayor, *or Great Temple of the Mexicas, the people of the Aztec city of Tenochtitlán, was a monument to the power of the Aztec empire. Shrines dedicated to Tlaloc (the god of water, rain and fertility) and to Huitzilopochtli (the god of war and of the sun) crowned the temple reflecting the dependence of the economy of the Mexicas on agriculture and on tribute collected by conquest. Excavation revealed seven major epochs of construction (indicated by Roman numerals on plan, opposite page). The earliest epoch to be excavated, Epoch II, dates from about 1390 AD and was found almost intact. The last construction epoch, Epoch VII, was razed to its foundations by the Spanish* conquistadores. *Above, a view of the site from the southwest corner of the façade. The Coyolxauhqui Stone can be seen (centre of photo) surrounded by a metal framework. In the foreground a sculptured snake (often used as a symbol of Huitzilopochtli) flanks the stairway leading to the war god's shrine. Further to the left along the façade are two sculptured frogs (not easily visible on this photo). Frogs were often used to represent Tlaloc the rain god. Left, artist Ned Seidler's drawing depicts the complexity of the edifice. Facing west, the temple rose to a height of some 60 metres, with twin stairways leading up to the double shrines. Excavating a major site in the centre of a major modern city is no easy task and it was even more difficult in Mexico City where the water table is only four to five metres below street level. City traffic often slowed the work down and thirteen buildings had to be removed before excavation could begin. However, the urban location had some advantages. Specialists, including city planners, architects, soil scientists, ethnologists, historians, ornithologists and ichthyologists were available for advice and many students volunteered their help.*

Photo © courtesy of the *Museo Arqueológico y Galerías de Arte Banco Central*, Quito

Plundering the past

The looting of archaeological sites and the illegal export and import of cultural property has become a booming worldwide business worth an estimated 3,000 million dollars a year. The principal victims of the art traffickers are the developing countries who often lack the resources to introduce effective controls. Not only are priceless artefacts being lost, but whole pages of history are being erased by the robbers' indiscriminate destruction of archaeological sites. Unesco has taken the lead in the fight to eliminate this illicit trade, notably through the establishment of the* Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property (1970) *and the* Convention for the Protection of the World Cultural and Natural Heritage (1972). ***Photo shows part of an exhibition of artefacts that had been illegally exported from Ecuador and which were recovered after a six-year legal battle in the Italian courts. Held in Quito, Ecuador, in May 1983, the exhibition was entitled Ecuador Recovers an Important Fragment of its Cultural Memory.

▶ form on which the image of the god must have stood. This Epoch is mostly earlier than 1428, the year when the Mexicas became independent of Azcapotzalco.

Epoch III — To this Epoch belong well-made stairways, and the facings of the steps of the base are still upright. Eight sculptures of standard-bearers were found in recumbent positions on the steps of the stairway on the Huitzilopochtli side. These figures may have adorned the edifice, but when a new construction Epoch was begun they were collected and ceremonially placed on the stairway where they were discovered. On the back wall of the platform, on the Huitzilopochtli side, is carved the glyph "4 Reed", which corresponds to the year 1431.

Epoch IV — This Epoch, with its additions, is one of the richest in decorative elements. The main platform was decorated on all four sides with braziers and serpent heads. The braziers on the Tlaloc side are adorned with the face of the god, while those on the Huitzilopochtli side bear a knot, a symbol of the warrior deity. Various offerings were found below the braziers and serpents.

Epoch IV b is an addition to the main (west) façade which was very rich in decorative elements. It consists of the vast platform on which the Great Temple stands. This platform had a continuous perron, at both ends of which enormous serpents with undulating bodies and huge heads were unearthed, still bearing some of the paint which originally covered them. The stairs leading to the platform are interrupted only by a small altar flanked by two frogs standing on the stone flags of which the altar is constructed. This altar is in line with the middle of the stairs that once led to the upper part of the temple dedicated to Tlaloc. On the Huitzilopochtli side, opposite the stairs leading to the sanctuary of this god, a two-metre-wide stone block decorated with serpents forms part of the top of the platform. The base formed by the remains of the two stairways which led to the upper part includes four serpent heads, one at each end and two in the middle, marking the junction of the two halves of the temple. In the middle of the platform, on the Huitzilopochtli side, is the place where the monumental stone sculpture of the god's sister, Coyolxauhqui, was found.

Chronologically, we believe that Epoch IV corresponds broadly to the reign of the Aztec ruler Moctezuma I, because the glyph "1 rabbit", equivalent to the year 1454, is carved on the back part of the platform on the Huitzilopochtli side. Coyolxauhqui and the serpents may have been added during the reign of Axayacatl. Another glyph on the south side of the edifice, with the symbol "3 house", corresponds to 1469, the year in which Axayacatl's reign began.

Epoch V — All that has been discovered of this period is the stuccoed main platform and part of the stone floor of the ceremonial precinct.

Epoch VI — This is the last Epoch but one. Its vestiges consist of part of the main platform. A wall of the main west façade is decorated with three serpent heads.

Epoch VII — This is the last Epoch of the Great Temple and the one the Spaniards saw. All that remains of it are part of the slab floor of the ceremonial precinct, some traces of the temple site, and part of the platform on the north side.

Offerings — During nearly five years of excavations, some 7,000 objects—the remains of almost a hundred offerings—were unearthed. These offerings were found in three distinct places—in stone cists whose sides and bottoms bore traces of stucco, inside movable stone boxes with stone lids, and actually in the fill of stone and earth covering a construction Epoch.

It may be said that, as a general rule, the manner in which objects were placed in the offerings was not haphazard but premeditated, conforming to some kind of symbolism which has still to be interpreted. In other words these objects and their positions correspond to a language. Thus in some offerings certain objects occupy the lower position, while others are always found higher up. We also noticed that the objects were placed facing in a certain direction. Both the offerings on the west (main façade) side as well as those at the back of the temple faced the spot where the sun sets, whereas those found in the middle of the edifice, in its northern and southern façades, were facing north and south respectively.

Offerings 7 and 61, located towards the middle of the edifice on the south side and on the north side, respectively, contained the same arrangement of objects—at the base, seashells facing north to south; above them, crocodiles; and at the top, seated deities which we thought to be representations of Xiuhtecutli, an ancient fire-god, centre of the universe and of the hearth. To the right of these gods was a coral, and to the left an earthenware vase

bearing an effigy of the god Tlaloc. Perhaps this arrangement means that the shells represent the sea, the crocodiles the earthly level, and Xiuhtecutli and Tlaloc the heavenly level. The same arrangement is found in offerings 11 and 17, the first located in the main façade between the two serpent heads marking the junction of the temples of Tlaloc and Huitzilopochtli, and the second at the back where the two edifices are joined. Both are placed in stone-walled cists and, apart from being very similar in their contents, the objects are arranged in a similar order.

Some of the objects unearthed were of purely Mexica origin; others came from tributary areas. The former include sculptures of seated ancients wearing only the "maxtatl" or loincloth and a headdress with two protuberances. They are thought to represent Xiuhtecutli. Others are effigies of the god Tlaloc sculpted in "tezontle" (volcanic stone) and in other kinds of stone. There are also representations of coiled serpents, serpent heads and rattlesnakes carved in obsidian, stone braziers with knots, and, of course, the magnificent representations of seashells which are real works of art although, like the Coyolxauhqui and serpent heads adorning the temple façade, they did not figure among the offerings.

Interesting objects from the tributary areas figure in greater numbers among the offerings from Epoch IV onwards (around 1454) when the Mexicas were in full expansion. They include a large quantity of masks and figures in the Mezcala style (from what is now the State of Guerrero), of various types and sizes, alabaster pieces from the Puebla region representing deer heads, arrows and seated deities. There are two magnificent orange ceramic funerary urns from the Gulf Coast. Inside them were the remains of burnt bones, necklaces, and other objects. The great variety of seashells, fishbones, sawfish bills and corals come from the Gulf and Pacific coasts. So do the crocodiles and jaguars, which may have come from Veracruz or Tabasco.

Another group of objects can definitely be attributed to societies very much earlier than the Mexica. Such are the Teotihuacan masks, which can be dated around the year 400 AD, and an Olmec mask. Petrographic analysis has shown that the latter originated in the area now occupied by the States of Puebla, Oaxaca and Guerrero. It is believed to be the oldest object discovered (800 BC).

We can say that most of the objects represent Tlaloc or symbols associated with him, including such objects associated with the sea as canoes and fishes. But there are also objects associated with Huitzilopochtli, a god who is only represented symbolically, in the form of braziers with a knot, skulls, "tecpatl" sacrificial knives with eyes and teeth of conch shell and, generally, objects from tributary areas, the spoils of military conquest. All this confirms our thesis of the existence of an agricultural and warrior people who depended for their sustenance on both agriculture and tribute. ■

Photo Salvador Guilliem Arroyo © National Anthropological Institute of Mexico

EAGLE WARRIOR. ***Nearly two metres in height, this pottery statue of a soldier of the eagle order is one of the most remarkable finds made at the Great Temple. There were two main orders of Aztec soldiery, the eagles and the jaguars.***

EDUARDO MATOS MOCTEZUMA, *of Mexico, is general director of the* Centro de Investigaciones y Estudios Superiores en Antropología Social *at Tlalpán. Before beginning the excavation of the Great Temple in Mexico City, which he describes in this article and which was carried out under his supervision, he had done extensive fieldwork on the pre-Columbian sites of Mexico.*

From the Throne of Stone

A treasure-trove of Greco-Bactrian art

by Boris A. Litvinskiy and Igor R. Pichikiyan

Photos © O. Tsessarskii, Moscow

In this silver bridle ornament depicting the gorgon, the monster of ancient Greek mythology has been transformed into a sweet maiden. The object is an illustration of the synthesis of Greek and Indian art known as the Gandhara style. The discovery of Indian silver coins and of many ivory objects in central Asia shows the existence of economic links between Bactria and India in the 1st century BC.

Finely wrought ivory sword-sheath, above, belongs to a spectacular treasure found by Soviet archaeologists at Takhti Sanghin in central Asia. The treasure has illuminated some dark corners in the history of the ancient land of Bactria, important as a meeting place for east-west overland trade and as a centre of artistic crosscurrents. The sheath is decorated with a relief carving of a lion seizing a deer. The lion's head is depicted frontally with tightly clenched teeth while the deer is shown in profile, its legs bent in submission (detail, above right). The carving is thought to be an allegorical depiction of a victorious conqueror, king or god, and his submissive subjects. Beneath the lion is a highly stylized scene showing a feline predator attacking a wild sheep. Typical of Achaemenid Persia, the sheath dates from the early 5th century BC and is 276 mm long.

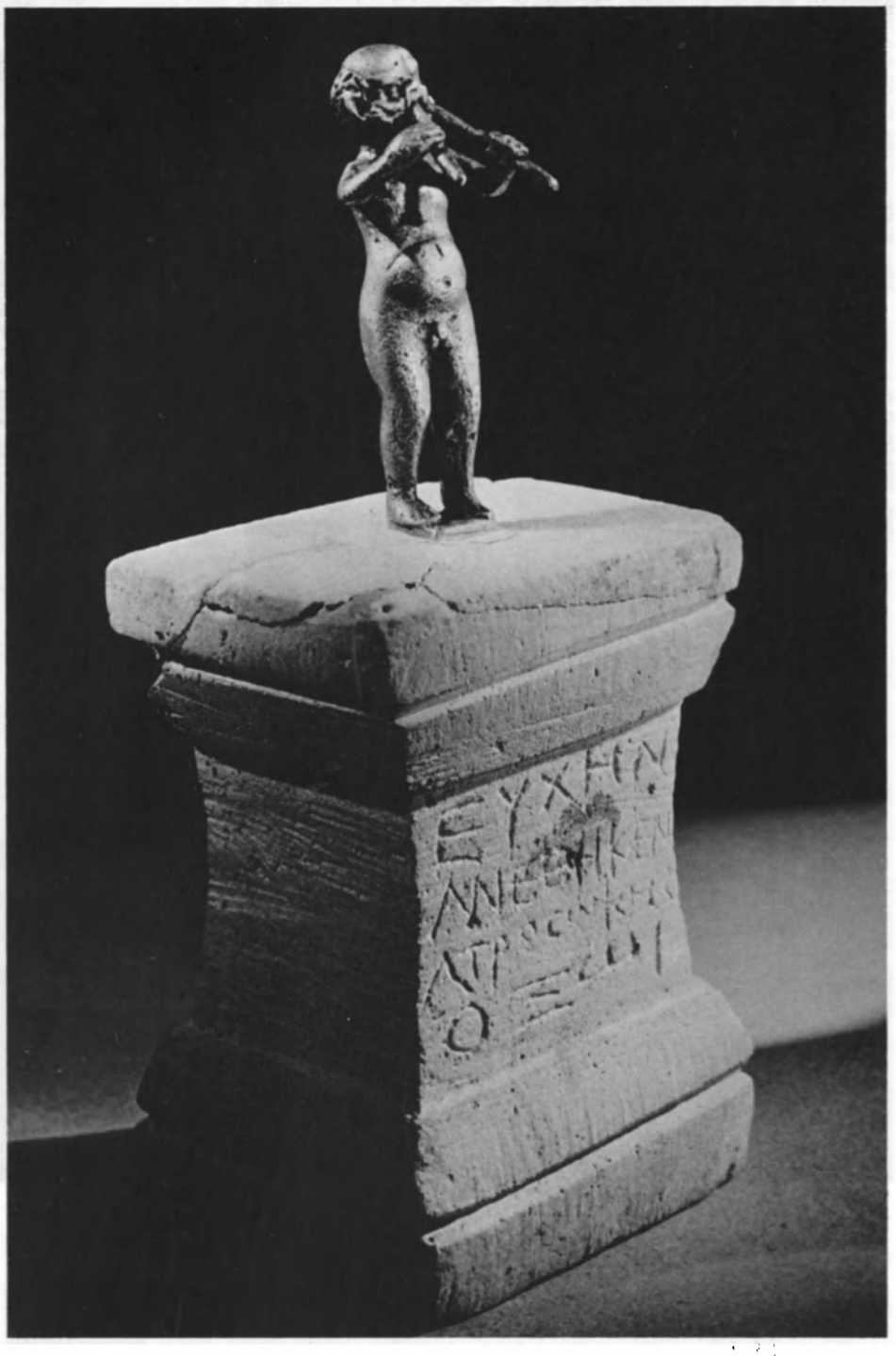
OVER a hundred years ago, in 1878, three Bukhara merchants en route for India halted in the oasis of Kobadian (in the south of what is now Tajikistan), where they bought a mass of objects and coins from an "old fortress", on the promontory at the confluence of two rivers. The objects and coins fell into the hands of Indian jewellers, then those of English collectors and finally, known as the "treasure of the Oxus", ended up in the British Museum in London.

The objects comprising the treasure of the Oxus are of superb artistic quality. They made it clear that ancient Bactria, whose territory covered what are today the southern regions of Tajikistan, part of Uzbekistan and the north of Afghanistan, held the promise of major historical and artistic discoveries. The laconic remarks of ancient authors about the wealth and power of the Bactrian kingdom were confirmed.

Descriptions of the site where the treasure of the Oxus was discovered suggest that it lay among the ruins of a city at the confluence of two rivers, the Vakhsh and the Piandj, which meet to form the Oxus (Amu Darya). The Techik-Tach mountain range runs close alongside the western bank of the Vakhsh. An ancient caravan route once passed through the narrow valley. Archaeologists have explored this site many times and have found traces of two ancient cities: Takhti Kuvad ("Throne of Kuvad") and, five kilometres further north, Takhti Sanghin ("Throne of Stone") where excavations in 1928 and 1956 did not yield interesting results.

In 1976, the archaeological mission to southern Tajikistan organized by the Institute of Oriental Studies of the USSR Academy of Sciences, the Academy of Sciences of the Tajik SSR and the Hermitage Museum, Leningrad, decided to begin new excavations at Takhti Sanghin. Our aim was not, of course, to locate the site where the treasure of the Oxus had been found. Takhti Sanghin's location near an old caravan route, its powerful fortifications, and the scattered remains of ancient columns, together with our intuition as archaeologists, were enough to convince us to begin work again on its ruins. We pitched our tents and erected our portable chalets. Dozens of Tajik students and specialists from Moscow got down to work.

The central part of the ancient city—the citadel—was rectangular (165 by 237 metres). It was surrounded by a six-metre-high wall, with sturdy towers at each cor- ▶



A striking example of cultural synthesis in central Asia over 2,000 years ago, this votive stone altar is surmounted by a bronze figurine of a Silenus playing a double flute. Carved on the base is an inscription which reads, "After making a vow, Atrossok dedicates it to Oxus." Although the inscription is in ancient Greek, the two names cited in it are of Iranian origin. It is thought that Atrossok, who dedicated the altar with its Greek inscription and Greek figure to the local god Oxus, may have been a Bactrian official of a fire cult.

▶ner, and a deep ditch. Two walls running from the mountains towards the river, 500 metres north and south of the citadel, marked the limits of the city.

A monumental building has been excavated on a hill in the western part of the citadel. It was almost certainly a temple, since it contained a votive stone altar dedicated to Oxus. At the centre was a vast white hall with four columns. It was enclosed on three sides by two lines of galleries. To the east (where the great main entrance stood) was a colonnaded portal.

The architecture of this massive building (the walls of the hall were four metres thick), which we called the temple of Oxus, suggests that it was built in the late fourth or early third century BC. Its plan recalls that of Persian fire temples; it is built of local materials; its columns, pilasters, altars and other details of the stonework are in Hellenistic style.

Offerings were brought to the temple and left in specially excavated ditches or in other receptacles. Later, they were piled in corners of the corridors which were subsequently blocked up and became secret treasuries.

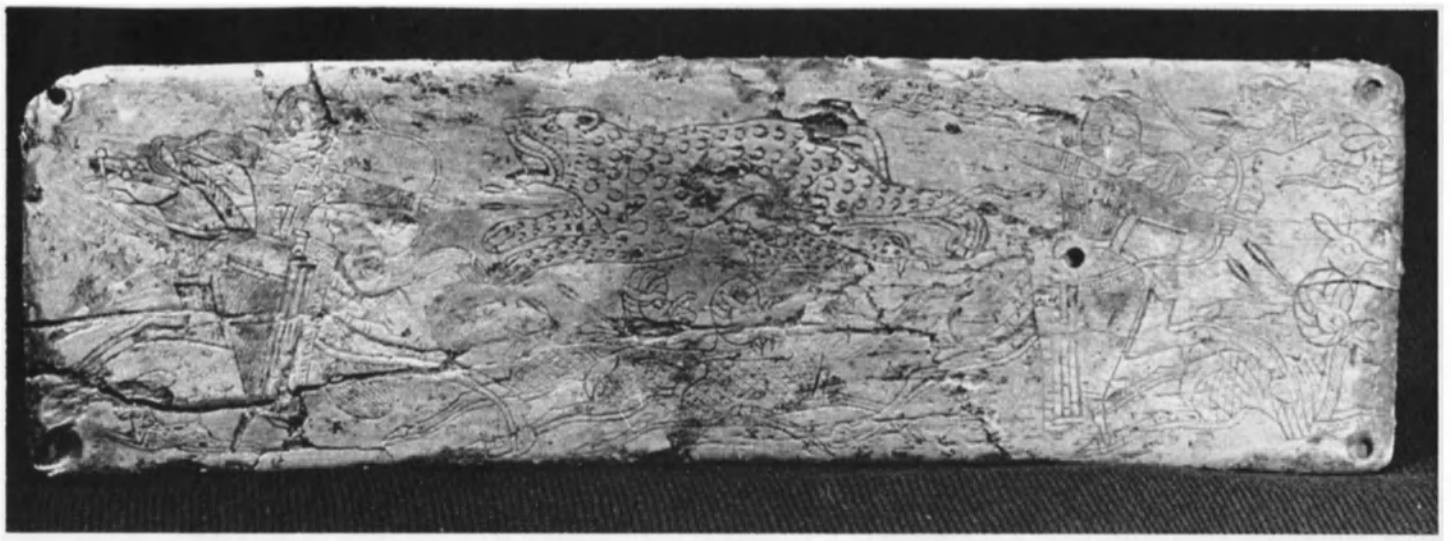
We had the pleasure of discovering these treasures. As the five metres of fill were removed, hundreds of works of the hitherto little-known Greco-Bactrian art appeared before our eyes: bronzes with a dark green patina, gleaming white alabaster sculptures, glittering gold. We also unearthed many carved ivory objects. In ten seasons of excavations, 5,000 specimens have been unearthed and restored.

Above all we were delighted to discover works of art dating from the sixth-fourth centuries BC, the period when the Achaemenid dynasty ruled in Persia, which recall those of the treasure of the Oxus. An ivory scabbard for a short sword is expressively decorated with a relief carving of a lion holding a deer between its outstretched paws (see photos on preceding double page). In size and shape (276 mm) it forms a pendant to a scabbard from the Oxus treasure.

Other works of art from Achaemenid Persia whose manufacture recalls pieces in the treasure of the Oxus have also been discovered in the temple. They include a rhyton (a drinking cup) the extremity of which depicts a crouching lion, and a horseman's sword-hilt topped by a griffon. More than fifty gold plaques have also been found.

The objects belonging to the next chronological period (late fourth-early second century BC) initiate the extremely interesting and until recently unknown Hellenistic period of Bactrian culture. In date and place of manufacture (Asia Minor, Bactria, the Scythian steppes) they are akin to specimens in the treasure of the Oxus. Clay and alabaster sculptures, the prototypes of which are found in the plastic schools of Asia Minor, are purely Hellenistic works of art. Besides many portraits of Greek and Oriental sovereigns wearing diadems, we have unearthed sculptures of maidens *(kore)* depicted in impetuous movement and a statue of Apollo (the "Apollo of Takhti Sanghin").

A special place among all these discoveries is held by a miniature ivory bust of Alexander the Great, a new addition to the rare Hellenistic effigies which have come down to us of the warrior king who was depicted by Lysippus, Leochares and other great artists. Alexander's effigies on coinage are probably based on a monumental statue, which has not survived, in which Lysippus depicted him as Heracles wearing a lion mask with the paws crossed on his breast. The iconography of the ivory portrait of Takhti Sanghin in which Alexander is shown frontally is taken from this same model. Because of certain differences from the coinage, in which Alexander is generally



Photos © O. Tsessarskii, Moscow

Hunting scenes carved on the side of an ivory casket illustrate the costume, weaponry, horses' trappings and riding skills of the Yueh-chih, conquerors of the Greco-Bactrian kingdom (late 2nd-early 1st century BC).

shown in profile, this portrait is unique (see colour photo page 22).

The discovery in the heart of central Asia of this "masquerade" in which Alexander is depicted with the attributes of Heracles is particularly important because Alexander-imagery played an important role in Greco-Bactrian art, just as it did in Buddhist art and in the art of Gandhara, in what is now northwestern Pakistan.

Another work of the highest quality is an original depiction of a combat between Heracles and Silenus, an extremely rare subject in the plastic art of Antiquity, which adorns a Greek ceremonial sword.

Among the many reliefs embellishing the Greek sword scabbards is a fantastic depiction of a female creature with the tail of a fish, horse's hooves and a bird's wings. One might think that an ancient Greek sea divinity had been transformed into a nymph-follower of the god of the river Oxus. This image dating from the second century BC, the period when the Greco-Bactrian kingdom collapsed, is a proof of the Hellenization of Bactrian culture and of an important measure of the influence of Antiquity in Greco-Bactrian art.

Probably from the same period is a hemispherical gold plaque with a relief image of three panthers in a circle; each biting the one before it (the "Round of the Panthers"). This is a fine example of the "animal style" characteristic of Scytho-Siberian art.

The abundance of objects made of ivory, a rare and extremely costly material, is evidence of close economic and commercial relations with India, which are also borne out by the extremely rare oval and rectangular punched coins which were struck in India from the fifth to the second century BC when the dynasty of Nanda and the Mauryas held sway. Other ivory objects found in the temple are incontestably works of Gandhara-Indian style.

The hypothesis concerning the cultural and artistic contacts which may have existed between the Parthians and the Bactrians has been put forward many times. The Takhti Sanghin sculptures and almost seventy silver coins, imitations of drachmas of the Parthian king Phraates IV (36-2BC), support this conjecture.

Some of the objects we have unearthed attest to permanent relations with the Scythian-Siberian world. Apart from the gold plaque described above there is a bronze disc with an image ("the Scythian holding 2 horses by the bridle") and several thousand bronze and iron arrowheads which must have been brought to the temple as offerings.

The discoveries at the temple of Oxus thus reveal with precision the components of Greco-Bactrian art: these elements are Oriental (original), Hellenistic (secondary) and that of Gandhara (a result of the Greco-Indian synthesis).

Most of our finds have analogies with objects in the treasure of the Oxus and in the metropolitan Iranian art of the Achaemenid period. There are many reasons to think that the treasure of the Oxus is organically related to the temple of Oxus, that it is part of the temple treasure.

Exploration of Takhti Sanghin is going ahead hand in hand with that of other Bactrian monuments. On the opposite, southern bank of the Amu Darya in Afghanistan where the Kocha Darya flows into it, our French colleagues have brought to light an entire Greek city the ruins of which are known as Ai Khanum. The objects from Ai Khanum and those discovered at the temple of Oxus complement each other and give a fair idea of Greco-Bactrian culture, its origins and extensions.

From a vast amount of material, science has been able to shed further light on the role of local tradition in the genesis of the Hellenistic Bactrian culture. Study of this material has informed us about the many-sided relationship between the peoples who had inhabited this region and various ancient civilizations (from India to the Mediterranean). The works of art discovered in the temple of Oxus and reintegrated in the cultural treasure of humanity brilliantly illustrate the extent and intensity of these links.

The synthesis of these civilizations was not confined to the field of material culture. On the right bank of the Oxus lived people who spoke and wrote Greek and worshipped the Hellenic gods; a syncretic Greco-Bactrian culture was created there. A Greek theatre and gymnasium, and other specifically Hellenic buildings, have come to light at Ai Khanum.

The literary, scientific and philosophical writings of Greek authors were, it seems, widespread in Bactria even at a later period. It is possible that elements of this culture survived the fall of the Kushan empire.

This is for the time being no more than a hypothesis. It is highly important to continue research, for the discovery of even faint traces of ancient cultural traditions which may have survived to the Middle Ages would throw a new light on the genesis of the science and philosophy of the Muslim east. ■

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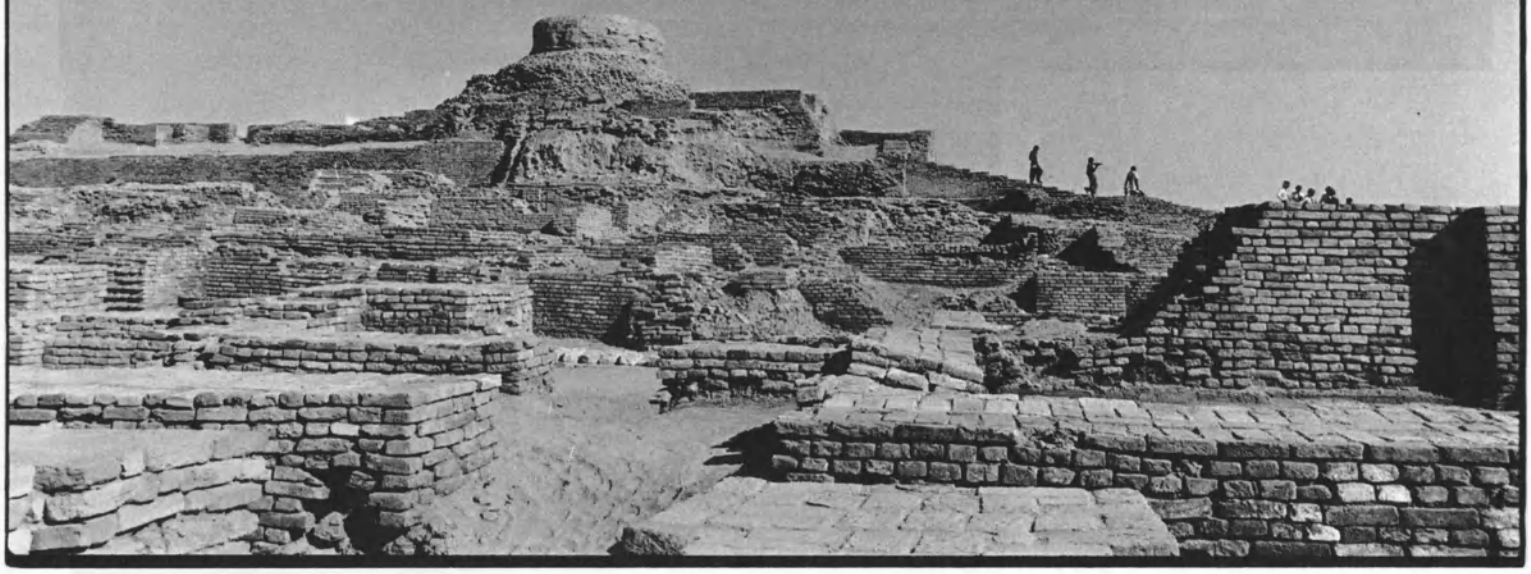
MOENJODARO

Threatened centre of an ancient civilization

by Syed A. Naqvi



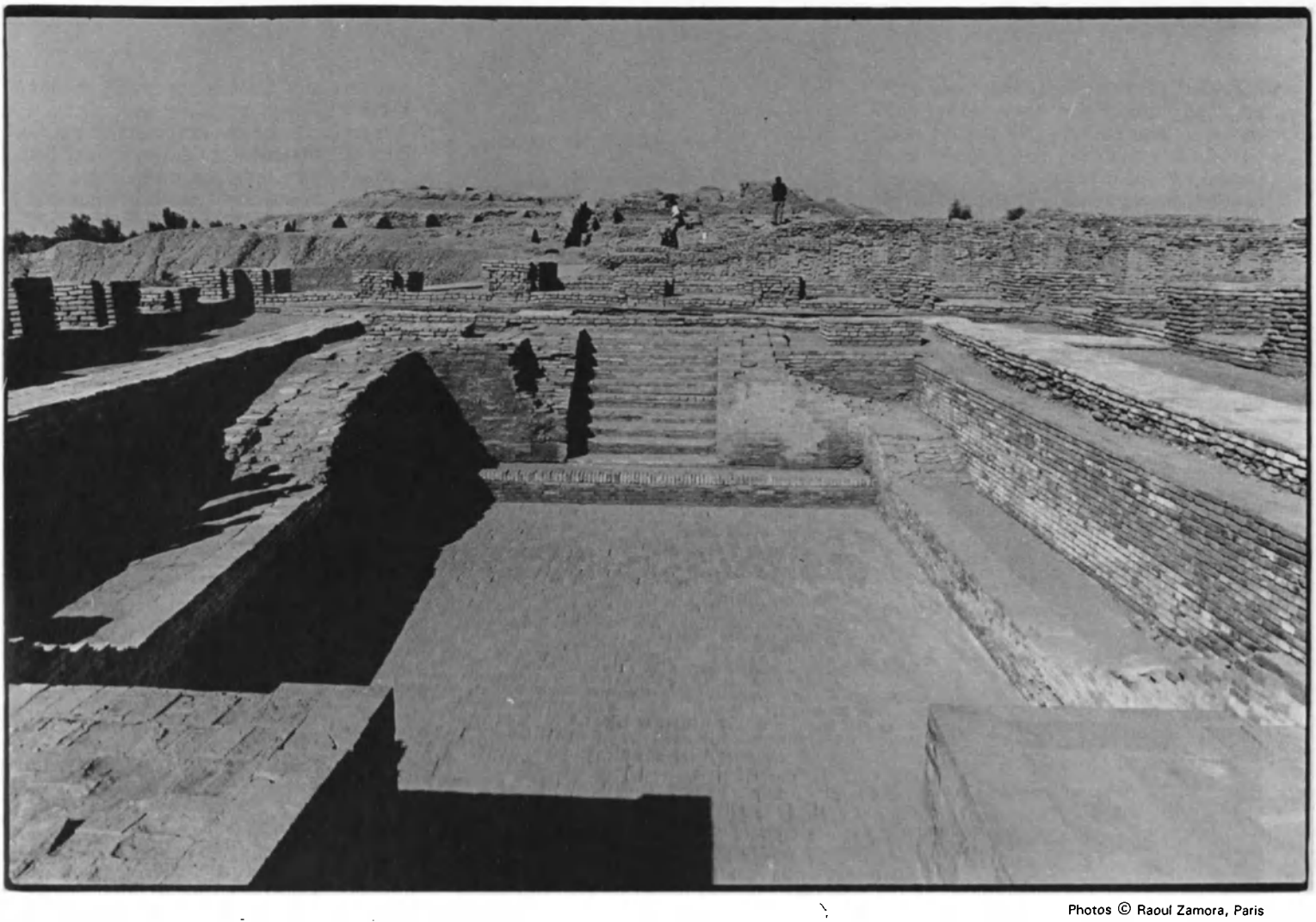
An incomparable monument to a great civilization that flourished in the Indus Valley some 5,000 years ago, the vast ruins of the city of Moenjodaro are located in the Sind Province of present-day Pakistan, some 400 kilometres north of Karachi. Sometimes referred to as "the Manhattan of the Bronze Age" because of its extraordinarily modern, scientifically-planned layout, Moenjodaro, even at the height of its splendour, has always been at risk from flooding by the Indus. Preserved for centuries beneath a protective layer of soil, the excavated city (the excavations began in 1922) now faces two additional threats: a rising water table and corrosion by salts. Since the 1960s, Unesco has been collaborating with the Government of Pakistan in preserving this outstanding site. With the aid of Pakistani experts, Unesco has established a master plan for the work of preservation, launched an international fund-raising campaign and included Moenjodaro on its World Heritage List. Above, a view of the site of Moenjodaro dominated by a Buddhist stupa of more recent construction.

MOENJODARO, a metropolis of the five-thousand-year-old Indus Valley civilization in Pakistan, presents the earliest example of town-planning and a setting for the future. Even in the limited area laid bare by the archaeologist's spade, it is like walking through a fossilized embryo of Manhattan. In the lower city, we find the crisscross grid-iron system of street layout, a broad boulevard over nine metres wide, running north to south and crossed at right angles by somewhat smaller east-west streets. The blocks of residential houses between are served by narrow lanes.

The prime considerations in planning the houses were safety and comfort. Avoiding the risk of heavy traffic on the main streets, the doors of the houses usually opened on to the side-lanes. Interior courtyards provided light and air, and windows were screened with grilles of terra-cotta or alabaster. The thickness of the walls of the houses in Moenjodaro proves the existence of at least two-storey-high structures. Most houses had stairways that led either to the second storey or to the roof, often used in Pakistan and elsewhere in the East as a cool sleeping place in summer. Besides other basic amenities, many houses also had wells for water supply which were lined with brickwork and had protective revetments at their head to prevent accidents to children and domestic animals.

The grid layout and residential architecture are not the only indications of the perception and care that went into the planning of Moenjodaro. Never before, and not until Greek and Roman times, was so much attention paid to sanitation and civic facilities. The water-discharge sluices from the houses first collected the refuse in small cesspits lined with bricks at the base of the walls, from which the dirty water was led through conduits to the main drains which ran along the streets below pavement level and were covered with sturdy bricks. This drainage system was connected to the larger sewerage outlets, also covered at the top, which finally led the dirty water outside the populated area.

A few hundred metres to the west of this densely built part of the city, excavations have revealed some most conspicuous monuments located on an artificial hill some seven to fourteen metres high. The Great Bath, a highly complex brick structure, symbolizes a triumph of engineering at that time. The pool, 11.9 metres long, 7 metres wide and 1.9 metres deep, was made watertight by an inner facing of bricks set on edge in gypsum mortar which was laid over a layer of asphalt 2.5 cm thick trowelled on to double brick walls. The floor sloped to an outlet that led in turn to a corbelled arched drain. This corbelled arch was one of the earliest achievements of architectural engineer-



Photos © Raoul Zamora, Paris

The Great Bath is undoubtedly the most spectacular building of Moenjodaro. Built like most of the city's buildings in brick, the 12-metre-long bath itself was made completely watertight by the application of a layer of bitumen between two layers of brick pointed with lime mortar. The sloping floor of the bath was equipped with an ingenious draining system.

A seal found at Moenjodaro. At top is an example of the pictographic writing of the Indus civilization. So far all attempts to decipher this writing have failed.

Photo © Department of Antiquities, Pakistan/Unesco

ing, spanning an opening without using wooden beams. (The possibilities of spanning wider openings were extended later on by the discovery of the keystone, and in our times developed still further with the use of reinforced concrete.)

A second architectural feature is the podium of the great Granary situated on the western flank of the mound. The podium, made of solid brick square-shaped platforms separated by a gridiron of straight and narrow passages, is thought to have been covered by a floor of wooden boards, and probably the superstructure was also made of wood. It has been suggested that it served as a State Treasury to which bullock carts brought sacks of grain from farmers, since in those days coins had not yet been minted. A quantity of charred grains of wheat collected from the excavations puts the nature of the building beyond any doubt. A third important building in this area is the Pillared Hall. It has twenty pillars and encloses a small courtyard, and probably served as the centre of administration.

The purpose of some of Moenjodaro's sophisticated structures is one of the many questions that still remain unanswered about the city. The discovery in 1922 of so complete and advanced a metropolis came as an immense surprise to the archaeologists who never had any inkling that such a full-fledged civilization existed in the Indus Valley as far back as 2500 BC. It was not until 1920 when excavations started at Harappa, about 640 kilometres north of Moenjodaro, that the existence of a whole network of such "modern" ancient cities was suspected.

When Harappa, the mother city of the Indus Valley civilization—because of which this civilization is also known as the "Harappan culture"—was discovered in the second half of the nineteenth century, it was found to be already robbed of its ancient burnt bricks by the engineers laying the railway line between Lahore and Multan and, of course, by local villagers hunting for easy building material for their own houses. Since then, archaeologists in the Indian sub-continent have located nearly 1,000 other Harappan sites. They show a remarkable similarity of cultural deposits and cover an astonishing geographical spread, from the Arabian Sea to the foothills of the Himalayas and from the eastern border of Iran to the vicinity of the Ganges Valley. This area was much larger than the combined size of contemporary cultures in Mesopotamia and the Valley of the Nile.

What was the mainstay of the life of the Indus Valley people in that remote past? The archaeological evidence shows that they were primarily farmers, growing grains, vegetables and cotton, and cattle husbandry was central to the farm economy. Their life-style was simple but ▶

▶not lacking in rich goods. They used copper and bronze for some tools and weapons, and occasionally worked gold and silver with other materials into the beads for their jewellery. Among the beads some were skilfully fashioned out of rare semi-precious stones such as agate, carnelian and lapis lazuli. At the same time, the bulk of their artifacts consisted of bone, shell, faience, flint, clay, and other locally abundant materials. Their handiwork in more vulnerable organic substances has not survived, and we are left to guess what kind of furniture they used or what varieties of textile patterns they preferred. The remains of the dyers' workshop at Moenjodaro and certain patterns depicted on dresses worn by sculptured figures do, however, suggest that they liked colourful clothing, often embroidered or printed.

A further striking aspect of this ancient civilization was the extent of standardization. In architecture, building bricks were of standard size, 27.94 cm in length, 13.42 cm in breadth, and 6.35 cm thick. Drainage and sewer systems were standard in pattern. The private houses were generally standardized in their plans and dimensions and only special structures, possibly public buildings, were treated differently but within the framework of the city plan. Above all, the existence of strictly controlled weights and measures throughout the Indus Valley civilization distinguishes it from other contemporary civilizations.

Photo © Department of Antiquities, Pakistan/Unesco

The King-Priest. This 18-cm-high statuette, carved in steatite and dating from about 2500 BC, is one of the few sculptures in stone found at Moenjodaro.

The people respected the rule of law which helped them to develop an egalitarian society on such a vast scale about 5,000 years ago, an achievement unparalleled in the history of mankind. By inference, therefore, the Indus Valley possessed an efficient mechanism of control, means of communication and transportation and an administrative framework free of such grandiose structures as forts, palaces or great temples serving as centres of authoritarian rule. It was here in those ancient times that a concept of some kind of Government of the people, by the people, for the people was evolved, laying the seed of democratic rules—a cherished goal of us all today.

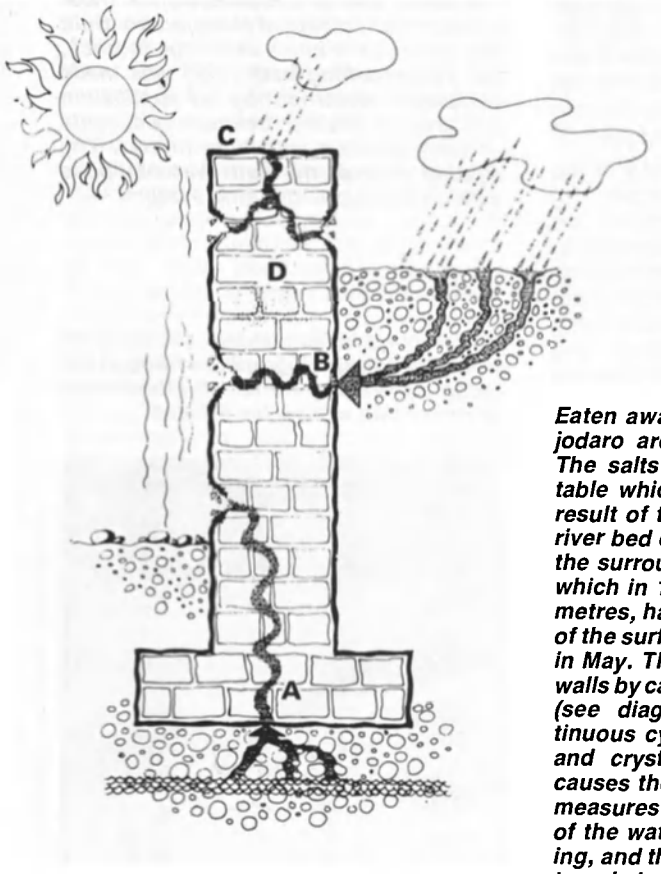
Of course the proof of this inference lies in the results of further research into the socio-cultural pattern of the Indus Valley civilization and particularly the deciphering of its enigmatic script which appears on seals and sealings discovered in the Indus Valley. The epigraphists and linguistic experts of the world have made many attempts to decipher this script in the last sixty years. An account of their efforts would make a long tale of trials and errors. The net gain of their researches so far has been recognition of nearly 350 different pictographs and the fact that the script was written from right to left. But in the absence of long texts even the use of computer technology has not yielded any positive results and one can only hope for a day when a bilingual inscription will be discovered making it possible to unravel the mysteries of the Harappan culture in the same way as the Rosetta Stone did in Egypt and the Behistun inscription in Iran.

A further insight into the skill of the people is provided by a wide range of utilitarian, recreational, artistic and cult objects made of baked clay, stone, metals, ivory, conch shell, faience and other substances. A whole range of pottery types, most wheel-turned, presents a multitude of forms, sizes and decorative features. Amongst the innumerable terracotta toys, miniature bullock carts with solid wheels are particularly striking. Such carts are being used even today around Moenjodaro. Here we also find the beginnings of a chess-board designed on brick tiles, with gamesmen made of agate or ivory.

Who were the founders of this far-reaching, long-vanished civilization? Scholars believe that the people of the Indus came down into the valley from the foothills of the mountains to the west. Of the early Harappan sites, recent discoveries at Mehrgarh in Baluchistan, southeast of the Sulaiman and Kirthar ranges, show an unbroken sequence of cultural evolution from the sixth millennium BC to the mature Harappan culture. As to the end of this highly developed civilization around 1500 BC, several theories have been put forward by archaeologists. Some of them attribute it to the Aryan invaders who swept over the Indus Valley about that time, others consider it due to a tectonic shift in the coastline of the Arabian Sea affecting the entire ecological system of the Valley. However, further research is needed to shed light on the causes of the sudden demise of this great civilization.

The ancient remains of Moenjodaro are now on the World Heritage List as a monument of universal interest and Unesco has launched an international campaign for

Movement of salts into the ruins



Drawing Unesco

A. Salt-impregnated water rises from the water table by capillary action.
B. Salty water also infiltrates through surrounding earth and débris which has yet to be cleared away.
C. Dust-laden winds carry salts and deposit them on bricks. Rain helps the salts penetrate the brickwork.
D. Accumulated salts within the bricks erode the walls.

Eaten away by salts, the walls of Moenjodaro are slowly crumbling into dust. The salts are absorbed from the water table which has risen considerably as a result of the rise, through silting, of the river bed of the Indus and of irrigation in the surrounding plains. The water table, which in 1922 was at a depth of about 8 metres, has risen to between 1.52 metres of the surface in October and 3.66 metres in May. The water impregnates the brick walls by capillary action and in other ways (see diagram) thus beginning a continuous cycle of saturation, evaporation and crystallization of the salts which causes the walls to disintegrate. Control measures envisaged include the lowering of the water table, by pumping or draining, and the complete excavation and external cleaning of the walls coupled with leaching out of the accumulated salts.

Photo Alain MacKenzie, Unesco

Most of the houses at Moenjodaro had interior wells to provide water for cooking and washing. Looking at first sight more like chimneys after excavation of the soil around them, these wells testify to the continual rise in the ground occupation level and provide archaeologists with a convenient time and depth scale. The inhabitants of the city were obliged to add fresh layers of brick at regular intervals to raise the tops of the wells above the level of the ground. Some wells have been found to go right through entire rooms of earlier houses.

their preservation. When excavations started at the site in 1922, the structural remains were in excellent condition. Soon after they were afflicted by the plague of waterlogging and the leprosy of salinity. These two diseases, combined with the menace of erosion by the River Indus, posed a grim threat to the very existence of Moenjodaro. This complex problem required not only huge finances which were beyond the resources of the Government of Pakistan but also technical know-how of a multi-disciplinary nature.

At the request of the Government of Pakistan, the General Conference of Unesco adopted a resolution at its seventeenth session, authorizing an international campaign for the preservation of Moenjodaro. In January 1974, the Director-General of Unesco launched an Appeal for international solidarity, stating that "By the generous provision of money, equipment and services, governments, public and private individuals will not merely be helping to save a precious record of man's past, they will also be demonstrating and strengthening that intellectual and moral solidarity on which true peace must be founded".

Since then, over US$4 million have been received in the Unesco Trust Fund from Member States and private sources. The Government of Pakistan, from its own resources, has already invested about US$6 million for the execution of the Master Plan, which includes schemes for groundwater control, conservation of structural remains and the training of the River Indus, at a total estimated cost of US$19 million.

The first phase of the groundwater control scheme, which envisaged fourteen tubewells, collector and disposal drains, and a pump house, has already been completed. Work on the conservation of structural remains has also advanced considerably. The amount required for the implementation of the River Training scheme, about US$9 million, has yet to be collected and work on this project has not yet begun. The Director-General of Unesco has, therefore, addressed a second Appeal to the international community urging that "This challenge is commensurate with the responsibility we all bear for our common history, to which Moenjodaro is a moving testimony we cannot and must not allow to disappear." ■

SYED A. NAQVI, *internationally known archaeologist and museologist, was head of the National Museum of Pakistan, and then General Director of Pakistan's Department of Archaeology and Museums. He has excavated at many Pakistani sites including Moenjodaro, Taxila and Mansura. In July 1973 he joined Unesco's Division of Cultural Heritage, which he has headed since January 1982. He has been directly responsible for the successful campaigns for Nubia and Borobudur, as well as supervising all Unesco's activities for the preservation of the cultural heritage. Among his studies on archaeology and ancient art are* The Muslim Art *(1966),* Gandhara Art *(1967) and* 1,400 Years of Quranic Calligraphy *(1973).*

My life as an archaeologist

by Guo Zhan

WHEN I entered Beijing University in 1973 to study archaeology, a whole new world opened up for me. I received a rigorous training in how to excavate and carry out archaeological surveys. Our teachers taught us not only how to unearth specific parts of ancient ruins but also principles of excavation work on large archaeological sites. As fieldwork I took part in the excavation of the Qin Dynasty E-fang Palace Ruins in Shanxi, of Stone Age ruins at Hong Hua Tao in the middle reaches of the Yangtse River, and worked on the site of the ancient capital of Qi City State of the Spring and Autumn period in Linzi, Shandong Province. Looking back now, I realize that these ruins where we beginners were allowed to work were not of the greatest importance, and yet working on a real archaeological site gave me practical experience and awakened in me a deep interest in my studies.

Apart from fieldwork, we also studied classical Chinese, ancient Chinese characters, the ancient history of China, major archaeological themes from each period of Chinese history, photography, cartography, the history of ancient architecture, the history of the different nationalities, philosophy and political science.

When I graduated in 1976, I was assigned to work in the Science and Technology Research Institute for Relics Protection affiliated to the State Relics Administration Bureau. The Institute is chiefly concerned with the conservation of all kinds of historical remains using modern technology, and the preservation and maintenance of ancient monuments. Along with some other staff members I was given the job of launching a brand-new subject: seismological archaeology. (First of all, we archaeologists working along the Yangtse River provided hydrological data relating to the last 2,000 years as reference material for the construction of hydrological projects. We thus opened up another new branch of science, hydrological archaeology.)

In 1976, an earthquake in Hebei Province literally flattened the city of Tangshan. Hundreds of thousands of people were injured or lost their lives, and the after-shocks threatened the safety of Beijing and another great city, Tianjin. What were the possibilities that Beijing would be devastated by an earthquake in the very near future? This was a question of nationwide concern.

Research into earthquakes must be based on an examination of the earliest possible historical documents. In this respect China is fortunate because all over the country there are documents and steles from ancient times bearing records of seismic activities. Together with the many ancient monuments which have survived earthquakes, these were valuable materials for us to study. The varying degrees of damage sustained by ancient monuments in different parts of Tangshan due to differences in the magnitudes of the earthquakes provided evidence which we were able to pro-

Chinese archaeologist Guo Zhan (second from right) and his colleagues during a survey of part of the Great Wall in 1976. The 2,400-kilometre-long Wall is largely the work of Qin Shihuang, the first emperor of China (221-210 BC), although parts of it date back to the 4th century BC. It was substantially rebuilt later, especially in the 15th and 16th centuries.

Photo © Unesco Courier, Chinese edition

Photo © Unesco Courier, Chinese edition

This immense tomb in Qinghai province, western China, is that of a Turfan aristocrat. During excavations which began in 1983 a large amount of silk fabrics, fragments of engraved bamboo slips and other articles have been unearthed. Situated in an oasis in the Sinkiang Uighur Autonomous Region, Turfan was an important staging post on the northern branch of the Silk Road (see the* Unesco Courier, *June 1984, issue on "Great Trade Routes").

cess scientifically. Seismological archaeology had begun.

Between 1976 and 1979, my colleagues and I travelled extensively in disaster-hit Tangshan, on both sides of the Great Wall in northern China, in Beijing and Tianjin, and completed our research. The results of our efforts were compiled in a book entitled "Seismic Archaeology in Beijing" which has won wide acclaim from our fellow professionals. From this experience I learned about the many-sidedness of archaeology and its close links with other branches of science.

In 1979 I took a graduate course in the history of the Yuan Dynasty at the Academy of Social Sciences. This opened a new page in my archaeological career and ended my work in seismic archaeology. When I finished the course, only two places really attracted me; one was the Institute of Historical Research, the other was my former place of work, the State Relics Bureau. Here I could do both research and conservation work. I decided to go back.

And so I joined the Relics Department, which takes part in drawing up and enforcing laws concerning historical relics and in administration related to relics and their protection, and is involved in archaeological work throughout the country. I had developed a strong interest in ancient religions during my post-graduate studies. My new post provided me with opportunities for contact with ancient religious remains and was ideal for carrying out research in this field.

I feel strongly that a patriotic archaeologist should not only undertake serious research into historical problems by himself; he should help a wider audience—the whole nation—to understand the importance of archaeological work so that they can take part in the protection, study and appreciation of our common historic culture.

I am wholeheartedly devoted to my administrative work and research into subjects that interest me. In the past three years I have visited ancient ruins on the three gorges of the Yangtse river, surveyed the Lama relics in Tibet, and visited Egypt. This year I was appointed deputy director of our Relics Department, a new honour that spurs me to make greater efforts in my work so as to fulfil the historic mission bestowed on our generation.

Like myself, young archaeologists of my generation are growing up. Before the founding of the People's Republic, there were few archaeologists in our country. In the first years of the young republic, several famous archaeologists, including some from abroad, set up a training course for future archaeologists. In 1955 an archaeological department opened at Beijing University. Its graduates became the main force for undertaking archaeological work in the new China. Now we of the next generation have become pillars of archaeological work throughout the country. Many of us have been promoted to directorships of museums and are leaders of archaeological teams. Our modernization drive is accelerating research and excavation work on ancient ruins. Heavy responsibilities have been placed on the shoulders of young archaeologists.

Today many other universities are setting up archaeology departments. With the development of the economy and the rise in living standards and levels of culture, greater demands are being made on archaeologists. Present numbers are insufficient. The new situation also calls for deeper professional knowledge. A course run by the State Relics Administration Bureau to train leaders of archaeological teams recruits only college graduates with three years of working experience. Only those who pass the examination at the end of the course are qualified to lead excavation work.

The most professional archaeological periodicals in China are "Archaeology" (published by the Archaeological Research Institute of the China Academy of Social Sciences) and "Relics" (published by Relics Publishing House). Other publications are edited by local museums and research institutes.

The scope for the study of archaeology is widening. In the past, because of the lack of professionals, the emphasis had been laid on periods before the Qin and Han dynasties. However, as China develops and exchanges with other countries increase, there is a growing interest in contemporary relics and in the artifacts of our minority nationalities. ■

GUO ZHAN, *of the People's Republic of China, is Deputy Director of the Relics Department of the State Relics Administration Bureau. He was one of the compilers of "Seismic Archaeology in Beijing", published by Relics Publishing House, 1985, and is the author of several historical studies.*

UNESCO NEWSROOM

In youthful hands, a future for the past

Each year, large numbers of young people show their concern for the cultural heritage by taking part in archaeological excavations as volunteers or by joining voluntary work camps organized to repair or restore historic buildings or sites. Each year since 1980 Unesco and the Paris-based association *Jeunesse et Patrimoine* ("Youth and Heritage") have issued a leaflet providing information about voluntary work camps and international courses for training camp leaders in various countries. This year's leaflet lists work camps in the following countries: Argentina, Australia, Austria, Belgium, Canada, Czechoslovakia, Finland, France, German Democratic Republic, Hungary, Ireland, Israel, Italy, Morocco, Netherlands, Norway, Poland, Portugal, Spain, Syrian Arab Republic, Tunisia, the United Kingdom. The training courses are designed to enable participants to set up or run voluntary restoration camps in their own countries. Students are instructed in a range of restoration and conservation techniques, from stone dressing to paving and roofing. For further information and to receive the leaflet, please write to: Jeunesse et Patrimoine, 9 Avenue Franklin D. Roosevelt, 75008 Paris, enclosing a stamped addressed envelope (postage paid for 50 grammes) for France, or an equivalent international reply coupon. Above, restoration of the columns of the Roman theatre at Bosra in the Syrian Arab Republic.

Photo Dominique Roger — Unesco

Violence of Nature and of Man

During the 121st session of the Unesco Executive Board, the Director-General of Unesco, the Chairman and members of the Board expressed their sympathy for the families of the thousands of victims of the recent cyclone and floods in Bangladesh and their solidarity with the Bangalee people and Government. The Director-General outlined the various steps he had taken in aid of the victims of the disaster.

The Chairman and members of the Board and the Director-General also deplored the violence that resulted in the tragedy at the Heysel stadium, Brussels, on the occasion of the final of the European Cup, when 38 spectators lost their lives. Mention was made of Unesco action designed to encourage fair play in sport.

World Archaeological Congress

The World Archaeological Congress to be held in Southampton and London from 1 to 7 September 1986, is the 11th Congress of the International Union of Prehistoric and Protohistoric Sciences (U.I.S.P.P.) sponsored by Unesco. Further information may be obtained from the UK National Secretary, Professor P.J. Ucko, Department of Archaeology, University of Southampton, Southampton SO9 5NH, England. (See article page 4).

International Simón Bolívar Prize 1985

On the recommendation of the Prize Jury, following its meeting at Unesco headquarters in Paris from 13 to 17 May under the chairmanship of Mr. Arturo Uslar Pietri (Venezuela), the Director-General of Unesco, Mr. Amadou-Mahtar M'Bow, has decided to award the International Simón Bolívar Prize 1985 to the Contadora Group (Colombia, Mexico, Panama and Venezuela).

The award is being made in recognition of the efforts of the Contadora Group to find a pacific, negotiated solution to the extremely serious problems now facing Central America. Established by Unesco in 1978, the Simón Bolívar Prize was first awarded jointly in 1983 to King Juan Carlos of Spain and Nelson Mandela, the African National Congress leader imprisoned in South Africa.

In announcing the award Mr. M'Bow also associated himself with the special tribute paid by the jury to Prince Talal Bin Abdul Aziz Al Saud, of Saudi Arabia, for his exemplary humanitarian action for development in general and for the world's needy children in particular.

The Prize was presented at a ceremony held at Unesco headquarters in Paris on 20 June.

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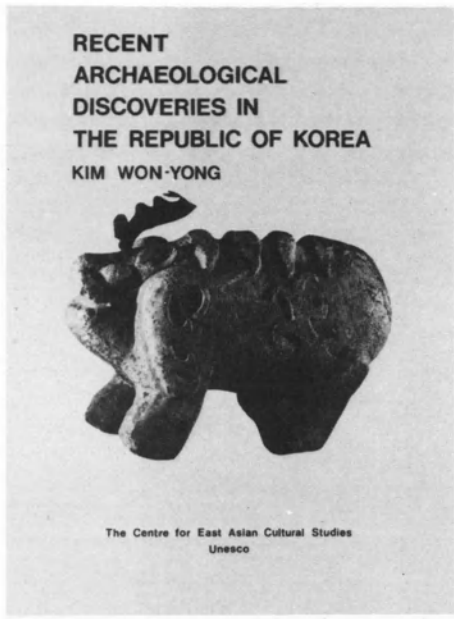

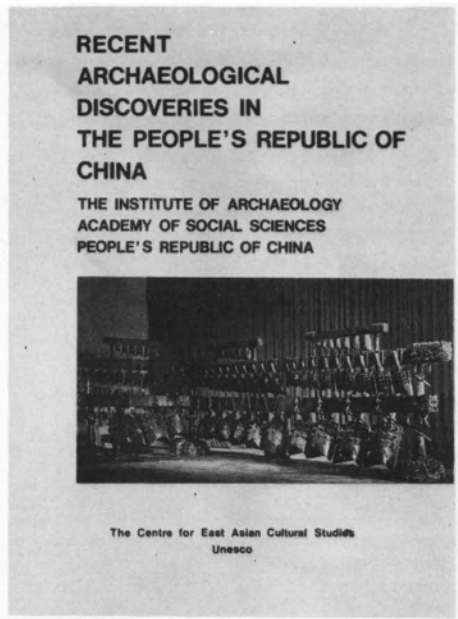

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Trees that rewrote history

This gnarled tree trunk protruding from rocky debris over 3,000 metres up in the White Mountains of California is an ancient bristlecone pine *(Pinus Longaeva)*. The bristlecone pine is the world's oldest known living tree. By counting the distinctive ring patterns that are produced in a tree trunk during each year of its growth, one bristlecone pine specimen was found to be about 4,900 years old. By fitting together tree-ring patterns from living trees and dead wood, scientists have established a system for dating archaeological remains which has led to the re-evaluation of some traditional theories about the development of ancient cultures.