



IGCP COUNCIL - 2017

GEODYNAMIC PROJECTS

INTERNATIONAL GEOSCIENCE PROGRAMME

A summary

February 2017

Presented by: Prof. Nellie Mutemeri, University of
Witwatersrand, Johannesburg, South Africa

- ▶ Reynaldo Charrier
- ▶ Nasser Ennih
- ▶ Kenichiro Hisada
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- ▶ Xiaochi Jin
- ▶ Victor Mocanu
- ▶ Altunkaynak Safak
- ▶ Randell Stephenson
- ▶ Virginia Toy

GEODYNAMIC TEAM



ON-GOING PROJECTS

- ▶ IGCP-589: Development of the Asian Tethyan Realm
- ▶ IGCP-592: Continental construction in Central Asia
- ▶ IGCP-628: The Gondwana Map Project
- ▶ IGCP-646: Dynamic interaction in tropical Africa
- ▶ IGCP-648: Supercontinent cycles andn global geodynamics
- ▶ IGCP-649: Diamond and recycled mantle

PROJECT LIST

- ▶ Six projects on-going projects.
- ▶ Geographic spread: 6 continents
- ▶ Participants diversity: Good global reach, however the participation of women needs to be enhanced.
- ▶ Principal Investigators (PI) spread: 19 different countries, more women are needed
- ▶ Scientific disciplines: petrology, tectonics, geochronology, geology, geophysics, environmental aspects, mineralogy, mantle dynamics, tectonics etc.

ON GOING PROJECTS

- ▶ Outputs: Many, many publications, meetings, workshop, conferences
- ▶ Capacity building: A good performance this area. Many young people are benefiting
- ▶ Collaboration: There is generally good collaboration with other UNESCO projects and other initiatives.
- ▶ Recommendation for improved reporting: It is recommended that the template for reporting by project principals and the template for reviews be aligned.

ON GOING PROJECTS (CONT'D)

Earth Resources: Sustaining our Society

Knowledge on natural resources - including minerals, hydrocarbons, geothermal energy, and water - and their management is the frontline of the struggle for more sustainable and equitable development. The environmentally responsible exploitation of these resources is a challenge for geoscience research. The progress of technological development is equally bound to this premise.

IGCP Scientific Board Members Earth Resources Theme

<i>Brigitte Vlaswinkel</i>	<i>Oceans of Energy</i>	<i>Netherlands</i>
George Beaudoin	University of Laal (Dep. Geology)	Canada
Jan Pasava	Czech Geological Survey	Czech Rep.
Reimar Seltmann	Natural History Museum	UK
Ozcan Yigit	Canakkale Onsekiz Mart University (Dep. Geol. Eng)	Turkey
Regina Baumgartner *	Gold Fields, Lima, Peru	Peru
Gema Olivo *	Queen's University, Kingston, Canada	Canada
Anne-Sylvie André-Mayer *	Université de Lorraine, Nancy, France	France
Susanne Paradis *	Geological Survey of Canada	Canada
Ferenc Molnar *	Geological Survey of Finland	Finland
Jafar Omrani *	Geological Survey of Iran, Tehran	Iran

* Newly appointed

Overview of Earth Resources Projects

Ongoing Projects (and 1 closing)

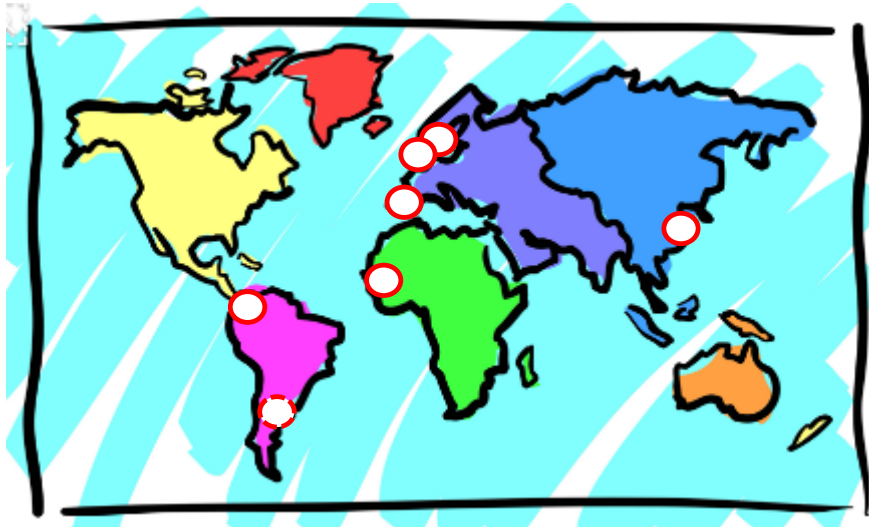
600 – Metallogensis of the Tethys – Dr. Zengqian Hou, China (4 reviewers) - closing

636 - Characterization and sustainable exploitation of geothermal resources – Dr. Daniela Blessent, Colombia (5 reviewers)

637 – Heritage Stone Designation, Dr. Dolores Pereira, Spain (4 reviewers)

638 – Geodynamics and mineralization of Birimian Terrains (West Africancraton) for a sustainable development, Dr. Moussa Dabo, Senegal (3 reviewers)

Geographic spread & Scientific participation from developing countries



Project 600: Australia, Canada, Georgia, Iran, Japan, Pakistan, China, USA (88% from developing countries)

Project 636: Colombia, Chile, Canada, France, Belgium (69% from developing countries)

Project 637: 52 countries, 29 active in 2016 (14% from developing countries)

Project 638: 13 African countries, 2 from Europe, 2 from Asia, USA (72% from developing countries)

Gender equality ratio



Project 600: 39% female

Project 636: well balanced

Project 637: 37% female

Project 638: 20% female

Age Profile Ratio

Project 600: 50% youngsters

Project 636: 77% youngsters

Project 637: 14% youngsters

Project 638: 67% youngsters



600 – Metallogenesis of the Tethys (2011-2016)

- Establish genetic links between the geodynamic processes that form large collisional orogenic belts and the specific controls on the most important ore deposits
- Principal Investigators from China, USA, Canada, Iran, Pakistan

Overall Achievements & Highlights

- Significant data (and multiple publications) has been generated on tectonic evolution, collisional processes and related ore systems - even without funding for the past 2 years from IGCP
- Researchers from various countries were able to work in areas that are both geographically and politically hard to access.
- Truly multi-national project, which resulted in international collaboration, exchange of scientific ideas between scientists from different developing and developed countries, and the training of young economic geologists.

NB: Project has been closed now (2011-2014 and two years On Extended Term)

Chinese team in Tibet



636 – Characterization and sustainable exploitation of geothermal resources (2016-2018)

- Promote sustainable exploitation of geothermal resources (focus on the *zona cafetera* of Colombia, declared UNESCO world heritage site). The growing interest in renewable energies is an attractive opportunity for scientific and technologic development to fulfill energy needs in South America and Caribbean, which should double by 2030.
- Principal Investigators from Colombia, Canada, Belgium, Chile, France

Overall Achievements & Highlights

- Many young scientists involved (it is a Young Scientist Project), and many women (3 out of 5 PI's is a woman), and a great geographic distribution of scientists.
- Development of innovative models of geothermal reservoirs through combination of field, lab and modelling work
- First project meeting Fall 2016 in Colombia with more than 250 participants from all participating countries

Fieldtrip Nevada del Ruiz Colombia



637 – Heritage Stone Designation (2015-2019)

- Establish the first international standard for building and ornamental stones that have been significant in human culture. International heritage stone designation will increase awareness of natural stone and its positive attributes in terms of sustainability and regional economic development.
- Principal investigators from Spain, Australia, Sweden, Slovenia

Overall Achievements & Highlights

- Unique project as it addresses the cross-over realm between the geological sciences and the human cultural heritage. It has achieved plentiful synergy, impact and a lot of public attention for natural stone use.
- Involvement of many scientists (75 scientists from 23 countries, incl. many from developing countries) in international heritage stone conferences, field trips, workshops
- Great book published on Stone Heritage of East and South East Asia

April 2015 Vienna



638 – Paleoproterozoic Birimian geology for sustainable development (2016-2020)

Expected results are of 1) scientific, 2) economic and 3) social nature

- Improve the knowledge about the relationship of gold-related structures to the geodynamic evolution, which will lead to a more sustainable exploration (better targeting).
- In the educational systems of West Africa geology is the 'underdog' among all scientific disciplines, due to a lack of knowledge on resources and general geological history of the basement rocks. Quality improvement of the high school geology programme is envisioned.
- Help public authorities and investors to acquire effective tools for ore prospecting and investment policy

Overall Achievements & Highlights

- First successful symposium was held in Dec 2016: 150 participants from 15 countries
- Good looking website but actual scientific research results cannot be found (only focus on meetings)
- Project has great potential, yet the principal investigators will need some help. IGCP will help connect them to ANESI (African Network)

Dec 2016 Dakar, Senegal





Hydrogeology: Geoscience of the Water Cycle

Yongje KIM

Hydrogeology: Geoscience of the Water Cycle

Life on Earth depends on water and its sustainable use is crucial for continued human existence. Earth's water resources include surface/ground water, ocean water, and ice. The study of Earth's water involves understanding and managing both surface and ground water systems, including sources, contamination, vulnerability and history of water systems

Hydrogeology experts in the Scientific Board

- 10 experts from America, Africa, Asia, Europe : **5 new experts and 6 women**
- China, DR Congo, Ecuador, **Egypt, Hungary, Italy, Russia, Spain**, USA, Vietnam

* Red color countries: newly appointed in 2017

The projects mainly consider and include

- Water resources sustainability, assessment, protection, and social services
- Activities such as workshops, meetings, and training programs
 - to expand the networks between countries and continents
 - to reach issues of global geoscientific interests
 - to ensure the results that meet society challenges

Hydrogeology theme covered 2 projects

▣ Paleoclimate and Groundwater (618)

- ▣ Understanding on how climate interacts with the major aquifers
- ▣ 11 countries in Africa and Estonia, China, Germany, USA, Argentina, Australia, Canada, UK, Lebanon, Spain, Tunisia

▣ Water Resources Management in Africa (643)

- ▣ Studying hydrogeological variability in relation with climate and land-use changes
- ▣ 3 countries in Africa (Benin, Ivory Coast, Niger) and France (1)

Hydrogeology theme covered 2 projects

Publications

- ❖ *Episodes* and International Journals such as *Nature Geoscience*, *Applied Geochemistry*, *Journal of Hydrology*, *J. Applied Science and Technology*, *J. Applied Geophysics*, etc.

Workshops and Meetings

- ❖ Paleoclimate and groundwater held public sessions in AGU (American Geophysical Union), San Francisco USA, bringing together about 80 experts including young scientists/students and female scientists from all around world
- ❖ Water resources management project had workshops in Benin to characterize aquifer systems by new geophysical tools including gravimetric and pumping test methods and TDEM, conductivity and topographic methods. A total of 55 scientists are participated including developing countries

IGCP Theme - **Geohazards: Mitigating the Risks**

Hazard is a process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation. **Geohazards** originate from internal Earth processes. Examples are earthquakes, volcanic activity and emissions, and related geophysical processes such as mass movements, landslides, rockslides, surface collapses and debris or mud flows. Hydrometeorological factors are important contributors to some of these processes. Tsunamis are difficult to categorize: although they are triggered by undersea earthquakes and other geological events, they essentially become an oceanic process that is manifested as a coastal water-related hazard.

Disaster risk is the potential loss of life, injury, or destroyed or damaged assets which could occur to a system, society or a community in a specific period of time, determined probabilistically as a function of hazard, exposure, vulnerability and capacity. The adverse impacts of hazards, in particular natural hazards, often cannot be prevented fully, but their scale or severity can be substantially lessened by various strategies and actions. **Mitigation** measures include engineering techniques and hazard-resistant construction as well as improved environmental and social policies and public awareness.

*The definitions have been adopted by the United Nations General Assembly
on 2 February 2017.*

IGCP Scientific Board Members of the Theme - Geohazards: Mitigating the Risks



Maria João Batista

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Portugal



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(*Theme Leader*)



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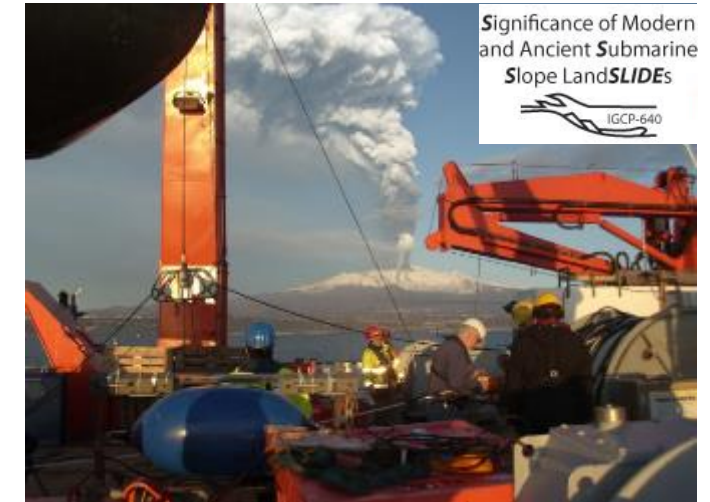
IGCP 640: Significance of Modern and Ancient Submarine Slope LandSLIDEs (S4SLIDE)

2015-2019

Subaquatic landslides pose a risk to coastal communities and offshore infrastructure. Lack of **understanding of the causal mechanisms and timing** of submarine landslides has hampered progress in the prediction effort. The project enhances our understanding of the landslides and fills the gap between landslide occurrence, dynamics and tsunami genesis.

Countries involved in the project (with 229 participants):

Australia, Austria, Canada, Colombia, China, Brazil, France, Germany, Ireland, Israel, India, Indonesia, Italy, Japan, Republic of Korea, Netherlands, New Zealand, New Caledonia, Nigeria, Norway, Spain, Switzerland, Taiwan, UK, USA



Main achievements in 2016:

1. The community effort to advance our understanding of subaqueous landslides continues with special emphasis on the collection of morphometric parameters and their potential relationship with pre-conditioning factors and triggering mechanisms. Several of these databases have been made available in the S4SLIDE webpage.
2. Important advances have also been made in the active monitoring of subaqueous sediment gravity flows in fjords and lakes.
3. S4SLIDE Scientific Sessions in China, Italy, and South Africa
4. S4SLIDE sponsored workshops in Germany and South Africa
5. 40 publications in peer-reviewed journals incl. *Nature Communication*

IGCP 641: Deformation and fissuring by exploitation of subsurface fluids (M3EF3)

2015-2018

Earth fissures and reactivation of pre-existing faults **caused by extraction of fluids** is observed in sedimentary basins worldwide. Unexpected fissure generation associated with **anthropogenic land subsidence** strongly impact the development of urban areas. The project is aimed to improve the understanding of the processes involved in ground rupturing.

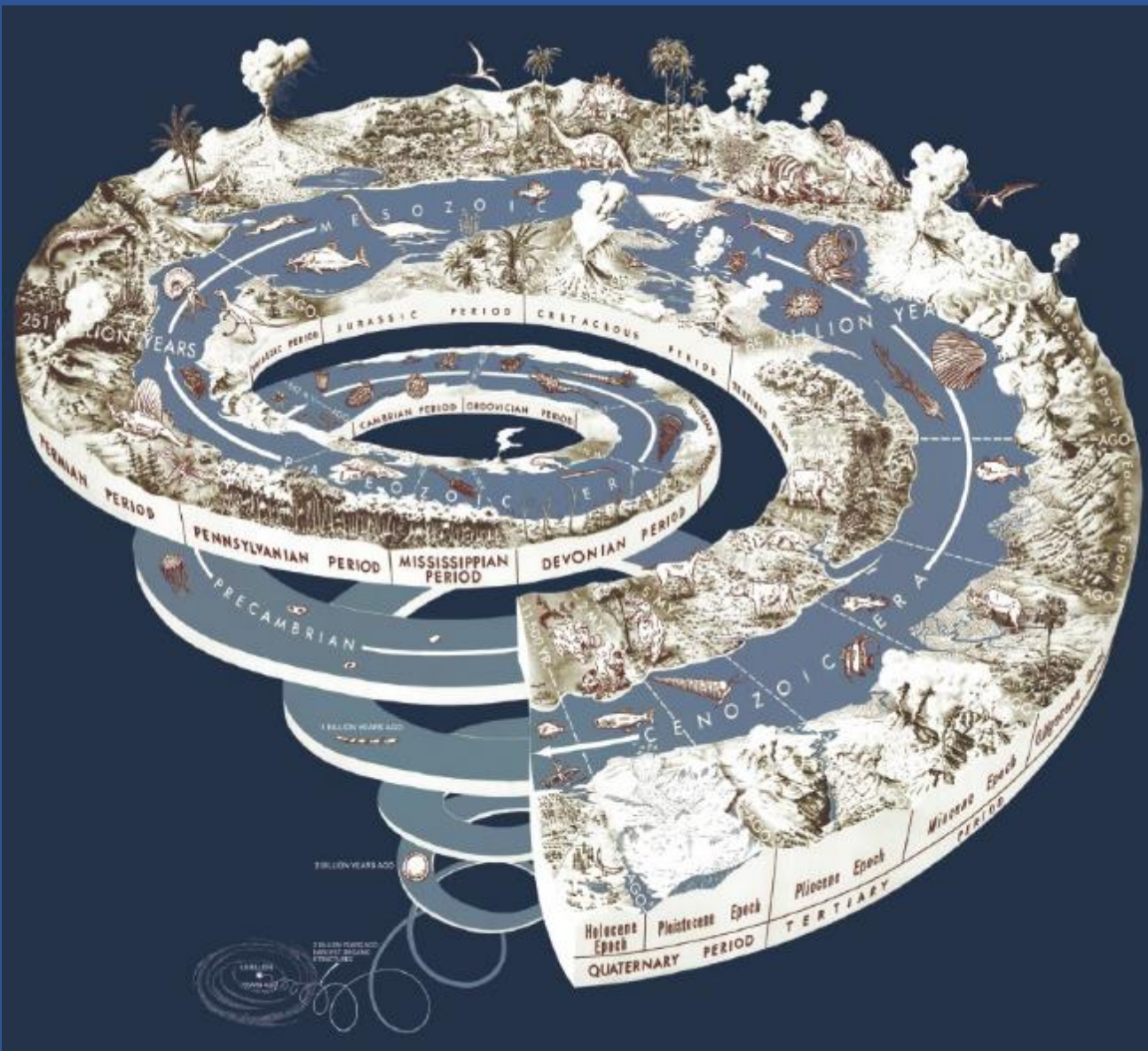
Countries involved in the project (with 47 participants):

China, Germany, Italy, Mexico, Philippines, Poland, Spain, UK, USA

Main achievements in 2016:

1. Contribution to the characterization of the major ground-failure features in selected areas of Mexico City, Arizona, and Nanjing, China, and the integration of the methodologies developed by each leader and project participants to investigate the generation/propagation of earth fissure and fault activation.
2. Progress in development of the global map of ground failures caused by subsurface fluid extraction.
3. Publication of 4 scientific papers, and papers in Symposium Proceedings.
4. Organization of the annual project meeting and workshop in Mexico, and several Scientific Sessions in Mexico and USA.





The inter-relationship between global change and life in deep time

- The fundamental underpinning of the evolution of the Earth, the history of life, and the Geologic Time Scale
- Provides geological insights into the effects of present and future global change on the Earth and life

IGCP Global Change: Evidence from the Geologic Record

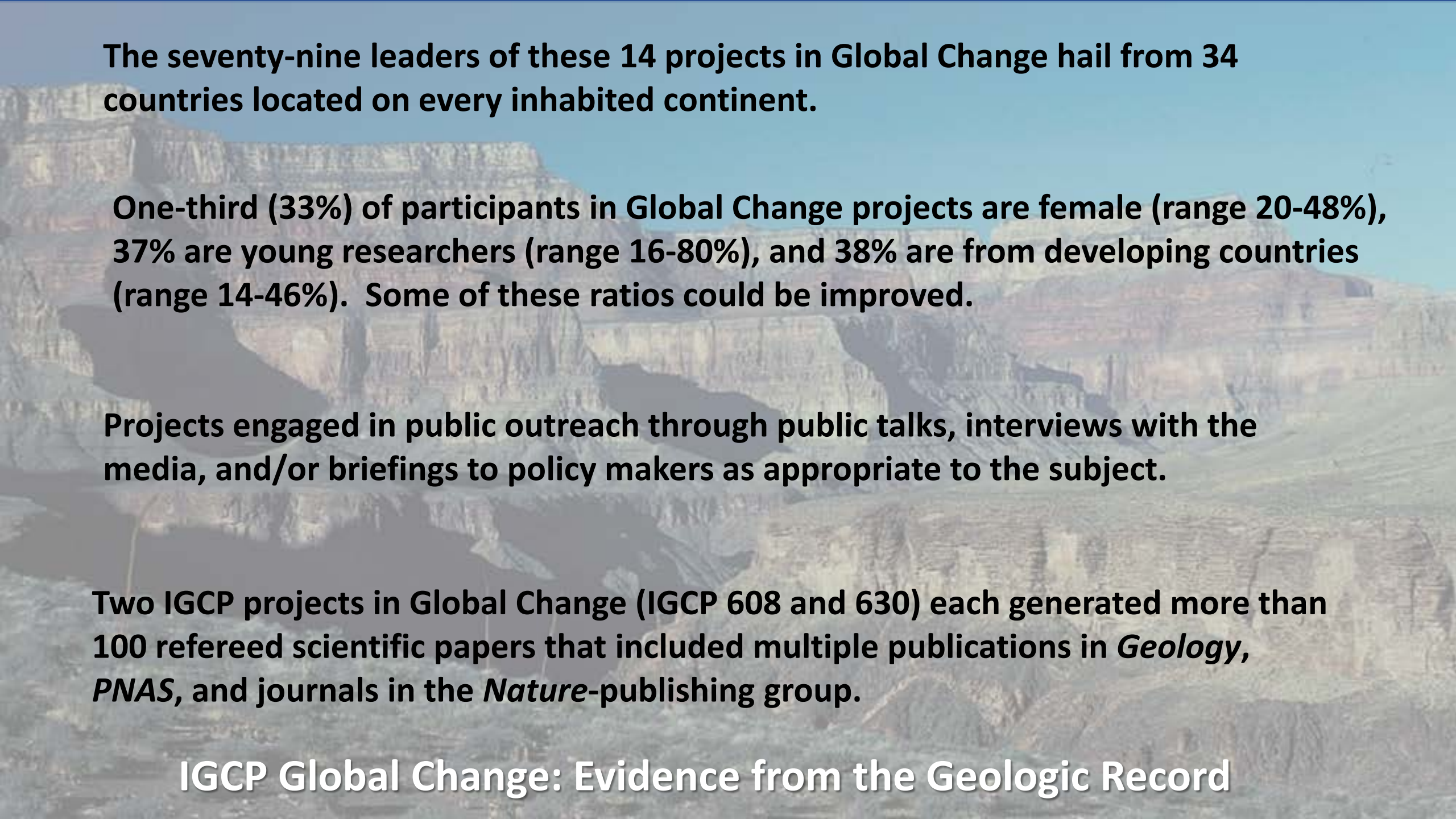
Theme Leader: Maria Julia Ortega (Argentina)

Projects:

- IGCP 655 – Toarcian Oceanographic Anoxic Event
- IGCP 652 – Reading Geologic Time in Paleozoic Rocks
- IGCP 653 – Great Ordovician Biodiversification Event
- IGCP 639 – Sea Level Changes from Minutes to Millennia
- IGCP 632 – Continental Crises of the Jurassic
- IGCP 630 – Permian-Triassic Climatic Extremes and Life
- IGCP 624 – OneGeology*
- IGCP 610 – Caspian to the Mediterranean
- IGCP 609 – Cretaceous Sea Level Changes
- IGCP 608 – Asia-Pacific Cretaceous Ecosystems
- IGCP 596 – Mid-Paleozoic Climate and Biodiversity*
- IGCP 591 – Early- to Mid-Paleozoic Revolution*
- IGCP 587 – The Ediacaran (Vendian) Puzzle*

IGCP Global Change: Evidence from the Geologic Record





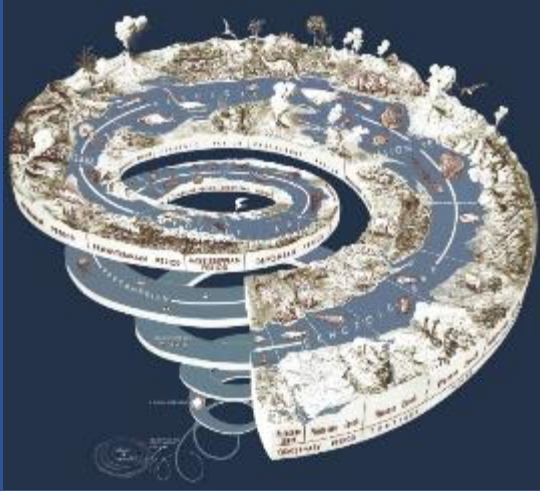
The seventy-nine leaders of these 14 projects in Global Change hail from 34 countries located on every inhabited continent.

One-third (33%) of participants in Global Change projects are female (range 20-48%), 37% are young researchers (range 16-80%), and 38% are from developing countries (range 14-46%). Some of these ratios could be improved.

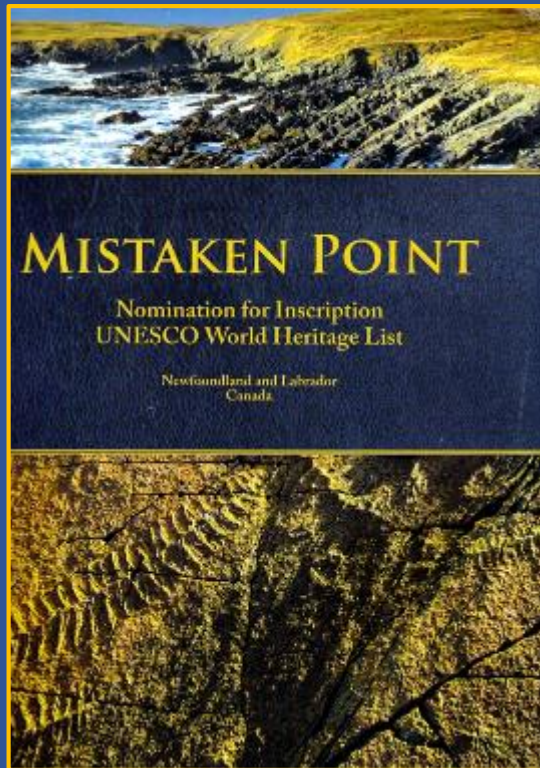
Projects engaged in public outreach through public talks, interviews with the media, and/or briefings to policy makers as appropriate to the subject.

Two IGCP projects in Global Change (IGCP 608 and 630) each generated more than 100 refereed scientific papers that included multiple publications in *Geology*, *PNAS*, and journals in the *Nature*-publishing group.

IGCP Global Change: Evidence from the Geologic Record



There are excellent collaborations with IUGS, principally through the subcommissions of the International Committee on Stratigraphy.



There are excellent collaborations with UNESCO, principally through the Global Geoparks program.

IGCP project 587 played a significant role in establishing a UNESCO World Heritage Site based on geological features of outstanding universal value.

IGCP Global Change: Evidence from the Geologic Record

World's oceans losing oxygen, threatening marine life

After studying 50 years of data, researchers forecast oxygen losses of as much as 7% by 2100

CBC News Posted: Feb 16, 2017 1:57 PM ET | Last Updated: Feb 16, 2017 2:37 PM ET



New research shows that the amount of oxygen in the world's ocean could decrease by seven per cent by the year 2100.
(John Schults/Reuters/File)

Media report of a paper in *Nature*, 16 February 2017



Cretaceous Global Oceanic Anoxic Event 1, Gubbio, Italy

IGCP Global Change: Evidence from the Geologic Record

TRANSFORMING OUR WORLD:



**THE 2030 AGENDA FOR
SUSTAINABLE DEVELOPMENT**

Goal 13. Take urgent action to combat climate change and its impacts*

IGCP Global Change: Evidence from the Geologic Record