

IGCP 2017 Annual Report

February 2018



Content:

- 1. Introduction (page 1)**
- 2. IGCP Projects 2017 Summary (page 4)**
- 3. IGCP Council member biographies (page 8)**
- 4. Finances (page 12)**
- 5. Conclusions (page 13)**

Annexes:

- 1. Earth resources theme summary (page 14)**
- 2. Global Change theme summary (page 17)**
- 3. Geohazards theme summary (page 24)**
- 4. Hydrogeology theme summary (page 29)**
- 5. Geodynamics theme summary (page 30)**
- 6. Funding table for active IGCP projects in 2017 (page 33)**
- 7. Active IGCP projects to be evaluated for funding in February 2018 (page 34)**
- 8. New IGCP project proposals to be evaluated for funding in February 2018 (page 35)**
- 9. List of IGCP Council Members and Scientific Board Members 2017 (page 36)**
- 10. IGCP projects 2017 meeting details (page 37)**

1. Introduction

UNESCO is the only United Nations Organization with a mandate in interdisciplinary research and capacity-enhancement in Earth sciences. Since 1972, partnering with the International Union of Geological Sciences (IUGS), the International Geoscience Programme (IGCP) has brought together many thousands of Earth scientists from around the world and allowed them to benefit from the cooperative spirit generated under the umbrella of UNESCO.

IGCP funds serve as seed grants to facilitate meetings or workshops for about 20-30 projects annually, bringing together 10-100 Earth scientists per project to meet and construct joint research, including developing capacity building activities, enabling the formation of truly global research teams working on challenging and societally relevant geological topics. IGCP projects primarily deal with geosciences on global issues within its five themes: Earth Resources, Global Change, Geohazards, Hydrogeology and Geodynamics. Each project has on average a lifespan of five years and its progress is assessed annually through a rigorous peer review process conducted by the IGCP Council following reports from members of the Scientific Board during the first half of February. The Scientific Board and IGCP Council are also responsible for evaluating new project proposals. The Scientific Board consists of about 50 specialists responsible for the technical reviews and it works electronically only. Board members are appointed as specialists in their given field for each of the five IGCP themes, with preferably little overlap in the Earth sciences fields, and reflects a worldwide geographic distribution. The IGCP Council consists of six members, a chairperson and five experts, one for each IGCP theme and they meet annually at UNESCO HQ.

Considering that the IGCP has a limited budget, IGCP support is specially earmarked to help scientists from developing countries. IGCP allows them to benefit from the cooperative spirit generated under the umbrella of UNESCO.

In 2016, under the new operating guidelines for the IGCP within the International Geoscience and Geoparks Programme, a new IGCP Council was appointed jointly by the Director-General of UNESCO and the President of the IUGS (see Annex 9) and during 2018 half of the IGCP council members will be renewed. The call for these open positions has been published following the approval of IUGS secretariat.

This report summarises the statistical results of the 21 IGCP projects annual reports submitted as of 31st January 2018 and provides IGCP Themes summaries/highlights provided by IGCP Council members regarding each IGCP theme (Annexes 1 to 5). As of January 2018, the annual reports of 20 IGCP projects were evaluated by the IGCP Council and Scientific Board ahead of the February 2018 IGCP Council meeting. The scientific results of these IGCP projects will be summarised by the IGCP Council members and published in February 2018.

2. IGCP Projects 2017 Summary

In 2017, a total of 21 IGCP projects were considered active and 20 of these projects received financial support from IUGS and UNESCO (both HQ and Field Offices) (Annex 6). One project was *On Extended Term* (OET), i.e. it remained active in 2017 but without receiving funding from IGCP.

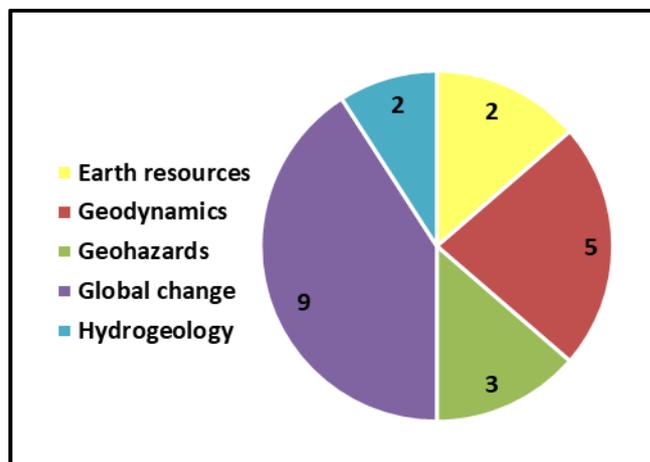


Figure 1: Distribution of active IGCP projects by theme in 2017

This report summarises the results of all 21 IGCP projects which submitted their annual reports as of 31st January 2018. IGCP 657 was a new project where the project team were unable to organise its first annual IGCP project meeting. As they didn't provide the required documents to obtain the funding allocated for this project in 2017, they didn't submit their annual activity report as of 31st December 2017.

As of 15 October 2017, UNESCO received an unexpectedly high number of 13 new IGCP project proposals requesting funding from 2018 onwards (Figure 2). These proposals will be evaluated by the IGCP Council on February 19-20 2018 during the IGCP Council session.

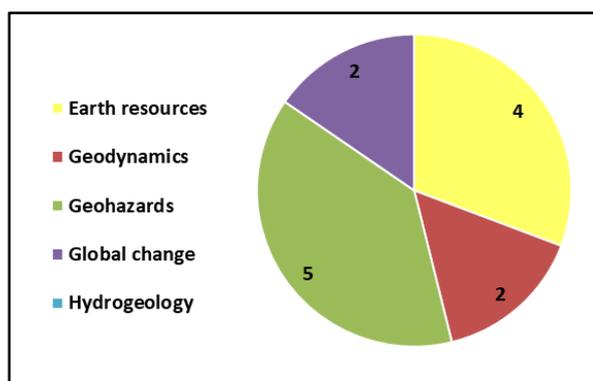


Figure 2: Distribution of the new IGCP project proposals by theme received in 2017.

Each IGCP project is led by several project leaders from different countries. In 2017 a total number of **135** IGCP Project leaders came from **110** different countries. IGCP 630

project was led by 14 project leaders from 9 countries and IGCP 637 had 13 project leaders came from 12 different countries (Figure 3).

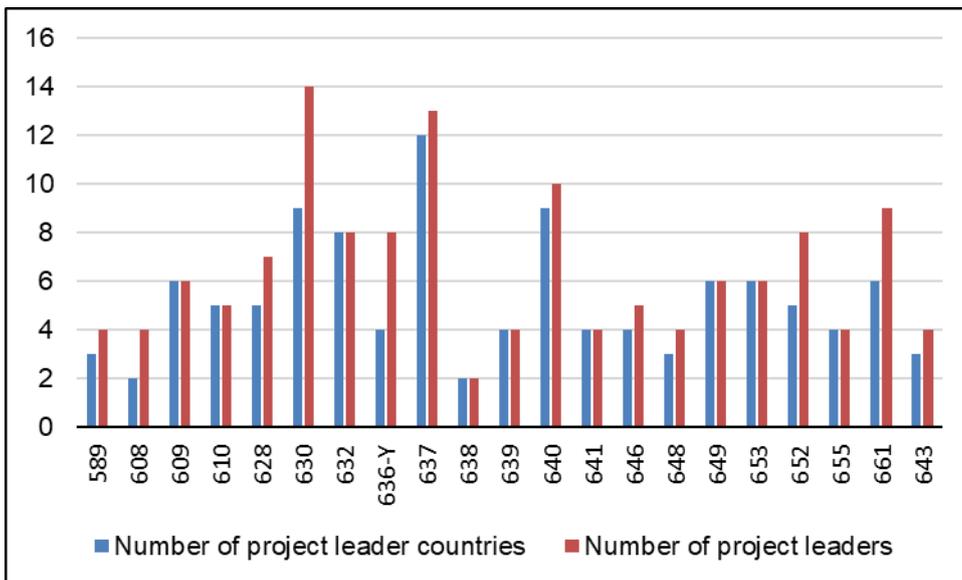


Figure 3: Distribution of active IGCP projects in 2017 against number of project leaders and their associated countries of nationality.

Furthermore, seven projects have project leaders from **African** countries, twelve projects have project leaders from **Asian** countries, eight projects have project leaders from **Pacific** countries (Figure 4).

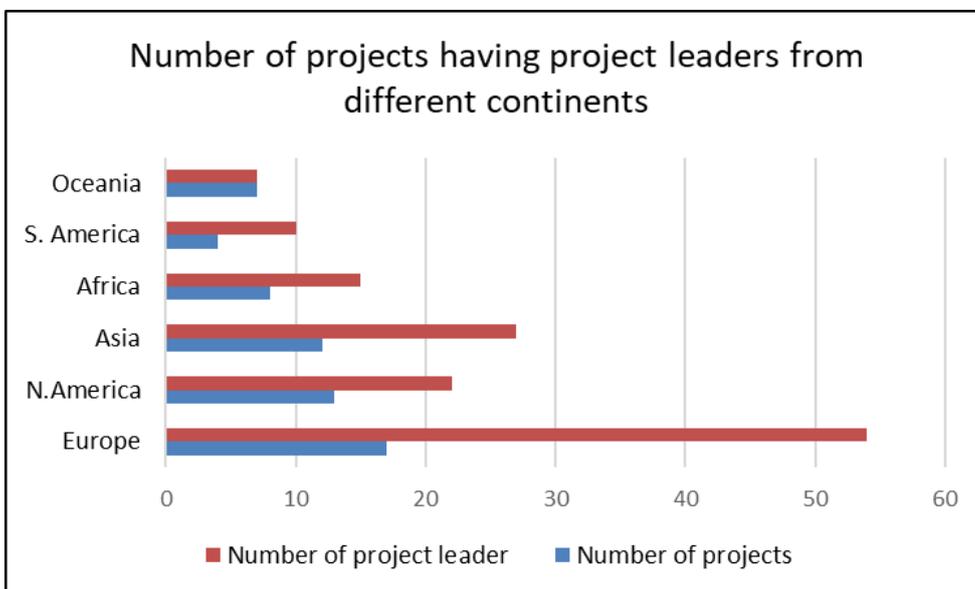


Figure 4: Distribution IGCP project leader continents and total number of projects having leaders from different continents.

Scientists from 135 countries have participated in the delivery of these 21 IGCP projects since their first funding approval. In 2017, scientists from 111 countries were active

(Figure 5), including 30 African countries, 8 Arab States, 27 countries from Asia-Pacific, 11 Latin American and Caribbean countries, 41 countries from Europe and North America and 3 Small Island Developing States (SIDS).

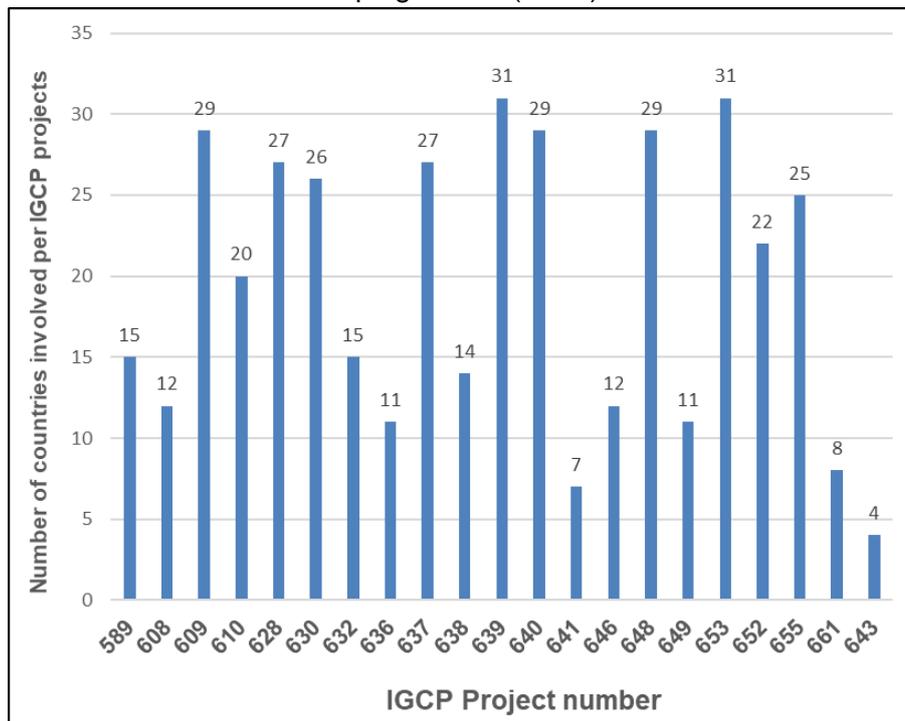


Figure 5: Distribution of active 2017 IGCP projects against number of countries that participated each project in 2017.

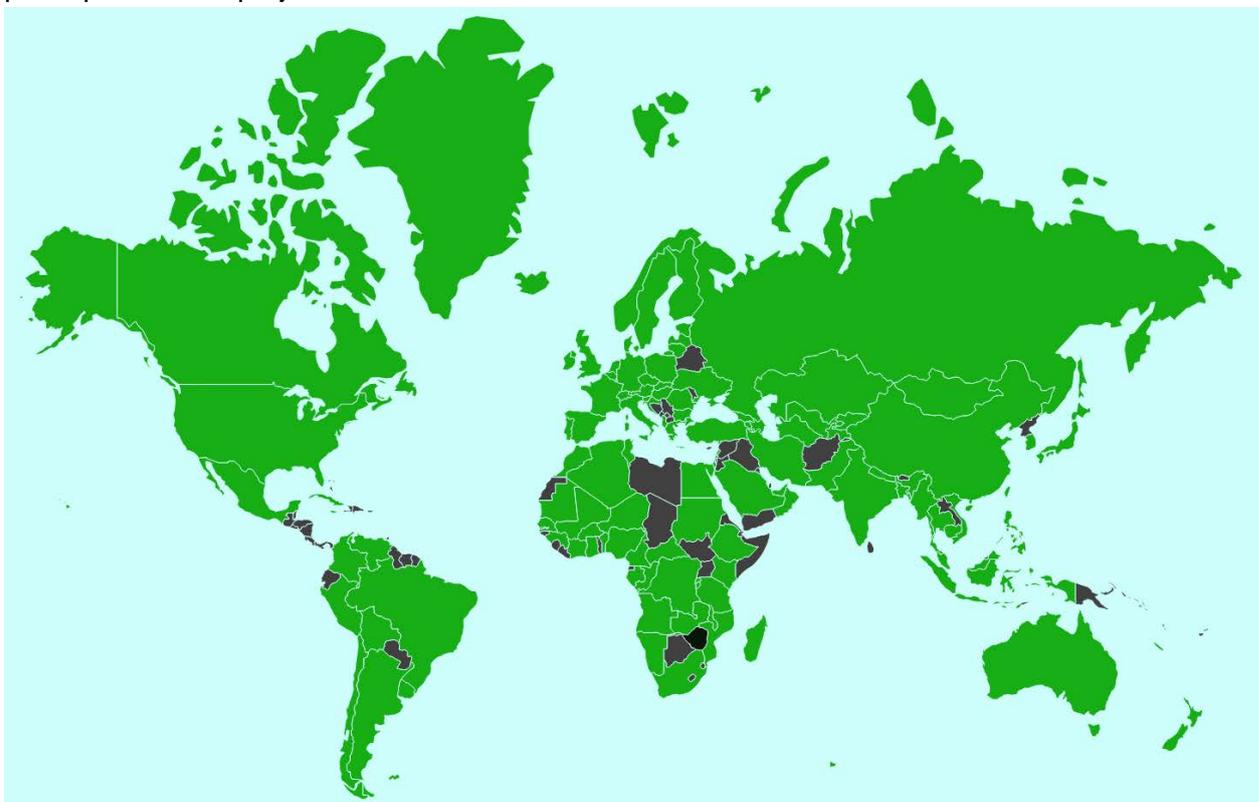


Figure 6: World map showing IGCP projects participating countries (in dark green) in 2017.

According to the 21 annual reports received from active IGCP projects in 2017, 46% of the participants are young scientists (<35 years old) and 47% of all participating scientists come from developing nations. Gender equality being one of UNESCO’s priority areas, IGCP shows very promising results on gender equality with a high number of female scientists participating in the projects. The 2017 annual reports indicate that 25 % of project leaders and 29% of participating scientists are women. This percentage increases in the young scientists group, where about 34% of the participants are female (Figure 7).

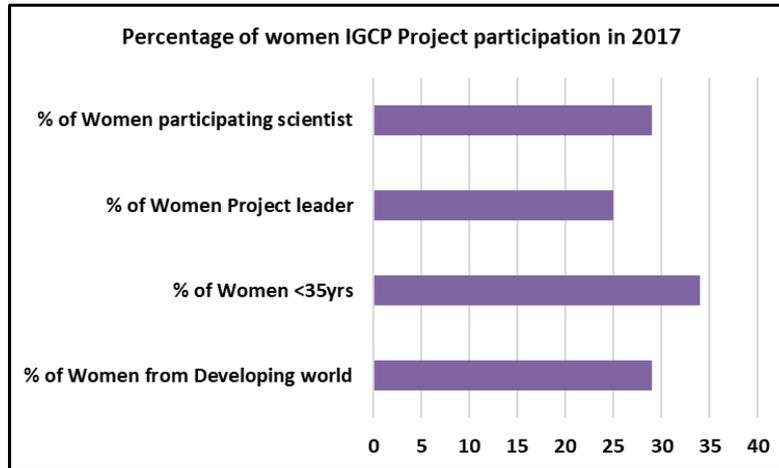


Figure 7: Representation of women scientist participation (in percentages) in 2017 IGCP projects.

In 2017, **135 project leaders** collaborated with at least **3377 project participants** to deliver the objectives of **21 active IGCP projects** which received financial supports from IUGS and UNESCO.

The overall analysis of the 2017 annual reports confirms the trend observed during last four years which shows that IGCP projects outreach and diversity has been increasing continuously over these years (Figure 8).

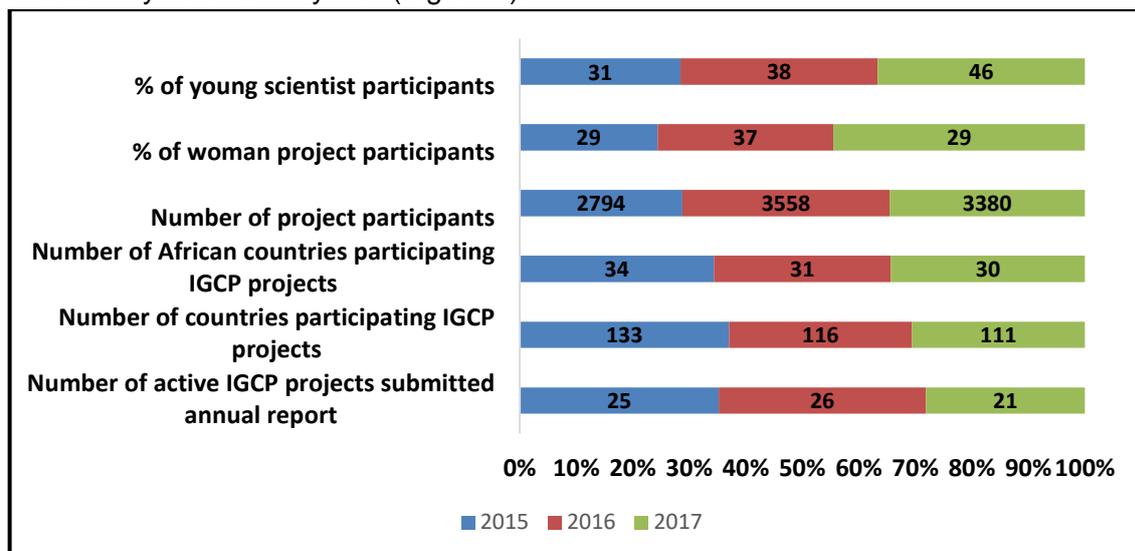


Figure 8: Comparison of IGCP projects participants between 2015 and 2017.

In 2017, a total number of 35 IGCP project meetings in 20 countries have been financially supported by the IGCP programme funds. Annex 10 shows the details of 35 IGCP project meetings funded jointly by the IUGS and UNESCO.

3. IGCP Council member biographies and 2017 IGCP Themes highlights

As stated previously, the IGCP Council, supported by the Scientific Board, is responsible for evaluating project proposals according to the IGCP Guidelines, as well as for the quality assessment of projects that are in progress. Council and Board members represent specific fields in the Earth sciences, and jointly reflect a worldwide geographic distribution. Current IGCP Council members were appointed by mutual agreement by the Director-General of UNESCO and the President of the IUGS in December 2016. The selection of the Scientific Board Members is the responsibility of the IGCP Council.

The IGCP Council is composed of six members, all high-level experts. The IGCP Council consists of a Chairperson and five theme group leaders who manage and represent the collective reviews and process of evaluating projects within their appointed theme. Once a year, the IGCP Council assisted by the Scientific Board assess the progress of about half a dozen existing projects as provided in their annual reports and also critique several new project proposals for the future funding. They have assembled at UNESCO Headquarters on the occasion of the IGCP Council meeting between 19-21 February 2018.

The IGCP Council Chairperson is Dr. Guy Narbonne (Canada), a Professor and Research Chair in the Department of Geological Sciences and Geological Engineering at Queen's University in Canada. He has been a member of the IGCP Scientific Board since 2008, and previously served as Theme Leader for "Global Change: Evidence from the Geological Record" for four years (2013-2016) before beginning his role as Chair of IGCP in 2016. Dr. Narbonne's research centers on the early evolution of complex multicellular life 1000-500 million years ago (Neoproterozoic–Cambrian) and the inter-relationship between this biotic evolution and coeval changes in the world's oceans and atmosphere. His more than 100 refereed scientific papers include a cover paper in *Science* and several that were selected for "Best Paper" awards from their respective journals. He was elected to the Royal Society of Canada in 2010 and is the recipient of the Howard Street Robinson Medal in Precambrian Geology (1994), the Billings Medal in Paleontology (2009), the Bancroft Award of the Royal Society of Canada (2014), and the Neale Medal of the Geological Association of Canada (2017).

3.1. 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. Annex 1 details the 2017 highlights of the IGCP Earth Resources theme drafted by Dr Brigitte Vlaswinkel (Netherlands) who is the IGCP Council member representing the Earth resources theme.

Dr Brigitte Vlaswinkel obtained her PhD in Marine Geology and Geophysics at University of Miami in 2007 with an NAF-Fulbright Fellowship. In addition to her field research in the Everglades, Florida Bay and the Bahamas focussing on coastal ecosystem dynamics, while researching her PhD she received a visiting scientist grant to work at St Anthony Falls Laboratory, an interdisciplinary fluids research and educational facility at the University of Minnesota. Here she designed and carried out world's first bi-directional physical modelling experiments to simulate tidal channel networks and study their evolution. After her PhD studies she worked for ten years at Shell International consecutively as a research carbonate geologist, production geologist, exploration geologist, geomodeler and risk analyst. Brigitte's expertise covers the field of marine geology, coastal morpho- and hydrodynamics, mathematical geology (Markov Chain modelling), subsurface 3D modelling and uncertainty analysis, quantitative (carbonate) sedimentology, remote sensing, tropical marine ecology and Building with Nature concepts. Since 2016 Brigitte has been the Head of Research at a newly established, clean-tech company "Oceans of Energy", which specializes in floating renewables and ocean energy. Brigitte is also the Environmental Impact Lead at The Ocean Cleanup, a Dutch, non-profit organisation whose mission is to develop advanced technologies to rid the world's oceans of plastic in a large-scale, efficient and environmentally sound way.

3.2. Global Change and the Evolution of Life: Evidence from the geological record

Changes in the Earth's climate and of life on Earth are preserved in the geologic record. Ice and dust records, terrestrial and ocean sediments, and sequences of fossil plant and animal assemblages all tell the story of our Planet, which holds important lessons about present-day environmental challenges and the ways to mitigate and manage environmental damage. Annex 2 details the 2017 highlights of the IGCP Global Change theme drafted by Dr María Julia Orgeira (Argentina) who is the IGCP council member representing IGCP Global Change theme.

Dr María Julia Orgeira is an Associate Professor at the University of Buenos Aires and Principal Researcher of the National Research Council of Argentina (CONICET). She has been an invited professor in other Argentinian Universities, as well as in Universidad de la República, Uruguay. She teaches courses of General Geology, Quaternary Geology, Environmental Geophysics and Environmental magnetism and has published over 90 peer-reviewed research papers and book chapters. Her researches focus mainly on Late Cenozoic geology, paleoclimate, geophysics applied to the resolution of quaternary problems, soil science and archeology, environmental magnetism, magnetostratigraphy, quaternary impact structures and micrometeorites, among others. Among her original academic works, can be mentioned: the determination of the magnetic ages of the late South American Cenozoic mammal ages; the indirect determination of the age of the establishment of the Isthmus of Panama as a continuous land bridge; the finding of the record of a magnetic event during the Late Cenozoic in the Southern Hemisphere; first scientific contributions in the field of environmental magnetism in South America; interpretation of the distinctive magnetic signal of paleosols developed on South American loess.

3.3. Geohazards: Mitigating the risks:

Geohazards include earthquakes, volcanic activity, landslides, tsunamis, floods, meteorite impacts and the health hazards of geologic materials. Geohazards can range from local events such as a debris slide or coastal erosion to events that threaten humankind (e.g., supervolcano eruption or meteorite impact). Earth scientists undertake research to better understand such hazards and contribute to risk reduction. Annex 3 details the 2017 highlights of the IGCP Geohazards theme prepared by Dr Alik Ismail-Zadeh (born in Baku, Azerbaijan) who is the IGCP council member representing Geohazards theme

Dr Ismail-Zadeh was awarded Ph.D. and D.Sc. degrees in theoretical geophysics from the the Russian Academy of Sciences (RAS). Currently he is Head of the Research Group on "Computational Geodynamics and Geohazards Modelling" at the Institute of Earthquake Prediction Theory and Mathematical Geophysics of the RAS in Moscow, and Senior Scientist at the Institute of Applied Geoscience, Karlsruhe Institute of Technology, Germany. He has been a visiting scholar/professor in several universities, including the University of Cambridge, Institute de Physique du Globe de Paris, University of Uppsala and KTH-Stockholm, University of California at Los Angeles, the University of Tokyo, and the Abdus Salam International Centre for Theoretical Physics in Trieste. His scientific interests cover lithosphere and mantle dynamics, their surface manifestations, including seismicity, lava flow, sedimentary basins, and application of the research to benefit the society, including natural hazards and disaster risk research. He is a principal author and co-author of over 100 peer-reviewed research papers, book chapters, and books. Ismail-Zadeh is Secretary-General of the International Union of Geodesy and Geophysics (IUGG), founding President of the Natural Hazards Focus Group of the American Geophysical Union (AGU) and founding Vice-President of the IUGG Commission on Geophysical Risk and Sustainability. He has also been the chair or member of several committees of international and intergovernmental organizations, including American Geosciences Union, the European Geosciences Union, EuroScience, International Council for Science Union, International Union of Geodesy and Geophysics and the U.N. Global Platform for Disaster Risk Reduction. He is a recipient of several prestigious awards including membership in Academia Europaea, Honorary Membership of the Royal Astronomical Society, AOGS Axford Distinguished Lecture Award in Natural Hazards, AGU International Award, A. von Humboldt Fellowship Award, the Royal Society Fellowship Award, Russian President Fellowship Award, and Academia Europaea Prize and Medal to Early Career Scientists

3.4. 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. Annex 4 details the 2017 highlights of the IGCP Hydrogeology theme summarised by Dr Yongje Kim who is the IGCP council member representing Hydrogeology theme and the rapporteur of the IGCP Council.

Dr Kim is a principal researcher in the Groundwater and Eco hydrogeology Research Center of the Geologic Environment Division at the Korea Institute of Geoscience and Mineral Resources (KIGAM). He received his PhD in Geology (Environmental Hydrogeochemistry) at Texas A&M University, USA in 1995.

During over 20 years of his professional research career, Dr Kim has been the technological and management leader for a variety of R&D projects for the Korean Government and from EU and UNESCO in areas of water-resource security. He is a two-time recipient (2006 and 2010) of a Korea Minister's Award (Ministry of Construction & Transportation and Ministry of Education, Science & Technology), and Chairman's Award in National Research Council of Science & Technology (2016), which recognize his outstanding contributions in the development of novel technologies for the analysis and modelling of groundwater-surface water flow systems and for artificial recharge. He has served as an advisor to the editor-in-chief and associate editor of the NGWA journal *Ground Water* (2011-2015), and is presently an associate editor for *Water Science and Engineering in China* (2013- present). He also serves as the Chair of IAH 2018 Congress (International Association of Hydrogeologists) held in Korea.

Dr Kim's service as a representative of CCOP (Coordinating Committee for Geoscience Programmes in East and Southeast Asia) since 2012 and as an executive director of the Global Cooperation Division at KIGAM, has allowed him to play important roles for prosperity of Asia, in the fields of geosciences including water resources security, water management, capacity building, and especially for encouraging and growing the capabilities of young geologists in Asia. His current research interests revolve around novel technologies for treating non-point source contaminants in urban runoff and integrated technology for securing groundwater/geothermal resources and conserving ecosystems with climate change.

3.5. Geodynamic: Control our environment

Our habitable environment at the Earth's surface is linked and controlled by processes occurring deep within the Earth. Earth scientists use, inter alia, geophysical techniques to study deep Earth processes ranging from changes in the Earth's magnetic field to plate tectonics to understand better the Earth as a dynamic planet. Those processes are also relevant to natural resource exploration, distribution and management of groundwater resources and the study and mitigation of natural hazards such as earthquakes. Annex 5 details the 2017 highlights of the IGCP Geodynamics theme drafted by Dr Nellie Mutemeri who is the IGCP Council member for the Geodynamic Theme.

Dr Mutemeri is an Associate Professor in the School of Mining Engineering at the University of Witwatersrand in South Africa. She also runs a boutique consulting firm MutConsult which specializes in mining, energy and climate change. Dr Mutemeri's other areas of research interest in geology include geochemistry and ore genesis of Archaean gold deposits in the greenstone belts of Southern Africa and fluid inclusion studies. She has experience in advanced mineralogical techniques including x-ray diffraction, electron microprobe, scanning electron microscopy and laser excited raman-microspectroscopy. Dr. Mutemeri's recent research centres on artisanal and small-scale mining, and she is the convener of the ASM-in-Africa Community of Practice.

Dr Mutemeri's experience with mining companies and consulting services in Africa, Latin America and Asia is in sustainable development focusing on mining policy and regulatory frameworks and strategies, responsible mineral supply, artisanal and small-scale mining formalisation and gender equality. She has worked in more than 15 African countries. Dr Mutemeri served for the Management Advisory and Group of the World Bank's Communities and Small-scale Mining (CASM) network.

4. Finances

In 2017, funds to support IGCP projects came from the IUGS and UNESCO (Annex 6).

In total, IGCP received 56,500 USD from UNESCO for the IGCP projects and another 8,614 USD for the organisation of IGCP Council meeting in February 2017., IUGS contributed 60,000 USD resulting in a total IGCP budget of 125,114 USD. The average project support in 2017 was around 5,500 USD of seed funding per project.

5. Conclusions

In 2017, UNESCO worked closely with the International Union for Geological Sciences (IUGS) to mobilize global cooperation in the Earth sciences through the International Geoscience Programme (IGCP). IUGS's financial contribution to IGCP secured the continuity of this program, with a heritage of over 45 years, providing a platform for scientists from across the world to push the frontiers of knowledge forward through concrete scientific research projects.

In 2017, 135 project leaders collaborated with at least 3380 project participants to deliver the objectives of 21 active IGCP projects. 46% of the participants are young scientists (<35 years old) and 47% of all participating scientists are coming from developing nations. Gender equality being UNESCO's priority area, 34% of project leaders and 29% of participants scientists are women.

IGCP projects published over 300 scientific papers, contributed scientific research regarding several UN SDGs (Annexes 1-5).

In 2017, thirty-five IGCP project meetings (Annex 10) have successfully been organised by building bridges between disciplines and between 3380 Earth scientists, including young ones, with aims of stimulating cutting-edge research and sharing scientific knowledge for the benefit of all.

The Council of the International Geoscience Programme (IGCP) held its 2nd Session in February 2017 and evaluated the progress of 26 existing projects as provided in their annual reports and also assessed nine new project proposals that requested new funding. In 2017, the UNESCO IGCP secretariat worked closely with the IUGS Secretariat and treasurer to provide regular updates about the progress of twenty-three IGCP projects and their meetings to the IUGS Secretariat and the wider Earth science community via the dedicated IGCP website (<http://www.unesco.org/new/en/natural-sciences/environment/earth-sciences/international-geoscience-and-geoparks-programme/>).

Due to the recent budget restrictions affecting UNESCO's programmes, IGCP would considerably benefit from new additional resources which will enable the Organisation to increase the impact and outreach of this highly respected programme. In 2017, the UNESCO IGCP Secretariat actively focused on resource mobilisation activities to increase the amount of existing funds of this programme. UNESCO has held several meetings with potential donors, the outcomes of these resource mobilisation activities will be reported in 2018 as the discussions are on-going with potential donors.

Annex 1: 2017 Summary of IGCP Earth Resources Theme

1) IGCP 637 Heritage Stone Designation

Duration: 5 years (2015-2019)

Aims: The scientific objectives of the project are protecting global heritage stone sites by certification, increasing professional and social awareness of the natural stone and cultural heritage to enhance international cooperation for the research and documentation on the global natural stone sites.

Related UN SDGs: The project contributes to Goal 4: Ensure inclusive and quality education for all and promote lifelong learning, as one of the specific project objectives are to support young scientists and students from developing countries.

Countries involved, approximate number of total 2017 participants: Twenty-nine countries and 30 participants are actively involved in the project this year: four developing and 25 developed countries (Argentina, Australia, Austria, Belgium, Brazil, Canada, China, Czech Republic, Egypt, Finland, France, Germany, Greece, India, Ireland, Italy, Malawi, Malta, Morocco, Norway, Portugal, Russia, Saudi Arabia, Slovenia, Spain, Sweden, UK, USA, Uruguay). 37% are female scientists, 63% male scientists and 22% are young scientists under 35 years old.

Scientific activities (meetings, workshops, training sessions): a very successful and well attended annual project meeting was organized within the EGU 2017, Vienna. 26 contributions were presented by authors representing 15 countries. The meeting favored the recruiting of collaborators from various countries including Slovenia, Malawi, Saudi Arabia, Italy, Portugal, Australia, Spain, India, France, Germany, Brazil, Norway, UK and Morocco.

Scientific achievements/ results (papers, new findings, new models, new data, new maps etc.): one of the major scientific achievements of 2017 is approval of 6 GHSR (Global Heritage Stone Resource) proposals, which include Portland Stone in UK, Larvikite in Norway, Petit Granite in Belgium), Podpec Limestone in Slovenia, Hallandia Gneiss in Sweden and Carrara Marble in Italy. The project also generated five publications in Geoheritage and Episodes, mostly related to approaches for outreach and public awareness of heritage stones

Societal/educational results/highlights (media coverage, science education, cultural activities): The present project leader has been interviewed about heritage stones by local newspapers and academic media aiming at a wider promotion of the topic. A video has been recorded at the university of Salamanca with information about the IGCP-637.

2) IGCP 636 Characterization and sustainable exploitation of geothermal resources [in the zona cafeteria of Colombia]

Duration: 3 years (2016-2018)

Aims: The general objective is to investigate innovative field methodologies and modeling techniques to facilitate the decision process tying to the management of

geothermal resources as well as evaluating public awareness and acceptance, which can further impact the management of these resources. This innovative approach highly supports development of new models for geothermal systems. The project established a wide cooperation between universities and research institutions from four continents and this provides a unique opportunity to complete comparative studies with comparable approach on different types of geothermal systems.

Related UN SDGs: The project contributes to Goal 4: Ensure inclusive and quality education for all and promote lifelong learning, as one of the specific project objectives are to support young scientists and students from developing countries; for that reason 75% of the scientists involved are under 35 years old. The project also contributes to Goal 7 Ensure access to affordable, reliable, sustainable and modern energy for all and Goal 13: Take urgent action to combat climate change and its impacts as one of the project objectives are to develop new and more effective methods to exploit geothermal resources, which, unlike fossil fuels, do not involve any form of combustion. This means geothermal [power plants] give off significantly few amounts of greenhouse gasses and thereby help offset global warming.

Countries involved, approximate number of total 2017 participants: Fifty-one participants from nine countries (Colombia, Chile, France, Belgium, Canada, Iceland, Sweden, Madagascar, Italy) actively participated last year. 37 % of scientists are women, 63% is male; 75% is under 35 years old.

Scientific activities (meetings, workshops, training sessions):

Many IGCP project meetings (8) were organized and attended (Colombia, Iceland, Sweden). The project was also represented on 6 international meetings with participation of many students and young scientists. Several graduate (5 Msc, 6 PhD) and undergraduate (13) students have been recruited to work on project-related subjects (can be seen as training).

Scientific achievements/ results (papers, new findings, new models, new data, new maps etc.): Some of the most important scientific-related achievements are related to estimation of the geothermal potential and numerical modelling of the Nevado del Ruiz geothermal field in Colombia; the collection of new analytical data and start of heat transfer modeling for new geothermal fields in Chile/France. In 2017, the project published 5 papers in peer-reviewed journals (6 were submitted – to GRC Transactions, Journal of Geochemical Exploration, Canadian Journal of Earth Sciences, Environmental Earth Sciences, Journal of South American Earth Sciences), and 8 short papers were published in proceeding volumes of international conferences.

Societal/educational results/highlights (media coverage, science education, cultural activities): Public outreach included two surveys, an international one to increase awareness of renewable energy sources and its sustainable exploitation (Restrepo et al., 2017) and another to analyze the perception of the rural community living around a potential geothermal power plant (VNR, Colombia).

3) IGCP 638 Geology and Societal Impact of the Gold Mineralizations in the Birimian Terrains (West African Craton)

Duration: 5 years (2016-2020)

Aims: This project aims to improve knowledge of the relationship between (gold-) bearing mineralizations and the geodynamic evolution of the old Birimian formations (2300-2000 million years ago) in the West African Craton, so better targeted prospecting and exploitation can take place. A second aim is to determine the types of pollutants used in 'gold washing' and their impact on public health by carrying out a hydrogeochemical study.

Related UN SDGs: This project contributes to Goal 6: Ensure access to water and sanitation for all as it tries to evaluate the effects of the traditional exploitation of gold on water quality and the availability of the water resources to manage public health risks. The project also contributes to Goal 8: Promote inclusive and sustainable economic growth, employment and decent work for all and Goal 12: Ensure sustainable consumption and production patterns as it tries to find new gold discoveries in West Africa and exploit them sustainably, creating jobs in the mining sector and thereby contributing to the economic and social development of the states.

Countries involved, approximate number of total 2017 participants: Sixteen countries and 145 participants are actively involved in the project this year: 13 African countries (Algeria, Burkina Faso, Côte d'Ivoire, Cameroon, Gabon, Ghana, Guinea, Morocco, Mali, Mauritania, Niger, Senegal) and three developed countries (Korea, Belgium, France). 32% is female scientist, 68% is male scientist participant and 62% are young scientists under 35 years old.

Scientific activities (meetings, workshops, training sessions): the project organized an annual meeting in Casablanca, Morocco in 2017 (145 participants from 14 countries) as well as a four-day field trip to the South Moroccan Atlas Belt. A field trip guide book was also realized.

Scientific achievements/ results (papers, new findings, new models, new data, new maps): the main scientific achievement is the establishment of a new collaboration programme with South America (Uruguay, Argentina and Brazil) to compare and correlate Paleoproterozoic mineralizations from the West African craton with the Rio de la Plata Craton, as well as reaching out to other research programs focusing on the western African areas (AMIRA/WAXI). Five articles were published in international peer-reviewed journals and one more is in review.

Societal/educational results/highlights (media coverage, science education, cultural activities): Public outreach of the health dangers related to the use of mercury and cyanide in gold washing was done through the online press, websites of different institutes, universities Associations and NGOs, as well as an item on the national TV channel.

Annex 2: 2017 Summary of IGCP Global Change Theme

Projects are listed following Geologic Time (from Cenozoic to Paleozoic):

1) IGCP 639 Sea Level Changes from Minutes to Millennia

Duration: 5 years (2016-2020)

Aim: Sea-level changes over timescales from minutes to millennia are of great concern to coastal communities. Long-term changes in sea level due to the solid earth's response to glaciation and tectonics are the background rate upon which the hazard from anthropogenic sea-level change and extreme inundation from tsunamis and storms must be superimposed. Short-term measurements from instrumental and historical records provide short glimpses at the hazard posed by sea-level change over varying temporal scales but must be placed within the long-term context that only geological and archaeological records provide. IGCP 639 provides a platform for the development of integrated records of sea-level change and coastal hazards obtained from instrumental, historical, archaeological, and geological records, focusing on Africa, South America, and the Middle East.

Three temporal levels of sea-level change are analysed by IGCP 639:

- Coastal hazards that range from **minutes to decades** – storms, tsunamis, and coastal earthquakes
- Coastal hazards that range from **years to centuries** – deltas and land subsidence
- Coastal hazards that range from **centuries to millennia** – ice budgets, sea level, and geological evolution

The overarching aims of IGCP 639 are:

- To gain a greater insight into coastal hazards by integrating different methodologies that consider varying timescales
- To bring together specialist scientists from related disciplines (e.g. historians, archaeologists, modellers, geodesists)
- To transfer knowledge of basic science methodologies developed over multiple IGCP projects (e.g., protocols for reconstructing geological records of relative sea level) to developing nations.

Achievements: They published 50 papers including in leading journals such as Proceedings of the National Academy of Sciences, Nature Communications, Geophysical Research Letters, Earth Science Reviews, and Quaternary Science Reviews. A Conference in Oman was organized and they submitted a meeting report to EPISODES for publication. Also a publication of a special issue arising from the EGU session on Extreme Wave Events is done and it will publish in Marine Geology. They reached over 300 followers across social media platforms. Formation and staffing of

three working groups based on the project themes identified the proposal was also reported.

2) IGCP 610 From the Caspian to Mediterranean: Environmental Change and Human Response during the Quaternary

Duration: 5 years (2013-2017)

Aim: This Project investigates the influence of environmental change on the development of humankind for the entire Caspian-Black Sea-Mediterranean Corridor ["CORRIDOR"] that encompasses the Eurasian intercontinental basins of the Caspian, Black, Marmara, Aegean, and Eastern Mediterranean seas with their connecting straits and coasts. During the Quaternary, these basins were repeatedly connected and isolated from each other. This predetermined their environmental conditions and hydrologic regimes and imposed specific impacts on diverse biological populations, including humans inhabiting the coastal domains.

The goal of IGCP 610 is to provide cross-disciplinary and cross-regional correlation of geological, archaeological, environmental, and anthropological records in order to:

1. explore interrelationships between environmental change and human adaptation during the Quaternary,
2. create a networking and capacity-building structure to develop new interdisciplinary research initiatives, and
3. provide guidance to heritage professionals, policy makers, and the wider public on the relevance of studying the "CORRIDOR" for a deeper understanding of Eurasian history, environmental changes and their relevance, and likely future impact on humans.

Six dimensions of evidence are integrated into this project: 1) geological investigations of the sedimentary record of vertical sea-level fluctuations and lateral coastline change; 2) paleoenvironmental evidence integrating paleontological, palynological, and sedimentological records to reconstruct paleolandscapes; 3) archaeological evidence from cultural remains; 4) paleoanthropological evidence of responses of different *Homo* species to environmental change; 5) mathematical modeling of climate, sea-level change, and human dispersal linked to environmental change; and 6) geo-information studies to explore the "big picture" of geoarchaeological events throughout the Quaternary.

Achievements: The leaders cited 17 major achievements of this project. As an example it could mention: In-depth study of the Quaternary stratotypes, archaeological monuments, and anthropological remains in countries surrounding the CORRIDORS; reference collection of Mediterranean, Caspian, and Black Sea foraminifera as well as the Ponto-Caspian molluscs, palynomorphs, NPP, artefacts, and anthropological records; Series of regional paleogeographic, tectonic, and geological maps. Among the multiples social benefits, it can be mentioned: implementing cultural heritage projects, open-air site museums, training centers for conducting experimental research, working together with local Governmental and Non-Governmental Organizations; among others.

3) IGCP 608 Asia-Pacific Cretaceous Ecosystems

Duration: 5 years (2013-2017)

Aim: The Cretaceous “greenhouse” period is known for elevated atmospheric CO₂ levels and much higher global sea levels than today. The Cretaceous Period is thus a geological proxy for understanding the development of ecosystems in greenhouse periods, such as may characterize our planet if present global warming trends continue into the future.

A great variety of well-preserved environments and ecosystems can be found in the Cretaceous geological records of Asia and the Western Pacific rim. The aim of IGCP 608 is to delineate these Cretaceous ecosystems in both marine and terrestrial environments to determine how they responded to paleo-environmental changes. This information is used to ascertain links between global and local environmental changes ecosystems. Close tie-ins with IGCP Project 609 “Cretaceous Sea-level Changes” permit analysis of the biological response to sea level rise during the Cretaceous greenhouse climates.

Achievements: This project includes the current state-of-the-art knowledge of Cretaceous Land, Ocean, Biosphere and Ecosystems in each participating countries: during meetings they overviewed such the topics as 1) biodiversity of terrestrial and marine ecosystems, 2) Cretaceous paleogeography and paleobiogeography, 3) Cretaceous climate and environmental changes, 4) Cretaceous stratigraphy and sedimentology and Cretaceous vertebrates of Asia and the Western Pacific. Four meetings were organized plus several educational trainings. Finally, they reported 109 papers published international journals.

4) IGCP 609 Cretaceous Sea-Level Changes

Duration: 5 years (2013-2017)

Aim: The recent rise in sea-level in response to increasing levels of atmospheric greenhouse gases and the associated global warming is a primary concern for society. Evidence from Earth history shows that glacial-interglacial and other sea-level changes occurred at rates an order of magnitude or more higher than that observed at present. To predict future sea-levels in a world that is likely to be characterized by increasingly greenhouse conditions, we need a better understanding of the record of past sea-level changes under similar climatic conditions.

IGCP 609 studies sea-level changes in the Cretaceous Period (145-66 million years ago), a greenhouse world with high sea levels and associated palaeoceanographic conditions including periods of global marine anoxia. The long-term sea-level record (i.e. 1st to 2nd order cycles occurring over millions to tens of millions of years, is controlled by the internal dynamic history of the Earth. The changing rates of ocean crust production led first to long-term sea-level rise, high stands, and then decline during Cretaceous times. Superposed shorter-term, 3rd to 4th order cycles (i.e. thousands to hundreds of thousands of years) sea level changes are recorded in Cretaceous sedimentary sequences as well, and the mechanisms for these are less understood, and may include brief glacial episodes, storage and release of groundwater, regional tectonism, and mantle-induced processes that are currently under study by IGCP 609.

IGCP 609 is closely associated with IGCP 608 “Asia-Pacific Cretaceous Ecosystems”, whose studies include the effects of environmental change on the terrestrial and marine animals and plants that lived during this period of rapid sea-level changes in a greenhouse world.

Achievements: Among numerous scientific achievements, this project obtained empirical evidence for “aquifer eustasy” during the (Cenomanian–Turonian) Cretaceous Super greenhouse period ; Increasing contribution of terrestrial/non-marine data-based studies to understand Cretaceous greenhouse climate and scientific cooperation with young scientists from developing countries within the project and visible in growing number of for publications. They informed two congress and scientific meetings and five educational trainings. The leaders informed a Special Topic “Cretaceous greenhouse palaeoclimate and sea-level changes”. Proceedings of the International Workshop on Climate and Environment Evolution in the Mesozoic Greenhouse World (Science China Earth Sciences, 60, Issue 1, 2017). Additionally, 29 papers were published in international journals

5) IGCP 632 Continental Crises of the Jurassic

Duration: 5 years (2014-2018)

Aim: IGCP 632 focuses on the interactions between the major events and climate, and the correlations between the evolution of these ancient lacustrine ecosystems and the marine realm during the Jurassic Period (202 to 145 million years ago). The Jurassic period was bound by two mass-extinctions, witnessed the rise to ecological dominance of the dinosaurs, the evolution of birds, extant subclasses of mammals, various major invertebrate fauna and flora, the fragmentation of Pangea, and two huge flood basalt events, both associated with massive biotic change, all in a context of generally elevated CO₂ and muted longitudinal temperature gradients. Despite the high-profile and charismatic nature of Jurassic fauna and environments, most of the major events of the period remain poorly constrained, as does the overall climatic context, especially in high-latitude settings. Particularly poorly understood is the role of zonal climate belts in the greenhouse world of the Jurassic and how the major events of that period are expressed along meridional climate gradients.

This project offers new insights into the timing and causes of major perturbations in the evolution of life on Earth, covering the entire Jurassic-stretching from the Jurassic-Triassic mass extinction event to the development of Early Cretaceous Lake systems. Besides the improved stratigraphy, climate data and global palaeoenvironmental interpretations in the Jurassic period, this project should provide new data and clarify the causal mechanism behind two major events in the Earth history: the Triassic-Jurassic mass extinction event and the Toarcian anoxic event, with implications for climatology, ecology and biodiversity.

Achievements: They published 51 papers including in in prestigious issues such as Nature, among others. They organized the following activities: A field excursion in Colorado Plateau, USA. The field trip looked at largely continental Triassic-Jurassic boundary through Late Jurassic sections. A filed excursion in Thailand was also organized with numerous participants. The project website (www.igcp632.org) has been

a highly-visible and widely utilized hub for the continental Jurassic research community and social activities.

6) IGCP 655 Toarcian Oceanic Anoxic Event: Impact on marine carbon cycle and ecosystems

Duration: 5 years (2017-2021)

Aim: Recent studies suggest that anoxia is increasing in the world's oceans, but the absence of historical oceanographic data on this subject make it difficult to determine causes for this decline in free oxygen. Study of changes in the geologic record can provide a background in which to interpret present and future changes in the world's oceans. Oceanic anoxic events occurred sporadically over Earth history, most commonly during periods of greenhouse climate, and provide ancient counterparts that assist in understanding the causes and potential implications of the current decline in oxygen in the world's oceans.

IGCP 655 is examining the Toarcian Oceanic Anoxic Event (183 million years ago in the early part of the Jurassic Period), a remarkable crisis in the world's oceans and life when large portions of the world's deep-ocean became depleted in free oxygen. This global decline in free oxygen produced an extinction event with up to 90% of all species of marine molluscs going extinct. IGCP 655 is conducting a multidisciplinary study of the Toarcian Oceanic Anoxic Event that integrates fossil data (microfossils, macroinvertebrates and vertebrate assemblages) and abiotic data (sedimentology, cyclostratigraphy, mineralogy, elemental geochemistry, organic geochemistry and isotopic geochemistry) from stratigraphic sections worldwide.

Achievements: Two Congress and four field trips for educational training are reported. Thirty-five scientific papers were published in high-level journals (e.g. *Nature Geoscience*, *Nature Communications*, *Scientific Reports*, *Geology*, *EPSL*, *Paleo-3*, *Paleobiology*, *Sedimentology*).

7) IGCP 630 Permian-Triassic climatic and environmental extremes

Duration: 5 years (2014-2018)

Aim: Many marine ecosystems are under threat at the present day. The geological record provides numerous analogues of environmental upheavals and major biocrises, the most disruptive of which occurred during the Permian-Triassic (P-Tr) transition at ~252 million years ago. Many of the factors that contributed to the P-Tr biotic crisis, e.g., increased atmospheric carbon dioxide concentrations, rapid global warming, oceanic anoxia, and hypercapnia (CO₂ poisoning) are also observed in the present day or are anticipated to develop in the near future.

The Permian-Triassic transition may thus record a natural experiment in global-scale ecosystem collapse that, if properly deciphered, could provide important insights into possible responses of modern marine ecosystems to present day climate and environmental change.

IGCP 630 addresses themes related to current global concerns and issues including the response of the biosphere to global warming, sustenance of global biodiversity, and maintaining the habitability of planet Earth. It is investigating the climatic and environmental extremes and ecosystem's response during the P-Tr mass extinction and its aftermath through analyses of the rock and fossil records worldwide. Through multidisciplinary studies of latest Permian to Early Triassic strata, IGCP 630 is documenting the end-Permian collapse of the global ecosystem and its subsequent early Triassic rebuilding. Ultimately, this project hopes to: (1) reveal climatic and environmental extremes at a global scale and their impacts on ecosystems in seas and on land, (2) elucidate the factors controlling biotic recovery in various habitats and climate zones, (3) determine the similarities and differences in the responses of different marine groups to biotic crisis, and (4) assess the effects of climate or other geological events on the restoration of defaunated ecosystems.

Achievements: The participants have achieved in following several aspects; as examples: Early-Middle Triassic biostratigraphy and more precise and comprehensive bio-chronological frameworks were established for the marine and terrestrial Lower and Middle Triassic successions in several major regions: China, India, Pakistan, Madagascar, South Africa, Armenia, Russia, and Spitsbergen; extinction and recovery of several major fossil groups. Thus, various fossil groups experienced different recovery rates after the end-Permian crisis;). Both extreme hot seawater temperature and widespread anoxia were suggested to be major killers for the P-Tr biocrisis and have delayed biotic recovery in Early Triassic; early and Middle Triassic astronomical cyclo-chronologic frameworks are established and update the newest Geological Time Scale (2016); Early Triassic hothouse regimes may have been controlled by obliquity-forced cycles (1.2 myr), while local/regional anoxia were controlled by ~100 kyr eccentricity. Additionally, they reported five scientific meetings plus educational and training activities.

8) IGCP 652 Reading geologic time in Paleozoic sedimentary rocks

Duration: 5 years (2017-2021)

Aim: Major events punctuated the Paleozoic: ecological crises and diversifications, including shifts in ocean chemistry, climatic changes, etc. One of the key-obstacles in understanding these events lies in the difficulty of providing precise estimates of the duration represented by a sequence of Paleozoic sedimentary rocks. This lack of temporal precision severely hampers the evaluation of forcing mechanisms and rates of climatic, ecological or biogeochemical changes in the Paleozoic. It is therefore essential to first improve the Paleozoic timescale to then unravel the history of the Paleozoic Earth system.

IGCP 652 will utilize and test cyclostratigraphy, a stratigraphic tool that is based on the detection of the Milankovitch cycles in the sedimentary record. Those cycles result from periodic variations in the Earth-Sun system, affecting the distribution of solar energy over the Planet and thus influencing Earth's climate on time scales between 10^4 and 10^6 years. This stratigraphic tool is revolutionizing our ability to subdivide Mesozoic and Cenozoic time but has been relatively little used in the Paleozoic. Through the integration of this astronomical time scale with biostratigraphy and radio-isotopic dating, this project intends to document the environmental evolution during the Paleozoic with a focus on

the Ordovician to Devonian (485 – 359 million years). It gathers participants (> 200) from all over the world (36 countries) and promotes the participation of young scientists and scientists from developing countries.

Achievements: The project enhanced the resolution of the geological time scale for the Homerian (Silurian), Pragian and Emsian-Eifelian (Devonian). Furthermore, they also improved the understanding of various major events, with a focus on the Ordovician-Silurian boundary, the Mulde (Silurian) event and the Kacak (Devonian) event. They organized three special sessions at the EGU in Vienna, the IMS in Toulouse, and the AGU in New Orleans. This allowed to reach a vast community and to develop the networking capacity of the project. The website platform was developed, as well as the Facebook page, and the project was advertised through radio interviews and university webpages. A list of 31 scientific papers is attached to the annual report.

9) IGCP 653 The onset of the Great Ordovician Biodiversification Event

Duration: 5 years (2016-2020)

Aim: IGCP 653 is studying the 'Great Ordovician Biodiversification Event' (GOBE) comprises the rapid diversification of marine organisms during the Ordovician Period. The GOBE completely modified marine food webs and established modern marine ecosystems for the first time. The project focuses on interdisciplinary investigations, including case studies from globally distributed sites, involving specialists from the fields of, for example, palaeontology, sedimentology, stratigraphy, geochemistry, cosmochemistry, climate modelling, palaeoceanography and palaeoclimatology, in collaboration with the Subcommittee on Ordovician Stratigraphy (ISOS). The results of the project will contribute to the understanding of the triggers and timing of the establishment of modern marine ecosystems and also provide insight on the reasons of the first collapse of these environments which may have led directly to the world's first large-scale mass extinction of life at the end of the Ordovician.

Achievements: Above question has been discussed in the year 2017 at 7 international meetings, and at a workshop organized for Chinese students. A major achievement of this first year is the discussion on the terminology of the Great Ordovician Biodiversification Event (GOBE), which is now recognized as the sum of individual events, including several Biotic Immigration Events (BIME). The advances obtained up to the present are contained in the 69 papers published in international journals, which include top-tier journals such as *Nature Communications* and *Geology*.

Annex 3: 2017 Summary of IGCP Geohazards Theme

1) IGCP project 640: Significance of Modern and Ancient Subaqueous Slope Landslides (S4SLIDE)

Duration: 2015-2020

Aims: Submarine landslides pose a risk to coastal communities and offshore infrastructure. However, our lack of understanding of the causal mechanisms and timing of submarine landslides has hampered progress in the prediction effort, which is essential to implement appropriate mitigation measures. This project seeks to create an international and multidisciplinary platform allowing geoscientists from academia and industry to sustain a dialogue conducive to the integration of findings from different fields into a more cohesive understanding of submarine landslides.

Related UN SDGs: This project contributes to the following sub-goals of the UN SDGs: Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture

2.4. By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality.

Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable

11.5. By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations.

Countries involved, approximate number of total 2017 participants:

Representatives of 30 countries collaborate in the IGCP project: Australia, Austria, Belgium, Brazil, Canada, Colombia, China, Czech Republic, Egypt, France, Germany, India, Ireland, Israel, Italy, Japan, Republic of South Korea, Russia, Netherlands, New Zealand, New Caledonia, Nigeria, Norway, Peru, Spain, Switzerland, Thailand, United Kingdom, USA, and Venezuela. About 250 people are involved in the project.

Scientific activities (meetings, workshops, training sessions): Six main scientific meetings and workshops in 2017 have been organized in London, Houston, Vienna, Washington, New Delhi and New Orleans as well as two main training events.

Scientific achievements/ results (papers, new findings, new models, new data, new map etc.): *S4SLIDE Morphometric Database*. Several steps in the right direction. The S4SLIDE community works on advancing the understanding of subaqueous landslides with special emphasis on the collection of morphometric parameters and their potential relationship with pre-conditioning factors and triggering mechanisms.

Development of Rapid Response Monitoring of Submarine Landslides. The 14 November 2016, Kaikoura (New Zealand) Mw7.8 earthquake triggered widespread landslides offshore. The earthquake-triggered landslides evolved into a full canyon flushing turbidity current that travelled at least 680 km along the deep sea Hikurangi Channel and most likely reached the terminal fan – 1500 km from the initial landslides. The event has reshaped much of the canyon and decimated one of the highest biomass benthic ecosystems documented in the deep sea. Although canyon flushing events like this have been recognized from the geological record and submarine cable breaks, this was the first direct documentation of the consequences of canyon flushing events on seafloor geomorphology and ecosystem structure.

Tsunamigenic Hazard Assessment in Lakes. Tsunami in lakes may pose a significant threat to lakeshore settlements and infrastructure but globally remain a relatively unknown hazard. A pilot study has been carried out in New Zealand's Lake Tekapo to assess the magnitude and frequency of landslide-generated tsunamis. Lake Tekapo is a 120 m deep glacial formed lake that attracts large numbers of tourists and is part of New Zealand's large hydroelectric power network. Analysis of seismic data indicate that some delta systems have collapsed repeatedly throughout the ~17,000 years following glacial retreat. Tsunami modelling indicates that landslides can cause tsunami up to 5 m at the southern shoreline where tourism and infrastructure is located. Modelling concurrent failures shows amplification of the generated waves indicating that basin-wide failure events could result in significant tsunami in this lake. These results are being used to determine the probability of landslide-generated tsunami and subsequently the hazard at the southern shoreline. Project team members published 49 papers in 2017.

Other achievements:

- IODP Expedition 372 Creeping Gas Hydrate Slides and Hikurangi LWD, starting in November, will certainly be a milestone for submarine landslide research;
- The European Union Funded International Student Training Network SLATE started in 2017 and will foster student training and research on submarine landslides over the next 4 years.
- Successful submission of new IODP Proposal 922 "Pre Slope failure and stability of the Cenozoic western Atlantic: Causes and history" (SASCWATCH) by Hugh Daigle et al.

Societal/educational results/highlights (media coverage, science, education, cultural and informal) related to the Climate Change (Paris COP21), Disaster risk reduction (Sendai framework) and SDGs (New York 2015): Scientists working on the IGCP project 640 "Significance of Modern and Ancient Subaqueous Slope Landslides (S4LIDE)" consider that the remains of landslide masses lie on the bed of many lakes (for example, Lake Tekapo). They conduct the research collecting data and analyzing them using mathematical and numerical models to find out what sort of tsunamis could occur if there was big landslide. If that happened, it could endanger local residents, tourists, and surrounding infrastructure. The observation and modeling help scientists seeing how big the landslides have been in the past and making forecasting on what can happen in the future. The S4LIDE project participants disseminate the gained scientific knowledge on landslides and tsunamis via scientific meetings, workshops and training courses co-sponsored by the UNESCO-IUGS International Geoscience Program.

The IGCP project URL: <https://sites.google.com/a/utexas.edu/s4slide/>

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

Duration: 2015-2018

Aims: Ground response to subsurface fluid extraction in terms of land subsidence is one of the classical issues in geosciences, bearing wide implications from a societal point of view, e.g. increasing flood risks, damaging buildings and infrastructures, reducing water availability, etc.. M3EF3 project aims to: (i) map the distribution of ground failure caused by subsurface fluid extraction at the world scale, with strong emphasis given to Africa where there are very few reports of systematic studies on subsidence and related processes; (ii) characterize the major features of the detected fissure systems and identify the factors that interact for their occurrence; (iii) appropriately integrate geo-mechanical analyses, effective and economic monitoring methodologies, and modeling techniques to investigate the generation/propagation of earth fissure and fault activation; (iv) understand the process of ground failure by focusing on a few sites (in Mexico, China, Arizona); (v) develop a procedure of risk assessment for determining the most probable conditions (from both the geological point of view and also in terms of human activities) of ground failure; (vi) identify effective management and mitigation strategies that have been used to reduce this geologic risk; (vii) promote the integration between scientists from different disciplines and experts from developed/developing countries; and (viii) disseminate the M3EF3 outcomes through workshops, a project website, guidelines for laboratory, monitoring, and modeling investigations, risk analyses applied to ground failure, and non-technical fact sheets for policy makers and citizens.

Related UN SDGs: This project contributes to Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable of the UN SDGs. Namely, “11.5. By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations.”

Countries involved, approximate number of total 2017 participants: Representatives of 15 countries collaborate within this project: Australia, Canada, Colombia, China, Germany, Iran, Italy, Mexico, Pakistan, Philippines, Poland, Spain, the Netherlands, UK, and USA. 65 people are involved in the project.

Scientific activities (meetings, workshops, training sessions); Main scientific meeting of the project was held in Alicante, Spain including a training session with 35 attendants from Spain, Mexico, USA, Italy, China, Japan, The Netherlands, Egypt, Pakistan, Poland, Colombia.

Scientific achievements/ results (papers, new findings, new models, new data, new map etc.) :

Mechanisms: The main 3-4 mechanisms responsible for ground rupture development in subsiding basins were defined. Appropriate new material was been added to the project website. A theoretical modelling study was begun and the ongoing study seeks to

quantify the main drivers/conditions causing earth fissures and fractures development (preliminary results will be presented at the international conference MODSIM 2017).

Monitoring: Specific in-situ and remote-sensing methodologies were developed, tested and established: fiber-optics horizontal extensometers were established in Wuxi (China); advanced FFT analyses of InSAR-based displacement maps and time series were applied to Mexico City; a novel 3D reconstruction of fissure geometries from drone acquisitions were developed in Spain and tested on specific study cases, ground-mapped fissures in Arizona. Furthermore, a first map of ground fractures was developed for Mexico City and a first world map of the ground ruptures occurrence has been released (http://www.igcp641.org/?page_id=45).

Modelling: To understand the geomechanical processes caused by groundwater pumping in a sedimentary basin they developed an integrative analysis using 3D numerical models with an accurate geological framework. A new methodology integrating regional and local models allows scientists (for the first time) to account for the development and motion on fissures as features in the propagation of deformation in sedimentary basins. A first example was published in the framework of the collaboration Italy-China (Ye et al., *submitted*). They published one map, one paper and one book chapter related to the project in 2017.

Societal/educational results/highlights (media coverage, science, education, cultural and informal) related to the Climate Change (Paris COP21), Disaster risk reduction (Sendai framework) and SDGs (New York 2015): Several articles in Mexican local newspapers on the topic of the project.

The IGCP project URL: <http://www.igcp641.org>

Annex 4: 2017 Summary of IGCP Hydrogeology Theme

1) IGCP 643: Water Resources in Wet Tropics and West-Central Africa (3WCA)

Duration: 5 years (2015-2020)

Project Aims: The 3WCA project, associated with different laboratories from west-central Africa and France, studies hydrological/hydrogeological variability in relation with climate and land use changes. The primary objectives are to build strong background in international collaboration, in particular (1) support for exchange students, (2) support for the mobility of teachers, (3) financing of laboratory materials, and (4) support for setting new research project. 3 countries in Africa (Benin, Ivory Coast, Niger) and France performed the project.

Related UN SDGs: Goal 4 Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. Targets 4.3, 4.7, and 4

Countries involved in the project (17 participants): Cameroon, Benin, France

Scientific activities:

- Remote sensing, geographic information systems (GIS), fieldwork techniques were employed to identify groundwater potential zones.
- International training workshop: Remote sensing as support for hydrological modeling in sub-humid Africa to serve train masters and PhD students

Scientific achievements

- A workshop series has been organized (02-10 Sept. 2017; 02-06 Nov. 2017, and 07-19 Dec. 2017) in Cameroon for master students in "Remote sensing as support for hydrological modelling in sub-humid Africa".
- A wide range of satellite sensors are used to retrieve hydrological-related parameters of vegetation and soil at different scales. These parameters contribute to the water modeling and aquifer assessment.
- Total water storage change in local scale was studied over selected aquifers using in-situ and satellite gravity measurements.
- Groundwater assessment was conducted by integrating the remote sensing products and other ancillary data using EALCO model.

2) IGCP 661: Structure, Substance Cycle, and Environment Sustainability of the Critical Zone in Karst Systems

Duration: 5 years (2017-2022)

Project Aims: Critical zone means the key sections for interaction among different spheres of earth surface (lithosphere-pedosphere-biosphere-hydrosphere-atmosphere), namely from tree crown, soil to aquifer. Traditional weathering crust is the major component of critical zone. The project pays mainly attention to scientific issues such as the structure, evolution, cycle of carbon-water-calcium and function of the critical zone

and its sustainable utilization of the resources and environments. The main purposes of this project are to significantly enhance the research on critical zone science in karst systems, as well as to promote international cooperation and technology sharing on karst environment protection, education and training.

Related UN SDGs: Goal 4 Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. Targets 4.3 and 4.7.

Countries involved in the project (41 participants): China, USA, Slovenia, Thailand, Iran, Cambodia, Finland, Japan, the Philippines

Scientific activities

- IGCP 661 working group meeting: 21 attendances from 5 countries in Kunming, China
- CCOP (Coordinating Committee for Geoscience Programmes in East and Southeast Asia) water resources exploitation and environment protection seminar: 20 attendances from 5 countries in Cebu, Philippines. 10 major cross-border aquifers have been delineated.
- Training course on hydrogeology, environmental geology and ecological geology of karst was organized to develop the capabilities of young karst geologists.

Scientific achievements

- An initial partition of karst critical zone has been finished based on different climate zones covering the karst areas studied.
- The cycle and transformation of C and N has been tested in a shallow karst critical system from plants to the water and soil.
- A standard working methodology in karst geology has been finalized and accepted in China which will be developed and submitted to the International Standardization Organization (ISO).
- The scientific achievements can be used as a tool to characterize karst systems globally and to help understand the cycle and transformation of elements in the rock-soil-water system in karst systems.
- Five (5) publications in peer-reviewed journals including *Biology & Fertility of Soils*.

New call for IGCP Project Proposal:

1. Project theme: Groundwater sustainability in volcanic regions.
2. The call will emphasize that women and young and early career scientists are especially encouraged to apply.
3. The project(s) will be sponsored by Jeju Province Development Corporation (JPDC) Korea for five (5) years.

Support to Stable Isotope Analyses for Djibouti Research Center and Studies

1. Purpose: The complex coastal aquifer has not well studied in despite that it is the only aquifer systems that deserve water to the Djibouti-city, which is the capital of the Republic of Djibouti and where 60% of the population of the country lives. Therefore, the

study of this aquifer system is of paramount importance for the capital city of Djibouti for a better management of this aquifer system. This coastal aquifer system experienced seawater intrusion concomitant to an over-exploitation as well as a pollution from a dumping site that they suspect some leak. Therefore, they have undertaken the current research and would like to complete their study by the analyses of isotopes.

2. Request via UNESCO IGCP program: Stable isotope analyses including 2H, 18O, 13C, 34S-SO₄, 18O-SO₄, 15N-NO₃, and 18O-NO₃.

3. Analyses performed by:

- KIGAM (Korea Institute of Geoscience and Mineral Resources and
- KBSI (Korea Basic Science Institute)

Annex 5: 2017 Summary of IGCP Geodynamics Theme

1) IGCP project 628: THE GONDWANA MAP PROJECT

Duration: 5 years (2013-2017)

Aims: The developing global cooperation on thinking around the evolution of Gondwana; and generating a new geological map of Gondwana by integrating data from Gondwana-derived fragments.

Related UN SDG: Goal 4 – Quality education.

Countries involved, approximate number of total 2017 participants: There are about 270 participants from more than 30 countries. Of these about 76 are under the age of 35 years, and 137 of the total are from developing countries. Of the 270 participants, 70 are female.

Scientific activities (meetings, workshops, training sessions). A very important meeting of the project was held and involved 150 scientists from about 20 countries. The researchers include postgraduate and undergraduate students.

Scientific achievements/ results (papers, new findings, new models, new data, new map etc.): A new paleogeological map of Gondwana resulting from the project will be published. Many peer publications have been produced. A new model of the amalgamation, and dispersion of Gondwana has resulted from the project.

Societal/educational results/highlights (media coverage, science, education, cultural and informal) related to the Climate Change (Paris COP21), Disaster risk reduction (Sendai framework) and SDGs (New York 2015): The project has an excellent website which publicises the project activities and showcases the key outputs. In line with SDG4, the project is providing an opportunity for young scientists and those from developing countries to benefit from collaboration with well-known geoscientists from developed countries. The project is also promoting geology among communities and young children.

2) IGCP project 646: DYNAMIC INTERACTION IN TROPICAL AFRICA

Duration: 4 years (2015-2018)

Aims: The original idea was to investigate the continental basement geology with neotectonics, mineral and hydrocarbon exploration, hydrology and climate change, especially in several West African countries. Modern geotechnical techniques were considered (AMS, GIS positioning, Remote sensing) having the potential to return large volumes of quantitative and semi-quantitative geoscientific data that helps the project to reach its goals. With very, very modest budget and limited external funds, largely because it has some access to modern facilities in Europe, this cannot aim to be more than a great opportunity for west African PIs to advance towards high performance managed by themselves, with very modest help from advanced.

Related UN SDG: *Goal 12 – Responsible consumption and production.* This is because the project is looking to use Geodata to identify potential minerals resources. *Goal 4 – Quality education.* The project is providing good quality education to young African geoscientists.

Countries involved, approximate number of total 2017 participants: A total number of participating scientists is 59 of which 13 are female. Of this total 40 are under 35 years of age, and 50 are from the 11 developing countries (i.e. Cameroon, Nigeria, Central Africa Republic, Congo, Ghana, Ethiopia, Democratic Republic of Congo, Tunisia, Morocco and Burundi).

Scientific activities (meetings, workshops, training sessions): There was characterization of the shear zone (or tectonic boundaries) around the Central Africa Fold Belt. In addition to the project annual meeting which included a field trip in Nigeria, the project held a training course in Cameroon.

Scientific achievements/ results (papers, new findings, new models, new data, new map etc.): The project applied remote sensing techniques. It investigated the possible links between various geodynamic processes which concluded the Precambrian Fold Belt in central and western Africa, and their potential control on iron deposits emplacement. A synthesis of publications is reported, including papers in very well regarded journals like Journal of African Earth Sciences, Ore Geology Review, and an abstract book (extended abstracts of 43 pages) is attached to the annual report.

Societal/educational results/highlights (media coverage, science, education, cultural and informal) related to the Climate Change (Paris COP21), Disaster risk reduction (Sendai framework) and SDGs (New York 2015): The project supported the training of young geoscientists. It addressed knowledge gaps in the geology of Central and West Africa. It delivered upgraded geosciences training focusing highly technical methods. It also facilitated networking amongst the young geoscientists. In line with SDGs 4 and 12, the project is looking to use Geodata to identify potential minerals resources, and providing good quality education to young African geoscientists.

3) IGCP project 649: DIAMOND AND RECYCLED MANTLE

Duration: 5 years (2015-2019)

Aims: The idea to investigate the peridotite and chromitites formations belonging to classic ophiolite belts around the globe already documented the existence of diamond occurrence in the mantle.

Related UN SDG: Goal 4 – Quality education.

Countries involved, approximate number of total 2017 participants: There are 103 participants 28 of whom are under the age of 35 years, and 75 of the total are from developing countries. Of the 103 participants, 21 are female.

Scientific activities (meetings, workshops, training sessions). Several conferences and workshops have been held. One main one was held in Cuba and resulted in more exposure on the research outputs of the study of ophiolites in Cuba and allowing for the development of collaboration with other regions in the world.

Scientific achievements/ results (papers, new findings, new models, new data, new map etc.): Many publications of have been produced in internationally recognised journals, such “Ore Geology Reviews”, “American Mineralogist” and “Lithosphere”. There is a lot of international collaboration.

Societal/educational results/highlights (media coverage, science, education, cultural and informal) related to the Climate Change (Paris COP21), Disaster risk reduction (Sendai framework) and SDGs (New York 2015): The project has a well-functioning website which publicises the project activities and encourages other scientists to join. In line with SDG4, the project is providing an opportunity for early career researchers to benefit from collaboration with well-known geoscientists specialising in the study of ophiolites. Economic benefits may be expected from the improved scientific understanding of the formation of chromitites which may provide new ideas for exploration for chrome.

ANNEX 6: 2017 Funding table for ongoing projects

N°	Projects	First Project Leader	IUGS	UNESCO HQ	UNESCO JAKARTA	Total USD
589	Development of the Asian Tethyan Realm	Xiaochi Jin (China)				OET
608	Asia-Pacific Cretaceous Ecosystems	Hisao Ando (Japan)		6,000	3,000	9,000
609	Cretaceous Sea-Level Changes	Michael Wagreich (Austria)	7,500			7,500
610	From the Caspian to Mediterranean: Environmental Change and Human Response during the Quaternary	Valentina Yanko-Hombach (Ukraine)		5,500		5,500
628	The Gondwana Map Project	Renata de Silva Schmidt (Brazil)		7,500		7,500
630	Permian-Triassic Climatic and Environmental Extremes and biotic responses	Zhong Qiang (China)	7,500			7,500
632	Continental Crisis of the Jurassic	Jongeng Sha (China)		7,500		7,500
636-Y	Characterization and sustainable exploitation of geothermal resources	Daniela Blessant (Columbia)	5,500			5,500
637	Heritage stone designation	Lola Pereira (Spain)		5,500		5,500
638	Paleoproterozoic Birimian geology for sustainable development	Moussa dabo (Senegal)		3,000		3,000
639	Sea Level Changes from minutes to millenia	Simon Engelhart (USA)		7,500		7,500
640	Significance of Modern and Ancient Submarine Slope and Landslides	Lorena Moscardelli (USA)	5,500			5,500
641	Deformation and fissuring caused by exploitation of subsurface fluids	Dora Carreon-Freyre (Mexico)	3,000			3,000
643	Water Resources in Wet Tropics of West-Central Africa	Bamory Kamagate (Côte d'Ivoire)	4,000			4,000
646	Dynamic interaction in tropical Africa	Kankeu Boniface (Cameroon)	3,000			3,000
648	Supercontinent Cycles and Global Geodynamics	Zheng-Xiang Li (Australia)	5,500			5,500
649	Diamonds and Recycled Mantle	Jingsui Yang (China)	5,500			5,500
652 new	Reading Geologic Time	A.C. Da Silva (Belgium)	5,500			5,500
653	The onset of the Great Ordovician Biodiversification Event	Thomas Servais (France)	5,500			5,500
655 new	Toarcian Oceanic Anoxic Event	Matias Reolid (Spain)		5,500		5,500
657 new	Information Platform on Earthquake Early Warning Systems	R. Allen (USA)		5,500		5,500
661 new	The Critical Zone in Karst Systems	Jiang Zhongcheng (China)	2,000			2,000
	TOTAL		60,000	53,500	3,000	116,500

IGCP 657 project didn't request approved funding in 2017 and didn't provide an annual report

ANNEX 7: 21 IGCP on-going projects to be evaluated in February 2018

N°	Project Title	IGCP Theme	Duration
EARTH RESOURCES			
<i>Sustaining our society</i>			
637	Heritage stone designation	Earth Resources	2015-2019
636-Y	Characterization and sustainable exploitation of geothermal resources	Earth Resources	2016-2018
638	Paleoproterozoic Birimian geology for sustainable development	Earth Resources	2016-2020
GLOBAL CHANGE			
<i>Evidence from the geological record</i>			
608	Asia-Pacific Cretaceous Ecosystems	Global Change	2013-2017
609	Cretaceous Sea-Level Changes	Global Change	2013-2017
610	From the Caspian to Mediterranean: Environmental Change and Human Response during the Quaternary	Global Change	2013-2017
630	Permian-Triassic Climatic and Environmental Extremes and biotic responses	Global Change	2014-2018
632	Continental Crisis of the Jurassic	Global Change	2014-2018
639	Sea Level Changes from minutes to Millenia	Global Change	2016-2020
653	The onset of the Great Ordovician Biodiversification Event	Global Change	2016-2020
652	Magnetic susceptibility and cyclostratigraphy - Improvement of Palaeozoic time scales	Global Change	2017-2021
655	Toarcian Oceanic Anoxic Event: Impact on marine carbon cycle and ecosystems	Global change	2017-2021
GEOHAZARDS			
<i>Mitigating the risks</i>			
640	Significance of Modern and Ancient Submarine Slope and Landslides	GeoHazards	2015-2019
641	Deformation and fissuring caused by exploitation of subsurface fluids	Geohazards	2015-2018
657	International platform on earthquake early warning systems	Geohazards	2017-2021
HYDROGEOLOGY			
<i>Geoscience of the water cycle</i>			
643	Water Resources in Wet Tropics of West-Central Africa	Hydrogeology	2015-2019
661	The critical Zone in Karsts Systems	Hydrogeology	2017-2021
GEODYNAMIC			
<i>Control of our environment</i>			
628	The Gondwana Map Project	Geodynamic	2013-2017
646	Dynamic interaction in tropical Africa	Geodynamic	2015-2018
648	Supercontinent Cycles an Global Geodynamics	Geodynamic	2015-2019
649	Diamonds and Recycled Mantle	Geodynamic	2015-2019

ANNEX 8: 13 New project proposals requesting funding from 2018, these proposals will be evaluated in February 2018

N°	Project Title
EARTH RESOURCES	
<i>Sustaining our society</i>	
664	Study of the clues of Iron in the border algerian-tunisian
665	Sustainable use of black soil critical zone
660* Resubmission	Basement Rocks and the formation of Mineral Deposits
671	Mineral Resources of the Republic of Djibouti
GLOBAL CHANGE	
<i>Evidence from the geological record</i>	
666	Paleodeltas-The History of the Earth
668	Equatorial Gondwanan history and early palaeozoic evolutionary dynamics
GEOHAZARDS	
<i>Mitigating the risks</i>	
663	Land Subsidence in coastal cities (IM2LSC)
659* Resubmission	Seismic risk assessment in Africa
669	FAULT2SHA-ME (Incorporating Faults into Seismic Hazard assessment: linking Mexico and Europe)
670	Resumption instrumental seismological observations in the territory of Pamirs
672	Himalayan glaciers and risks to local communities
GEODYNAMIC	
<i>Control of our environment</i>	
662	Orogenic architecture and crustal growth from accretion to collision
667	World map of the Orogens

ANNEX 9: Scientific Board Members and IGCP Council members 2017

CHAIRPERSON					appointed term	
	Mr Narbonne, Guy	narbonne@queensu.ca	Queen's University, Kingston	Canada	2017-2018	
EARTH RESOURCES	Ms Vlaswinkel, Brigitte Team Leader	bvlaswinkel@live.com	The Ocean Cleanup	The Netherlands	2017-2020	
	Mr Beaudoin, Georges	georges.beaudoin@ggl.ulaval.ca	University of Laval (Dep. Geology)	Canada	2017-2020	
	Mr Pasava, Jan	jan.pasava@geology.cz	Czech Geological Survey	Czech Rep.	2017-2020	
	Mr Seltmann, Reimar	R.Seltmann@nhm.ac.uk	Natural History Museum	UK	2017-2020	
	Mr Yigit, Ozcan	oyigit@comu.edu.tr	Canakkale Onsekiz Mart University (Dep. Geol. Eng)	Turkey	2017-2020	
	Ms Baumgartner, Regina	regina.baumgartner@gmail.com	Gold Fields, Lima, Peru	Peru	2017-2020	new
	Ms Olivo, Gema	olivo@queensu.ca	Queen's University, Kingston	Canada	2017-2020	new
	Ms André-Mayer, Anne-Sylvie	anne-sylvie.andre@univ-lorraine.fr	Université de Lorraine, Nancy	France	2017-2020	new
Ms Paradis, Susanne	suzanne.paradis@canada.ca	Geological Survey of Canada	Canada	2017-2020	new	
Mr Molnar, Ferenc	ferenc.molnar@gtk.fi	Geological Survey of Finland	Finland	2017-2020	new	
GLOBAL CHANGE	Ms Orgeira, Maria Julia Team Leader	orgeira@gl.fcen.uba.ar	IGEBA (University of Buenos Aires and Conicet)	Argentina	2017-2018	
	Mr Königshof, Peter	Peter.Koenigshof@senckenberg.de	Senckenberg Forschungsinstitut und Naturmuseum	Germany	2017-2020	
	Ms Leroy, Suzanne	leroy@cerege.fr	CNRS-INSU	Belgium	2017-2020	
	Mr Lukeneder, Alexander	alexander.lukeneder@nhm-wien.ac.at	Natural History Museum Vienna	Austria	2017-2020	
	Ms Mangano, Maria Gabriela	gabriela.mangano@usask.ca	University of Saskatchewan	Argentina	2017-2020	
	Ms Oboh-Ikuenobe, Francisca	ikuenobe@mst.edu	Missouri University of Science & Technology	Nigeria	2017-2020	
	Ms Yanko Hombach, Valentina	valyan@avalon-institute.org	Avalon Inst. of Applied Science	Ukraine	2017-2020	
	Ms Vickers-Rich, Patricia	pat.rich@monash.edu	Monash University	Australia	2017-2020	
Mr Jaramillo, Carlos	jaramillo@si.edu	Smithsonian Tropical Research Institute	Colombia	2017-2020	new	
Mr Servais, Thomas	Thomas.Servais@univ-lille1.fr	CNRS – Lille1	France	2017-2020	new	
GEOHAZARDS	Mr Ismail-Zadeh, Alik Team Leader	Alik.Ismail-Zadeh@kit.edu	Karlsruhe Institute of Technology	Azerbaijan	2017-2018	
	Mr Campbell, Hamish	h.campbell@gns.cri.nz	GNS Science	New Zealand	2017-2020	
	Mr Cundy, Andy	a.cundy@brighton.ac.uk	University of Brighton	UK	2017-2020	
	Mr Sintubin, Manuel	manuel.sintubin@ees.kuleuven.be	Katholieke Universiteit Leuven	Belgium	2017-2020	
	Mr Wright, Robert	wright@higp.hawaii.edu	University of Hawaii	USA	2017-2020	
	Ms João Batista, Maria	mjoao.batista@lNEG.pt	National Laboratory of Energy and Geology (LNEG)	Portugal	2017-2020	new
	Mr Singh, Vimal	vimalgeo@gmail.com	Department of Geology, University of Delhi	India	2017-2020	new
HYDROGEOLOGY	Mr Kim, Yongje Team Leader	yjkim@kigam.re.kr	Korea Institute of Geoscience and Mineral Resources (KIGAM)	Rep. of Korea	2017-2020	
	Ms Bernal, Isabel Carolina	isabel.bernal@epn.edu.ec	National Polytechnic School	Ecuador	2017-2020	
	Mr Cheng, Zhang	chzhang@karst.ac.cn	Inst. of Karst Geology-CAGS/IRCS	China	2017-2020	
	Ms Le, Thi Phuong Quynh	quynhltq@yahoo.com	Vietnam Acad. of Sc. & Tech	Vietnam	2017-2020	
	Mr Tshimanga, Raphael	raphtm@yahoo.fr	University of Kinshasa	DR Congo	2017-2020	
	Mr Dzhamalov, Roald G.	dzhamal@aquas.laser.ru	Water Problems Institute, Russian Academy of Sciences	Russia	2017-2020	new
	Ms Szócs, Teodóra	szocs.teodora@mbfsz.gov.hu	The Mining and Geological Survey of Hungary	Hungary	2017-2020	new
	Mr Ibrahim, Reda Gamil Mohamed	redagad75@hotmail.com	Department of Hydrogeochemistry, Desert Research Center	Egypt	2017-2020	new
	Ms Vallejos Izquierdo, Angela	avallejo@ual.es	University of Almeria	Spain	2017-2020	new
	Ms Fidelibus, Maria Dolores	mariadolores.fidelibus@poliba.it	Politechnique de Bari	Italy	2017-2020	new
GEODYNAMIC	Ms Mutemeri, Nellia Team Leader	mutemerinellie@gmail.com	School of Mining, University of Witwatersrand	Zimbabwe	2017-2020	
	Mr Charrier, Reynaldo	rcharrie@ing.uchile.cl	University of Chile (Dep. of Geology)	Chile	2017-2020	
	Mr Ennih, Nasser	nasser_ennih@yahoo.fr	University of El Jadida	Morocco	2017-2020	
	Ms Halla, Jaana	jaana.halla@helsinki.fi	Helsinki Geological Museum	Finland	2017-2020	
	Mr Hisada, Kenichiro	hisadak@geol.tsukuba.ac.jp	University of Tsukuba (Graduate School of Life & Envir. Sc.)	Japan	2017-2020	
	Mr Jin, Xiaochi	jinxchi@cags.net.cn	Chinese Academy of Geological Sciences	China	2017-2020	
	Mr Mocanu, Victor	vi_mo@yahoo.com	University of Bucharest	Romania	2017-2020	
	Ms Safak, Altunkaynak	safak@itu.edu.tr	Istanbul Technical University	Turkey	2017-2020	
Ms Toy, Virginia	virginia.toy@otago.ac.nz	University of Otago	New Zealand	2017-2020	new	

ANNEX 10: Details of 35 IGCP Projects meetings funded by IUGS and UNESCO in 2017

N°	Project Title	Meeting title and location	Meeting date
608	Asia-Pacific Cretaceous Ecosystems	The Fifth International symposium of IGCP 608 International Convention Center Jeju, Jeju Island, Korea	22-28 October 2017
609	Cretaceous Sea-Level Changes	10th International Symposium on the Cretaceous Vienna, Austria	20-25 August 2017
610	From the Caspian to Mediterranean: Environmental Change and Human Response during the Quaternary	5th Plenary meeting and Field Trip on the Plio/Pleistocene geological history of the central Mediterranean of southern Italy, Palermo, Italy	1-9 October 2017
628	The Gondwana Map Project	16th Gondwana International Conference Bangkok, Thailand	7-21 November 2017
630	Permian-Triassic Climatic and Environmental Extremes and biotic responses	<p>Primary events: (1) IGCP 630 Annual Meeting in Sendai, Japan, Tohoku University, Sendai, Japan. Post-Meeting Field Excursions in northeastern Japan (2) IGCP 630 Field Workshop and Meeting in Armenia to investigate the marine Lower Triassic in Armenia.</p> <p>Other symposia/workshops: (3) IGCP630 Session joint with the 4th International Geobiology Conference, Wuhan, China; (4) IGCP630 Session joint at GSA 2017 Annual Meeting, Seattle, USA (5) IGCP630 Session joint at AGU 2016 Annual Meeting, Oregon, USA</p>	<p>Primary events: (1) 13-16 June 2017. Post-Meeting Field Excursions in northeastern Japan, 16-20 June 2017. (2) 8-14 Oct. 2017</p> <p>Other symposia/workshops: (3) 24-26 June 2017 (4) 22-28 Oct. 2017 (5) Dec. 2017</p>
632	Continental Crisis of the Jurassic	The 5th Symposium of the IGCP 632: Jurassic Tropical to Polar Biotic and Climatic Transects Flagstaff, Arizona, USA	30 Sept. to 1 Oct. 2017

636-Y	Characterization and sustainable exploitation of geothermal resources	Meeting on "Unifying international research forces to unlock and strengthen geothermal exploitation of the Americas and Europe" Santiago de Chile, Chile	20-24 November 2017
637	Heritage stone designation	EGU General Assembly, Vienna, Austria	24-28 April 2017
638	Paleoproterozoic Birimian geology for sustainable development	International Geoscience Programme on Geodynamics and mineralizations of Paleoproterozoic formations for a sustainable development, Casablanca, Morocco.	7-12 November 2017
639	Sea Level Changes from minutes to millenia	Meeting on Sea Level Changes from minutes to millenia University of KwaZulu-Natal, St Lucia, South Africa.	17-23 September 2017
640	Significance of Modern and Ancient Submarine Slope and Landslides	<p>1. 1st Workshop on Subaqueous Landslides and Morphometric Parameters – The Royal Trafalgar, London.</p> <p>2. S4SLIDE Session as part of the 100th AAPG Annual Meeting – Houston, TX. Non-turbidite DW units as key petroleum system elements.</p> <p>3. Two S4SLIDE sessions as part of the European Geosciences Union General Assembly - Vienna, Austria, Submarine landslide hazard and marine paleoseismology: Regional and global implications.</p> <p>Subaquatic sediment gravity flow processes and products</p> <p>4. S4SLIDE Hackathon as part of the EVAN Conference – Southampton, UK – Statistics of Natural Hazards Hackathon.</p> <p>5. 9th International Conference on Geomorphology - Vigyan Bhawan, New Dehli à S4SLIDE Session: S30 Submarine Geomorphology (IAG-WG).</p>	<p>1. 23-24 January 2017, The Royal Trafalgar, London. Minutes of meeting here</p> <p>2. 2nd to 5th April, 2017 Houston, TX.</p> <p>3. 23rd to 28th April 2017 Vienna, Austria Submarine landslide hazard and marine paleoseismology: Regional and global implications - Link</p> <p>Subaquatic sediment gravity flow processes and products - Link</p> <p>4. 12th -15th September, 2017 Southampton, UK – Statistics of Natural Hazards Hackathon</p> <p>5. 11th November 2017 Vigyan Bhawan, New Dehli-S4SLIDE Session: S30 Submarine Geomorphology (IAG-WG).</p>

641	Deformation and fissuring caused by exploitation of subsurface fluids	Third workshop on Mechanisms, Monitoring and Modeling Earth Fissure generation and fault activation due to subsurface fluid exploitation University of Alicante, Spain	16-17 November 2017
643	Water Resources in Wet Tropics of West-Central Africa	Training workshop: Remote sensing as support for hydrological modeling in sub-humid Africa Yaoundé, Cameroon	2-15 Sept. 2017
646	Dynamic interaction in tropical Africa	Training Course: Geological map interpretation and Cross Section Construction using modern tools and software Yaoundé, Cameroon. Annual meeting: Mesozoic-Cenozoic sedimentary basins and related minerals resources. Training course, workshops with scientific presentation and discussion. Post workshop field excursion, Nigeria.	06-07 July 2017 25-29 Sept. 2017
648	Supercontinent Cycles and Global Geodynamics	Rodinia 2017-Supercontinents and Global Dynamics Townsville, Queensland, Australia	11-14 June 2017
649	Diamonds and Recycled Mantle	IGCP 649-Workshop on diamond and recycled mantle Havana, Cuba.	3-14 April 2017
653	The onset of the Great Ordovician Biodiversification Event	(1) 4th International conodont symposium, June 25-30, Valencia, Spain. (2) 6th International conference on trilobites and their relatives, July 7-10, Tallinn, Estonia. (3) Ordovician Geodynamics, September 4-9, Figueras, Spain. (4) 10th Baltic Stratigraphic Conference, September 12-14, Kielce, Poland. (5) Dayangcha International Workshop on the Cambrian-Ordovician Boundary, September 20-25, Changchun, NE China (6) MAIN ANNUAL MEETING IGCP 653, October 8-18, Yichang, China. (7) GSA Annual Meeting. October 2-25, Seattle, USA.	(1) June 25-30, Valencia, Spain (2) July 7-10, Tallinn, Estonia (3) September 4-9, Figueras, Spain. (4) September 12-14, Kielce, Poland. (5) September 20-25, Changchun, NE China. (6) October 8-18, Yichang, China. (7) October 2-25, Seattle, USA.

652 new	Reading Geologic Time	<p>Special Session at the International Meeting of Sedimentology (IMS) entitled: RTS2 Time calibration of paleoclimatic and paleoceanographic events Toulouse, France.</p> <p>Special Session at the American Geophysical Union (AGU) entitled: Cyclostratigraphy: from the Phanerozoic to the Precambrian and from Geology to Astronomy New Orleans, USA.</p>	<p>10-12 October 2017</p> <p>11-15 December 2017</p>
653	The onset of the Great Ordovician Biodiversification Event	<p>(1) 4th International conodont symposium, June 25-30, Valencia, Spain.</p> <p>(2) 6th International conference on trilobites and their relatives, July 7-10, Tallinn, Estonia.</p> <p>(3) Ordovician Geodynamics, September 4-9, Figueras, Spain.</p> <p>(4) 10th Baltic Stratigraphic Conference, September 12-14, Kielce, Poland.</p> <p>(5) Dayangcha International Workshop on the Cambrian-Ordovician Boundary, September 20-25, Changchun, NE China</p> <p>(6) MAIN ANNUAL MEETING IGCP 653, October 8-18, Yichang, China.</p> <p>(7) GSA Annual Meeting. October 2-25, Seattle, USA.</p>	<p>(1) June 25-30, Valencia, Spain</p> <p>(2) July 7-10, Tallinn, Estonia</p> <p>(3) September 4-9, Figueras, Spain.</p> <p>(4) September 12-14, Kielce, Poland.</p> <p>(5) September 20-25, Changchun, NE China.</p> <p>(6) October 8-18, Yichang, China.</p> <p>(7) October 2-25, Seattle, USA.</p>
655 new	Toarcian Oceanic Anoxic Event	1st International workshop on the Toarcian Oceanic Anoxic Event (IW-TOAE), Jaén, Spain.	4-7 October 2017
661 new	The Critical Zone in Karst Systems	First international working group on Structure, substance cycle and environment sustainability of the critical zone in Karst Systems Kunming, China	21-22 July 2017