International Geosciences Programme - IGCP

2019 Annual Report

Table of Contents

1 Introduction

Developing an advanced understanding of the Earth's fundamental processes and resources is essential to reaching UN sustainable development goals.

UNESCO is the only United Nations organization with a mandate to support research and capacity in Earth Sciences and the International Geoscience and Geoparks Programme is our flagship.

The International Geoscience and Geoparks Programme (IGGP) consists of two pillars:

1. International Geoscience Programme (IGCP), since 1972, has harnessed the intellectual capacity of a worldwide network of geoscientists to lay the foundation for our planet's future, focusing on responsible and environmental resource extraction, natural hazard resiliency and preparedness, and adaptability in the era of a changing climate.

2. UNESCO Global Geoparks (UGGp) are laboratories for sustainable development, which promote the recognition and management of Earth heritage, and the sustainability of local communities. As of December 2019, there are 147 UNESCO Global Geoparks within 39 Member States.

UNESCO's International Geoscience and Geoparks Programme (IGGP) is implemented through these two activities: the International Geoscience Programme, a co-operative venture with the International Union of Geological Sciences (IUGS), and the UNESCO Global Geoparks. They coordinate their work through a shared UNESCO Secretariat and joint coordination meetings of their respective bureau which convene as necessary. The chairpersons of the two respective Councils co-chair the IGGP (Annex 9).

In the framework of the International Geoscience and Geoparks Programme (IGGP), this report is drafted by UNESCO IGGP Secretariat.

This report summarizes:

- UNESCO IGCP Secretariat 2019 activities,

- The results, scientific achievements and the project meeting activities of **31** IGCP projects annual reports submitted as of 31 December 2019,

- Details of 26 new IGCP project proposals received as of 15 October 2019 for the evaluation of the IGCP Scientific Board in March 2020.

UNESCO Global Geoparks 4th Council meeting report is published separately and is available on UNESCO's website.

.

2 Definition of IGCP

The International Geoscience Programme (IGCP) serves as a knowledge hub of UNESCO to facilitate international scientific cooperation in the geosciences. The IGCP mission includes promoting sustainable use of natural resources, advancing new initiatives related to geo-diversity and geo-heritage and geohazards risk mitigation.

Since 1972, the International Geoscience Programme (IGCP) has partnered with the International Union of Geological Sciences (IUGS) to bring together thousands of Earth scientists from around the world and allowed them to benefit from the cooperative spirit generated under the umbrella of UNESCO.

The IGCP promotes collaborative projects with a special emphasis on the benefit to society, capacity-building, and the advancement and sharing of knowledge between scientists with an emphasis on North-South and South-South cooperation. IGCP operates by providing seed funding grants donated by UNESCO, IUGS and extra-budgetary sources. IGCP projects primarily deal with geosciences on global issues within its five themes:

- Earth Resources,
- Global Change,
- Geohazards,
- Hydrogeology and
- Geodynamics.

Each project has an average lifespan of five years and its progress is assessed annually through a rigorous peer review process conducted by the IGCP Council following the evaluation 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 an 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 Headquarters.

As the IGCP has a limited budget, IGCP support is specially allocated to supporting scientists from developing countries.

3 Summary of IGCP in 2019

IGCP statutory Meeting: The Council of the International Geoscience Programme (IGCP) held its 4th Session in February 2019 in Paris and evaluated 49 projects including 21 new proposals (Section 4.1).

The 2019 IGCP Council also adopted a new vision and nine special topics for prioritization in the IGCP 2019 call for project proposal. In 2019, the IGCP UNESCO secretariat received 26 new IGCP project proposals, which is a substantial increase from previous years. We believe that this considerable increase in IGCP project proposals is due to the extensive outreach and communication activities led by the IGCP Secretariat (Section 4.4).

IGCP projects funded by UNESCO: In 2019, nine new projects were approved and 31 projects were active, 26 projects receiving financial support from UNESCO, IUGS, Republic of Korea and China National Commission to UNESCO.

IGCP project meetings: In 2019, 203 IGCP Project Leaders from 57 different countries organized 39 IGCP project meetings in 27 countries with the participation of over 4,400 scientists from 110 countries, these meetings were financially supported by the IGCP Programme funds (Section 5.1) in collaboration with UNESCO Secretariat and IUGS treasurer.

IGCP capacity building activities: UNESCO Secretariat co-organized and financially supported two short courses in Ivory Coast and Ireland (Section 4.2).

IGCP outreach and visibility: The IGCP Secretariat participated in International Conferences to disseminate the achievements of the IGCP at the Deep-time Digital Earth Forum (25.02-02.03 2019, Beijing, China), 2019 European Geosciences Union General Assembly (Vienna, Austria), and during 11th Jeju Water World Forum (Jeju Island, Korea). New IGCP brochures and posters designed and distributed during these conferences. IGCP Secretariat published new international publications including Korean journal of geosciences as well as Geological Society of London to disseminate the impact of the IGCP (Section 4.3).

4 UNESCO IGCP Secretariat 2019 activities

In 2019, UNESCO IGCP Secretariat focused on below listed main activities.

1. Organization of the annual statutory meeting of the 4th IGCP Council from 18-21 Feb. 2019
2. IGCP capacity building activities: new field trip exchange initiative
3. Participation in the International Conferences to disseminate the achievements of the IGCP,
4. Launch of 2019 IGCP New Project Proposal open call and upon the receipt of **26** new proposals the management of their evaluation along with the active projects annual reports.
5. Organization of IGGP information meeting for the representatives of UNESCO delegations,
6. Establishment of a new Category 2 center in Iceland
7. Management and funding of **31** IGCP projects and their meetings in 27 countries.

4.1 International Geoscience Programme Council Session

UNESCO IGCP secretariat is responsible for the organization and financial support of the annual statutory meeting of the IGCP Council, which assess new IGCP project proposals and annual reports of existing projects as well as to agree yearly fund allocation to each project. In 2019, IGCP Council meeting was organized with full participation of six Council members using UNESCO HQ Paris facilities between 18 and 21 February 2019 to select new projects that will be supported by UNESCO and the International Union of Geological Sciences (IUGS), the Democratic Republic of China as well as the Jeju Province Development Corporation Supporting (JPDC) from the Republic of Korea during 2019.

During the closed session (**18-20 February 2019**), the IGCP council members council reviewed 21 new project proposals and assessed the progress of the 27 ongoing IGCP projects. The IGCP Council approved a list of nine new projects for 2019 and agreed to continue funding 18 ongoing projects while extending four projects for their fifth year without funding. This resulted in a total of 31 IGCP projects approved by the Council to be active in 2019 (***Figure 1***).

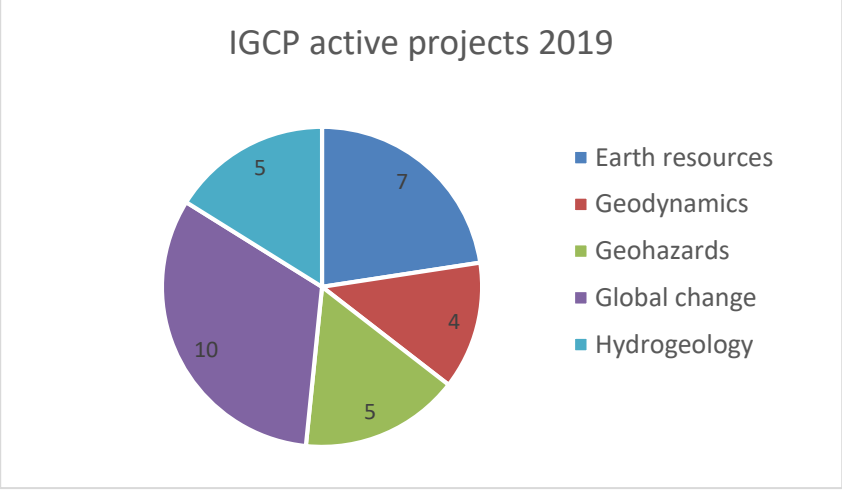


Figure 1: Distribution of 31 active IGCP projects in 2019

Following the completion of the closed IGCP council session, the Council presented their recommendations to the members of IGCP, National Commissions for UNESCO, IGCP National Committees and Permanent Delegations to UNESCO on 21 February 2019. Total of 80 representatives participated in this meeting and were informed about IGCP 2019 activities and the decisions of the closed IGCP 2019 Council session as well as new initiatives.

4.2 IGCP Field trip exchange project

IGCP International exchange network for young geosciences researchers project was approved by the International Geoscience Programme (IGCP) Council in 2018 to establish opportunities for post-graduate (PhD and post-doc) researchers to participate in pre-existing fieldwork and short courses projects within the subjects of Earth Sciences.

IGCP Secretariat issued a call for applications from both qualified early career Earth scientists from developing countries as well as host institutions that offer local and international fieldwork studies as part of graduate and postgraduate research degrees. Active and completed IGCP project leaders were invited to inform UNESCO IGCP Secretariat if they could accommodate additional participants from developing countries who will be sponsored by UNESCO.

IGCP Secretariat received high number of applications and following the approval of IGCP Council members the suitability of the candidates UNESCO supported 32 early career scientists from 21 countries to participate five short courses and IGCP field trips organized in Ireland, Ivory Coast, Tunisia, China and Nepal in 2019 listed below:

- RESTORE: Researching Social Theories, Resources, and Environment International Summer School: from 1st to 5th July 2019, Dublin, Ireland co-organized by IGCP by bringing together 42 postgraduate students and early career practitioners from 28 nations, including 18 developing countries sponsored by UNESCO and JPDC.

- 6th SGA-SEG-UNESCO-IUGS Short Course on African Metallogeny, Gold Deposits: from Exploration to Mining co-organized by UNESCO was held in Yamoussoukro, at the INP-HB (Institut national polytechnique Félix Houphouët-Boigny), Ivory Coast, from 28th October to 1st November 2019. The short course gathered 130 participants from 8 countries. It was largest SGA short course on African Metallogeny the geological surveys of Ivory Coast, Ghana, Niger, Burkina Faso sent delegates to join the meeting. Foreign PhD and Master students, and junior scientists from Cameroon, Nigeria, Senegal and Algeria could join the meeting thanks to generous sponsoring of UNESCO.

- 2nd Conference of Arab Geoscience Journal in Sousse – Tunisia (25 – 29 November 2020). Five early careers scientists from Ethiopia, Kenya, DR Congo, Sudan and South Africa participate in this conference and IGCP 659 field trip with the financial support of UNESCP.

- IGCP 672 - Himalayan Glaciers and risks to local communities Field training to Ponkar Glacier, Nepal, from 5 to 16 November 2019. Two early career scientists from India and Nepal were sponsored UNESCO Secretariat to join to this field course.

- IGCP 679 - Cretaceous Earth Dynamics and Climate in Asia, 11-17 October 2019, Qingdao, Shandong Province, China: Two early career scientists from Thailand and Nepal were sponsored by UNESCO Secretariat to join to this field course.

4.3 UNESCO IGCP Secretariat Participation in the International Conferences to disseminate the achievements of the IGCP

In 2019, Dr Ozlem Adiyaman from UNESCO IGCP Secretariat presented IGCP's objectives and achievements during the International Conferences listed below:

- Deep-time Digital Earth (DDE) forum, from 25 February to 2 March 2019: DDE is proposed as an IUGS-recognized 'Big Science Program' to be launched at the 36th International Geological Congress in New Delhi. UNESCO participated to the first forum of the DDE in Beijing China and presented collaboration opportunities between DDE and IGCP.

- European Geosciences Union General (EGU) Assembly 2019 which was organized in Vienna, Austria from 9 to 14 April 2019 with the participation of 15,075 scientists from 106 participating countries, of which 53% were under the age of 35 years. UNESCO IGCP Secretariat and our IGCP partner, the International Union of Geological Sciences (IUGS) and the Commission for the Geological Map of the World (CGMW) jointly hired a booth to present the IGCP programme during the EGU 2019 Assembly in Vienna and received inquiries from young scientists about the IGCP. IGCP hold two sessions with IGCP project leaders who presented their projects to other project leaders.

- The 6th Asia Pacific Geoparks Network (APGN) Symposium Rinjani-Lombok UNESCO Global Geopark, Indonesia: The 6th Asia Pacific Geoparks Network (APGN) symposium was held from 3rd to 6th September 2019 in Rinjani-Lombok UNESCO Global Geopark, Indonesia. This event provided participants from Asia-Pacific UNESCO Global Geoparks as well as National Geoparks from Indonesia and Asia-Pacific countries the knowledge exchange and networking opportunity. About 800 people participated in the symposium including geopark managements, scientists and the government representatives from all over the world. The theme of the 6th APGN focused on "UNESCO Global Geoparks Toward Sustaining Local Communities and Reducing Geohazard Risk". UNESCO Secretariat provided lectures for geopark evaluators during this conference and explained IGCP and IGGP contribution to the geoparks.

- 11th Jeju Water World forum: This forum is organized by the Jeju province development corporation (JPDC) from Republic of Korea, JPDC, since 2018, is first private sector donor of the International Geoscience and Geoparks programme. JPDC donated $100k/year to UNESCO Earth sciences projects. IGCP2019 activities were presented during the 11th Jeju Water world forum in October 2019 in Jeju.

4.4 IGCP 2019 New Project Proposal Call, New IGCP vision

At the Council session in February 2019, the IGCP Council adopted a new vision and special topics for prioritization in the IGCP 2019 call for project proposals.

Vision:

1. Efficient, safe and sustainable earth resources exploration and extraction,
2. Innovative renewable energy production and CO2 mitigation,
3. Better understand and predict climate change and geohazards.

The Council also announced IGCP 2019 Special Topics:

1. Mining geosciences and sustainability
2. Efficient and sustainable extractive industry technologies and stimulation methods
3. Geology for the Sustainable and Safe Scale-up of Renewable Energy Production
4. Big data, Cloud Computing and Artificial Intelligence in Geosciences
5. Geohazards nearby metropolitan areas
6. Global warming CO2 emission mitigation using new methods (such as Carbon Storage and Sequestration)
7. Sustainable small and volcanic islands: water, energy, resource management
8. Geoheritage for sustainable development
9. Geoscience and the Anthropocene

The Council agreed that only new proposals addressing above topics will be accepted in 2020 and the proposals will be ranked, with the top project receiving a Council award and special funding.

The deadline for project proposals was the 15 October 2019 and the IGCP UNESCO secretariat received 26 new project proposals, which is a substantial increase from previous years (***Figures 2, 3, 4***). We believe that this considerable increase in IGCP project proposals is due to the extensive outreach and communication activities led by the IGCP Secretariat since 2017 by participating to the international conferences and forums.

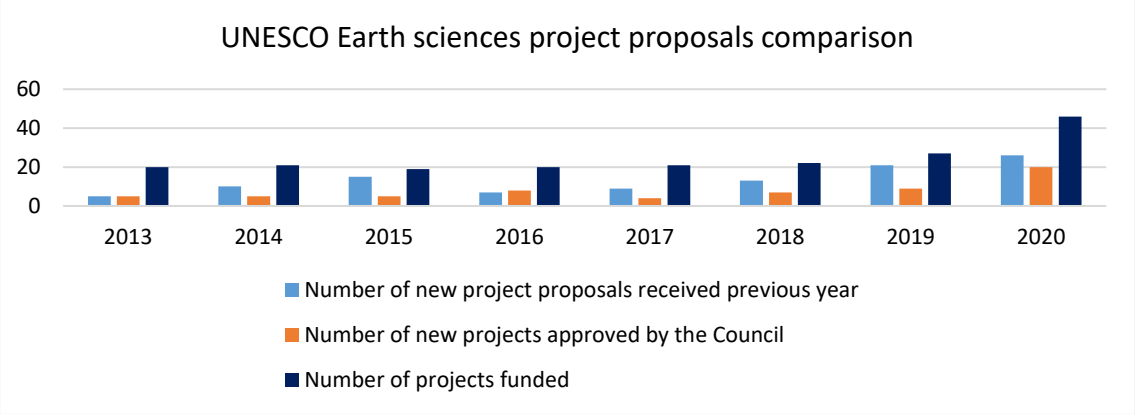


Figure 2: IGCP project proposals submission and Council approval comparison table.

These proposals are being evaluated by the Scientific Board members and the Council will meet at UNESCO HQ from 13 to 17 March 2020 during the 5th IGCP Council session to decide financial allocation for each project.

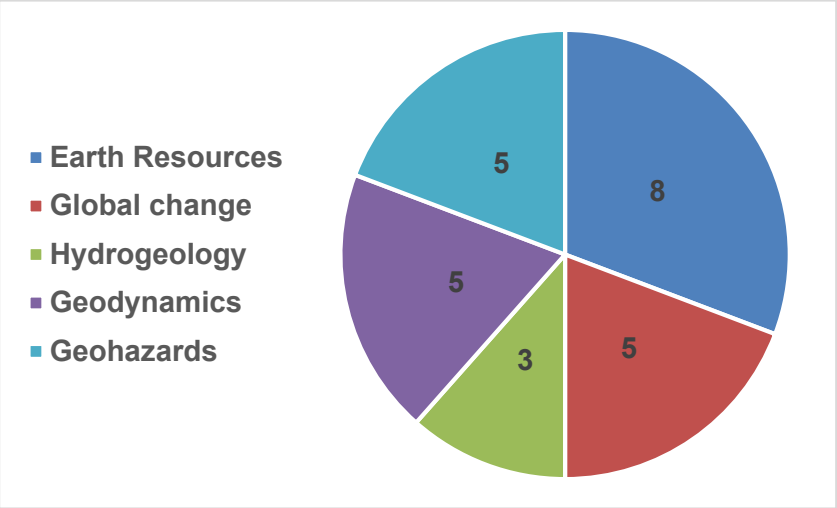


Figure 3: Distribution of 26 new IGCP project proposals submitted in 2019

A total of **125** project leaders from **50** member states jointly submitted **26** new IGCP project proposals which are requesting funding from 2020 (***Figure 4***).

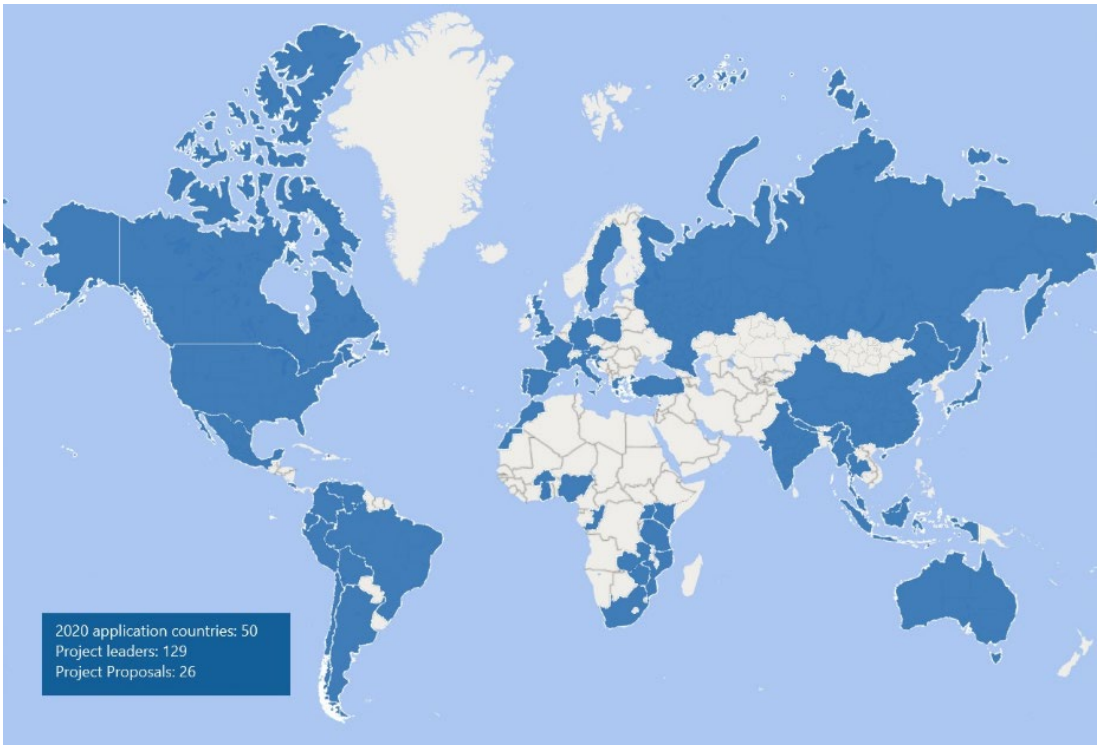


Figure 4: 2019 New IGCP Project Proposals distribution by Project Leader countries

4.5 UNESCO Information Session for Member States

Since the establishment of the IGGP in 2015 with the merger of IGCP and UNESCO Global Geoparks Programme (UGGP), the Secretariat did not have an opportunity to explain the management process of the IGGP to the Members states. Earth Sciences and Geohazards Risk Reduction Section of UNESCO who is responsible of the IGCP and UGGP Secretariat role organized an Information Meeting on 20 September 2019 in Paris UNESCO HQ. The meeting was very popular with the participation of over 70 representatives of UNESCO Permanent Delegations and was opened with the welcome speech of Dr Shamila Nair-Bedouelle, Assistant Director-General for Natural Sciences of UNESCO. UNESCO Chair on Geology for Sustainable Societies Prof Iain Stewart explained IGCP's contribution to societal needs and challenges. IGCP Council Chairperson, Dr Brigitte Vlaswinkel, presented the structure and projects of the IGCP which was followed by the UNESCO Global Geoparks Chairperson, Mr Guy Martini who presented the UNESCO Global Geoparks structure and the outcomes of 4th UNESCO Global Geoparks Council meeting which was held in Lombok, Indonesia early September. UNESCO Global Geoparks is managed in partnership between UNESCO and Global Geoparks Network (GGN) and Prof Nikolaos Zouros, GGN President, explained the capability building activities of the UNESCO Global Geoparks. Finally, Prof Benjamin van Wyk de Vries presented the objectives and progresses of the IGCP 695 project entitled Geoheritage for Geohazard resilience.

4.6 Establishment of a new Category 2 Centre in Iceland focusing on Geothermal Training

UNESCO IGCP Secretariat supported the activities for establishment of a new International Centre for Capacity Development, Sustainable Use of Natural Resources and Societal Change as a Category 2 Center in Iceland under the auspices of UNESCO. The centre is the first multidisciplinary Category 2 Centre in UNESCO's network bringing together four existing training programs on geothermal energy, fisheries, land restoration and gender equality. The goal of the Centre is to enhance the capacities of developing countries in Africa, Asia and Latin America and the Caribbean in the four fields , and in so doing strengthen their abilities to attain international and national targets set with respect to the Sustainable Development Goals.

IGCP is closely connected with the Geothermal Training Programme which is a postgraduate training programme, aiming at assisting developing countries in capacity building within geothermal exploration and development.

5 IGCP Projects 2019 Annual Reports Summary

5.1 IGCP Meetings 2019

In 2019, a total number of 70 IGCP project activities took place in 26 countries (***Figure 5***) with the participation of over 4000 scientists from **114** countries to the scientific and outreach activities (such as project meetings, fieldtrips, training sessions, workshops, symposiums as well international conferences) of **31** active IGCP projects. Annex 11 shows the details of the 70 IGCP activities.

Figure 5: World map showing 31 IGCP 2019 projects participating member states (**in green**) and different locations of the IGCP projects activities of 2019 (**in black**)

5.2 IGCP Project Leaders 2019

In 2019 a total number of **207** IGCP Project Leaders from **52** different countries (***Figure 6***) delivered the activities and objectives of 31 active IGCP projects (***Figure 7***).

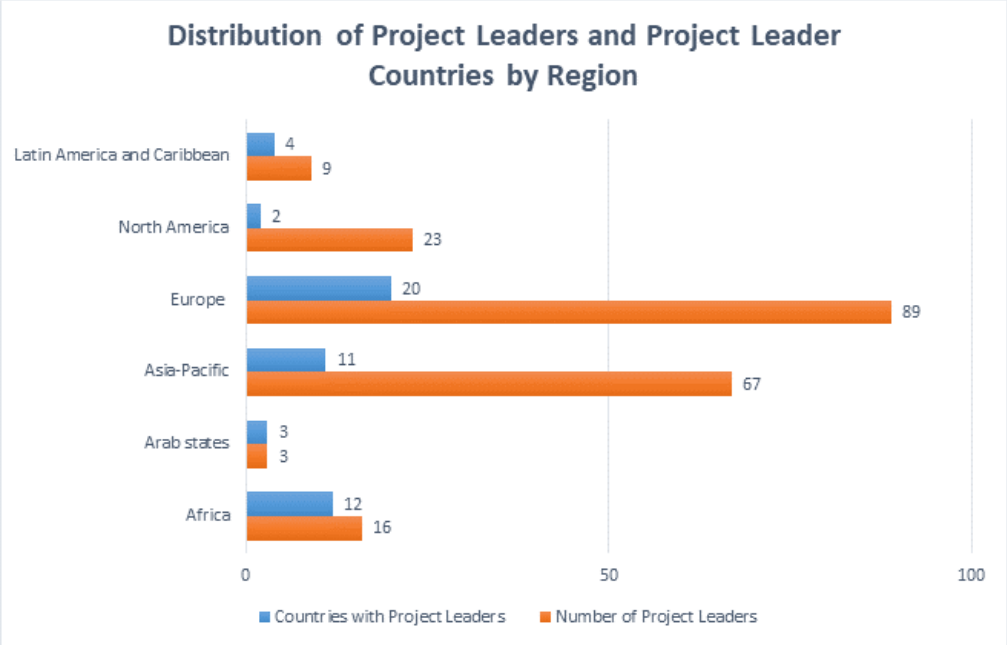


Figure 6: Distribution of 207 Project Leaders from 52 Project Leader countries by region

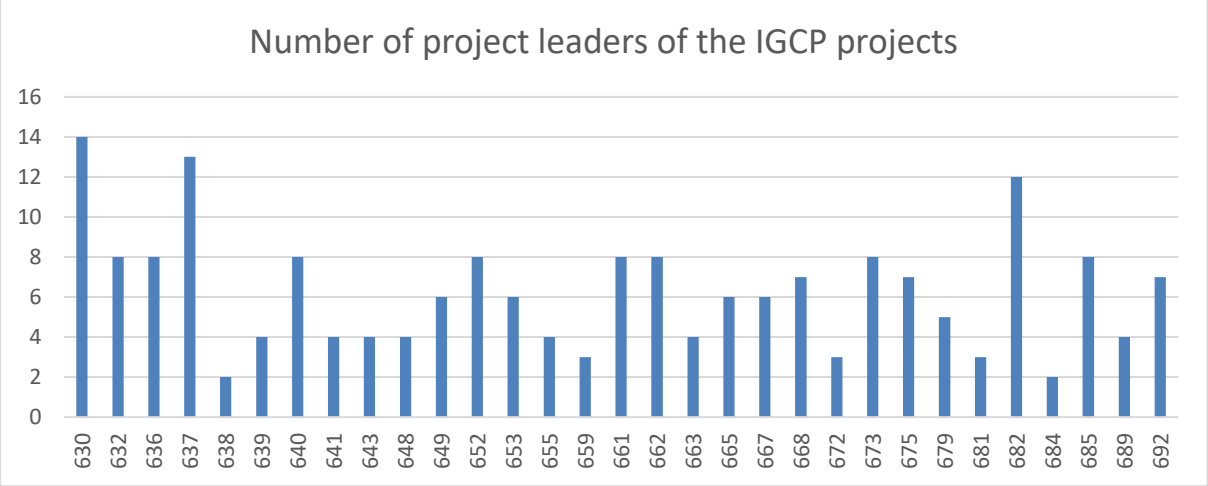


Figure 7: Number of Project Leaders in each IGCP project

5.3 Country distribution

In 2019, the number of countries participation from Africa, Latin America and Caribbean region, Arab States, Asia/Pacific participation has increased. ***Figure 8*** displays the number of countries in each region that are active in the 27 IGCP projects in 2018 and the **31** IGCP projects in 2019, and ***Figure 9*** displays the number of member states involved in each project.

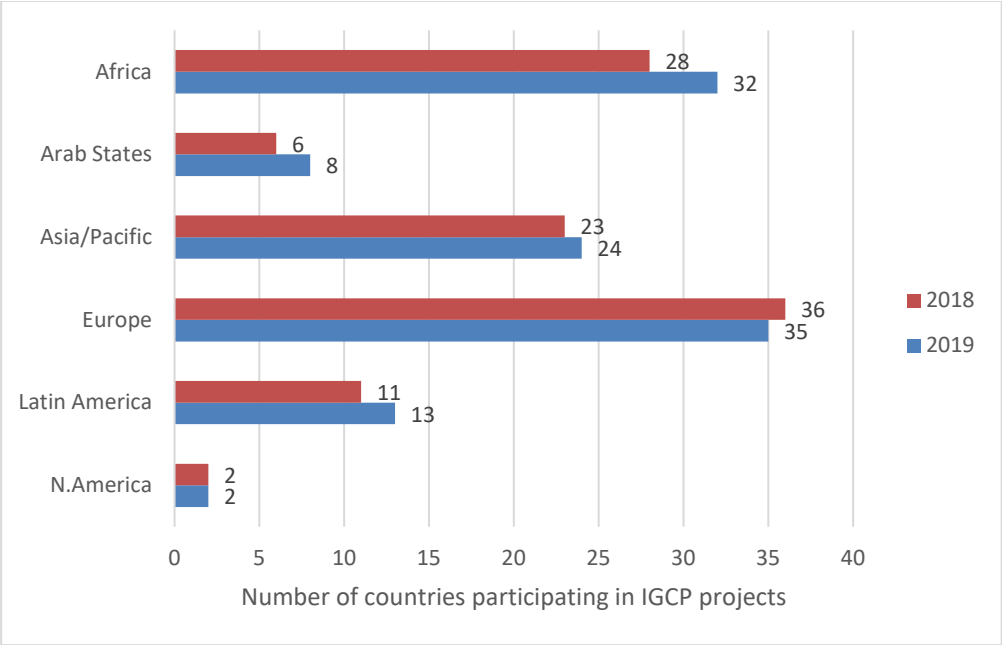


Figure 8: Distribution of the countries participating to the IGCP projects in 2018 and 2019

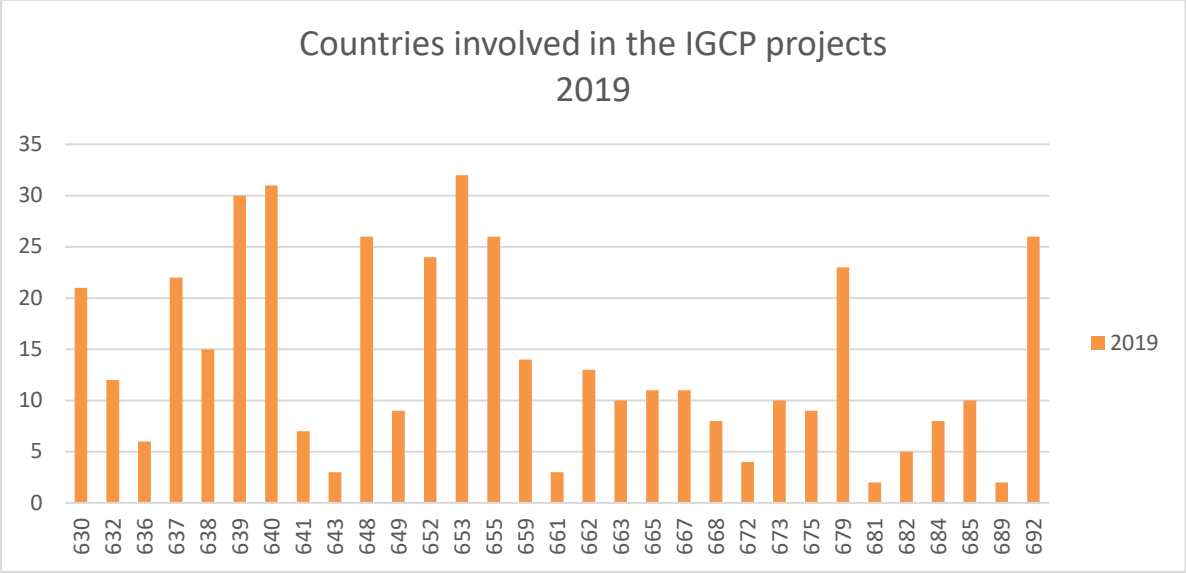


Figure 9: Number of Countries involved in each IGCP Project in 2019

5.4 IGCP Project participation demographics

According to the project annual reports, a total of 207 project leaders brought together 4417 project participants to deliver the objectives of the **31** active IGCP projects that received financial supports from IUGS and UNESCO. Of all the project participants, 49% are young scientists (<35 years old) and 50% of all participating scientists are from developing nations.

The overall analysis of the 2019 annual reports confirms the trend observed during last four years which shows that IGCP project outreach and diversity have increased continuously over the years. Gender equality is one of UNESCO's priority areas, and the IGCP projects show very promising results, with women comprising of a total of 34% of all participating scientists in 2019 (***Figure 10***).

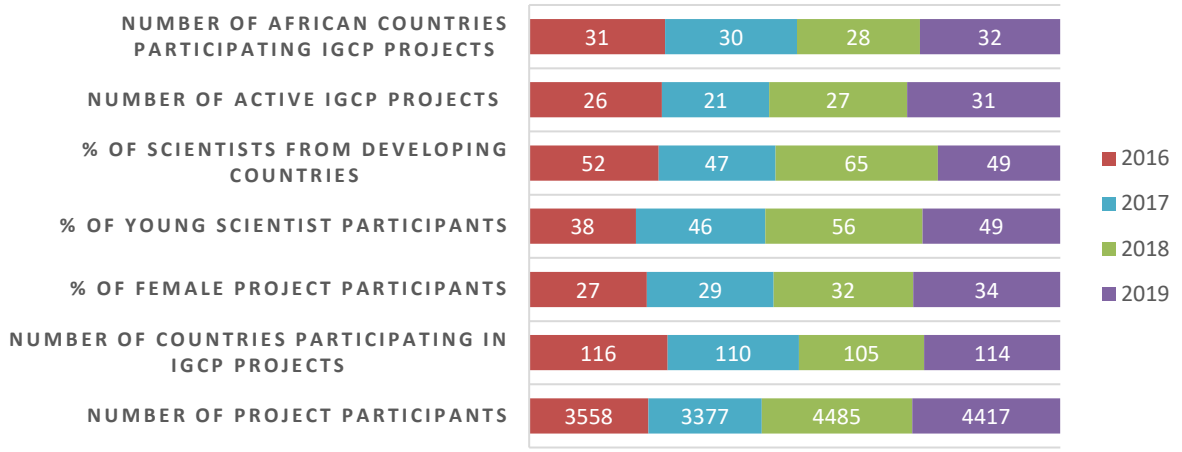


Figure 10: IGCP projects and participants details since 2016

Additionally, the 2019 annual reports indicate that 32% of the 207 project leaders are women. Women also make up 33% of the 1944 participants from developing countries. These percentages increase in the young scientists group, where out of 1939 young scientists, 38% are young women (***Figures 11 and 12***).

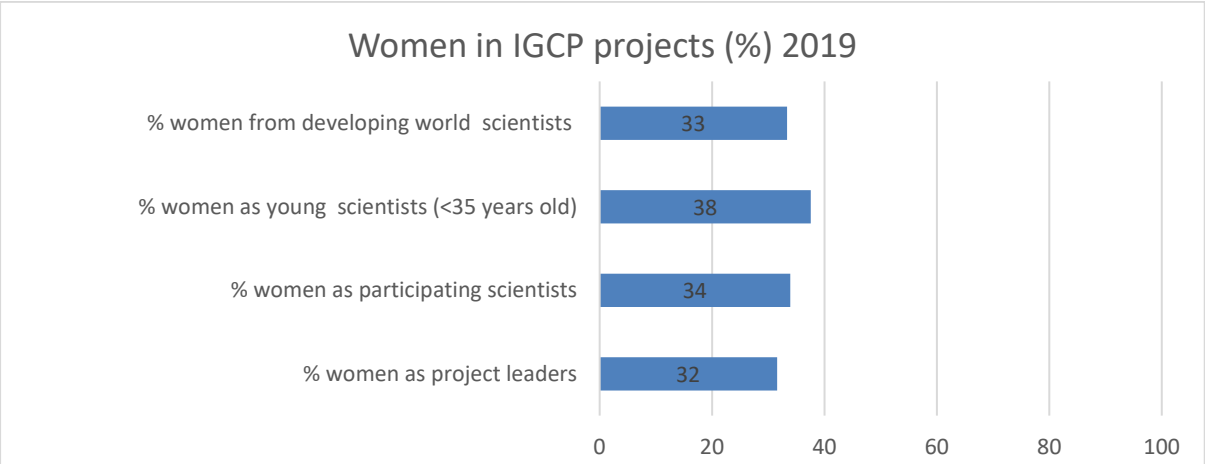


Figure 11: IGCP project female participant details 2019

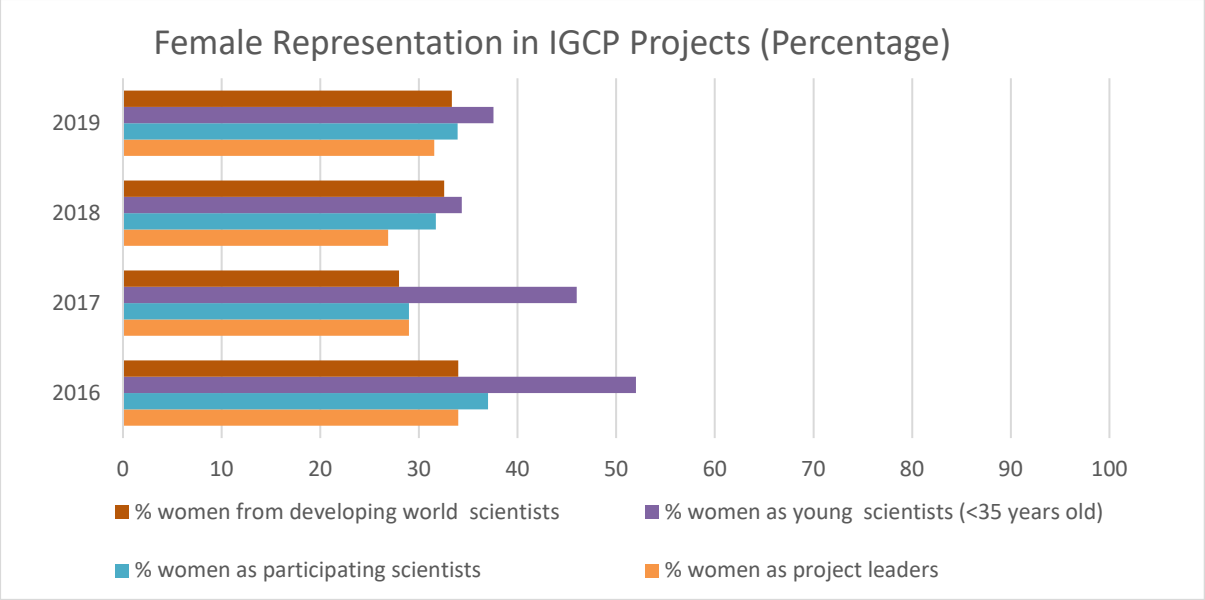


Figure 12: IGCP project female participant details since 2016

6 Collaboration between UNESCO Global Geoparks and IGCP projects

The **International Geoscience and Geoparks Programme** (IGGP) consists of two pillars: **International Geoscience Programme** (IGCP) and **UNESCO Global Geoparks** (UGGp) which are delivering jointly UNESCO's mandate for Earth sciences research and capability for Sustainable development of our Member States. During 2019 several IGCP projects worked in collaboration with the UNESCO Global Geoparks:

- IGCP Project 692 - Geoheritage for Geohazard Resilience project leaders participated to the Global Geoparks Network meetings and workshops (Sevilla European Geoparks meeting, 2nd Latin America Geopark Workshop and the Manizales UNESCO Geoparks workshop) and also helped several aspiring Geoparks with the application process to become an UNESCO Global Geopark. In 2020 the project is planning to organize a Field Workshop in Ometepe Aspiring Geopark in Nicaragua and a workshop during the Global Geopark Network Conference Meeting in Jeju, republic of Korea in September 2020.

- IGCP Project 685 - Geology for Sustainable Developement worked actively together with the Aspiring Torotoro Andean Geopark, organized a meeting in the Geopark (Geological mapping in context of Andean Geoparks).

- IGCP Project 661 - The Critical Zone in Karst Systems is delivered by the International Research Centre on Karst (IRCK) under the auspices of UNESCO. IRCK and IGCP 661 project supported the Aspiring Xiangxi Geopark and organized an international training course in this Geopark.

- IGCP 668 - Equatorial Gondwanan history and Early Palaeozoic Evolutionary Dynamics is an integral part of the UNESCO Satun Global Geopark.

7 IGCP UNESCO Internal Oversight office (IOS) evaluation in 2019

The International Geoscience and Geoparks Programme (IGGP) is part of the UNESCO portfolio of activities and programmes aimed at supporting research and capacity in Earth Sciences supporting UN 2030 Sustainable Development Agenda.

UNESCO evaluates its programmes every 4-5 years and IGGP 2019 evaluation has assessed performance of the overall IGGP, while looking at the appropriateness of its implementation mechanisms and processes. Upon the request of UNESCO's Internal Oversight Service and the Natural Sciences Sector (SC), the recommendations stemming from the evaluation are meant to help shape the future of the IGGP and increase its impact and meaningfulness.

The evaluation is expected to yield conclusions and lessons on the results generated by the IGGP, which are meant to feed into the programme's learning process, acknowledging what works well and what are the factors of success; and suggest how to improve different aspects of the functioning of the programme and its two pillars in order to ensure results are fully in line with intended objectives. Specifically, the evaluation set out to:

- Assess the IGGP's (i.e. IGCP and UGGp) relevance, efficiency, effectiveness and impact, sustainability, partnership and cooperation

- Provide evidence on key achievements and value added of each component of the UNESCO geoscience work to the SDGs, the Sendai Framework and the African Union Agenda 2063

- Draw conclusions and formulate lessons learnt for the International Geoscience Programme (IGCP), the UNESCO Global Geoparks Programme (UGGp) and the IGGP as a whole

- Provide recommendations for the future design and functioning of the IGGP programme and its two pillars to be followed by a management response leading to concrete actions. With a final report are intended to be used by a range of stakeholders. This includes UNESCO (headquarters and field offices), as well as the governing bodies of the programme such as the IGCP Council and Bureau, the UNESCO Global Geoparks Council and the UNESCO Global Geoparks Bureau, the IGCP Scientific Board. Additional expected users of the evaluation are key strategic partners to UNESCO in the delivery of the programme such as the Global Geoparks Network (GGN) and the International Union of Geological Sciences (IUGS), national / regional IGCP and geopark committees.

The evaluation has covered the entire IGGP including its two sub-programmes (i.e. IGCP and UGGp) for the 2014 -2019 period. It has been built on previous evaluations carried out which have addressed UNESCO's work in support of the geosciences.

First draft of the report indicated positive review and assessment of the IGCP and requested UNESCO to provide further financial and human resources support for the management of the IGCP. The final report of this evaluation is being finalised and will be presented during 209th Session of UNESCO Executive Board in April 2020.

8 IGGP 2019 Financial Summary

In 2019 UNESCO HQ contributed, $125,250.00 for IGCP 2019 Projects and $16,770.00 for IGCP Council meeting related logistics, adding up total UNESCO contribution to the IGCP in 2019 total amount of $142,020.00. IUGS kindly provided $ 60,000.00 and total IGCP budget for projects and Council meeting was $202,020.00. This is a substantial increase from previous years (***Figure 13***) however due to high number of new IGCP project proposal submission in 2019 (26 new proposals) and the potential of over 35 projects would be eligible for funding in 2020 (***Figure 1***) there is a need for further budget increase hence IGCP secretariat is carrying resource mobilization activities to secure additional financial support for the IGCP projects.

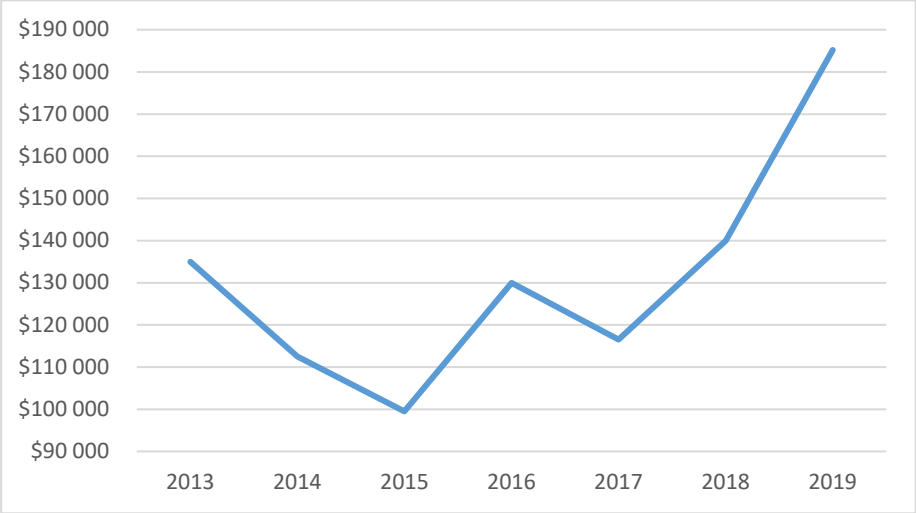


Figure 13: IGCP projects funding changes between 2013 and 201 showing, considerable increase in 2018 and 2019 thanks to new donations from the JPDC of Republic of Korea.

Additionally, thanks to the extra-budgetary donation from Jeju Province Development Corporation (JPDC) from the Republic of Korea as well as underspent regular programme funds from previous years, UNESCO IGCP secretariat financially supported the participation 32 early career scientists from 21 Member States to five IGCP field trips and International conferences in 2019 and UNESCO spent additional $37,000 for the co-organization of five events in China, Nepal, Tunisia, Ireland and Ivory Cost to sponsor 32 early career scientists (***Figure 14***)

	IGCP projects	IGCP mentorship and exchange initiative
2019 budget	**$ 185k**	**$37k**
Number of participants received funding from UNESCO	226	32
Number of IGCP events received funding from UNESCO	39	5
Total number of IGCP events organized in 2019	70	5
Total number of total participants the IGCP project events	4,417	175

Figure 14: IGCP projects and IGCP Secretariat led capability activities outreach and funding distribution showing that IGCP financially supported **258** geoscientists in 2019 with total $222k.

9 IGCP Council Members and theme summaries of active projects in 2019

As stated previously, the IGCP Council, supported by the Scientific Board (Annex 10), is responsible for evaluating project proposals according to the IGCP Guidelines, as well as the quality assessment of projects that are in progress.

The IGCP Council is composed of six members, all of which are 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 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 for the IGCP 4th Council meeting in February 2019 and voted that Dr Brigitte Vlaswinkel as the chairperson, Dr Prof Sobhi Nasir as vice-Chair person and Prof Carlos Vargas Jimenez as the Rapporteur of the Council.

Dr Brigitte Vlaswinkel obtained her PhD in Marine Geology and Geophysics at University of Miami, USA, in 2007. She presently works as Head of Research at a young, clean-tech company Oceans of Energy, which specializes in floating renewables and ocean energy. Besides this, Dr Vlaswinkel is the Environmental Impact Lead at The Ocean Cleanup.

9.1 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 2019 highlights of the IGCP Earth Resources Theme drafted by Prof. Sobhi Nasir (Jordan/Canada).

Professor Sobhi Nasir graduated in Mineralogy/Petrology at Wurzburg University, Germany (1986). Prof. Nasir joined the Sultan Qaboos University in Oman in 2004 as a Head of Department and now he is the Director of Earth Sciences Research Centre and the UNESCO Chair for Ophiolite Studies as well as an Adjunct Professor at Western University, Canada.

9.2 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 2019 highlights of the IGCP Global Change Theme drafted by Prof. Weijian Zhou (China).

Dr Weijian Zhou was graduated from Guizhou University, (1976) and a PhD in Geology from North-West University, China (1992-1995). Currently, she is the Director and Professor of the Xi'an Accelerator Mass Spectrometry (AMS) Centre, the Director of the academic board of State Key Laboratory of Loess and Quaternary Geology, CAS (Chinese Academy of Sciences).

9.3 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., super volcano eruption or meteorite impact). Earth scientists undertake research to better understand such hazards and contribute to risk reduction. Annex 3 details the 2019 highlights of the IGCP Geohazards Theme prepared by Dr Carlos Vargas Jimenez (Colombia).

Dr Carlos Alberto Vargas J. is Professor in the Department of Geosciences of the Universidad Nacional de Colombia at Bogota. He is the Director of the Geophysics Research Group, and Director of the Seismological Network of this institution. Prof Vargas obtained his PhD in Geophysics from the Technical University of Catalonia (UPC), Barcelona, Spain in 2003.

9.4 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 2019 highlights of the IGCP Hydrogeology Theme summarized by Dr Yongje Kim who is the IGCP Council Member representing Hydrogeology Theme.

Dr Yongje 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.

9.5 Geodynamics: 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 2019 highlights of the IGCP Geodynamics Theme drafted by Dr Nellie Mutemeri who is the IGCP Council member for the Geodynamic Theme.

Dr Nellie 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.

Annexes

Annex 1

2019 Summary of IGCP Earth Resources Theme

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

Duration: 3 years (2016-2018) + 1 year OET (2019)

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 successfully managed to generate substantial funding for research, infrastructure and mobility for the whole consortium. The project established a wide cooperation between universities and research institutions from four continents and this background provides a unique opportunity to complete comparative studies with comparable approach on different types of geothermal systems. The project obtained many excellent achievements, including field works and data collections, meetings, graduate students involvements and development of research projects

Related UN SDGs: This project addresses the main objectives of IGCP, UNESCO and IUGS. It contributes to **SDG 4-**Quality Education, as one of the specific project objectives are to support young scientists and students from developing countries; for that reason 67% of the scientists involved are under 35 years old. The project also contributes to **SDG 7-**Affordable and Clean Energy and **SDG 13-**Climate Action 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 2019 participants: 226 participants from six countries (Colombia, Chile, France, Belgium, Canada, Madagascar) actively participated last year. 50% of scientists are female, 50% are male; 55% is under 35 years old.

Scientific activities *(meetings, workshops, training sessions)***:**

1. Hydrogeochemical short course (February, 2019): UdeM, 3 countries (Colombia, Chile, Italy), around 40 participants. Course taught by Professor L. Daniele from CEGA.
2. Geothermal Day (October 24, 2019): Update on the research activities on geothermal resources at UdeM, around 70 participants.
3. RENAG 2019, Medellin, Colombia (November 25-29, 2019); around 80 participants, countries: Colombia, Italy, Chile, Peru, Ecuador, Canada, Bolivia, France, and Argentina
4. GAC-MAC-IAH, Quebec City (May 2019), Canada's largest geosciences conference organized by the Geological Association of Canada (AGC), Canada Mineralogical Association (CMA) and the International Association of Hydrogeologists (IAH), three

Canadian geoscience organizations. A seminar was organized by the IGCP636Y group

5. First annual meeting of the RIGS network, organized by Mar Alcaraz from IHLLA. Mar Alcaraz is a research co-leader of the new IGCP proposal submitted on October 2019. 13 participants, countries: Colombia, Chile, Argentina, Ecuador, Mexico, Spain.
6. Canadian geothermal student day at INRS: https://canadiangeothermal.wixsite.com/cgsd

Scientific achievements/ results *(papers, new findings, new models, new data, new maps etc.)***:** The project published five scientific papers this year.

Societal/educational results/highlights *(media coverage, science education, cultural activities)***:** At the end of 2019 the project started working with a school in the metropolitan area of Medellin (Colegio Leonardo da Vinci, in the municipality of Envigado). The goal is to offer scientific support for the execution of the Science Festival, which is organized yearly in the school.

UdeM continues working with INRS (works on energy issues related to remote communities of the Arctic, in Inuit villages where geothermal energy could replace fossil fuel), ULaval, and UChile to improve the assessment of geothermal potential at the NRV and a new contact has been made with the Viva Villamaría, which wants to promote the study area for eco-sustainable tourism.

A radio interview was conducted with Professors D. Blessent, J. Raymond, and I.J. Lopez, and several TV interviews to the same Professors and other researchers attending the RENAG 2019 conference at UdeM were conducted.

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. The project aims to include more heritage stone sites from emerging countries where professional and social awareness are limited to preserve geological and cultural heritage.

Related UN SDGs: The project contributes to **SDG 4-**Quality Education as one of the specific project objectives are to support young scientists and students from developing countries

Countries involved, approximate number of total 2018 participants: 22 countries and 19 participants are actively involved in the project this year: 6 from developing countries and 13 from developed countries (Argentina, Australia, Austria, Belgium, Brazil, Canada, France, Germany, India, Ireland, Italy, Malta, Netherlands, Norway, Portugal, Romania, Slovenia, Spain, Sweden, UK, Uruguay and USA). 49% are female scientists, 51% male scientists and 25% are young scientists under 35 years old.

Scientific activities *(meetings, workshops, training sessions)***:** The IUGS Heritage Stones Sub-Commission had its sixth European Geosciences Union meeting in Vienna on 11th April 2019 13 oral contributions and 10 posters were presented, following a very active Splinter Meeting on the 10th of April 2019. The project also presented their project at the EGU 2019 using an abstract and a poster.

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

- 37 published papers
- New seven GHSR have been ratified by IUGS EC
- A special heritage stone issue has been published by "Geoheritage" (Springer). The publication was co-ordinated by Pereira and Cárdenes (Guest Editors)
- A new series of books on Natural Stones and World Heritage has been initiated. The first book, edited by D. Pereira, was published in February 2019, on Salamanca, Spain.
- D. Pereira, L. Catarino and G. Dino were editors of a Special Issue on Natural Stones and Architecture, published by the journal Sustainability.

Societal/educational results/highlights *(media coverage, science education, cultural activities)***:** Several articles have been generated for technical journals and local papers. The present project Leader has been interviewed about heritage stones and related projects by local newspapers and academic media aiming a wider diffusion. A video has been recorded at the University of Salamanca with information about the IGCP-637. The HSS is organizing a workshop on Heritage Stones in 2020, in Torino, and information on this activity will be published in different media.

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 addresses the scientific objectives of IGCP, UNESCO and IUGS. It contributes to **SDG 6-**Clean Water and Sanitation 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 **SDG 8-**Decent Work and Economic Growth and **SDG 12-**Responsible Consumption and production 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 2019 participants: Fifteen countries and 150 participants were actively involved in the project this year: 12 African countries (Algeria; Benin; Côte d'Ivoire; Gabon; Ghana; Guinea; Morocco; Mali; Nigeria; Niger; Senegal; Tunisia), Mexico and two developed countries (Australia, France). 16% is female scientist, 84% is male scientist participant and 73% are young scientists under 35 years old.

Scientific activities *(meetings, workshops, training sessions)***:** The project organized the Fourth IGCP 638 conference in Algeria which was attended by 150 scientists from 15 countries.

Scientific achievements/ results *(papers, new findings, new models, new data, new maps etc.)***:** The project produced a field trip guide book and abstract book of the 4th IGCP 638 conference, organized field trips in Paleozoic-Mesozoic Formations and published 34 papers.

Societal/educational results/highlights *(media coverage, science education, cultural activities)***:** Some results of the project works were released by press online and websites of different institutions, universities, task group, Associations and non-governmental organization (NGO).

IGCP 665-Sustainable use of black soil critical zone

Duration: 5 years (2018-2022)

Aims: This project focusses on investigating the three major black soil zones located along the mid-latitude, how they were formed and how they evolve. An observation system using remote sensing, geochemistry and critical zone observatories will be established for a comprehensive understanding of the black soil critical zone and its mutual impacts with global change. The research might extend to other black soils, e.g., Pampas Prairie in South America if possible. The outcomes including data and observatories will be open to the public for education and research purposes.

Related UN SDGs: Caring and preserving black soils through sustainable soil management practices and global cooperation is imperative for achieving Zero Hunger (**SDG 2**) and Climate Change (**SDG 13**). This project brings together several Black soils countries (**SDG 17-** Partnerships for the Goals).

Countries involved, approximate number of total 2019 participants: 70 participating scientist, 30% female scientist, 70% male scientist and 43% are young scientists/students. Countries: China, US, Czech Republic, Russia, Greece, Canada, Ukraine, UK, Cyprus, Mongolia, Poland North Korea

Scientific activities *(meetings, workshops, training sessions)***:** An IGCP 665 workshop (the third workshop on global black soil critical zone geo-ecological survey, BASGES) was held on Nov. 19-21, 2019. About 70 scientists from China, US, Russia, Czech, Ukraine, Greece, Mongolia and Cyprus attended the workshop. Aca. Peng Suping, president of IBSS attended the workshop and gave a speech.

Scientific achievements/ results *(papers, new findings, new models, new data, new maps etc.)***:** The second volume atlas on geo-ecological content of black soil critical zone of different scales has been finished including 89 pictures and specifications. The data were mainly from existing research achievements of the scientists involved in IGCP 665, e.g. Geochemical and Mineralogical Surveys by USGS, Multi-purpose Geochemical Surveys by SGS, GEMAS by EuroGeoSurvey, Land Remote Sensing Program by USGS, World Soil Spectrum Lib by CSIRO and Space-Air-Ground RS Survey by SGS.

Societal/educational results/highlights *(media coverage, science education, cultural activities)***:** A training session on RS and CZ methods and techniques was held in Fushun Liaoning province on June 16-18 and about 200 scientists attended the session. The training content included remote sensing and geochemical survey methods, theories, and the critical zone modelling ideas, and also included mapping skills.

IGCP 675-Sandstone-type Uranium Deposits

Duration: 2 years (2019-2020)

Aims: The project focus on the comparative analysis of mineralization and geological background of worldwide sandstone-type uranium deposits, application and dissemination of new technologies and new approaches of mining, development of guidance for global ore exploration, and training of young geologist and utilization of uranium resources to facilitate global energy saving and carbon emission reduction.

Related UN SDGs: This project addresses **SDG 7-**Affordable and Clean Energy as well as **SDG 9-**Industry, Innovation and Infrastructure and **SDG 11-**Sustainable Cities and Communities.

Countries involved, approximate number of total 2019 participants: Total more than 90 members from 9 countries participated in the IGCP 675, including scientists from China, Russia, the USA, Canada, France, Zambia, Australia, Tanzania and Austria. 70% of the scientists were male, 30% female and 44% young scientists/students.

Scientific activities *(meetings, workshops, training sessions)***:** The 675 project organized one Field Excursion in China, an annual symposium, several group meetings, scientific and training activities in Zambia, two field works in France and Australia and the members of the project have attended multiple international conferences.

Scientific achievements/ results *(papers, new findings, new models, new data, new maps etc.)***:** The project published 17 papers and one book (“Geological background of sandstone-type uranium mineralization in the Ordos basin”). They achieved to construct a Sandstone-type uranium metallogenic model controlled by the vertical tectonic movements of the Mesozoic and Cenozoic basins in Northern China and to generalize the materials for the Vitim uranium ore district in Transbaikalia. They also discovered the paleo-environmental constraints on uranium mineralization in the Ordos Basin.

Societal/educational results/highlights *(media coverage, science education, cultural activities)***:** Last year the project trained young geologists to construct the database of drill holes, to understand the uranium geological survey standards, and geological survey methods in China. The project also organized a public presentation and visiting for students on the 'Earth Day' in 2019 and published three books on popular science.

IGCP 682-Mine Tailing Revalorization

Duration: 3 years (2019-2021)

Aims: The project aims to 1) improve the understanding of the geological processes controlling metals mobility in mining and industrial tailings, 2) improve the bioleaching efficiency through the detailed understanding of the tailing mineralogy, geochemistry and microbiology, and iii) achieve an efficient and repeatable REE and other CRM recovery from bio-leachates using advanced sorbent materials.

Related UN SDGs: By contributing to the sustainable mining in developing countries, this project contributes to the **SDG 1-**No Poverty, **SDG 7-**Affordable and Clean Energy, **SDG 11-**Sustainable Cities and Communities.

Countries involved, approximate number of total 2019 participants: 59 participants from 5 different countries were active in this project this year (Chile, Spain, Ireland, Australia and South Africa). 49% of the scientist are female, 51% male and 28% of the scientist are younger than 35.

Scientific activities *(meetings, workshops, training sessions)***:** Project IGCP 682 organized 3 meetings; 2 project delivery meetings at Santiago and Barcelona and one GRCT combined meeting at Barcelona. In total 25 scientists participated to these events. They also organized a Session at Goldsmidt 2019 Conference (Barcelona) where 34 scientists were present.

Scientific achievements/ results *(papers, new findings, new models, new data, new maps etc.)***:** The project generated a special issue with the UNESCO-IGCP682 research topic in Journal of Geochemical Exploration.

IGCP 685-Geology for Sustainable Development

Duration: 5 years (2019-2023)

Aims: The aim of the GeoSD project is to unite a diverse global 'community of practice' around the emergent theme of geology for sustainable development.

Related UN SDGs: This project addresses **17 SDGs**

Countries involved, approximate number of total 2019 participants: In 2019, 105 scientists from 10 countries were involved in this project (Brazil, Bolivia, Colombia, Germany, India, Italy, Portugal, Spain, Turkey, USA)

Scientific activities *(meetings, workshops, training sessions)***:**

- Meeting: UN Forum on Science, Technology and Innovation for the SDGs; New York, USA; 14-15 May
- Meeting: Geological mapping in context of Andean Geoparks; Torotoro Andean Geopark, Bolivia; 22 July-1 August
- Meeting: Sustainability and energy summit; Cartagena, Colombia; 11-12 December
- Meeting: 7th GfGD Annual Conference - Earth Science, Health & Wellbeing; Londen, UK, November (Not funded by IGCP)
- Workshops (Not funded by IGCP):
    - Bologna University, Italy 25-26 February
    - Lisbon University, 1-2 March
    - Kandilli Observatory and Earthquake Research Institute, Boğaziçi University, Istanbul, 5-7 Oct 2019)
    - Ashoka University, Songipat, India (Nov)

Scientific achievements/ results *(papers, new findings, new models, new data, new maps etc.)***:** The first year of IGCP Project 685 has been focused on communicating the emerging profile of 'sustainable geoscience' across a variety of sectors, publishing 2 papers.

Societal/educational results/highlights *(media coverage, science education, cultural activities)***:** The project organized four workshops as indicated in the scientific activities.

Annex 2

2019 Summary of IGCP Global Change Theme

IGCP 630-Permian-Triassic Climatic and Environmental Extremes

Duration: 4 years (2014-2018) + 2 years OET (2019-2020)

Aim: This project aims to investigate the climatic and environmental extremes and ecosystem response during the Permian-Triassic mass extinction and its aftermath through analyses of the worldwide rock and fossil records.

Related UN SDGs: **SDG4-**Quality Education, **SDG 13-**Climate Action, **SDG 15-**Life on Land

Countries involved: Total 424 persons/times from 21 countries participated in the IGCP 630: Armenia, Australia, Austria, Canada, China, Croatia, Czeck Republic, France, Germany, India, Italy, Japan, Malaysia, Poland, Romania, Russia, Slovenia, South Africa, Switzerland, UK, USA

Scientific activities:

- IGCP 630 Workshop: Wuhan, China, 15-22 September 2019, China University of Geosciences (Wuhan), Wuhan, China; Field Workshop in Three Gorge area, western Hubei Province, 18-22 September 2019. [Co-leaders: Jinnan Tong, Zhong-Qiang Chen, Paul Wignall chairing this workshop]
- IGCP 630 Session: "Triassic stratigraphy and environmental & Biotic events", joint with the 2nd International Stratigraphy Congress, 2-6 July 2019, Milan, Italy; Co-leaders Charles Henderson, Zhong-Qiang Chen, chairing the session)
- IGCP 630 Session: End-Permian and Triassic extreme events and global correlations, joint at 19th International Congress on Carboniferous and Permian, Cologne, 29 July to 2 August 2019 (Co-leaders: David Bond, Zhong-Qiang Chen etc chairing the session)

Scientific achievements/results: The project published three special issues and a total of 152 papers in SCI-cited journals. These papers contained the new findings deepening the understanding of the P-Tr events and biotic responses.

Societal/educational results: The project has organized one Workshop at China University of Geosciences in Wuhan, China to train young researchers/or students on biotic and environmental modelling during deep-time critical periods. During the events, the young members obtained important trainings and face to face communicated with the established researchers on PTB extinction and recovery patterns and possible causes. Total 250 persons/times were trained in both indoor workshops and field excursions.

IGCP 639-Sea Level Changes from Minutes to Millennia

Duration: 5 years (2016-2020)

Aim: The aim of the project is to study records of past coastal sea-level change, provide a platform for the development of integrated records of sea-level change and coastal hazards obtained from instrumental, historical, archaeological, and geological records, promote the understanding of the impacts of human interactions, coastal dynamics and vulnerability at different timescales.

Related UN SDGs: SDG 13-Climate Action, **SDG 11-**Sustainable Cities and Communities

Countries involved: 146 scientists from**:** Australia, Brazil, Canada, China, Denmark, Estonia, France, Germany, Hong Kong, India, Iran, Italy, Jamaica, Japan, Korea, Lithuania, Morocco, Netherlands, New Zealand, Norway, Oman, Philippines, Portugal, Republic of Ireland, Republic of Korea, Russia, Singapore, South Africa, Spain, Sweden, Switzerland, Taiwan, Thailand, UK, USA.

Scientific activities:

- EGU Sea Level (>150), 13 presenting countries
- EGU Extreme Waves (>50), 5 presenting countries
- Annual Meeting (49), 14 presenting countries
- AGU Centennial Session (>200) 11 presenting countries

Scientific achievements/results:

1. Published 26 papers including in leading journals such as Quaternary Science Reviews, Frontiers in Earth Science, Progress in Physical Geography, Geomorphology, and Journal of Geophysical Research.
2. Published a second newsletter, edited by Jerome Gosling
3. Accepted the first papers for their fully open access Open Quaternary Special Issue

Societal/educational results: Prof Engelhart is a regular speaker at high schools and community events, disseminating the results of the project to a wide audience within his home region. Further, Engelhart led a two-week residential field trip for students aged 16-18 on climate change and sealevel rise in June 2019. Students learnt the science behind climate change and sealevel rise, as well as being introduced to how we undertake coastal hazards research under the IGCP banner.

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

Duration: 3 years (2017-2019)

Aim: This project aims to (1) reveal the impact on marine ecosystems of carbon cycle perturbation and the global warming through productivity, water stagnation and oxygen

depleted conditions, (2) elucidate the causes triggering this environmental change and to (3) clarify the initial phases of the biotic crisis and the factors controlling biotic recovery in different trophic levels from various habitats and climate zones.

Related UN SDGs: **SDG 13-**Climate Action, **SDG 14-**Life below Water, **SDG 15-**Life on Land

Countries involved: 111 scientists from**:** Algeria, Argentina, Brasil, Canada, China, Denmark, France, Germany, Hungary, Iran, Italy, Japan, Luxembourg, Morocco, Norway, Poland, Portugal, Russia, Saudi Arab, Slovakia, Spain, Switzerland, Tunisia, United Arab Emirates, UK, USA

Scientific activities: The project organized the 3rd International Workshop on the Toarcian Oceanic Anoxic Event in Erlangen (Germany) which included 111 researchers from 65 research centers corresponding to 26 countries.

Scientific achievements/results: The project published 23 new papers representing their improved knowledge about the T-OAE from different approaches and topics (Stratigraphy, geochemistry, effect on the marine and terrestrial communities).

Societal/educational results: The project organized an educational course dedicated to teachers of high-schools and 25 teachers participated. Prof. Duarte also participated in the "Conferência Alterações Climáticas: As variabilidades climáticas na História da terra Paleoambientes, Extinção e Biodiversidade" oriented to the Global Change.

IGCP 652-Reading geologic time in Paleozoic sedimentary rocks

Duration: 5 years (2017-2021)

Aim: The project intends to improve the Paleozoic timescale in order to unravel the history of the Paleozoic Earth system and study the environmental evolution during the Paleozoic with a focus on the Ordovician to Devonian (485 – 359 million years).

Related UN SDGs: **SDG 4-**Quality Education, **SDG 13-**Climate Action

Countries involved: 107 scientists from**:** Algeria, Austria, Belgium, Brazil, Canada, China, Czech Republic, Estonia, Germany, Iran, Lithuania, Mongolia, Myanmar, Netherlands, Poland, Portugal, Russian Federation, Sweden, Switzerland, Spain, Tunisia, UK, USA, Vietnam.

Scientific activities:

- Session at EGU-2019 (Vienna) - CL1.07 Climate response to orbital forcing
- Session at EGU-2019 (Vienna) - SSP2.2 Integrated Stratigraphy - Recent advances in stratigraphic systems and age modelling, (De Vleeschouwer as convener),
- Session at Strati-2019 (Milano) - ST2.3 Applications of cyclostratigraphy in understanding Earth history. (Sinnesael convener).

- Session at Strati-2019 (Milano) - ST3.3 Silurian odyssey towards advanced stratigraphy and correlation, Conveners: Petr Štorch, Carlo Corradini, Zhan Renbin.
- Session at Strati-2019 (Milano) - ST3.4 The Devonian: life, environments and time. Conveners: John Marshall, Ladislav Slavik, Carl Brett.
- Joint session with IGCP-653 project at GSA 2019 - T116. The Ordovician Earth: Integrated Perspectives on the Fossil and Rock Records
- Geology of Western Mongolia, Workshop, 4-6 November 2019, Vienna, 9 participants, 4 female, 5 male - out of them 1 PhD student (female)

Scientific achievements/results: The project has been working on building a high-resolution database of paleoclimatic proxies. They also published more than 20 papers concerning topics as improving the Paleozoic time scale and biostratigraphy of target intervals, the study of major biological crises and the paleoclimatic evolution.

Societal/educational results: The project organized two workshops with teaching/exercises on cyclostratigraphy in Lanzhou and Oklahoma.

IGCP 653-The onset of the Great Ordovician Biodiversification Event

Duration: 5 years (2016-2020)

Aim: The project focuses on the understanding of the onset of the Ordovician radiation, attempts to answer a main question: what is and what triggered the Ordovician biodiversification?

Related UN SDGs: **SDG 4-**Quality Education, **SDG 13-**Climate Action

Countries involved: 269 scientists from: Algeria, Argentina, Australia, Belgium, Canada, China, Colombia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Iran, Ireland, Italy, Japan, Latvia, Lithuania, Morocco, Norway, Poland, Portugal, Russia, Saudi Arabia, South Korea, Spain, Sweden, Switzerland, UK, USA, Vietnam

Scientific activities:

- Meeting: “The International Symposium on Paleozoic Geological Time and The Annual Meeting of IGCP 652 Project of the International Earth Science”; Lanzhou, China; 21-27 August 2019
  - Workshop: Milankovitch, climatic theories and the spectral analysis package Acycle
  - Fieldtrip: Paleozoic succession of North China
- Workshop: Geology of Western Mongolia; Vienna, Austria; 4-6 November 2019 (Not funded by IGCP)

Scientific achievements/results: The project published 74 papers in peer-reviewed journals, some with high impact. Several papers in journals of high impact demonstrated that the Great Ordovician Biodiversification Event (GOBE) was a follow-up of the Cambrian explosion, and

that the entire Cambrian radiation was a continued biodiversification with a cascading trend (Rasmussen et al., 2019, PNAS). This follows on the continuation of understanding the details of the cause behind that GOB. They also produced two special issues (Palaeoworld, Palaeo3) which would not been possible without the IGCP 653 project.

IGCP 668-Equatorial Gondwanan history and Early Palaeozoic evolutionary dynamic

Duration: 5 years (2018-2022)

Aim: The connection between the global biodiversification and extinction and the Cambrian-Ordovician transition has been poorly understood. A block formed by the intense felsic magmatism in equatorial Gondwana could potentially provide high geochronologic resolution for the Cambrian and Ordovician based on its intrusive and extrusive rocks and thus give opportunity to 1) determine whether episodes of regional extinction correlate with peaks in magmatic activity and whether such regional patterns could be globally. The project will also 2) provide international coordination in updating taxonomy by integrating the disparate data across equatorial Gondwana in the context of the long history of stratigraphic research in the South and Southeast Asia. Accordingly, a further aim of this project will be 3) to input a wide range of information from stratigraphic logs from equatorial Gondwana into a single Constrained Optimization database, obtaining a unified geochronology.

Related UN SDGs: **SDG 13-**Climate Action, **SDG 14-**Life below Water, **SDG 15-**Life on Land

Countries involved: 839 scientist from: Thailand, China, Japan, USA, Brazil, Madagascar, Bangladesh, India

Scientific activities:

- Meeting: North American Paleontological Convention (NAPC); Riverside, California; 22-27 June 2019
- Symposium: International Symposium on Environment and Climate Crises; Kolkata, India; 20 December 2019 (Not funded by IGCP)

Scientific achievements/results: The project has published 8 papers in 2019, mainly focused on geotectonics of the region and early Palaeozoic paleobiodiversity of invertebrate faunas. They also strengthened scientific and educational capacity in relevant developing countries.

Societal/educational results: Establishment the UNESCO Satun Global Geopark has promoted of geoscience education and appreciation of nature, and generated positive spin-offs to the local economy. Co-leader Hughes has written the Gutishuti story about marine fossils on mountain tops for the geological outreach project in Myanmar.

IGCP 673-The End of A Supereon–Winners and Losers at the Precambrian-Phanerozoic Transition

Duration: 2 years (2019-2020)

Aim: This project aims to bring together all of the detail known about the geology of Southern Namibia where the first remains of large, multicellular organisms were found (dating from the Precambrian). They intend to seek answers to the questions yet unresolved, then produce a publication pulling all of this detail together in print and in documentary.

Related UN SDGs: **SDG 4-**Quality Education, **SDG 13-**Climate Action

Countries involved: 75 scientists from: Namibia, Australia, Germany, Australia, Switzerland, USA, Spain, Israel, Russia, Belgium, Canada, South Africa

Scientific activities: The project organized two Field workshops and a workshop with local residents involved in GeoTourism introducing 75 participants to the project.

Scientific achievements/results: This year the project focused on revisiting a number of stratigraphic sections in the area of southern Namibia and collating all of the data gathered from the early 1990's to present, including sedimentological, regional, geochemical, geochronological, and palaeontological. In addition many new sections were documented and specimens and data collected, which had never been documented and that new data has now been added to the ever growing database. In total the project published 16 papers.

Societal/educational results: The program works together with the School of Earth, Atmosphere and Environment at Monash University, Namibian Scientific Society and the Namibian Geological Survey to provide a long-term program of both public and primary/secondary educational programs.

This first year of IGCP 673 has led to a number of public lectures in Namibia – in Windhoek and Swakopmund, and the turnout to these lectures has been significant (more than 100 in Windhoek). Some of the material that has resulted from the research in Namibia was also showcased in an exhibition (DINOQUEST) at the Singapore Science Centre in Singapore. Several hundred thousand visitors attended this expo that was open from March through September 2019. The media coverage of this exhibition was significant, appearing on tv, radio and in newspapers, especially for the first 2 months of the expo.

IGCP 679-Cretaceous Earth Dynamics and Climate in Asia

Duration: 5 years (2019-2023)

Aim: The program aims to use earth system science to reveal the Cretaceous 'Greenhouse' Earth's oceanic and terrestrial climates and environmental conditions and their evolution. This will lead to an in-depth understanding of the existing characteristics of rapid climate and environmental changes and global warming.

Related UN SDGs: SDG 4-Quality Education, **SDG 13-**Climate Action

Countries involved: 300 scientists from: Argentina, Australia, Brazil, Cambodia, China, Czech Republic, France, Germany, India, Japan, Malaysia, Mongolia, Myanmar, Pakistan, The Philippines, Republic of Korea, Romania, Russia, Slovak Republic, Thailand, Tunisia, USA, Viet Nam

Scientific activities: The project organized their first international symposium in Shandong, China. 139 participants from 14 countries were present.

Scientific achievements/results: IGCP 679 participants have successfully published research results covering a broad spectrum of fields reflecting many facets of biodiversity, palaeoenvironment, palaeogeography and palaeoclimate from the marine and non-marine Cretaceous sequences in Asia, publishing more than 100 papers. These new research achievements can be divided into four parts: 1) new fossil records from marine Cretaceous; 2) new Cretaceous non-marine fossil records providing information on the palaeogeography, palaeoecology and palaeoclimate on land in Asia and South America, which help us to discuss the origin of angiosperm, the turnover of fossil floras and faunas; 3) new progress in the Cretaceous stratigraphy in China, Malaysia, Pakistan, the Far East of Russia, Thailand and Vietnam; 4) Cretaceous palaeoclimate reconstruction based on evidence from fossil records, special lithology and palaeo-weathering index.

Societal/educational results: 100 grade school and high school science teachers in Cebu City attended an information and education campaign titled “Geo-lecture series: Geology and geohazards in Central Cebu Island, Philippines”, at the University of the Philippines, Cebu campus. Members of the Philippine working group presented the latest geological data on Cebu Island as well as new information on earthquakes, landslides, coastal hazards and sinkholes. The project also organized an open educational lecture for schoolchilds in Siberian cities (Russia).

IGCP 681-History of toxic phytoplankton in Patagonia

Duration: 5 years (2019-2023)

Aim: The aim of this study is to reconstruct phytoplankton (microalgae) distribution and composition over the last 1000 years in sediments from western Patagonia. The results of this project could contribute to preserve and protect natural heritage from Patagonia, and to predict HAB’s (harmful algae) response on assessing future aquaculture feasibility for the region.

Related UN SDGs: SDG 13-Climate Action, **SDG 14-**Life below Water

Countries involved: 14 scientists from Chile and Argentina

Scientific activities: The project organized their first meeting “History of toxic phytoplankton in Patagonia. Work plan and protocols for sediment analysis.” in Valdivia, Chile.

Scientific achievements/results: The project has not published any papers yet but focused on determining the sediment sampling sites based on the critical sites related to the effects of harmful algal blooms in Chile and Argentina. A participant studied taxonomy of some sediment samples from San Matias Gulf, Argentina, and classified the species considering their capability to cause harmful algal blooms.

Societal/educational results: The project have increased the study group and stablished collaboration with 5 academic institutions and Plancton Andino, which is a private company that provides services as analysis of toxic phytoplankton for the aquaculture industry. Their first meeting was published in 10 local media of Los Rios Region and during the meeting interviews with the participants were organized.

Annex 3

2019 Summary of IGCP Geohazards Theme

IGCP project 640-Significance of Modern and Ancient Subaqueous Slope Landslides (S4LIDE)

Duration: 5 years (2015-2019)

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:

SDG 2-Zero hunger. *Target 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.

SDG 11-Sustainable Cities and Communities. *Target 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: Representatives of 29 countries collaborate in the IGCP project: Australia, Austria, Brazil, Canada, Colombia, China, Czech Republic, Egypt, France, Germany, India, Ireland, Israel, Indonesia, Italy, Japan, Republic of South Korea, Russia, Netherlands, New Zealand, Nigeria, Norway, Peru, Spain, Switzerland, Thailand, UK, USA, and Venezuela. About 75 people are involved in the project.

Scientific activities *(meetings, workshops, training sessions)***:** In 2019 the project organized their 2nd Workshop on Subaqueous Landslides and Morphometric Parameters in Colorado together with a S4SLIDE Special Session as part of the 34th IAS Meeting of Sedimentology in Rome.

Scientific achievements/ results *(papers, new findings, new models, new data, new map etc.)***:** The project published 51 peer-reviewed papers including a GSL Special Publication SP477 with forty-nine published papers.

Societal/educational results/highlights *(media coverage, science, education, cultural and informal)***:** S4SLIDE provides travel grants to students and early career researchers to encourage their participation in S4SLIDE events. Therefore, these events are heavily attended by graduate students who see these venues as an ideal place to present their academic work. S4SLIDE also continued to be fundamental in providing input for the framing of scientific questions of the ongoing SLATE initiative (Submarine Landslides and Their Impact on European Continental Margins) which is innovative training network.

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

IGCP 659-Seismic Risk Assessment in Africa (SEISMOSHAF)

Duration: 4 years (2018-2021)

Project Aims: The SEISMOSHAF aims to build upon the previously funded IGCP-601 project, new information and datasets to improve the seismotectonic map of Africa. The SEISMOSHAF project will include GPS monitoring, modelling of crustal stresses, InSAR data and field investigations of relevant structures with the aim to understand the links between the earthquake generation on active faults and the crustal deformation and to mitigate seismic risks in the African continent. In addition, it aims identifying the best pilot sites for a future early warning network of seismometers, and to build man-power in the field of seismic hazard assessment and risk management.

Related UN SDGs: This project contributes to the following sub-goals of the UN SDGs:

SDG 2-Zero hunger. *Target 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.

SDG 11-Sustainable Cities and Communities. *Target 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: 21 scientists from 15 countries collaborate in the IGCP project: Ethiopia, South Africa, Kenya, Cameroun, Morocco, Tunisia, Algeria, Tanzania, DR Congo, Botswana, Belgium, France, Egypt, Ghana.

Scientific activities *(meetings, workshops, training sessions)***:** The project organized their Annual meeting in Sousse, Tunisia in November 2019.

Scientific achievements/ results *(papers, new findings, new models, new data, new map etc.)***:** The IGCP-659 Working Group launched several local and regional studies in order to improve the seismotectonic database, improve existing seismic hazard models and initiate a

proper evaluation of the building stock and seismic risk evaluation. Scientific achievements are:

1. The IGCP Project "SEISMOSHAF" included the development of a pilot project in Seismic Early Warning System in Africa in cooperation with the NRIAG Cairo (Egypt), EOST Strasbourg (France), and the University of Naples (Italy). Field experiment associated with the pilot project is in preparation on the Aswan Dam and Nasser Lake site in Egypt.
2. A seismic risk programme with evaluation of building stock is prepared for the Accra region in Ghana.
3. A seismic hazard and zonation model is in development as a cooperation between the CGS Pretoria, EOST Strasbourg, NRIAG in Helwan-Cairo, the CRAAG Algiers and the Khartoum University in Sudan.
4. The database for the seismic hazard assessment is enriched with new results on the GPS analysis and the study of major earthquake faults in Tunisia.
5. A probabilistic model of seismic hazard assessment and risk reduction has now been launched for main cities along the Cameroon Volcanic Line as a cooperation between EOST Strasbourg and Buea University
6. The project published 2 new papers in 2019.

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):** A one-day Training Course with 5 modules was organized before the IGCP-659 Annual Meeting. 41 students and young researchers attended the course. The program also introduced new cooperation's between different African Universities and research centers.

The IGCP project URL: http://www.unesco.org/new/en/natural-sciences/environment/earth-sciences/international-geoscience-programme/igcp-projects/geohazards/project-659/

IGCP 672-Himalayan glaciers and risks to local communities

Duration: 5 years (2018-2022)

Project Aims: 1) Mapping glaciers and lake extents using semi-automated remote sensing methods; 2) Using object-oriented and photogrammetric technology on freely available satellite imagens for detecting surface features on glaciers and estimating glacial hazards.

Related UN SDGs: This project contributes to the following sub-goals of the UN SDGs:

SDG 2-Zero hunger. *Target 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.

SDG 11-Sustainable Cities and Communities. *Target 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: 29 scientists from three countries collaborate in the IGCP project: India, Nepal and UK.

Scientific activities *(meetings, workshops, training sessions)***:** The project organized one meeting in London, 'Debris-covered glaciers: from remote sensing and field-based tools to local communities' and one training session, 'PONKAR GLACIER field training' in Nepal.

Scientific achievements/ results *(papers, new findings, new models, new data, new map etc.)***:** The main scientific achievement this year was summarizing and advancing the knowledge on debris covered glacier evolution and associated hazards particularly in the Eastern Himalaya. The project submitted one paper.

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):** This project organized a glacier training benefiting young women scientists from India, Nepal and Bhutan (6 female participants out of 10), all young MA graduates or PhD candidates. During the field training, local Nepalese and Sikkim participants were introduced to the remote sensing and field based assessment of the hazard potential of Gangapurna Lake in the Annapurna region.

The IGCP project URL:
http://www.unesco.org/new/en/natural-sciences/environment/earth-sciences/international-geoscience-programme/igcp-projects/geohazards/project-672/

https://wordpress.aber.ac.uk/discover-glaciers-IGCP672/

http://www.rockyglaciers.org/

IGCP 692-Geoheritage for Resilience

Duration: 5 years (2019-2023)

Project Aims: The objective is to empower areas with the capacity to communicate and manage geohazards, and to establish a global community for best practice in Geoheritage for Geohazard Resilience, especially, but not exclusively in UNESCO World Heritage sites, Global Geoparks and also other protected areas.

Related UN SDGs: SDG 17-Partnerships for the Goals, **SDG 13-**Climate Action, **SDG 8-**Decent Work and Economic Growth

Countries involved: 40 scientists from 27 countries collaborate in the IGCP project: Canada, USA, Mexico, Guatemala, Nicaragua, Colombia, Ecuador, Peru, Chile, Argentina, Ethiopia,

Nigeria, Iran, Indonesia, Japan, Philippines, New Zealand, Vanuatu, France, UK, Italy, Spain, Greece, Sweden, Germany, Hungary, Czech Republic.

Scientific activities *(meetings, workshops, training sessions)***:** The project organized the first 'Geoheritage for Geohazard resilience' meeting and the second Latin American Global Geoparks workshop in Manizales, Colombia (workshop not funded by IGCP). They also participated in Teleconferences and in the ongoing project 'Knowing Planet Earth 2019".

Scientific achievements/ results *(papers, new findings, new models, new data, new map etc.)***:** So far all work has been finalized during the project, benefiting from the network activities. They plan to publish with preference in Episodes.

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):** Apart from the multiple educational meetings the project organized (see activities), the project introduced the Dallol Website, which is providing risk information to visitors. They also have initiated policy changes in Peru and Nicaragua, with re-reorientation their geoheritage policy through local efforts.

The IGCP project URL: http://www.geopoderes.com/ and http://dallol.lmv.uca.fr/

Annex 4

2019 Summary of IGCP Hydrogeology Theme

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

Duration: 5 years (2015-2019)

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: **SDG 4-**Quality Education: *Targets 4.3, 4.7* and **SDG 6-**Clean water and Sanitation

Countries involved: 25 scientist from five different countries are involved (Benin, Cameroon, Ivory Coast, France, Niger)

Scientific activities: IGCP 643 is a training project and therefore organized a Synthesis Workshop and prospective hydrogeology training workshop in Côte d'Ivoire, training 20 students.

Scientific achievements: The 3WCA project is a training project, reflecting that no research work is related to this project, and thus any scientific achievements are difficult to expect to be achieved. The training provided during the five years of the project has, in particular, improved the skills of learners in the field of hydrological and hydrogeological modeling necessary for better management of water resources.

Societal/educational results/highlights: The project has a huge impact in the challenge of capacity-building in African countries, involving not only scientists from universities but also some stakeholders (National Office of Drinking Water in Côte d'Ivoire). This project provides an exchange and training platform for specialties and young researchers/students from France (North) and South countries (Côte d'Ivoire or Benin).

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

Duration: 5 years (2017-2021)

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: SDG 4-Quality Education: *Targets 4.3 and 4.7*.

Countries involved: 34 participants from 10 countries: China, USA, Slovenia, Thailand, Iran, Cambodia, Vietnam, Egypt, Romania, Myanmar

Scientific activities: International training course on the Belt and Road Initiative and Karst Landscape; An annual meeting organized in Guilin, China during 20-22 Sept.; Participated international meetings, forums, etc.

Scientific achievements: This year the project was able to characterize the cycle of C, N and other key elements in karst soils and published 6 papers in the process.

Societal/educational results/highlights: In 2019, the project focused on organizing different popularization of science activities, introducing the project to the general project. These activities were attended by more than 100 students from preschool and middle school accompanied by their families.

IGCP 663-Impact, Mechanism, Monitoring of Land Subsidence in Coastal cities (IM2LSC)

Duration: 4 years (2018-2021)

Project Aims: Land subsidence, as a global geohazard, not only reduces the flood control capacity in urban areas, but also brings security risk and damage to buildings, roads, bridges, rail transits, underground lines, etc. The impact of land subsidence is especially obvious in coastal cities and proximity to shorelines, such as Shanghai China and Jakarta Indonesia. The primary objectives of IM2LSC are to study the impacts of human activities and sea-level rise, hydro-mechanism and monitoring methods of land subsidence in coastal cities. The project can be a platform for the service of society, including urban planning and construction, underground management, flood prevention, etc. occurred in the areas of coastal cities, and give important information for mitigating the land subsidence to policy makers and publics.

Related UN SDGs: **SDG 4-**Quality Education: *Targets 4.3 and 4.7* and **SDG 13-**Climate Action: *Targets 13.3 and 13.B*.

Countries involved: 112 participants from 10 countries: China, Italy, The Netherlands, Indonesia, Mexico, USA, Vietnam, Thailand, Nigeria, Pakistan

Scientific activities:

- The 2019 Annual Meeting of IGCP 663, 17-21 Sept. 2019, Jakarta, Indonesia. Attendance: 100; Countries: 10
- Fourth Annual Meeting of IGCP Project 639, 13-19 October 2019, Xiamen University, Xiamen, China. Attendance: 60; Countries: 11.
- Land Subsidence Displacement Measuring and Monitoring, Numerical Modelling, Water Management Strategies. Taiwan Geosciences Assembly (2019 TGA) 16 May 2019. Attendance: 70; Countries: 9.
- Workshop for Land Subsidence Prevention, 14 May 2019, sponsored by Water Resource

Scientific achievements: The project generated scientific achievements in 4 different aspects: 1) Assessments of the effect of relative sea level rise were performed with the data from Shanghai China, Po delta Italy, and Mekong Delta Vietnam; 2) Global subsidence mapping has been carried out including 90 countries with collaboration of the UNESCO Land Subsidence International Initiative (LaSII) and IGCP 641; 3) New monitoring system has been installed in China and the Netherlands and the data obtained were used to simulate land subsidence; and 4) The project team supports policy-making to manage the control of land subsidence in Shanghai, coastal lowland of Indonesia, and Mekong Delta Vietnam. The project published 9 Articles, one Map and one Monograph this year.

Societal/educational results/highlights: The project established a long-term cooperation with 8 universities on technical teaching. They also co-guide middle school students and organize scientific popularization activities for middle and primary school students and ordinary people.

IGCP 684-Advancing Groundwater Sustainability within the Water-Energy-Food-Climate Nexus by Transferring Knowledge between Developed and Developing Countries

Duration: 5 years (2019-2023)

Project Aims: The purpose of the project is to quantify the impacts and feedbacks of the WEF Nexus (complex relationship between water, energy, and food resources and climate change) and identify how those concepts may help scientists and resource managers design optimal groundwater sustainability (WEF-GW Nexus) plans to best meet diverse stakeholder interests.

Related UN SDGs: **SDG 6-**Clean Water and Sanitation: *Targets 6.1 and 6.A*, **SDG 13-**Climate Action: *Targets 13.2 and 13.3*.

Countries involved: 14 participants from 8 countries: Argentina, Botswana, Italy, Lebanon, Nigeria, Portugal, Tunisia and Zambia

Scientific activities: The project organized one annual meeting among project investigators to introduce the project and website. The meeting was done in Malaga, Spain and 14 scientists have participated.

Scientific achievements: The project has been currently preparing a comprehensive matrix to collect data related to pilot areas in participating countries to compile baseline information about groundwater, and linkages as well as existing policies or guidelines related to the WEF nexus. This project also focused on recruiting of additional participants. They published 3 papers.

IGCP 689-A Better Management of the Ali-Sabieh Aquifer

Duration: 4 years (2019-2022)

Project Aims: The project investigates the high sulphate and nitrate concentrations of the Ali-Sabieh aquifer groundwater which supplies drinking water to the second most populated city of the Republic of Djibouti. They aim to characterize the main geochemical process in the aquifer and its geochemical evolution. At the end a conceptual model for this aquifer system will be proposed.

Related UN SDGs: **SDG 6**-Clean Water and Sanitation: *Targets 6.3 and 6.B*.

Countries involved: (6 participants) from 2 countries: Republic of Djibouti and Comoros

Scientific activities: The project launch meeting was organized in Ali-Sabieh town on November 27, 2019, with 18 participants. Ali-Sabieh region stakeholders were sensitized to the benefit of this project so as to facilitate the sampling process of the different water points of the Ali-Sabieh region.

Scientific achievements: No useful scientific achievements of the 1st year work was accomplished; an article in a newspaper about the project was made.

Societal/educational results/highlights: The first meeting of the project was covered by the National TV and News Paper of Djibouti informing the local habitants about the project. Because of this media coverage, the project has been contacted by several local communities to exchange the outcomes of this project and how they can be involved allowing the project to get an exhaustive list of borehole and hand dug wells in the region.

Annex 5

2019 Summary of IGCP Geodynamics Theme

IGCP 648-Supercontinent Cycles and Global Geodynamics

Duration: 5 years (2015-2019)

Aims: To shed light on the occurrence and evolution of supercontinents through time, and the underlying geodynamic processes, and also examine how the supercontinent cycles interacted with the deep mantle to produce episodic and unevenly distributed Earth resources.

Related UN SDG: SDG 17-Partnerships for the Goals: because of the large number of people from different countries involved, the project contributes towards global partnership for sustainable development.

Countries involved, approximate number of total 2019 participants: 280 scientist from: Australia, Botswana, Brazil, Canada, China, Denmark, Egypt, Ethiopia, Finland, France, Germany, India, Iran, Republic of Korea, Madagascar, Morocco, Netherlands, Namibia, Norway, Poland, Russia, Senegal, South Africa, Sweden, UK, USA. 31% of the scientist were women, 69% men, 34% young scientists/students and 35% scientists from developing countries.

Scientific activities *(meetings, workshops, training sessions)***:** The project organized three meetings, the IGCP 648 Field Symposium in Madagascar, the GAC-MAC 2019 – Special Session in Quebec and the AGU Fall meeting – Special Session in San Francisco, USA.

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

- Over 117 peer-reviewed publications reporting new geological and palaeomagnetic findings that help to constrain supercontinent cycles and related dynamic processes.
- Numerous high-impact papers published in some of the highest rated journals in our field including Nature (3), Nature Communications (2), Geology (4), JGR: Solid Earth (1), and PNAS (1).
- In two Nature papers, Holder et al. (2019) and Sobolev and Brown (2019) published major advances in understanding the onset of plate tectonics from both metamorphic and continental erosion points of view.
- In a Nature Communication paper, PhD student Gamal El Dien and colleagues report new evidence for supercontinent-plume intensity coupling, arguing for a dynamic LLSVP model.
- The Curtin team published a model (Li et al., 2019) that supercontinents assemble alternatively through introversion and extroversion, thus enabling superoceans to live twice as long (~1.2 billion years) as supercontinents (500–700 million years).

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):** Selected students received targeted database training in a workshop held at Curtin University in March 2019. Training of graduate and undergraduate students on supercontinent cycles and global geodynamics are routinely carried out by members in classrooms and at conferences and workshops.

IGCP 649-Diamond and Recycled Mantle

Duration: 5 years (2015-2019)

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

Related UN SDG: SDG 4-Quality Education: Cutting-edge research including use of sophisticated analytical method is an important aspect of this project.

Countries involved, approximate number of total 2019 participants: 85 scientist from Australia, China, Egypt, Iran, Russian, UK, USA, New Caledonia and Oman. 17% of the scientists were women, 83% men, 39% young scientists/students and 94% of the scientists were coming from developing countries.

Scientific activities *(meetings, workshops, training sessions)***:** The project organized the 5th IGCP 649 “Diamonds and Recycled Mantle Workshop and Field trip” in Muscat, Omar.

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

- The project continually made progress in research of Diamonds in ophiolites, newly finding diamonds and other ultra-high pressure minerals in Pulang ophiolite in China and Kalaymyo ophiolite in the IndoMyanmar Ranges (western Myanmar), which confirmed the existence of ophiolite-hosted diamonds on Earth.
- Abstract volume on Acta Geologica Sinica (English Edition), volume 94, Supp. 1 2020 was published for the 5th IGCP-649 workshop and field trip in Oman.
- The project published 29 papers.

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):** Participants of the 5th IGCP 649 workshop in 2019 were mostly from developing countries. The projects also focusses on supporting students, early-career researchers, and women scientists join their community.

IGCP 662-Orogenic Architecture and Crustal Growth from accretion to Collision

Duration: 5 years (2018-2022)

Aims: The aim of the project is to understand the differences between accretionary and collisional orogens by exploring differences in crustal composition, architecture and dynamics, and to evaluate their implications to metallogenesis.

Related UN SDG: SDG 17-Partnerships for the Goals: The topic of the project is global and there are 19 participating countries, which provides a great platform for future research.

Countries involved, approximate number of total 2019 participants: Scientists from China, Mongolia, Russia, Pakistan, Turkey, Iran, India, Indonesia, Kazakhstan, Tajikistan, Uzbekistan, Vietnam. 38% are female scientist, 62% male scientists, 43% young scientists/students and 87,5% of the scientists are from developing countries.

Scientific activities: The project organized a 5-day workshop which included a field excursion in Mongolia in July 2019. About 80 people attended from China, Mongolia, Russia, Czech Republic, Australia, South Korea, Japan, Brazil, Pakistan and Vietnam. The project leaders had a session at the European Geosciences Union (EGU); participated in a symposium in Potsdam, Germany and met at a meeting organized by UNESCO/IUGS/CGMW at EGU in April 2019.

Scientific achievements/ results *(papers, new findings, new models, new data, new map etc.)***:** In 2019 the project published 33 papers discussing for example their discovery of a sharp contrast between the deep crustal compositions of Altai and Juggar Orogents by mapping isotope delineates orogenic architectures, the revealing that isotopic compositions of magmatic rocks can trace deep compositions of origins and the final closure of the Paleotethys was probably later than 205 Ma.

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 training course of “Using isotopes in zircon and sulfides to understanding curst-mantle evolution” has been held at 23 September 2018 in Beijing. More than 70 young researchers and students take took part in this training course.

The project is creating databases and a map of granitoid in Asia and adjacent area which will benefit the broad community by providing better exploration tools for mineral, construction material and tourist scenery.

IGCP 667-World Map of the Orogens

Duration: 3 years (2018-2020)

Aims: Compiling a digital World Map of the Orogens using a Generic Mountain Range whose characteristics could be applied to the majority of the orogens in the world. This map will provide a good basis for future research.

Related UN SDG: SDG 17-Partnerships for the Goal: This project is valuable in that it allow collaborative contributions from representatives of the scientific community in many different countries.

Countries involved, approximate number of total 2019 participants: 42 scientists of: Democratic Republic of the Congo, Burundi, Republic of Korea, Democratic People's Republic of Korea, Cameroon, Belgium, China, Russia, Germany, Turkey, France, Switzerland, Brazil. 54% of the scientists are men, 46% women, 33% young scientist/students and 31% of scientists are from developing countries.

Scientific activities (meetings, workshops, training sessions): The project organized a meeting in Tervuren, Belgium, which was combined with a fieldtrip to the Meuse Valley (Belgium). They also attend the European Geoscience Union 2019 in Vienna, Austria.

Scientific achievements/ results *(papers, new findings, new models, new data, new map etc.)***:** The project started a researchgate project to better disseminate the IGCP 667 project in the scientific community and created a detailed legend and first map in accordance to the first year meeting.

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):** Connections with African continent and in particular with the University of Kinshasa in Democratic Republic of Congo were made to diffuse the IGCP667 project ideas for educational purposes. The project also aims at producing a map and a user-friendly database for teaching purposes.

Annex 6: Financial table for 31 active IGCP Projects in 2019

N°	Projects	Theme	Duration	IUGS	UNESCO, JPDC and China National Commission	Total USD
630	Permian-Triassic Climatic and Environmental Extremes amd biotic responses	Global Change	2014-2018			
632	Continental Crisis of the Jurassic	Global Change	2014-2018			
636-Y	Characterization and sustainable exploitation of geothermal resources	Earth Resources	2016-2018			
641	Deformation and fissuring caused by exploitation of subsurface fluids	Geohazards	2015-2018	$4,500		$4,500
637	Heritage stone designation	Earth Resources	2015-2019	$5,000		$5,000
638	Paleoproterozoic Birimian geology for sustainable development	Earth Resources	2016-2020		$7,500	$7,500
639	Sea Level Changes from minutes to millenia	Global Change	2016-2020	$9,000		$9,000
640	Significance of Modern and Ancient Submarine Slope and Landslides	Geohazards	2015-2019		$7,500	$7,500
643	Water Resources in Wet Tropics of West-Central Africa	Hydrogeology	2015-2019	$5,000		$5,000
648	Supercontinent Cycles an Global Geodynamics	Geodynamic	2015-2019		$9,000	$9,000
649	Diamonds and Recycled Mantle	Geodynamic	2015-2019		$7,500	$7,500
652	Reading Geologic Time	Global Change	2017-2021	$9,000		$9,000
653	The onset of the Great Ordovician Biodiversification Event	Global Change	2016-2020		$7,500	$7,500
655	Toarcian Oceanic Anoxic Event	Global Change	2017-2019	$7,500		$7,500
659	Seismic Risk Assessement in Africa	Geohazards	2018-2021	$5,000		$5,000
661	The Critical Zone in Karst Systems	Hydrogeology	2017-2021		$7,500	$7,500
662	Orogenic architecture and crustal growth from accretion to collision	Geodynamic	2018-2022		$7,500	$7,500
663	Land subsidence in coastal cities	Hydrogeology	2018-2021		$7,500	$7,500
665	Sustainable use of black soil critical zone	Earth Resources	2018-2022		$7,500	$7,500
667	World Map of the Orogens	Geodynamic	2018-2020	$5,000		$5,000
668	Equatorial Gondwana history and Early Palaeozoic Evolutionary Dynamics	Global Change	2018-2022		$5,750	$5,750

672	Himalayan glaciers and risks to local communities	Geohazards	2018-2022		$9,000	$9,000
673 New	The End of A Supereon – Winners and Losers at the Precambrian-Phanerozoic Transition	Global Change	2019-2020			
675 New	Sandstone-Type Uranium Deposits	Earth Resources	2019-2020			
679 New	Cretaceous Earth Dynamics and Climate in Asia	Global Change	2019-2023		$7,500	$7,500
681 New	History of Toxic Phytoplankton in Patagonia	Global Change	2019-2023	$5,000		$5,000
682 New	Mine Tailing Revalorization	Earth Resources	2019-2021		$7,500	$7,500
684 New	The Water-Energy-Food and Groundwater Sustainability Nexus (WEF-GW Nexus)	Hydrogeology	2019-2023		$10,000	$10,000
685 New	Geology for Sustainable Development	Earth Resources	2019-2023		$9,000	$9,000
689 New	Study the Ali-Sabieh aquifer recharge (Republic of Djibouti)	Hydrogeology	2019-2022	$5,000		$5,000
692 New	Geoheritage for Geohazard Resilience	Geohazards	2019-2023		$7,500	$7,500
	TOTAL project funding			**$60,000**	**$125,250**	**$185,250**

UNESCO: Support for IGCP 2019 Projects	**$125,250**
UNESCO: Support for 2019 IGCP Board	**$16,770**
Total UNESCO, JPDC and China National Comission Support	**$142,020**
Total IUGS Support	**$60,000**
Total 2019 IGCP Budget	**$202,020**

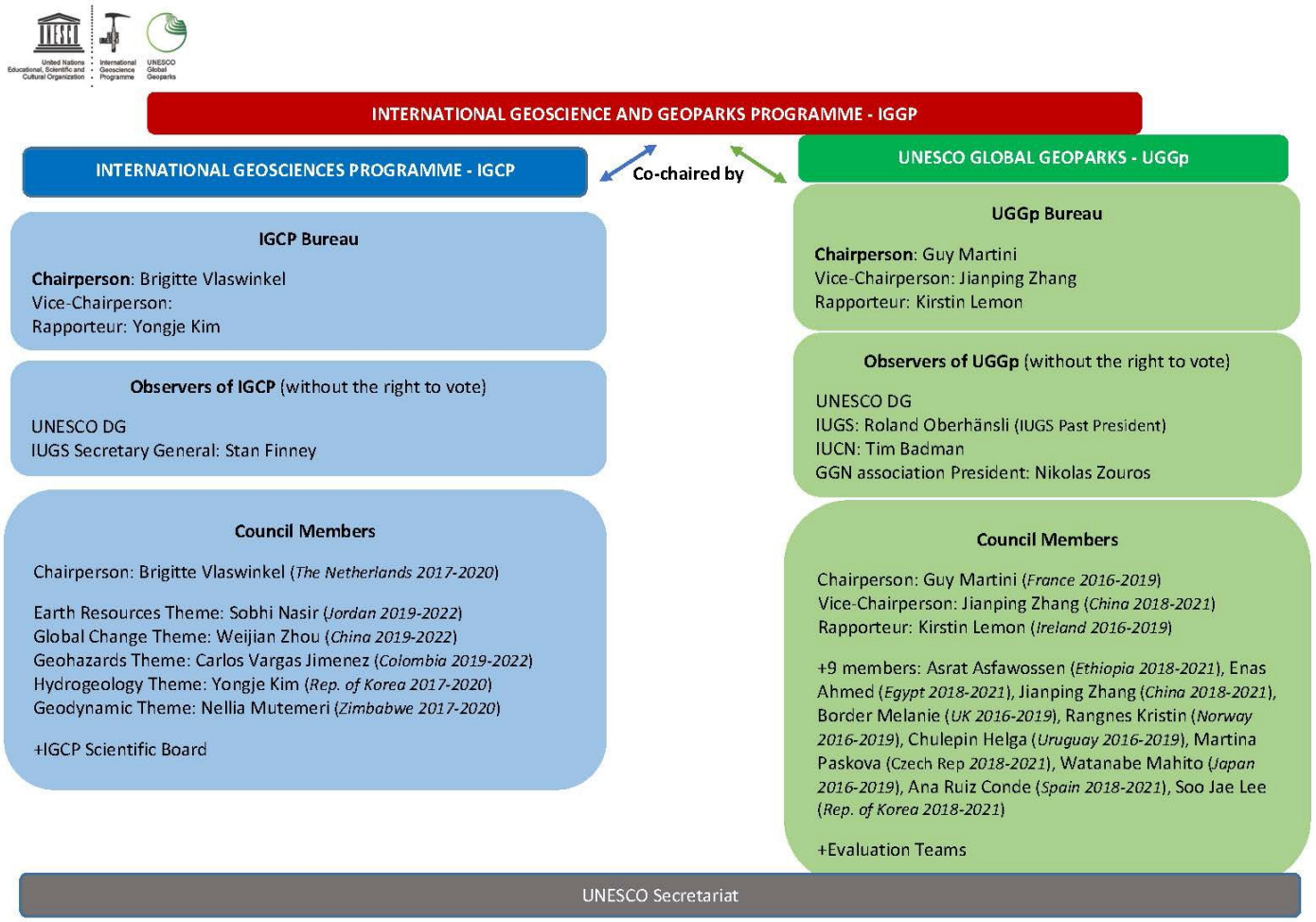
ANNEX 7: 21 Active IGCP which are being evaluated by the Council for 2020 funding allocation

N°	Projects	First Project Leader	Theme	Duration
638	Paleoproterozoic Birimian geology for sustainable development	Dr. Moussa Dabo (Senegal)	Earth Resources	2016-2020
639	Sea Level Changes from minutes to millenia	Dr. Simon Engelhart (USA)	Global Change	2016-2020
652	Reading Geologic Time	Dr. A.C. Da Silva (Belgium)	Global Change	2017-2021
653	The onset of the Great Ordovician Biodiversification Event	Prof. Thomas Servais (France)	Global Change	2016-2020
659	Seismic Risk Assessment in Africa	Prof. Mustapha Meghraoui (France)	Geohazards	2018-2021
661	The Critical Zone in Karst Systems	Dr Jiang Zhongcheng (China)	Hydrogeology	2017-2021
662	Orogenic architecture and crustal growth from accretion to collision	Prof. Tao Wang (China)	Geodynamic	2018-2022
663	Land subsidence in coastal cities	Prof. Xuexin Yan (China)	Hydrogeology	2018-2021
665	Sustainable use of black soil critical zone	Prof. Daming WANG (China)	Earth Resources	2018-2022
667	World Map of the Orogens	Dr Manuel Pubellier (France)	Geodynamic	2018-2020
668	Equatorial Gondwana history and Early Paleozoic Evolutionary Dynamics	Prof Nigel Hughes (USA)	Global Change	2018-2022
672	Himalayan glaciers and risks to local communities	Dr Adina E. Racoviteanu (UK)	Geohazards	2018-2022
685	Geology for Sustainable Development	Prof Iain Stewart (UK)	Earth Resources	2019-2023
682	Mine tailing revalorization	Dr Manuel A. Caraballo Monge (Chile	Earth Resources	2019-2021
679	Cretaceous earth dynamics and climate in Asia	Prof. Gang Li (China)	Global Change	2019-2023
681	History of Toxic Phytoplankton in Patagonia	Dr. Claudia Mineli Aracena Perez (Chile)	Global Change	2019-2023
689	A Better Management of the Ali-Sabieh Aquifer	Dr Osman Awaleh (Djibouti)	Hydrogeology	2019-2022
684	The Water-Energy-Food and Groundwater Sustainability Nexus (WEF-GW Nexus)	Dr Johanna Doumar (Lebanon)	Hydrogeology	2019-2023
692	Geoheritage for Geohazard Resilience	Prof Benjamin van Wyk de Vries (France)	Geohazards	2019-2023
673	The End of A Supereon – Winners and Losers at the Precambrian-Phanerozoic Transition	Prof Patricia Vickers Rich (Australia)	Global Change	2019-2020
675	Sandstone-Type Uranium Deposits	Mr Ruoshi Jin (China)	Earth Resources	2019-2020

ANNEX 8: 26 New project proposals requesting funding from 2020, these proposals are being evaluated in March 2020

N°	Project Title (short)	Main project leader country
Earth Resources		
692	HERITAGE STONES RECOGNITION: A STEP FORWARD (HerSTONES)	Italy
694	Modeling human health impacts of mining activities in Africa for sustainable earth resource extraction	Ghana
695	Geothermal resources for energy transition: direct uses and renewable base-load power around the globe.	Colombia
696	The Fate of Mercury Used in Artisanal and Small-Scale Gold Mining (ASGM) in Amazonian Ecosystems	Canada
697	Building New Tools for Data Sharing and Re-use through a Transnational Investigation of the Socioeconomic Impacts of Protected Areas	USA
698	Piloting a sustainability atlas for mining in southern Africa (NextMine)	UK
699	MUSE - Managing Urban Shallow geothermal Energy	Austria
715	Assessment of Sustainable development Goals in small, middle and big scale Colombian mining.	Colombia
Global Change		
700	CARBONATE BUILD-UPS IN SOUTH EAST ASIA	Thailand
702	Cretaceous biota from southern high latitudes and the relations between Antarctica and Patagonia: multiproxy evidence	Chile
703	Application of integrated provenance analysis to river systems, aridity evolution and climate change in Southern Africa	USA
704	Carbon in Peat on Earth through Time: Tropical peatland processes and ecosystem services	Thailand
716	Carbon Storage in Venezuela: Building Geoscience Knowledge and Capabilities	USA
Hydrogeology		
714	Artificial intelligence applied to develop a new methodology to assessment the hazard of groundwater pollution	Venezuela
706	Examination of Recent Transformations of the Eastern Rift Valley Lakes of Kenya and Tanzania	Kenya
707	Origin, Distribution, and Biogeochemistry of Arsenic in the Altiplano-Puna plateau of South America	Argentine
Geodynamics		
708	Evaluation of geophysical anomalies for archaeological purposes on the marine platform of Kauai and Maui, Hawaii	France
689*	Pre-Atlantic geological connections among northwest Africa, Iberia and eastern North America: Implications for continental configurations and economic resources	Morocco
709	High pressure-Ultrahigh pressure metamorphism and geochemical cycles in subduction zones	China
710	Western Tethys meets Eastern Tethys – geodynamical, paleoceanographical and paleobiogeographical events	Poland
711	Melt dykes from the Vredefort impact structure (South Africa): geochemical, geophysical, (micro) structural, remote sensing and anthropological study.	South-Africa
Geohazards		
712	Identification of seismogenic faults in populated areas of Latin America and its incorporation into seismic hazard assessment	Spain
713	Changing the paradigm in observational volcano science: Community plan for the Global Volcano Observatory (GloVO) Initiative	USA
705	Building Global Capacity for the Observation of Volcanic and Atmospheric Change	Sweden
693	Seismic risk assessment in Haiti: insight from paleoseismology, site effects and societal exposure	Haiti
701	Seismic vulnerability of buildings located on hillsides. Case study: Latin American Countries.	Chile

ANNEX 9: IGGP Chart



ANNEX 10: IGCP Scientific Board Members and Council members

	CHAIRPERSON		Nationality	appointed term
	Ms Vlaswinkel, Brigitte	The Ocean Cleanup	The Netherlands	**2017-2020**
	Mr Nasir, Sobhi Team Leader/IGCP Council Member	Sultan Qaboos University	Jordan/Canada	**2019-2022**
EARTH RESOURCES	Mr Beaudoin, Georges	University of Laval (Dep. Geology)	Canada	2017-2020
	Mr Pasava, Jan	Czech Geological Survey	Czech Rep.	2017-2020
	Mr Yigit, Ozcan	Canakkale Onsekiz Mart University (Dep. Geol. Eng)	Turkey	2017-2020
	Ms Baumgartner, Regina	Gold Fields, Lima, Peru	Peru	2017-2020
	Ms Olivo, Gema	Queen's University, Kingston	Canada	2017-2020
	Mr Molnar, Ferenc	Geological Survey of Finland	Finland	2017-2020
	Ms Castro, Liliana	University of Buenos Aires	Argentina	2019-2022
	Mr Canet-Miquel, Carles	UNAM – Centro de Ciencias de la Atmósfera	Mexico	2019-2022
	Ms Munkhtsengel, Baatar	Mongolian University of Science and Technology	Mongolia	2019-2022
	Ms Zhou, Weijian Team Leader/IGCP Council Member	Institute of Earth Environment, CAS	China	**2019-2022**
GLOBAL CHANGE	Mr Königshof, Peter	Senckenberg Forschungsinstitut und Naturmuseum	Germany	2017-2020
	Ms Leroy, Suzanne	CNRS-INSU	Belgium	2017-2020
	Mr Lukeneder, Alexander	Natural History Museum Vienna	Austria	2017-2020
	Ms Mangano, Maria Gabriela	University of Saskatchewan	Argentina	2017-2020
	Ms Oboh-Ikuenobe, Francisca	Missouri University of Science & Technology	Nigeria	2017-2020
	Ms Yanko Hombach, Valentina	Avalon Inst. of Applied Science	Ukraine	2017-2020
	Ms Vickers-Rich, Patricia	Monash University	Australia	2017-2020
	Mr Servais, Thomas	CNRS – Lille1	France	2017-2020
	Mr Narbonne, Guy	Queen's University, Kingston	Canada	2019-2022
	Ms Orgeira, Maria Julia	IGEBA (University of Buenos Aires and Conicet)	Argentina	2019-2022
	Ms Marsicano, Claudia Alicia	Facultad de Cs. Exactas y Naturales, University of Buenos Aires	Argentina	2019-2022
	Mr Valenzuela Rios, José Ignacio	University of Valencia	Spain	2019-2022

ANNEX 10: continued: IGCP Scientific Board Members and Council members

	Mr Vargas, Carlos Team Leader/IGCP Council Member	Universidad Nacional de Colombia at Bogota	Colombia	2019-2022
GEOHAZARDS	Mr Campbell, Hamish	GNS Science	New Zealand	2017-2020
	Mr Cundy, Andy	University of Brighton	UK	2017-2020
	Mr Sintubin, Manuel	Katholieke Universiteit Leuven	Belgium	2017-2020
	Ms João Batista, Maria	National Laboratory of Energy and Geology (LNEG)	Portugal	2017-2020
	Mr Singh, Vimal	Department of Geology, University of Delhi	India	2017-2020
	Mr Gezahegn, Yirgu	School of Earth Sciences, Addis Ababa University	Ethiopia	2019-2022
	Ms Alcántara Ayala, Irasema	National Autonomous University of Mexico (UNAM)	Mexico	2019-2022
	Mr Ghafory-Ashtiany, Mohsen	International Institute of Earthquake Engineering and Seismology (IIEES)	Iran	2019-2022
	Mr Kim, Yongje Team Leader/IGCP Council Member	Korea Institute of Geoscience and Mineral Resources (KIGAM)	Rep. of Korea	**2017-2020**
HYDROGEOLOGY	Ms Bernal, Isabel Carolina	National Polytechnic School	Ecuador	2017-2020
	Mr Cheng, Zhang	Inst. of Karst Geology-CAGS/IRCS	China	2017-2020
	Ms Le, Thi Phuong Quynh	Vietnam Acad. of Sc. & Tech	Vietnam	2017-2020
	Mr Tshimanga, Raphael	University of Kinshasa	DR Congo	2017-2020
	Mr Dzhamalov, Roald G.	Water Problems Institute, Russian Academy of Sciences	Russia	2017-2020
	Ms Szőcs, Teodóra	The Mining and Geological Survey of Hungary	Hungary	2017-2020
	Mr Ibrahim, Reda Gamil Mohamed	Department of Hydrogeochemistry, Desert Research Center	Egypt	2017-2020
	Ms Vallejos Izquierdo, Angela	University of Almeria	Spain	2017-2020
	Ms Fidelibus, Maria Dolores	Politechnique de Bari	Italy	2017-2020
	Mr Schwartz, Frank	The Ohio State University - School of Earth Sciences	USA	2019-2022
	Mr Muzuka, Alfred	The Nelson Mandela African Institute of Science and Technology	Tanzania	2019-2022
	Ms Mutemeri, Nellia Team Leader/IGCP Council Member	School of Mining, University of Witwatersrand	Zimbabwe	**2017-2020**
GEODYNAMIC	Mr Charrier, Reynaldo	University of Chile (Dep. of Geology)	Chile	2017-2020
	Mr Ennih, Nasser	University of El Jadida	Morocco	2017-2020
	Ms Halla, Jaana	Helsinki Geological Museum	Finland	2017-2020
	Mr Hisada, Kenichiro	University of Tsukuba (Graduate School of Life & Envir. Sc.)	Japan	2017-2020
	Mr Jin, Xiaochi	Chinese Academy of Geological Sciences	China	2017-2020
	Mr Mocanu, Victor	University of Bucharest	Romania	2017-2020
	Ms Safak, Altunkaynak	Istanbul Technical University	Turkey	2017-2020
	Ms Toy, Virginia	University of Otago	New Zealand	2017-2020

ANNEX 11: Details of 70 IGCP activities delivered in 2019 (*indicates UNESCO funding)

N°	Projects	Country	Meeting date
630	Characterization and sustainable exploitation of geothermal resources	Montreal, Canada Medellin, Colombia Quebec, Canada	February 2019; Hydrogeochemical short course 4 October; Geothermal day 25-29 November; RENAG 2019 May 2019; seminar at GAC-MAC-IAH
632	Continental Crises of the Jurassic: Major Extinction Events and Environmental Changes within Lacustrine Ecosystems	Riverside, USA Utah, USA	23-27 June 2019; The 8th Symposium of IGCP632: Ecological Development during Jurassic 11-16 May 2019; ICDP - EarthRates Workshop and Fieldtrip: CPCP 2 / EMCT
636	Permian-Triassic Environmental and Climate Extremes and biotic responses_	Wuhan, China Milan, Italy Cologne, Germany	15-22 September; IGCP 630 2019 Workshop 2-6 July; IGCP630 Session: “Triassic stratigraphy and environmental & Biotic events” 29 July – 2 August; IGCP630 Session: End-Permian and Triassic extreme events and global correlations
637	Heritage stone designation	Vienna, Austria	8-12 April 2019; European Geosciences Union 2019*
638	Paleoproterozoic Birimian geology for sustainable development	Algiers, Algeria	28 October-2 November 2019; Fourth annual meeting*
639	Sea Level Changes from minutes to millennia	Xiamen, China Vienna, Austria San Francisco, USA	13-19 October 2019; 4th annual meeting; Xiamen, China and coastal Fujian province* EGU Sea level EGU Extreme Waves AGU Centennial Session
640	Significance of Modern and Ancient Submarine Slope and Landslides	Rome, Italy Colorado, USA	10-13 September; 34th IAS Meeting of Sedimentology* 7-8 June; 2nd workshop on Subaqueous Landslides and Morphometric Parameters in conjunction with the 7th International Conference on Debris-Flow Hazards Mitigation events*
641	Deformation and fissuring caused by exploitation of subsurface fluids	Arizona, USA	4 November 2019; Round Table Meeting* 5 November 2019; IGCP 641 Arizona Project Workshop* 6 November 2019; IGCP 641 Field trip*
643	Water Resources in Wet Tropics of West-Central Africa	Abidjan, Côte d'Ivoire	22-25 October 2019; Synthesis Workshop and prospective and hydrogeology training workshop*
648	Supercontinent Cycles an Global Geodynamics	Quebec, Canada Ifaty, Madagascar San Francisco, USA	12-15 May 2019; GAC-MAC 2019- Special Session* 22 June-6 July; IGCP 648 Field Symposium* 9-13 December, AGU Fall Meeting*
649	Diamonds and Recycled Mantle	Oman	12-22 November 2019; The 5th IGCP-649 Diamonds and Recycled Mantle Workshop and Field Trip*
652	Reading Geologic Time	Lanzhou, China Vienna, Austria	21 -27 August 2019*: • 21-22 August 2019: Pre-meeting workshop for spectral analysis. Lectures by Anne-Christine Da Silva from University of Liege and Xu Yao from Lanzhou University. • 23-25 August 2019: Pre-meeting fieldtrip to look at cyclical Cambrian -Ordovician platform and slope deposits, as well as bentonites in the southwestern Ordos, China. • 26-27 August 2019: Indoor meetings include oral presentations, poster sections, breakout group discussions and planning for future studies. 4-6 November: Workshop Geology of Western Mongolia*

653	The onset of the Great Ordovician Biodiversification Event	Riverside, California, USA Novosibirsk, Russia Phoenix, Arizona, USA	June 2019; Symposium at 11th NAPC meeting (joined with 668)* July 18-232019; Main Annual meeting* September 2019; Annual Meeting of the Geological Society of America; topic: Topical session T116: The Ordovician Earth: Integrated Perspectives on the fossil and rock records (joined with 652) *
655	Toarcian Oceanic Anoxic Event	Erlangen, Germany	2-5 September; 3rd International Workshop on Toarcian Oceanic Anoxic Event*
659	Seismic Risk Assessment in Africa	Sousse, Tunisia	25-28 November; Meeting on the Seismic Hazard and Risk assessment in Africa*
661	The Critical Zone in Karst Systems	China and Spain	9 August, 2019, Xiangxi, China; Meeting 22 September, 2019, Guilin, China; Work group meeting and field trips* 24 September, 2019, Malaga, Spain; Meeting
662	Orogenic architecture and crustal growth from accretion to collision	Ulaanbaatar, Mongolia Potsdam, Germany	04-10 July; Second Annual Workshop* 26 June -1 July 2019; Symposium: “The Geology of Eurasia”*
663	Land Subsidence in Coastal cities	Jakarta, Indonesia Taiwan	17-21 September 2019; The 2019 Annual Meeting of IGCP 663* 14 May; Workshop Land Subsidence Prevention
665	Sustainable use of Black soil critical zone	Chengdu, China Fushun Liaoning province, China	25-27 October, Chengdu; The 3rd workshop on Global Black Soil Critical Zone Geo-ecology Survey* 16-18 June 2019 Fushun Liaoning province; Training: RS and CZ methods and techniques*
667	World Map of the Orogens	Vienna, Austria Royal Museum for Central Africa, Belgium	11 April 2019; European Geosciences Union 2019* 10-12 December 2019; Meeting and fieldtrip*
668	Equatorial Gondwana history and Early Palaeozoic Evolutionary Dynamics	University of California, Riverside, USA Kolkata, India	23-28 June; North American Paleontological Convention (NAPC)* 20 December 2019; International Symposium on Environment and Climate Crises
672	Himalayan glaciers and risks to local communities	London, UK Nepal, Ponkar Glacier expedition	2-4 September 2019; Meeting: Debris-covered glaciers: from remote sensing and field-based tools to local communities 6-16 November 2019; Training: PONKAR GLACIER field training*
673	The End of A Supereon – Winners and Losers at the Precambrian-Phanerozoic Transition	Windhoek, Namibia	4-12 March; Field workshop: Precambrian-Cambrian boundary, Ediacara biota, Snowball Earth deposits and geology of the Nama basin around Aus (Southern Namibia)*
675 New	Sandstone-Type Uranium Deposits	Ordos and Tianjin, China Zambia	06-10 October 2019; Pre-workshop field excursion, Indoor workshop, Annual Symposium, Youth Geological Forum workshop* 30 April 2019; Scientific and training activities
679 New	Cretaceous Earth Dynamics and Climate in Asia	Qingdao, Shandong Province, China	11-17 October 2019; First International Symposium*
681 New	History of Toxic Phytoplankton in Patagonia	Laboratory of Aquatic Resources, Calfuco, Valdivia, Chile	15-16 October 2019; First meeting “History of toxic phytoplankton in Patagonia. Work plan and protocols for sediment analysis*
682 New	Mine Tailing Revalorization	Santiago, Chile Barcelona, Spain	12 July 2019; 1st Internal IGCP_682 Meeting* 12 August 2019; 1st Combined IGCP_682 and GRCT Meeting* 22 August 2019; 2nd Internal IGCP_682 Meeting* 23 August 2019; Scientific Session at Goldschmidt 2019*

684 New	The Water-Energy-Food and Groundwater Sustainability Nexus (WEF-GW Nexus)	Johannesburg, South Africa Malaga, Spain Apuo versiliese Region, Forte dei Marmi (Lucca) San Francisco, California, USA	04-06 September 2019* 22-27 September 2019* 02-05 October 2019* 09-13 December 2019*
685 New	Geology for Sustainable Developement	UN HQ, New York, USA Bolivia, Columbia Cartagena, Columbia Londen, UK Bologna, Italy Lisbon, Portugal Istanbul, Turkey Songipat, India	14-15 May 2019; UN Forum on Science, Technology and Innovation for the SDGs* 22 July - 1 August 2019; Geological mapping in context of Andean Geoparks* 11-12 December 2019; Meeting: Sustainability and energy summit November 2019; 7th GfGD Annual Conference - Earth Science, Health & Wellbeing 25-26 February; Workshop Bologna University 1-2 March; Workshop Lisbon University 5-7 October; Workshop Boğaziçi University November 2019; Workshop Ashoka University
689 New	Study the Ali-Sabieh aquifer recharge (Republic of Djibouti)	Ali-Sabieh region, Djibouti	26 November 2019; Meeting*
692 New	Geoheritage for Geohazard Resilience	Manizales, Colombia	19-27 October; 1st Geoheritage for Geohazard Resilience meeting* 19-27 October; 2nd Latin American Global Geoparks workshop