



INTERNATIONAL UNION OF GEOLOGICAL SCIENCES

President Report

Qiuming Cheng

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to

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IUGS President Report (2016-2020)

Qiuming Cheng

I prepared the early version of this report in February, less than a month in advance of the planned 36th IGC in New Delhi. The outbreak of COVID-19 prevented delegates from all over the world to attend the congress. The IUGS EC and the Indian LOC of 36th IGC proactively expressed their sympathy and immediately took measures and actions to communicate with the Indian Government to find ways to minimize the impact. Solutions included offering video presentations and providing help in arranging meetings, monitoring booth exhibitions, etc. I sincerely hoped the spread of the Coronavirus will be contained, and its negative effects eliminated soon. I thanked all who have expressed concern and support in this matter.

Unfortunately, COVID-19 spread rapidly across the global, causing devastating impacts on humanity, social and economic development, and collective communication. The 36th IGC, proposed by the Indian Government, will be postponed to November of 2020, and then to August 2021. The IUGS EC and the IGC Committee (IGCC) are diligently taking actions to expedite the LOC to handle refund registration fees and hotel costs to delegates who have already paid.

The IUGS EC has decided to hold an extraordinary session of IUGS – IGC Council Meeting on October 28-30, 2020 via virtual conference. I would like to thank all EC members and IUGS Council members who have agreed to participate in the efforts of organizing a fruitful upcoming session.

Reviewing the promises and priorities set at my election as IUGS president, I should say that IUGS has generally been doing very well for the last four years, although some of the original priorities will need more time to be achieved. I must admit that the former EC handed over to the current EC an IUGS administration in good standing: especially, the Past President (Prof. Roland Oberhänsli) and Secretary General (Prof. José P. Calvo) as well as many others have offered comments and provided advice which helped us defining priorities and pending businesses. After a short learning period filled with broad communications and consultations with organizations and individuals, the new EC identified its priorities and set strategic action plans concerning both grand challenges and opportunities, particularly in playing collective leading roles in promoting frontier Earth science and better serving society, finding ways to increase the engagement and interactions of its members as well as collaboration with other organizations such as ISC and UNESCO, and sustaining memberships and further improving its international influence and contributions. In this report I would just like to briefly review of a few key areas of progress and achievements.

1. Enhancing IUGS's contributions and its role in leading global geoscience

Numerous scientific advances indicate that geoscience is entering a new era for real-time integrative and interdisciplinary Earth system innovation as a result of modern space observation technology, new analytical and experimental facilities, outdoor experimental infrastructure, computer simulation and data discovery technology. Geoscientists have been

continually making gratifying progress in many fields of the Earth sciences with findings filling gaps in our knowledge about the Earth and how it works, as well as other findings directly associated with the sustainable development of our society. One of the fastest-growing research fields worth mentioning is the automatic extraction, integration and analysis of information from big data in cloud environment, aided by machine learning and artificial intelligence. The tools and technologies of the digital revolution combined synergistically with transdisciplinary and integrative efforts are boosting innovation and discovery in fundamental and applied earth science research. Digital revolution and societal sustainable development have indeed become central to global science as is reflected in the strategic challenge domains of ISC and UN programs. In view of the trend of digital revolution and challenges faced by governments and professional organizations to contribute to the transformation of earth science in the big data era, the International Union of Geological Sciences (IUGS) has keenly initialized a new big science program – Deep-time Digital Earth (DDE), which is being developed on the basis of other programs IUGS involving cooperation with other organizations. The objective of DDE is to promote and facilitate international collaboration in big science programs particularly in transforming earth science from human learning to integration of human learning and artificial intelligence, including machine-learning, as well as from known questions seeking unknown answers to seeking unknown questions with unknown answers. The DDE program after it commenced about two years ago has already generated global interest and broad publicity. It not only motivates the engagement and interaction of IUGS bodies including national members, constituent members and affiliated international associations but also facilitates broad collaboration with other international organizations including ISC, UNESCO and the GeoUnions. Open science, data driven science and interdisciplinary research have become core topics in the IUGS and ISC Action Plans.

2. Establishing Deep-time Digital Earth (DDE) - IUGS Big Science Program for International Collaboration

2.1 Initiative of IUGS Big Science Program

In view of facilitating efficient utilization of geoscience data for transforming traditional approaches in conducting research, at the 72th IUGS EC meeting held in Potsdam Germany January 2018, President Qiuming Cheng proposed to establish IUGS Big Science International Programs and Centers of Excellence, which aim to increase public awareness and education, international collaboration, open data sharing, and transdisciplinary research. Big science programs should meet the following criteria:

- ✧ Global and major issues
- ✧ International collaboration
- ✧ Transdisciplinarity
- ✧ Global – Free – Open – Sharing - Service
- ✧ Collaboration with ISC, UNESCO etc.
- ✧ Promotion in underrepresented nations

International collaborations are required and encouraged in establishing any big science program, especially among IUGS members including adhering national and regional committees

and affiliated international associations. The primary areas of consideration include, but are not limited to, (i) integration of data-driven sciences and Earth science focusing on major Earth science questions such as converging plate boundary dynamics and their effects on natural resources, environment, hazards and human resilience, (ii) big data discovery for resources assessments on the African continent, and (iii) predictability of extreme geological events such as earthquakes, volcanos and landslides. Over the past several years, President Cheng took all opportunities of attending numerous conferences and other occasions to promote new IUGS initiatives. For example, President Cheng introduced the IUGS initiative at the Council Meeting of the Geological Society of America (GSA) 2017, the 24th Council Meeting of the Association of Iberoamerican Geological and Mining Surveys (ASGMI), which was attended by the leaders of 22 geological surveys, some from countries which are not yet IUGS members, at the Session on “Changing Role of Geological Surveys” at the RFG2018 conference attended by several national geological surveys (GSC, USGS, BGR, BGS, Japan, Finland, Norway, Australia etc.), and at Sessions of Directors of Geological Surveys at the China Mining Expo and ASEAN Mining Forum attended by directors of several geological surveys and Ministries of Mines including the Organization of African Geological Survey (OAGS) which is an organization comprising Geological Surveys of 54 nations in Africa. President Cheng has consulted and interacted with most of the adhering members including US National Academy of Science, Indian Academy of Science, and most of the geological surveys. Besides the adhering members, the IUGS initiatives have been presented to affiliated members and other international organizations at their annual conferences, council meetings and celebrations such as the IUGG 100 annual celebration, IAMG 50th Annual Celebration, EGU General assembly and AGU annual meeting, CGMW General assembly, IODP council, International Paleontological Association (IPA) and International Association of Sedimentologists (IAS), IGCP council meetings, Alliance of International Science Organizations (ANSO), International Consortium on Landslides (ICL), International Society of Soil Mechanics & Geotechnical Engineering (ISSMGE), International Association for Engineering Geology and the Environment (IAEG) and American Association of Petroleum Geologists (AAPG). The IUGS initiatives were also proactively promoted in consultations with ISC, GeoUnions, and UNESCO. The main effort was to convince organizations to collectively develop proposals for establishing IUGS big science programs with the primary objective of sharing new knowledge and developing cutting-edge technology to tackle global issues, as well as solving current problems facing numerous countries. An article titled “A New International Initiative for Facilitating Data-Driven Earth Science Transformation” coauthored by President Cheng and Past President Oberhänsli and published by GSL elaborates on the details of the rationale and evolution of the initiative. These efforts have generated awareness and interest of other organizations. With the DDE inspiration a collective initiative along the lines of Data-Driven Science is under consideration for ISC or UNESCO in collaboration with other GeoUnions.

2.2 Kick off Deep-time Digital Earth – the first IUGS Big Science Program

At the 73rd IUGS EC meeting the Deep-time Digital Earth (DDE) proposal jointly developed by Qiuming Cheng, Roland Oberhänsli, Chengshan Wang and others in consultation with several IUGS bodies including Commissions, Adhering Committees and Affiliated Organizations was approved by IUGS EC as its first Big Science Program. The DDE forum was successfully held in

conjunction with the 73rd IUGS EC meeting which attracted more than 250 scientists including about 30 Chinese Academicians and more than 80 world top scientists from more than 40 international organizations. The ISC, UNESCO and several GeoUnions (IUGS, IUGG, IGU, ISPRS, ANQUA) sent representatives to the DDE Forum. This event celebrated the kickoff of the new program DDE. So far 17 organizations have signed as founding members at the time when this report was prepared. These members include five national members of IUGS (BGS, CGS, GSC, KIGAM, SEVGEL), ten affiliated international associations (CGMW, AAPG, IAMG, CCOP, IAG, IAS, IAGOD, IPA, ILP, FBGU) and two IUGS commissions (ICS and CGI). Several new members are expected to join. The program will run as an open program which encourages broad collaboration among geosciences as well as in transdisciplinary fields including engineering, social science and economics. DDE aims to establish a link between earth big-data hubs that are interoperable with other databases including published data in the public domain and unpublished data at institutions and centers of expertise. DDE will be an international consortium that aims to provide “Geological Google” with harmonized data convenient for science, industry, and the general public. DDE has been set as a 10-year international big science program (2019-2028) with milestones anticipated at subsequent International Geological Congresses (37th IGC in 2024, Busan, and 38th IGC 2028).

During the first two years 2019 and 2020, under the guidance of the ad-hoc Steering Committee chaired by President Cheng (members include Michael Stephenson - Chair of DDE Governing Council, Roland Oberhänsli - Chair of Science Committee, Chenshang Wang - Chair of Executive Committee, and Junxun Fan - Secretary General), DDE has made tremendous progress both in terms of program structure, infrastructure construction and collaborative projects. The Governing Council was established which consists of authoritative representatives from the 17 founding members. The GC scheduled its first meeting at the 36th IGC which has been changed to a Zoom meeting on October 20, 2020. The Science Committee of DDE has been set up consisting of 15 world top scientists covering various fields of earth science and data science. The SC successfully had its first meeting in Busan in conjunction with the 74th IUGS EC meeting. Two Centers of Excellence have been agreed to be constructed one in Shuzhou China and one at the Carnegie Institute, USA. Other centers are also under consideration. Several collaborative projects have been proposed and some of them are already in implementation. These projects include “Data Driven Earth Science Knowledge Graph” proposed by DDE in collaboration with CGI and CODATA, “a 5-million scale global continental geological map” proposed by CGMW, CAGS and DDE, “New Geological Time Scale and Chart” by ICS and DDE, “Eurasian Marginal Seas Study: past and future” by IAMG and DDE. Progresses have been regularly updated in the IUGS E-Bulletins and several publications and outreach articles have been published; for example, an article published in SCIENCE on the same day as the DDE forum “Earth scientists plan to meld massive databases into a ‘geological Google’”, a research article “A high-resolution summary of Cambrian to Early Triassic marine invertebrate biodiversity” published in SCIENCE in January 2020. An article titled “A New International Initiative for Facilitating Data-Driven Earth Science Transformation” is published by GSL. A progress report on DDE has been published in Episodes and an editorial appears in Jour. Geol.Soc.India. More information about the DDE can be found at the DDE website www.ddeworld.org.

3. Interaction and collaboration of IUGS with other international communities

3.1 IUGS Bureau meetings and EC meetings

Three Bureau meetings and an EC meeting have been organized yearly in places chosen to maximize the interactions of IUGS EC and IUGS bodies with local and regional communities. In addition to the ordinary IUGS EC meeting, started two years ago, the IUGS EC meetings have been hosted in conjunction with a scientific forum (e.g., DDE forum) to facilitating interactions and collaboration of IUGS EC with its members as well as with other organizations such as ISC, UNESCO, and GeoUnions. This new form of IUGS EC meeting increased the attendance of the IUGS EC and the visibilities of IUGS especially in underrepresented areas within IUGS.

3.2. IGCs and IGCC

The IGC Committee (IGCC) met twice in New Delhi in 2017 and 2019, respectively. Both times the IGCC members visited the 36th IGC venue and had good interaction with the LOC of the 36th IGC and met with the leaders of the hosting ministries (MoM - Ministry of Mines, MoES - Ministry of Earth Science, and INSA - India Science Academy). IGCC contributed valuable suggestions to the host of 36th IGC especially about the preparation processes considering the Congress to be held in March. Various IUGS business meetings including IUGS-IGC Joint Council Meeting have been scheduled at the 36th IGC. IUGS EC had visited the venue of the 37th IGC during the EC meeting in Busan. A new MOU has been drafted and is to be signed with the host of the 37th IGC in Korea. The MOU reflects the new IGC Statutes and Bylaws ratified at the 34th IGC in Brisbane 2012. Since then IGC serves as the international scientific forum of the IUGS and also serves as a scientific forum for other geoscience organizations as appropriate. The IGCC is a permanent IUGS-IGC joint committee of IUGS dealing with IGC matters. Among other responsibilities the LOC of IGC will ensure acknowledgment of IUGS, clearly and prominently display of its logo and the statement "The IGC is the scientific forum of the IUGS" on the website, and putting the IUGS logo on all publications, including bulletins, flyers, conference proceedings and other information releases. IUGS makes all necessary efforts to promote and support the LOC to run the IGC including, but not limited to regular announcements of the IGC in the IUGS E-Bulletin and in its Social Media outlets.

3.3. ISC and UNESCO

The International Science Council (ISC) was created by the merger of the International Council for Science (ICSU) and the International Social Science Council (ISSC). IUGS played an important role in the merger and the positioning of geological sciences in the administrative structure. Four members from the GeoUnion consortium were elected as the first ISC Governing Council members and IUGS President Cheng was elected as a member of the ISC Committee of Science Planning (CSP). At the first CSP meeting held in Paris, President Cheng introduced the DDE initiative and suggested to develop a joint project on Data Driven Science for Sustainable Development Transformation. IUGS appreciates the support of ISC who sent its Governing Body member Professor Alik ISMAIL-ZADEH, ISC Secretary, to address delegates at the opening of the DDE Forum in Beijing.

The relationship of IUGS with UNESCO was strengthened with participation of IUGS in aspects of the UNESCO Global Geoparks Program and by its continued major financial support of, and participation in, IGCP. In addition to the funding from IUGS and UNESCO, funding from China and Korea sustains and increases the number of IGCP projects granted each year so as to increase the number of researchers involved, especially young researchers and female researchers as well as the number of countries. Special thanks are due to the IGGP program management team at UNESCO for their efforts in promoting the program. IUGS has also been proactively supporting and participating in the global Geoparks programs and the UNESCO Category 2 Centers. IUGS appreciates the support of UNESCO which sent its representative Dr Özlem ADIYAMAN, to give his address at the opening of DDE Forum in Beijing.

3.4. ISC GeoUnions

The Presidents and Secretary Generals of ISC GeoUnions have met five times including at meetings prior the ISC general assembly in Oslo, an extraordinary assembly in Taipei, election of ISC Governing Bodies in Paris and at IUGG's 100th Anniversary in Paris. GeoUnions have actively participated in the whole process of merging ICSU and ISSC and election of ISC GB. Collective efforts were intended to propose new initiatives in line with strategic challenge domains identified by ISC. Pertinent topics include Deep-time Digital Earth, geo-education, and geo-hazards. Upon the invitation of President Qiuming Cheng representatives from five GeoUnions members (IGU, ISPRS, ANQUA, IUGG and IUGS) attended the DDE forum and offered constructive suggestions supporting the DDE initiative. Further development of joint initiatives is in progress.

Other joint initiatives included the International Lithosphere Program (ILP) with IUGG as well as the Task Group on Isotopes, Geochronology (TGIG) with IUPAC. IUGS participated in the TROP ICSU project led by the International Union of Biological Sciences (IUBS) and co-led by the International Union for Quaternary Research (INQUA). A topic project proposed by IUGS Vice President Kristine Asch and Treasurer Hiroshi Kitazato on "Mapping the Ocean Realm" will explore collaboration with IUGG and other organizations.

3.5. Other initiatives and collaborative projects

(1) RFG 2018

The Resources for Future Generations Conference, RFG2018, was held in Vancouver, Canada on 16-21 June 2018. It was sponsored by IUGS and was considered as an Inter-IGC Meeting with a theme closely related to the IUGS new initiative Resourcing for Future Generation (RFG). The RFG2018 conference was an outgrowth of collaboration between the IUGS and a number of organizations representing Canada's geoscience and geo-engineering communities. The conference successfully attracted a few thousand participants including members of several adhering organizations (e.g. Canada, US, German, UK, Japan, Finland, Norway, Australia), IUGS constituent groups (e.g. CGI), and affiliated organizations sponsored symposia. The next conference of such series will be held in 2022. Several interested venues including joint DDE congress are under consideration. Its venue choice is open for suggestions.

(2) IUGS Special Funding Program

The IUGS Finance Committee, which is supposed to oversee all IUGS financial activities, was reestablished in 2018. Upon the recommendation of the IUGS Finance Committee (FC) the EC decided to allocate \$200,000-300,000 USD to financially support several new projects for 2020-2022 including for the first-round projects proposed by ICS and IFG, respectively.

(3) DDE Special Projects

The IUGS DDE program has set up collaborative projects with its founding members. Collaborative projects including: (i) Standard Task Group (STG) with CGI (IUGS Commission of Geological Information) in collaboration with ISC-CODATA; (ii) Eurasian Marginal Seas Studies (EMS) by IAMG (International Association for Mathematical Geosciences) involving about 25 scientists from 8 countries including China, Germany, Poland, Italy, Spain, UK, USA, and Russia; (iii) DDE-Survey by CGS (China Geological Surveys) which aims to develop DDE China Grid which provides support to facilitating internationalization of its Geological Cloud, a web-based database system developed by CGS. President Qiuming Cheng invites India, China, Russia, UK, Canada and others to form a joint project working group on geology over Himalaya or other interesting regions crossing national boundaries. Qiuming hopes geological surveys can work collaboratively on developing new initiatives using the DDE platform; and (iv) 5Million scale Continent Geology jointly by CGMW, CAGS (Chinese Academy of Geological Sciences) and DDE aiming to compile a 1:5 million continent geological map with the CGMW and DDE standard which can be used as DDE portal for data searching.

4. IUGS Administration

The Secretariat Office located in China and sponsored by the Ministry of Natural Resources has provided strong support to IUGS administration. The Secretariat Office consisting of Mr. Ma Yongzheng (Director) and Miss Li Wei (co-director) and four members have provided excellent support which ensures the high efficiency of day to day operation. Special thanks are also due to the infrastructural and financial supports from the Chinese Government which make it possible for IUGS to run EC and Bureau meetings as well as to provide booth exhibitions at various conferences including IGC, GSA, EGU, AGU and China Mining Expo. The EC has decided to keep the permanent secretariat office in Beijing for the next four years.

In summary, we are pushing the envelope for big data program, Code of Ethics, innovation in EC meetings, electronic voting, inter – IGC meetings, publications (E-Bulletins and Episode), IUGS memberships and globe community engagement. At the same time, we are giving voice to geoscience of the future, and we are collecting and curating narratives of IUGS's accomplishments since its establishment.

When I assumed the role as president of IUGS in 2016, I looked forward to finding ways to sustainably increase memberships and further improve our contributions, enhance international influence and better serving both the science and the society.

As I end my term, I am proud to say that IUGS has been playing a leading role in international collaborations during this time. I am honored to have been able to help the organization set its

direction through a period of reflection and innovation. I am proud to have led an organization that is rising to its challenges.

This report only provides the summary of some of the relevant issues and activities. A more complete list of events and progress made can be found in the report of the IUGS Secretary General regarding the administration of IUGS. Financial details can be found in the Treasurer's report. To end this report, I would like to thank all EC members and leaders of constituent groups for their cooperation and engagement. I also give my sincere gratitude to those who have made generous contributions supporting me and IUGS. Without their hard work and supports, participations and collaborations, it would have been impossible to make any significant progress. As the President of IUGS, I appreciate the opportunity to work with everyone making collective efforts to advance the geological sciences and to empower the IUGS.

Thank you for your continued support and engagement !