



# CGI ANNUAL REPORT 2020 & 2021 BUDGET REQUEST

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## 1. Main role of CGI

The Commission for the Management and Application of Geoscience Information (CGI) is a Commission of the International Union of Geological Sciences (IUGS).

- *Mission*

To foster the interoperability and exchange of geoscience information to the entire earth-system, by active community leadership, collaboration, education, and the development and promotion of geoscience information standards and best practice.

- *Vision*

- that geoscience information can be exchanged, understood, and used without limitation,
- that geoscience information can be readily integrated with standards-based information from other knowledge domains,
- that geoscience information is semantically rich and structured to enable seamless interaction in all environments,
- that global education about the management, modeling, exchange, and use of geoscience information enables its best possible application,
- that geoscience information is used for the benefit of all society.

## 2. Role within IUGS science policy

The CGI fills the role of the geoscience information body of the IUGS. It represents IUGS on geoscience information matters, provides the means for transferring knowledge on geoscience information and systems, assists international dissemination of best practice in geosciences information, stimulates and supports initiatives which are developing standards and its Council members hold several significant positions within the international geosciences information community.

## 3. Organization, Council members and officers

- *Council Officers 2020-2024*

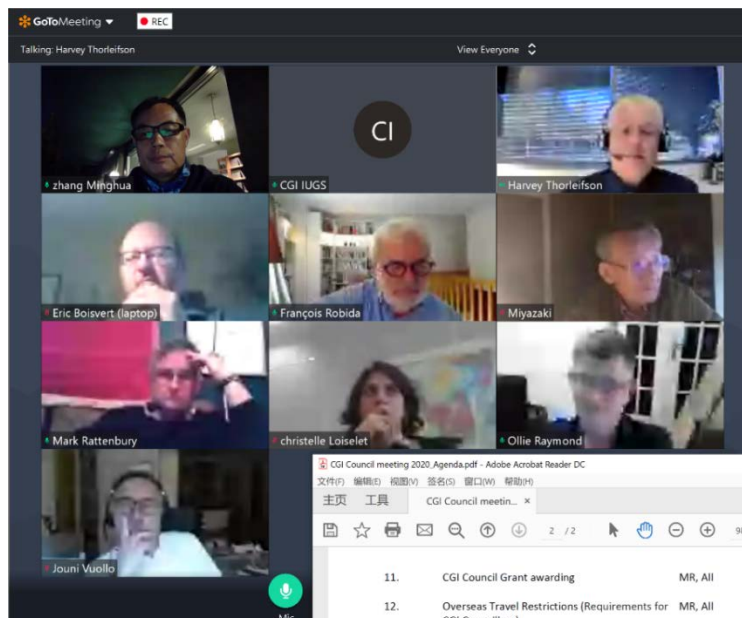
The CGI Council members are:

- Harvey Thorleifson (Chair) – USA
- Zhang Minghua (Co-Secretary General) – China
- Kombada Mhopjeni (Co-Secretary General) – Namibia
- Mark Rattenbury (Treasurer) – New Zealand
- Kazuhiro Miyazaki – Japan
- Éric Boisvert – Canada
- Christelle Loiselet – France
- Edward Lewis – UK
- Ollie Raymond (Observer) – Australia
- David Percy (Observer) – USA
- François Robida (former Chair) – France

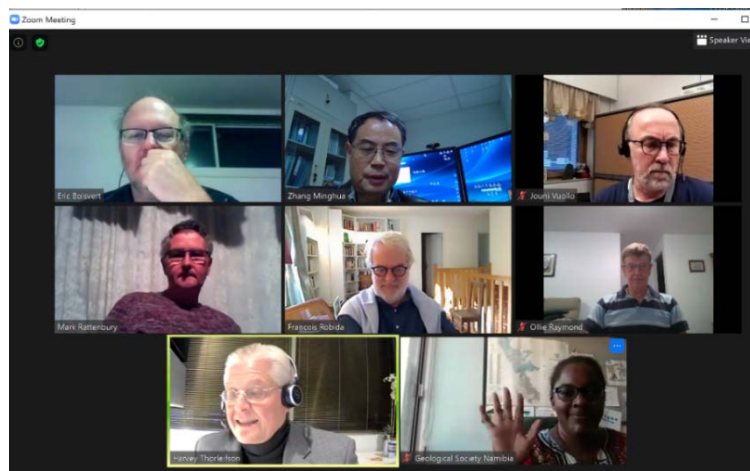
The Council was elected in 2020 for the term 2020-2024. The newly elected Council members are widely distributed across many of the continents. The list of contacts is given in Appendix.

The planned annual face to face Council meeting in Delhi, India at the 36<sup>th</sup> IGC was canceled due to the COVID-19 pandemic. CGI Council thus held two online meetings on Oct. 7 and Nov. 12, 2020 to elect the new Council and to manage progress. New CGI Council Chair Harvey Thorleifson thanked outgoing CGI Council members François Robida, Ollie Raymond and Jouni Vuollo for their dedication and contributions to CGI in his remarks.

CGI Council Chair Harvey Thorleifson attended the IUGS extraordinary session on 28-30 October 2020 and reported for CGI to IUGS at the session.



CGI Council meetings online – Oct 7 (upper) and 12 Nov(lower), 2020.

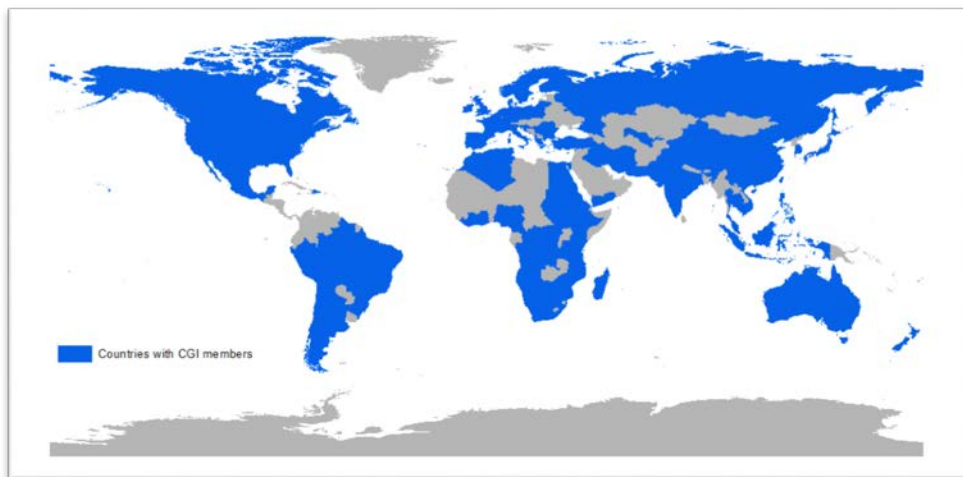


The CGI secretariat is located at the Development Research Center of China Geological Survey, Ministry of Land and Resources, P. R. China. The contact email is

[CGIsecretariat@mail.cgs.gov.cn](mailto:CGIsecretariat@mail.cgs.gov.cn).

The CGI working groups are coordinated by:

- GeoSciML Standards Working Group (GeoSciML) – Éric Boisvert, Canada in collaboration with the Open Geospatial Consortium (OGC)
- EarthResourceML Working Group (ERML) – Jouni Vuollo, Finland, followed by Michael Sexton, Australia, as of January 2021
- Geoscience Terminology Working Group (GTWG) – Mark Rattenbury, New Zealand
- GeoScience Domain Working Group – Mickael Beaufiles, France in collaboration with the Open Geospatial Consortium (OGC)
- Geoscience Information in Africa – Network (GIRAF) – Mesfin Wubeshet Gebremichael, Tanzania



*Global distribution of CGI members (countries in blue).*

- **Membership**

CGI now has 520 members in 82 countries across the world. Since the last face to face council meeting in Madrid in 2019, CGI gained 57 members mostly from Africa and Asia. From 2016-2020, 109 members from 91 organizations in 41 countries joined CGI. Five new members from UK, India, Australia, and China have joined in 2020, during the pandemic that affects activities of all geoscience organizations.

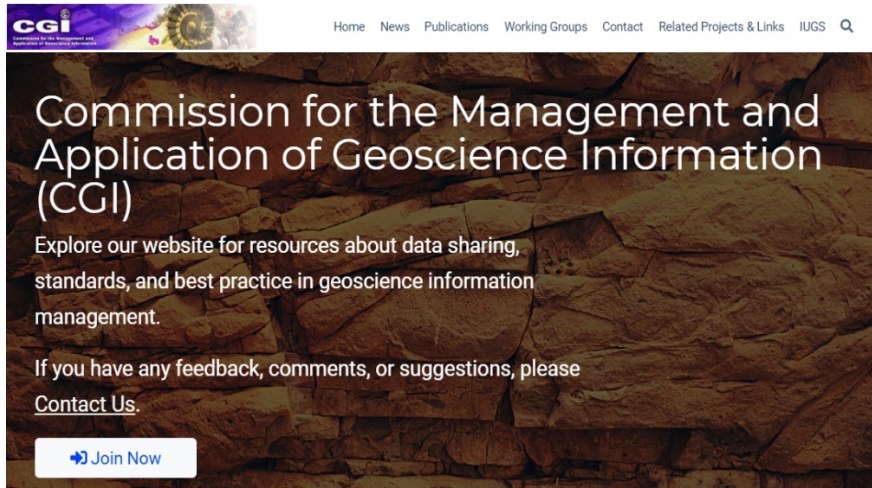
The CGI created a LinkedIn group (<http://www.linkedin.com/groups/6539642>) to publicize conferences and other CGI-related documents. Ollie Raymond, the outgoing treasurer gave Harvey Thorleifson, Kombada Mhopjeni and Zhang Minghua administrative rights to the CGI LinkedIn group this October.

## **4. CGI online presence and Newsletters**

The British Geological Survey (BGS) has agreed to manage the CGI website as an in-

kind contribution, with the hosting and editing of the CGI web content done on GitHub. Edd Lewis is responsible for managing the website, however this approach does allow others to more easily submit news articles, updates or edits directly.

A BETA version of the site, which can be viewed at <https://cgi-iugs.github.io/>, will be migrated to [www.cgi-iugs.org](http://www.cgi-iugs.org) after final edits in Q1 2021.



All content from the old site has been migrated to the new beta site, including Newsletters which have been converted from PDF to HTML.

Website: [www.cgi-iugs.org](http://www.cgi-iugs.org)

Twitter: [https://twitter.com/CGI\\_IUGS](https://twitter.com/CGI_IUGS)

LinkedIn: <https://www.linkedin.com/groups/6539642/>

Below working group addresses will change to [www.cgi-iugs.org/XXXXXX](http://www.cgi-iugs.org/XXXXXX) shortly

ERML: <https://cgi-iugs.github.io/project/earthresource/ml/>

GeoSciML: <https://cgi-iugs.github.io/project/geosciml/>

GTWG: <https://cgi-iugs.github.io/project/geoscienceterminology/>

OGC-CGI Geoscience Domain WG: <https://cgi-iugs.github.io/project/geosciencedwg/>

The editorial role of the CGI newsletter has been discussed at the Council meeting.

## 5. Extent of support from sources other than IUGS

Other than the substantial in-kind contribution of the geological organizations that pay the salaries and expenses of CGI Council and members, the CGI does not receive additional support. Sometimes CGI workshops and activities are co-organized or supported by other organizations such as UNESCO, Minnesota Geological Survey, Geological Survey of Canada, China Geological Survey, GNS Science (New Zealand), Geological Survey of Namibia, Australian Aid, and the United Nations Development

program.

## 6. Interaction with other international organizations

- *CGI collaboration with OGC*

CGI, in collaboration with OGC, is continuing to develop GeoSciML geology data model standard. Both the linked global OneGeology project and the past European EC project OneGeology-Europe are using GeoSciML to make geological data interoperable and accessible via their web portals. The EC Directive INSPIRE used for the Geology and Mineral Resources Implementing Rules CGI products: the GeosciML and Earth Resource ML (ERML) data model and CGI vocabularies. ERML was adopted by major EU funded projects as Mineral4EU or EURare.



GeoSciML is now hosted on the OGC GeoSciML website.

The original CGI GeoSciML website still maintains access to historic versions of GeoSciML and links to other supporting resources like UML models and vocabularies.

*OGC is an international industry consortium of over 538 companies, government agencies and universities, which is driven to make geospatial information and services findable, accessible, interoperable and reusable.*

- *CGI-YES Competition Award on CGI-IUGS Standards for Geoscience Data*

CGI and the Young Earth Scientists (YES) Network have cooperated successfully in holding a Competition on CGI-IUGS Standards for Geoscience Data. Passionate young geoinformatics professional were to present their application of CGI standards at the 36th IGC by sharing the payment of the successful applicant's travel, accommodation and registration cost. CGI had committed to pay the successful applicant up to \$2,000 USD towards the cost of travel and accommodation at the IGC, and the registration cost was to be covered by the YES Network. The winner out of 8 applicants selected by the CGI EC was Dr. Cao Yaqin from Jilin University, China.



- *CGI and CODATA*

CGI standards were presented at past CODATA conferences, especially 2019 in Beijing. CGI's excellent governance of geoscience vocabularies resulted in an invitation to contribute to the FAIR Vocabularies Session at the 2020 FAIR Convergence Symposium co-organised by CODATA. Cooperation needed to jointly set up the Standards Task Group (STG) for the IUGS big science program DDE has been successfully launched



(<http://www.ddeworld.org/read>). Leaders of the DDE- STG were honored to be chosen by DDE as one of the five empowered projects in 2020. A 3-year project proposal has been submitted to the DDE Science Committee for evaluation.

- **2. CGI and DDE**

CGI is one of the founding members of the IUGS DDE program, recognizing the importance of standards in the building of this large international initiative that was kicked off in February 2019 and that will last 10 years.



CGI has been continuously active and successfully leading the DDE Standards Task Group in collaboration with CODATA and other DDE working groups. Some 25 geoscientists including 14 CGI member geoscientists and CGI councillors now work in DDE-STG. The focus is on the short-term plan for the DDE knowledge system review, based on CGI Geoscience Terminology experience, GeoSciML, and EarthResourceML. There will be training for DDE cross-disciplinary scientists, especially for DDE national nodes, and DDE metadata standards based on ISO19115 as well as implementation metadata standards.

- **CGI and OneGeology**



GeoSciML was adopted by OneGeology upon initiation of this international initiative in 2007. CGI's EarthResourceML data standard has also been implemented in OneGeology for mineral resource data. The OneGeology mineral service based on ERML lite was prepared in 2020.

*OneGeology has been recognized as an innovative initiative largely due to the extensive use of CGI standards. It has been recognized at international conferences as demonstrating efficient interoperability based on international standards. Through OneGeology and other projects, the geological surveys around the world have broadly adapted GeoSciML and ERML, which is now implemented on a large scale in Europe and Oceania.*

## 7. Chief accomplishments and products

### 7.1 CGI News

- **CGI's leading role in the DDE Standards Task Group**

As one of the founding members of the IUGS big science program DDE program, CGI organized the first face to face meeting of the DDE Standards Task Group (DDE-STG) together with the Suzhou center of DDE in Beijing on 12-13 January 2020. Some 28 participants including CGI, CODATA and DDE scientists from 11 countries in Asia, Africa, Europe, Oceania and South America, along with the President of IUGS Prof Qiuming Cheng, Secretary General of DDE EC Prof Fan Junxuan, Vice President of China Geological Survey Dr Li Pengde, attended the meeting. Chaired by François Robida and co-chair Zhang Minghua, the meeting discussed the STG organizational structure and work mechanisms, the 10-year work proposal, and the short-term work plan for 2020, including DDE knowledge system review, metadata standard, international standards training, activity plan for the 36th IGC, and budget for fruitful results.



*Group photo of the DDE-STG face-to-face meeting, Beijing, Jan. 12-13, 2020.*



*Meeting photo of the DDE-STG face-to-face meeting, Beijing, Jan. 12-13, 2020.*

- ***CGI standards promotions***

CGI standards were introduced to scientists, geologists and officials of science and geoscience organizations at events and workshops in 2020, including DDE meetings, especially to the DDE-CGMW and DDE Big Data groups, as well as CCOP and ASEAN online sessions. For example, with the organization and participation of Zhang Minghua and Jouni Vuollo, and also with preparation from Éric Boisvert and Mark Rattenbury, a presentation titled International Earth Resource and Geosciences Data Standards and Implementation at the UNFC/PRMS online/off-line conference on Sustainable Resources Management, Technology and Best Practice was successful in the promotion of CGI standards to this sector of UN resource management, especially in minerals, and also for CCOP in the region of East and Southeast Asia to follow CGI



standards in geosciences data management. Also, opportunities for cooperation with UNECE on a common/general resource classification code and standard framework, and with CCOP for training, was clearly seen from discussion at the conference, so CGI may be invited to take part in relevant project work.



*UNFC/PRMS online/off-line conference on Sustainable Resources Management, Technology and Best Practice on 28-29 Sep. 2020.*

- *CGI-IAMG-OneGeology symposium at 36th IGC was postponed due to the pandemic*

The symposium organized by CGI together with IAMG and OneGeology at the 36<sup>th</sup> IGC with the session number 45.10 and the title of Advances in Geoscience Data Sharing and Processing was postponed due to the COVID-19 pandemic in 2020.

The symposium had received and viewed 29 submitted abstracts, with 24 accepted including 18 for oral presentation.



## 7.2 Working Group Reports

### 7.2.1 GeoSciML Standards Working Group



- *Membership and repository*

The official OGC GeoSciML Standards Working Group (SWG) membership stands at 49 members and observers. The public GeoSciML mailing list has 98 registered members from Australia, Austria, Belgium, Brazil, Canada, China, Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, New Zealand, Poland, Portugal, Russia, Spain, Sweden, UK, and USA.

GeoSciML schemas on the OGC public schema site are at <http://schemas.opengis.net/gsml/4.1/>. The GeoSciML SWG's GitHub repository provided by OGC is located at <https://github.com/opengeospatial/GeoSciML>. Sylvain Grellet (BRGM) and Éric Boisvert (GSC) have management responsibilities.

- *Meetings and activities*

Since publication of the standard in 2017 (OGC 16-008), the GeoSciML Standard Working Group is mostly in maintenance mode. There were few official GeoSciML activities during 2020. The only formal meeting where GeoSciML was discussed was during the December 2020 virtual meeting of the GeoScience DWG.

Other activities do not affect the model itself, but reflect a shift regarding how data are used, by machine learning and artificial intelligence. The emergence, and fast growth, of these technologies is pressuring geoscience information providers to feed data-hungry algorithms with data and knowledge. Loop3D (<https://loop3d.org/>) in partnership with OneGeology, is concluding the current phase of development of the Knowledge Management Work Package, a knowledge encoding (OWL/RDF) of GeoSciML. The ontology community is leveraging the GeoSciML model and vocabulary – with strong emphasis on the latter - in an attempt to encode geoscience knowledge. Loop3D presented their activities at the December Geoscience DWG virtual meeting in December and seek comments from the community.

- *Uptake*

There is an increasing amount of GeoSciML based web services, mostly because of OneGeology and INSPIRE and spinoff projects (such as EPOS <https://www.epos-ip.org/tcs/geological-information-and-modeling/data-services/wp15-services-and-architecture>) and large initiatives such as GeoEra (<http://geoera.eu/>), USGIN (<http://usgin.org/>), and GIN (<http://gin.gw-info.net>), etc. GeoSciML lite is by far the most popular version because of its simplicity. This sends a strong message that simple models are a key to driving uptake.

IDBE Geotech is including GeoSciML in their standardization effort (Geotechnical Standardization Working Group), and planning to create a Geotechnical Extension of GeoSciML. This work will come to fruition by the end of 2021.

The emerging focus is to build knowledge representations (such as OWL) while several projects are looking into encoding vocabularies to enable machine reasoning and linked data applications. GeoSciML, and especially the work of the Geoscience Terminology Working Group, is attracting much interest from the knowledge representation community (for example OntoGeonous-GS, Loop3D).

- *Future work*

At the latest GeoScience DWG, it was agreed that progress be made on GeoSciML encoding issues that have been lingering. The uptake of the new OGC API – while not imposing any specific encoding – brings some expectation from developers that services provide formats from the JSON family.

Because of its simplicity, and popularity, GeoSciML-Lite has been identified as a quick win for \*JSON encoding. BRGM suggested that a one- or two-day workshop could be organized around March or April 2021 to kickstart the process.

RDF encoding is already being undertaken by Loop3D, under the OneGeology umbrella. This effort follows early contributions from BRGM, addressing a different modelling and encoding perspective.

(by *Éric Boisvert*)

## 7.2.2 Geoscience Terminology Working Group

- *Activities*

The group has 27 members, from Australia, Brazil, China, Denmark, Finland, France, Germany, Great Britain, Italy, New Zealand, Poland, Russia, Slovenia, Spain, Sweden and USA. Membership is defined and managed through a Google Group with membership rights administered by Mark Rattenbury (NZ, chair since 2014) and Steve Richard (USA). Actual participation in vocabulary development and management involves only about half of the membership.

The 2020 face-to-face meeting was not held. The meeting had been scheduled to coincide with the IGC Delhi in March, but was cancelled due to Covid-19 concerns and travel restrictions.

The GTWG activities are described under links from the CGI website, simplified and updated in late 2016, [http://www.cgi-iugs.org/tech\\_collaboration/geoscience\\_terminology\\_working\\_group.html](http://www.cgi-iugs.org/tech_collaboration/geoscience_terminology_working_group.html) and from the GeoSciML website at <http://www.geosciml.org/>

- *Achievements*

No new vocabularies have been adopted. The vocabulary host service has been moved to a cloud-based VocPrez instance managed by Geoscience Australia. The SKOS-RDF vocabulary files are now stored on a CGI-IUGS Github repository and accessed by VocPrez. The SKOS-RDF files can be edited and republished instantly by those with appropriate access. The CGI-IUGS vocabularies are all published for general discovery in the Australian National Data Service (ANDS)'s Research Vocabularies Australia (RVA) Portal:

<https://vocabs.ands.org.au/search/#!/?p=1&publisher=CGI%20Geoscience%20Terminology%20Working%20Group&q=>

Particular thanks are due to Ollie Raymond and his GA team for making their server facilities available for CGI.

IUGS's Deep-time Digital Earth Project has included a significant component of data standards to be guided by the Standards Task Group (DDE-STG). Much of the work involves uptake and improvement of geoscience vocabularies and several members of GTWG (Mark Rattenbury, Zhang Minghua, Tim Duffy, Ollie Raymond) are involved in the DDE-STG to facilitate this.

Mark Rattenbury was invited to present to the online-only Earth Science Information

Partners (ESIP) meeting in July on the importance of governance for vocabularies, and chaired a breakout session on reusable vocabulary governance and maintenance for the virtual International FAIR Convergence Symposium, December 2020, convened by CODATA and GO FAIR.

- *Future Work and Issues*

There remain a number of outstanding GeoSciML data model vocabularies still to complete, although the GeoSciML Basic module and EarthResourceML requirements have been prioritised. The EarthResourceML data model still requires the key but problematic mineralDepositType vocabulary and some progress has been made using critical minerals classification of several geological surveys.

A CGI Council grant has been awarded to the British Geological Survey to advance and deliver three vocabulary-related items in 2021:

1. Functioning VocPrez service on Github architecture
2. Updated SKOS-RDF files for all vocabularies with translated MTG terms and links added to all related INSPIRE vocabularies
3. Published SKOS-RDF files for all vocabularies with translated MTG terms and links where available

Working group activity is still unsatisfactorily low, and this has been exacerbated by the lack of a face-to-face meeting in 2020 due to Covid-19-imposed restrictions.

*(by Mark Rattenbury)*

### 7.2.3 EarthResourceML (ERML) Standards Working Group

- *Activities*

This ERML SWG-report covers the period from November 2019 to December 2020.

The ERML WG has 20 members, from Australia, China, Canada, Denmark, Finland, Sweden, France, Great Britain, New Zealand, Poland and USA. Membership is defined and managed through a Google Group with membership rights administered by Jouni Vuollo (FIN, chair since 2014).

The 2020 face-to-face meeting was not held. The meeting was scheduled to coincide with the IGC Delhi in March but was cancelled due to Covid-19 concerns and travel restrictions. At the end of 2020, the ERML WG hold its first Online annual “F2F2” meeting on 14.12.2020 via MS Teams, with twelve members participating in the meeting. Michael Sexton from GeoScience Australia was elected the new chair.

The ERML WG participated in many promotional activities, including meetings such as the FennoScandian Exploration and Mining conference (2-4 November 2019), RDA meeting in Helsinki (23-25 October 2019), and the UNFC/PRMS online/off-line

conference on Sustainable Resources Management, 28-29 September 2020. Successful adoption of ERML in several endeavors such as OneGeology, and by Canadian Geological Survey agencies is needed to keep up momentum. A funding proposal done by Nordic countries and BGS, with Geoscience Australia (GA) as a potential associate partner, for building a OneGeology mineral service based on ERML lite has been prepared, but no funding has been secured yet.

It is critical for CGI to maintain and renew the expertise as core people retire.

The ERML WG activities are described under links from the CGI website [http://www.cgi-iugs.org/tech\\_collaboration/earthResourceML.html](http://www.cgi-iugs.org/tech_collaboration/earthResourceML.html). Vocabulary work for ERML and GeoSciML standards can be seen via GTWG website at [http://www.cgi-iugs.org/tech\\_collaboration/geoscience\\_terminology\\_working\\_group.html](http://www.cgi-iugs.org/tech_collaboration/geoscience_terminology_working_group.html).

- *Data Model Development and Documentation*

***The ERML data model***

Version 2.0 of the CGI data standard for mineral occurrences and mines was published in 2014: <http://www.earthresourceml.org/>. After small modifications in 2015 and 2016, ERML is now fully compatible with the requirements of the European Commission's INSPIRE data specification for Mineral Resources.

ERML Lite 2.0.1 was published 2018, and its implementation is in progress in Australia (AusGIN) and on the OneGeology Portal.

There were few official ERML activities during 2020, and new full version of ERML is in progress, in relation to European needs for mining waste.

***Documentation***

All the CGI SWG web pages have been harmonized, and the ERML web pages ([http://www.cgi-iugs.org/tech\\_collaboration/earthResourceML.html](http://www.cgi-iugs.org/tech_collaboration/earthResourceML.html)) have been updated. The data model documentation has been published in the ERML web pages.

- *Uptake of EarthResourceML*

It is pleasing to note that there has been wide uptake of the ERML data standard in national and subnational geological surveys, for example in Australia and Europe, mainly through its adoption by data sharing communities such as OneGeology, AuSGIN, INSPIRE/Minerals4EU and EGDI. In the short term, the major challenge is to get USGS/USA and GSC/Canada to join as active participants to develop/implement the ERML standard. Recently, Chinese organizations and the British Columbia Geological Survey in Canada have been actively supporting the SWG.



*New version of the OneGeology portal published in early 2019. Data are from the Circum Arctic and Fennoscandian area and British Columbia, Canada, and are based on the ERML Lite 2.0.1 data model.*

- *Work planned*

Future development of ERML and ERML Lite will be undertaken by the ERML Working Group based on feedback from use of ERML v2.0 such as Minerals4EU and ProSum projects. The next versions of ERML v.3.0 will be published in 2021.

The EarthResourceML data model still requires the key but problematic mineralDepositType vocabulary. GA, USGS, and GSC have started critical mineral projects that include vocabulary work, which may play a role.

Plans for the rescheduled 36th IGC have been ongoing, and new services to OneGeology Mineral Resource service is in progress (e.g GeoScience Australia and European data sets - EGD).

*(by Jouni Vuollo)*

#### 7.2.4 The Joint CGI/OGC Geoscience Domain Working Group

A report on the Borehole Interoperability Experiment was delivered in May 2019. At the Dublin OGC meetings, plans had been made to start a working group on 3D standards, and the leadership position is still open.

Some peripheral work has been done in EPOS on description and access to 3D models. There are OGC and CGI efforts on geotechnical data. Several discussions were held with other OGC groups especially with the IDBE (Integrated Digital Built Environment), a joint working group between OGC and building Smart International (bSI) on BIM standards, and on developing standard models for describing the city subsurface.

The recent MUDDI (Model for Underground Data Definition and Integration) SWG is

also targeting a conceptual model to describe the urban subsurface. With the spread of BIM and the Digital Twin concept, more and more cities are asking for or even experimenting the definition of Urban Digital Twins, including their subsoil. This context emphasizes the demand for standardized APIs and vocabularies for subsurface description. CGI has great potential for a more significant role in OGC, so more coordination is needed.

Following its official creation in September 2017 (Southampton TC), several sessions of the GeoScience DWG were held in 2018 (Orleans TC, Stuttgart TC), 2019 (Toulouse TC) and 2020 (Virtual TC). Several use cases have been identified and are addressed. Currently the group is chaired by Mickaël Beaufils (BRGM). Since the departure of the second co-chair Carina Kemp (Geoscience Australia) no substitute was proposed yet.

About GeoScienceDWG: <https://www.ogc.org/projects/groups/geosciencedwg>

Resources: [https://external.ogc.org/twiki\\_public/GeoScienceDWG/WebHome](https://external.ogc.org/twiki_public/GeoScienceDWG/WebHome)

- *The Borehole Interoperability Experiment (Borehole IE)*

The Borehole IE is defining a domain neutral semantic for a general concept for boreholes and associated data. This activity resulted with the redaction of a public OGC engineering report (<https://portal.ogc.org/files/19-075r1>) that summarize the overall cross-domain (including Oil&Gas, with Energetics), inter-standard findings and recommendations for a best practice implementation that should follow.

About Borehole IE: <https://github.com/opengeospatial/boreholeie>

Resources: <https://github.com/opengeospatial/boreholeie/>

<http://www.opengeospatial.org/projects/initiatives/boreholeie>

Final report: <https://portal.ogc.org/files/19-075r1>

*(by Mickaël Beaufils and François Robida)*

## 7.3 CGI Regional Group Reports

### 7.3.1 CGI in Asia

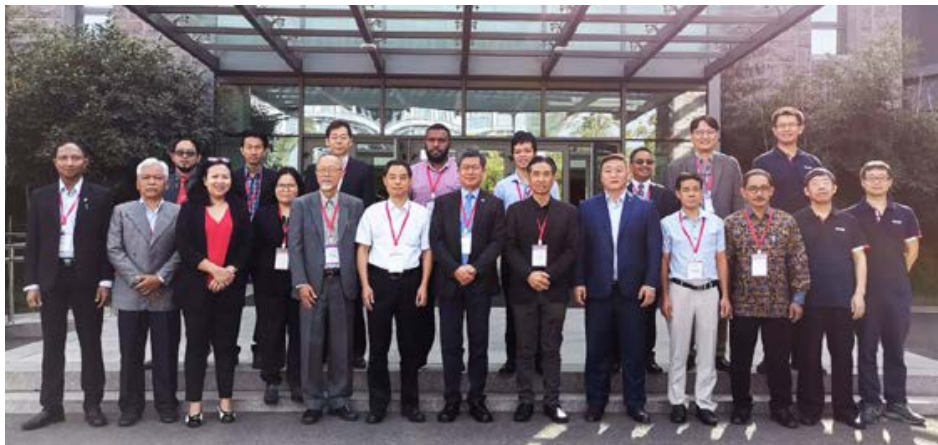
Meetings, activities and projects were greatly affected by the COVID-19 pandemic in 2020. However, several important activities in promotion and implementation of CGI-IUGS standards have been conducted, and achievements were made with efforts of the local group.

The Geological Survey of Japan (GSJ) supported the OneGeology MSW map from the Coordinating Committee for Geoscience Programs in East and Southeast Asia (CCOP) countries, hosting various geological maps. Most of WMSs of the geological maps of the countries in East and Southeast Asia are hosted by GSJ servers, including geological

maps of Indonesia, Malaysia, Vietnam, Myanmar, Philippines and Papua New Guinea. The WMSs of Laos, Thailand and South Korea are hosted by these countries' servers.

GSI added 98 sheets of 1:200K geological maps covering most of Japan's prefectures, 20 1:50K geological maps covering major Japanese volcanoes, 1:10M Geological Map of Asia, the 1:10M Plutonic and Volcanic rocks of Asia, 1:10M Earthquake Source Region of East Asia, 1:10 Tephra Fall of East Asia, 1:200K Seamless Geological Map of Japan V1, and 1:200K Seamless Geological Map of Japan V2.

In the Asia region, CCOP has continued leading geoscience information efforts. Participants from 15 CCOP member countries were trained on integrated geological data processing and CGI-IUGS geosciences data standards by CCOP-CGS-IGDP project in September 2019 in Qingdao, China.



CGI standards were promoted at the 55th CCOP annual session in Chiangmai, Thailand in November 2019, and at a United Nations Framework Classification for Resources (UNFC) meeting under the theme Sustainable Resources Management, Technology and Best Practice in September 2020. Experts from Sinopec, one of the largest Chinese oil companies, and the Ministry of Natural Resources showed interest in cooperation with CGI on a resource classification code and standard framework under UNECE.



*CGI-IUGS standards introduction at the 55th CCOP annual session.*



EarthResourceML and other CGI standards were introduced at the ASOMM +Three (China, Korea, Japan) online conference to ASEAN senior officers in mining and mineral sector for effective platform and databases development to implement AMCAP phase 2: 2021-2025.

Testing was completed in 2019-2020 for implementation of ERML and GeoSciML at China Geological Survey for data releases.

*( by Zhang Minghua and Kazuhiro Miyazaki)*

### 7.3.2 CGI in Africa

Several CGI outreach activities were carried out to promote CGI work, including presentations on CGI standards at the Organisation of African Geological Surveys technical committee meeting (11-13 June 2019) and the Geoscience Information Consortium (GIC) Africa annual conference (27-29 November 2019) in Windhoek.

To revive Geoscience Information in Africa (GIRAF) activities and improve engagement with members, the Geological Society of Africa and GIRAF Secretariat held discussions in an online meeting. A GIRAF workshop and meeting are planned for the 28th Colloquium of African Geology (28CAG) in Morocco, postponed to 2021.

*( by Kombada Mhopjeni)*

### 7.3.3 CGI in South/Latin America

No report from South America this year due to lack of Council representation of this region.

### 7.3.4 CGI in North America

In the US, the Federal Geographic Data Committee (FGDC) is now governed by the National Geospatial Act 2018, which will improve reporting on the status of national geospatial data assets, including geology. EarthCube and USGIN are active. USGS is increasing focus on EarthMap, a digital twin of U.S. There have concurrent developments in Canada on Canada 3D, a spatial equivalent of EarthMap. The U.S. Congress has provided USD10 million a year to launch National Geologic Map Database (NGMDB) Phase Three, focused on seamless, evergreen compilations.

Several in-person meetings shifted to virtual, including the 3D webinar planned for November 2020, and the Digital mapping Techniques meeting in June 2020, and the Geological Mapping Forum. The USGS National Geological and Geophysical Data Preservation program (NGGDPP) is launching a national borehole index.

There has been increased activity in EarthMRI, a USGS led mineral information system,

due to robust funding from congress.

In Canada, GIN is migrating to a new platform based on linked data. A pilot project concluded with the USGS for ground and surface water has implemented some of the linked data approach. There will be efforts to coordinate North American efforts on the borehole index with the EU borehole index work. There is ongoing work to implement GeoSciML and ERML to support a national infrastructure for data exchange between federal and subnational data providers in Canada.

*( by Harvey Thorleifson and Éric Boisvert)*

### 7.3.5 CGI in Europe

The anniversary of INSPIRE was in October 2020, and the final implementation/delivery of data for INSPIRE is based on CGI standards. There has been much activity on the EGDI and development of EPOS infrastructure, a platform for EU researchers. There is a new project of EU geological surveys on digital twins and the contribution of geosciences to digital twins.

In 2019, two European initiatives developing Pan-European infrastructure with the support of the European Union have been developed. Both are implementing and supporting CGI standards.

- *GeoERA* <http://geoera.eu/>

A group of 45 national and regional geological survey organisations (GSOs) from 32 European countries have joined forces to develop an ERA-NET Co-Fund Action programme titled “Establishing the European Geological Surveys Research Area to deliver a Geological Service for Europe (GeoERA)”.

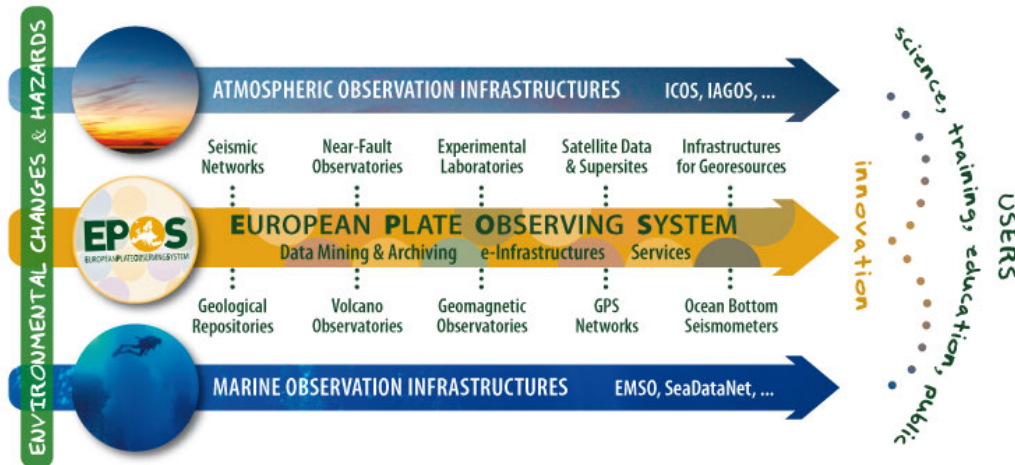
Funding of the projects will partly be covered by the GeoERA consortium members (70%) and partly by the European Commission (30%). The programme has a total budget of 30.3 M€, and the projects will run for three years starting in June of 2018. Only members of the GeoERA consortium are beneficiaries of the GeoERA projects.

The main objective of GeoERA is to contribute to the optimal use and management of the subsurface. GeoERA will fund 15 research projects that will support 1) more integrated and efficient management and 2) more responsible and publicly accepted exploitation and use of the subsurface. The projects will cover the applied geosciences, addressing the following four themes: geo-energy, groundwater, raw materials, and information platform. The information platform will support the requirements of the three other themes, and in particular for data dissemination. It is built on the top of the EGDI (European Geological Data Infrastructure). Edd Lewis of CGI Council is involved in those parts of the project. GeoERA uses CGI standards for the geological and mineral resources data, and contributes to the evolution of 3D practices.

- *EPOS* <https://www.epos-ip.org>

EPOS, the European Plate Observing System, is a long-term plan to facilitate integrated use of data, data products, and facilities from distributed research infrastructures for solid Earth science in Europe.

EPOS brings together Earth scientists, national research infrastructures, ICT (Information & Communication Technology) experts, decision makers, and public to develop new concepts and tools for accurate, durable, and sustainable answers to societal questions concerning geo-hazards and those geodynamic phenomena (including geo-resources) relevant to the environment and human welfare.



The EPOS vision is that the integration of the existing national and trans-national research infrastructures will increase access and use of the multidisciplinary data recorded by the solid Earth monitoring networks, acquired in laboratory experiments and/or produced by computational simulations. The establishment of EPOS will foster worldwide interoperability in the Earth sciences and services to a broad community of users.

The EPOS mission is to integrate the diverse and advanced European Research Infrastructures for solid Earth science, and build on new e-science opportunities to monitor and understand the dynamic and complex solid-Earth System.

EPOS has been initiated through H2020 co-funded projects, and became a legal body in October 2018. The main H2020 project was finished in September 2019. The geological data are served through “Thematic Core Services” based on CGI standards, delivering for instance access to millions of boreholes across Europe. EPOS also contributed to the CGI/OGC Borehole Interoperability Experiment.

- *5th European Meeting on 3D modelling* <http://3dgeology.org/bern.html>

The 5th European workshops on 3D geological modelling took place between May 21st – 24th 2019 in Bern – Switzerland.

Discussions addressed the developments of modeling tools and practices, but also focused on the need for standards to access and use 3D models. The concept of digital twins, that requires this type of standards, was also discussed during the event.

( by François Robida and Edd Lewis)

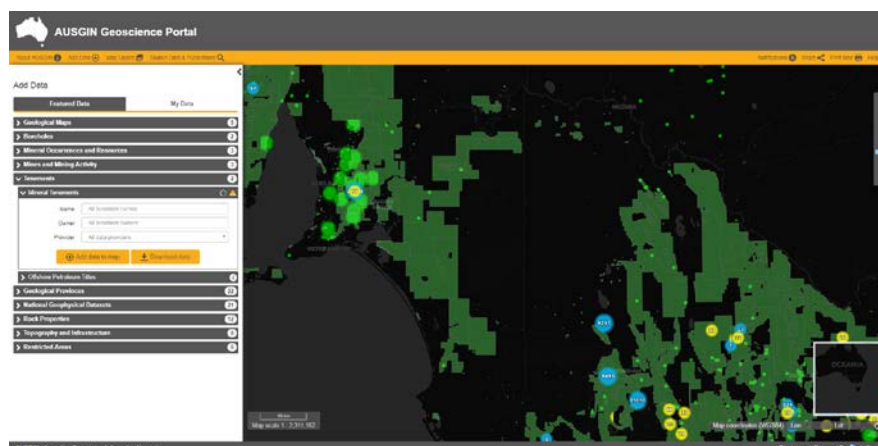
## 7.2.6 CGI in Oceania

The Australia/New Zealand Government Geoscience Information Committee (GGIC) met twice in 2020, both virtual meetings due to pandemic travel restrictions. New projects include:

- GeochemistryML Working Group
  - developing an agreed data transfer standard for inorganic geochemistry data for solid earth materials (ie, not hydrochemistry, not organic chemistry)
  - will require vocabularies for sample type, sampling method, material class, which are under development in CGI GTWG
- Petroleum Data Working Group
  - developing stricter national standard guidelines for submission of petroleum exploration data to government jurisdictions
  - developing an Aus/NZ data transfer standard for Petroleum Tenement data
- Developing tools for spatial data matching within and between databases, and data validation of mandatory industry reporting to Geological Survey Organisations

### AusGIN – Australian Geoscience Information Network

- flagship project of GGIC
- ongoing developments of AusGIN Portal functions to deliver and analyse interoperable data services
- ongoing collaboration between Australasian GSO's to improve the quality of interoperable web services and improve the web services skills bases of State and Territory GSO's working with limited budgets



*AusGIN Geoscience Portal, showing web map services of mineral exploration tenements, mineral occurrences, and petrophysical measurements as clustered points*

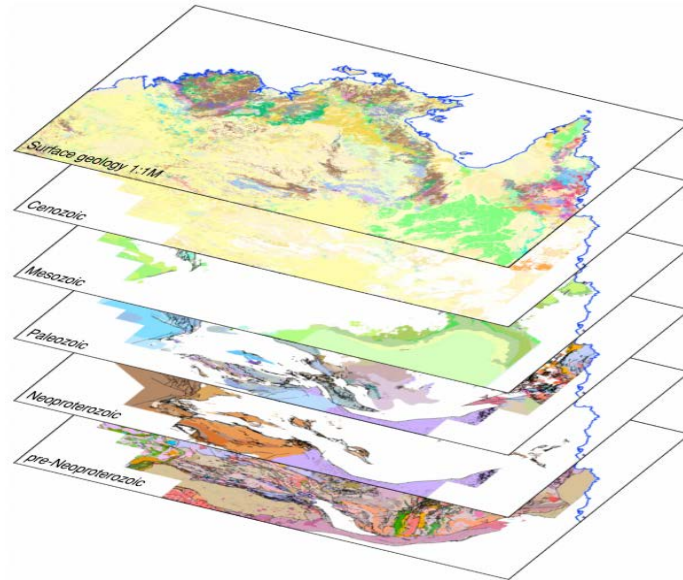
### Cloud

Geoscience Australia has redeveloped the aging Australian [Geophysical Data Delivery application](#) to now be a cloud hosted, open format (NetCDF), web services-based (WMS, WFS) system for delivering geophysical datasets such as magnetics, radiometrics, and gravity data from all Australian GSO's. The new system will be extended to deliver AEM and

magnetotelluric data in 2021.

### New Data Releases

In Australia, a national coverage of subsurface geology was begun with the publication of the solid geology of the northern half of Australia at 1:1,000,000 scale - <http://pid.geoscience.gov.au/dataset/ga/135277> - the dataset includes 2.5D geological interpretation of time slices through the Australian crust.



*New geological time slice maps through the northern Australian continent*

In New Zealand, there have been some significant data releases:

- Bathymetric and tectonic maps of Te Riu-a-Māui/Zealandia, extending over New Zealand's Exclusive Economic Zone and Extended Continental Shelf have been printed as a poster at 1:8,500,000. Their underlying data are GeoSciML-Lite compliant where applicable and are accessible from [https://data.gns.cri.nz/gis/rest/services/TRAMZ/TRAMZ\\_webmap\\_2020/MapServer](https://data.gns.cri.nz/gis/rest/services/TRAMZ/TRAMZ_webmap_2020/MapServer)



Te Riu-a-Māui/Zealandia maps dataset lead author Nick Mortimer at the launch of the poster publication, February 2020. Photo: M. Low/GNS Science

- The Antarctic GeoMap project under the Scientific Committee for Antarctic Research auspices has been led by GNS Science and produced a new continent-wide Antarctica geological map dataset based on best-available information provided by many contributing countries. The dataset is GeoSciML-Lite compliant and accessible from [https://data.gns.cri.nz/gis/rest/services/SCAR\\_GeoMAP/ATA\\_Geology/MapServer](https://data.gns.cri.nz/gis/rest/services/SCAR_GeoMAP/ATA_Geology/MapServer)
- Other map datasets of regional-local extent include the eastern Canterbury geomorphology (NZL\_GNS\_GM3), Tongariro National Park area geology (NZL\_GNS\_GM4 2nd edition), Victoria Range geology (NZL\_GNS\_GM6) and Napier-Hastings urban geology (NZL\_GNS\_GM7), all GeoSciML-Lite-compliant and accessible from <https://data.gns.cri.nz/gis/rest/services>

*(by Mark Rattenbury and Ollie Raymond)*

## 7.4 IUGS Deep-time Digital Earth (DDE)

CGI has submitted a proposal for a 3-year project, and is leading work of the DDE Standards Task Group (DDE-STG). Several CGI council members attended the DDE-STG meeting in January 2020 in Beijing. Then-chair of CGI, François Robida, was the founding chair of DDE-STG, and since November 2020, Harvey Thorleifson is chair, with Zhang Minghua and CODATA vice president Alena Rybkina as co-chairs.

DDE funds (USD 5000.00) have been allocated for annual activities. The three-year project proposal, with a budget of \$150,000 USD, was submitted by DDE-STG in mid-2020. An updated version was submitted to the DDE Science Committee on 4<sup>th</sup> December 2020 for final evaluation.

There are 25 scientists, including 14 CGI members, 5 current councilors, and three CODATA officers on the project staff list. John Broome from CODATA joined DDE-STG in June.

The main goals of the project are:

- to conduct and complete timely reviews of the system functionality and standardization of DDE knowledge graphs and system.
- to conduct stakeholder review of requirements and challenges related to use and implementation of data standards & frameworks.
- to provide in-depth training to DDE working groups on existing relevant geoscience data standards and implementation methodologies.
- to issue a practical DDE standard system architecture based on coordination of the portfolio of standards necessary to implement DDE.
- to develop efficient practical metadata standards for DDE on data to be Findable throughout the web for all the DDE Working Groups, Task Groups and Big Data Group, Big Knowledge Group and DEEP platform.

- to develop geoscience data exchange standards for multiple geoscience disciplinary data to be Accessible and Interoperable among worldwide distributed geoscience databases and datasets, and knowledge systems in convenient forms, and
- to develop methodology, guides and necessary digital tools help DDE data Reusable.

The main products to be delivered by the DDE Project will be:

- DDE Knowledge System review documents with recommendations for change and improvement, including science content review, system functionality review and standardization of DDE knowledge graphs and system.
- Results of stakeholder review and survey with recommendations from the larger geoscience community data standards requirements and needs.
- Standardization procedures documents that outline geoscience data standards processes for working groups to follow in drafting standards together with this GDS-DDE project and with the DDE-STG.
- In-depth training for DDE-WGs and other task groups on existing relevant well-implemented standards and implementation methodologies and experiences and training documentation.
- A practical DDE Standard Architecture document based on coordination of the portfolio of standards necessary to implement DDE.
- DDE metadata standard on data Findable throughout the web.
- GeoSciML and EarthResourceML compatible DDE Geoscience Data Exchange Standards for multiple geoscience disciplinary data to be Accessible and Interoperable.
- DDE standard implementation guides and software tools including licencing.
- Publish 1-3 papers on introduction to DDE metadata standard and Data exchange standards

All CGI scientists will be encouraged to play more active roles in supporting the task group on DDE standards once the project is proved.

## 8. CGI Council Grants

A funding boost from IUGS in June 2020, reflecting positive feedback from the IUGS ad hoc review of CGI Council activities, will largely be directed at supporting external projects that align with geoscience data interoperability goals, through CGI Council

Grants. A call for proposals from the membership in August resulted in three proposals being considered at the CGI Council business meeting in November. Two proposals met the CGI grant criteria. One project is led by Éric Boisvert, Geological Survey of Canada, to develop digital docker containers to more easily roll-out and install geoscience data model installations (\$10,000 USD). The other is led by Edd Lewis, British Geological Survey, to complete multi-lingual vocabulary implementation and github hosting of vocabulary services (\$5000 USD committed with a further \$5000 USD approved in principle pending confirmation of the 2021 CGI annual allocation from IUGS).

## 9. Main problems encountered

The COVID-19 pandemic strongly affected CGI activities in 2020, especially the well prepared joint symposium for the postponed 36<sup>th</sup> IGC in India, and face-to face training courses on CGI standards for DDE working group scientists which were planned during the January DDE-STG meeting in Beijing.

The world economic crisis is still having strong impact on monetary support for regional activities of the CGI.

Also, some working group chairs and key members are nearing retirement. To find young geoscientists capable and willing to work on CGI standards is also a big issue.

The difficulties in cross-border communication and low budget for meeting organization make also it a challenge to maintain group cohesion and to stay informed on the issues that each of the CGI member countries are struggling with.

The CGI Council acknowledges the financial plight of many representatives, and that travel expectations of council members should not be applied as strictly to them. While every effort should be made by all council members to attend annual meetings in person, if this is not possible, Council members are expected to participate in online meetings.

Also, other outreach activities are often being organized synergistically, based on any opportunities given, rather than merely on medium term planning.

Another common issue is how to open IUGS-CGI bank accounts other than as a private person during Treasurer position changeovers and achieve more robust expenditure approval and transparency and minimize risk to funding.

## 10. Annual Financial Report

### 10.1 2020 Income and Expenditure Summary



All CGI funds were transferred from the previous CGI account in Australia to a new account in New Zealand administered by the new treasurer (Mark Rattenbury). This was completed on 12 November 2020. Some foreign currency transfer fees and currency conversion costs were incurred by CGI in the course of the transfer of banking arrangements between countries. All CGI funds are in a single consolidated New Zealand bank account, all in New Zealand dollars. Net funds transferred from Australia to New Zealand (after bank fees): NZD 28,067.49 (= USD 19,295.46).

There were relatively few transactions in 2020 owing to cancellation of the meetings associated with the IGC and general curtailment of travel due to the Covid-19 pandemic.

Significant income:

9 June 2020 IUGS annual grant AUD 10894.73

Significant expenditure:

5 May 2020 Panthur Holdings for domain name hosting AUD 864.00

Summary transactions:

	Transaction description	Debit	Credit	Balance
<i>1 January</i>				
2020	Opening balance (Australian account AUD)			\$17,690.20
	IUGS annual grant		\$10,894.73	
	Panthur Holdings for domain name hosting	\$864.00		
	Credit interest		\$3.30	
	International transaction fee	\$32.00		
	Transfer to new New Zealand CGI account	\$27,692.22		
<i>12 November</i>				
2020	Closing balance (Australian account AUD)			\$0.01
<i>5 November</i>				
2020	Opening balance (New Zealand account NZD)			\$0.00
	Transfer from old Australian CGI account		\$28,067.00	
<i>31 December</i>				
2020	Closing balance (New Zealand account NZD)			\$28,067.00

(by Mark Rattenbury)

## 11. Work plan for next year

- Actively participate and to play important roles in the IUGS Deep-Time Digital Earth program. Also, to make efforts to play a leading role in the DDE Standard

Task Group for both strong support to DDE and implementation of CGI standards.

- Attempt to reorganize the Joint symposium of CGI/IAMG/OneGeology/CCOP on *Advances in Global Geological Data Sharing* at the 36<sup>th</sup> IGC if it is held online.
- Form a 3D group of CGI/OGC; continue to push forward the joint CGI/OGC Geoscience DWG work, especially a work plan for CGI within the DWG.
- Continue to push forward the implementation of GeosciML after becoming an OGC Standard.
- Continue the development and implementation promotion of EarthResourceML, especially ERML-lite for OneGeology in 2021.
- Consider how GeoSciML and ERML function with the new OGCAPI suite of standards.
- Continue to develop and publish new geoscience vocabularies, improve existing vocabularies including the addition of multi-lingual terms.
- Actively connect UNECE for the possible cooperation for a general resource classification code and standard framework.
- Continue to push forward promotion of CGI products and to draft a marketing plan.
- Update and enrich the CGI website.
- Take measures to publish the CGI newsletter regularly.
- Take measures to publish more publications of CGI related issues within IUGS “Episodes”.
- Organize a GIRAF workshop and a meeting at the 28th Colloquium of African Geology (28CAG) in 2021 in Morocco.
- Represent the IUGS in Geoscience information matters
  - Effective collaboration with CODATA in DDE Standards Task group, and more.
  - Enhanced relation with RDA
  - More activities on geoscience information relevant to IUGS involved events towards UN Goals 2030 and ISU
- Hold the next CGI annual meeting in association with the IGC, or with GIC in June 2021 whenever is feasible for the council.
- Complete a draft 4-year future action plan for CGI.

## 12. Critical milestones

- CGI/OGC Geoscience Domain Working Group completed the report of the OGC/CGI Borehole IE project for a successful geoscience data description, sharing and interoperable experiment of Boreholes.

- The formal setting up of the DDE Standard Task Group (STG) under the lead of CGI for the DDE program in Oct. 2020. The DDE-STG is now consisting of some 25 geoscientists with 14 CGI and 3 CODATA member geoscientists, and CGI chair as the group chair. A face to face meeting funded by DDE was successfully held in January 2020 on the workplan and implementation of CGI standards. The annual proposal and a three-year project proposal were submitted to DDE in time in 2020 and the achievement to be made in 2021 and relevant products to be delivered are critical.

### **13. Budget request for 2021 and potential funding sources**

CGI Council would request a similar budget to that provided by IUGS in the previous year 2020, \$10,000 USD to enable the full delivery of interoperability projects supported by two CGI Council grants as agreed at the November Council meeting and the CGI-YES Award of the Competition on CGI-IUGS Standards for Geoscience Data (discussed above), and to support CGI activities as the commission for geoscience information of IUGS. CGI understand the difficulty caused by the pandemic.

The Deep-time Digital Earth grant of USD 5,000 will support the DDE Standards Task Group through involvement of CGI members in project work.

CGI will continue to search for other financial supports to the planned face-to-face meetings for 2021.

### **14. Objectives and work plan for the next 5 years**

A new CGI Council is in the process of updating the 5-year workplan. Some of the objectives include:

- Actively participate in and support the IUGS DDE program by playing a leading role in the DDE Standard Task Group, to provide standards, tools, and methods to support harmonized Deep Time data in a convenient form to science, public and industry, i.e. to provide insights into the distribution and value of earth's resources and materials, as well as hazards.
- Enable CGI grant-funded projects with the Geological Survey of Canada on developing digital docker containers for geoscience data model installations and with the British Geological Survey to complete multi-lingual implementation and github hosting of CGI vocabulary services.
- Play a more visible role in coordination of regional initiatives, e.g. by organizing workshop and training courses on geoscience information management and application, standards and language.
- Review the scope and intent of the CGI working groups as data standards mature

and new opportunities arise, for example, developing interoperability of 3D - 4D geosciences data models and geoscience ontologies.

- Catalyze productive alliances between geoinformation bodies, including OGC, CODATA, RDA, Linked Data;
- Promote international use of data exchange standards (especially broad adoption of GeoSciML, EarthResourceML and CGI geoscience vocabularies) in regions, commissions, countries, and organizations in collaboration; Facilitate outreach, knowledge transfer and take-up of best practice in geo-information (e.g. with the South America initiative, the Asia initiative, and the GIRAF).
- Enhance collaboration with other IUGS commissions, e.g. ICS.
- Reorganize the IGC CGI/IAMG/OneGeology geoscience information symposium, and organize a symposium at 37 IGC in Busan on geoscience information.

## 15. Suggestions for improvement of IUGS activities

It would be helpful if IUGS Council can continue to approve CGI's management and carryover of annual IUGS allocations over multiple years. This enables CGI to meet intermittent, larger expenditure items such as contracts for specific standards development work, website maintenance and a CGI presence at major conferences (eg, IGC).

## 16. Conclusion

CGI was productive in 2020, although affected by the COVID-19 pandemic. Successes included several events in geoinformation sciences, milestone achievements in geosciences data standards; successful leading the setting up of DDE Standards Task Group, the well-prepared joint symposium of CGI/IAMG/OneGeology/CCOP for the subsequently postponed 36<sup>th</sup> IGC, election of the 2020-2024 Council, and CGI grants sought and awarded to improve and implement geoscience information standards.

The ambition of the CGI is to pursue its approach of developing standards for geoscience data, by taking into account current technological developments and new needs for the future, such as semantic web, linked data, big data, artificial intelligence, digital twins, and more.

To do this it seems important to maintain and strengthen links:

- with ***scientific communities***, in the field of geosciences, with the support of geological organizations, through presence in major international or continental projects (DDE, OneGeology, EPOS, AuScope, ...), and also with

- other disciplines through CODATA and the RDA for example,
- with the **geoscience industry**, a major producer of data, to promote their adoption of CGI standards,
- with the other actors of standardization in the digital domain such as OGC or W3C (semantic web),
- with software developers to encourage and facilitate their implementation of CGI standards,
- with the communities of geoscientists around the world to push the deployment of these standards.

To achieve these ambitions, it is of primary importance to maintain and renew the expertise available to CGI by reinforcing necessary skills in new technologies.

Finally, CGI would like to express its thanks to all members of the CGI and its regional and the working groups, and also to the members of the IUGS Executive Committee for their help and encouragement. We are very much looking forward to continuous and productive cooperation in 2021, hopefully during a waning pandemic.

*CGI Council, 26 January, 2021*

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