CGI ANNUAL REPORT 2024
&
2025 BUDGET REQUEST

Content

1. 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). Short name is Commission on Geoscience Information of IUGS.

- ***Mission***

To foster the interoperability and exchange of geoscience information, 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 of CGI within IUGS science policy

CGI fulfills 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 Councilors hold leadership positions within the international information community..

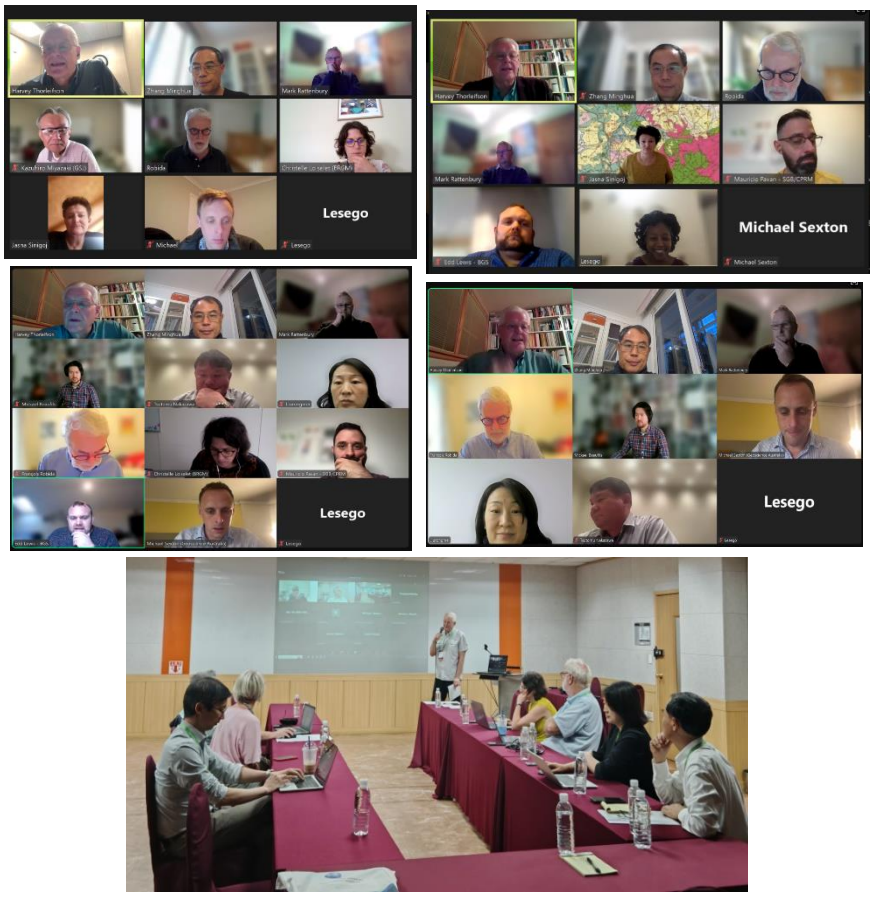
3. Organization, Council members and officers

- *Council Officers 2024-2028*
  - Harvey Thorleifson (Chair) – USA
  - François Robida (past Chair) – France
  - Jasna Sinigoj (Co-Secretary general) – Slovenia
  - Lesego Ramaabya (Co-Secretary general) – Botswana
  - Mark Rattenbury (Treasurer) – New Zealand
  - Zhang Minghua – China
  - Michael Sexton – Australia
  - Christelle Loiselet – France
  - Edward Lewis – UK
  - Liu Rongmei – China
  - Mauricio Pavan Silva – Brazil
  - Michael Beaufils – France
  - Tsutomu Nakazawa– Japan

Members of the CGI Council 2024-2028 was elected, reported and approved by IUGS in August 2024. CGI Council members are widely distributed across all the continents. The contact information is given in Annex 2.

- ***Meetings***

Under the group leadership of Chair Harvey Thorleifson, CGI remains much active in 2024 in a combination of in-person and online means of meetings and activities. Five Council meetings were held in 2024, on 24 Jan, 26 Jun, 30 Aug, 30 Oct and 11 Dec. The council meeting on 30Aug was attended in person in Busan, Korea during the 37IGC. In addition, Officers met at leadership meetings monthly, and several task groups' meetings were held separately in Nov and Dec for the strategic plan implementation.

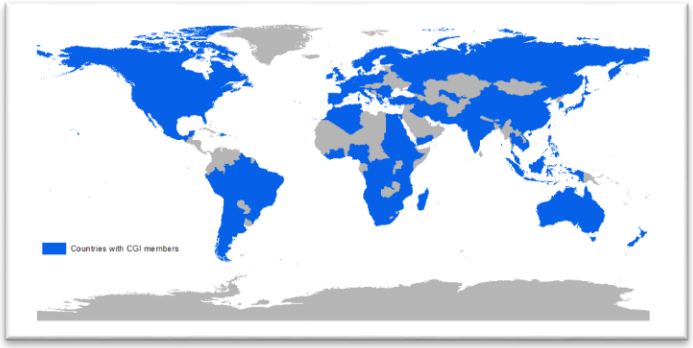


Pictures of CGI council meetings online and in-person in 2024.

- ***CGI Membership***

CGI now has 534 members in 82 countries across the world. There were 6 new CGI members in 2023 from Nigeria, Australia, Mexcio, Sri Lanka, and Italy in 2024, a few more than 2023.

The CGI Council highly appreciates and is grateful to the IUGS Secretariat office for the help provided in logistics and relevant activities of CGI in the past 8 years at the Development Research Center of China Geological Survey, Ministry of Natural Resources. The CGI Secretariat office is transferred form China Geological Survey to Geological Survey of Slovenia in late 2024.



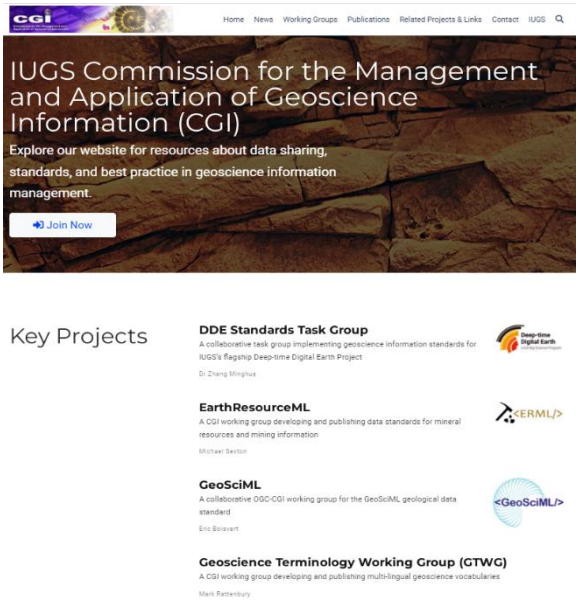
Global distribution of CGI members (countries in blue)

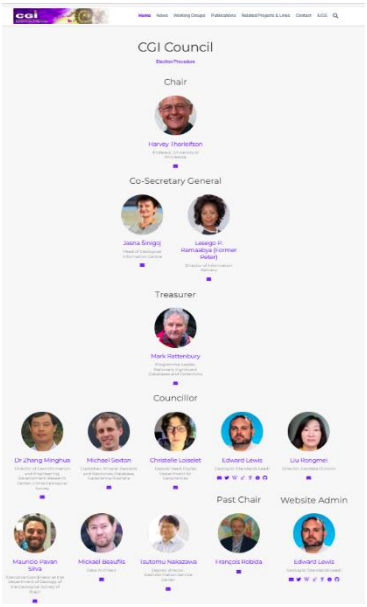
4. CGI online presence and Newsletters

The CGI website (https://cgi-iugs.org/) has been updated with the new term Council members information, CGI newsletters and news of some activities. There have been no major updates or changes to the structure of CGI, ERML or GeoSciML websites in 2024.

Website: https://cgi-iugs.org
Twitter: https://twitter.com/CGI_IUGS
LinkedIn: https://www.linkedin.com/groups/6539642/

Working group / project links:
DDE: https://cgi-iugs.org/project/ddestandards/
ERML: https://cgi-iugs.github.io /project/earthresourceml/
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/

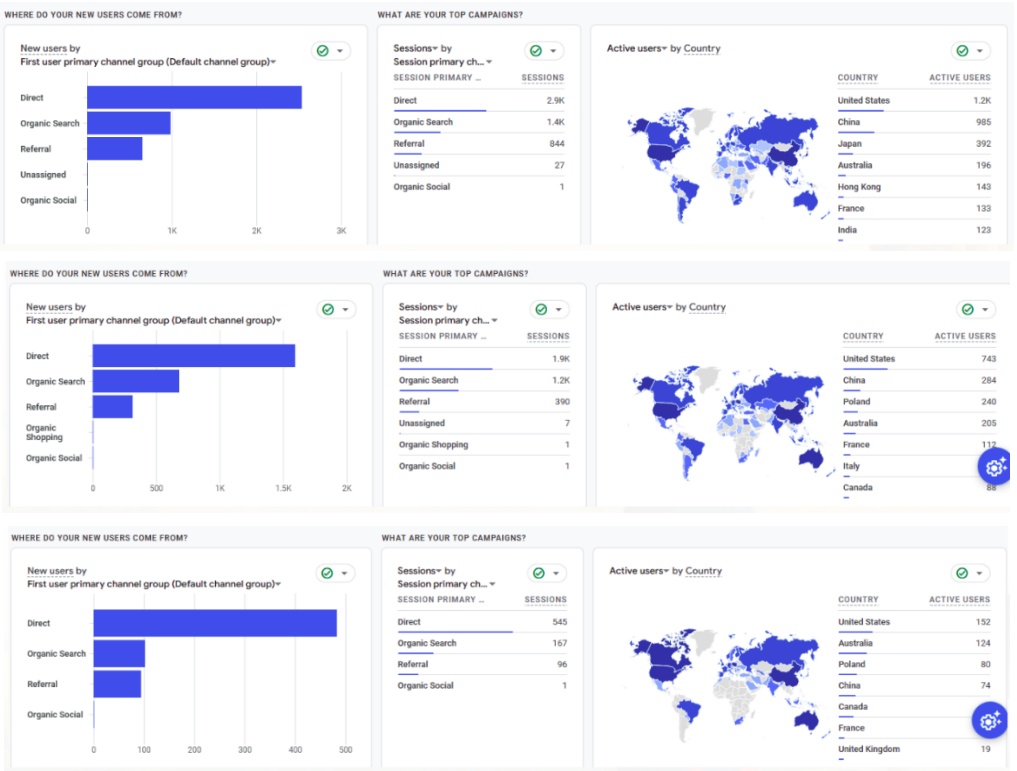




The main page of CGI website and the CGI Council member page

The collection of web statistics for the site can be found below in the following three figures. We've had a moderate increase in traffic over the previous year.

Users are most commonly accessing the site from United States and China and using a Desktop device. Most users are then accessing the Geoscience Terminology, GeoSciML and ERML Pages. This may reflects that CGI standards and vocabulary are adopted or referenced by DDE scientists in China and US.

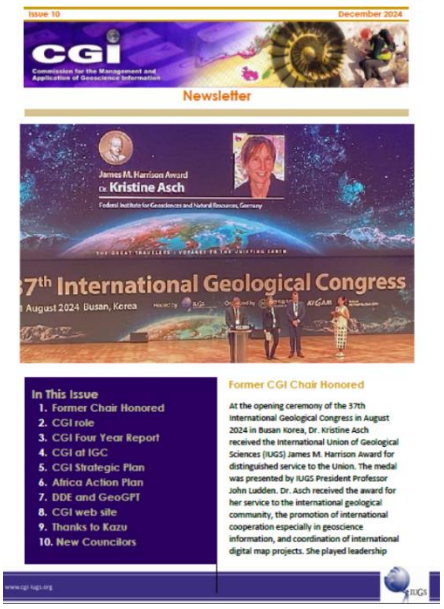


CGI website (upper), GeoSciML (Mid) and ERML website (lower) summary statistics

(by Edward Lewis)

Important CGI activities have been reported to IUGS in news paragraphs to IUGS e-bulletins and are read widely within geoscience communities.

The 10th CGI newsletter published (https://cgi-iugs.org/post/newsletter-issue-10) in December 2024 contains briefs of important activities such as the CGI Four Year Report (2020-2024), the CGI session at 37th IGC and the CGI strategic plan, as well as significant progress and information on new councilors for the term 2024-2028. The Africa Action Plan and CGI partnership cooperation with DDE were also introduced.



5. Extent of support from sources other than IUGS

Other than the substantial in-kind contribution by the geological organizations that pay the salaries and expenses of CGI Council and members, the CGI does not receive additional support. CGI workshops and activities are sometimes co-organized or supported by other organizations and programs/projects such as University of Minnesota (USA), China Geological Survey, GNS Science (New Zealand), BRGM (France), BGS (UK), Geological Survey of Slovenia, Geoscience Australia, Botswana Geological Survey, Geological Survey of Japan, Geological Survey of Brazil, United Nations Development Program, the annual funding for DDE standards group and R&D project from DDE.

6. Interaction with other international organizations

- ***CGI collaboration with OGC***

In collaboration with OGC, CGI is continuing to maintain and update geological data model standard GeoSciML, joint working in Geoscience Domain Working Group (GDWG) on interoperable standards of Geotechnical and Borehole. Both OneGeology initiative and the past project OneGeology-Europe are using GeoSciML to make geological data interoperable and accessible via their web portals. The European EC Directive INSPIRE used CGI standards for their Geology and Mineral Resources Implementing Rules: the GeoSciML and EarthResourceML (ERML) data model and CGI vocabularies.

- ***CGI and CODATA***

CGI and CODATA jointly set up the DDE Standards Task Group (DDE-STG) in Oct 2019 and actively conducted relevant work plan continuously ever since, including a 3-year R&D project since 2021 on Geoscience Information Standards for DDE which was conducted smoothly with expect outcomes and products. The R&D project final report was accept and approved by DDE in 2024. And the second phase R&D project proposal on FAIR principles Implementation for DDE was also approved in 2024. The project agreement for 3-years 2025-2027 has been signed and project work will commence in early 2025.

- ***CGI and DDE***

CGI is one of the first 13 founding members of the IUGS DDE program. And CGI has been continuously active and successfully leading the DDE-STG in collaboration with CODATA and some DDE working groups (DDE-WGs). A total of more than 30 geoscientists, including 15 CGI member geoscientists and CGI councilors, have been working in DDE-STG and the R&D projects.

In addition to DDE geoscience knowledge system review procedures, DDE geosciences information metadata standard (DS01-2023) and Geonetwork based App for global geoscience communities, CGI has demonstrated standards implementation for DDE, and in

collaboration with international communities, is helping set up an international geoscience knowledge infrastructure for DDE.

- ***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 is a flagship initiative for CGI standards implementation, which realized worldwide geological map data sharing thru web for the first time in the world.

7. Chief accomplishments and products

The CGI has completely achieved its planned goal in 2024 with planned activities successful conducted. The CGI strategic plan 2024-2028 has been compiled with strategy task groups addressing 8 initiatives, including CGI Governance, Geoscience Vocabularies, Logical Data Models, Artificial Intelligence, 3D Geology & Digital Twins, Cross-IUGS Collaboration, CGI Working Groups and Communication. CGI has strengthened geoscience standards promotion and implementation in 2024 through collaboration with partners, including DDE for new approved RD project, with CODATA involving deeper and wider collaboration in science data FAIR Principles, with OGC for 3D and borehole standards workshops on interoperability, and with ISO for a liaison membership.

7.1 CGI News

- ***International award***

François Robida, Past Chair of CGI, has won the 2024 EGU Ian McHarg Medal! This medal was established by the Earth and Space Science Informatics Division in recognition of the scientific achievements of Ian McHarg. It is awarded for distinguished research in information technology applied to Earth and space sciences. François has contributed hugely to the development, implementation and promotion of geoscience information standards through CGI, BRGM, Inspire and OneGeology.
This award news was also posted by IUGS at 37IGC in Busan, Korea.

- ***Strategic plan***

The CGI Strategic Plan 2024-2028 has been issued in 2024 by the CGI Council, see annex 1. This plan confirms CGI current status as the widely recognized leader in geoscience information standards development and foresees future opportunities to enable other IUGS commissions and international groups to utilize CGI's expertise and infrastructure for their standards, collaborate with other standards-focused commissions and international organizations in supporting artificial intelligence applications with standards and vocabularies, and presents a roadmap for CGI initiatives outlined in 8 initiatives.

The CGI Strategic Plan 2024-2028 identifies three Goals and Objectives:

- To become IUGS's principal delivery point for information standards and resources
- To be IUGS's authority on international best-practice geoscience information management
- To collaborate with international and influential geoscience information projects and standards-setting groups

- ***Hosting geosciences standards outside CGI***

One of CGI's ambitions has been to play a more inclusive role in hosting of geoscience information standards, including non-CGI geoscience information standards, such as well-formed vocabularies that have had little or no CGI input.
Following the CGI strategic plan in 2024, CGI signed an agreement with the International Commission on Stratigraphy (ICS) on hosting the International Chronostratigraphic Chart vocabulary. A second non-CGI vocabulary to be hosted is the Critical Minerals Mapping Initiative (CMMI)'s mineral deposit type classification.

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

As one of the founding members of the IUGS DDE big science program, CGI set up the DDE Standards Task Group (DDE-STG) together with CODATA and some DDE-WGs in 2019. With the strong support from CGI, CODATA and DDE-WGs scientists, DDE-STG issued and delivered The Formal DDE Geoscience Knowledge System Review Procedure in Aug 2020, DDE geoscience information metadata standard (DS01-2023) adhere with FAIR data principles in Nov 2023, and DDE metadata app deployed on DDE platform in Aug 2024 for populating and metadata harvesting. The DDE accessible data evaluation guide and DDE geoscience data standards framework have also been drafted. CGI and DDE co-hosted the international in-person Workshop and Forum on Status and the Future of Global Geoinformation Standards and DDE Progress in Nov 2023 at Suzhou with magnificent success on both CGI promotion and for CGI Strategic Plan 2024-2028 on geoscience standards.

- ***CGI standards promotion***

CGI geoscience standards and vocabularies were continuously introduced to scientists, geologists and officials from a variety of organizations and initiatives at seminars, workshops, and other events in 2024, including CGI hosted and co-hosted workshop, DDE meetings, as well as regional sessions in Asia and others. For example, CGI promotion at the 39 GIC meeting at TNO Netherlands, CODATA Global Open Science Cloud (GOSC) international training workshops, and CGI/OGC standards talks at The Belt and Road Resource & Environment Scientific Data Sharing in Beijing.

CGI was active at the August 2024 International Geological Congress (IGC) in Korea, including a prominent presence in many sessions, and a successful Council meeting. There were three main sessions at the 37th IGC related with CGI standards, Geoscience Information in the 2020 chaired by Harvey Thorleifson, Geoscience Data Standards and Knowledge Graph chaired by Zhang Minghua. The

Geoscience information, geological mapping and modelling chaired by former CGI Council member Kristine Asch.

- ***New Developments***

Through promotion and collaborative activities in 2024, CGI has become more visible and authoritative in global geoscience standards.

CGI has become a liaison member of ISO in 2024 on behalf of IUGS, which will allow CGI formally participation in ISO/TC211 activities that benefit both sides in standards work, particularly CGI's role in geoscience standards management and application.

CGI working groups, regional networks, and current collaboration projects and working groups include,

- DDE geoscience standards task group, in collaboration with CODATA – Zhang Minghua (China) and Harvey Thorleifson (USA)
- GeoSciML Standards Working Group (GeoSciML), in collaboration with the Open Geospatial Consortium (OGC) – Éric Boisvert (Canada)
- EarthResourceML Working Group (ERML) – Michael Sexton (Australia)
- Geoscience Terminology Working Group (GTWG) – Mark Rattenbury (New Zealand)
- GeoScience Domain Working Group, in collaboration with the Open Geospatial Consortium (OGC) – Mickael Beaufils (France)
- Geoscience Information in Africa – Network (GIRAF) – Mesfin Wubeshet Gebremichael, Tanzania.

New working/task groups are being considered through implementation of CGI Strategic Plan 2024-2028, potentially around geoscience knowledge graph and AI applications in geoscience.

7.2 Working Group Reports

7.2.1 GeoSciML Standards Working Group

The official OGC GeoSciML Standards Working Group (SWG) is jointly administered by the CGI. 2023 marked the 20th anniversary of the SWG.
The SWG again was largely inactive in 2024 due to the maturity of the GeoSciML standard.

- ***Membership and repository***

The GeoSciML SWG membership stands at 45 members and observers. The public GeoSciML mailing list has 97 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 GeoSciML: https://cgi-iugs.github.io/project/geosciml/ and 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***

There were no official GeoSciML SWG meetings during 2024.
A CGI Council grant to GeoSolutions for docker containerization of the ERML (an extension of GeoSciML standard), managed by Mark Rattenbury and Eric Boisvert, was completed in 2023.

- ***Uptake***

Beyond implementation of web services, GeoSciML keeps attracting attention from various standardization initiatives that seeks to extend it to associated domains, such as GEOL_BIM (https://www.espazium.ch/fr/actualites/mieux-proteger-les-batiments-contre-les-glissements-de-terrain-avec-le-bim) and Geotechnic (https://aecmag.com/opinion/ifc-for-infrastructure/). GeoSciML and the extensive work made on GeoSciML vocabularies remains the starting point from the knowledge representation community, demonstrating its lasting influence. GeoSciML also mentioned in online courses (https://www.coursehero.com/study-guides/wmopen-geology/outcome-scientific-tools/).

- ***Future work***

A collabaration on OGC Sprint for GeoSciML from XML to GeoJSON encoding was planned in 2024 and will be conducted in 2025 which will enable its better implementation with current web technology.

(by Edd Lewis and Eric Boisvert)

7.2.2 Geoscience Terminology Working Group

- ***Activities***

The membership of the Geoscience Terminology Working Group numbers 27. Members come 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).
A 2024 face-to-face meeting was not held. Resumption of vocabulary publication is awaiting implementation of a modified Excel->RDF-SKOS->VocPrez system at Geoscience Australia who host the CGI vocabularies.
The GTWG activities are described under link from CGI's website, simplified and updated in late 2016, http://www.cgi-iugs.org/tech_collaboration/geoscience_terminology_working_group.html and from the GeoSciML website at http://www.geosciml.org/ .
While the GTWG itself has not been active, there has been significant discussion and developments around vocabulary development, hosting and management at CGI Council-organised over the year. These have been captured through CGI's 2024 Strategic Plan that includes specific addressing of vocabularies as one of eight initiatives. A series of goals for vocabularies have been developed as follows:

Short term

- Review website content, make improvements where needed
- Highlight vocabulary uptake e.g. as used by Geoscience Australia, British Geological Survey, European Geological Data Infrastructure and AuScope
- Accelerate publication of CGI vocabularies by lowering completion thresholds (i.e. good drafts are good enough to publish)
- Medium term
- Encourage third party submission of vocabularies for CGI hosting
- CGI (through the Geoscience Terminology Working Group) adopt more of a review or endorsement role for vocabularies provided by third parties
- Long term
- Identify any vocabularies that may benefit from transformation into ontologies and initiate the work to do this

These goals are being fine-tuned and incorporated into an implementation plan through a Vocabularies Strategy Task Group for CGI Council until mid 2025.

- ***Achievements***

No new vocabularies have been adopted in 2024. Agreement has been reached between CGI and the International Commission on Stratigraphy around CGI hosting the International Chronostratigraphic Chart vocabulary following new protocols developed by CGI. This vocabulary has been hosted by CGI for over a decade already and the agreement simply formalizes the arrangement but it is intended to be a template to encourage other commissions, agencies and organizations to consider co-locating their geoscience vocabularies with CGI's.

- ***Future Work and Issues***

There remain a number of outstanding GeoSciML data model vocabularies still to complete, including for GeoSciML and EarthResourceML data models. The Deep-time Digital Earth (DDE) Big Science Program includes a large component of semantic ontology development and this overlaps with GTWG vocabularies to some extent. The DDE Standards Group, co-led by CGI, is monitoring this.

Working group activity is still unsatisfactorily low but the implementation of CGI's Strategic Plan initiative around vocabularies will hopefully lead to more focus and efficiency of vocabulary publication.

(by Mark Rattenbury, Chair, GTWG)

7.2.3 EarthResourceML (ERML) Standards Working Group

- ***Activities***

The ERML WG has 25 members, from Australia, Brazil, 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 Michael Sexton (GA, chair since 2021). There were activities on the Critical Minerals Mapping Initiative's deposit classifications mainly in GA and GSC. And no meetings were held for the ERML working group during the year.

The ERML WG activities are described under links from the CGI website https://cgi-iugs.org/project/earthresourceml/. Vocabulary work for ERML and GeoSciML standards can be seen via GTWG website at https://cgi-iugs.org/project/geosciencetерminology/.

- ***Data Model Development and Documentation***

Version 2.0 of the CGI data standard for mineral occurrences and mines was published in 2014: http://www.earthresourceml.org/. 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 it's implemented in Australia (AusGIN) and on the OneGeology Portal.

Work on ERML 3.0 was paused due to the unavailability of working group members for large periods of the year. All the CGI SWG web pages have been harmonized, and the ERML web pages (https://cgi-iugs.org/project/earthresourceml/) have been updated. The data model documentation has been published in the ERML web pages.

- ***Uptake of EarthResourceML***

The uptake of ERML continues, albeit at a reduced pace compared to previous years. However the ERML data standard continues to be used for 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 medium 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.

- ***Work planned***

Future development of ERML and ERML Lite will be undertaken by the ERML Working Group based on feedback from users, building on the current focus on critical minerals. ERML 4.0 will be released for the Critical Minerals Mapping Initiative.

(by Michael Sexton, Chair, ERML)

7.2.4 The Joint CGI/OGC Geoscience Domain Working Group

- ***Activities***

The GeoScience DWG met regularly in 2024 including OGC TC meetings in Oct Korea. Main work conducted was focused on the progress of the Geotech Interoperability with BIM and significant progress was made.

The Geotech IE strengthened links within the bSI, AGS and DIGGS communities. The work is

presented in spring 2024 during a workshop of the International Society for Soil Mechanics and Geotechnical Engineering (ISSGMGE) TC222 dedicated to BIM and Digital Twins for Geotechnics. A paper is also planned.
The group renewed their recommendation that we have a second or third co-chair to share lead effort, and to ensure a more systematic presence.

- ***Achievements***

For the GeotechIE, a final presentation was made in March '24 to the Delft OGC TC. Scot Simmons has made a .pdf version of the wiki. Mickaël will review and validate it. Deliverables are here: https://github.com/opengeospatial/Geotech/wiki

For the ISSMGE TC222 Workshop #3 on April 4, this was dedicated to Digital Standards for Geotech, including highlights of the Geotech IE, AGS, DIGGS, & IFC; 153 attended. Replay is here: https://www.youtube.com/channel/UC7eMKzvagK7DN3MnIvK7yCQ

A paper has been envisaged by the Geotech IE team, in a journal such as Underground Space, Computer & Geoscience, or Computer & Geotechnics.

Regarding ISSMGE TC222 and other workshops, Workshop #4 was on May 30th. This was about National Geotech Database and Asset registers, including presentations from PGI, TNO, and NUAR (UK). There were 120 attendees. NGI found issues to recover the replay.

Workshop #5 in September was also about National Geotech Database. Speakers were from SwissTopo, BGS, GTK, & NGU. Workshop #6 in October was a Forum of Geotech Digital Oriented TCs. Speakers: ISSMGE JTC2 (Geotech standards), ISSMGE TC309 (Machine Learning), ITA WG22 (Tunneling) discussed joining efforts and common roadmap.

- ***Future Work and Issues***

The GeoScience DWG has expressed interest in standardization for geophysics and 3D modelling. A poll in Spring 2024 confirmed this interest and to identify potential participants for a possible third Interoperability Experiment is underway.
Recent standardization activities were on enhancing geoscience observations and measurements provision and access (OMS + STA). The next OGC TC will be November 4-8, in Goyang, Korea – ***AI for Geo***.

(by Mickaël Beaufils, GeoScienceDWG Chair and Christelle Loiselet, BRGM)

7.3 CGI Regional Group Reports

7.3.1 CGI in Asia

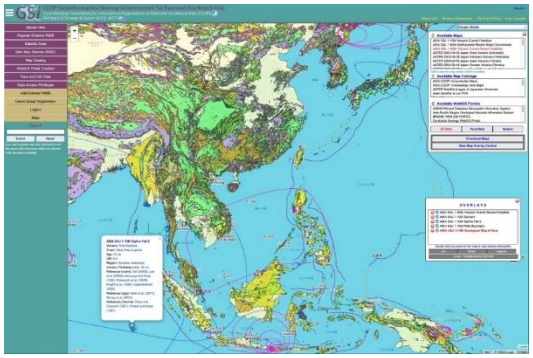
In Asia in 2024, development and progresses in geoscience information amongst national

geological surveys and geoscience institutes were continuously achieved. Significant progresses were made in Geo3DMl update, Karst critical zones monitoring technical specification, Regional and global cooperation in geoscience information activities in Asia with strong support from China Geological Survey(CGS), Geological Survey of Japan (GSJ), Korea Institute of Geoscience and Mineral resources(KIGAM) and many other geological survey organizations in Asia. Regional and international cooperation and collaborations and in-person activities were enhanced, particularly with the help of the 37IGC activities in Korea.

- ***CCOP Geoinformation Sharing Infrastructure***

The Geological Survey of Japan (GSJ) continuously supports the Coordinating Committee for Geoscience Programs in East and Southeast Asia (CCOP) member countries in the formulation and server hosting of the Web Map Services (WMS) of their geological maps for OneGeology portal registration. These WMSs include the geological maps of Indonesia, Malaysia, Vietnam, Mongolia, Myanmar, Philippines, and Papua New Guinea. The WMSs of Laos, Thailand, and South Korea are hosted by these countries' servers. Furthermore, Japan registered 120 maps to the OneGeology portal. These maps include the 1:10M Geological Map of Asia, 1:200K Geological Maps of Japan, 1:200K Seamless Geological Map of Japan, 1:10M Earthquake Source Region, 1:10M Tephra Fall Distributions, 1:2M Volcanoes of Japan, 1:2K to 1:50K Geological Maps in volcanic areas in Japan.

GSJ has been implementing the CCOP Geoinformation Sharing Infrastructure (GSi) for East and Southeast Asia project in cooperation with the geological institutes in East Asia since 2016. More than 2,800 geological maps and related information are available on the GSi system. More than 20 portal sites from CCOP countries were also set up using the GSi system. The GSi Server has been updated and now runs on AlmaLinux 9 OS (New URL: https://geohazards-info.gsj.jp/main/). GSJ also developed the ASEAN Mineral Database and Information System (AMDIS). GSJ attended the Seventeenth ASEAN Senior Officials Meeting on Minerals plus Three (China, Japan, ROK) Consultation on Nov. 21, 2024, in Bali, Indonesia.



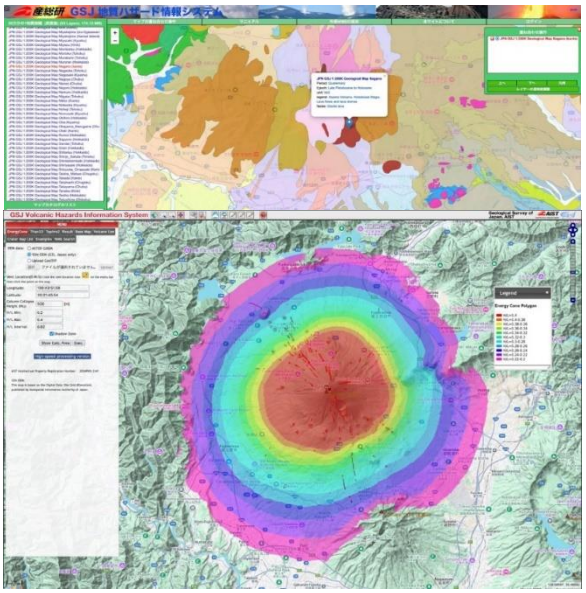
CCOP GSi Portal site. https://geohazards-info.gsj.jp/main/

Seventeenth ASEAN Senior Officials Meeting on Minerals Plus Three (China, Japan, ROK) Consultation Meeting, Bali, Indonesia

- ***Geological DX project***

GSJ has been promoting a project, "Development of High-Precision Digital Geological Information for Hazard Prevention and Mitigation," since 2022. The major components of this

project include the Volcanic Craters DB, High-resolution Active Faults, Slope Disaster Risk Assessment, Digital Marine Geology, and Geological Digital Transformation (DX) of various geological information. The Geological Hazards Information System and Volcanic Hazard Information System are also part of the Geological DX project. The Geological DX project team is working on data distribution using API, a data download service, a web-based spatial information viewing platform, and the Geological Hazards Information System. The Geological Hazards Information System provides web-based data browse and search functions and download of GIS data. Currently, about 1,450 layers are included in the system. The Volcanic Hazards Information System is developed for (1) real-time hazard assessment using online numerical simulations, (2) eruption parameter analysis at various volcanoes, (3) digitization of tephra fall, PDC, and debris avalanche distributions, (4) online tephra fall volume estimation, and (5) display volcanic crater distributions. The Volcanic Hazards Information System allows it to execute Energy Cone, Titan2D, and Tephra 2 numerical simulations on Quaternary volcanoes worldwide using ASTER GDEM and GSI 10 m DEM. Therefore, quasi-real-time volcanic hazard assessment is possible using a more rapid display and comparison with previous eruption cases. The examples of eruption parameters are essential for numerical simulations even after eruption initiation to determine the appropriate parameters, hazards and risk assessment, and future prediction of eruption scenarios. Currently, 313 cases, in total, are analyzed on the system (as of Dec. 2024).



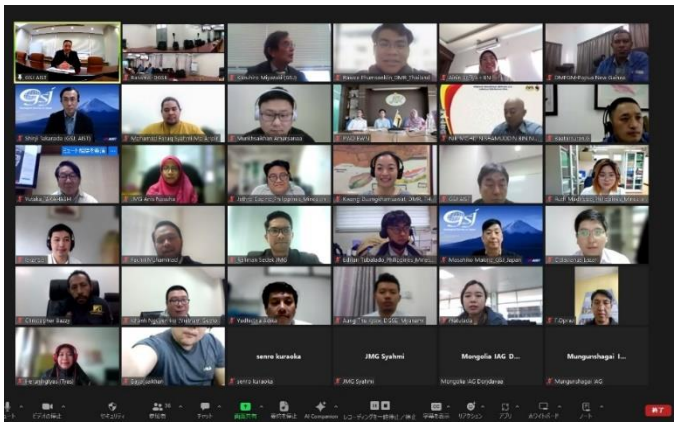
GSJ Geological Hazards Information System, showing 1:200,000 Geological Map of Nagano, central Japan. https://geohazards-info.gsj.jp/geological_hazards/index.php

GSJ Volcanic Hazards Information System, showing Energy Cone simulation result at Mt. Fuji volcano, Japan. https://geohazards-info.gsj.jp/vhazard/HazardAssessment/

The API function using WMS provides all simulation results and allows them to be displayed on various servers, GIS software (e.g., QGIS), and Google Maps. Volcanic Hazards Information System is expected to be used by many stakeholders, such as researchers, students, consultants, local government staff, and Geopark staff members for geological hazard assessments, revision of disaster prevention maps, and education purposes.

- ***GSJ Webinar FY2023***

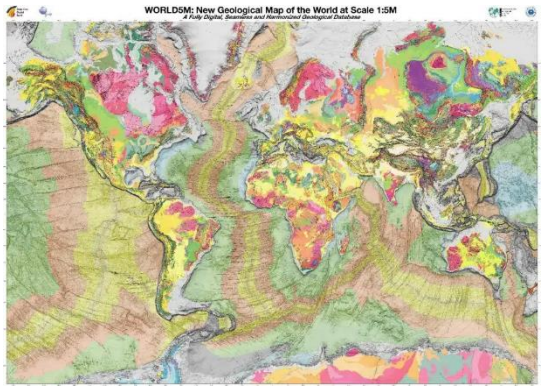
GSJ held the GSJ Webinar FY2023 on Practical Geological Survey Techniques — Application to Geological Disaster Mitigation from January 22 to 24, 2024. The webinar was delivered via online lectures and practical training sessions. Lectures were given on the geology of Asia and Japan, the CCOP GSi project, landslides, earthquake prediction, tsunamis, volcanic geology, remote sensing, and geophysical exploration of shallow geology. The participants were from nine countries: four from Brunei, five from Indonesia, five from Malaysia, four from Mongolia, six from Myanmar, two from Papua New Guinea, three from the Philippines, three from Thailand, and two from Vietnam. The lecture on geology of Asia and Japan was the most well-received to among trainees, followed by the lecture on landsides. The lectures on earthquake ground motions, volcanic geology, and remote sensing were also highly evaluated. The most useful points of the lectures can be summarized as that trainees were able to recognize various viewpoints by asking questions to the lecturers, such as understanding geology as a whole, which studies the activities of the earth, the occurrence of natural disasters and their effects, and methods of disaster mitigation. Many of the lectures they would like to attend in the future are related to disaster mitigation, especially earthquake, volcanic geology, landslides, and remote sensing. They would like training in data processing, disaster assessment, and risk management, as well as practical lectures on remote sensing and GIS. In addition, lectures on geological development and minerals, geoparks, geological mapping, and disaster forecasting were also of interest.



Participants of GSJ Webinar FY2023 on Practical Geological Survey Techniques

GSJ plans to hold a GSJ Training Course FY2024 in Tsukuba, Japan, on Practical Geological Survey Techniques —Application to Geological Disaster Mitigation— from Feb.18 to Feb. 20, 2025. This Training Course is organized for young geological researchers and engineers in the CCOP member countries. The GSJ Training Course focuses on practical geological survey techniques because accurate geological mapping is fundamental for natural resources development, environmental conservation, and mitigation of geological disasters.

- ***1:5M World Geological Map***



With the leadership and support by the Commission of the Geological Map of the World(CGMW), China Academy of Geological Sciences(CAGS) of CGS and the IUGS science program DDE(Deep-time Digital Earth), a uniform and homogeneous digital geological map at the scale of 1:5 M was achieved and improved in 2024. Thus a correlation of the world geological continental maps and oceanic structural maps, all digital is complede. It integrates 8 continental geological maps and 4 oceanic structural maps at a scale 1:5 million.

- ***DDE-China***

With the guide of the DDE program, aimed to integrate China's geoscience data, geoscientific research methodologies and software tools of China Geological Survey for a data driven study demonstration for DDE, CGS has continuously supported the DDE program on DDE-China node development. In 2024, significant improvements of DDE-China in the implementation of international standards, particularly GeoSciML and EarthResourceML for the Chinese geological map data at the scale of 1:500,000 and 1:1million have been made together with the utilization of the DDE knowledge system.

1:500,000 China geological map released on DDE-China platform

- ***Global-Scale Geochemistry***

From May 15 to 17, 2024, the representative of CGS attended the International Seminar of UNESCO Category II centers in the Natural Sciences, co-sponsored by UNESCO, the Government of Malaysia and the UNESCO International Centre for Science, Technology and Innovation for South-South Cooperation, held in Kuala Lumpur, Malaysia. The seminar aims to strengthen coordination and cooperation among Category II centers, promote knowledge exchange among disciplines, and provide support and action plans to achieve the common goals of sustainable development.

And the 10th Anniversary of China-Laos Geochemical Mapping Cooperation and the Achievements Handover Ceremony was successfully held in Vientiane, Laos in 2024. The event was co-hosted by the Department of Geology and Minerals of the Ministry of Energy and Mines of Laos and the UNESCO International Centre on Global-Scale Geochemistry (ICGG).

Throughout ten years of unremitting efforts, geochemists from China and Laos have achieved a series of significant achievements. The global-scale geochemical mapping of Laos has been completed, and the geochemical baselines network of Laos has been established to provide baselines data for the sustainable development of resources and environment in Laos. The national scale 1:1million geochemical mapping of the whole area of Laos has been completed with a 71-element geochemical atlas for the first time.

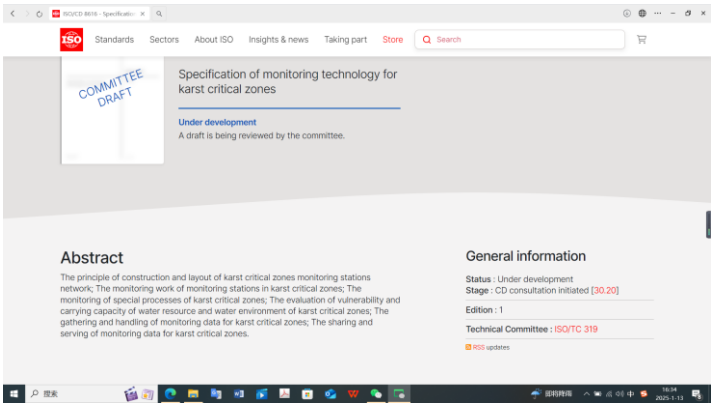
The 10th Anniversary of China-Laos Geochemical Mapping Cooperation and the Achievement Handover Ceremony

- ***Geo3DML***

Aimed to solve the interoperability problem of 3D geological model data in geoscience and minerals industry, the three-dimensional geological data exchange format (Geo3DML)" standard was jointly drafted by the China Geological Survey, the Institute of Hydrogeology and Environmental Geology of the Chinese Academy of Geological Sciences and other organizations with consultation and references to international standards. The standard was upgraded in 2023-2024 upon feedbacks and summarizes of 7 years and with further improvement of compatibility with GML and main frame geological models expanded with improved compatibility of geometric types for different industries. In addition, compatibility with international standards has been improved in terms of texture materials and spatial reference frame management, which enable its application in geotechnical application such as hydrogeology, engineering and environmental geology, and in mineral resources, but also in active docking verification with BIM standards in the field of urban planning and construction.

- ***Karst critical zones monitoring technical specification***

In Feb 2024, the "Karst critical zones monitoring technical specification" project lead by Chinese scientists was approved by the Karst Technical Committee of the International Standards Organization (ISO/TC319). This standards work stipulates the global monitoring work layout of karst critical zones, process (special process) monitoring, monitoring data exchange and processing, monitoring information sharing and service, etc., based on existing Chinese national standards with international comparisons and practices.



(by Tsutomu Nakazawa, Liu Rongmei, Zhang Minghua and Kazuhiro Miyazaki)

7.3.2 CGI in Africa

In 2024, African Geological Surveys continue to advance on strategic initiatives on aligning geoscientific data with OCG and CGI data standards, as well as undertaking of projects and training aiming at enhancing geological findings through research.

The IUGS Executive Committee met in Nairobi in February 2024, and African geoscience leaders hosted a workshop on geoscience in Africa. An outcome is an action plan that includes a geoscience information initiative, starting with a February 2025 workshop in Belfast, leading to a paper on status of geoscience information in Africa.

CGI have expanded its coverage through partnerships and collaborations by linking various websites that targets to disseminate and share CGI standards and vocabularies. CGI is linked to sites such as, www.bgi.org.bw, http://geos.bgi.org.bw, https://portal.miningcadastre.gov.bw/page/landing , and http://bh.bgi.org.bw.

GCI does not receive direct support but collaborates with other institutions which have similar interest with what CGI is doing such as CODATA, Digital Earth Africa, RCDM, etc. Other support organizations are OAGS, PanAfGeo, etc.

CGI drives the IUGS mandate of increasing the visibility of the earth sciences and demonstrate their importance in global environmental planning as well as creating geoscience data standardization.

(by Lesego Ramaabya)

7.3.3 CGI in South America

The CGI councilor from South America joined CGI meetings throughout 2024.
South American geological surveys are active in national geoscience information initiatives, and also in multinational coordination, including participation in CGI working groups.

There has been an increasing pace of digital transformation and database development

including a focus on knowledge graphs. For example, Brazil Geological Survey is seeking cooperation for national geosciences database integration with standards and to update the mineral resources database of South America.

The meeting is considered to hold in 2025 on discussion the potential partnership with the Association of Iberoamerican Geological and Mining Surveys (ASGMI) on the purposes of geoscience standards development and implementation, including the expertise of the CGI groups. ASGMI has several working groups, including one focused on the South America Map for Critical Minerals.

(by Mauricio Pavan Silva)

7.3.4 CGI in North America

In the US, national datasets continue to be a focus. The emphasis is on applications such as earthquake propagation modeling, water resource management, energy and minerals assessment, and infrastructure planning. The National Geological and Geophysical Data Preservation Program, and the National Cooperative Geologic Mapping Program, have been reauthorized by Congress, and funding increased. To support critical minerals planning, the Earth MRI program, largely focused on aeromagnetic surveys, has received major funding increases. Similar progress is underway in Canada, with emphasis on groundwater protection, as well as national geoscience planning for example related to minerals.

Post-pandemic, the annual Digital Mapping Techniques geological GIS conference has returned to in-person, and the Geological Mapping Forum has remained a monthly online conference over the boreal winter, with the first post-pandemic in-person meeting planned for September 2025 in Minneapolis. A very successful, 2-day 3D geological mapping workshop was held at GSA in California in September 2024. The next 3D workshop is planned for 2026 at GSA.

(by Harvey Thorleifson)

7.3.5 CGI in Europe

In 2024, the European Geological Data Infrastructure (EGDI) continued as a geoinformation focus, along with development of the European Plate Observing System (EPOS) infrastructure and Geological Service for Europe (GSEU).

- ***European Geological Data Infrastructure (EGDI)***

The EGDI (https://www.europe-geology.eu/) provides access to Pan-European and nationalgeological datasets from the Geological Survey Organizations of Europe. EGDI is a central element of EuroGeoSurveys' ambition to establish a Geological Service for Europe. EGDI gives access to more than 800 map layers and uses CGI standards (GeoSciML and EarthResourceML) for geological and mineral resource data. In addition, scientific terms are

documented in 15 project vocabularies (https://www.europe-geology.eu/data-and-services/vocabularies/).

- ***Geological Services for Europe (GSEU)***

A Geological Service for Europe (GSEU; (https://www.geologicalservice.eu/) is being built by 48 partners from 35 countries. Under a 5-year agreement, the GSEU Project will develop a plan for a sustainable service as a permanent collaborative network of European geological surveys. An objective is to develop pan-European harmonized data on critical raw materials, geothermal energy resources, and subsurface storage capacities for sustainable energy carriers and CO2 sequestration, groundwater dynamics and quality, coastal vulnerability, and baseline information. The European Centre of Excellence for Sustainable Resource Management will be established under the project to support the implementation of the United Nations Framework Classification of Resources (UNFC) and the United Nations Resource Management System (UNRMS). The geological data infrastructure will be developed based on the existing EGDI to enable continuous access to and dissemination of data and information services. The common European Geological Knowledge Base Platform will be provided as an open access portal to the results and the underlying national and regional data collections and infrastructures. CGI Councilors Edd Lewis, Christelle Loiselet, and Jasna Šinigoj are involved in the project. These European initiatives are using CGI standards for geological and mineral resource data, while contributing to the development of 3D practices.

- ***EPOS and GeoInquire Horizon Europe Project***

The EPOS (https://www.epos-eu.org/) is a long-term plan to facilitate integrated use of data and facilities from distributed research infrastructures for solid Earth science in Europe. In this context, the Geo-INQUIRE (Geosphere INfrastructures for QUestions into Integrated Research) project begins in 2022. Geo-INQUIRE is a Horizon Europe-INFRA project funded by the European Commission. Geo-INQUIRE consists of 51 partners from 13 countries across Europe and is led by GFZ Potsdam. The activities and objectives of the project are closely linked to several Research Infrastructure such as EPOS, EMSO, and ECCSEL and contribute to a reinforcement at European level between the different Research Infrastructures. Within this project, geological data will be made available via “Thematic Core Services” based on CGI standards, providing access to millions of boreholes across Europe, for example. EPOS has also contributed to the CGI/OGC Borehole Interoperability Experiment.

- ***Future Availability of Secondary Raw Materials (FutuRaM)***

The FutuRaM project will establish a methodology, reporting structure and guidance to improve the raw materials knowledge base up to 2050, and facilitate the exploitation of SRMs with a particular focus on CRMs. The project will integrate SRM and CRM data to model their current stocks and flows and consider economic, technological, geopolitical, regulatory, social and environmental factors to further develop, demonstrate and align SRM recovery projects with the United Nations Framework Classification of Resources (UNFC). This project will be carried out by a consortium of 28 partners from 11 countries across

Europe. Universities and research institutes will combine their expertise with industry to implement FutuRaM. In close cooperation with the European Commission and other policy makers, the project will run for 4 years. The project cooperates with GSEU and EGDI and will use CGI standards for mine waste.

- ***Mineral potential of the ESEE region (RESEERVE)***

The RESEERVE project (https://reseerve.eu/) was an EIT Raw Materials project mapping the mineral resources of the six ESEE countries: Albania, Bosnia and Herzegovina, Croatia, Serbia, Montenegro and North Macedonia, which were not previously included in the existing data platforms. The main result was the WEST BALKAN MINERAL REGISTER for primary and secondary raw materials as a starting point for integrating the region into the pan- European Mineral Intelligence Network and bringing it closer to the global mineral market. The project was finalized in 2021 and in 2023 the data was included in the Min4EU database and is available on EGDI using CGI standards.

- ***INSPIRE Datasets***

In the INSPIRE Directive, the CGI standards - GeoSciML and EarthResourceML - were selected as the mandated European data transfer standards for geological and mineral resource information.

- ***Geoscience Information Consortium (GIC) 39th Annual Conference***

CGI members are also active in the Geoscience Information Consortium (GIC, http://www.g-i-c.org), a global initiative for the exchange of information between GSOs on the use and management of geoscience information systems to support Earth science internationally. The members of the GIC are currently representatives of 36 GSOs from 34 countries in Europe, North America, South America, Asia, Africa and Australia. The 39th GIC Annual Conference was held by Geological Survey of the Netherlands (TNO) in Utrecht from 6- 8 May 2024. Cooperation between GIC and CGI was discussed at the meeting.

(by Loiselet Christelle and Jasna Šinigoj)

7.3.6 CGI in Oceania

Most multi-agency geoscience information standards coordination in Oceania occurs through the Australia/New Zealand Government Geoscience Information Committee (GGIC) comprising information managers from state and national geological survey organizations from Australia and New Zealand. GGIC met five times online and once in person in Perth in 2024. The following projects have been completed or have made substantial progress:

- ***Geoscience vocabularies***

Vocabulary development is continuing in Oceania with state geological surveys in South Australia, Queensland and Western Australia add to their own services as is Geoscience Australia nationally. These vocabulary services adopt CGI vocabularies where appropriate for their needs and augment them with vocabularies that are more specific to individual state

requirements or Australia in general (for example mineral tenement type and status). The vocabulary production process is continuing to utilize the data systems implementation company KurrawongAI and utilizing the GitHub web-based coding repository. Geoscience Australia's vocabularies https://vocabs.ga.gov.au/vocab/ include groups based around **Borehole Geology** (Construction Material, Construction Type, Date Qualifier, Directional Survey Azimuth, Directional Survey Class, Directional Survey Method, Directional Survey Path Computing Method, Directional Survey Recording Mode, Drilling Methods, Legislation, Location Method, Purpose, Status**), Field Geology** (Contact Character, Contact Type, Field Site Purpose, Field Site Type, Landform Type, Mode of Occurrence, Proportion Terms), **General Geology** (Confidence Level, Entity or Feature Type, QA Status Code, Sample Material Class, Sample Type, Sampling Method) and **Geology Rock Properties** (Petrophysical, Result Qualifier, Statistical Uncertainty Type).

- ***AGSON***

The Australian Geological Survey Organisations Network (AGSON) portal, a government geoscience data and services access point https://www.geoscience.gov.au/ for Australia, is being decommissioned. The Australian state and territory geological surveys will continue to host web services relevant to their areas and maintain their own portals.

(by Mark Rattenbury and Michael Sexton)

7.4 DDE Standards Group and R&D Project

The goal of the DDE Standards Task Group (DDE-STG) is to support the work of DDE in use of geosciences data standards by DDE-WTGs for harmonized FAIR data resources. With the support of CGI, CODATA, and the DDE program, the DDE-STG made significant achievements in 2024 in geoscience standards for DDE and for the world geoscience community.

In 2024, there were over 30 scientists in CGI, CODATA, DDE, and other organizations from China, USA, France, New Zealand, UK, Italy, Australia, Canada, Denmark, Netherlands, Slovenia, Russia, Brazil, Argentina, Namibia, Botswana, Costa Rica, Brunei, India, Korea, and elsewhere who continuously contributed to the DDE-STG and the DDE R&D project on standards. They are 34% female, 43% early career, and 64% from developing countries.

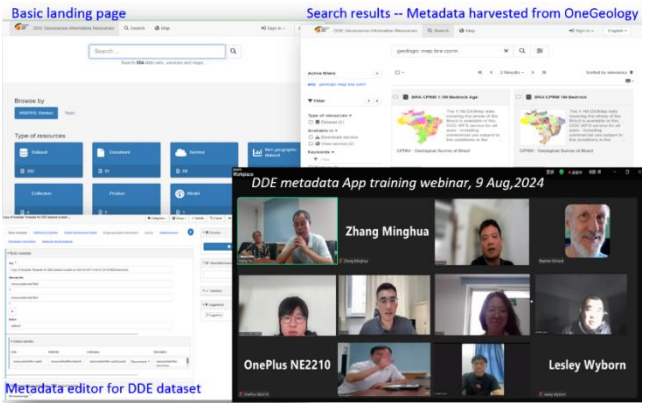
- ***Major achievements and products***

DDE-STG successfully conducted its annual work plan in 2024 and completed the DDE R&D project 'Geoscience Data Standards for DDE (project number: EP2020-04)' in 2024 with the Final Project Report approved by DDE Science Committee (DDE-SC) with a high score in August 2024. Also, the proposal for the second phase of DDE R&D project 'FAIR Principles Implementation for DDE' in close cooperation with CODATA was approved by the DDE SC and DDE executive committee (DDE-EC) in September 2024.

(1) The metadata App was developed based on the DDE Geoscience information metadata standard (DS01, 2023) and GeoNetwork, an open source software system with much

functionality for managing varying metadata repositories that is deployed on the DDE platform for harvest of metadata and DDE resources cataloguing; see the figure below.

Population of the metadata standard with the App within the DDE-WTG and global geoscience communities was successfully conducted in 2024 to develop a shared understanding of current practice, cross-domain interoperability, and machine-actionability of data and metadata. Seminars in Aug 2024 and at the International Geological Congress (IGC) session on geoscience data standards and knowledge graph (T37-S10) promoted the metadata standard with great success; see pictures below.



Seminar of DDE metadata standard and App population, 9 Aug2024

37IGC-session 10, geoscience data standards and knowledge graph, 30 Aug2024

(2) In 2024, the jointly proposed R&D project with CODATA on FAIR DDE data resources that was approved in Sep 2024 was prepared for initiation. Focusing on CGI geoscience standards and CODATA WorldFAIR methodology, training workshops on geoscience data FAIR profiles using the cross domain interoperable framework (CDIF) were held to promote DDE standards work and products, and to receive feedback.

Zhang Minghua and Steve Richard delivered talks at the 2024 International Training Workshop on Scientific Data Standards and Technology, Beijing, 18-27 Nov 2024 in person and online.

(3) The FAIR DDE geoscience data demonstration was continuously carried out in 2024 to ensure examination of technical documents and gauge experience for FAIR existing geoscience datasets, largely with DDE-China node geological map and mineral deposit data. Demonstrations of GeoSciML and EarthResourceML implementation were successful. Preparations for Mindat, OneGeochemistry, OneSedimentology, OneStratigraphy, and other initiatives were made during in 2024 as well, in collaboration with relevant DDE WTGS and communities.

(4) Preparation was made in 2024 for the DDE Knowledge System review, release, and FAIR evaluation. This was done by a review team consisting of relevant top experts who will evaluate the FAIRness of the system, in collaboration with CGI and relevant communities such as OneGeochemistry, OnePetrology and other geosciences communities. Common consensus on the importance of geoscience standards and knowledge graphs to ensuring that geoscience resources will be FAIR was reached among several geological surveys, universities, academies, and relevant communities, who all are facing the challenge of emerging AI applications in geoscience. There is a clear consensuses that a geoscience standards repository and vocabularies should be set up as FAIR geoscience resources are critical to Large Language Model application in geoscience.

(5) We actively promoted FAIR DDE resources and standards, with support from methods and expertise of DDE/CGI/OGC/ISO, etc., with collaboration with global organizations and communities, particularly CGI, CODATA, and IUGS. Much activity was conducted in 2024 including the mentioned 37IGC sessions, the AGU meeting, and CODATA training workshops, with fruitful results obtained.

- ***Milestones***

(1) With co-presentation of the final report to DDE-SC by Harvey and Zhang on 21 Aug 2024, the DDE-STG successfully completed its first R&D project 'Geoscience Data Standards for DDE (EP2020-04)' with high approval by the DDE-SC, after three years of diligent effort and with anticipated products and outcomes achieved despite difficulties caused by pandemic.

(2) The DDE geoscience information standard App was released on the DDE platform for FAIR global geoscience information harvest and sharing. This has laid a solid base for CDIF implementation in the geoscience domain worldwide.

(3) The DDE-STG proposal for the second phase of the DDE R&D project 'FAIR Principles Implementation for DDE', in close cooperation with CODATA, was approved by the DDE in 2024, which ensures another three years of contributions to FAIR DDE resources from DDE-STG scientists and a broad range of global communities.

DDE-STG leaders, prof. Harvey Thorleifson and prof. Zhang Minghua maintained regular online and in person meetings to deal with group affairs, with much support from Mark Rattenbury and Francois Robida at joint leadership meetings of CGI.

Zhang was actively in charge of the R&D project management with help from Harvey and group scientists. The secretariat (ddestgsecretariat@ddeworld.org), Ms Kathy (Yu Rui) continuously looked after logistics, meeting arrangements, and relevant issues.

DDE-STG members were pleased and honored to be informed that prof. Harvey Thorleifson was elected as president of the DDE Governing Council (DDE-GC).

The DDE-STG hosts its website on both the CGI website (https://cgi-iugs.org/project/ddestandards) and the DDE website (https://www.ddeworld.org). DDE-STG has continuously contributed activities news, standards documents, and workshop outcomes to the DDE secretariat and DDE website in 2024.

DDE-STG also supported the maintenance of the DDE metadata App on the DDE platform (https://geonetwork.deep-time.org:8080/geonetwork)

- ***Work Plan for 2025***

Apart from much activity contributing to DDE and to geoscience standards globally, the main activities in 2025 of the DDE-STG will be as follows.

(1) Closer cooperation with CODATA on the implementation of the R&D project FAIR Principles Implementation for DDE, including jointly CDIF implementation, and metadata population.

(2) We will continue DDE-related data resource and knowledge resource FAIR demonstrations. Together with WorldFAIR methodology training workshops and geoscience metadata App population, CGI/OGC standards implementation, etc., we will continue to prepare technical documents and experiences for FAIR on existing geoscience databases, typically in collaboration with DDE-China, Igneous Rock database, OneGeochemistry, OneSedimentology, OneStratigraphy, and Mindat.

(3) The DDE Knowledge System review, release, and FAIR evaluation will be carried out by a review organization consisting of relevant top experts, and an evaluation of the DDE Knowledge System in relation to “FAIRness” will be conducted in collaboration with CGI and relevant DDE-WTGs and geosciences communities.

(4) The DDE platform geoscience catalog using the DDE metadata standard and CGI/DDE relevant vocabularies will be maintained in close collaboration with the DDE platform team to set up a standardized terminology for the platform through all the terms on webpages, module dialogues and relevant software tools.

(5) The DDE-STG will be reorganized and adjusted to improve efficiency and effectiveness and to align with DDE medium and long term plans.

- ***Relevant information***

Members of DDE-STG thank DDE-SC and DDE-EC for their strong support and guidance in the group's work and achievements.
DDE-STG thanks the DDE Secretariat and Suzhou center for support in past years in conference organization and in many other ways.

DDE-STG leadership thanks all group member scientists and their organizations for their support and contributions to the DDE geoscience standards work. Thanks also go to DDE-WTGs for cooperation and support.

(by Zhang Minghua and Harvey Thorleifson)

8. Main problems encountered

CGI activities have evolved to the post-pandemic paradigm of mixed online and in-person meetings. CGI has succeeded in 2024 recruiting new leaders and completed election of the new term 2024-2028 CGI Council members presenting all the continents.
Major challenges remain in finding capable people, particularly young scientists who are able and willing to dedicate significant time to needed technical work, and funding necessary international travel as well.

9. Annual Financial Report

- ***CGI Council Grants***

CGI Council Grants were anticipated for 2024 but none reached contracting stage. Work relating to CGI-DDE vocabulary and a GeoJSON implementation version of GeoSciML is still in the pipeline but the service provider is now expected to be the Open Geoscience Consortium with work to occur in 2025. CGI agreed to support the Status of Geoscience Information in Africa Workshop in Belfast (February 2025) with a $17,000 USD payment to assist with its running costs.

- ***2024 Income and Expenditure Summary***

The CGI bank account is held in New Zealand and is administered by CGI Council Treasurer Mark Rattenbury. There has been a 6 percentage point softening of the New Zealand dollar against the American dollar in 2024.
Transactions in 2024 continued to be light. The face-to-face meeting of the CGI Council in Busan, South Korea in August did not require any expenses.
Invoices and financial statements are stored in Finance folders in the CGI Council's Google Drive document repository.

- ***Significant income***

IUGS awarded an annual grant of USD 10,000 for CGI operational activities.

- ***Significant expenditure***

(1) Payment of USD 2,500 to François Robida as an honorarium for continued, unsalaried and exemplary contribution to CGI.
(2) Payment of USD 17,000.00 to Queens University Belfast to support running costs of the upcoming Status of Geoscience Information in Africa Workshop in February 2025.

- ***Summary of transactions***

Transaction Date	Transaction description	Debit	Credit	Balance
1-Jan-24	Opening balance (New Zealand account NZD)			*$40,281.07*
13-May-24	IUGS annual grant		$16,298.86	
13-May-24	Bank Charge	$15.00		
30-Jul-24	Francois Robida honorarium payment	$4326.76		
30-Jul-24	Bank Charge	$32.55		
30-Jul-24	Bank Charge	$5.00		
12-Dec-24	Queen's University Belfast workshop grant	$29,885.38		
12-Dec-24	Bank Charge	$33.82		
31-Dec-24	Closing balance (New Zealand account NZD)			*$22,281.42*

Closing balance is equivalent to USD 12,629 (as of 23 December 2024 NZD-USD exchange rate).

(by Mark Rattenbury)

10. Work plan for next year

- Implementation of CGI strategic plan2024-2028 with significant progress.
- Continue the support to DDE with resource and expertise on FAIR principles for data and knowledge.
- Continue to push for the well implementation of CGI standards like GeoSciML and EarthResourceML, including GeoJson encoding and promotion.
- Improve service functionality of geoscience vocabularies for global users.
- Hosting geoscience standards in collaboration with ISC, DDE and other relevant organizations.
- Update CGI website.
- Publish standard products, CGI newsletters, papers, and improve contributions to IUGS publications.

- Enhance collaboration with IUGS commissions, task groups.
- Strengthen collaboration with partners like CODATA, RDA, OGC, ISO, and DDE regarding UN SDGs.
- support regional initiatives through workshops, recruit younger scientists.
- Hold CGI annual meeting in Demark during the GIC meeting.

11. Critical milestones

- Complete an implementation pathway for the CGI Strategic Plan 204-2028 by identifying tasks and timelines to achieve stated goals.
- Commencement of CGI cooperation with CODATA on DDE R&D project FAIR Principles Implementation for DDE approved by DDE-SC in 2024
- Populate and promote the Geoscience information metadata standard App for Findable data, knowledge and services.

12. Budget request for 2025

In 2025, CGI will request an operating grant of $10,000 USD from IUGS Executive Committee and is anticipating a $10,000 USD grant from the Deep-time Digital Earth program for expenses relating to operation of the DDE Standards Task Group.

A major expenditure item, provisional on income being received, is a contract to the Open Geospatial Commission to run a sprint to enable GeoJSON coding of the GeoSciML data model to enable software application uptake. The expenditure includes the allocation provided by the DDE Standards Task Group. Further expenditure on one or more CGI-commissioned projects is planned subject to a call for proposals and evaluation by CGI Council. Travel expenses for the Chair to attend the early 2026 IUGS Executive meeting is also budgeted.

Balance 1 January 2025 (USD)

$12,629 Carried over from 2024

Income for 2025 (USD)

$10,000 DDE grant for 2025 for DDE-STG activities

$10,000 Requested 2025 funds from IUGS

Expenditure for 2025 (USD)

$20,000 OGC contract for vocabulary and GeoJSON development*

$5,000 CGI Grant funds for commissioned projects - proposal(s) to be sought

$3,000 Travel to IUGS Executive Committee meeting for Chair

Balance 31 December 2025 (USD)
$4,629
* Includes $10,000 DDE contribution via the DDE Standards Task Group grant

13. Objectives and work plan for the next 5 years

As outlined in the CGI Strategic Plan 2024-2028, main Objectives and the work plan for the next 5 years of CGI include:

- Implementation of CGI Strategic Plan 2024-2028 for enhanced governance, better communication and cooperation, more efficient working groups and assisting development of products to meet demands for emerging new technologies application in geosciences.
- Support the IUGS DDE program by leading the DDE Standards Task Group, through R&D projects that ensure DDE data and knowledge will be FAIR, including closer cooperation with CODATA on the DDE R&D project, and implementation of the DDE geoscience information metadata standard.
- Recruit capable people, especially younger scientists from geoscience and IT backgrounds to work with CGI standards working groups and to undertake collaboration projects.
- Play a visible and authorized role within IUGS on geoscience standards and to prepare for current AI applications and update geoscience knowledge by enhancing cross-IUGS collaborations and strengthen alliances amongst standards and geoinformation bodies, including OGC, ISO, CODATA, RDA, Linked Data, CGMW, etc.
- Select and fund projects with capable organizations on GeoSciML, EarthResourceML in GeoJSON to widen use, and to provide better services of CGI vocabularies, including multilingual implementation.
- Good governance of hosting geoscience standards co-issued by CGI or solely outside CGI for global geoscience standards management and maintenance, to meet demands from all sides.
- Strengthen the role in coordination of regional initiatives, e.g. by organizing workshops and training on geoscience information management and applications, 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, as well as geoscience knowledge graphs.

- Provide support to UNESCO Open Science and ISC FAIR data principles by promoting international use of data exchange standards (especially adoption of GeoSciML, EarthResourceML and CGI geoscience vocabularies) in regions, commissions, countries, and organizations; 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).
- Present on CGI activity with DDE, geoscience events, and organize relevant sessions at 38th IGC in Calgary, Canada on geoscience information.

14. Suggestions for improvement of IUGS activities

It will be helpful if the IUGS Executive can continue to approve of 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.

15. Conclusion

CGI was active, productive, and influential in 2024 in the field of geoscience information standards, utilizing both online and in-person meetings and activities, with fruitful outcomes. By far the most important highlight of the year was the CGI strategic plan 204-2028 outlined achievable goals that will meet needs both urgent and long-term from the global geoscience community and relevant stakeholders, the deep cooperation with CODATA on DDE R&D project FAIR Principles Implementation for DDE approved by DDE-SC and will conducted form 2025-2027 supporting geoscience data FAIR and UNESCO Open Science, population of geoscience information metadata standard supporting FAIR, and CGI session and Council meeting at 37IGC in Busan Korea.

Throughout the year, five CGI Council meetings were held in Jan, Jun, Aug, Oct and Dec, and monthly leadership meetings also held. A new CGI strategic plan has been issued. CGI has active and productive topical working groups, and regional alliances. The CGI website is up to date. Timely CGI News items were produced and the CGI Newsletter released on CGI website and in IUGS E-Bulletins. The CGI-led DDE R&D project on geoscience standards was completed with high approval by DDE-SC and the second phase project on FAIR implementation was also approved by DDE.

The ambition of CGI is to accelerate our response to global geoscience community needs for standards and procedures for FAIR information, by considering current technological developments and new needs for the future, such as semantic web, linked data, big data, artificial intelligence, digital twins, ontology, knowledge graph, and more. To do this it will be

important to maintain and strengthen relationships:

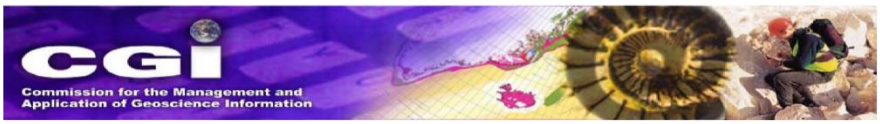
— with **geoscience professional communities**, with the support of their organizations, through a presence in international conferences and projects such as DDE, EPOS, and AuScope, OneGeology, and also with other disciplines through CODATA and RDA, etc.
— with the **geoscience industry**, a major producer of data, to promote their adoption of CGI standards, and to learn about needs,
—with ***IT and data science sectors***, whose powerful and efficient tools facilitate data-driven and knowledge-driven geosciences,
— with other **standards** organizations such as OGC, ISO and W3C,
— with software **developers** to encourage and facilitate their implementation of CGI standards, and
—with **geoscientists** around the world to facilitate the deployment of these standards.

To achieve these ambitions, it will be important to maintain and renew the expertise available to CGI through recruitment of capable people and establishment of effective working groups.

Finally, CGI Council would like to express its thanks to all members of the CGI and its regional and 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 and collaborations with cross-IUGS and global communities and partners in 2025, with the implementation of CGI Strategic Plan 2024-2028.

CGI Council, 17 January, 2025

Annex 1 CGI Strategic Plan 2024-2028



CGI Strategic Plan 2024-2028

Executive Summary

The Commission for the Management and Application of Geoscience Information (CGI) has the task and responsibility to develop, promote, apply and disseminate geoscience information standards on an international level. CGI has demonstrated leadership in geoscience information standards development and is widely recognised for this. CGI has diversity in its active membership with broad technical and geoscience expertise and its affiliation with the international Union of Geological Sciences provides a stable governance framework for international geoscience data standards. Future opportunities for CGI include enabling other IUGS commissions and international groups to utilise CGI's expertise and infrastructure for their standards, collaborating with similar information standards-focussed commissions in other international unions and supporting artificial intelligence applications with standards and vocabularies.

Vision

CGI's vision is:

- 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, modelling, exchange, and use of geoscience information enables its best possible application,
- for the benefit of all society.

Mission

CGI's mission is:
To foster the interoperability and exchange of geoscience information, by active community leadership, collaboration, education, and the development and promotion of geoscience information standards and best practice.

Environmental Analysis

One of the strengths of CGI is its global representation and reach. Its standards are used by geological survey organisations, research institutes, industry and academia around the world. CGI has also gained a wide level of recognition and a good reputation for its involvement in developing, maintaining and promoting geoscience information standards. CGI has enduring status and visibility as a commission affiliated to IUGS affiliation. CGI is diverse in terms of members' affiliation to organisations, technical and/or geoscientific expertise, geographic distribution and first language. CGI has always worked collaboratively and arrived at achieved consensus-based results.

The extensive consultation in the development of CGI standards demonstrates sector leadership and results in widely accepted, high quality and innovative standards.
CGI is not well funded, which is a significant weakness for maintaining momentum and productivity. Annual grants from IUGS to CGI allow small value contracts and cover some expenses but generally do not fund the time or travel that CGI members spend on developing information standards. Instead, CGI members' time and travel costs are typically borne by individual members' organisations, which have varying motivations and commitment towards supporting the development and governance of standards. As a result, the time available for standards development and governance can be fragmented. The number of CGI members actively contributing can fluctuate but is generally small from year to year. Many of the active members are late in their careers and the relative lack of younger active members suggests that succession and continuity is a looming issue.
Opportunities for CGI include a broader role in hosting geoscience information standards, both for IUGS and for other organisations needing technical and/or infrastructure support. CGI can seek to support and utilise artificial intelligence applications for the development, maintenance and improvement of information standards and vocabularies and present itself as a trusted source in an age of misinformation and disinformation. CGI broadening its scope into the role of information standards in artificial intelligence applications could help in the recruitment of early career information.
Artificial intelligence could also pose a threat as information standards could be displaced by AI algorithms. Increasing technical capabilities among key information standards users, for example, some of the more progressive geological surveys, could lead to CGI standards being bypassed in favour of locally relevant standards.

Goals and Objectives

To become IUGS's principal delivery point for information standards and resources
To be IUGS's authority on international best-practice geoscience information management
To collaborate with international and influential geoscience information projects and standards-setting groups

Roadmap for CGI Initiatives

		Short term (2024-25)	Medium term (2025-2026)	Long term (2026-28)
1	**Governance**	Consider restructure of CGI Council • Define what good governance looks like	• Document CGI standards in a systematic way, including process for maintaining standards, methods of establishing working groups • Encourage third party standards that CGI host are also documented	• Review structure of CGI Council
2	**Vocabularies**	• Review website content, make improvements where needed • Highlight vocabulary uptake e.g. as used by Geoscience Australia, British Geological Survey, European Geological Data Infrastructure and AuScope	• Encourage third party submission of vocabularies for CGI hosting • CGI (through the Geoscience Terminology Working Group) adopt more of a review or endorsement role for vocabularies provided by third parties	• Identify any vocabularies that may benefit from transformation into ontologies and initiate the work to do this

		• Accelerate publication of CGI vocabularies by lowering completion thresholds (i.e. good drafts are good enough to publish)		
3	**Logical Data Models**	• Conceptualise how to govern EarthResourceML v.3	• Publish journal papers on GeoSciML, ERML, DWG IE experiments	• Explore opportunities for new and improved logical data models
4	**Artificial Intelligence**	• Contact scientists currently using GeoSciML and EarthResourceML vocabularies for AI	• Provide measured advice to IUGS on the importance of information standards in AI applications • Continue to horizon scan developments in the AI space that relate to geoscience information • Engage with AI and knowledge graph community	• Present CGI standards at semantic web/knowledge graph/AI conferences • identify developments in adjacent fields of science and information management that are employing AI in standards and knowledge graphs.
5	**3D Geology & Digital Twins**	• Investigate the new information standards requirements of process-focussed geoscience digital twins	• Investigate the new information standards requirements of a global 3D geology model	
6	**Cross-IUGS Collaboration**	• Connect CGI with Data and Information activities across IUGS • Encourage DDE scientists (especially early career) to get involved in international information standards development, including working with CGI working groups • Connect CGI with Data and Information activities across IUGS	• Promote CGI standards at many more conferences not just government geological activities (e.g. AGU, EGU, GIC, RDA, CODATA) • Leverage on IUGS connections with CODATA, the international Science Unions and UNESCO • Work with affiliated organisations in supporting geoscience mapping standardisation such as OAGS, GSAf • Support the development of online platforms through which standards and vocabularies can be hosted through GIMS, AMREC and Digital Earth Africa.	• Sub-contract academic institutions who are willing to implement identified projects with CGI • CGI be involved with WorldFAIR as it takes approaches forward in the context of EU Funded projects.
7	**CGI Working Groups**	• Review the scope and relevance of existing working groups and consider refocussing or forming new working groups in emerging geoscience information areas	• Review methods of operation for working groups to improve responsiveness	• Review the scope and relevance of existing working groups
8	**Communication**	• Identify important people and organisations in the research community and industry, establish partnerships and engage with them to increase the uptake of CGI standards.	• Initiate a lobbying campaign aimed at the decision-makers in the geological survey organizations and associated industry and research bodies to strengthen support for CGI standards.	• Share CGI websites link with other geoscience websites to have it placed on these other websites to broaden sharing more CGI information

Annex 2 Contact – CGI Council members

Harvey Thorleifson (Chair)
Department of Earth Sciences
University of Minnesota
2609 West Territorial Road, St Paul MN 55114-1009, USA
Telephone: +1 612-626-2150
Email:thorleif@umn.edu

Jasna Šinigoj (Co-Secretary General)
Head of Geological Information Centre,
Geological Survey of Slovenia
Dimičeva ulica 14, 1000 Ljubljana, Slovenia
Telephone: +386 (0)1 2809 712,
Email: jasna.sinigoj@geo-zs.si

Lesego Ramaabya (Co-retary General)
Director of Information Delivery,
Botswana Geoscience Institute
Khama 1 Avenue, Private Bag 0014, Lobatse, Botswana
Telephone: +267 5336762
Email: peterl@bgi.org.bw

Mark Rattenbury (Treasurer)
Program Leader
Nationally Significant Databases and Collections
GNS Science,
1 Fairway Drive, Avalon 5010,
PO Box 30368, Lower Hutt 5040, New Zealand
Telephone: +64 04 570 4697
Email: m.rattenbury@gns.cri.nz

Zhang Minghua
Development Research Center
China Geological survey
45 Fuwai St., Bejiing, 100037, China
Telephone: +86 10 5631 5800
Email: zminghua@mail.cgs.gov.cn

Michael Sexton
Mineral Deposits and Resources Database
Geoscience Australia
Cnr Jerrabomberra Avenue and Hindmarsh Drive
Symonston ACT, GPO Box 378, Canberra ACT 2601, Australia
Telephone: +61 2 6126 8781
Email: Michael.Sexton@ga.gov.au

Christelle Loiselet
Deputy head of Digital department for Geosciences
BRGM
3 Avenue C Guillemin - BP 36009
4506 Orleans cedex 02, France
Telephone: +33 7 860 358 50
Email: c.loiselet@brgm.fr

Edward Lewis
Standards Lead, British Geological Survey
Nicker Hill, Key worth,
Nottinghamshire, NG12 5GG, UK
Telephone: +44 07487559371
Email: edlew@bgs.ac.uk

Liu Rongmei
Divion director, Geoscience Data Center
Chine geological Survey
55 Honglian Rd, Beijng, 100055, China
Telephone: +86 01 83276141
Email: lrongmei@mail.cgs.gov.cn

Mauricio Pavan Silva
Department of Geology
Geological Survey of Brasil (CPRM)
Rua Costa, 55, 01304-010, São Paulo, SP, Brazil
Telephone: +55 11 37755108
Email: mauricio.pavan@cprm.gov.br

Tsutomu Nakazawa
Deputy director
Geoinformation Service Center
Geological Survey of Japan,
AIST Tsukuba Central 7, 1-1-1 Higashi
Tsukuba, 305-8567, Japan
Telephone: +81-29-861-2390
E-mail: t-nakazawa@aist.go.jp

Mickaël Beaufils
Data Architect, BRGM
3 Avenue C Guillemin - BP 36009
4506 Orleans cedex 02, France
Telephone: +33 2 38 64 37 03
Email: M.Beaufils@brgm.fr

François Robida (Past Chair)
28 allée de Limère
41506, ARDON - France
Telephone: +33 6 21 05 21 10
Email: f.robida@outlook.fr