Meetings on the Status and Future of Global Geoscience Information Standards

CGI in partnership with IUGS's Deep-time Digital Earth Project are hosting in-person meetings in Suzhou, China, 7-10 November 2023, on the Status and Future of Global Geoscience Information Standards.

There are two meetings, described in more detailed below:
>   7-8 November - Geoscience Information Standards for DDE Workshop
>   9-10 November - Future Geoscience Information Standards Forum (invitation only)

These will be followed by a CGI Council Meeting on the afternoon of 10 November.

For more information on these meetings contact Dr Zhang Minghua

Geoscience information standards for DDE Workshop

7-8 November 2023

Kunshan Xin Place Hotel, Suzhou, China

Commission for the Management and Application of Geoscience Information
Deep-time Digital Earth Standards Task Group
Deep-time Digital Earth Secretariat

The Deep-time Digital Earth (DDE) Project involves many science working groups organized around geoscience domains building interconnected digital information to enable massive-scale computing applications in earth science and Earth history. Effective communication of information relies heavily on the adoption of geoscience standards to ensure FAIRness of data. This workshop will evaluate the current status of geoscience information standards implementation in the DDE science working groups, identify areas where standards could facilitate information exchange and map out the steps needed to achieve good standards implementation. Our **objective** will be to optimize coordination and planning of geoscience standards, to support the success of DDE to enable acceleration of research and provision of benefits to support science to manage earth resources and address challenges of climate change.

The workshop is being coordinated through the DDE Standards Task Group led by Prof. Harvey Thorleifson, Prof. Zhang Minghua, Dr Mark Rattenbury and François Robida.

Agenda (subject to change)

Date	Time	Topics	Chair

		Day 1. Global information standards and the DDE major science program	
7 Nov Tue	8:00-9:00	**Registration**	DDE Secretariat, DDE-STG PIs
	9:00-9:50	**Opening** Welcome by CGI Chair Prof. Harvey Thorleifson Address by IUGS President, Prof. John Ludden (==TBC==) Address by DDE Secretary general Prof. Natarajan Ishwaran Welcome by Suzhou City	
	9:50-10:30	**Keynote Presentations** ● Role of Geoscience Information Standards for international initiatives and programs – François Robida (15 min) ● The Deep-time Digital Earth major science program – Prof. Hans Thybo (15 min) Release of the DDE geoscience information metadata standard – Prof. Zhang Minghua and Dr Steve Richard (10 min)	
	10:30-11:00	Group Photo and Coffee Break	
	11:00-12:30	**DDE Science Working Groups progress and plans:** with emphasis on standards. (10 min + 5 min discussion each) 1. Geological mapping – Dr Benjamin Sautter and Dr Song Yang 2. Stratigraphy – Prof. Fan Junxuan 3. Petrology database and standard (Igneous Rock) – Prof. Wang Tao and Dr Ding Yi 4. Geological time standard – Prof. Li Xianhua and Dr Li Yang 5. Marginal Seas – Dr. Jinpeng Zhang and Xinong Xie **6.** Mineral resource assessment (Porphyry copper) – Dr Yang Jie	Zhang Minghua
	12:30-13:30	Lunch	
	13:30-15:00	**DDE Science Working Groups progress and plans:** with emphasis on standards continued. (10 min + 5 min discussion each) 7. DDE-China – Dr Liu Rongmei and Dr Cui Ning 8. Paleogeography – Dr Haipeng Li 9. Hydrogeology – Prof. Cheng Jianmei and Chen Yanpei **10.** Geomorphology – Dr Li Sijin and Dr Chen Yang	Zhang Minghua
		The DDE Platform and related major geoscience initiatives: (10 min + 5 min discussion each) 11. OneGeology – Matt Harrison 12. GSEU – Jasna Sinigoj 13. The DDE Platform – Du Zhenhong Discussion on current geoscience standards needed for DDE and concurrent initiatives.	François Robida, Mark Rattenbury
	15:00-15:30	Afternoon break	
	15:30-17:30	**DDE Secretariat & RCE Suzhou visit**	
	18:00-19:30	**Reception**	
8 Nov	**Day 2. Geoscience information technologies and standards**		

Wed			
	9:00 – 10:30	**The DDE Knowledge System:** (20 min + 10 discussion each) 14. The DDE Knowledge System – Prof. Zhu Yuanqiang 15. Construction of Knowledge Graphs for Petroliferous Basin Evaluation – Dr Tang Xianming 16. Sedimentology Knowledge Graph – Prof. Hu Xiumian	Zhang Minghua
	10:30-11:00	Coffee Break	
	11:00-12:30	**DDE Knowledge System and global geoscience information** 17. **Keynote:** Machine-Readable Semantics in Data Science for Geosciences – Prof. Marshall Ma 18. CGI and DDE: geoscience terminology – Dr Mark Rattenbury 19. LOOP Knowledge Management – Dr Steve Richard Discussion	François Robida
	12:30-13:30	Lunch	
	13:30-15:00	20. Lightning talks, 6 presentations, 4 min talk, 1 min discussion Panel discussion – status, needs and challenges for geoscience standards	Harvey Thorleifson, Francois Robida, Zhang Minghua, Mark Rattenbury
	15:00-15:30	Afternoon break	
	15:30-17:10	21. Planning for DDE success – vision, progress, plans, actions (1) Leadership presentation, (2) Breakouts, (3) Open Discussion, (4) Actions	Harvey Thorleifson, Francois Robida, Zhang Minghua, Mark Rattenbury
	17:10-17:30	**Closing** CGI Chair Prof. Harvey Thorleifson/ DDE Secretary General	

Future Geoscience Information Standards Forum

9-10 November 2023

Kunshan Xin Place Hotel, Suzhou, China

Commission for the Management and Application of Geoscience Information (CGI)
Deep-time Digital Earth Standards Task Group (DDE-STG)

Building on the geoscience information standards needs of IUGS's Deep-time Digital Earth (DDE) project, the subject of a workshop in the preceding two days, CGI as the lead IUGS commission for developing and promoting geoscience information standards is

organizing this forum to look at future geoscience information standards requirements. The **objective** is to anticipate needs for and better support emerging projects such as DDE and Digital Twins that require efficient communication of information across borders and between agencies, institutions, companies and even beyond geosciences. The role of geoscience information standards in assisting technologies such as Artificial Intelligence is also within scope. The organizers invite experts and leaders from partner organizations to attend and contribute to forward-looking in this crucial field. Planned **topics** include**:**

(1) Current status of global geoscience information standards
(2) Emerging geoscience information standards and future opportunities
(3) New technologies such as knowledge graph, artificial intelligence

Agenda (as participants are all confirmed, this agenda will be updated)

Date	Time	Topics	Chair
9 Nov Thu	8:00-9:00	Registration	
	09:00-09:15	**Opening** Welcome by CGI chair – Prof. Harvey Thorleifson	CGI
	Geoscience information standards; now and next		
	09:15-10:30	The present geoscience standards landscape; geoscience data models maturity and geoscience terminology. 　　　10-minute talks on: (i)　　Mature data models – Michael Sexton (ii)　　Emerging data models – Dr Mickael Beaufils (iii)　　Geoscience vocabularies – Dr Mark Rattenbury 　　　Discussion 1	François Robida
	10:30-11:00	Coffee Break	
	11:00-12:30	The need for geoscience standards; why and how. 　　　10-minute talks on: (i)　　Promoting and influencing geoscience standards – François Robida (ii)　　Resourcing and governance of geoscience standards –TBA (iii)　　Connecting geoscience domains together – Dr Lesley Wyborn (iv)　　Connecting geoscience standards with other disciplines – TBA 　　　Discussion 2	Mark Rattenbury
	12:30-13:30	Lunch	
	Future geoscience information projects and initiatives		
	13:30-15:00	Future geoscience standards needed; why and how. 　　　5-10 minute talks on the gaps and opportunities for new and refined geoscience standards – Clinton Smyth (industry application), Steve Richard (ontologies), TBA 　　　Discussion 3	François Robida
	15:00-15:30	Coffee Break	
	15:30-17:30	Current, emerging and future projects and technologies and their geoscience standards needs for human and machine information exchange.	Mark Rattenbury

		5-10 minute talks on DDE, Digital Twins, Data Science, AI –Prof. Marshall Ma, Prof. Harvey Thorleifson & others Discussion 4	
10 Nov **Fri**	**Future geoscience information projects and initiatives (continued)**		
	9:00-10:30	Specific ideas for future geoscience standards. 5-10 minute talks on potential geoscience standards initiatives Discussion 5	François Robida
	10:30-11:00	Coffee Break	

	11:00-12:00	Next steps for geoscience standards.
		    General discussion
		    Wrap up
			Mark Rattenbury

The Future Geoscience Information Standards Forum is an opportunity afforded to CGI to capitalize on an adjacent workshop of geoscience standards implementation for the DDE major science programme. The Forum aims to briefly look to the past, assess the present and look forward to the future regarding geoscience information standards. With a small group of invited experts, the Forum will follow a flexible and lightly structured agenda with plenty of time for discussion and brain-storming. The Forum aims to conclude with a sense of purpose and direction around further development of geoscience information standards that are needed.

Background of Geoscience Information Standards

Many of the geoscience information standards we have today had their origins in geological maps, particularly those produced by geological surveys as part of map series. Map series typically require and achieve levels of consistency around, for example, mapping philosophy, scale, stratigraphic and technical terminology, colour and symbology. These elements were expressed in map style guides, procedures and other technical documentation. Consistency of approach benefits not only the map compiler but also the map user who can switch between maps more easily. The advent of digital geological maps, particularly those built with GIS software, facilitated exchange of information through common software formats and contained feature attributes. One of the drivers was wanting to share geoscience information across jurisdictional borders, whether they be state, province or country. Development of the North America Data Model (NADM) through 1996-2006 involved US and Canada and evolved into Geoscience Markup Language (GeoSciML) through greater international participation involving UK, France, Australia and wider through CGI and more recently the Open Geospatial Consortium (OGC). The seminal OneGeology global geological map project, started in 2007 and involving more than 40 countries, provided the quintessential use case for utilizing geoscience information standards and this accelerated their development and implementation. Geoscience information is much wider than that contained in geological maps and the role of standards is fundamentally to convey information in an understandable way.

Present Geoscience Information Standards Landscape

The present landscape of geological information standards consists of a mature geology data model (GeoSciML), an advanced minerals and mining data model (EarthResourceML) and many of the geoscience vocabularies needed to support them.

GeoSciML is a model of geological features commonly described and portrayed in geological maps, cross sections, geological reports and databases. It covers the domain of geology (earth materials, geological units and stratigraphy, geological time, geological structures, geomorphology, geochemistry) and sampling features common to the practice of geoscience, such as boreholes and geological specimens. The specification describes a logical model and GML/XML encoding rules for the exchange of geological map data, geological time scales, boreholes, and metadata for laboratory analyses and its primary goal is to enable information systems to interoperate with such data. GeoSciML's latest iteration (version 4.1) has been released as an OGC standard. GeoSciML development has tailed off, apart from GeoJSON implementation.

EarthResourceML is a model of economic geology encompassing mineral occurrences, commodity resource, mining activity, mineral processing and mining waste. Its latest published iteration (version 2.0), implemented by many countries, is undergoing a significant overhaul.

GroundwaterML is a data model for hydrogeology and there are other data models for specialised geoscience domains such as seismology and emerging areas such as geotechnical. Thus, most of the wider geoscience domain is or will be catered for by logical data models.

The geoscience logical data models are supported by controlled vocabularies, that is, lists of terms that are describe properties and relationships of objects. Vocabularies supporting the above logical data models are typical hierarchical with parent-child associations, with synonyms and multi-lingual equivalents, include definitions and sources and are made available in machine-readable formats. CGI's vocabularies currently number 60.

The Ongoing Need for Geoscience Information Standards

The requirement to share geoscience information is as important as ever, particularly in an era where machine-to-machine sharing is commonplace and artificial intelligence applications grow. Well-organized geoscience data conforming to information standards are always going to reduce ambiguity and uncertainty to enable clearer patterns to emerge and make possible the production of FAIR data by scientists.

Among the questions that this Forum is addressing are:
- How fit-for-purpose are existing geoscience information standards?
- What improvements are needed for existing geoscience information standards?
- What new geoscience information standards are needed e.g., new data models, ontologies?
- What is the role of international groups in guiding and governing geoscience information standards?

- How are geoscience information standards development and maintenance resourced and by whom?
- What are the emerging projects and technologies that will benefit from geoscience information standards?
- Who will benefit by using geoscience information standards?
- Who are the geoscience information standards leaders, compilers and implementers of the future?