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Global-scale Geochemical Baselines Mapping: Steps forward in 2016

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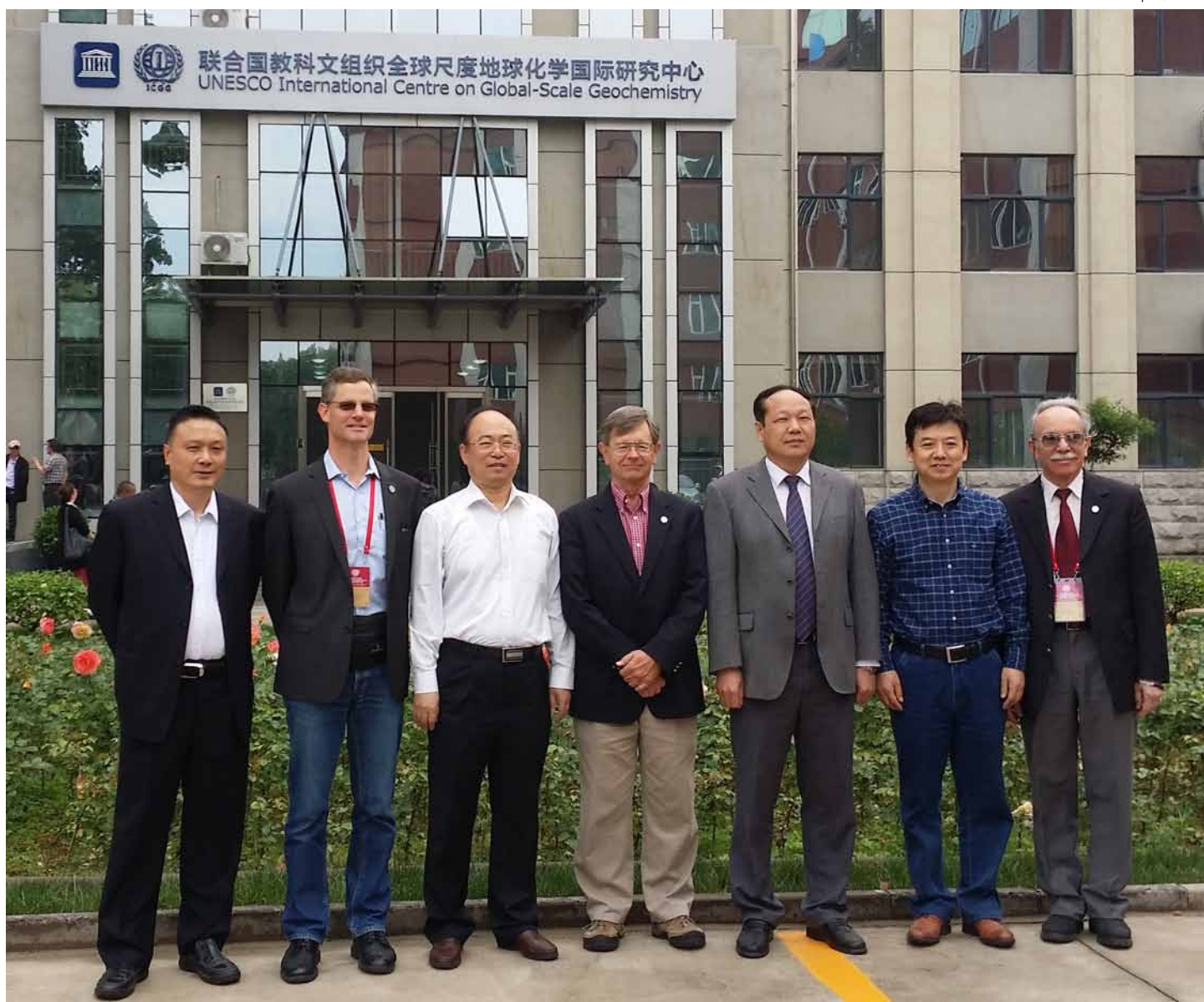
Global-scale geochemical mapping refers to conducting geochemical surveys of very large areas (millions of km²) of the Earth's continents using very low sampling densities (1 site per a few thousand km²). This has been a subject of formal discussion and consideration in the geoscience community since at least 1988 (see below). In 2016, two events occurred that have the potential to greatly further the cause of global-scale geochemical mapping. In May 2016, the United Nations Educational, Scientific, and Cultural Organization (UNESCO) International Centre for Global-Scale Geochemistry (hereafter referred to as 'the Centre') opened in Langfang, People's Republic of China. This opening was followed in August by the International Union

of Geological Sciences (IUGS) establishing the Commission on Global Geochemical Baselines (hereafter referred to as 'the Commission'). The purpose of this article is to describe each of these new organizations and to summarize the mission of each. As will be seen, each organization has strong ties to the Association of Applied Geochemists (AAG).

IUGS Commission on Global Geochemical Baselines

According to IUGS Bylaws, one of the primary objectives of IUGS Commissions is to "coordinate long-term international cooperative investigations to establish standards in appropriate fields." The long-term mission of this Commission is to work with applied geoscientists throughout the

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Left to right: Zhang Qin (Chief of Laboratory, IGGE), Patrice de Caritat, Shi Changyi (Deputy Director, IGGE), David Smith, Peng Xuanming (Director of IGGE and the Centre), Xueqiu Wang (Executive Director of the Centre), and Alecos Demetriades stand in front of the Centre's new facility in Langfang, May 2016.

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world to standardize methods for conducting global-scale geochemical baseline studies.

The new IUGS Commission is led by a four-person steering committee: David Smith (U.S. Geological Survey, retired, and long-time AAG Secretary), Xueqiu Wang (Institute of Geophysical and Geochemical Exploration and UNESCO International Centre on Global-scale Geochemistry, China, and current AAG Regional Councillor for China), Alecos Demetriades (Institute of Geology and Mineral Exploration, Greece, retired, and current AAG Fellow), and Patrice de Caritat (Geoscience Australia, former AAG Councillor and Society News editor for ELEMENTS).

The Commission is essentially a continuation of the Task Group on Global Geochemical Baselines, which operated from 1997 to 2016 under the auspices of both IUGS and the International Association of GeoChemistry (IAGC). The Task Group, in turn, was a follow-on of Projects 259 (International Geochemical Mapping, 1988–1992) and 360 (Global Geochemical Baselines, 1993–1997) of the International Geological Correlation Program (IGCP), now known as the International Geoscience Program. Both these projects were initiated under the leadership of Arthur G. Darnley (Geological Survey of Canada). The final report of IGCP 259, A global geochemical database for environmental and resource management (Darnley et al., 1995), was published by the Earth Sciences Division of UNESCO with financial support from IUGS, IAGC, Association of Exploration Geochemists (now the AAG), International Atomic Energy Agency, and the Royal Society. This report, fondly known in the geochemical mapping community as the Blue Book, is still the fundamental reference on global geochemical mapping and provides very useful information for geochemical mapping at any scale.

Soon after publication of the Blue Book in 1995, the Directors of the Forum of European Geological Surveys (FOREGS) approved the first multi-national, continental-scale, multi-media geochemical mapping of Europe according to Blue Book specifications. The culmination of this project was the publication of the two-volume Geochemical Atlas of Europe (Salminen et al. 2005; De Vos et al. 2006). Other global-scale geochemical mapping projects have since been completed in Australia (Caritat and Cooper 2011), China (Wang et al. 2015), India, Mexico, and the United States (Smith et al. 2013, 2014).

In 2008, the Task Group organized the First Arthur Darnley Symposium on Geochemical Mapping in conjunction with the International Geological Congress (IGC) in Oslo. Organizing a symposium has continued every four years at the IGC in Brisbane (2012) and Cape Town (2016). The new Commission plans to convene the fourth Darnley symposium at the IGC in Delhi in 2020.

More information about the activities of the Task Group can be found on its website at <http://www.globalgeochemicalbaselines.eu/>. Please note that this same URL will be used for the Commission in early 2017.

UNESCO International Centre on Global-scale Geochemistry

Although much progress was made during the tenure of the IUGS Task Group on Global Geochemical Baselines, the authors of the Blue Book recognized that it would be virtually impossible for such an ad hoc group of scientists, working under a non-government organization, to sustain and manage an international sampling effort to establish a global geochemical database. This was the impetus for the establishment of the new Centre.

The Centre is a “Category 2” research centre operating under the auspices of UNESCO. Though not legally part of UNESCO, the Centre is associated with UNESCO through formal arrangements between UNESCO and the People’s Republic of China. The long-term mission of the Centre includes: (1) fostering knowledge and technology of global-scale geochemistry, (2) documenting the global concentration and distribution of chemical elements in the Earth’s surface, (3) training scientists in global-scale geochemical mapping methods and providing technical assistance to developing countries, and (4) developing a bridge from the scientific community to both decision makers and the general public in the field of global-scale geochemistry.

The establishment of the Centre was spearheaded by Xie Xuejing (AAG Gold Medal recipient). In 2009, he presented a draft proposal to the attendees at the Global-scale Geochemical Mapping Symposium in Langfang. The revised proposal was signed by Xie Xuejing, David B. Smith, and Wang Xueqiu (co-leaders for the IUGS/IAGC Task Group on Global Geochemical Baselines). In 2010, the proposal was formally submitted to UNESCO and included a letter of support from AAG signed by AAG President Paul Morris. It took another six years for the proposal to gain official approval by UNESCO and the Chinese government. In May, 2016, the festive opening ceremonies of the new Centre took place in Langfang in the Centre’s new seven-story building located on the premises of the Institute of Geophysical and Geochemical Exploration (IGGE). The new facility includes offices, chemical laboratories, sample storage space, a data centre and five apartments for visiting scientists.

The Centre is led by a Director (Peng Xuanming, who is also the Director of IGGE) and an Executive Director (Xueqiu Wang). The functioning of the Centre is overseen by an international Governing Board and technical guidance is provided by a Scientific Committee composed of geoscientists from all over the world.

The Centre has established a global cooperation network with 80 countries participating in the Global Geochemical Baselines Project and International Project on Mapping the Chemical Earth. In 2016, the Centre financially and technically supported 12 countries (Mongolia, Russia, Laos, Cambodia, Indonesia, Papua New Guinea, Iran, Turkey, Mexico, Peru, Madagascar and Pakistan) to carry out global geochemical baselines mapping.

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Although the missions of the Centre and Commission overlap considerably, there is a notable difference. The Commission is tasked with establishing standards for global-scale geochemical baselines mapping, whereas the Centre is tasked with implementing these standards through international collaborative agreements with participating countries. Both the Centre and the Commission will work together to provide training in geochemical mapping techniques, particularly for the developing countries.

More information about the Centre can be found on its website (www.globalgeochemistry.com).

Questions about either the Centre or the Commission can be addressed to the corresponding authors of this article.

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From the EXPLORE Archives...

The **EXPLORE** archives on the AAG website are an invaluable reference tool and provides a record of how our industry is constantly changing. In this edition of **EXPLORE**, we are highlighting an article that was published in April 1997, (EXPLORE issue 95).

The “Technical Note: SEARCHMAP – Interactive Map Interpretation System for Mineral Exploration” describes how software can be used for data presentation and interpretation purposes. To read the article, please click on: <https://www.appliedgeochemists.org/images/Explore/Explore,%20Number%2095%20April%201997.PDF>.

Software continues to play an increasingly important role in our industry. Continued improvements in instrumentation provides lower detection limits and a wider array of elements than could ever have been dreamt of 20 years ago. It is interesting to consider how software has evolved in order to keep up with datasets that become progressively larger and more complex with time. It also brings up questions of how software is being used in risk reduction or the decision making process. What sort of limitations are imposed by software? Human thought vs. software predictions? The questions posed are virtually endless – but consider the role that software currently has in your career versus 20 years ago. We expect it would be a rather lively debate.

By highlighting an article from the **EXPLORE** archives, we hope to promote discussion and encourage you to revisit a publication or perhaps reconnect with an author. Old ideas that may have been overlooked could provide solutions for current problems. Please visit the **EXPLORE** archives by clicking <https://www.appliedgeochemists.org/index.php/publications/explore-newsletter/2-uncategorised/93-explore-issues>.

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