

**2010 ANNUAL REPORT FOR THE INTERNATIONAL UNION OF GEOLOGICAL SCIENCES
(IUGS)/ INTERNATIONAL ASSOCIATION OF GEOCHEMISTRY (IAGC)
TASK GROUP ON GLOBAL GEOCHEMICAL BASELINES**

URL: <http://www.globalgeochemicalbaselines.eu/>

1. TITLE OF CONSTITUENT BODY

IUGS/IAGC Task Group on Global Geochemical Baselines.

2. OVERALL OBJECTIVES

The mission of the IUGS/IAGC Task Group on Global Geochemical Baselines is to prepare a global geochemical database, and its representation in map form, to document the concentration and distribution of chemical elements and species in the Earth's near-surface environment. This database is urgently needed by environmental and resource managers throughout the world. To reach this goal, the Task Group promotes and facilitates the implementation of harmonized sampling, sample preparation, quality control, and analytical protocols in geochemical mapping programmes. Task Group activities include the following:

- Developing partnerships with countries conducting broad-scale geochemical mapping studies;
- Providing consultation and training in the form of workshops and short courses;
- Organising periodic international symposia and conferences to foster communication among the geochemical mapping community;
- Developing criteria for certifying those projects that are acceptable for inclusion in a global database;
- Acting as a repository for data collected by projects meeting the standards of harmonisation;
- Preparing complete metadata for the various certified projects; and ultimately
- Preparing a global geochemical database and atlas.

3. FIT WITHIN IUGS SCIENCE POLICY

Current IUGS scientific policy objectives relate to global earth science issues, such as identification of mineral resources, global change, geological hazards, environmental geology and sustainable development. The work of the Global Geochemical Baselines Task Group relates directly to all of these objectives through the establishment of a land-surface global geochemical reference network, providing multi-media, multi-element baseline data for a wide variety of environmental and resource applications. The project is also consistent with the strategic plan published by the IUGS Strategic Planning Committee (2000), and the International Year of Planet Earth (2005-2009) of 'Earth Sciences for Society'.

4. ORGANISATION

The project is led by a Steering Committee, which co-ordinates the activities of five Technical Committees and contributions made by regional representatives.

Steering Committee

Co-Leaders

Dr David Smith
Dr Xueqiu Wang

US Geological Survey
IGGE, China

Scientific Secretary Mr Shaun Reeder British Geological Survey
Treasurer Mr Alecos Demetriades IGME, Greece

Analytical Committee

Chair Ms Gwendy Hall Geological Survey of Canada
Co-ordinates the work plan for the analysis of GRN samples, the activities of the laboratories, and the supervision of analytical quality control data.

Sampling Committee

Chair Prof Reijo Salminen Geological Survey of Finland
Supervises development and co-ordination of sampling protocols in the various climatic and geomorphic provinces throughout the world.

Data Management Committee

Chair Dr Timo Tarvainen Geological Survey of Finland
Supervises sampling strategy, co-ordinates the sampling progress of the participating countries, manages the database of sample information and analytical results.

Regional Co-ordination

Chair Prof Reijo Salminen Geological Survey of Finland
Co-ordinates project activities of groups of neighbouring countries.

Regional Representatives

South America:

Gloria Prieto; INGEOMINAS, Bogota, Colombia
Carlos Alberto Lins; CPRM - Geological Survey of Brazil; Recife - PE, Brazil

Africa

Theo Davies; University of Venda; Limpopo Province, South Africa
Marthinus Cloete; Council for Geoscience; Pretoria, South Africa

South-east Asia:

Pradip Govil; National Geophysical Research Institute; Hyderabad, India
Mathew Joseph, Geological Survey of India; Kerala, India
Ashvin Wickramasooriya; South Eastern University of Sri Lanka; Sammanthurai, Sri Lanka

China:

Xueqiu Wang, Institute of Geophysical and Geochemical Exploration, Langfang, China

Australia:

Patrice de Caritat, Geoscience Australia, Canberra

Europe:

Clemens Reimann, Geological Survey of Norway, Trondheim, Norway

North America:

David Smith, United States Geological Survey, Denver, USA

Public Relations and Finance Committee

Chair Mr Alecos Demetriades IGME, Greece
Advertises and promotes the aims, objectives and achievements of the project world-wide, including by use of the World Wide Web, and takes responsibility for trying to secure funding for the project.

5. EXTENT OF NATIONAL/REGIONAL/GLOBAL SUPPORT FROM SOURCES OTHER THAN IUGS and IAGC

The project does not have any other source of direct funding. However, within Europe, National Geological Surveys, and associated Institutes, have provided staff time and support to the project to complete the preparation and updating of the European GRN as part of the FOREGS/EGS programme as an input to the IUGS/IAGC Global Geochemical Baselines project [<http://www.gtk.fi/publ/foregsatlas>]. A very conservative estimate of the cost for the production of the *Geochemical Atlas of Europe* is on the order of 5 million Euro (approx. 7.1 million USD). A few other countries, including China, Russia, Colombia, India, Brazil, Canada, Mexico, Nigeria and the United States have provided funds through their National Geological Surveys or related institutes for pilot studies on establishing the GRN or for national- to continental-scale geochemical mapping projects.

6. INTERFACE WITH OTHER INTERNATIONAL PROJECTS

This project is closely associated with the work of the EuroGeoSurveys Geochemistry Expert Group (previously the Forum of European Geological Surveys, FOREGS Geochemistry Working Group). The project also has links with the International Atomic Energy Agency (IAEA) and potential links with GTOS, the Global Terrestrial Observing System. The EGS Geochemistry Expert Group has also established closer links with the European Soil Bureau over the past few years (a Memorandum of Co-operation has been recently signed), and was actively involved in the European Commission's 'Soil Thematic Strategy Group' for the preparation of the EU's Soil Protection Document, and the final draft of the pending Soil Protection Directive. The EuroGeoSurveys Secretary General has established links to other European Commission projects, such as the GMES Forum (Global Monitoring of Environment and Security), and INSPIRE (Infrastructure for Spatial Information in Europe), since the Geochemical Atlas of Europe has been produced in a harmonised manner, according to IGCP 259 specifications (Darnley *et al.*, 1995) and, therefore, according to INSPIRE specifications. He is also attempting to link the project with GEOSS (Global Earth Observation system of Systems). In North America, the project has established links with the North American Soil Geochemical Landscapes Project involving the Geological Survey of Canada (GSC), the United States Geological Survey (USGS), and the Servicio Geológico Mexicano (SGM).

7. CHIEF ACCOMPLISHMENTS IN 2010

Scientific Accomplishments:

There has been continued and significant progress in a number of areas during 2010, including:

North America: (David B Smith, USGS)

The North American Soil Geochemical Landscapes Project, a collaborative effort to establish a soil geochemical database for all of North America has seen significant progress in 2010. All the sampling in the conterminous United States (4,800 sites, 14 400 samples) has been completed. These samples are being prepared for chemical analysis and will be analysed as funding permits (probably by 2012). Approximately 62% of Mexico (over 900 sites; more than 2 700 samples) has been sampled with completion anticipated in 2012 and chemical analysis performed by 2013. Unfortunately, during 2010, the Geological Survey of Canada dropped out of the project to focus on other priorities.

China and other Asian countries (Xueqiu Wang, IGGE, China)

China Geochemical Baselines

The China Geochemical Baselines (CGB) project was launched as part of the Global Geochemical Baselines Task Group in 2008, with a 5-year plan (2008 to 2012) to cover the whole of mainland

China. The project is to provide China with nationwide geochemical baseline data, maps showing the spatial distribution of all elements, and a holistic database “China Digital Chemical Earth”. Approximately 1500 CGB grids cover mainland China (9.6 million km²). Each CGB grid is approximately equal to a quarter of one Global Reference Network (GRN) cell. Approximately 10 typical rock samples are being taken from each CGB grid to estimate the primary geological (geogenic) background, and 2 soil/floodplain sediment sites are selected from each CGB grid to provide secondary geochemical baselines. The soil samples collected at each site include a sample from 0-25 cm depth, and a sample from 100-150 cm depth or from the soil C-horizon. Seventy-eight elements are being determined by ICP-MS/AES following a 4-acid digestion and by XRF following fusion, in addition to 10 other minor analytical methods. Other parameters such as organic carbon and soil pH are also being determined. In 2010, the third year of the project, about 600 soil sites were sampled and about 5000 typical rock samples were taken. Over half of China has been covered in the past 3 years. All sampling should be completed in 2012. Some of results will be presented at the 2012 International Geological Congress in Australia and the complete data set and geochemical atlas is planned for publication in 2013.

Geochemical Mapping across the Boundary Regions of China and Mongolia

China is cooperating with Mongolia in geochemical mapping at a scale of 1:1 000 000 covering an area of approximately one million km² across the two countries. The project was launched in 2008 under an agreement issued by the China Geological Survey and the Mineral Resources and Petroleum Authority of Mongolia. The Institute of Geophysical and Geochemical Exploration is helping with training in sample-collection protocols and free chemical analysis. In 2010, an area of 500 000 km² has been covered at a density of one sample per 100 km². Sixty-nine elements have been determined on each sample. Regional geochemical patterns were identified for the first time across the world’s largest REE ore deposit in Inner Mongolia. These REE results will be presented at the International Applied Geochemistry Symposium in Finland in 2011.

CCOP Geochemical Baseline Program

The member countries (China, Japan, Vietnam, Indonesia, Singapore, Cambodia, Thailand, Malaysia, Papua New Guinea, Philippines and Korea) of the Coordinating Committee for Geoscience Programmes in East and Southeast Asia (CCOP) have been keen to establish a Geochemical Baseline Program in their region for some time. In 2008, at the Business Meeting of the IUGS/IAGC Task Group on Global Geochemical Baselines during the 33rd IGC in Oslo, the CCOP coordinators expressed their desire that such a project should be given priority for the future, with financial and technical support from the China Geological Survey (CGS). Prof. Xueqiu Wang wrote a proposal in 2008 and a feasibility study report in 2009 to the CGS. In 2010, the project was approved by the China Geological Survey, and a five-year project will be supported by the Chinese Government from 2011-2015. The project will run over three stages:

Stage 1: Preparation and Training courses (the 1st year): A coordinating meeting and a training course will be held in 2011. The CCOP country members are diverse in landscape from tropical to tundra terrains with mountains, forests, grassland, desert, karst, etc. A sampling manual will be adapted to the diverse geographical and geomorphologic landscapes based on the IGCP259/360 final report. Training courses will be given to the people who will be in charge of sampling, chemical analyses and map production.

Stage 2: Global-scale Geochemical Baseline Mapping (the 2nd to 4th year): A global-scale geochemical baseline project will be conducted in the all CCOP countries using wide-spaced sampling according to the Global Reference Network (GRN) grid based on the IGCP 259/360 final report.

Stage 3: National-scale Geochemical Mapping (the 5th through 10th year): The Member Countries can carry out National-scale geochemical mapping projects in their respective countries. The sampling densities used depend on each country’s size, available budget, time duration, and stated objectives. Proposed sampling densities used are shown in the following table.

	Sampling grid	Map scale	Country area
National scale	1km×1 km	1:100 000	<n×100 000km ²
	2km×2 km	1:200 000/250 00	
	5km×5 km	1:500 000	
	10km×10 km	1:1 000 000	>n×100 000km ²
	20km×20 km	1:5 000 000	
Global scale	80km×80 km		

Publication of Multi-purpose Regional Geochemical Atlases

The China Geological Survey and provincial governments have jointly implemented multi-purpose geochemical survey projects at a scale of 1:250 000 since 2002. The projects provide geochemical data for environmental assessment, land use planning, and agricultural production increase in the agriculturally and industrially developed regions of eastern China. Soils are taken as the general sampling media. Soil samples are collected from two depths: 0-20cm and 150-200 cm. The near-surface samples provide an indication of anthropogenic influence and the deep samples indicate primarily natural (geogenic) influence. The sampling density for the surface samples is 1 sample/km² and for the deep samples is 1 sample/4 km². Four samples are composited into one analytical sample, i.e. one analytical top soil sample per 4 km² and one deep soil sample per 16 km². Samples are ground to <200 mesh for analysis of 52 elements (Ag, Al, As, Au, B, Ba, Be, Bi, Br, C, Ca, Cd, Ce, Cl, Co, Cr, Cu, F, Fe, Ga, Ge, Hg, I, K, La, Li, Mg, Mn, Mo, N, Na, Nb, Ni, P, Pb, Rb, S, Sb, Sc, Se, Si, Sn, Sr, Th, Ti, Tl, U, V, W, Y, Zn and Zr) plus organic carbon and pH. An area of approximately 1.5 million km² has been covered up to 2010. A series of geochemical atlases for each province will be published. In 2010, a multi-purpose regional geochemical atlas of Poyang Lake and its surrounding economic zones, Jiangxi Province, was published by the Geological Publishing House, Beijing (www.gph.com.cn).

India (Pradip K. Govil, National Geophysical Research Institute, Hyderabad)

Dr Pradip K. Govil and his group at the National Geophysical Research Institute (NGRI) carried out the interpretation of top soil data generated by XRF spectrometry for all the sites throughout India. Soil sampling work for the entire country including the Andaman Islands has been completed. Final maps for top soil have been prepared for chromium, nickel, copper, zinc, strontium, rubidium, vanadium, iron, silica, aluminium, titanium, calcium, magnesium, sodium and potassium. These maps are planned to be released in January 2011. Maps for other elements are being interpreted and finalised.

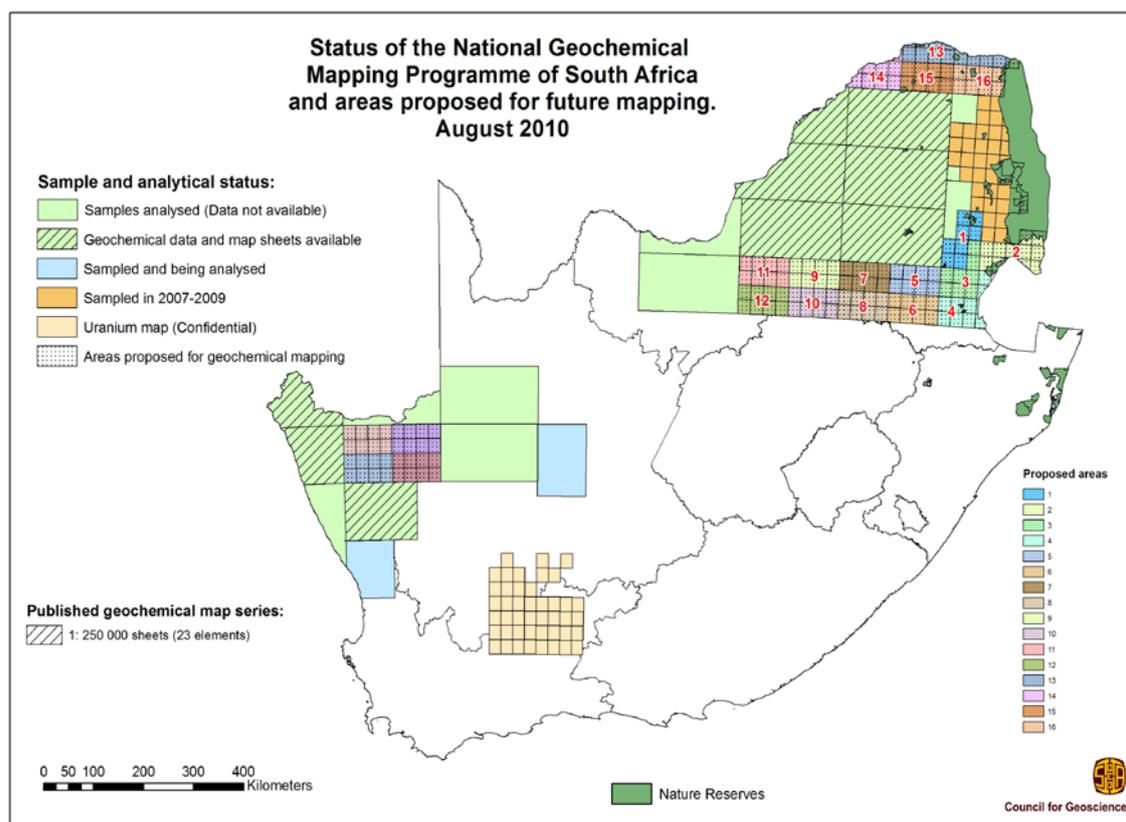
Africa (Theo Davies, University of Venda, Thohoyandou, Limpopo Province, South Africa)

A few African countries, e.g. South Africa, Botswana, Morocco and Nigeria, have made some progress with the African Geochemical Database project (part of the former IGCP 259 Project), although little attention has been paid by some to adoption of the agreed sampling procedures and analytical protocols set forth in the original recommendations. The United States Geological Survey is engaged in geological and geochemical mapping in several areas of Morocco (<http://international.usgs.gov/regional/>). The Federal Government of Nigeria launched a field proceedings manual for the Geochemical Mapping Technical Assistance Project of Nigeria (GMTAP) in 2010. The project, which actually commenced in 2007, consists of 44 cells in the Global Reference Network (GRN). Preliminary results have been obtained from cell NO6EO4 in south-western Nigeria. The programme is intended to generate high quality environmental geochemical baseline data from sampling of stream water, stream sediments and residual soils, that would boost mineral exploration efforts as well as find applications in agriculture, public health issues and land use planning. This programme is supported by the World Bank, and is being undertaken by the Nigerian Geological Survey (NGSA) in collaboration with the British Geological Survey (BGS) and the Geological Survey of Finland (GTK).

South Africa (Marthinus Cloete, Council for Geoscience, Pretoria)

The Council for Geoscience routinely conducts baseline geochemical mapping of the land surface of South Africa and has opted to do so by means of an ongoing, high-density regional geochemical survey using a sampling density of one sample per square kilometre. First order stream sediments and soil samples have been collected for two separate regions, respectively, each about 200,000 km² in extent (see attached status map). The national regional geochemical mapping programme has been ongoing for about 30 years and has seen major improvements over time, especially with regard to sample collection, sample preparation, range of elements analysed and data applications. The key aspects of sample density, total analysis and archiving of samples, however, have not changed.

Due to the global financial crisis, routine geochemical mapping was not undertaken during the 2010–11 financial year. Instead of going to the field, it was decided that the mapping team would undertake a data mining exercise in which the soil geochemistry database of the entire Bushveld Complex (~100,000 km²) would be geochemically evaluated and baseline values produced down to formation/lithological unit level. It is well recognised, however, that the sampling density of the South African National geochemical mapping programme is orders of magnitude higher than that required for global baseline mapping. The Council for Geoscience is nevertheless keen to get involved with global baseline mapping as envisaged by the Task Group, but will in the short to medium term need to adhere to the current high density sampling of select areas (when funds become available again). The current high-density coverage will provide an excellent opportunity to ground-truth the low density method as high-density baseline maps of a couple of world class and other well-known metallogenic provinces occur in the catchments of the previously identified ‘large African rivers’.



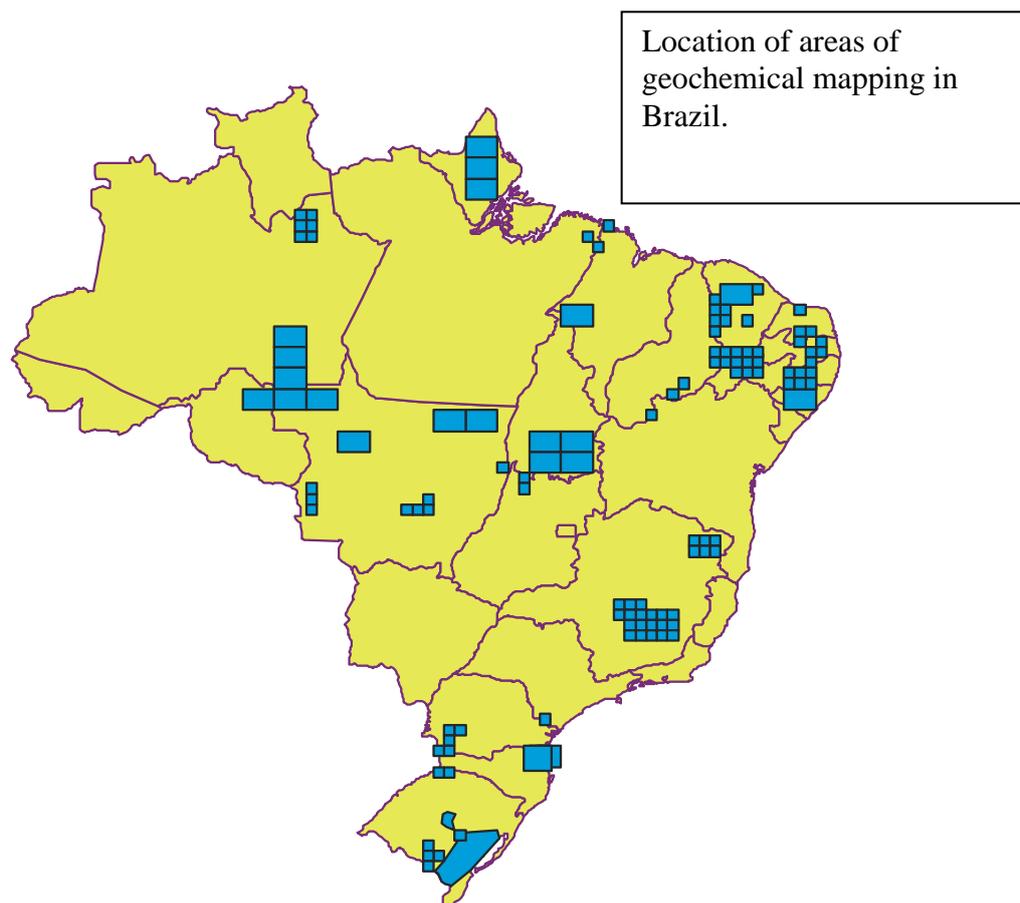
Australia (Patrice de Caritat, Geoscience Australia, Canberra)

Up to 8 November 2010, the National Geochemical Survey of Australia (NGSA) had collected all intended samples, with 1186 catchments sampled nationally (covering ~80% of Australia). Within each catchment, at least one site was sampled near the surface (0-10 cm) as well as at depth (~60-80 cm on average). Sample preparation is fully completed, based on two grain size fractions per sample

(<2 mm and <75 µm). Geochemical analysis is also fully completed, including total, aqua regia and partial digestions, in addition to bulk measurements (pH, electrical conductivity, laser grain size, Vis-NIR spectroscopy). Data compilation, quality assessment and preliminary data interpretation are all under way, with data files, reports and a geochemical atlas due for release by 30 June 2011.

Brazil (Carlos Alberto Lins, Geological Survey of Brazil, Recife)

Geochemical mapping conducted in Brazil by the CPRM, Geological Survey of Brazil, covers an area of 600 000 km² and has included, over the last three years, about 30 000 stream sediment samples, 10 000 pan concentrates, and some lesser surveys of soils and drainage waters. It is part of the so called PAC - Programa de Aceleração do Crescimento (Growth Acceleration Program) of the Brazilian Government. This is the first stage of PAC in the geological area. The report on the pilot study conducted in Brazil for the International Geochemical Mapping Project is now available at http://www.cprm.gov.br/publique/media/rel_mapa_geoquimico1.pdf. The location of the geochemical mapping areas is shown in the following figure:

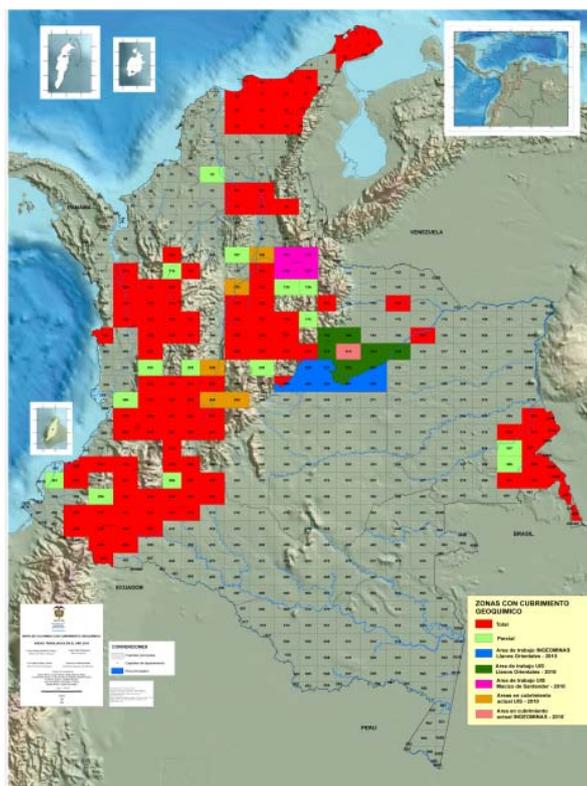


Colombia (Gloria Prieto, Geological Survey of Colombia, Bogotá)

Following accepted methodologies of the International Geochemical Mapping Project (IGCP Projects 259 and 360), the Geological Survey of Colombia (INGEOMINAS) continues to carry out systematic geochemical sampling. During 2010, INGEOMINAS conducted regional geochemical cartography in new areas of the country using both low and medium density sampling. In eastern Colombia, in a plain region of geological homogeneity (“Llanos Orientales”), 26000 km² was covered by collecting 1 stream sediment sample each 25 km². At the same time, a sampling program in central Colombia covered 12000 km² collecting 1 stream sediment sample each 4 to 9 km². Additionally during 2010, new advances in medical and environmental geochemistry applications were accomplished (geochemistry of potential harmful elements including mercury). A zone of mining influence in the northern Colombia (Mompós Depression) was studied using stream sediments, waters and flood plain sediments. Also, stream sediments, waters, soils and fluoride minerals were collected in areas where dental fluorosis in children was reported. Rocks, waters,

soils, salts and stream sediments were collected in areas where spring water is reported to have therapeutic uses.

INGEOMINAS will continue its geochemical program during 2011 covering new zones with ultra low density sampling and also carrying out regional cartography at low and high density sampling.



Systematic geochemical sampling program in Colombia (1:100.000 sheets)

Russia (Arkadiy Golovin, IMGRE, Moscow)

Geochemical mapping of the Russian territory at a scale of 1:1000000 (MPGM-1000) is conducted under the guidance and by the efforts of specialists of the Institute of Mineralogy, Geochemistry and Crystal Chemistry (IMGRE), which is a leading Russian institute in the field of applied geochemistry and is affiliated with the Geological Survey of Russia (Federal Agency of Mineral Resources) of the Ministry of Natural Resources and Ecology of the Russian Federation.

From 1992 to 2010, MPGM-1000 was carried out in Russia for 33 map sheets representing a total area of 2694.6 thousand square kilometers. For the same period, geochemical maps at a scale 1:1000000 were compiled for 71 sheets (8208 thousand square kilometers) with the use of previously conducted geochemical sampling at scales from 1:1000000 – 1:100000. Thus, the total area covered by low-scale geochemical mapping in Russia is 10 900 thousand square kilometers or 63.8% of the country. The total number of samples taken for the various environment compartments is: 179688 samples of country rock, 614628 samples of stream sediments, 372796 samples of soils, 19966 samples of water, and 1308 samples of concentrates.

A significant development in regional geochemical mapping has been the “Geochemistry of Northern Europe” (NEG) Project, which covered the territory of north-western Russia, Finland, Sweden, Norway, Estonia, Latvia and Lithuania - representing a total area of 2175000 km². The work involved compilation of soil, surface water, stream sediments and moss data from previous projects, including “Kola Ecogeochemistry”, “Barents Ecogeochemistry”, “Nordcollot project”, “FOREGS Geochemistry”, “Baltic Soil Survey” and others). Data from these projects were compiled and processed along with data from national Russian projects (MPGM-1000 on Karelia-Kola region, materials of geochemical base (GCB-1000), geocological research and mapping

(GESM-1000) and others).

A further significant result of work conducted by IMGRE is the Geochemical Map of Russia at a scale of 1:2500000, constructed between 2007 and 2010. This map was produced on the basis of generalisation, correlation and reinterpretation of geochemical maps at a scale of 1:1000000 and data from heavy-mineral concentrate sampling of the areas of Russia for which such maps are missing. Major layers of this map are structure-formation base with geochemical characteristics of structure-matter complexes, reference deposits of various formation types with geochemical characteristics and anomalous geochemical fields with areas of localised high-resource sites. The results demonstrate that a new stage of geochemical work should be started. This stage would involve a new specialised geochemical survey of the territory of Russia at a scale of 1:2500000 with a sample density of 1 site per 1000 km² on average and sample analysis with the use of modern analytical methods, which would allow us to assess both the mineral base of the country and its ecological condition.

On February 10–12, 2010 the 3rd All-Russia Research and Practice Conference on Applied Geochemistry, “Regional geochemical survey as a basis of preparing areas for the search for useful mineral deposits” was held in IMGRE. Representatives of more than 50 geological organisations, including academia, from 24 Russian cities, as well as representatives from Norway, Finland, Ukraine, and Turkmenistan participated in the conference. At the conference, 62 oral reports and 15 posters were presented covering a wide range of scientific and methodological examples of regional geochemical mapping. The conference participants agreed that mutually beneficial cooperation is desirable between IMGRE and the EuroGeoSurveys Geochemical Expert Group to share common protocols of field research, construct a joint integrated data base and coordinate protocols for computer processing of data. A noncommittal Memorandum of Understanding between IMGRE and Clemens Reimann, representing the EuroGeoSurveys Geochemical Expert Group, was signed in the hope that this would initiate cooperation. A stated ambition was to construct a new Geochemical Atlas of Europe that included all of Russia.

Europe (Clemens Reimann, NTU, Norway)

The two volumes of the FOREGS-EuroGeoSurveys Geochemical Atlas of Europe (Salminen *et al.*, 2005; De Vos *et al.* 2006) are still proving to be very popular. Both volumes are available for free download from <http://www.gsf.fi/publ/foregsatlas/>. The complete European database of all field and geochemical data collected as part of this project and the related digital photo archive are also freely available at this website.

New analytical data on composite soil samples have been provided by Professor Xie Xuejing (China) during 2009/10, including data for the elements Au, B, Cl, F and N for which previously there was no information. Several papers are in progress, and the new analytical data will be made available from the GTK server in 2012 directly after the publication of the papers.

The EuroGeoSurveys Geochemistry Expert Group, under the chairmanship of Clemens Reimann of the Geological Survey of Norway, has been active in developing new scientific initiatives throughout the European geochemical community. A business meeting of the Expert Group was held in Athens, Greece (IGME) on 6-8 October 2010. The focus of the meeting was on the GEMAS project, which is partly funded by the European Association of Metals (Eurometaux - <http://www.eurometaux.org/>) for the provision of data for compliance with the European Commission's REACH Directive (Registration, Evaluation and Authorisation of Chemicals – http://ec.europa.eu/environment/chemicals/reach/reach_intro.htm/). Also, short sessions were held on (i) the status of the Urban Geochemistry project of major European cities using a common approach; since the Geological Survey of Norway is no longer able to offer *free gratis* analysis, it was decided to analyse the samples, following preparation, at the same commercial laboratory that was used for the analysis of the GEMAS samples; (ii) a report on the status of the European

Groundwater Geochemistry Atlas project, which was completed in 2010 with the publication of (a) the geochemical atlas with the title “*Geochemistry of European Bottled Water*” in September 2010 (<http://www.schweizerbart.de/publications/detail/artno/001201002>), and (b) a Special Issue of the Journal of Geochemical Exploration entitled “*Mineral Waters of Europe*” (http://www.sciencedirect.com/science?_ob=PublicationURL&_toctext=23TOC%235960%232010%23998929996%232754735%23FLA%23&_cdi=5960&_pubType=J&_auth=y&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=f0427a89457bf0b2609eaf6e855d8175); and (iii) a report on the progress of the urban geochemistry book project, due to be published in the spring of 2011 (<http://eu.wiley.com/WileyCDA/WileyTitle/productCd-0470747242.html>).

Danube River catchment basin countries: The EuroGeoSurveys Geochemistry Expert Group has supported the initiative of the Danube River catchment basin countries to use the FOREGS/EuroGeoSurveys data from the European Geochemical Atlas. The International Commission for the Protection of the Danube River programme (ICPDR) is the largest river basin programme of the UN worldwide. The main activity of ICPDR is to assist member states in the implementation of the Water Framework Directive (WFD) and other EU legislation. Although the programme's Website was launched (<http://hantken.mafi.hu/icpdr/>) in autumn 2009, the geochemical data have not yet been uploaded. The main purpose of this site is to make use of European Geological Surveys' geochemical maps, especially those of the European Geochemical Atlas. The website will support environmental assessment, and it is intended for use by decision makers, planners, researchers and the public in general. Another aim of the website is to increase interested parties' awareness for geochemical maps and data. The site has been developed and it is maintained by the Geological Institute of Hungary (MAFI).

Public Relations Accomplishments:

The main priority of the Public Relations and Finance committee is to promote the project for the purpose of attracting sponsors that may be interested to finance the Global Geochemical Baselines project in different parts of the World.

One of the main priorities is the reorganisation and update of the Task Group's website material, including preparation of templates and uploading material to the server of the new website provider (<http://www.globalgeochemicalbaselines.eu/>). Unfortunately, progress was hindered somewhat due to the resignation of the IGME webmaster during the crucial period of updating, although this problem has now been resolved. The website hosting the Geochemical Atlas of Europe (<http://www.gtk.fi/publ/foregsatlas/>) is still very important for the promotion of the Global Geochemical Baselines project. Hotlinks have been established to the Atlas site from the sites of EuroGeoSurveys, many European Geological Surveys, and also professional organisations, e.g. the Association of Applied Geochemists, International Medical Geology Association, and the Society of Environmental Geochemistry and Health.

During 2010 the EuroGeoSurveys Geochemistry Expert Group initiated two new website projects for the GEMAS project. The first includes uploading information about the GEMAS project with links to the Global Geochemical Baselines website, and other similar project websites; this work has been undertaken by Paolo Valera from Italy. The second concerns the compilation of the GEMAS Google Earth photograph archive undertaken by Edith Haslinger from Austria. The material of both website projects will be uploaded during 2011 to the EuroGeoSurveys server, and will be accessible through the EGS website.

In 2010, the EuroGeoSurveys Geochemistry Expert Group decided to produce a GEMAS calendar, for the promotion of the project. The first calendar for 2011 was produced by Peter Hayoz and his

team from Switzerland, and is available through the EuroGeoSurveys website. The calendar has 12 photographs from different countries, which display European agricultural and grazing land landscapes. The plan is to produce further calendars for 2012 and 2013, the final year of the project.

The CD of the FOREGS/EuroGeoSurveys Geochemical Atlas of Europe, which includes the two volumes of the Atlas, the analytical data, the field manual, the IGCP 259 Report "A *global geochemical database for environmental and resources management*" (Darnley *et al.*, 1995), and other useful information, is still being distributed at international conferences, congresses and meetings. More than 2100 copies have been distributed to date (1300 copies by EuroGeoSurveys office and over 800 copies by the Public Relations and Finance Committee).

Another significant promotional activity has been the distribution of the memorial issue DVD to honour Arthur G. Darnley (1930-2006). The DVD includes all the material from the Geochemical Atlas of Europe CD, all publications from 1988 to 2007 of the two IGCP programmes 259 'International Geochemical Mapping' and 360 'Global Geochemical Baselines', and copies of all papers from the *Arthur Darnley Symposium - Geochemical Mapping from the Global to the Local Scale* - held at the 32nd IGC, Oslo, Norway. About 1500 copies of the DVD were made, and up to the end 2010, more than 900 copies have been distributed at conferences, congresses and meetings.

8. CHIEF PROBLEMS ENCOUNTERED IN 2010

The main problem still facing the project is the lack of funding that is required to achieve the aims and objectives of the project at the global scale. The geochemical baseline project in Europe has now been completed with funding by the participating European Geological Surveys. Ongoing work in North America, Australia, India and China, for example, are similarly funded by national geological surveys or other national scientific institutions. Some proposed activities, such as the international geochemical mapping project by the member countries of the Coordinating Committee for Geoscience Programmes in East and Southeast Asia (CCOP), have been delayed because of a lack of available funding by the individual countries. Funds are required for training, transportation, additional analytical services and quality control. In addition, the Task Group is almost entirely dependent on funds from participating agencies for marketing activities, such as website development and workshops.

9. CHIEF PRODUCTS IN 2010

Articles, Papers and Atlases

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Others:

The Arthur G. Darnley memorial DVD was distributed to participants at 12th International Congress of the Geological Society of Greece, University of Patras, Greece, 19-21 May 2010.

10. SUMMARY OF EXPENDITURES IN 2010

The Task Group has received 4000 USD from IUGS in 2010. This amount is very small for the planned promotional activities, and even for assistance to developing country participants. It was decided, therefore, to keep it for future small promotional activities, and in the hope that IUGS will approve the requested amount.

The cost of the EuroGeoSurveys programme over the past year is estimated to be in excess of US \$45,000. The overall cost of the FOREGS/EGS activities over the past decade or so is difficult to estimate as the work has been funded independently from each of the participating countries, but is thought to be in excess of US \$10M. These funds were provided from the Geological Surveys of the

participating countries within Europe. The cost of the recently completed soil sampling in the conterminous United States as part of the North American Soil Geochemical Landscapes Project was approximately US \$1M with a similar amount to be spent on chemical analyses. There has also been considerable expenditure within a range of countries worldwide, as indicated in Section 7.

11. WORK PLAN FOR NEXT YEAR

The next business meeting of the Task Group will take place in 2011. It will either be timed to coincide with the annual business meeting of the EuroGeoSurveys Geochemistry Expert Group, scheduled for autumn of 2011 in Helsinki (Finland) or an international geochemical baselines mapping workshop. The next meeting of the Task Group will consider details of issues raised at the 2009 Global Geochemical Baselines Symposium in China arising from the agreed change in direction, including establishment of the Continent Representatives, database management, stipulations for the Task Group being able to award the 'seal of approval', etc.

The immediate priority for the Task Group for 2011 will be to finalise plans for the 2nd Arthur Darnley Symposium "Global Geochemical Mapping: Understanding Chemical Earth" to be held at the 34th International Geological Congress in Brisbane, Australia in 2012. In addition, the Task Group will pursue opportunities within Africa and the CCOP countries as funding permits.

The revision of the FOREGS Geochemical Mapping Field Manual (Salminen *et al.*, 1998) is progressing, and will be completed in 2011. It will include new details on sampling in (a) Karstic terrains, prepared by A Demetriades, S Pirc, M Bidovec and F Sustersic, (b) Desert terrains by Xueqiu Wang (first draft completed in 2010), (c) Arctic terrains by Rolf Tore Ottesen, and (d) Tropical terrains by Chris Johnson, Reijo Salminen and others.

The Task Group's Analytical committee will consider a proposal for the exchange of laboratory standard reference materials and a small number of samples from some large national and international projects to ensure that geochemical data from these projects are consistent and comparable.

12. COMMUNICATION AND DISSEMINATION PLANS

The IUGS/IAGC Task Group and all the national- and international-scale geochemical mapping projects being carried out in many countries plan to continue active participation in national and international symposia, conferences and workshops for the promotion of the global-scale project. Communication will also be achieved through continued output of peer-reviewed scientific papers, oral presentations, posters and promotional materials.

In addition, the new Task Group's website will be the key forum for communication and dissemination of information.

13. SUMMARY BUDGET FOR NEXT YEAR AND POTENTIAL FUNDING SOURCES OUTSIDE IUGS

The success of the IUGS/IAGC Task Group on Global Geochemical Baselines has been, to date, almost entirely dependent on funding from sources outside IUGS and IAGC. This funding has come primarily from national geological surveys and other scientific institutions in participating countries. We conservatively estimate that over the past ten years, US \$30M has been spent on broad-scale geochemical surveys conducted according to recommendations from the IUGS/IAGC Task Group and its predecessors.

Funding from IUGS has consisted of US\$ 1500 per year for 2003 and 2004-2008, and US\$ 4000 for 2009 and 2010. This funding has been used for promotional purposes such as the DVDs distributed at the 33rd IGC, hosting of the Task Group's website, and organisation of the 2009 Data Management Committee's Workshop in Athens, Greece. IAGC has provided sporadic funding of US\$2000 on three occasions (2000, 2003, and 2004) over the past ten years to assist with travel expenses of Task Group members from developing countries to attend our business meetings. While this funding is greatly appreciated, it is barely enough for the Task Group to function as a viable entity within IUGS and IAGC. The IUGS *ad-hoc* review committee, led by Prof. Ryo Matsumoto of the University of Tokyo, recommended in their 2008 report that funding from IUGS to the Task Group be increased to US\$5000 per year for routine operations of the Task Group, such as maintenance of the Website and preparation of educational materials. This review committee also recommended that IUGS provide occasionally an influx of about US\$25,000 to the Task Group for the purpose of holding workshops in African and Asian countries to promote the establishment of international-scale geochemical mapping projects, similar to that conducted from 1995 and 2005 by the Forum of European Geological Surveys.

The Task Group appreciates the recognition by the review committee for the need of this additional funding and we have plans to use this increased amount to hold training workshops in south-east Asia, India, or Africa in 2011 or 2012. With this report, we formally ask the IUGS Executive Committee to consider the committee's recommendation for this increased funding and officially request US\$30,000 in 2011. A similar request was turned down in previous years. We ask for reconsideration in 2011. Our Public Relations and Finance Committee will continue to seek funding from other sources, but this has proven to be most difficult.

14. CHIEF ACCOMPLISHMENTS 1998-2010

- 1998 Publication of Salminen R, *et al.* (1998) *FOREGS Geochemical Mapping Field Manual*. Geological Survey of Finland Guide Number 47.
- 1998 Release of the UGS/IAGC Global Geochemical Baselines website, hosted by the British Geological Survey at www.bgs.ac.uk/IUGS.
- 1998 Annual Meeting held in Naples, Italy (1-3 October 1998) in conjunction with the FOREGS Geochemistry Working Group Annual Meeting.
- 1998 European GRN sampling programme commenced.
- 1999 Completion of pilot study for geochemical mapping carried out in Colombia.
- 2000 The Committee for Coastal and Offshore Geoscience Programmes (CCOP) agreed to act as a Regional Co-ordinator for their member countries (China, Japan, Vietnam, Indonesia, Cambodia, Thailand, Malasia, Papua New Guinea, Philippines, and Korea) in SE Asia.
- 2000 Symposium on geochemical baseline activities organised as part of the 31st International Geological Congress in Rio de Janeiro.
- 2000 First draft of promotional papers to possible sponsors prepared and sponsorship campaign commenced.
- 2000 Annual Business Meeting of the IUGS/IAGC and FOREGS Working Groups held in Athens, Greece (14-17 November 2000).
- 2001 Sampling and the majority of analysis completed in FOREGS countries. Preliminary maps of geochemical data for Europe prepared and preliminary interpretation begun.
- 2001 Meeting held with CCOP member countries during the Seminar on Regional Geochemical Exploration, Beijing, China to discuss their participation in the global project.
- 2002 Annual Business Meeting of the IUGS/IAGC and FOREGS Working Groups held in Svincice, Czech Republic (22-25 April 2002).
- 2002 Sampling and analysis completed in Southern India. Pilot studies partially completed within Colombia and Brazil.

- 2003 Annual Business Meeting of the FOREGS Working Group held in Dublin, Ireland (18-21 March 2003).
- 2003 FOREGS poster, as the European contribution to IUGS/IAGC Working Group on Global Geochemical Baselines, and a two-page flyer prepared for promotional purposes.
- 2003 Annual Business Meeting of the IUGS/IAGC and FOREGS Working Groups held in Edinburgh, Scotland (9 September 2003).
- 2003 Launch of North American Soil Geochemical Landscapes Project.
- 2003 Launch of geochemical baseline mapping programme in India.
- 2004 IUGS/IAGC/FOREGS Working Groups' workshop (DW016) at the 32nd International Geological Conference, Florence, Italy held on 22 August 2004.
- 2005 Production of Part 1 of the FOREGS Geochemical Atlas of Europe, including background and introductory texts and geochemical maps for a wide range of sample media and chemical elements.
- 2006 Production of Part 2 of the EuroGeoSurveys/FOREGS Geochemical Atlas of Europe, including interpretation, papers on specialised data treatment, and supplementary tables, and figures and maps.
- 2007 Launch presentation of the Geochemical Atlas of Europe to the European Commission in Brussels on 21 September 2006.
- 2006 Completion of pilot studies for the North American Soil Geochemical Landscapes Project.
- 2006 Launch of the Geochemical Mapping Project across China and Mongolia.
- 2007 Launch of the Geochemical Atlas of Europe in Athena, Hellas, on the 23rd April 2007
- 2007 Initiation of soil sampling for the soil geochemical survey of North America, under the north American Soil Geochemical Landscapes Project.
- 2007 Completion of provisional soil geochemical mapping in India.
- 2007 National Geochemical Survey of Australia approved for funding by the Australian Government's "Onshore Energy Security Initiative".
- 2007 Publication of Geochemical Atlas of 76 Elements in south-western China.
- 2008 Compilation of the Arthur G. Darnley memorial DVD with published material of the "Global Geochemical Baselines" project, and distribution of more than 500 copies.
- 2008 Publication of a special issue of the journal *Geochemistry: Exploration, Environment, Analysis* [Vol. 8, 3/4] with the title "*Thematic set in honour of Arthur G. Darnley (1930-2006)*".
- 2008 Organisation of the Arthur Darnley Symposium entitled "*Geochemical Mapping from the Global to the Local Scale*" at the 32nd IGC, Oslo, 9 August 2008.
- 2008 Organisation of session entitled "*Soil Geochemistry: Databases and Applications at Regional to Continental Scales*" for the joint meeting of the Geological Society of America, American Society of Agronomy, Crop Science Society of America, Soil Science Society of America, and Gulf Coast Association of Geological Societies, 5-9 October 2008, Houston, Texas (USA).
- 2008 Launch of the China Geochemical Probe Project (China All-Elements Scope Project).
- 2009 Organisation of Data Management Committee's Workshop in Athena (Hellas), 4-7 May 2009, for the development of the Task Group's "*Global Geochemical Baselines database*".
- 2009 Publication of the Geochemical Atlas of Italy using the FOREGS/EGS data.
- 2009 Launch of Task Group's new website at <http://www.globalgeochemicalbaselines.eu/>.
- 2009 Launch of the International Commission for the Danube River's (ICPDR) website at <http://hantken.mafi.hu/icpdr/>. 2009 Organisation of the "*Global Geochemical Mapping symposium*" in Langfang (China), 10-12 October 2009.
- 2010 Publication of the groundwater geochemical atlas of Europe using bottled water as the sampling medium "Geochemistry of European Bottled Water" (September 2010)
- 2010 Publication of national interpretations on the geochemistry of groundwater using bottled water as the sampling medium in a Special Issue of the Journal of Geochemical Exploration "Mineral Waters of Europe" (December 2010, vol. 107, No. 3).
- 2010 Completion of soil sampling at approximately 4800 sites in the conterminous United States as part of the North American Soil Geochemical Landscapes Project

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NAME: Mr Shaun Reeder
POSITION: Scientific Secretary
DATE: 14 January 2010
ADDRESS: British Geological Survey
Keyworth, Nottingham, United Kingdom, NG12 5GG +44
TELEPHONE: (0)115 936 3523 +44
FACSIMILE: (0)115 936 3261
E-MAIL: s.reeder@bgs.ac.uk