2013 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 (i) to prepare a global geochemical database, and its representation in map form, and (ii) 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 harmonised 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	US Geological Survey
	Dr Xueqiu Wang	IGGE, China
Scientific Secretary	Mr Shaun Reeder	United Kingdom
Treasurer	Mr Alecos Demetriades	Hellas

Analytical Committee

Chair	Dr Gwendy Hall	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	Mr Alecos Demetriades	Hellas

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	Finland

Supervises sampling strategy, co-ordinates the sampling progress of the participating countries, manages the database of sample information and analytical results.

Public Relations and Finance Committee

Chair	Mr Alecos Demetriades	Hellas

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.

Regional Representatives

South America:
Gloria Prieto; INGEOMINAS, Bogotá, Colombia
Carlos Alberto Lins; CPRM - Geological Survey of Brazil; Recife - PE, Brazil
João H. Larizzatti; CPRM – Geological Survey of Brazil; Rio de Janeiro, Brazil

Africa
Theo Davies; Mangosuthu University of Technology, Umlazi, South Africa
Marthinus Cloete and J.H Elsenbroek; Council for Geoscience; Pretoria, South Africa
Keith Sheppard, World Agroforestry Centre (ICRAF), Nairobi, Kenya
Alhaji Lamin Turay, Geological Survey Department, Ministry of Mineral Resources, Sierra Leone

Indian subcontinent:
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

Japan:
Atsuyuki Ohta, Geological Survey of Japan, AIST, Tsukuba

Europe:
Clemens Reimann, Geological Survey of Norway, Trondheim, Norway

North America:
David B. Smith, United States Geological Survey, Denver, USA
Francisco Moreira, Servicio Geológico Mexicano, San Luis Potosí, SLP, Mexico
Andy Rencz, Geological Survey of Canada, Ottawa

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, many National Geological Surveys, and related institutes, have provided significant funds towards national- to continental-scale geochemical mapping projects in support of the Task Group's activities.

Within Europe, 26 National Geological Surveys, and associated institutes and universities, have provided staff time and support to the project to complete the preparation and updating of the European GRN as part of the FOREGS/EuroGeoSurveys programme as an input to the IUGS/IAGC Global Geochemical Baselines project [http://weppi.gtk.fi/publ/foregsatlas/]. A very conservative estimate of the cost for the production of the *Geochemical Atlas of Europe* is of the order of 5 million Euro (~7 million USD). A conservative estimate of the Geochemical Mapping of Agricultural and Grazing land soil in Europe (a follow-up of the Geochemical Atlas of Europe) reached the sum of 930,000 Euro (~1 million USD) for just the field sampling; sample preparation and analytical costs exceed 2 million Euro (>2.5 million USD). The Cyprus Geological Survey Department recently carried out a fairly detailed soil geochemical project according to the specifications of the Global project. The cost of this project was in the order of 800,000 Euro (~1 million USD).

From 2007–2013, the USGS has provided funding of approximately 6 million USD for sampling, chemical/mineralogical analyses, and staff salaries for the soil geochemical survey of the conterminous United States.

From 2008–2013, the China Government has provided funding of approximately 5 million USD for sampling, chemical analyses, and staff salaries for the China Geochemical Baselines Project.

The cost of the National Geochemical Survey of Australia that was completed in 2011 reached A$ 1,900,000 (~2 million USD). This amount covered only the fieldwork, equipment, materials and external lab analyses, but does not include in-house XRF and ICP-MS analyses and salaries.

The geochemical mapping of two GTN cells in Nigeria from 2009 to 2011 cost about GBP 2,000,000 (~3 million USD).

In 2011, the Ministry of Commerce of the People's Republic of China sponsored a training course on Geochemical Mapping and Environmental Geochemical Survey for African Countries that took place in Beijing in 2011 at a cost approximately 600,000 Chinese Yuan (~95,000 USD). The course was organised by China Geological Survey.

In 2012, the Ministry of Commerce of the People's Republic of China sponsored the CGS-CCOP-IUGS/IAGC Seminar on CCOP Geochemical Mapping that took place from the 28 to 29 March 2012 in Nanjing, China at a cost of 400,000 Chinese Yuan (approx. 64,000 USD). The seminar was organised by the Coordinating Committee for Geoscience Programmes in East and Southeast Asia (CCOP) and China Geological Survey in collaboration with the IUGG/IAGC Task Group on Global Geochemical Baselines.

In 2013, the Ministry of Finance of the People's Republic of China sponsored through China Geological Survey the CGS-CCOP-ASEAN-IUGS/IAGC Workshop on "*CCOP-ASEAN Geochemical Mapping*" that took place from the 3 to 8 September 2013 in Nanning (Guangxi Province), P.R. China, at a cost of 300,000 Chinese Yuan (approx. 50,000 USD). The Workshop was organised by the Coordinating Committee for Geoscience Programmes in East and Southeast Asia (CCOP), the Association of Southeast Asian Nations (ASEAN), the Institute of Geophysical and Geochemical Exploration (CAGS), Department of Land and Resources (Guangxi) and Guangxi Geological Survey in collaboration with China Geological Survey and the IUGG/IAGC Task Group on Global Geochemical Baselines. The latter also sponsored the travel of the Sampling Committee Chair from Europe to China at a cost of 1303.42 Euro (1762.87 USD).

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 Expert 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, 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. In 2013, EuroGeoSurveys became member of FAO’s Global Soil Partnership, since the Geological Surveys of Europe are actively involved in soil geochemical mapping. A memorandum of understanding has been signed by EuroGeoSurveys and the European Commission Joint Research Centre at Ispra (northern Italy), and representatives of the two institutions will meet at the end of January 2014 discuss and finalise the cooperation. 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 Geologico Mexicano (SGM). The Task Group also interfaces with the National Geochemical Survey of Australia and the China Geochemical Baselines Project.

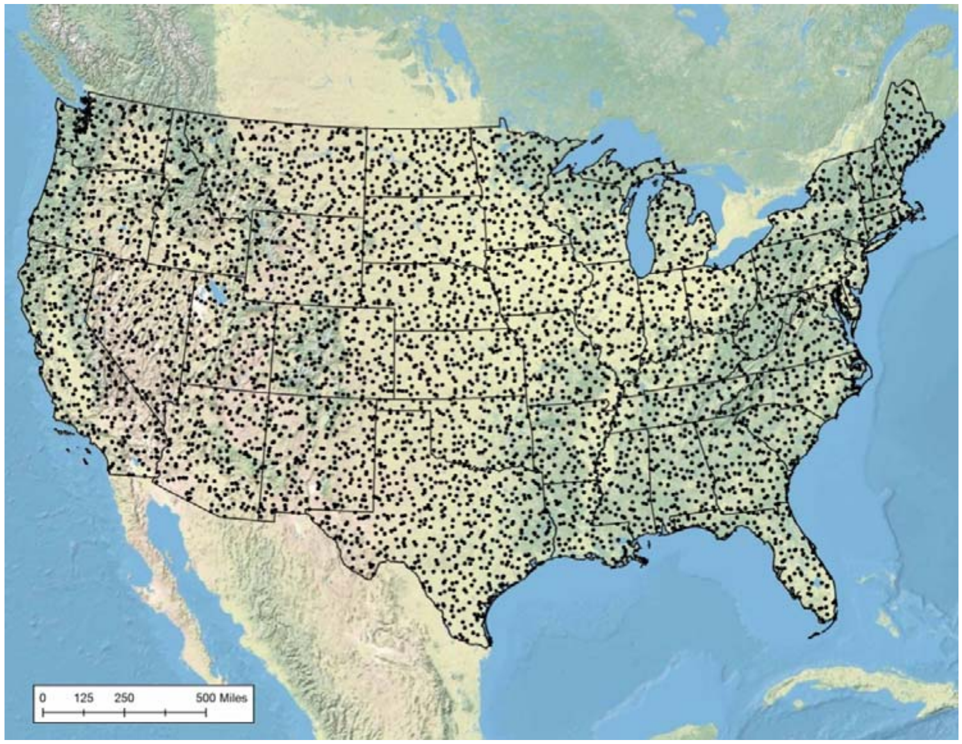
7. CHIEF ACCOMPLISHMENTS IN 2013

Scientific Accomplishments

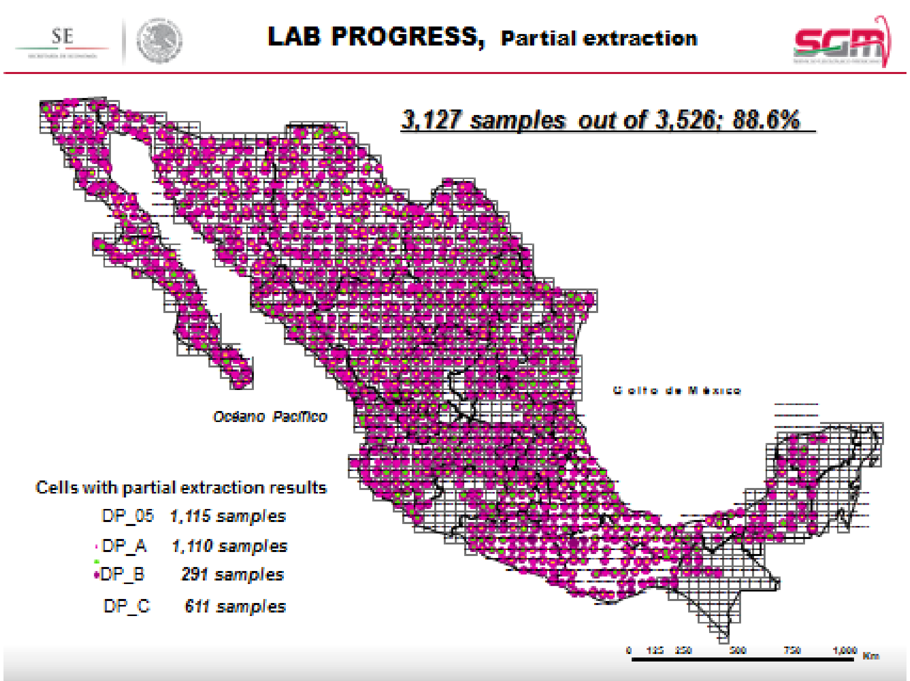
There has been continued and significant progress in a number of areas during 2013, including:

North America ***(David B Smith, USGS; Francisco Moreira, SGM)***

The collaboration between the U.S. Geological Survey (USGS) and the Servicio Geológico Mexicano (SGM) for geochemical and mineralogical mapping of soils in the US and Mexico continues. In 2013, the USGS published soil geochemical and mineralogical data from 4,857 sites (1 site per 1,600 km^2) throughout the conterminous U.S. as USGS Data Series 801 (http://pubs.usgs.gov/ds/801/). In total, the publication contains geochemical data on more than 14,400 soil samples and mineralogical data on approximately 9,600 soil samples. In Mexico, sampling was completed in 2012. This sampling represents 1,327 40 km x 40 km subcells of the Global Geochemical Reference Network and 3,127 samples. Chemical and mineralogical analyses are currently underway and should be completed by the end of 2014. Chemical analyses include both a partial extraction method (water extraction) and a total-extraction, multiple acid, method.



Map showing the location of 4,857 soil sampling sites, representing 14,439 samples, in the conterminous United States



Map showing the progress of partial extraction analysis for 3,127 soil samples from Mexico

***<u>Colombia</u>* (Gloria Prieto, INGEOMINAS, Bogotá)**

The Geological Survey of Colombia continues developing systematic geochemical sampling along the country in order to complete the entire territory.

During 2013, a geochemical sampling program was carries out in areas declared as strategic areas for the national government comprising the Andean region and the Eastern part of Colombia (Figure 1).

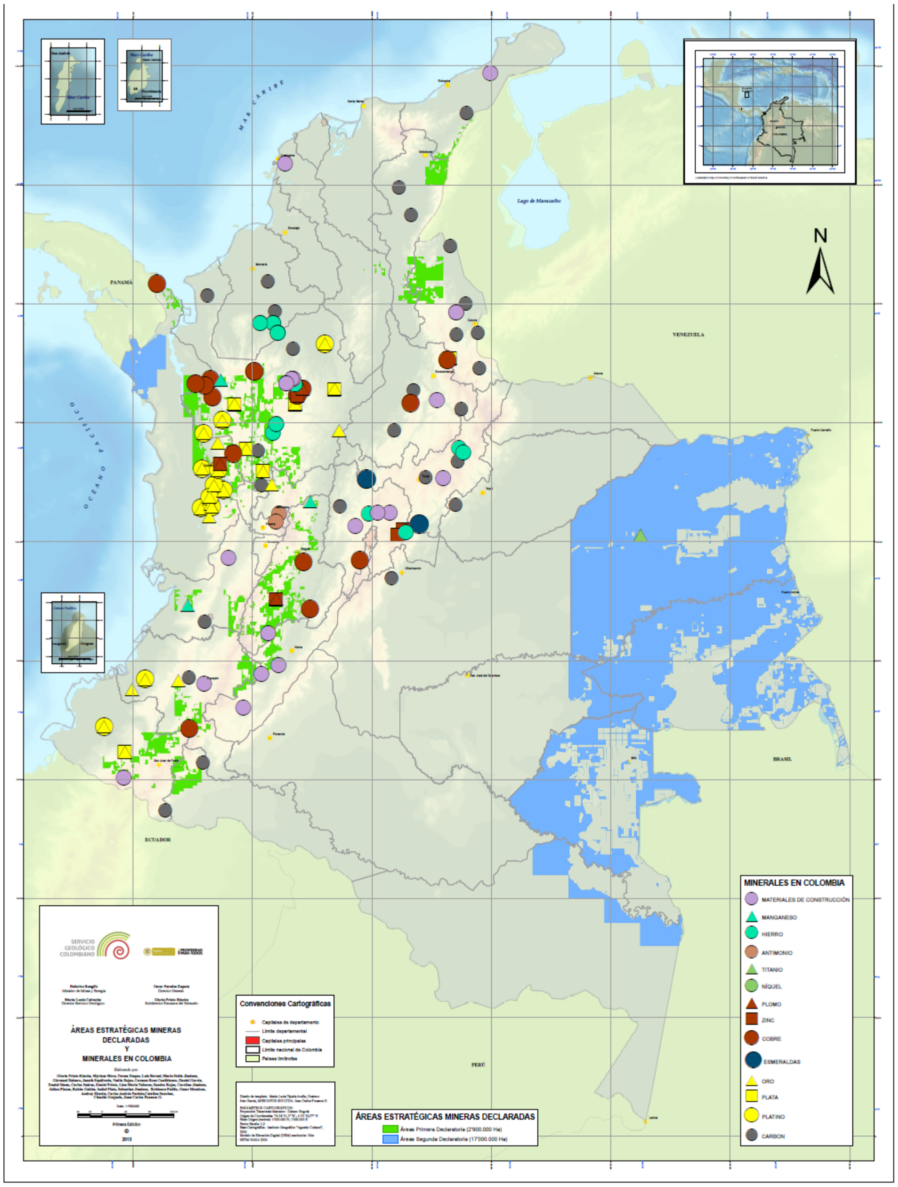


Figure 1. Strategic Areas in the Andean Region

During 2013, the Antioquia Region, located in the Western and Central Cordillera belonging to the Andean region (Figure 2), was covered. In that region, a geological reconnaissance and geochemical sampling of 3100 stream sediments, and rocks in mineralized areas, was carried out.

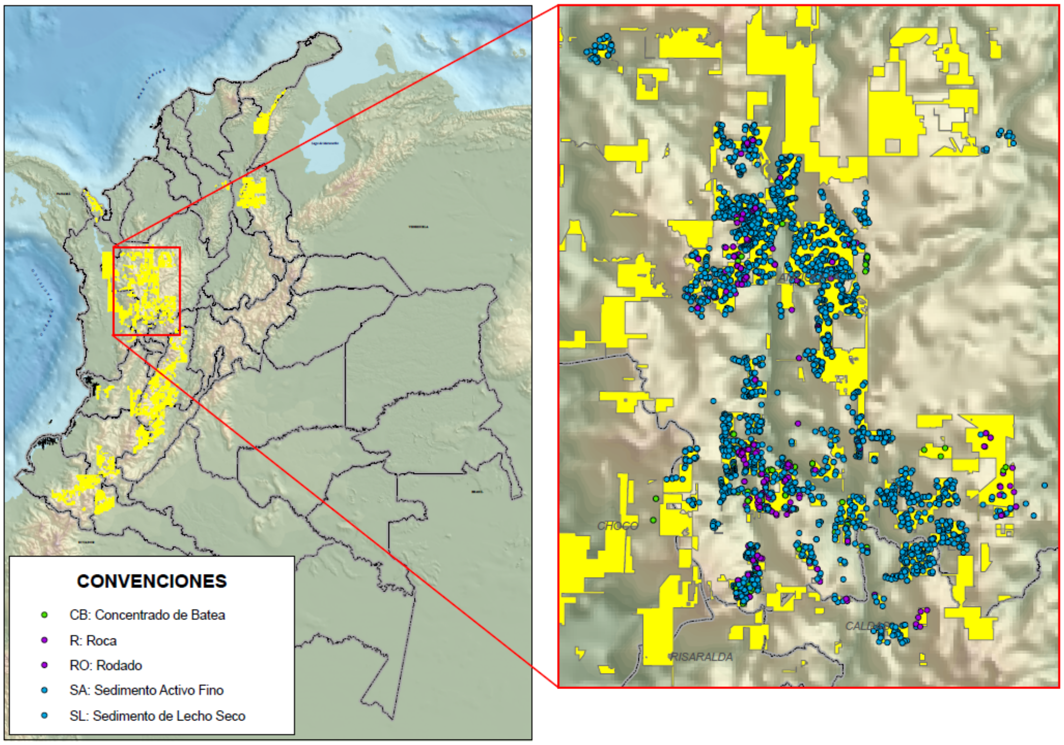


Figure 2. Sampled Areas in the Antioquia Region

In other areas located in the north-east of Colombia, a low density sampling program was developed.

Additionally, the Geological Survey established a cooperation agreement with the Geological Survey of Spain in order to review the geochemical data base and to look for new data applications.

The Geological Survey of Colombia will continue to carry out its regional geochemical program at different density sampling during 2014 to cover new zones located in the Andean and Eastern Regions to provide geochemical information to the Colombian society.

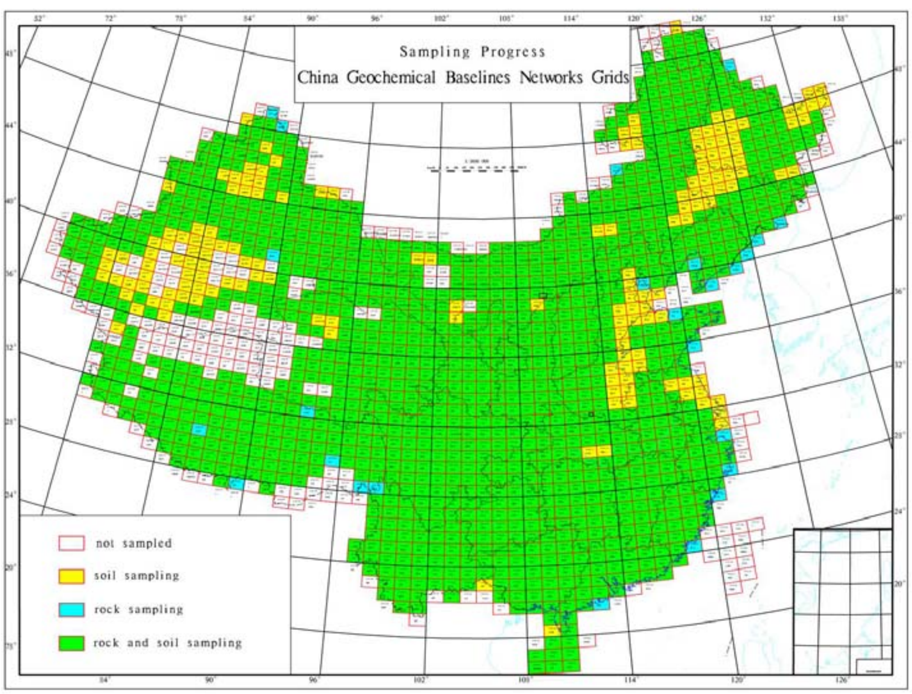
<u>China and other Asian countries</u>* *(Xueqiu Wang, IGGE, China)

China Geochemical Baselines: Preliminary Results

The China Geochemical Baselines Project (CGB) is a contribution to the IUGS/IAGC Task Group on Global Geochemical Baselines. Its purpose is to document China's nationwide geochemical baselines, spatial distribution and evolution of all elements. Each Global Reference Network (GRN) cell is divided into 4 CGB cells. Approximately 1,500 CGB cells cover the whole of China (9.6 million km^2). Soil samples for pedosphere and rock samples for lithosphere geochemical baselines will be collected in each cell. At two sampling sites homogeneous samples of soils/overbank/floodplain sediments from each CGB cell will be collected. At each site, two samples are taken: 0-25 cm depth and >100 cm depth. Typical rock samples, representing different geological units, are concurrently collected in each CGB cell to interpret the geogenic sources of secondary geochemical patterns, and to explore the evolution of elements with geological time from Archaeozoic to Quaternary. A 1000 g sample is ground to <200 mesh in an agate or pure-aluminium-porcelain mill. A 500 g sample is sent to the lab for analysis. The remaining sample is bottled and archived. Seventy-six elements are determined by ICP-MS/AES following 4-acid digestion and by XRF following fusion as the backbone methods combined with another 10 methods. Analytical quality is under strict control by using standard reference samples.

Internet-based software named Digital Chemical Earth, similar to Google Earth, is being developed, which can manage the geochemical database and allow people to access vast amounts of geochemical data and maps through the Internet.

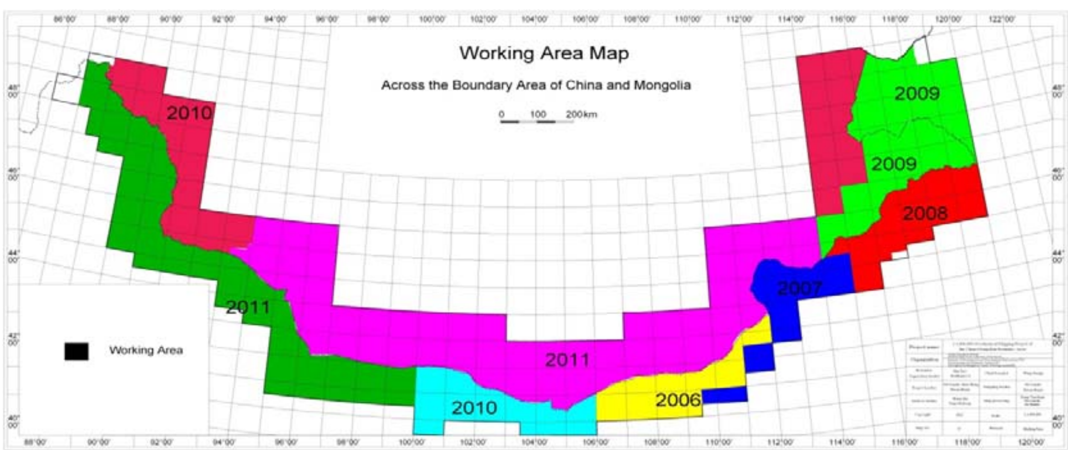
A 5-year term, from 2008 to 2012, is planned for covering the whole of China's mainland, and a 2-year extension term from 2013-2014 is for data interpretation and publications. A one-year pilot study was conducted in 2008 to test and refine the recommended protocols and to optimise field logistics for the geochemical sampling. After completion of the pilot studies, approximately 3,287 soil sites (7000 samples) and 12,373 rock samples have been collected in eastern China from 2009 to 2012. Analysis is expected to be completed in 2013 with the data and atlas published in 2014. Preliminary results show that (i) lithosphere geochemical baselines provide geochemical responses for geological boundary or geological events (e.g. Ir background values in Cretaceous and Tertiary rocks are 0.02 ppb, Ir anomalies in Cretaceous and Tertiary (K-T) boundary range from 0.2-0.8 ppb; (ii) many of the toxic elements such as Hg, As, Cd, Pb and halogen elements such as F, Cl, Br and I tend to concentrate in top soils and are influenced by human activities; (iii) major elements such as Ca and Al show the influence of climate and geography; (iv) metallic elements such as Au, Ag, W, Sn, Cu, and U are related to metallogenic provinces and geology. These results were presented at the 34th IGC in Australia in August, 2012, and the 26th IAGS in New Zealand in November, 2013.



Sampling Coverage of China Geochemical Baselines (colour areas are finished)

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 km^2 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 is providing free chemical analysis. The sampling methods were developed specifically for the project landscapes of desert, Gobi, grassland and mountains. A total of 10532 samples have been collected across the boundary area of approximately 1 050 000 km^2 at a sample density of 1 per 100 km^2. The analytical methods were principally ICP-MS, ICP-AES and XRF combined with a further 10 methods. High-quality data were reported under strict quality control using standard reference materials. Geochemical atlas of 69 elements and organic carbon were produced. The results showed that (i) regional geochemical patterns were identified for the first time across the world's largest REE ore deposit in Inner Mongolia; (ii) regional geochemical patterns of Ag-Pb-Zn have good correlation with the polymetallic province along the east part of the boundary region; (iii) regional geochemical patterns of Cu-Au-Mo have good correlation with the porphyry metallogenic province along the middle part of the boundary region. The final report, analytical data and atlas were presented to Mongolia in August 2012. Four scientists were awarded the Mongolian Medal of Honour, which is the highest-ranking honour for geologists who have made a great contribution for Mongolian Geology and Mineral Resources. The results were presented at the China Mining Conference in China in November, 2013. The geochemical atlas will be published in 2014.



Coverage area of geochemical mapping across the boundary region of China and Mongolia

CCOP Geochemical Baseline Mapping Programme

As detailed in the 2012 Annual Report, the China Geological Survey has approved a proposal to provide financial and technical support for a Geochemical Baseline Programme within 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). The CCOP/ASEAN Working Group on Geochemical Mapping was approved at the CCOP meeting in November 2013 after a proposal was discussed in the workshop in Nanning, China in September 2013.

Geochemical mapping training course

A workshop on "*CCOP-ASEAN Geochemical Mapping*" took place from 3 to 8 September 2013 in Nanning (Guangxi Province), P.R. China.

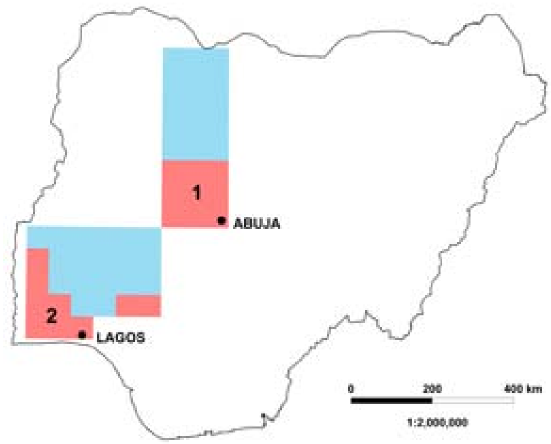
Participants at the CCOP-ASEAN Geochemical Mapping Workshop, Nanning (Guangxi Province), P.R. China, 3 to 8 September 2013

***Africa* (T.C. Davies and D. Nadasan, Faculty of Natural Sciences, Mangosuthu University of Technology, Umlazi, South Africa)**

Regional geochemical investigations gathered some pace in the last few years in Nigeria and Sierra Leone, through the 'Mining Technical Assistance Project' (MTAP) initiative funded by the World Bank.

Nigeria

The Nigerian geochemical mapping programme commenced in 2008 (see figure below). In 2009, under the MTAP for Nigeria, a group of geoscientists from the Nigerian Geological Survey Agency (NGSA), the Geological Survey of Finland (GTK), Nigerian Universities and the British Geological Survey, carried out stream-sediment sampling in two pilot areas ('cells') in the west-central part of the country, establishing the basis for the ongoing geochemical mapping programme. This study has provided important new background/baseline geochemical values for common geological domains in Nigeria (which extend across other parts of West Africa) for assessment of contamination from urban/industrial land use changes and mining activities.



Map showing the location of the Nigerian geochemical mapping areas supervised by BGS (pink: 1 - Minna cell and 2 - SW Cell). Areas in blue have been sampled by the Nigerian Geological Survey Agency. Source: http://www.bgs.ac.uk/gbase/international/nigeriaMappingProject.html (accessed 11.11.13)

Sierra Leone

In April, 2010, the Government of Sierra Leone invited consultants to undertake geochemical sampling of the country for mineral exploration purposes under the MTAP. The main objective of the assignment was to provide geoscientific/geochemical information (maps at a scale of 1:10,000) for 9 areas (sheets). To this end, the project is focused on sampling, analysing and mapping mineral occurrences in the selected areas to produce metallogenic maps and an assessment of the resource potential of the surveyed areas.

Capacity building initiatives

The obvious need for a critica mass of well-trained applied geochemists in Africa has, thankfully, met with a favourable response reflected in the number of training courses held recently by relevant national and international institutions and agencies.

A training course on 'Geochemical Mapping and Environmental Geochemical Survey for African Countries' took place in Beijing, China, 13 August - 12 September, 2012. This was the third training course on geochemical mapping for Africa given by China, after the first two courses in 2004 and 2011, respectively. Lectures covered the following topics:

- Basic principles related to geochemical mapping;
- Geochemical mapping procedures - design and planning, field sampling, chemical analysis, data processing and map generation;
- Global-scale geochemical baselines;
- Regional/national-scale geochemical mapping;
- Application of geochemical mapping data for mineral resources;
- Environmental geochemical survey and its applications;
- Laboratory analysis for 76 elements used in geochemical mapping, and
- Geochemical data management and map generation.

The field sampling trip to Beijing suburb focused on stream sediments and overbank sediments sampling in mountainous terrains, and soil sampling in plain terrains. Field sampling trip to Inner Mongolia focussed on grassland sampling.

South Africa (M. Cloete, J. H. Elsenbroek, S. W. Strauss, E. Mulovhedzi, D. M. Van der Walt and M. Bensid; Council for Geoscience, Pretoria, South Africa)

The Council for Geoscience conducted a baseline geochemical soil mapping programme in the KwaZulu-Natal Province in the Nkandla area on the Nsuze Group (see Figure 1). An area of 2500 Km^2 was covered. Four 5 kg soil samples were taken on a quarter square-kilometre grid giving a total of approximately 8600 samples. Helicopter transport was utilized to take the samples on a preselected grid, and the sample positions were logged using a GPS.

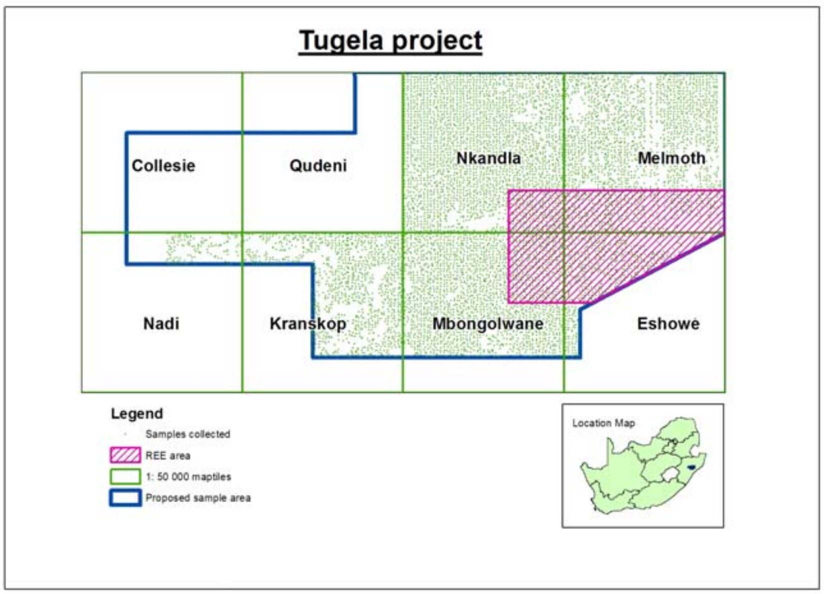


Figure 1: The area sampled in the KwaZulu-Natal Province during the 2013 season.

The samples were transferred to the CGS laboratory in Pretoria where they were dried and a preselected size fraction was screened out for analyses. The analyses are done in the CGS laboratory for 28 elements (Al_2O_3, CaO, Fe_2O_3, TiO_2, K_2O, MgO, MnO, SiO_2, Na_2O, P_2O_5, S, Hf, Mo, Ga, As, Ba, Co, Cr, Cu, Nb, Ni, Pb, Rb, Sb, Sc, Sn, Sr, Th, V, W, Y, Zn, Zr, U, Ag, Ce and Ta) on a simultaneous WD XRF spectrometer and in China for trace elements As, Li, Mo, Te, Sb and Cd, Pt, Pd, Au and for the REE elements: Yb, Ce, Pr, Nd, Eu, Gd, Dy, Ho, Er, Tm, Lu.

A similar programme is planned for the 2014 season in the Northern Cape Province of South Africa where the CGS envisages to collect 16000 soil samples covering an area of 16 000 Km^2 (see Figure 2).

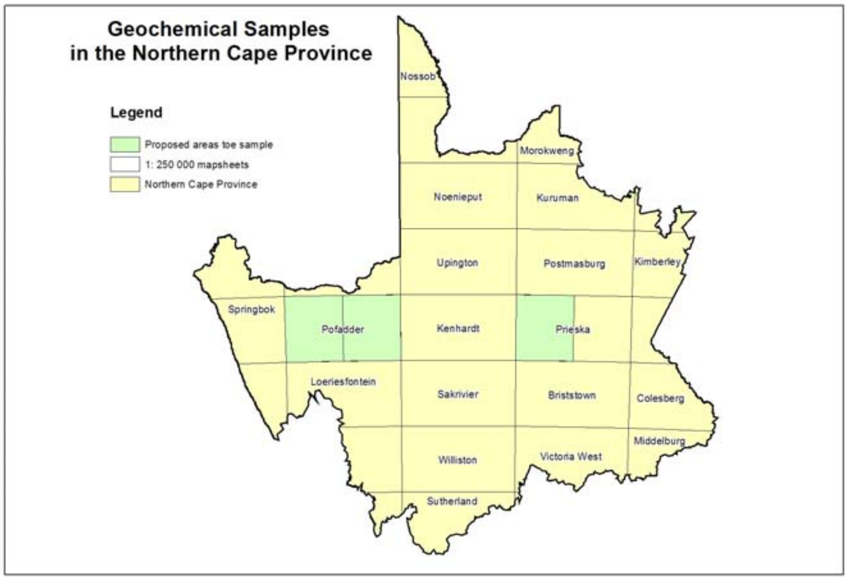


Figure 2: The area in the Northern Cape Province earmarked for sampling during the 2014 field season.

An International geochemical project is also being conducted in partnership with the BGSi in Tanzania. The project started in June 2013 with an orientation study where three different sampling techniques were tested (soil, stream sediment and termite hills). The stream sediment sampling media was adopted at a density of one sample per three square kilometres (1s/3 km$^{2)}$. Stream orders 1 and 2 were collected in different areas of the country representing 9 quarter degree sheets. A total of 2916 stream sediment samples plus 288 duplicates are being collected.

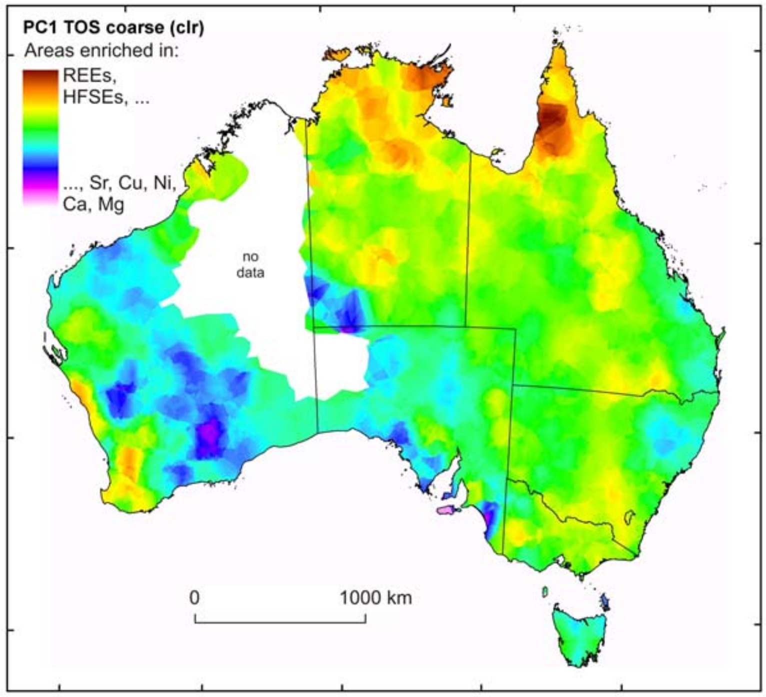
It is, however, clear that the sampling density of the South African National geochemical mapping programme is orders of magnitude higher, than what is envisage/required for global baseline mapping. The CGS also prefers soil sampling at the moment since all our programmes are mainly directed at mineral exploration. The Council for Geoscience is, nevertheless, keen to get involved with global baseline mapping as envisaged by the Task Group (should funds become available), but will for the short to medium term need to adhere to the current high density sampling of select areas.

<u>Australia</u> (Patrice de Caritat, Geoscience Australia, Canberra)

This year has seen the release of a few more publications on the National Geochemical Survey of Australia (NGSA) dataset. Multivariate statistical analysis of the total element content has been carried out at the continental scale (Caritat et al., 2013), for example. Presentations on NGSA have been made at several meetings (e.g., Goldschmidt 2013, the International Association for Mathematical Geosciences (IAMG) conference, the International Applied Geochemistry Symposium (IAGS)).

Visible-shortwave infrared and thermal spectroscopic analysis of the samples has begun with a test batch of 200 samples or so and will be rolled out in 2014. Several follow-up, regional scale surveys (e.g., on the Cape York Peninsula of northern Queensland; and in the southern Thomson region of northern New South Wales and southern Queensland) have been initiated to follow up NGSA anomalies or as part of multi-disciplinary regional investigations expected to be leading up to stratigraphic drilling.

Also a higher resolution, second phase continental geochemical survey has started with soil samples being collected on a grid pattern at sites where geophysical (e.g., magneto-telluric and seismic) surveys are being deployed. This is expected to take several years, and only the first one hundred sites or so have been sampled to date.

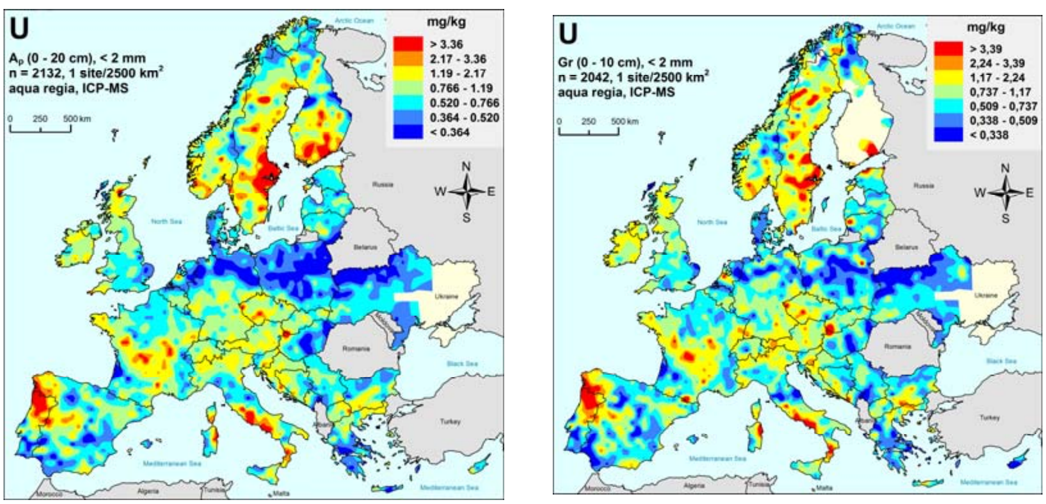


Map of the first Principal Component (PC1) of the total element concentrations in the surface samples (0-10 cm depth) from NGSA across Australia reflecting Rare Earth Elements (REEs) and High Field Strength Elements (HFSEs) associations in the warm colours versus mafic and transition element (Mg, Ni, Cu) and mobile element (Ca, Sr) associations in the cool colours (Caritat et al., 2013).

Europe ***(Clemens Reimann, NGU, Trondheim, 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://weppi.gtk.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. The data that are of widest interest are the stream water data, since this is the only harmonised data set in Europe and complies to the specifications of the Directive on Infrastructure for Spatial Information in the European Community (INSPIRE: http://inspire.jrc.ec.europa.eu/), and to the Water Framework Directive 2000/60/EC (http://ec.europa.eu/environment/water/water-framework/index_en.html).

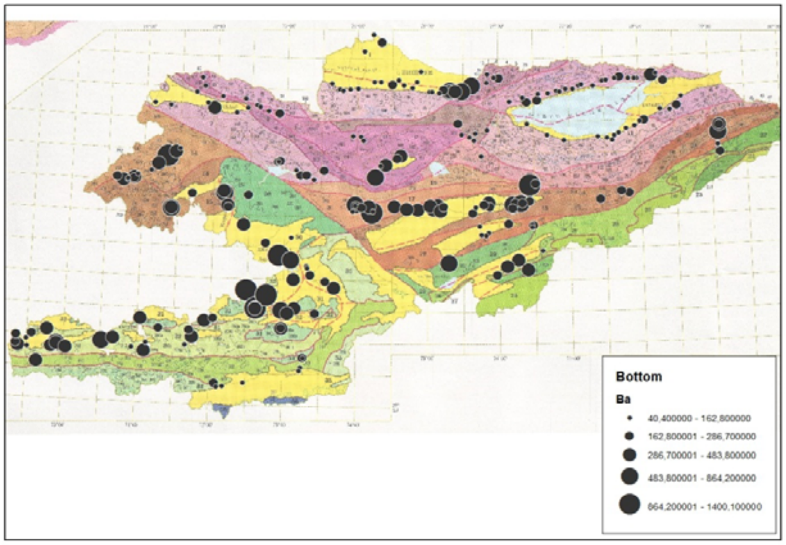
The EuroGeoSurveys Geochemistry Expert Group, under the chairmanship of Clemens Reimann of the Geological Survey of Norway, continues to be active in developing new initiatives throughout the European geochemical community. A three-day business meeting of the Group was held in Rome, Italy, from the 4th to 6th of December 2013. The focus of the meeting on the 4th December 2013, hosted by the Italian Geological Survey, was the refinement of the presentations of the GEMAS project workshop (http://gemas.geolba.ac.at/), planned for the afternoon of the 5th December 2013. The GEMAS project is partly funded by the European Association of Metals (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/enterprise/sectors/chemicals/reach/index_en.htm). On the 5th December 2013, the results of the GEMAS project were presented at the plenary session of World Soil Day, organised by FAO at its premises in Rome, and the two volumes of the GEMAS atlas entitled "*Chemistry of Europe's Agricultural Soils*" were presented and displayed. More than 250 people from all of over the world attended this international event. The publication date of the two volumes is the spring of 2014. In the afternoon, the EuroGeoSurveys Expert Group organised a workshop, which was held in the Iranian room of FAO, where there were more detailed presentations on different aspects of the GEMAS project, and a keynote presentation of the North American Soil Landscape project. The meeting on the 6th of December 2013, hosted again by the Italian Geological Survey, was devoted to ongoing activities of the GEMAS project, and a session on the status of the Urban Geochemistry project of major European cities (URGE project) using a common approach; all samples, following preparation, are being analysed at the same commercial laboratory that was used for the analysis of the GEMAS samples. A detailed plan of the URGE project will be submitted for 2014-15, and its completion is scheduled for 2015.



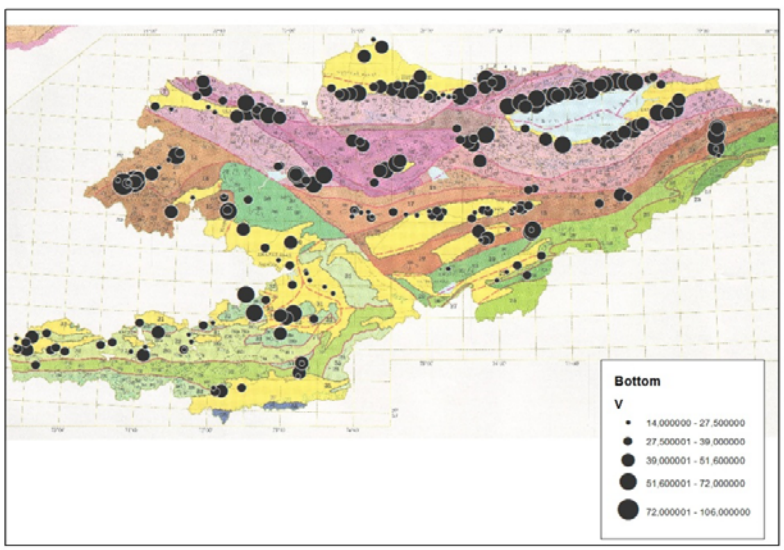
Spatial distribution of aqua regia extractable uranium (U) in the <2 mm grain size of agricultural (Ap – left) and grazing land (Gr – right) soil in Europe.

Regional geochemical mapping of Kyrgyzstan (Rolf Tore Ottesen and Jim Bogen, NGU, Norway)

The four year (2010-2014) regional geochemical mapping of Kyrgystan is a collaboration project between KG-Asanaliev's Kyrgyz Institute of Mining Technology, the Department of Geology of the University of Tromsø, the Norwegian University of Science and Technology, the Norwegian Water Resources and Energy Directorate and the Geological Survey of Norway. Its estimated cost is about NOK 4 M (≈USD 0.7 M) and is financed by the Norwegian Cooperation Programme with Eurasia (CPEurasia). It is a research and training project for Kyrgyz and Norwegian University students. After their training, a regional geochemical programme was planned and the students collected in 2013 top and bottom overbank sediments from 300 sites. The samples were analysed for 40 chemical elements at the ALS laboratory in Kyrgystan. Presently the geochemical maps are being plotted, and the end product will be in 2014 a geochemical atlas (see first maps below).



Spatial distribution of barium (Ba mg/kg) in bottom overbank sediment, Kyrgystan.



Spatial distribution of vanadium (V mg/kg) in bottom overbank sediment, Kyrgystan.

__Russia__ (Arkadiy Golovin, Institute of Mineralogy, Geochemistry, and Crystal Chemistry of Rare Elements, Moscow)

In the territory of the Russian Federation, in accordance with the state program, geochemical mapping at a scale of 1: 1,000,000 has been continued, which is primarily aimed at creating the basis for the State Geological Map of the third generation in the same scale (Fig. 1).

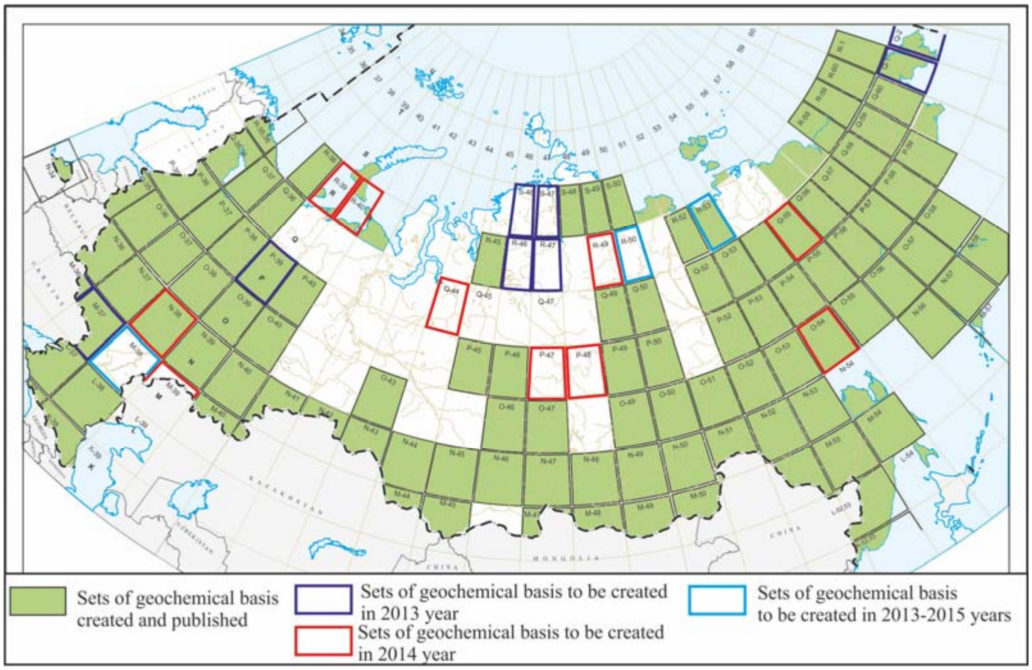


Fig. 1. Current status of geochemical mapping of the territory of Russia at a scale of 1:1 000 000 (as of 01.11.2013)

Work has been completed on the territories covered by sheets M-36, 37; P-39; R-46, 47; S-46, 47; Q-1, 2 in the Central, Northwestern, Siberian and Far-Eastern Federal regions of Russia of a total area of 763.2 thousand sq. km . Work has been going on the areas of sheets M-39; N-38; O-54; P-47; P-48; Q-44; Q-55; R-39; R-40; R-49 of a total area of 860.7 sq.km. Work has been started on the territories of sheets M-38; R-50 and R-53 in the Volga and Far-Eastern federal regions of a total area of 371.0 sq.km. All work is carried out in compliance with the standard technology described in previous reports.

All results obtained are included in the geochemical data bank, including analytical cartographic and attribute blocks. All digital maps (auxiliary, basic and final) (of geochemical studies, of zoning of the territory according to the conditions of conducting geochemical work, of the geochemical specialization of geological formations, of geological and geochemical zoning of geological formations, of geochemical forecast and ecological and geochemical map) are created with the use of GIS technology in program Arc- GIS.

In geochemical mapping of the territory of the East-European Platform (sheets M-36, 37; M-39; N-38), mobile forms of chemical elements were studied instead of the analytical studies of the bulk samples.

Figure 2 shows fragments of maps of the distribution of Cu and Ni contents from acid extracts of soil samples in the territory of sheet M-37. In this area, the thickness of platform cover increases from SW to NE from 100 to 300 m. From the ICP MS results on acid extracts from soils, as it may be seen in Figure 2, contrasting anomalous geochemical fields (AGCF) of Cu and Ni were revealed in the soil horizon A on the surface. Two of these anomalies coincide with the projection of small copper- nickel deposits localized in the basement rocks. Furthermore, AGCFs are delineated that are of the same composition, but much larger in area and in contrast in the area where no copper -nickel ore deposits are known. From these data, industrial copper- nickel deposit may be predicted under cover of platform sediments in this area.

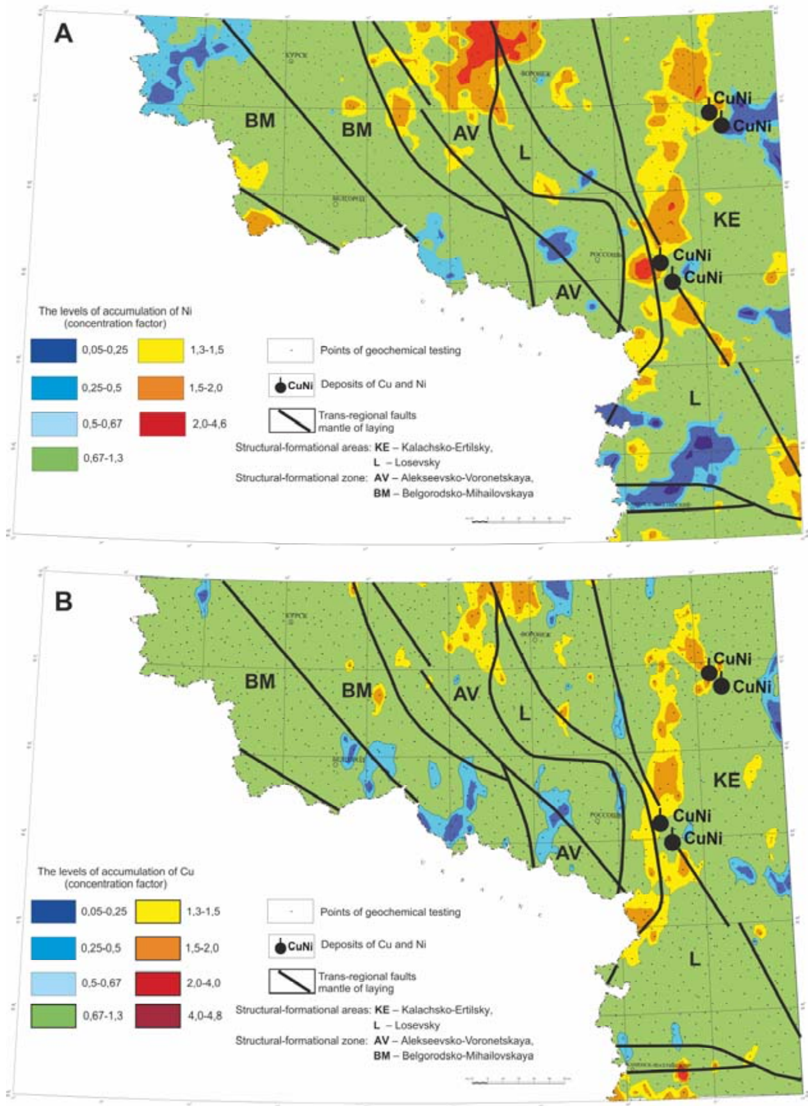


Fig. 2. Distribution mobile forms Ni (A) and Cu (B) in soils of list M (36), 37

Geochemical data obtained by studying the components of the environment (soil, surface water, flow sediment), allowed us to estimate the ecological conditions of the territory and identify areas with intense anthropogenic load from the value of the total pollution index Zc ≥ 8 (Fig. 3).

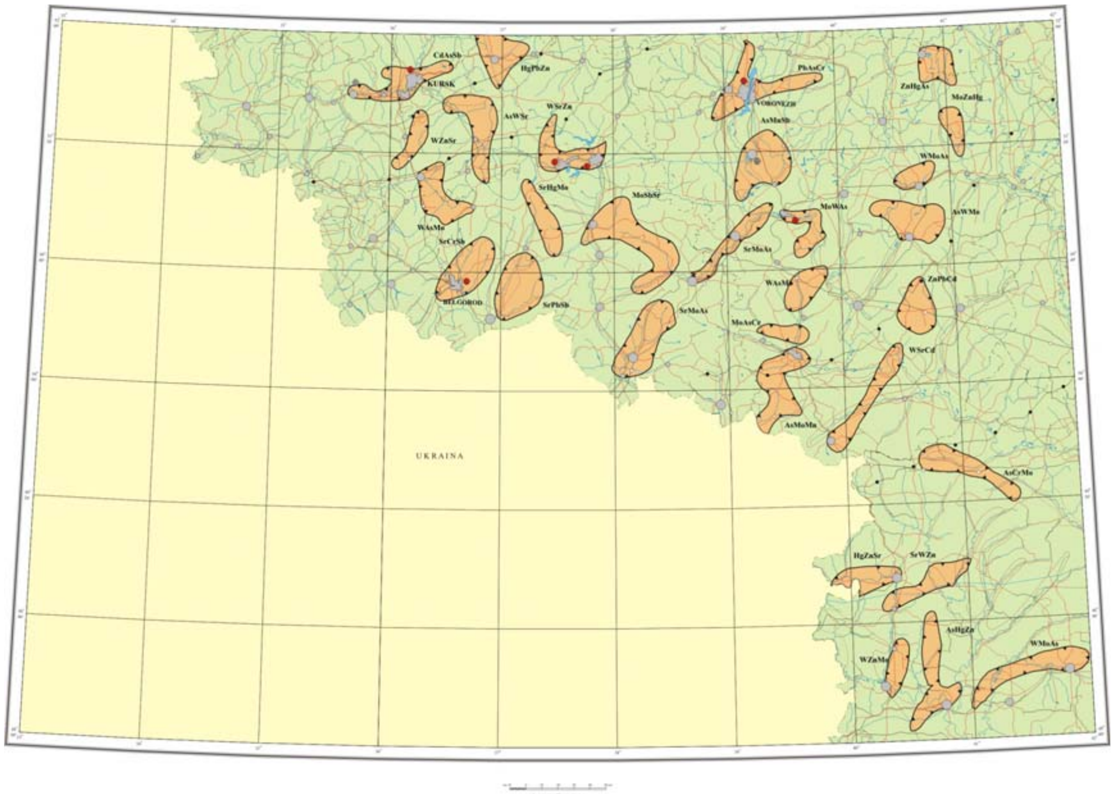


Fig. 3. Ecological geochemical map of M-36, 37

The area is situated in the southern Russian plain, in a temperate climate zone, in the forest-steppe and steppe landscape areas with fertile black earth. Unique iron-ore deposits (Kursk magnetic anomaly area) are identified and mined there. It is a highly developed and populated area with developed transport infrastructure. The natural environment of the territory is subject to intense impact of a variety of land use types. First of all, mining, processing and metallurgical production, as well as mechanical engineering and chemical industries show negative effects on the environment in Kursk, Voronezh and Belgorod. Arable farming considerably pollutes the soil of the region. Adverse impact on the environment is also related to the functioning of the major administrative centers, with a dense network of roads and railways and operating thermal and nuclear power plants.

The areas of intense man-caused load and poor environmental and geochemical conditions (30 zones) make up about 25% of the work. The composition of these zones corresponds to the geochemical specialization of pollution sources.

In cities with diversified industry, major elements-pollutants are As Pb Zn Cd Hg Cr Sb Sr W Mo, and in the areas of iron ore mining, such elements are Zn Ni Cr Mo W Sr and Mn. In contaminated zones of predicted and well-known coal-bearing areas including mined areas, anomalous contents of W Zn Mo As Pb Cd Sb Hg and Cu are noted.
Soil contamination with Sr, Mo, W, Hg, Pb, Zn, Cd, As, Cr and Sb is characteristic of the other areas with intense anthropogenic load, confined to farming lands, often in conjunction with non-metallic minerals mining areas, and administrative centers.

Public Relations Accomplishments (Alecos Demetriades)

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 at the end of 2012 and beginning of 2013 was the reorganisation and update of the Task Group's website material. The website was reorganised and redesigned by a contract commercial company in collaboration with the public relation officer. The new website became operational in February 2013 (http://www.globalgeochemicalbaselines.eu/).

The website hosting the Geochemical Atlas of Europe (http://weppi.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.

Another important website, which is now in operation, concerns the GEMAS project of the EuroGeoSurveys Geochemistry Expert Group. The website is hosted by the Geological Survey of Austria (http://gemas.geolba.ac.at/) and the webmaster is Paolo Valera from Italy, and the Task Group's public relation officer has an active role in the compilation of the material that is uploaded to the GEMAS website. A novel idea is the uploading of two photographs from each sampling site to Google Earth – work that is done by Edith Haslinger in her own time. Thus, interested people can fly directly to the sampling site and see a landscape and a soil profile photograph.

In 2010, the EuroGeoSurveys Geochemistry Expert Group decided to produce a GEMAS calendar for 2011, 2012 and 2013, for the promotion of the project. The calendar for 2013 has been produced in electronic and print versions (A3 size). Each calendar has 12 photographs from different countries, which display European agricultural and grazing land landscapes. The cost of the printed version was paid by the royalties received from the sales of two books (1) '*Geochemistry of European Bottled Water*' and (2) '*Mapping the Chemical Environment of Urban Areas*'. See website links below:

- http://www.schweizerbart.de/publications/detail/artno/001201002
- http://eu.wiley.com/WileyCDA/WileyTitle/productCd-0470747242.html.

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 2500 copies have been distributed to date (1300 copies by EuroGeoSurveys office and over 1200 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 2008 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 of November 2013, more than 1300 copies have been distributed at workshops, conferences, congresses and meetings, and also posted to interested university students and professionals.

In 2012, the Task Group published a paper in *Earth Science Frontiers* titled "T*he IUGS/IAGC Task Group on Global Geochemical Baselines*." This paper provided a summary of the history and accomplishments of the Task Group. See Section 9 for the complete reference.

The Task Group supported the travelling expenses of the Sampling Committee Chair to participate at the CCOP-ASEAN-IUGS Workshop on Geochemical Mapping, which was held in Nanning (Guangxi Province, P.R. China) from the 3 to 8 September 2013.

International Centre on Global-scale Geochemistry approved by UNESCO

The Proposal for the establishment of the International Centre on Global-Scale Geochemistry in Langfang, China under the auspices of UNESCO as a category II centre, was approved by the 37th session of UNESCO in Paris on the 13th November, 2013.

Since the 1980s, in light of the importance of global geochemical baselines for recognition of global environmental changes, formidable efforts have been made by applied geochemists through the International Geochemical Mapping Project (IGCP 259), the Global Geochemical Baselines Project(IGCP 360), and the IUGS/IAGC Task Group on Global Geochemical Baselines. However, the progress is slow and limited. It is just like what Darnley et al. (1995), in the final report of IGCP Project 259, stated: "*Because of the number of organizational and technical steps involved it seems highly unlikely that any group of scientists convened under a non-government organization, however enthusiastic, could sustain or manage an international sampling activity (other than as a small test project in a sympathetic jurisdiction) over the period of time required for completion. . . .Assuming the importance of the geochemical information to be obtained is recognized by the international scientific community, there is a clear need for a single permanent agency to accept formal responsibility for securing funds, managing and coordinating these activities according to scientific guidelines determined by an external advisory committee*."

The past twenty years, experience and lessons have made it clear that there is an urgent need for the establishment of a single permanent agency to accept formal responsibility for securing funds, managing and coordinating these activities according to scientific guidelines determined by an external advisory committee.

In September 2009, Prof. Xie Xuejing (China), Dr. David Smith (USA) and Dr. Wang Xueqiu (China), forwarded a proposal to the China IGCP National Committee for establishing an International Research Centre on Global Geochemical Mapping (The name was changed to International Centre on Global-scale Geochemistry) under the auspices of UNESCO. The proposal had also been thoroughly discussed by the participants of the Global Geochemical Mapping Symposium held in Langfang China on Oct. 9-12, 2009. All participants expressed their support for establishment of an International Research Centre for Global Geochemical Mapping in the Institute of Geophysical and Geochemical Exploration (IGGE), Langfang, China.

The proposal has been supported by the Ministry of Land and Resources of P.R.China, the International Union of Geological Sciences (IUGS), the Association of Applied Geochemists (AAG) the Coordinating Committee for Geoscience Programmes in East and Southeast Asia (CCOP), the IUGS/IAGC Task Group on Global Geochemical Baselines，the China Geological Survey (CGS), the Chinese Academy of Geological Sciences (CAGS), and the Geological Society of China.

In October 2010, the Ministry of Land and Resources formally requested the Director-General, through the Permanent Delegation of the People's Republic of China, that UNESCO carry out a feasibility study for the establishment of a category 2 centre in Langfang, located at same address of the Institute of Geophysical and Geochemical Exploration (State Research Institute). The IGCP Scientific Board reviewed the feasibility study report and made a resolution in support of the proposal at the 39th IGCP Scientific Board Meeting, 16 – 18 February, 2011. The decision was adopted by the UNESCO Executive Board at its 191st session in Paris on the 3rd June, 2013. Finally, the proposal was approved by the General Conference at its 37th session in Paris on the 13th November, 2013.

The centre will master knowledge and technology for documenting global-scale geochemical data and accompanying distribution maps, sustaining development for natural resources and the environment, and act as the platform for training and transferring up-to-date knowledge and technology between the developed and developing countries, and promote equal access to basic services in the field of global-scale geochemistry.

8. CHIEF PROBLEMS ENCOUNTERED IN 2013

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 was completed with funding by the participating European Geological Surveys. Ongoing work in North America, Australia, India, China, Cyprus, Nigeria and Kyrgyzstan, 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 2013

ARTICLES, PAPERS, ATLASES AND BOOKS

(1) Martiya Sadeghi, M., Petrosino, P., Ladenberger , A., Albanese, S., Andersson, M., Morris, G., Annamaria Lima, A., De Vivo, B., The GEMAS Project Team, 2013. Ce, La and Y concentrations in agricultural and grazing-land soils of Europe. *Journal of Geochemical Exploration*, 133, 202-213.
http://www.sciencedirect.com/science/article/pii/S0375674212002695

(2) Ottesen, R.T., Birke, M., Finne, T.E., Gosar, M., Locutura, J., Reimann, C., Tarvainen, T., The GEMAS Project Team, 2013. Mercury in European agricultural and grazing land soils. *Applied Geochemistry*, 33, 1–12.
http://www.sciencedirect.com/science/article/pii/S0883292712003514

(3) Saaltink, R., Griffioen, J., Mol, G., Birke, M., The GEMAS Project Team, 2013. Geogenic and agricultural controls on the geochemical composition of European agricultural soils. *Journal of Soils and Sediments*. October 2013 http://dx.doi.org/10.1007/s11368-013-0779-y.
http://link.springer.com/article/10.1007%2Fs11368-013-0779-y

(4) Scheib, A.J., Birke, M., Dinelli, E., GEMAS Project Team, 2013. Geochemical evidence of aeolian deposits in European soils. *Boreas*, xx, 1-18.
http://onlinelibrary.wiley.com/doi/10.1111/bor.12029/abstract. Article first published online: 20 June 2013. http://dx.doi.org/10.1111/bor.12029

(5) Soriano-Disla, J.M., Janik, L., Mclaughlin, M.J., Forrester, S., Kirby, J.K., Reimann, C., The EuroGeoSurveys GEMAS Project Team, 2013. The use of diffuse reflectance mid-infrared spectroscopy for the prediction of the concentration of chemical elements estimated by X-ray

fluorescence in agricultural and grazing European soils. *Applied Geochemistry*, 29, 135-143. http://www.sciencedirect.com/science/article/pii/S0883292712003216

(6) Tarvainen, T., Albanese, S., Birke, M., Poňavič, M., Reimann, C., The GEMAS Project Team, 2013. Arsenic in agricultural and grazing land soils of Europe. *Applied Geochemistry*, 28, 2-10. http://www.sciencedirect.com/science/article/pii/S0883292712002788

(7) Soriano-Disla, J.M., Janik, L., McLaughlin, M.J., Forrester, S., Kirby, J.K., C. Reimann, C., The EuroGeoSurveys GEMAS Project Team, 2013. Prediction of the concentration of chemical elements extracted by aqua regia in agricultural and grazing European soils using diffuse reflectance mid-infrared spectroscopy. *Applied Geochemistry*, 39, 33-42. http://www.sciencedirect.com/science/article/pii/S0883292713002370

(8) Smith, D.B., Smith, S.M, Horton, J.D., 2013. History and evaluation of national-scale geochemical data sets for the United States. *Geoscience Frontiers*, 4, 167–183. http://www.sciencedirect.com/science/article/pii/S1674987112000886

(9) Smith, D.B., Cannon, W.F., Woodruff, L.G., Solano, F., Kilburn, J.E., Fey, D.L, 2013. Geochemical and mineralogical data for the conterminous United States. *U.S. Geological Survey Data Series 801,* 19 p. http://pubs.usgs.gov/ds/801

(10) Caritat, P. de, Grunsky, E.C., 2013. Defining element associations and inferring geological processes from total element concentrations in Australian catchment outlet sediments: multivariate analysis of continental-scale geochemical data. *Applied Geochemistry*, 33, 104-126. http://www.sciencedirect.com/science/article/pii/S0883292713000383

(11) Scheib, A.J., 2013. The National Geochemical Survey of Australia - Selected interpretations for Western Australian data. *Geological Survey of Western Australia Record***,** 2013/4: 47 pp.

(12) Towett, E.K., Shepherd, K.D., Cadisch, G., 2013. Quantification of total element concentrations in soils using total X-ray fluorescence spectroscopy (TXRF). *Science of the Total Environment,* 463–464, 374–388.

ORAL AND POSTER PRESENTATIONS

245th American Chemical Society National Meetings, 7–11 April 2013, New Orleans, Louisiana (USA). Symposium on Arsenic Contamination of Food and Water

Smith, D.B., Cannon, W.F. & Woodruff, L.G.: *Distribution of arsenic in soils of the conterminous United States*

Soil-based use of residuals, wastewater, and reclaimed water, Workshop sponsored by U.S. Environmental Protection Agency, 10 June 2013, Denver, Colorado (USA).

Smith, D.B.: A new national-scale soil geochemical database for the conterminous United States: A tool for risk assessment, environmental regulation, and public health.

Goldschmidt 2013 conference, 25-30 August, Florence, Italy (http://goldschmidt.info/2013/)

C. Reimann, A. Demetriades & M. Birke: *Chemistry of Europe's Agricultural Soils – The GEMAS Project*

A. Ladenberger, J. Uhlbäck, M. Andersson, C. Reimann, T. Tarvainen, M. Sadeghi, G. Morris & M. Eklund: *Elemental Patterns in Agricultural and Grazing Land Soils in Norway, Finland and Sweden – What Have We Learned from Continental Scale Mapping?*

E. Dinelli, V. Lancianese, M. Birke, B. De Vivo, M. Gosar, E. Hasliger, P. Hayoz, H. Reitner & I. Salpeteur: *GEMAS Results at a Regional Scale: The Alps*.

D. Cicchella, S. Albanese, E. Dinelli, L. Giaccio, A. Lima, P. Valera & B. De Vivo: Geochemical Atlas of Italian Soils.

P. Govil: *Geochemical Baseline Mapping in India Using Top and Bottom Soil Samples for Environmental Management*.

M. Sadeghi, P. Petrosino, M. Andersson, S. Albanese, A. Ladenberger, G.A. Morris, J. Uhlbäck, A. Lima & B. De Vivo: *REE Contents in Soils and Sediments from the GEMAS and FOREGS Data-Bases: Comparison between Different Geological Contexts in Italy and Sweden.*

V. Lancianese & E. Dinelli: *Regional Geochemical Mapping at High Density Sampling: Various Criteria in Representation of Romagna Apennines, Northern Italy*.

K. Knights & R. Scanlon: *Tellus: Regional-Scale Baseline Geochemical Mapping of Soil, Stream Sediment and Stream Water for the Island of Ireland*.

P. de Caritat: *The National Geochemical Survey of Australia (NGSA) Project*.

A. Cosenza, R. Ayuso, N. Foley, S. Albanese, A. Lima, A. Messina & B. De Vivo: T*he Origin of Geochemical Anomalies in Top Soils of Eastern-Central Peloritani Mountains (Sicily, Italy)*.

15th Annual Conference of the International Association of Mathematical Geosciences (IAMG), Madrid, Spain, 2-6 September 2013

Caritat, P. de, Grunsky, E., Mann, A. *Do CoDa principles improve interpretation of geochemical data for mineral prospectivity analysis?*

Lo, J., Mueller, U., Caritat, P. De, Grunsky, E.C. *Structural analysis of the National Geochemical Survey of Australia data.*

Grunsky, E.C., Drew, L.J., Smith, D.B., Sutphin, D.M. *Multivariate analysis of the United States portion of the North American Soil Geochemical Landscapes Project—A compositional approach.*

CGS-CCOP-ASEAN-IUGS/IAGC Workshop on "CCOP-ASEAN Geochemical Mapping" that took place from the 3 to 8 September 2013 in Nanning (Guangxi Province), China

Liu Dawen (CGS): C*GS International Cooperation Project on Geochemical Mapping*

Wang Xueqiu (IGGE & TGGB): *Geochemical Mapping: Principles and Methodologies*

Wang Xueqiu (IGGE & TGGB): *Global-scale geochemical baselines-China Geochemical Baselines*

Wang Xueqiu (IGGE & TGGB): Regional-/National-scale Geochemical Mapping: 1:200,000 *and 1:1,000,000 scale*

Zhou Guohua (IGGE): *Theory and Methodology of Eco-environmental Geochemical Mapping*

Dr. Zhou Guohua (IGGE): *Theory and Methodology of Eco-environmental Geochemical Mapping*

Alecos Demetriades (TGGB): *Sampling, Laboratory Scheme and Quality Control Monitoring System for Geochemical Mapping Used in Europe*

Alecos Demetriades (TGGB): *Geochemical Data Management and Map Generation*

Alecos Demetriades (TGGB: *Application of Geochemical Mapping for Mineral and Environmental Assessment*

Zhang Qin (IGGE): *Laboratory Analysis and Quality Control System for Geochemical Mapping Used in China*

Wang Xueqiu (IGGE & TGGB): *Discussion on the Protocol of CCOP-ASEAN Geochemical Mapping Project*

Australian Institute of Mining and Metallurgy (AusIMM) World Gold Conference 2013, Brisbane, Queensland 26–29 September 2013

Mann, A., Davidson, A., Caritat, P. de. *High resolution soil geochemistry for gold exploration at the continental, regional and prospect scale*.

Geological Society of America Annual Meetings, Denver, Colorado, USA, 27–30 October, 2013 (http://community.geosociety.org/2013AnnualMeeting/Home). Session T79. Geochemical mapping at regional to continental scales; David B. Smith and Laurel G. Woodruff, Presiding.

L. Woodruff, D. Smith, W. Cannon, & F. Solano: *New soil geochemistry and mineralogy for the conterminous United States.*

W. Cannon, F. Solano, & T. Westphal: *Quartz distribution in A-horizon soils of the conterminous United States—Its effect on major and trace element distribution patterns.*

E. Grunsky, L. Drew, & D. Smith: *Characterization and classification of soil geochemistry within the conterminous United States.*

F. Solano, D. Smith, W. Cannon, & L. Woodruff: *A dynamic database for geochemical and mineralogical data for soils of the conterminous United States.*

D. Smith, W. Cannon, & L. Woodruff: *Mapping the distribution of arsenic in soils of the conterminous United States.*

F. Moreira: *Methodology for a soil geochemical and mineralogical survey of Mexico.*

G. Lee, M. Granitto, B. Wang, N. Shew, J. Mauk, T. Hayes, J. Jones III, J. Schmidt, E. Todd, & M. Werdon: *Geochemical mapping of Alaska using large legacy databases.*

H. Thorleifson & R. Lively: *Minnesota Geological Survey geochemical mapping.*

K. Ellefsen, D. Smith, & J. Horton: *Mixture-model clustering of regional geochemical data.*

B. Wang, C. Hults, D. Eberl, & L. Gough: *Geochemistry and mineralogy in soils from a N-S trans-Alaska transsect.*

M-C. Williamson, J. Harris, J. Percival, R. McNeil, S. Day, C. Kingsbury, E. Grunsky, M. McCurdy, J. Shepherd, & G. Buller: *Regional geochemical mapping of oxide-sulphide gossans and their reactive zones in permafrost, Canadian Arctic archipelago.*

26th International Applied Geochemistry Symposium, 18-21 November 2013, Rotorua New Zealand (http://www.gns.cri.nz/iags/)

A. Mann, C. Reimann, P. De Caritat, N. Turner and GEMAS project team: *Mobile Metal Ion (MMI®) geochemistry of European agricultural soils.*

J. Wilford, P. De Caritat (Presenter) and E. Bui: *Modelling the distribution and abundance of calcium carbonate in the Australian regolith using environmental covariates.*

B. McClenaghan: *Government's role in applied geochemistry−a Canadian perspective.*

G. Lee, M. Granitto, B. Wang, N. Shew, J. L. Mauk (Presenter), T. S. Hayes, J. V. Jones III, J. M. Schmidt, E. Todd, and M. B. Werdon: *Geochemical mapping of Alaska.*

M. Rattenbury, N. Mortimer and S. N. Haubrock: *Geochemical maps of New Zealand.*

A. J. Scheib: *Validity of low-density continental-scale surveys: discovering new geochemical features in sediments from Western Australia.*

L. Ren, D. R. Cohen (Presenter), N. F. Rutherford, A. M. Zissimos and E. Morisseau: *Lithological and mineralogical controls on REE patterns in the soils of Cyprus.*

Wang Xueqiu, Wang Wei and Liu Xuemin: *How to use geochemical baselines to quantify environmental changes?*

Liu Xuemin, Wang Xueqiu, P. De Caritat and R. Salminen: *Comparison of data sets obtained by global-scale geochemical sampling in Australia, China and Europe.*

S. M. Hlatshwayo, S. W. Schalk and J. H. Elsenbroek: *Regolith geochemistry of the Rustenburg Layered Suite, south western Bushveld Complex, South Africa.*

P. De Caritat, S. Jaireth, E. Bastrakov, E. C. Grunsky and A. Mann: *Distribution of lithium in Australian regolith: An indicator of potential lithium resources in salt lake brines?*

Z. Qichao and C. Qinghua: *Spatial-temporal distribution of elements in clastic sedimentary rocks in a transect across South China: Implications for the W, Sn metallogenic province.*

P. Sarala: *Advanced till geochemical and heavy mineral methods for mineral exploration in glaciated terrain in Finland.*

EuroGeoSurveys Geochemistry Expert Group Meeting – Geological Survey of Italy (ISPRA, 4 & 6 December 2013) and FAO (5 December 2013), Rome, Italy.

Ilse Schoeters: *The use of the GEMAS data for compliance with European Chemicals Legislation*

Koen Oorts: *Use of monitoring data for risk assessment of metals in soil*

Les J. Janik, Sean Forrester, Jason K. Kirby, Michael J. McLaughlin, José M. Soriano-Disla, Clemens Reimann: *Prediction of metal and metalloid partitioning coefficients (Kd) in soil using mid-infrared diffuse reflectance spectroscopy*

Rainer Baritz, Dietmar Zirlewagen, Vibeke Ernstsen: *Relevance of GEMAS for soil property mapping*

Anna Ladenberger: *GEMAS - soil, geology and health implications*

Timo Tarvainen, Tarja Hatakka, Merja Eurola: *Field balances of trace elements at the farm scale in Finland and levels of trace elements on the GEMAS maps*

Ray Scanlon, Katherine Knights, Mairead Glennon, Patrick O'Connor: *Natural and anthropogenic signatures in Irish soil: A view from the local to the continental scale*

Benedetto De Vivo, Dominico Cicchella, Stefano Albanese, Enrico Dinelli, Lucia Giaccio, Annamaria Lima, Paolo Valera: *The geochemical atlas of agricultural and grazing land soil of Italy based on GEMAS samples*

Laurel G. Woodruff, David B. Smith, William F. Cannon: *Soil geochemistry and mineralogy for the Conterminous United States – Results from the North American Soil Geochemical Landscapes project*

Rannveig Anna Guicharnaud, Luca Montanarella: *Heavy metal concentrations in European soil*

Dee Flight, Andreas Scheib, The Geochemical Baselines Team: *London's soil chemistry: A continental scale anomaly*

EuroGeoSurveys Geochemistry Expert Group, ISPRA, Rome Italy, 6th December 2013

10. SUMMARY OF EXPENDITURES IN 2013

The Task Group did not receive any funds from IUGS in 2013. In 2013, the Task Group had the following expenditures totalling 4,840.17 USD:

(1) payment of design and uploading of the new Website of the Task Group	2779.18 USD
(2) travel for Alecos Demetriades to participate at the "CCOP-ASEAN Geochemical Mapping" Workshop, Nanning, China	1762.87 USD
(3) annual fee for the hosting of the Task Group's website	298.12 USD

In addition to the expenditure of funds provided to the Task Group by IUGS, many Task Group goals are supported by various national Geological Survey organisations. The cost of the EuroGeoSurveys programme over the past year is estimated to be in excess of US $150,000. The overall cost of the FOREGS/EuroGeoSurveys 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 a conservative estimate is in excess of US $11M. These funds were provided from the Geological Surveys of the participating countries within Europe. The cost of the soil geochemical mapping project in the conterminous United States during 2013 was approximately US $750K. 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 tentatively take place in 2014. It will likely be timed to coincide with the annual business meeting of the EuroGeoSurveys Geochemistry Expert Group, scheduled for autumn of 2014 in Dublin (Ireland).

For historical reasons it was decided to leave the FOREGS Geochemical Mapping Field Manual (Salminen, Tarvainen *et al.,* 1998) as it is, because it deals with sampling in Temperate and Mediterranean terrains. An additional field manual will be published in 2014 by the Task Group to include sampling instructions in (a) Karstic terrains, prepared by A Demetriades, S Pirc, M Bidovec and F Sustersic with an input from Xueqiu Wang, (b) Desert terrains by Xueqiu Wang (first draft completed in 2010), (c) Tundra terrains by Xueqiu Wang, (d) Arctic terrains by Rolf Tore Ottesen, and (e) Tropical terrains by Alecos Demetriades, Wang Xueqiu, Chris Johnson, Reijo Salminen and others.

Geochemical mapping projects will continue in many countries throughout the world as detailed in section 7.

In 2012, the Task Group received inquiries from Iran and Brazil about conducting training in geochemical mapping in those countries. Because of financial problems in most surveys no further action was taken during 2013. However, it is possible that such training could occur in 2014, since we are in direct contact with both countries.

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. A technical session on GEMAS – Geochemical mapping of agricultural and grazing land soil in Europe is organised during the European Geosciences Union General Assembly from the 27 April to 2 May 2014 in Vienna, Austria (http://meetingorganizer.copernicus.org/EGU2014/session/14793).

Communication will also be achieved through continued output of peer-reviewed scientific papers, oral presentations, posters and promotional materials.

In addition, the Task Group's new website will be a 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 $32 M 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 2003-2008, US$ 4000 for 2009 and 2010, and US$ 5000 for 2011 and 2012, and no funding for 2013. IAGC has provided funding of US$2000 on three occasions (2000, 2003, and 2004) over the past fourteen years to assist with travel expenses of Task Group members from developing countries to attend our business meetings. The Task Group currently has reserves of approximately US$ 13,197. Taking into account the necessity to publish in 2014 the Field Manual for all the remaining terrain types, the need for field training courses and workshops in the CCOP and other countries, we are requesting financial support of USD 5,000 from IUGS for 2014.

14. CHIEF ACCOMPLISHMENTS 1998-2013

1998 Publication of Salminen R, *et al.* (1998) *FOREGS Geochemical Mapping Field Manual.* Geological Survey of Finland Guide Number 47.

1998 Release of the IUGS/IAGC Global Geochemical Baselines website, hosted by the British Geological Survey at www.bgs.ac.uk/IUGS.

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.

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 Sampling and analysis completed in Southern India. Pilot studies partially completed within Colombia and Brazil.

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 Launch of North American Soil Geochemical Landscapes Project.

2003 Launch of geochemical baseline mapping programme in India.

2004 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.

2005 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.

2006 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 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 Completion of soil sampling at approximately 4800 sites in the conterminous United States as part of the North American Soil Geochemical Landscapes Project.
2011 Release of the National Geochemical Survey of Australia (NGSA) results and atlas (www.ga.gov.au/ngsa).
2011 Completion of the Cyprus Soil Geochemical Atlas project, and publication in July 2011 of the "Cyprus Geochemical Atlas" and four technical reports.
2011 Publication of the EuroGeoSurveys Urban Geochemistry Book project "*Mapping the Chemical Environment of Urban Areas*" (April 2011).
2011 Publication of Multi-purpose Regional Geochemical Atlas of the Reaches of Yangtze and Huai River, Anhui Province, 2011, Geological Publishing House, Beijing.
2011 Publication of Multi-purpose Regional Geochemical Atlas of Hainan Island, Hainan Province, 2011, Geological Publishing House, Beijing.
2012 CGS-CCOP-IUGS/IAGC Seminar on CCOP Geochemical Mapping, Nanjing, China, 28 March 2012.
2012 Organisation of the 2nd Arthur Darnley Symposium entitled *"Global geochemical mapping: understanding chemical Earth"* at the 34th IGC, Brisbane, Australia, 8 August 2012.
2012 Participation in the IUGS Ad Hoc Review of the Task Group. Financial support provided for two graduate students to attend the 34th IGC.
2013 CGS-CCOP-ASEAN-IUGS/IAGC Workshop on Geochemical Mapping, Nanning, Guangxi Province, P.R. China, 3-8 September 2013.
2013 Release of geochemical and mineralogical results for the conterminous United States, 25 October 2013.
2013 Launch of the European Geochemical Atlas of Agricultural and Grazing Land Soil (GEMAS) on World Soil Day (5 December 2013) at FAO premises in Rome.
2013 GEMAS Workshop at FAO premises in Rome, 5 December 2013.

15. REFERENCES

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De Vos W, *et al.* 2006. FOREGS Geochemical Atlas of Europe: Part 2 - Interpretation of Geochemical Maps, Additional Tables, Figures, Maps, and Related Publications. Geological Survey of Finland, 690p. Also available at http://weppi.gtk.fi/publ/foregsatlas/.

Respectfully submitted, 13 December 2013

Dr David B. Smith and Dr. Xueqiu Wang
Co-Leaders, IUGS/IAGC Task Group on Global Geochemical Baselines

Mr Shaun Reeder
Scientific Secretary

EurGeol Alecos Demetriades
Treasurer