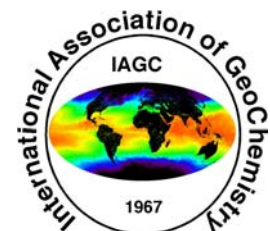


**2009 ANNUAL REPORT  
FOR THE  
INTERNATIONAL UNION OF GEOLOGICAL SCIENCES (IUGS)/  
INTERNATIONAL ASSOCIATION OF GEOCHEMISTRY (IAGC)**

**TASK GROUP ON  
GLOBAL GEOCHEMICAL BASELINES**

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



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**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 harmonization;
- 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**

<i>Co-Leaders</i>	Dr David Smith	US Geological Survey
	Dr Xueqiu Wang	IGGE, China
<i>Scientific Secretary</i>	Mr Shaun Reeder	British Geological Survey
<i>Treasurer</i>	Mr Alecos Demetriades	IGME, Greece

##### **Analytical Committee**

*Chair* Ms Wendy 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

###### South-east Asia:

Pradip Govil; National Geophysical Research Institute; Hyderabad, India  
Sujatha Dantu; 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

###### 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**

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 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 in 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 is trying to link the project 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 2009****Organisational Accomplishments:***Global Geochemical Mapping Symposium*

The Global Geochemical Mapping Symposium, sponsored by the China Geological Survey (CGS), and organised by the Institute of Geophysical and Geochemical Exploration (IGGE), was held on 10-12 October 2009 at the Langfang International Hotel, Langfang, China. The

purposes of the symposium were to: (1) share methodology and experiences of geochemical mapping at regional to continental scales; (2) discuss future options for global geochemical mapping, specifically, the feasibility of using delta and overbank sediments as sampling media; (3) discuss the possibility of establishing the International Research Centre for Global Geochemical Mapping to promote the implementation of global-scale geochemical mapping; and (4) visit the lower reaches of the Yangtze River to view delta sediment sampling sites and discuss the proposed sampling protocols. Fifty registered participants from Canada, USA, Mexico, Colombia, Australia, South Africa, Norway, Finland, Germany, India, and China attended the symposium. Additional details may be found in Appendix 1.

#### *Data Management Workshop*

A workshop on geochemical project database and data management procedures was held in Athens, Greece, 4-7 May 2009. The workshop was chaired by Timo Tarvainen (Finland) with participants from Russia (Igor Bogatyrev), USA (Steven M. Smith) and Greece (Alec Demetriades, Christina Papadimitropoulou, Panagiotis Karakonstantis).

A pilot version of the project database was established at the Institute of Geology and Mineral Exploration, Athens. The database was modified from the North Europe Geochemistry (NEG) database designated by SC Mineral, St Petersburg, with kind permission from the SC Mineral company and the board of the NEG project (<http://www.noreurgeoch.net/>). The Global Geochemical Baselines database was tested with information from two projects, and was further developed after the workshop. It can be accessed at <http://www.globalgeochemicalbaselines.eu/>.

#### **Scientific Accomplishments:**

There has been continued and significant progress in a number of areas during 2009, most notably:

*North America:* 2009 was the third year of sampling for the North American Soil Geochemical Landscapes Project (NASGLP). The project is a collaborative effort among the US Geological Survey, the Geological Survey of Canada, and the Mexican Geological Survey. Its long term goals are: (i) establishing a soil geochemical database and its representation in map form for the continent of North America (21 million km<sup>2</sup>); (ii) interpreting the delineated geochemical patterns in terms of processes that caused the observed spatial distribution of the elements; and (iii) establishing an archive of samples for future investigators. To date, approximately 60% of the conterminous US has been sampled (over 2,800 sites, representing about 8,400 samples) and 42% of Mexico is complete (more than 500 sites and 1,500 samples) (Figure 1). Sampling is completed in the Maritime Provinces of Canada and along a transect extending from Vancouver Island in the west to Newfoundland in the east. Results of the pilot studies for this project were published in the August 2009 issue of Applied Geochemistry. A complete list of references for the 21 papers is given in a later section of this annual report.

*Asia:* China and Mongolia Geochemical Mapping Project. The Chinese Geochemical Baselines Project (CGBP) launched in 2008 is continuing. Sampling over the whole mainland of China will be completed by the end of 2012 (see Appendix 1 for more details).

The project aims to provide nationwide geochemical baseline data, spatial distribution and evolution of all elements, and establish a holistic “China Digital Element Earth”.

China is cooperating with Mongolia in geochemical mapping at a scale of 1:1M covering an area of approximately one million km<sup>2</sup> across two countries. From 18 July to the 5 August 2009 a team of eight Chinese geochemists trained their Mongolian counterparts in sampling techniques (see Appendix 2 for more details).

*CCOP countries:* The CCOP Member Countries are very keen to undertake the Geochemical Baseline Programme in their region but, due to lack of financial and technical support, it has not yet been possible to start the project (see Appendix 2 for more details).

*India:* The National Geophysical Research Institute (NGRI) collected soil samples from the states of Jammu and Kashmir in 2009. This marked the completion of sampling top and bottom soils throughout the country. The samples have been analysed by XRF at NGRI for 25 elements. Interpretation of the data, based on geochemical maps for both top soil and bottom soil, is in progress and geochemical maps for top soil may be released in early 2010. High-resolution sampling using a grid of 10 x 10 km cells is not yet started and will be initiated after completing the top soil maps in 2010. Dr Pradip Govil presented a paper at the Global Geochemical Mapping Symposium held in China during October 9-16, 2009. He also participated in the discussions held for a new International Research Centre for Geochemical Mapping in China and it was suggested to initiate the geochemical baseline work in the neighbouring countries in the Indian sub-continent.

*Africa:* Specialists from BGS and GTK (Finland) ran a workshop on geochemical mapping techniques in Kaduna, Nigeria, from 19-23 Jan 2009. Over 50 people attended, including staff from the Nigerian Geological Survey Agency (NGSA) and Nigerian universities. The workshop was opened by representatives of the Kaduna State Governor and Nigeria’s Minister of Mines and Steel Development, and was covered in the national media. During the week-long workshop, participants were trained in practical sampling techniques, digital mapping, and analysis of geochemical data. The workshop was widely agreed to be a success by both trainers and trainees. The workshop was part of a larger World Bank-funded Nigerian Geochemical Mapping Technical Assistance Project, in which BGS and GTK will provide technical assistance to the NGSA as they develop a national geochemical mapping programme. The geochemical maps will be used for mineral exploration in Nigeria, as well as for environmental issues. Two cells were sampled during 2009 and analysis is already progressing well.

A training course in geochemical survey methods was also run in Entebbe, Uganda, from 18-29 May 2009. The course was part of an IDA and NDF funded project on geochemical mapping, geochemical surveys and mineral resource assessment in selected regions of Uganda. Unfortunately, it is unlikely that a full geochemical survey will be undertaken because of lack of funds.

*Australia:* The National Geochemical Survey of Australia (NGSA) project was initiated in 2006 as part of the Federal Government’s Energy Security Initiative. It aims to provide data and knowledge to support exploration for energy resources in Australia. In particular, it will improve the existing knowledge of the concentrations and distributions of energy-related elements such as uranium and thorium. The project aims to collect catchment outlet (overbank) sediment samples from ~1400 large catchments covering >90% of Australia

using an ultra-low sampling density to keep costs down. Samples are air-dried, split and sieved to <2 mm and <75 µm fractions. The samples are analysed for more than 60 elements using mainly XRF and collision-cell ICP-MS. As of late 2009, 83% of the samples have been collected and most analyses are completed for the first 50% of samples. The project is due for completion in June 2011.

*Brazil:* For more than 30 years, the Geological Survey of Brazil (CPRM) has conducted geochemical mapping at a variety of scales and for a variety of purposes throughout the country. High-density mapping has been conducted for purposes of exploration for metallic mineral resources, phosphate, and diamonds. Low-density studies have been conducted for environmental purposes to define geochemical background distribution for areas of interest. Current research involves orientation surveys to develop methodology for sampling in Amazon landscapes. Projects carried out between 1972 and 2007 have resulted in the collection and chemical and mineralogical analysis of more than 152,000 stream sediments, 85,000 pan-concentrates and 107,000 soil samples. The data are available on-line through the GEOBANK database at <http://geobank.sa.cprm.gov.br/>. Current projects are being carried out at both 1:100000-scale (1 stream sediment sample per 10 km<sup>2</sup>) and 1:250000-scale (1 stream sediment sample per 40 km<sup>2</sup>). These studies are covering approximately 500,000 km<sup>2</sup> and are scheduled to be completed in 2010. The samples are analysed for 53 elements by ICP-MS following aqua regia digestion.

*Colombia:* The Geological Survey of INGEOMINAS of Colombia has been developing systematic geochemical sampling at different sampling densities for the past twelve years in order to compile a national geochemical atlas according to the recommendations of the IGCP Projects 259 and 360 (see Appendix 3). Very useful results are now available, and for the next five years the systematic geochemical sampling will continue. Some chemical analyses were carried out at IGGE of China. Results are available in reports, and were presented in different symposia and meetings related to global geochemical baselines.

*Europe:* 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, 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 2010 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 Keyworth, Nottingham (BGS) on 17-18 March 2009. The focus of the meeting was on the European Groundwater Geochemistry Atlas project using bottled mineral water as sample material as a first approximation of groundwater composition. The water samples were analysed on a *free gratis* basis by BGR (Germany). Minutes of this meeting are attached at Appendix 4. One of the main aims of the meeting was to finalise plans of data processing, presentation, interpretation and writing of chapters with the aim to

complete the manuscript of the atlas by the end of 2009, and its publication in the first half of 2010. Apart from the Atlas, national interpretations will be published in a special issue of the Journal of Geochemical Exploration.

A second business meeting of the Expert Group was held in Belgrade on 24-25 September 2009 to discuss mainly progress on (a) the GEMAS project (Geochemical mapping of agricultural and grazing land soil); (b) the European Groundwater Geochemistry Atlas; and (c) the start of new project on Urban Geochemistry of major European cities using a common approach. Minutes of this meeting are attached at Appendix 5.

The GEMAS project 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/](http://ec.europa.eu/environment/chemicals/reach/reach_intro.htm/)). Sampling of European agricultural and grazing land soil was completed by the end of March 2009. All soil samples were subsequently prepared in Slovakia, and sent to different laboratories for analysis. The first aqua regia results were received in September 2009 and, following an assessment of their quality, national results were sent to the participating countries. The quality control report is available for downloading at <http://www.ngu.no/en-gb/hm/Publications/Reports/2009/2009-049/>. As pointed out in the 2008 report, this study will provide complementary data to that already collected in support of the Global Geochemical Baselines Project. Laboratory standard reference materials will be exchanged with the North American Soil Geochemical Landscapes Project to ensure that soil geochemical data from these two international projects are consistent and comparable.

The EGS Geochemistry Expert Group is also at the final stages of preparation of a textbook on urban geochemical cases studies that will be published in 2010.

*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. In the autumn of 2009, the programme's Website was launched (<http://hantken.mafi.hu/icpdr/>). 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 this year has been to reorganise and update the Task Group's website material, including preparation of templates and uploading material to the server of



the new website provider. The Task Group's website new website was launched in August 2009, and can be viewed at <http://www.globalgeochemicalbaselines.eu/>. There are plans to make the website more dynamic, and to establish links to and from the IUGS and IAGC websites, and all National Geological Surveys. The intention is for the website to represent a forum for the dissemination of information, and to make people aware of the significance of geochemical information and data that have on our daily lives and the quality of the environment in which we live.

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, the Society of Environmental Geochemistry and Health.

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 2000 copies have been distributed to date (1300 copies by EuroGeoSurveys office and over 700 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 32<sup>nd</sup> IGC, Oslo, Norway. About 1500 copies of the DVD were made, and up to now more than 800 copies have been distributed at conferences, congresses and meetings.

## **8. CHIEF PROBLEMS ENCOUNTERED IN 2009**

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 web site development and workshops.

## 9. CHIEF PRODUCTS IN 2009

### *General*

The major products of the Task Group during 2009 were:

- (i) launch of the Task Group's new website [<http://www.globalgeochemicalbaselines.eu/>];
- (ii) launch of ICPDR website [<http://hantken.mafi.hu/icpdr/>];
- (iii) publication of a special volume of *Applied Geochemistry*, 24(8), August 2009, that focussed on the North American Soil Geochemistry Landscape Project.

### *Articles, Papers and Atlases*

De Vivo B, Bove M, Lima A, Albanese S, Cicchella D, Frizzo P, Sabatini G, Di Iella LA, Protano G, Raccagni L, Riccobono F and Grezzi G. 2009. *Atlante geochemico-ambientale d'Italia* (The Geochemical Atlas of Italy addresses the need for a large scale geochemical mapping based on FOREGS procedures). Aracne Editrice Srl, Rome, 516 pp.

Reimann C, Matschullat J, Birke M and Salminen R. 2009. Arsenic distribution in the environment: The effects of scale. *Applied Geochemistry*, **24(7)**, 1147-1167.

The following papers were published in a Special Issue of *Applied Geochemistry*, Volume 24, Issue 8: "Geochemical Studies of North American Soils: Results from the Pilot Study Phase of the North American Soil Geochemical Landscapes Project" (Guest Editor: David B Smith):

Smith D B. 2009. Geochemical studies of North American soils: Results from the pilot study phase of the North American Soil Geochemical Landscapes Project. *Applied Geochemistry*, **24(8)**, 1355-1356.

Smith D B, Woodruff L G, O'Leary R M, Cannon W F, Garrett R G, Kilburn J E and Goldhaber MB. 2009. Pilot studies for the North American Soil Geochemical Landscapes Project – Site selection, sampling protocols, analytical methods, and quality control protocols. *Applied Geochemistry*, **24(8)**, 1357-1368.

Woodruff L G, Cannon W F, Eberl D D, Smith D B, Kilburn J E, Horton J D, Garrett R G and Klassen R A. 2009. Continental-scale patterns in soil geochemistry and mineralogy: Results from two transects across the United States and Canada. *Applied Geochemistry*, **24(8)**, 1369-1381.

Klassen R A. 2009. Geological controls on soil parent material geochemistry along a northern Manitoba–North Dakota transect. *Applied Geochemistry*, **24(8)**, 1382-1393.

Eberl D D and Smith D B. 2009. Mineralogy of soils from two continental-scale transects across the United States and Canada and its relation to soil geochemistry and climate. *Applied Geochemistry*, **24(8)**, 1394-1404.

Garrett R G. 2009. Relative spatial soil geochemical variability along two transects across the United States and Canada. *Applied Geochemistry*, **24(8)**, 1405-1415.

Chiprés J A, de la Calleja A, Tellez, J I, Jiménez, F, Cruz, C, Guerrero E G, Castro J, Monroy M G and Salinas J C. 2009. Geochemistry of soils along a transect from Central Mexico to the Pacific Coast: A pilot study for continental-scale geochemical mapping. *Applied Geochemistry*, **24(8)**, 1416-1428.

Bern C R. 2009. Soil chemistry in lithologically diverse datasets: The quartz dilution effect. *Applied Geochemistry*, **24(8)**, 1429-1437.

Garrett R G, Hall G E M, Vaive J E and Pelchat P. 2009. A water-leach procedure for estimating bioaccessibility of elements in soils from transects across the United States and Canada. *Applied Geochemistry*, **24(8)**, 1438-1453.

Morman S A, Plumlee G S and Smith D B. 2009. Application of in vitro extraction studies to evaluate element bioaccessibility in soils from a transect across the United States and Canada. *Applied Geochemistry*, **24(8)**, 1454-1463.

Griffin D W, Petrosky T, Morman S A and Luna V A. 2009. A survey of the occurrence of *Bacillus anthracis* in North American soils over two long-range transects and within post-Katrina New Orleans. *Applied Geochemistry*, **24(8)**, 1464-1471.

Reeves J B III and Smith D B. 2009. The potential of mid- and near-infrared diffuse reflectance spectroscopy for determining major- and trace-element concentrations in soils from a geochemical survey of North America. *Applied Geochemistry*, **24(8)**, 1472-1481.

Goldhaber M B, Morrison J M, Holloway J A M, Wanty R B, Helsel D R and Smith D B. 2009. A regional soil and sediment geochemical study in northern California. *Applied Geochemistry*, **24(8)**, 1482-1499.

Morrison J M, Goldhaber M B, Lee L, Holloway J A M, Wanty R B, Wolf R E and Ranville J F. 2009. A regional-scale study of chromium and nickel in soils of northern California, USA. *Applied Geochemistry*, **24(8)**, 1500-1511.

Wanty R B, Goldhaber M B, Morrison J M and Lee L. 2009. Regional variations in water quality and relationships to soil and bedrock weathering in the southern Sacramento Valley, California, USA. *Applied Geochemistry*, **24(8)**, 1512-1523.

McCafferty A E and Van Gosen B S. 2009. Airborne gamma-ray and magnetic anomaly signatures of serpentinite in relation to soil geochemistry, northern California. *Applied Geochemistry*, **24(8)**, 1524-1537.

Holloway J A M, Goldhaber M B and Morrison J M. 2009. Geomorphic controls on mercury accumulation in soils from a historically mined watershed, Central California Coast Range, USA. *Applied Geochemistry*, **24(8)**, 1538-1548.

Tuttle M L W and Breit G N. 2009. Weathering of the New Albany Shale, Kentucky, USA: I. Weathering zones defined by mineralogy and major-element composition. *Applied Geochemistry*, **24(8)**, 1549-1564.

Tuttle M L W, Breit G N and Goldhaber M B. 2009. Weathering of the New Albany Shale, Kentucky: II. Redistribution of minor and trace elements. *Applied Geochemistry*, **24(8)**, 1565-1578.

Chiprés J A, Castro-Larragoitia J and Monroy M G. 2009. Exploratory and spatial data analysis (EDA–SDA) for determining regional background levels and anomalies of potentially toxic elements in soils from Catorce–Matehuala, Mexico. *Applied Geochemistry*, **24(8)**, 1579-1589.

Cannon W F and Horton J D. 2009. Soil geochemical signature of urbanization and industrialization – Chicago, Illinois, USA. *Applied Geochemistry*, **24(8)**, 1590-1601.

Grunsky E C, Drew L J and Sutphin D M. 2009. Process recognition in multi-element soil and stream-sediment geochemical data. *Applied Geochemistry*, **24(8)**, 1602-1616.

### ***Other papers***

The following papers use data from the FOREGS/EGS Geochemical Atlas of Europe:

Filzmoser P, Hron K and Reimann C. 2009. Univariate statistical analysis of environmental (compositional) data: Problems and possibilities. *Science of the Total Environment*, **407**, 6100-6108.

Jordan G. 2009. Sustainable mineral resources management: from regional mineral resources exploration to spatial contamination risk assessment of mining. *Environmental Geology*, **58(1)**, 153-169.

The following report was recently brought to our attention by Kaj Lax (Sweden), and is very interesting, because it mentions the FOREGS Geochemical Atlas of Europe and the Global Geochemical Baselines project:

Parkman H (Editor). 2007. Critical Review of “*Metals Environmental Risk Assessment Guidance for Metals*” (MERAG). TemaNord 2007:579, Nordic Council of Ministers, Copenhagen, 85 pp. (<http://www.norden.org/pub/miljo/miljo/uk/TN2007579.pdf> - last accessed on 3/12/2009).

It is worthwhile to quote some examples from this report:

*“Lately the FOREGS data have been made available and may be used to derive typical values for abiotic factors in European freshwaters. The metal concentrations in this database may, with careful considerations, be used as surrogates for current background levels”* (p.9).

*“In addition, the term “natural background” is used alternately with “ambient concentrations” and “background concentrations” in the documents. A more strict definition of “natural” should be presented. The data that are referred to as natural background levels of metals, in the fact sheet should not be used for that purpose, since they are in general extremely high compared to e.g. levels in the FOREGS database”* (p. 19).

*“Instead data from randomised sampling and high spatial coverage should be used to increase the realism of such scenarios. The FOREGS data base may be used to choose typical values for abiotic factors and the metal concentrations in this database may be used as surrogates for current background levels in remote areas. Surrogates for natural background levels may be found in far north. However, the definition of current and natural background level is a complicated issue” (p.22).*

*“The second example is taken from the European geological mapping program of FOREGS (see <http://www.gsf.fi/foregs/geochem/>). This sampling program is based on the same statistical criteria as are used in the global mapping program. That is, randomised sampling and high coverage of the EU countries. This approach will certainly produce data spatially more representative for the EU than aforementioned datasets. Thus, the aim of this mapping program is in FOREGS own words “to show the actual situation within Europe”.*

**Conclusions:**

- 1. Representative data sets in space may rest on randomised sampling and high spatial coverage, as practised by FOREGS.*
- 2. FOREGS water chemical data are to prefer before biased data sets, when calculating “worst case” scenarios for the EU.*
- 3. FOREGS data may be used as surrogates for current background metal levels in remote areas. Surrogates for natural background levels may be found in far north (National data bases).*
- 4. However, the definition of current and natural background level is a complicated issue depending on several factors (fact sheet 3, 1.2.5)” (p.56).*

It is quite apparent from the above that the approach used in the Global Geochemical Baselines project is gradually being accepted by other scientists.

***Other Presentations, Posters, Abstracts and Dissemination of Promotional Material***

Abstract for oral presentation at the international meeting on “*Practical Applications of Medical Geology*” organised by the British Geological Survey, Keyworth, 19-20 March 2009, and supported by the Society of Environmental Geochemistry and Health (SEGH) and the International Medical Geology Association (IMGA).

Reimann C. 2009. *EGG: European Groundwater Geochemistry Part I: Mineral Water*. See abstract at <http://nora.nerc.ac.uk/7492/1/OR09026.pdf> - last accessed on 3/12/2009).

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Xie X. 2009. Outlines of global geochemical mapping program. Abstracts, Global Geochemical Mapping Symposium, Langfang, China, October 10 – 12, 2009, p. 1 – 4.

Bogan J and Ottesen R-T. 2009. Global geochemical mapping and sediment associated flux of major world rivers. Abstracts, Global Geochemical Mapping Symposium, Langfang, China, October 10 – 12, 2009, p. 5.

Smith D B. 2009. National-scale geochemical mapping in the United States: History and progress. Abstracts, Global Geochemical Mapping Symposium, Langfang, China, October 10 – 12, 2009, p. 6 – 9.

Rencz A. 2009. Evolution of geochemical surveys at the Geological Survey of Canada. Abstracts, Global Geochemical Mapping Symposium, Langfang, China, October 10 – 12, 2009, p. 10.

Chiprés J A and Moreira F. 2009. Current activities and advances of the soil geochemical mapping in Mexico. Abstracts, Global Geochemical Mapping Symposium, Langfang, China, October 10 – 12, 2009, p. 11 – 12.

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de Caritat P. 2009. The National Geochemical Survey of Australia: Rationale, strategy and progress. Abstracts, Global Geochemical Mapping Symposium, Langfang, China, October 10 – 12, 2009, p. 15 – 19.

Cloete M, Elsenbroek J H and Strauss S W. 2009. Regional geochemical mapping in South Africa and future planning. Abstracts, Global Geochemical Mapping Symposium, Langfang, China, October 10 – 12, 2009, p. 20 – 23.

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Tarvainen T. 2009. Geochemical mapping in Finland: Progress and future plans. Abstracts, Global Geochemical Mapping Symposium, Langfang, China, October 10 – 12, 2009, p. 29 – 30.

Cheng Z, Xie X, Zhang Q and Yao W. 2009. Multi-element geochemical mapping in south China. Abstracts, Global Geochemical Mapping Symposium, Langfang, China, October 10 – 12, 2009, p. 31 – 35.

Govil P K, Krishna A K, Gowd, S S, Machender G, Murthy N and Demri V P. 2009. Global geochemical baseline mapping for environmental management in India: an overview. Abstracts, Global Geochemical Mapping Symposium, Langfang, China, October 10 – 12, 2009, p. 36 – 40.

Wang X, Zhang Q, Chi Q, Nie L and Xie X. 2009. Introduction to China Geochemical Baselines Project. Abstracts, Global Geochemical Mapping Symposium, Langfang, China, October 10 – 12, 2009, p. 41 – 46.

Smith D B. 2009. The IUGS/IAGC Task Group on Global Geochemical Baselines. Abstracts, Global Geochemical Mapping Symposium, Langfang, China, October 10 – 12, 2009, p. 47 – 51.

Horowitz A J. 2009. The effects of land use on fluvial sediment chemistry for the conterminous U.S. Abstracts, Global Geochemical Mapping Symposium, Langfang, China, October 10 – 12, 2009, p. 52 – 54.

Chakraborti D. 2009. Characterization of arsenic bearing sediments in Bengal Delta responsible for groundwater arsenic contamination and sufferings of people in Ganga-Plain. Abstracts, Global Geochemical Mapping Symposium, Langfang, China, October 10 – 12, 2009, p. 55 – 60.

Ottesen R T. 2009. Urban geochemistry in Europe (URGE). Abstracts, Global Geochemical Mapping Symposium, Langfang, China, October 10 – 12, 2009, p. 61.

Xi X. 2009. National multi-purpose regional geochemical survey and eco-geochemistry in China. Abstracts, Global Geochemical Mapping Symposium, Langfang, China, October 10 – 12, 2009, p. 62 – 63.

Xi X, Yang Z, Liao Q, Zhang J, Bai R, Zhang X, Jin L, Wang H, Xia X and Lie M. 2009. Soil organic carbon storage in China on a basis of multi-purpose regional geochemical survey. Abstracts, Global Geochemical Mapping Symposium, Langfang, China, October 10 – 12, 2009, p. 64 – 66.

Zhao C and Cheng H. 2009. A methodology of source tracking of cadmium anomalies and their quantitative estimation along the Yangtze River basin. Abstracts, Global Geochemical Mapping Symposium, Langfang, China, October 10 – 12, 2009, p. 67 – 70.

Zhao G, Sun B, Liu Z, Wei H and Zen D. 2009. Regional geochemical mapping on environmental research. Abstracts, Global Geochemical Mapping Symposium, Langfang, China, October 10 – 12, 2009, p. 71 – 73.

Yang Z, Hou Q, Xia X and Yu T. 2009. Geochemical characteristics of heavy metals in Yangtze River, China. Abstracts, Global Geochemical Mapping Symposium, Langfang, China, October 10 – 12, 2009, p. 74 – 75.

Yang Z, Yu T and Hou Q. 2009. Geochemical cycle of selenium in Fujiang River catchment. Abstracts, Global Geochemical Mapping Symposium, Langfang, China, October 10 – 12, 2009, p. 76 – 79.

Liu D, Lian C, Yuan C and Wu J. 2009. Brief introduction of cooperative geochemical mapping projects by China Geological Survey in Asian, African, and South American countries. Abstracts, Global Geochemical Mapping Symposium, Langfang, China, October 10 – 12, 2009, p. 80.

Extended abstracts for oral and poster presentations focusing on the North American Soil Geochemical Landscapes Project, given at the 24th International Applied Geochemistry Symposium, Fredericton, New Brunswick, June 1 – 4, 2009:

Goldhaber M B, Morrison J M, Wanty R B, Mills C T and Holloway J M. 2009. The landscape geochemistry of the Sacramento Valley, California. Proceedings of the 24th International Applied Geochemistry Symposium, Vol. II, p. 697 – 700.

Goodwin T A, Friske P W B, Ford K L and Grunsky E C. 2009. The North American Soil Geochemical Landscapes Project: preliminary results from Nova Scotia. Proceedings of the 24th International Applied Geochemistry Symposium, Vol. II, p. 701 – 703.

Grunsky E C, Garrett R G, Friske P W and McCurdy M. 2009. Testing the variants of aqua regia digestion using certified reference materials. Proceedings of the 24th International Applied Geochemistry Symposium, Vol. II, p. 705 – 708.

Grunsky E C, Smith D B, Friske P W B and Woodruff L G. 2009. Preliminary results of the North American Soil Geochemical Landscapes Project, northeast United States and Maritime Provinces of Canada. Proceedings of the 24th International Applied Geochemistry Symposium, Vol. II, p. 709 – 712.

Pronk T, Parkhill M A, Boldon R, Desrosiers M, Friske P and Rencz A. 2009. The North American Soil Geochemical Landscapes Project in New Brunswick. Proceedings of the 24th International Applied Geochemistry Symposium, Vol. II, p. 713 – 716.

Smith D B, Woodruff L G, Rencz A and de la Calleja A. 2009. The North American Soil Geochemical Landscapes Project: overview, goals, progress. Proceedings of the 24th International Applied Geochemistry Symposium, Vol. II, p. 717 – 720.

Woodruff L B, Smith D B, Eberl D D and Cannon W F. 2009. Continental-scale patterns in soil geochemistry and mineralogy: results from two transects of the United States and Canada. Proceedings of the 24th International Applied Geochemistry Symposium, Vol. II, p. 721 – 724.

Abstracts for oral presentations given at the National Environmental Public Health Conference, Atlanta, Georgia, October 26, 2009:

Smith D B and Woodruff L G. 2009. The North American Soil Geochemical Landscapes Project: Providing data for exposure assessment. National Environmental Public Health Conference, Atlanta, GA, Oct. 26, 2009.

Woodruff L G, Smith, D B, Eberl D D, Cannon W F, Garrett R G and Klassen R. 2009. Continental-scale variations in soil geochemistry: Implications for human exposure. National Environmental Public Health Conference, Atlanta, GA, Oct. 26, 2009.

Abstract for presentation to the U.S. National Academy of Sciences, Washington, DC, April 17, 2009:

Smith D B. 2009. The North American Soil Geochemical Landscapes Project: Overview, goals, and progress. Invited presentation to the U.S. National Committee for Soil Science, National Academy of Sciences, Washington, DC, April 17, 2009.

***Others:***

The Arthur G. Darnley memorial DVD was distributed to participants at different meetings, including:



- (a) international meeting on “*Practical Applications of Medical Geology*”, British Geological Survey, Keyworth, 19-20 March 2009;
- (b) kick-off meeting of the European Commission co-financed eContentplus project “*Assessment and strategic development of INSPIRE compliant Geodata-Services for European Soil Data (GS Soil)*”, Hannover, Germany, 3-4 June, 2009 (<http://www.gssoil.eu/>);
- (c) progress meeting of the European Commission co-financed project “*Nano-particle products from new mineral resources in Europe (ProMine)*”, Thessaloniki, Greece, 6-9 October, 2009; and
- (d) the March and September 2009 meetings of the EuroGeoSurveys Geochemistry Expert Group.

## 10. SUMMARY OF EXPENDITURES IN 2009

The Task Group has received 4000 USD from IUGS in 2009. 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 pilot studies in the US and Canada for the proposed soil geochemical survey of North America is estimated to have been approximately US \$0.5M in 2007 and approximately US \$1.6M over the 3-year pilot phase of the project. Total costs for carrying out the soil geochemical survey of North America are estimated to be US \$15-20M over the next ten years. There has also been considerable expenditure within India, China, Australia Brazil, Nigeria and Colombia.

It should be mentioned that the cost of the Data Management Workshop in Athens was more than 6000 US\$, of which only 2958 US\$ were debited to the TGGGB's account. The annual fee for hosting the Task Group's Website was approximately 153 US\$.

## 11. WORK PLAN FOR NEXT YEAR

The next business meeting of the Task Group will take place in 2010. It will either be timed to coincide with the annual business meeting of the EuroGeoSurveys Geochemistry Expert Group, scheduled for autumn of 2010 in Athens (Greece) 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 2010 will be to pursue opportunities within Africa and the CCOP countries. This will be very much dependant on securing appropriate funds from IUGS (see section 13).

The revision of the FOREGS Geochemical Mapping Field Manual (Salminen *et al.*, 1998) has started, and will be completed in 2010. It will include new details on sampling in karstic terrains, prepared by A Demetriades, S Pirc, M Bidovec and F Sustersic, and other key terrains, such as tropical, desert and arctic.

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.

The activities of the EuroGeoSurveys Geochemistry Expert Group, under the chairmanship of Clemens Reimann, will continue with the "*Geochemical Mapping of Agricultural and Grazing Land Soil*" project, quality control of incoming analytical results, archiving of analytical data, data processing and interpretation. An extra day at the 2010 Athens autumn meeting will be devoted to the presentation of national interpretations on the aqua regia results. The EuroGeoSurveys Atlas of "*European Groundwater Geochemistry: Bottled water*" will be published by Schweizerbart; the EuroGeoSurveys book entitled "*Mapping the Chemical Environment of Urban Areas*" will be published by Wiley; and a Special Issue of the Journal of Geochemical Exploration will be devoted to the national interpretations on the geochemistry of European groundwater using bottled water as the sampling medium.

## **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. This funding has come primarily from national geological surveys and other scientific institutions in participating countries. For example, the North American Soil Geochemical Landscapes Project, funded primarily by the U.S. Geological Survey, the Geological Survey of Canada, and the Mexican Geological Survey, is spending well over US \$1M per year to collect and analyse soil samples from about 1800 sites in North America. Anticipated expenditures in Europe for the GEMAS project are estimated to be in excess of US \$1.2M over 4 years, approximately half of which will be provided from industry. Ongoing national-scale geochemical surveys in Australia, Brazil, China, Colombia and India are funded in a similar manner. 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. 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 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\$25000 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 1995-2005 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 2010 or 2011. With this report, we formally ask the IUGS Executive Committee to consider, without any reservations, the review committee's recommendation for this increased funding and officially request US\$30000 in 2010. A similar request was turned down in 2008 because of IUGS commitments to IGC. We ask for reconsideration in 2010. 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 1998-2009**

- 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](http://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.
- 1999 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.
- 1999 Launch of the south-western China Geochemical Atlas of 76 Elements Project.
- 2000 Symposium on geochemical baseline activities was 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 to 17 November).

- 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 to 25 April 2002).
- 2002 Sampling and analysis completed in Southern India. Pilot studies partially completed within Colombia and Brazil. A major new campaign under the auspices of the Coordinating Committee for Geoscience Programmes in East and Southeast Asia is currently in the planning stages.
- 2003 Annual Business Meeting of the FOREGS Working Group held in Dublin, Ireland (18 to 21 March 2003).
- 2003 Quality control of the analytical results of the FOREGS project completed.
- 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 32<sup>nd</sup> International Geological Conference, Florence, Italy, 20-28 August 2004, 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.
- 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 23<sup>rd</sup> 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 32<sup>nd</sup> 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 Athens (Greece), 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.

## 15. REFERENCES

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International Union of Geological Sciences Strategic Planning Committee. 2000. *International Earth Science in the 21<sup>st</sup> Century. Science and Organisational Strategy for the International Union of Geological Sciences*. Trondheim, Norway, International Union of Geological Sciences, 49p.

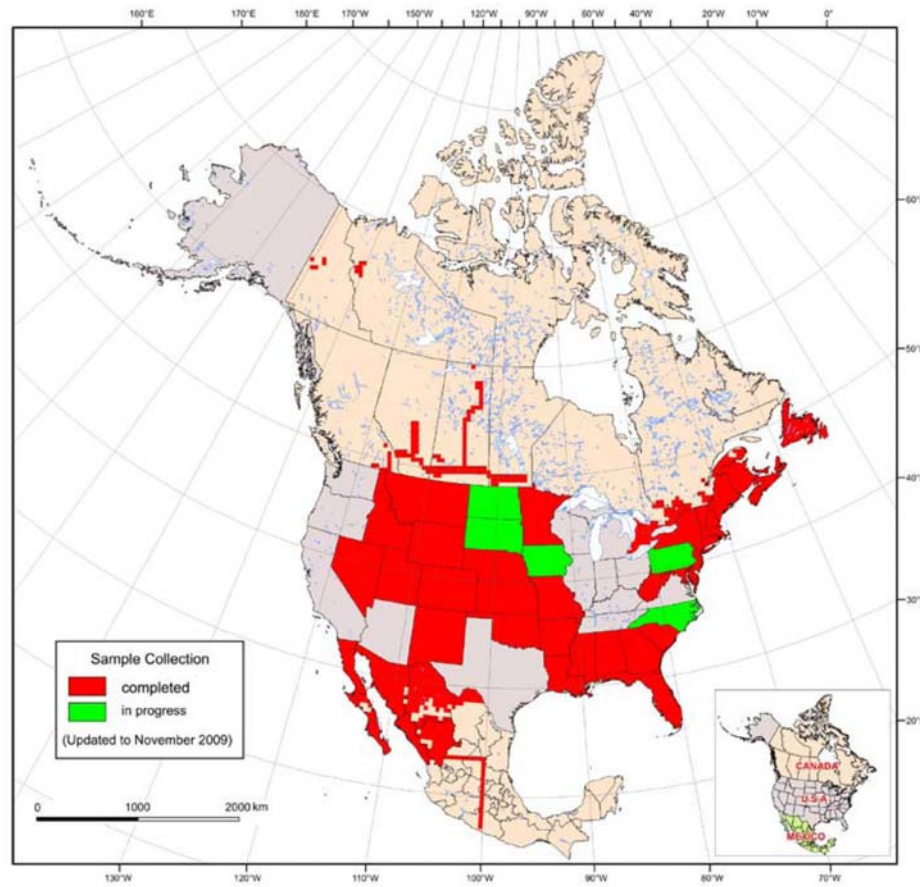
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NAME: Mr Shaun Reeder  
 POSITION: Scientific Secretary  
 DATE: 21 December 2009  
 ADDRESS: British Geological Survey  
 Keyworth, Nottingham, United Kingdom, NG12 5GG  
 TELEPHONE: +44 (0)115 936 3523  
 FACSIMILE: +44 (0)115 936 3261  
 E-MAIL: [s.reeder@bgs.ac.uk](mailto:s.reeder@bgs.ac.uk)

Figure 1 Progress to date on the North American Soil Geochemical Landscapes Project (NASGLP), as of November 2009.



## **Appendix 1**

**Global Geochemical Mapping Symposium in China**

**Langfang, China  
9-12 October 2009**

# **SUMMARY OF Global Geochemical Mapping Symposium in China**

October 9-12, 2009, Langfang, China

## **A. INTRODUCTION**

1. The Global Geochemical Mapping Symposium was held on October 10–12, 2009, at the Langfang International Hotel, Langfang, China.
2. The Symposium was sponsored by the China Geological Survey (CGS), and organized by the Institute of Geophysical and Geochemical Exploration (IGGE). The Chairman of the Organizing Committee was Dr. Wang Min, Deputy Minister of the Ministry of Land and Resources and Director of the China Geological Survey. The Chair of the Symposium was Prof. Xie Xuejing, Honorary Director of the IGGE.
3. The purposes of the symposium were to: (1) share methodology and experience of geochemical mapping at regional to continental scales; (2) discuss future options for global geochemical mapping; specifically, the feasibility of using delta and overbank sediments as sampling media; (3) discuss the possibility of establishing the International Research Center for Global Geochemical Mapping to promote the implementation of global-scale geochemical mapping; and (4) visit the lower reaches of the Yangtze River to view delta sediment sampling sites and discuss the proposed sampling protocols.
4. The Symposium was divided into 4 sections: (i) Opening Ceremony, (ii) Thematic Presentations, (iii) Discussion, and (iv) Field Trip.
5. Fifty registered participants from Canada, USA, Mexico, Colombia, Australia, South Africa, Norway, Finland, Germany, India, and China attended the symposium.

## **B. OPENING CEREMONY**

1. Prof. Xie Xuejing hosted the Opening Ceremony. He welcomed all participants to the Symposium and to the beautiful city of Langfang. He expressed his gratitude to all members of the organizing committee. He also thanked all participants for their contributions to the symposium.
2. Dr. Zhong Ziran, deputy Director of the China Geological Survey, delivered his opening remarks and welcomed all participants to China. He expressed his warmest congratulations to the organizers and attendees of the symposium, and extended a cordial welcome to the geochemists from ten countries. He highlighted that geochemical mapping projects conducted by the CGS over the past 30 years, have made great contributions to discoveries of mineral resources, environmental assessments, land use



and agricultural planning, etc. He also highlighted that establishing a global geochemical database and its representation in map form is a grand and challenging scientific activity to be contributed to humanity by the geochemists from all nations. He expressed that the China Geological Survey will continue to support the implementation of the global geochemical mapping program, and make positive contributions to sustainable resource development and understanding our environment at the national and global scale.

3. Dr. Dong Shuwen, Deputy President of the Chinese Academy of Geological Sciences (CAGS), highlighted the unique role of geochemical mapping in mineral exploration, environmental assessment, and basic geological studies. Dr. Dong, on behalf of the Chinese Academy of Geological Sciences and the China Committee of the IGCP, expressed full support for the establishment of the International Research Center for Global Geochemical Mapping in the IGGE. He was confident that the Center will make great contributions to (1) refining the recommended standardized methodology of Darnley et al. (1995) for obtaining comparable geochemical data for the entire land surface of the Earth, (2) facilitating the implementation of this methodology throughout the world; (3) transferring this knowledge and technology to developing countries, and (4) fostering the application of the technology to related fields.

### **C. Thematic Presentations**

A total 23 oral presentations were given in the symposium (speaker's name in bold):

1. Global Geochemical Mapping and Sediment Associated Flux of Major World Rivers: **Prof. Rolf Tore Ottesen** (Geological Survey of Norway), and Prof. Jim Bogen, (Norwegian Water Resources and Energy Administration).
2. Outline of Global Geochemical Mapping Program: **Prof. Xie Xuejing** (Institute of Geophysical and Geochemical Exploration, China).
3. National-scale Geochemical Mapping in the United States: History and Progress: **Dr. David B. Smith** (U.S. Geological Survey).
4. Evolution of Geochemical Surveys at the Geological Survey of Canada: **Dr. Andrew Rencz** (Geological Survey of Canada).
5. Current Activities and Advances of the Soil Geochemical Mapping in Mexico: **Dr. J.A. Chiprés**, Universidad Autónoma de San Luis Potosí, Mexico.
6. Geochemical Atlas of Colombia, Exploring the Colombian Territory: **Dr. Gloria Prieto** (INGEOMINAS, Colombia).
7. The National Geochemical Survey of Australia: Rationale, Strategy and Progress: **Dr. Patrice de Caritat** (Geoscience Australia).

8. Regional Geochemical Mapping in South Africa and Future Planning: **Dr. M. Cloete** (Council for Geoscience of South Africa).
9. Progress of Geochemical Mapping in Germany: **Dr. Manfred Birke** (Bundesanstalt für Geowissenschaften und Rohstoffe, Germany).
10. Geochemical Mapping in Finland: Progress and Future Plans: **Dr. Timo Tarvainen** (Geological Survey of Finland).
11. Multi-element Geochemical Mapping in South China: **Dr. Cheng Zhizhong** (Institute of Geophysical and Geochemical Exploration, China).
12. Global Geochemical Baseline Mapping for Environmental Management in India: an Overview: **Dr. Pradip K. Govil** (National Geophysical Research Institute, India).
13. Introduction to China Geochemical Baselines Project: **Dr. Wang Xueqiu** (Institute of Geophysical and Geochemical Exploration, CAGS, China).
14. The IUGS/IAGC Task Group on Global Geochemical Baselines: **Dr. David B. Smith** (U.S. Geological Survey).
15. The Effects of Land Use on Fluvial Sediment Chemistry for the Conterminous U.S.: **Dr. Arthur J. Horowitz**, (U.S. Geological Survey).
16. Characterization of Arsenic Bearing Sediments in Bengal Delta Responsible for Groundwater Arsenic Contamination and Sufferings of People in Ganga-Plain: **Dr. Dipankar Chakraborti** (School of Environmental Studies, Jadavpur University, India).
17. Urban Geochemistry in Europe (URGE): **Prof. Rolf Tore Ottesen** (Geological Survey of Norway).
18. National Multi-purpose Regional Geochemical Survey and Eco-geochemistry in China: **Prof. Xi Xiaohuan** (China Geological Survey).
19. Soil Organic Carbon Storage in China on a Basis of Multi-purpose Regional Geochemical Survey: **Prof. Li Min** (China Geological Survey).
20. A Methodology of Source Tracking of Cadmium Anomalies and Their Quantitative Estimation Along the Yangtze River Basin: **Dr. Zhao Chuandong** (Institute of Geophysical and Geochemical Exploration, CAGS, China).
21. Regional Geochemical Mapping focused on Environment: **Dr. Zhou Guohua** (Institute of Geophysical and Geochemical Exploration, CAGS, China).

22. Geochemical Characteristics of Heavy Metals in Yangtze River, China: **Dr. Hou Qingye** (School of the Earth Sciences and Resources, China University of Geosciences).
23. Geochemical Cycle of Selenium in Fujiang River Catchment: **Dr. Yu Tao** (School of the Earth Sciences and Resources, China University of Geosciences).

## **D. DISCUSSION**

*Co-Presided by Prof. Xie Xuejing of IGGE, China and Dr. David Smith of US Geological Survey*

The discussions were mainly focused on two topics:

1. The possibility of establishment of the International Research Center for Global Geochemical Mapping under UNESCO, and
2. The feasibility of using delta and overbank sediments as sample media for global geochemical mapping, starting with developing a data base for delta sediments taken at the mouths of 26 world major rivers.

### **Dr. David Smith**

At the beginning of discussion, Dr. Smith gave a review of the chapter titled “Implementation” in the “Blue Book” (A Global Geochemical Database, Final Report of IGCP 259, Darnley, et al., 1995). This chapter recognizes the need for a central, government-funded agency to coordinate the implementation of global geochemical mapping protocols recommended by the Blue Book.

...“Because of the number of organizational and technical steps involved (*in the implementation of global geochemical mapping programme*) 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. The systematic approach which is required militates against an ad hoc temporary organization.”...

“Assuming that the importance of the 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.”...

### **Prof. Xie Xuejing**

Prof. Xie stressed that all kinds of negotiation channels (e.g., scientist to scientist, government to government, and also UNESCO to governments)

should be established for the efficient implementation of global geochemical mapping.

Prof. Xie expressed his opinion that if the Center is established, it will get strong support from the China Geological Survey, the Ministry of Land and Resources, and as well as other related government agencies in China. According to the guidelines of UNESCO, the activities of the Center will be guided by an international scientific committee, or governing board, consisting of representatives from UNESCO, IUGS, China Geological Survey, Chinese Academy of Geological Sciences, IGGE, and other related scientific organizations. The Center will have its own full-time staff to coordinate and evaluate research proposals, carry out research projects, coordinate the accumulation of appropriate geochemical data sets throughout the world, establish metadata for these data sets, design and manage a consistent global geochemical database, solicit funds from appropriate organizations for carrying out global-scale sampling, and other routine management activities.

Prof. Xie also addressed concerns from some participants about the possible funding sources, scientific committee structure, and the governing board for the Center.

#### **Dr. Wang Xueqiu**

Dr. Wang Xueqiu briefly introduced the rationale for proposing the establishment of the International Center in China under the auspices of UNESCO. Firstly, the government of China greatly supports establishing such international centers related to mineral resources and environmental problems. For example, the Chinese government has given great support to establish the International Center for Karst Geology, located in China, last year. Secondly, the CGS and the CAGS strongly support the Center's being housed within the IGGE in Langfang. Thirdly, it is an appropriate time to submit such a proposal to UNESCO, because the year 2011 will be the International Year of Chemistry, which "will draw attention to the UN Decade of Education for Sustainable Development 2005-2014 and ...will emphasize the importance of chemistry in sustaining natural resources".

#### **Prof. Rolf Tore Ottesen:**

Prof. Ottesen from Norway stated that he strongly supports the establishment of the Center in the IGGE. He also expressed that he and his colleagues have advocated for many years the use of delta and overbank sediments as sampling media for global-scale geochemical mapping (<http://www.globalgeochemistry.org/>) and will, of course, continue to support such activities through the proposed International Center.

Other participants expressed their support for establishing the Center and made suggestions for issues to be addressed by the Center:

- (i) to encourage governments to allow and to support their scientists in participating in Global Geochemical Mapping activities;.
- (ii) to support additional research on sampling methodology for ultra-low density geochemical mapping;.
- (iii) to promote multidisciplinary research that will demonstrate the usefulness of geochemical mapping in addressing issues related to global climate change, environmental sustainable development, water resources protection, etc.
- (iv) to give training courses for geochemists from the developing countries and university students.

All participants were in general agreement on the following points:

- (i) There is a clear need for a single permanent agency, governed by an external advisory committee, to accept formal responsibility for securing funds, managing and coordinating global geochemical mapping activities. For this goal, all the participants support the establishment of the International Research Center for Global Geochemical Mapping to be located at the IGGE in Langfang, China. All participants agreed to send their comments and revisions for the preliminary proposal provided by Prof. Xie Xuejing when they get back to their home countries. The IGGE will prepare the final proposal and documents according to the UNESCO guidelines.
- (ii) A global geochemical database is urgently needed for resource and environmental management throughout the world. The IUGS/IAGC Task Group on Global Geochemical Baselines promotes and facilitates the implementation of geochemical mapping programs to ensure compatibility with the 'Blue Book' and will provide advice and guidance to the proposed Center.
- (iii) Using delta and overbank sediments may provide the fastest way to produce a simplified global geochemical map. The success of such an approach has been demonstrated in China. Research in different geographic and geomorphologic landscapes, particularly in continents without many large rivers (e.g., Africa and Australia) is still needed. The implementation of the delta and floodplain sampling remains a major problem because of lack of funding in most countries.

## **E. FIELD TRIP**

After the symposium, a 4-day field trip was organized for overseas participants to Nanjing and Shanghai to visit.

- (i) The sample storage facility of the Eco-geochemical Survey Project of Jiangsu Province, China;
- (ii) Jiangsu Geological Museum, which is also the office house of the former China Geological Survey;
- (iii) Pilot sampling sites for delta sediments in Zhangjiagang and Chongming Island at the lower reaches of Yangtze River.

## **ACKNOWLEDGEMENT**

All participants expressed their sincere appreciation to the organizing committee for excellent arrangements and the China Geological Survey for the funding of symposium.

## **Appendix 2**

**Annual report from China and some Asian countries**

## **Annual report from China and some Asian countries**

### **China Geochemical Baselines**

China Geochemical Baselines Project (CGBP) was launched in 2008 and a 5-year term from 2008 to 2012 was designed for covering the whole China mainland. The project is to provide China nationwide geochemical baseline data, spatial distribution and evolution of all elements, and finally to establish a holistic “China Digital Element Earth”. Approximately 1500 CGB grids cover the whole China mainland (9.6 millions km<sup>2</sup>). Each CGB grid is approximately equal to a quarter of one Global Reference Network (GRN) grid. Total 6 000 soil (overbank/floodplain) samples and 15 000 typical rock samples will be collected in the whole China. Nearly all elements except gases in the periodic table will be determined by ICP-MS/AES following 4-acid digestion and XRF following fusion as backbone methods combined with other 10 methods. Analytical quality is under strict control by using standard reference samples. The database and maps will be managed through an Internet-based software named Digital Element Earth.

One year pilot study was begun in 2008 to test and refine the recommended protocols and to optimize field logistics for the geochemical sampling. In 2009, approximately 1600 soil samples and 3000 rock samples have been collected. It is expected to publish the whole data and atlas in 2013.

### **Geochemical Mapping across the Boundary Regions of China and Mongolia**

China is cooperating with Mongolia in geochemical mapping at Scale of 1:1Million covering an area of approximately one million sq km across two countries. The project was launched in 2008 under the agreement issued by the China Geological Survey and Mineral Resources and Petroleum Authority of Mongolia. The Institute of Geophysical and Geochemical Exploration will offer help with sampling training and free chemical analysis for the samples from Mongolia.

A group of 8 geochemists from China went to Mongolia for training and sampling from July 18 to August 5, 2009. A training course on 1:1 M geochemical mapping was given by Dr. Wang Xueqiu. Total 22 persons have participated in the training course including a half-day lecture, 3-day field sampling training in east Mongolia grassland region and 5-day field sampling training in the South Mongolia Gobi desert region.

An area of 350 000 km<sup>2</sup> have been covered with one sample per 100km<sup>2</sup> till 2009. 54 elements are determined for each sample. It is expected to publish the geochemical atlas in 2011.

### **CCOP Geochemical Baseline Programme**

The CCOP Member Countries are very keen to have Geochemical Baseline Programme in their region. In 2008, in the IUGS/IAGC Task Group on Global Geochemical Mapping business meeting during the 33rd IGC in Oslo, the CCOP Coordinators expressed that the CCOP has decided to coordinate the implementation of the geochemical baseline programme in the member countries. The CCOP would like to have financial and technical support from



the China Geological Survey, which is one of CCOP members. Dr. Wang Xueqiu has written a formal proposal report to the CGS. The proposal report includes 4 parts: background, technology available, implementation stages, and cooperation ways and financial support. After the report was evaluated by the CGS, a project protocol has been submitted to the CGS. The protocol gives implementation of the CCOP geochemical mapping programme with the following stages:

**Stage 1: Manual preparation and Training courses (the 1<sup>st</sup> year)**

A seminar should be held on discussion on the cooperation ways. The CCOP countries are diverse in landscape with mountains, forestry, grassland, desert and agriculture land. Sampling manual has to be adapted to the diverse geographical and geomorphologic landscapes based on the IGCP259/360 final report "the Blue Book". Training courses should be given for the people who will take in charge of sampling, analyses and map production.

**Stage 2: Global-scale Geochemical Baseline (the 2<sup>nd</sup> and 3<sup>rd</sup> year)**

A Global-scale Geochemical Baseline project will be conducted in the all CCOP countries using wide-spaced sampling according to the Global Reference Networks (GRN) grid based on the IGCP360 final report "the Blue Book".

**Stage 3: National-scale Geochemical Mapping (the 4<sup>th</sup> years up to the 10<sup>th</sup> year)**

The Member Countries can carry out National-scale geochemical mapping project in their respective states. The sampling densities used depend on their countries size, budget, time duration and objectives. A proposal sampling densities used are referred to the following table.

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

## **Appendix 3**

### **Report of the Geochemistry Program in Colombia**

**Report of the Geochemistry Program in Colombia**  
**Prieto Gloria - [gprieto@ingeominas.gov.co](mailto:gprieto@ingeominas.gov.co)**

Responding to the call of the International Geochemical Mapping Project (Projects 259 and 360 of UNESCO, Darnley et al., 1995) headed by the Dr. Arthur Darnley, the Geologic Service of INGEOMINAS promoted from 1996, a geochemistry program using a systematic sampling in bi-dimensional network, stratified, balanced, and random, that took as sampling unit the drainage river basin, following the IGCP projects recommendations. The main target of the program was to acquire systematic data, multimedia and multipurpose that contributes to improve the knowledge of the Colombian territory as base to solve problems of the population in health, agriculture planning, resources and environment.

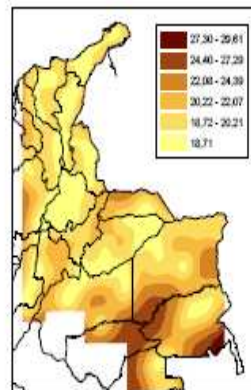
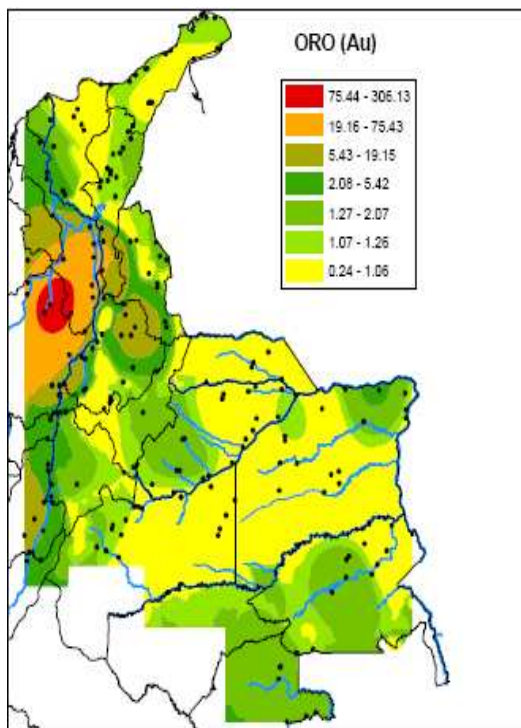
The project began in 1997 with a diagnosis of the geochemistry information of Colombia that allowed promoting low density sampling projects since 1998. The initial programs were carried out during 1998 up to 2004, and in its execution samples of stream sediments, overbank and floodplain sediments, soils and waters were systematically collected. Large regions of Colombia were covered with ultra low density sampling (ULD) (Figures 1, 2, 3), (600.000 km<sup>2</sup> -1 sample/1600 km<sup>2</sup>); very low density, (327.000 km<sup>2</sup> - 1 sample/400 km<sup>2</sup>), low density, (9.600 km<sup>2</sup> - 1 sample/100 km<sup>2</sup>) and high density (6.000 km<sup>2</sup> -1 sample/25 km<sup>2</sup>, 1 sample/1 km<sup>2</sup>).

Following similar methodologies, INGEOMINAS continues developing systematic geochemical sampling of regional exploration using stream sediments. From 2006 until 2009 systematic sampling was carried out collecting 1 sample/9km<sup>2</sup>, covering the zone of the Esmeraldiferous Belts of Colombia, the Savannah of Bogotá and some parts of the high Magdalena River Basin,. On the Atlantic Coast of Colombia, it was covered 24.000 km<sup>2</sup> in the region of the Sierra Nevada of Santa Marta (1 sample/4 km<sup>2</sup>) and 7.200 km<sup>2</sup> of the region of the Alta Guajira. In the last one region, for being a semi arid zone, with ephemeral drainages that are active only during high rains, and it is strongly influenced by marine winds, sediments of the river bed have been used as sampling media as well as soils that generally are poor developed. Similar sampling programs have been carried out along the middle Magdalena River basin, Eastern Colombia covering the Eastern Plains and the Catatumbo Region.

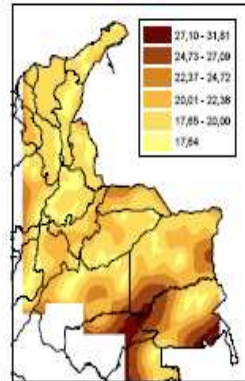
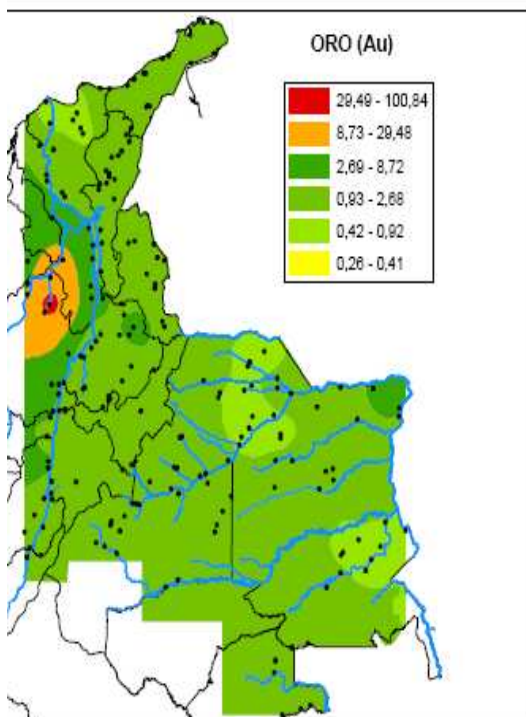
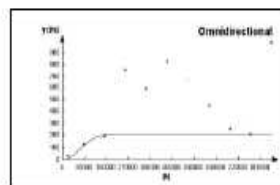
In order to organize the geochemical information produced by INGEOMINAS since 1917 up today, a Geochemical Data Base (GDB) (Figure- 4) was developed. Up to the moment the GDB contain information of 161.588 sampling stations supporting 1.671.000 records including coordinates, sampling methodologies, chemical analysis (methodologies, QA/QC parameters), reports, photos, and maps. As a Service of geochemical information for entities and public users there were produced a map of geochemical anomalies (historic and news) (Figures 5, 6) and a map of zones with geochemical potential for detailed mineral exploration. The geochemical information of INGEOMINAS could be consulted on line (station sampling, chemical analysis, geochemical anomalies, and zones with geochemical potential for mineral exploration).

This geochemical program allowed to INGEOMINAS to acquire experience in systematic multipurpose sampling, as well as in processing geochemical information and producing thematic maps for entities and mining investors. At the same time this program allowed compiling and organizing geochemical information and advancing in geochemical knowledge of the territory, to contribute to define the geochemical baselines of Colombia and to define zones and regions of domain of elements interesting for mineral resources exploration, agricultural planning, health and environment studies, and for land-use planning. The results of this program demonstrated that the systematic geochemical sampling are useful independent of the sampling density (Figure ---) and are practical to define geochemical baselines of Colombia, as well as geochemical distribution patterns, and to identify zones of concentration or impoverishment of elements or its associations. Specific reports focused in using this geochemical information to solve regional and local problems have been produced.

INGEOMINAS will continue its geochemical program for 2010 covering new zones with ULD sampling and also carrying out regional cartography at low and high density sampling. New applications to medical and environmental geochemistry have been carried out in 2009 and will continue for the next years.



Límite de detección: 0.2 ppb  
 Análisis : AAN / CP-GF-AAS  
 Medio de muestreo: Sedimentos superficiales de llanuras de inundación



Límite de detección: 0.2 ppb  
 Análisis : AAN / CP-GF-AAS  
 Medio de muestreo: Sedimentos profundos de llanuras de inundación

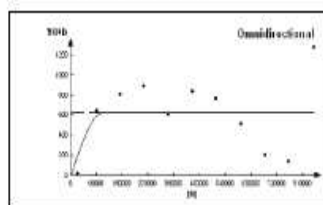
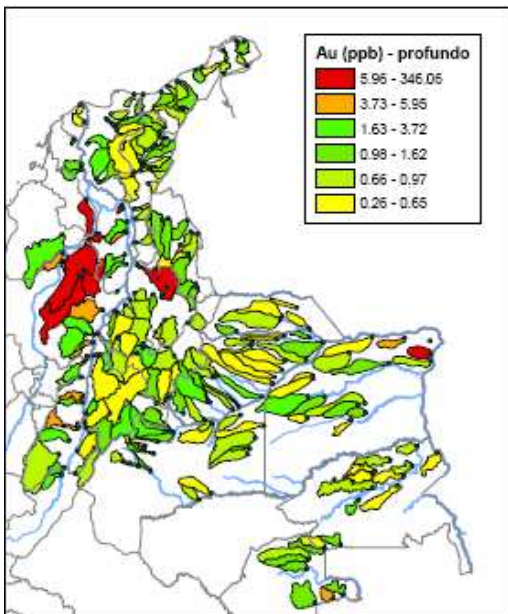
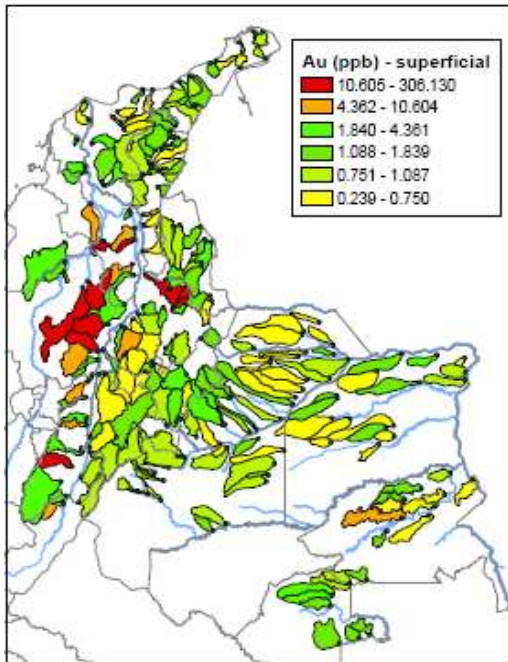
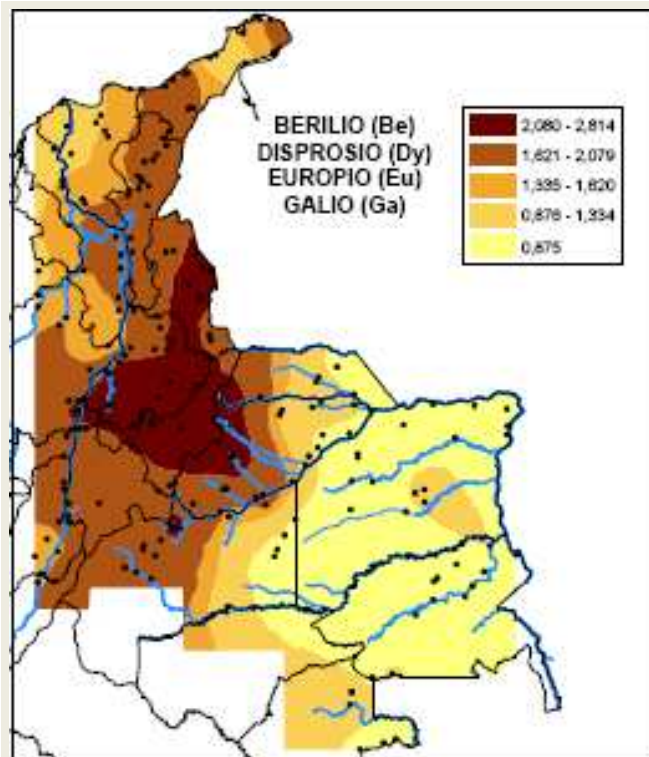


Figure 1. Distribution of Au from Ultra Low Density sampling



ORO (Au)  
 Límite de detección: 0.20 ppb  
 Análisis : AAN / CP-GF-AAS

**Figure 2.** Concentration of Au by basins from Ultra Low Density sampling



**Figure 3.** Association of elements from Ultra Low Density sampling

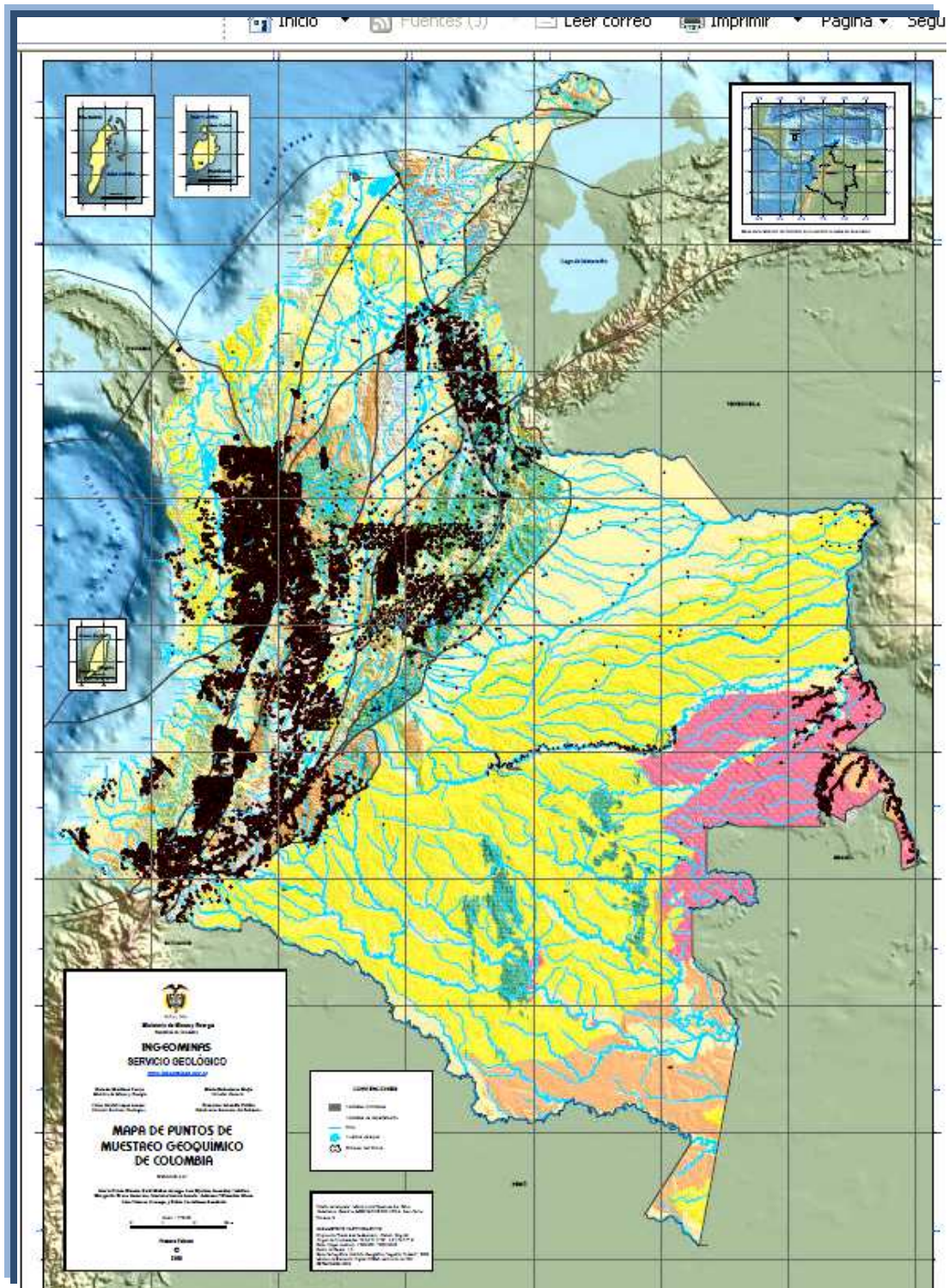


Figure 4. Sampling stations map

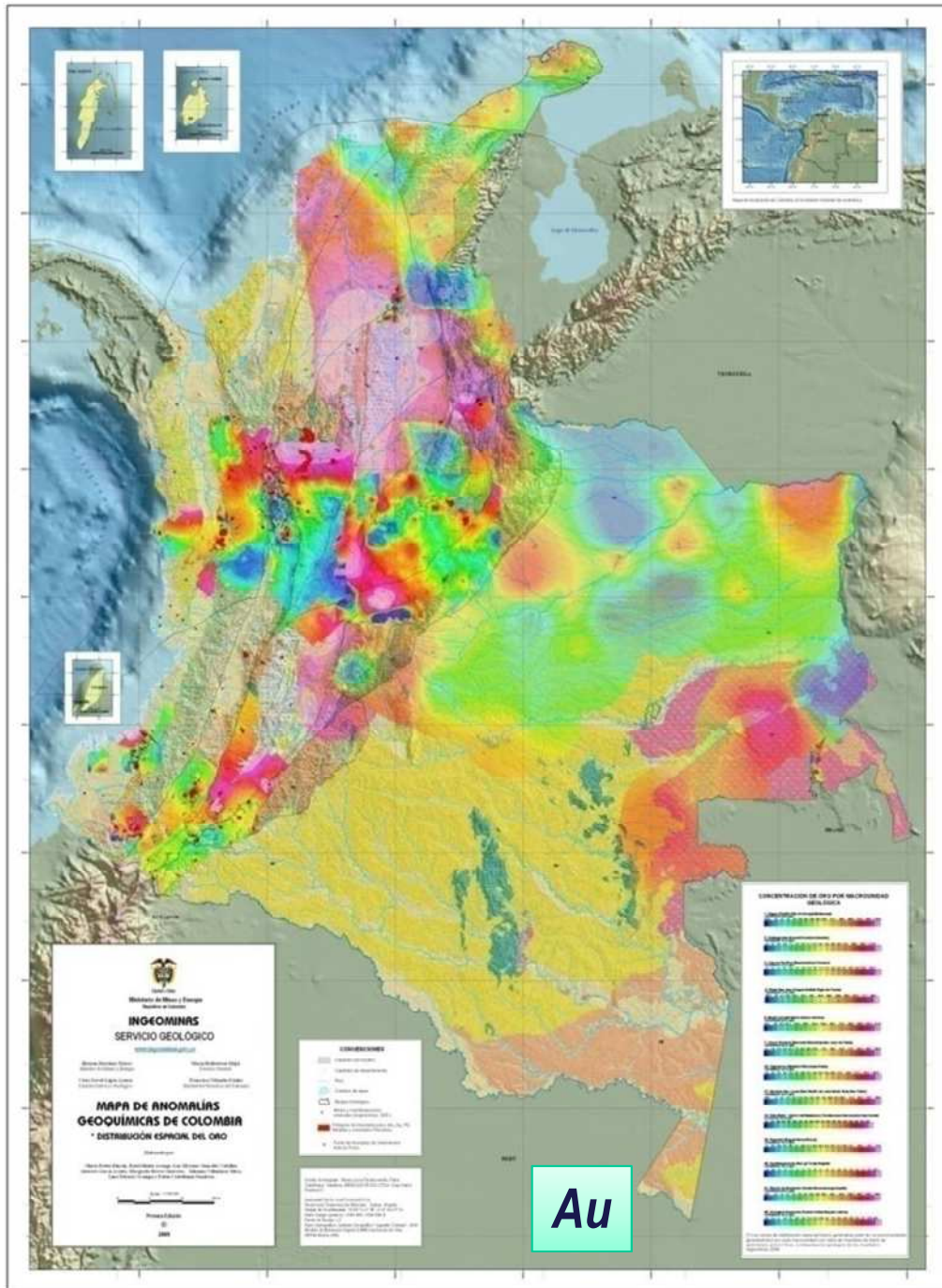


Figure 5. Map of Distribution of Au in Colombia



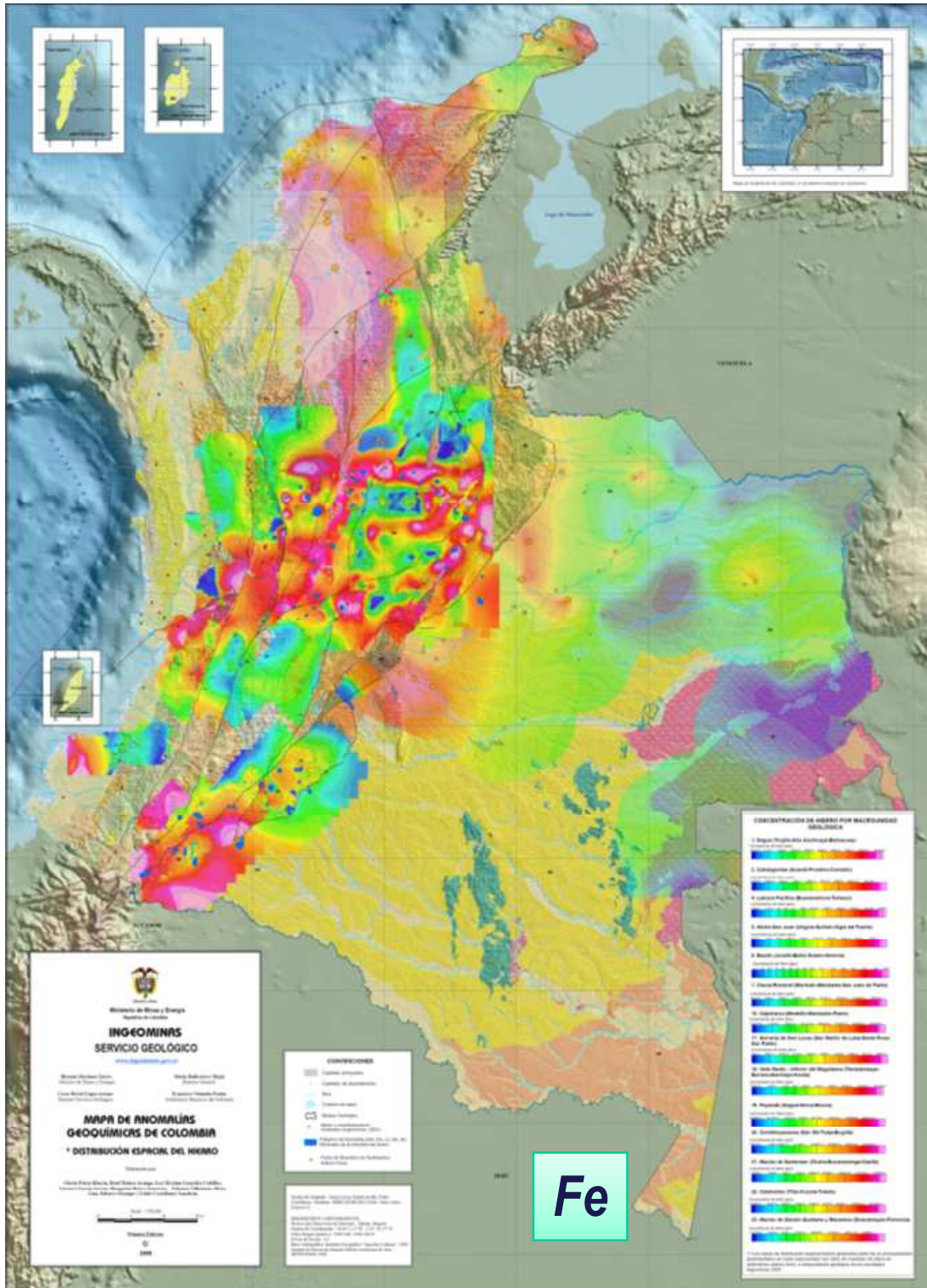
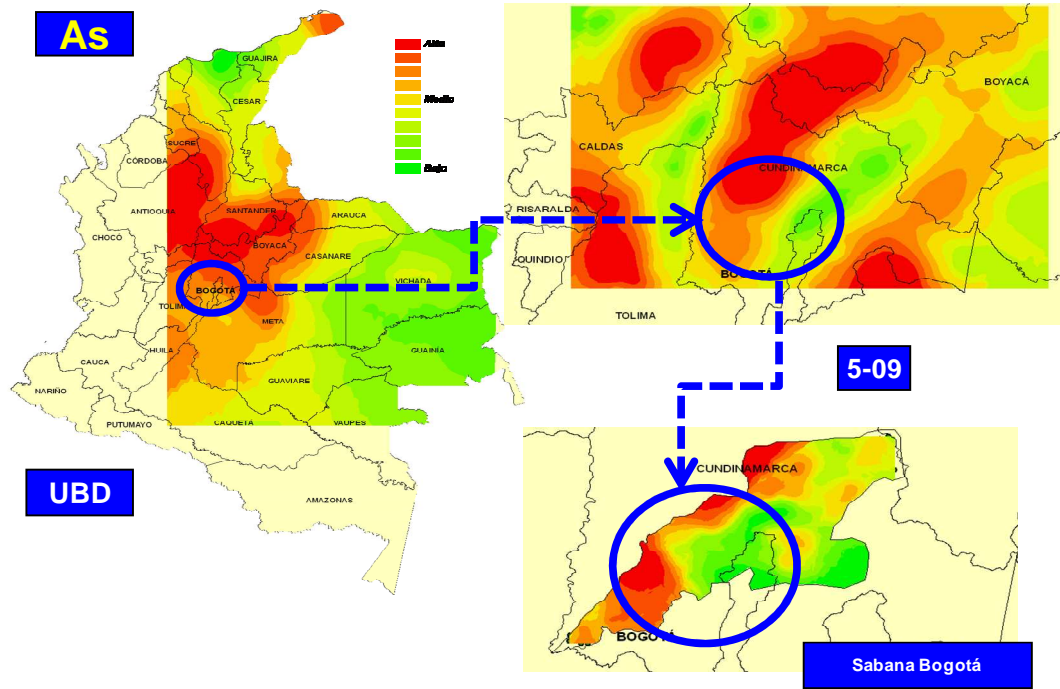


Figure 6. Map of Distribution of Fe in Colombia



**Figure 7.** Consistency of distribution patterns for As in ultra Low density sampling (ULD), low density sampling (5-09) and high density sampling (Sabana Bogotá)

## **Appendix 4**

**European Groundwater Geochemistry Part 1: Bottled Mineral Water**

**Meeting of the EuroGeoSurveys  
Geochemistry Expert Group**

**British Geological Survey, Keyworth, U.K.  
17-18 March 2009**

**Record of meeting of the EuroGeoSurveys Expert Geochemistry Group  
held at BGS, Keyworth, 17<sup>th</sup> March 2009 to discuss the project 'European  
Groundwater Geochemistry Part 1: Bottled Mineral Water'**

**Present:**

<b>Clemens Reimann</b>	<b>NGU, Norway</b>	<b>EGG Chairman</b>
<b>Stefano Albanese</b>	<b>Univ. Napoli, Italy</b>	
<b>David Banks</b>	<b>Holymoor Consultancy Limited, UK</b>	
<b>Manfred Birke</b>	<b>BGR, Germany</b>	
<b>Alejandro Bel-lan</b>	<b>IGME, Spain</b>	
<b>Alecos Demetriades</b>	<b>IGME, Greece</b>	
<b>Enrico Dinelli</b>	<b>Univ. Bologna, Italy</b>	
<b>Dee Flight</b>	<b>BGS, UK</b>	
<b>Kaj Lax</b>	<b>SGU, Sweden</b>	
<b>Ignace Salpeteur</b>	<b>BRGM, France</b>	

**Meeting chaired by Clemens Reimann.  
Record of meeting prepared by Dee Flight.**

1. Participants were welcomed to the BGS by Dr Chris Johnson, BGS Head of Science for Environmental Geoscience Baselines. The BGS Director, John Ludden, sent apologies for his absence and best wishes to the group. Chris Johnson left the meeting and was not part of subsequent discussions.
2. **Clemens Reimann (CR)** introduced the meeting and thanked the participants for attending. CR outlined the need to progress this work on a rapid schedule. Thus this meeting had been required in order to make plans for publication of the mineral water data, with a target publication date of 2009, and preparation of a draft manuscript required by end of September 2009.
3. **Manfred Birke (MB)** gave a presentation of analytical progress and data generated so far. 1772 bottled waters had been analysed – 958 from Germany and 865 from elsewhere in Europe. Most were submitted in PET bottles, but glass-bottled waters had been presented with many samples from UK and Germany. MB had undertaken detailed QC procedures during the ICP-MS analytical process and has comprehensive QC data. Multivariate statistical analysis of the data suggested that the glass bottles had introduced added levels of some trace elements into the waters. MB proposed that glass-bottled water data should not be presented alongside data for PET-bottled waters.
4. **CR** gave a second presentation to explore ways of handling and presenting the data. The main issues covered were: dealing with the glass/PET bottle issue; do we include glass or not?; do we present the mapped data as proportional symbol plots (variable size dot plots); do we use colour?; should we include tap water samples for comparison in the CP-diagrams. CR presented numerous cumulative frequency plots showing the differences in trace element frequency distributions for samples bottled in water and glass.
5. A general discussion was held regarding the mineral water project. **CR** proposed that the data should be published as an Atlas. Everyone present agreed that an atlas was a suitable publication style. CR informed the group that while EuroGeoSurveys had supported the project, there were some

countries that were sceptical about the project, and that care must be taken over use of terminology, with emphasis on the mapping of groundwater chemistry at the continental scale.

6. The meeting addressed the structure, content and authorship of the proposed atlas. **The following points 6.1-6.6 were agreed by those present:**
  - 6.1 The authorship of the atlas would be referenced as EuroGeoSurveys rather than a long multi-authorship. All contributors and participants would be listed in the front of the atlas, in the style of BGS geochemical atlas series. **Dee Flight (DF)** presented a copy of a BGS atlas so that all could see an example.
  - 6.2 Proposed title: 'European Groundwater Geochemistry Part One: Bottled Water'
  - 6.3 Proposed size – A4
  - 6.4 Proposed content and section authors:
    - list of participants and contributors
    - Forward; CR to invite Prof Kumpel (BGR) and EGS Board to jointly prepare foreword. CR will draft preparatory text for circulation.

#### **PART 1**

- Introduction & objectives [**Dave Banks**]
- What is bottled water ('water, not just H<sub>2</sub>O'?) [**Dave Banks**]
- Action levels for drinking water and bottled mineral or spring water for each participating country. [**Alecos Demetriades (AD)**] *Each country must send their information to Alecos.*
- Methods. To include sampling analysis and Q.C. (Ionic balance will be incorporated into QC). [**Manfred Birke and Clemens Reimann**] AD also expressed interest to process the QC data.
- Importance of bottle composition. [**Clemens Reimann and Manfred Birke**]
- Importance of carbonatisation and water type. [**Dave Banks, Manfred Birke, Clemens Reimann?**]

#### **PART 2 Results**

- Statistical overview, to include summary stats tables, boxplots, cumulative frequency plots, percentile distribution. Boxplots of data classified by country to be presented as an appendix. [**Peter Filzmoser & Clemens Reimann**]
- Black and white proportional symbol maps (variable size dot plots) of 72 parameters [**Peter Filzmoser & Clemens Reimann**]. Each accompanied by summary statistics and cumulative frequency. Short descriptive text of 1 page or less which includes explanation of highest values, . Where appropriate, a second map will be presented showing distribution of values that exceed action levels and a discussion of significance to human health risk will be included in the text. [**Clemens Reimann**] *Maps to be based on PET bottles. Data from Glass bottles to be used (with care) only when they provide the only information for a location.*
- Discussion/Summary [**Clemens Reimann, Manfred Birke, David Banks**] may include classification of water types by major ions, use of multivariate stats and multi-element maps.

- References [no compiler agreed]

6.5 All chapters to be circulated around participants for comment. Dave Banks' chapter on bottled water and hydrogeology to be sent (via DF) to Pauline Smedley, BGS for review.

**6.6 *All participants should look for (i) photographs of wells, bottled waters etc which may be used; (ii) suitable scale geology, hydrogeology, metallogenic maps that will be require; (iii) references relating to consumption of mineral water in different parts of Europe.***

7. Contact with trade association. There was some discussion over whether to contact the bottled water producers trade body prior to publication. No clear agreement was reached and this requires further discussion as it is a delicate situation. ***Needs further discussion and decision on way forward.***

8. Publications from bottled water data. Each country is encouraged to publish their own country data. Benedetto de Vivo has suggested a special edition of JGE, it was noted that this Journal has a relatively low impact factor compared to many other suitable journals. Dave Banks suggested that publications in food science journals may engage with interested parties in other disciplines and form new collaborations. The authorship of publications should reflect those doing the work rather than the wider group of atlas participants. Publication ideas/intentions should be notified to CR who will keep a list. Presentations should be notified to AD who will keep a list. Italy has already started looking at REE geochemistry of their waters from the data generated in this project – Enrico Dinelli presented plots to the Group. In general each country is free to publish its own data anytime and where ever they wish.

9. Data accessibility. Given the experience with the FOREGS data (ISPRA presenting FOREGS data on their server for download) some discussions whether the data should again be freely available took place. The following alternatives exist: (1) follow FOREGS example and make data freely available on internet once atlas is published – we lose control of what happens with the data but the data will be used a lot; (2) include the data on a CD-ROM in the back of the atlas (like BSS atlas) – the dataset is directly copyright protected just like the book; (3) the data will only be available upon written application to the board of directors of EGS – creates bureaucracy and once the dataset is given out we again lose control.

There was agreement that this topic needs further discussion on the next meeting of the group and with the secretary general of EGS. However, it was agreed that each country stays responsible for the accessibility and release of its own country data.

10. **Outstanding actions on participating countries. Each country needs to deal with the following :**

- Check co-ordinates of uncertain sample localities, in response to Manfred Birke's email
- Provide tap/drinking water samples to Manfred as per instructions in his email
- Provide details of drinking water/mineral water action levels to Alecos Demetriades

## **Appendix 5**

**Minutes of  
EuroGeoSurveys Geochemistry Expert Group  
Meeting  
Belgrade, Serbia  
September 24-25, 2009**

**Minutes of EuroGeoSurveys Geochemistry Expert Group Meeting  
Belgrade, Serbia  
September 24-25, 2009**

**Present:**

Clemens Reimann	NGU, Norway	(Chair)
Dee Flight	BGS, UK	(Secretary)
Miroslav Duris	CGS, Czech Republic	
Manfred Birke	BGR, Germany	
Alecos Demetriades	IGME, Hellas	
Gyözö Jordan	MAFI, Hungary	
Pat O'Connor	GSI, Ireland	
Rolf Tore Ottesen	NGU, Norway	
Mateja Gosar	GEO ZS, Slovenia	
Alejandro Bel-lan	IGME, Spain	
Maria Joao Batista	Geological Survey of Portugal	
Walter De Vos	Geological Survey of Belgium	
Enrico Dinelli	University of Bologna, Italy	
Aleksandra Gulan	Geological Institute of Serbia	
Josip Halamic	HGI-CGS, Croatia	
Edith Haslinger	Geological Survey of Austria	
Peter Hayoz	Geological Information Centre, Federal Office of Topography, Switzerland	
Kaj Lax	Geological Survey Sweden	
Pawel Kwecko	Polish Geological Institute	
Andreas Scheib	British Geological Survey	
Ilse Schoeters	Rio Tinto Minerals, Brussels	
Ajka Sorsa	HGI-CGS, Croatia	
Timo Tarvainen	GTK, Finland	
Hanna Tomassi-Morawiec	Polish Geological Institute	
Dragana Vidojevic	Serbian EPA	
Benedetto De Vivo	University of Napoli, Italy	

**Apologies from:**

Ignace Salpeteur	BRGM, France
Volodymyr Klos	SNRGC 'Pivnichgeologiya', Ukraine
Maryna Vladymyrova	SNRGC 'Pivnichgeologiya', Ukraine

*Outstanding actions in red; agreements in green*

**1. Welcome and introductions**

Participants were welcomed to the meeting by **Dragana Vidojevic and Dejan Lekic** representing the Serbian hosts, Serbian Environmental Protection Agency (SEPA). SEPA was created in 2004 and is working towards acquiring integrated environmental data with a view to European integration. The hosts indicated that they are grateful for the opportunity to be involved in the European-wide activities of the EuroGeoSurveys Expert Geochemistry Group.



**Clemens Reimann (CR)** welcomed all participants on behalf of the EGS Geochemistry Expert Group and thanked SEPA and GIS for organising the meeting. **Aleksandra Gulan (AG)** welcomed all on behalf of the Geological Institute of Serbia (GIS).

## 2. Actions from previous meetings

### *2.1 Outstanding actions from Brussels, September 2007*

Action 8, Popular version of FOREGS Atlas is still outstanding. **Alecos Demetriades (AD)** reported that there had been problems with figures that had caused a delay but that progress had been made. The agreement was for an electronic publication to be published by the EGS Geochemistry Expert Group. When he has finished with the urban geochemistry book, **AD** will continue work on the popular atlas with expected publication date of end 2010. **AD to circulate draft version to group for comment by June 2010.**

**Action 4.2.1** (Shaun Reeder and Timo Tarvainen to produce paper/report on lessons learnt from the FOREGS analytical exercise) is still outstanding. **DF** to check with Shaun.

**Action 4.2.2** (Release of FOREGS QC data) progress uncertain. **DF** to clarify with Shaun Reeder.

**Action 4.3** (Updated FOREGS Field Manual) **AD** is co-ordinating. The manual will include information on additional terrains and will be viewed as a manual for FOREGS style sampling across the world. **AD** is still waiting for a chapter from the Chinese. **Action:AD expects the manual to be published by Easter 2010.**

**Action 9.3.2** (FOREGS Atlas CD-ROM provision at IGC, Oslo). **This action is complete**-DVDs containing the Arthur Darnley edition of GEEA , all publications from 1988-2007 and the EGS/FOREGS Geochemical Atlas were given out at IGC, Oslo, August 2008. Copies of the Arthur Darnley DVD edition are still available and can be obtained from **AD**.

### *2.2 Actions from Berlin, March 2008.*

**Action 5.2** URGE (urban geochemistry project). First version of field handbook has been completed by **Rolf-Tore Ottesen (RTO)** and circulated to all group members prior to Belgrade meeting. **Action completed.**

**Action 6.** Preparation of surface water proposal for next Director's Meeting, **Manfred Birke (MB)** and **CR**. **This has not been followed up and was discussed as a later agenda item. See section 4.4 below**

**Action 8.** Use of FOREGS data in Danube Project, **Gyozo Jordan (GJ)**. Gyozo gave a presentation on this work as an Agenda Item at Belgrade meeting. **Action completed.**

**Action 9.5** Participation in GEMAS Project. All countries had been contacted but not all able to participate **Action Completed.**

## **2.2 Outstanding actions from Keyworth, March 2009.**

10. All participants to check co-ordinates of uncertain localities and let CR/MB know.  
**Still outstanding-Action on all.**

All participants to provide tap water samples to Manfred as per his instructions.  
**Action completed.**

All participants to provide details of national drinking water/bottled water action levels to AD. **Action partially outstanding.**

All participants to provide photographs of wells/bottled waters etc to MB. **Action outstanding-all to complete.**

Where possible, participants to provide bottled water consumption statistics to MB (1950's to present), and tap water consumption. **Action outstanding-all to complete.**

## **3 Belgrade Meeting Agenda Items**

### **3.1 Danube Project (GJ)**

GJ gave an update on the work supported by the International Commission for the Protection of the Danube River (ICPDR). Geochemical maps prepared from the FOREGS data (Ni, Cd, Hg, Pb, Zn, Cr, Cu) have been used to support the UN – funded project. It is hoped that this has demonstrated the value of the geochemical maps and will initiate fill-in mapping.

Current status of the project is that the web pages have been created and are awaiting approval from EGS and ICPDR. The anticipated go-live date for the website is 15<sup>th</sup> October. Any comments on web-site are welcomed.

The next stage in the project requires each Danube country to contribute their national geochemical data and the ICPDR will send relevant pollution data. Outstanding issues relate to the way national country geochemical data is presented; can Google earth be used for maps and finally should the website go to a full GIS and meet INSPIRE.

### **3.2 EU Inventory of Mine Waste Directive (GJ)**

GJ presented information on the risk-based approach to the inventory and emphasised the opportunity for using geochemical data in support of the requirements of this directive.

### **3.3 EU Water Framework Directive and Environmental Quality Standards (GJ)**

GJ pointed out that geochemical data is highly relevant to these EU requirements and that the WFD requires stream water and stream sediment data. GJ and Maria Jaoa Batista (MJB) propose a special issue of an environmental journal to include publications showing how geochemical data can be used to contribute to risk-assessment of contamination.

GJ noted that the proposed EU Soil Framework Directive has been delayed and TT notified the group that the updated IPPC will be called IE (Industrial Emissions) directive and it will include a requirement for baseline soil chemistry for industrial areas.

### **3.4 FOREGS Geochemistry**

CR gave a progress report on continued FOREGS geochemistry activities.

**3.4.1 The FOREGS field manual** is sold out but a new, updated manual will appear in 2010. **(Action AD to ensure new manual published by Easter 2010)**

**3.4.2 New data** has been provided by Professor Xie including the elements: Au, B, Cl, F, N for which previously there was no information. Several publications are in progress. **TT** advised that the new data will be made available from the GTK server. **Action TT to make the new data accessible via the GTK server.**

**CR** presented maps reflecting the new Au data on FOREGS samples. This prompted much discussion as some unexpected patterns were shown, eg Au anomalies in SE England and in Belgium. **Walter De Vos (WDV)** expressed concern that the ultra-low density mapping for Au is not appropriate and the limitations of sample spacing had been overstepped. **CR** countered this point. **DF** noted that there could be a non-mineralisation source for Au in SE England and we must keep an open mind. The known Au mineralisation in northern Ireland was identified by anomalies in the new maps. **Miroslav Duris (MD)** added that this new data may identify non-geological sources of gold.

**3.4.3 Publications** **CR** encouraged members of the FOREGS team to write-up several publications from the new data.

**Benedetto De Vivo (BDV)** is preparing a publication comparing Chinese and original FOREGS data for some materials and only where concentrations are above detection limit. Expects to complete by end Oct 2009. **BDV** explained that his comparison of 'statistical composites' against the composite samples that were analysed in China gave very good agreement. Individual anomalies were, however, lost and so best application is as a background mapping technique.

**AD** expressed concern that the agreement was so good and suggested that we cannot have too much confidence that the Chinese samples were, in fact, composites. Wider discussion regarding the history of the Chinese analysis.

**MJB** gave a short presentation on her ongoing work on the new Sn data and comparison with the original FOREGS data. She noted that when comparing topsoil Sn values with Sn in deeper soils, values tend to be higher in topsoils. **MJB** noted that the comparison of Sn values between old and new data showed same general patterns but with some differences and felt that her data supports the hypothesis that the Chinese data is from composited samples.

**AD** is working on Au data and needs a mineralisation map in order to make progress. He expects this map in October and so can make progress after that.

**TT** informed the group that **Reijo Salminen** is willing to prepare a publication on F<sup>-</sup> Cl<sup>-</sup>, B.

**3.4.4 Sample storage.** **AD** raised the issue that different sample splits had been spread around different countries; there was agreement that it would be better to store all splits in the same place. Although the main splits are in Slovakia, others were in BRGM (France), Holland, Finland, Australia. **CR** explained that the 10-year storage agreement with Slovakia is almost at its end and would need to pay more afterwards. **DF** indicated that BGS could probably offer free storage space for FOREGS samples.

**Patrick O'Connor (PO'C)** suggested that we should prepare a business case to look into cost of shipping the sample archive and other splits to BGS versus cost of storage in Slovakia. **Action on CR to prepare business case looking at costs of options for of sample storage.**

**3.4.5 Use of FOREGS sample materials.** There have been no further requests for FOREGS samples since the Berlin meeting (March 2009).

**3.4.6 Perchlorate data.** Perchlorate data from the USGS is not yet ready and no delivery date has been provided.

**3.4.7 Publications.** **Action on all to keep AD updated of all new FOREGS-related publications.**

### **3.5 European Groundwater Geochemistry Project (CR MB)**

**3.5.1 ATLAS.** CR gave an update on the progress towards publication of the 'European Groundwater Geochemistry, Part One: Bottled water', hereafter referred to as 'the atlas.' Schweizerbart have agreed to publish the atlas with a planned publication date of early 2010. The layout has been agreed with Schweizerbart with a maximum of 300 pages. The introduction has been written. The atlas will be an official EGS publication and the Foreword will be written by Luca Demicheli, EGS Secretary General. Atlas map pages in black and white. There will be a maximum of 1 page explanation/description per element. CR will prepare draft maps and text for each element and will circulate to all for comment. Comments should be brief and if possible to give additional explanation to patterns/anomalies. CR indicated that he hoped that publication of this bottled water atlas would prompt the concept of a true groundwater atlas.

- There was discussion of whether to include brand names of waters in the atlas and it was agreed that they should be listed in an appendix with sample locational and chemical information.
- CR presented examples of proposed layout of map pages and discussion followed. It was agreed that numbers used to identify anomalies should be removed from maps.
- It was agreed that 'EuroGeoSurveys Geochemistry Expert Group' should be added as embedded text in the bottom left corner of the map box.
- It was agreed by the group that all available elements should be presented.

There was an open discussion of whether the bottled water producers trade association should be contacted and informed of the proposed atlas. MB indicated that he had re-analysed the most anomalous waters and his results showed the data to be robust and reproducible so we can be confident about the validity of anomalies.

- The group agreed that it would be better to try and engage with the trade association.

#### **Actions resulting**

- **Action on CR to contact Schweizerbart to establish their position on payment of royalties.**
- **Action on CR to contact Bottled water trade association.**
- **Urgent action on all to reply to CR email requests for explanation of specific geochemical features.**
- **Action on CR to add Maria Joao Batista and Walter de Vos to the EGG project email list.**

- **Action on all to send any relevant references to CR.**
- **Action on all to send ideas for cover page to CR.**
- **Action on all to send legislative limits for bottled waters to AD**

### **3.5.2 Special issue of JGE (BDV)**

BDV informed the group that 18 papers have been submitted but that the deadline had been extended to October 15<sup>th</sup> for further submissions. BDV asked that authors please respect this deadline. He hopes that the Special issue will be published in Spring 2010. AD added that the time he has devoted to editing the urban geochemistry book volume has caused delays with his contribution to editing water manuscripts. CR Thanked Benedetto for his efforts in making this special issue of JGE happen. **Action on all to let BDV know how many extra copies of the special Issue that each survey/contributor requires.**

### **3.5.3 EGS Groundwater Group**

CR informed the group the EGS Groundwater Group were invited to the Bottled water meeting held by our Geochemistry Expert Group in Keyworth in March but did not reply. Further, the chairman of the Groundwater Group was at the Contact Persons' meeting held recently in Dublin. The atlas was discussed at this meeting so he is fully aware of progress but has made no contact or comment.

### **3.5.4 Brief presentation of results (CR)**

CR showed data that demonstrated how Sb data is affected by PET bottles. However, only Sb is significantly affected by PET. A few elements are affected by glass bottles, showing higher values-also related to the glass colour. CR commented on the exceptionally high levels of Li in some waters. Leaching tests have been run by MB showing that Pb leaches progressively over 150 days in all colours of glass. MB and CR are preparing a publication on leaching from bottles.

In general the bottled water results are good for the industry as few analysed waters show values in exceedence of regulatory standards. Some As and U values exceed regulatory standards but only in a few cases.

## **3.6 GEMAS (CR)**

**3.6.1 Progress Report** CR provided a detailed progress report with the key points listed below:

- No samples have been collected/submitted from Albania, Belarus or Romania.
- All samples have been prepared in Slovakia and have been dispatched for analysis
- Eurometaux have increased their funding to €600,000 but this is still not enough to cover all the basic analyses. We need a further €120, 000 for Au, Pt, Pd and grain size analyses.

*Analyses undertaken so far:*

- 800 samples from each, Ap and Gr samples for grain size (reported by end Nov 2009)
- All samples for CEC and TOC (reported by end Nov 2009)
- All samples analysed for 53 elements using aqua regia extraction at ACME in Canada (results received in Sept 2009)

- All samples to be scanned by mid infra-red (MIR) in Australia. Should be completed by Nov 2009

#### Future analyses

- pH (CaCl<sub>2</sub>) reported by end of 2009
- Total S, total C reported by mid-2010
- Pb isotopes on arable samples reported by mid 2010
- XRF-40 elements by end 2010
- Pd, Pt ultra-trace not currently possible
- Sr isotopes under discussion with external lab. (*subsequently agreed with Jurian van Hoogewerf*)
- Kd values for selected elements available 2010

CR is currently undertaking QC of ACME multi-element data and will be finished by November. No serious data quality problems have been encountered. **Action CR to send QC report and raw data to each country participant.**

There are still outstanding issues with the *geographical co-ordinates* from some countries. These must be resolved shortly. **Action on those concerned to check and get back to CR by end of October**

**3.6.2 Project reference materials** were discussed. Volunteers are needed to provide further analyses of project reference materials by various methods. DF and MB volunteered to take this forward in BGS and BGR. **Action DF and MB to follow-up. Action on all to consider this request.**

#### **3.6.3 Results and publication**

- Data will be released to Eurometaux, for relevant commodities, by end of October 2009
- Country-specific data will be made available to each country soon (excluding those elements that are of special interest to Eurometaux). Each country is encouraged to publish relevant data from their country.
- There are restrictions on the use of some elements (Au, Ag, Se, Sn, V, Te)
- Industry is keen to see publications on particular elements/commodities
- Under the agreement with Eurometaux, raw data will not be publicly available until 2013
- Au, Pt, Pd (if obtained) will remain confidential for a further year.
- **Eurometaux (via Ilse Schoeters) would like to review any proposed publications to check acknowledgements and contact details and to ensure that they are happy with the way the data is presented and the amount of information that could be used by other industries who have not contributed to the costs of the project. Action on all.**
- **The 90<sup>th</sup> percentile of the data distribution for any elements should not be defined, discussed or presented in any way on publications or presentations of the data. Action on all.**
- **Action on CR to email all participants with a list of restrictions on the use of GEMAS data.**

An open discussion was held regarding use and *publication* of the GEMAS data. **IS** suggested that we should target environmental journals in order to increase the chances of engagement with environmental regulators. **GJ** asked if element

distribution maps could be presented. **CR & IS** indicated that this is OK as long as the 90<sup>th</sup> percentile is not shown and maps could first be reviewed by industry before publication. The issue of future data accessibility was discussed and how to deter 'freeloaders.' **PO'C** expressed the view that under Freedom of information legislation, we may be forced to release data. **Action CR to look at future options for data release.**

**EH** asked about the possibility of having standard text describing sampling, analytical and QC methodologies that could be used in publications. **CR** indicated that this information will be in the NGU report on QC, and could be reproduced/referenced in publications.

**RTO** asked if pesticide analysis could be undertaken on the GEMAS samples. This led to a debate about sample preservation of materials for organic compound analysis. *Issue unresolved.*

- No publication of national atlases based on GEMAS data can take place until after the GEMAS atlas is published.
- An extra day will be allocated at the next planned meeting (Athens, 2010) for presentation of ongoing publications/work based on GEMAS data.
- Publications can start soon and should be well advanced by Athens.
- We should aim for publication in a variety of Journals.
- **CR** would like to see many publications using GEMAS data.
- Publication priorities should include: QC report (NGU); availability of elements from aqua-regia digest; natural vs anthropogenic controls on element distribution; influence of climate on element distribution. Suggestions of topics are welcome.

**3.6.4 Authorship.** Authorship of publications other than the atlas should be a few named authors plus the 'EGS Geochemistry Expert Group'. **Action on all to respond to Clemens by email and provide him with a list of changes to the update the project team list for GEMAS.**

#### **3.6.5 Field Photographs.**

- There is a need for someone to archive and document the field photographs. Volunteers required.
- In order to find suitable photographs for the cover of the GEMAS atlas there will be a photo competition at the Athens meeting. **Action on all to submit 5 photographs to the photo competition at Athens 2010 meeting of EGS Geochemistry Expert Group.** AD will provide a bottle of Metaxa 7-star brandy for the winners. The winner will be determined by a ballot.

**3.6.6 GEMAS project time plan.** **CR** indicated that GEMAS atlas publication is planned for early-mid 2013.

**3.6.7 Conferences:** **CR** suggested that GEMAS results should be presented at conferences quite soon.

**(1) Action on AD and CR to prepare a list of relevant upcoming conferences. (2) Action on CR to prepare a general GEMAS presentation (and poster?) for use by all at conferences.**

#### **3.6.8 Eurometaux involvement**

Ilse Schoeters expressed thanks on behalf of the sponsors, Eurometaux, to all involved in the GEMAS project. She indicated that the data is very valuable to the sponsors and that they are very impressed with the ability of the group to adopt harmonised methodologies and work together. She expressed gratitude for the hard work that had been put in and for the speed of progress.

**3.6.9 Video presentation of field sampling training.** AB-L presented a video of the GEMAS field training exercise, held near Berlin in March 2008.

### **3.7 Urban geochemistry Book**

DF presented a written progress report submitted by Chris Johnson.

- There will be 29 chapters
- **Outstanding contributions must be received by end October**
- The reviews should be completed by end December. CJ would welcome any offers to review book chapters. WDV offered to review. **Action on AD/CJ to send WDV book chapters for review.**
- CJ wished to thank PO'C for his help with reviewing book chapters.
- There is a need for good quality colour photos or other ideas to use as cover material for the book. **Action on all to send possible cover material to CJ. RTO will send photos with children and MB will send aerial photos.**
- AD informed the group that the publishers, Wiley, were keen to have a more global aspect to the book, and that it is hoped to gain contributions relating to Nigeria, Hong Kong, Mozambique and USA.
- There was much discussion over how to use any royalties generated from the book. It was agreed that royalties should be paid in to the EGS account and retained for the purchase of extra copies required by contributors. **Action on CJ to contact Luca Demicheli, EGS Secretary General, to discuss this and to establish if this money can be ring-fenced in EGS account. Action on CJ to obtain EGS bank account name and number to put into Wiley contract.**

## **4. Any Other Business**

**4.1 Date and venue of next meeting:** AD proposed that the 2010 meeting be held in Athens next Sep/Oct and all agreed. **Action on AD to provide a date for the meeting ASAP. Action on CR to inform EGS that the group needs a meeting in 2010.**

**4.2 EGS Contact Persons meeting in Dublin.** Kaj Lax (KL) presented the group's report on behalf of CR reported back the satisfaction of the Contact Persons on the good work performed by our group. The name of our Geochemistry Group was discussed and Clemens will be notified soon as to whether we will retain the name Geochemistry Working Group or be renamed Geochemistry Expert Group. **Action on CR to notify our group if there is a formal agreement from the EGS Directors on our name following their annual meeting, October 2009. Follow-up: Action completed, CR has notified that we are to be named Geochemistry Expert Group.**

**4.3 Project proposal from Russia.** CR informed the group that he had received a project proposal from Russian Geochemists. The Russians proposed to gather all geochemical data from existing country/surveys in Europe and to prepare a



harmonised geochemical map from it. Discussion followed. There was consensus that this project proposal is ill-advised and it would be much more valuable for Russia to collaborate through i) contribution of samples to the GEMAS project, or ii) FOREGS-style low-density geochemical mapping or, iii) contributing to a possible future Europe-wide surface water project.

**Action on CR to contact the Russian contacts to discuss the above suggestions. Action on CR to keep Group informed of outcomes of discussion with Russian contacts.**

**4.4 Surface water geochemical mapping project.** There was some further discussion of a possible future Europe-wide surface water geochemical mapping project. There was consensus that this could be a viable and valuable future project. The results would directly support the Water Framework directive and Ilse Schoeters indicated that Industry may be interested in supporting such a project.

**4.5 Raw Materials Directive.** CR raised the Raw Materials Directive and the relevance of geochemical data to this directive. CR suggested that this directive may be a driver for the collection of localised high-density geochemical data in parts of Europe. CR indicated that our group should not be by-passed in this case.

**4.6 IUGS/IAGC Global Geochemical Baselines Website.** AD indicated that the **Global Geochemical Baselines** project website has been uploaded and comments are welcomed. The plan is to update the website every month.  
<http://www.globalgeochemicalbaselines.eu/>

**4.7 EC GIS database (GISCO).** GJ drew attention to the EC GIS database (GISCO) which holds a variety of spatial datasets for the EU countries. <http://www.ec-gis.org/> GJ proposed that we investigate the possibility of having the FOREGS geochemical data loaded to GISCO. **Action on GJ to investigate further.**

**4.8 Acknowledgements.** The group expressed their thanks to CR for his work over the year and for his contribution to this meeting. AG, on behalf of the Serbian team, expressed her thanks to all who attended the meeting.

CR thanked the Serbian hosts for their hospitality and organisation and declared the meeting close

## **5. EuroGeoSurveys Expert Geochemistry Group: Urban Geochemistry Project Meeting**

**Belgrade, 25<sup>th</sup> September, 2009**

Meeting led by **Rolf-Tore Ottesen (RTO)**

**5.1 Welcome.** RTO welcomed participants to the meeting.

**5.2 Overview of Urban Geochemistry Project.** RTO presented an overview of his urban geochemistry projects in Norway. In Norway the work had evolved from systematic geochemical mapping to look specifically at soil pollution in day care centres, and to help in the setting of health-based 'action levels.' They have also looked at the dynamics of soil movement and transportation, dispersal of pollution

from cities to the marine environment and at the chemical composition of pollution sources.

**5.3. Project aims. RTO** gave the aims of the project:

- To map the geographical distribution of heavy metals, arsenic and organic pollutants in surface soils in the populated part of the cities
- To identify the main pollution sources

**5.3.1 Operational Conditions.** The project will operate under the following conditions:

- In each city the project should be carried out in co-operation with national or local authorities to improve the knowledge of risks to human health. A letter of intent from the city authority must be received.
- There will be a limit of 10 European cities in the project; The first 10 cities that meet all conditions will be offered the free analyses described below.
- NGU will offer 500 free ICP-ES and Hg analyses for each city; further analyses can be purchased from NGU
- Each collaborating city/geological survey must be able to pay for at least 200 analyses of PAH and PCB. (These analyses may be undertaken by NGU or may be put out to competitive tender)
- Each collaborating city/geological survey must undertake the sample preparation in their own country.
- Each collaborating city/geological survey must undertake their own sampling exercise and must provide their own sampling equipment.
- Each collaborating city/geological survey is responsible for the reporting of their own information/data.

**5.4 Discussion and agreement of sampling protocols.**

**5.4.1 Sampling depth.** There was much discussion of the sampling depth that should be adopted for this survey. In the end, a vote was held. 15 votes were received for 0-10cm, while only 5 votes were received for 0-5 cm.

Agreed sampling depth 0-10 cm with 0 cm at the base of the grass layer.

**5.4.2 Sampling density.** RTO suggested a sampling density of 4 per km<sup>2</sup> in the city and 1 per km<sup>2</sup> in the suburbs. This was agreed by all.

**5.4.3 Composite vs single samples.** There was a lively discussion on whether samples should be composites or single samples. RTO proposes single samples but many participants feel that samples should be composites in order to give greater reproducibility and representivity. MD presented work from urban geochemical study in Prague, proposing that samples should comprise at composite of at least 4 sub-samples. **Action on RTO to find agreement on whether composites or single samples should be used.**

**5.4.4 Soil sample weight.** Samples should be approximately 500g in weight.

**5.4.5 Field duplicates.** Five % of the field samples will be duplicates taken from 1m separation.

**5.4.6 Sample bags.** Samples for organic analysis must be collected in RILSAN bags.

### **5.5 Sample preparation protocols**

RTO proposes that the samples should be air dried and sieved to 2mm through a nylon mesh and stored in plastic containers. They will not be pulverised. 1g will be subsampled for ICP analysis. RTO proposes no special preparation of samples for organic analyses. This provoked much debate; many feel that samples for organic analyses should be preserved by freezing to prevent volatilisation of organic compounds.

### **5.6 Analysis.**

Samples will be analysed by ICP-ES for metals and As, following a Nitric acid digest. Hg will be determined by a cold vapour technique. The organic analyses cannot be undertaken by NGU but must be put out to tender.

There was much debate and some disagreement about the sampling methodologies proposed by RTO. Some aspects were left undefined at the close of the meeting.

**5.7 Participation** The following cities were proposed by the participant surveys:

- Dublin Ireland
- Porsgrunn Norway
- Karlstad Sweden
- Acherschleben Germany (*proposed by MB in follow-up email*)
- Brussels Belgium
- Prague Czech Republic
- Sisak Croatia
- Belgrade Serbia
- Lisbon Portugal
- Maribor Slovenia
- Athens Hellas
- Oviedo/Murcia Spain
- Hämeenlinna Finland
- Naples Italy
- Budapest Hungary
- Kiev Ukraine (*proposed in follow-up email by Ukrainian Geological Survey*)

It is hoped that the UK and France can also participate. Action on DF to discuss at BGS and report back to RTO on UK participation.

Each city/geological survey must make a firm undertaking, and the first 10 that come forward and meet the conditions of the project will be accepted for free inorganic analyses by NGU.

Dublin is the first confirmed city to participate. Sampling will be undertaken as a joint venture between GSI and NGU.

### **5.8 Funding**

Various options for gaining additional funding were suggested, including: NATO Science, COST, INTERREG (EU). **No Action to follow-up was agreed.**

## **5.9 Schedule**

No detailed schedule for the project was presented but sampling should be undertaken in 2010.

### **Actions on RTO:**

- **Send guide prices of organic and inorganic analyses to all.**
- **Provide more detail on type of trowels/spades to be used, e.g. stainless steel.**

Outstanding methods that need to be agreed/defined:

- Should samples be composites/single samples
- Details of sample-site selection
- Photographic record of samples sites
- **Action on RTO to find a way forward on the above**

**Action on DF to send RTO link to BGS Field Procedures Manual, which includes section on sample-site selection in urban environment.**

- **Field manual to be finalised (Action on RTO to circulate draft final version for comments)**

Following the close of the meeting, a field trip was held in Belgrade city-centre at which sample-site selection for urban geochemical surveys was studied and discussed but no clear agreement was reached.

Dee Flight 14<sup>th</sup> October 2009