International Union of Geological Sciences
Manual of
Standard Methods for Establishing the
Global Geochemical Reference Network

edited by
Alecos Demetriades, Christopher C. Johnson, David B. Smith,
Anna Ladenberger, Paula Adánez Sanjuan, Ariadne Argyraki,
Christina Stouraiti, Patrice de Caritat, Kate V. Knights,
Gloria Prieto Rincón and Gloria Namwi Simubali
International Union of Geological Sciences

Manual of
Standard Methods for Establishing the Global Geochemical Reference Network

edited by
Alecos Demetriades, Christopher C. Johnson, David B. Smith, Anna Ladenberger, Paula Adánez Sanjuan, Ariadne Argyraki, Christina Stouraiti, Patrice de Caritat, Kate V. Knights, Gloria Prieto Rincón and Gloria Namwi Simubali

International Union of Geological Sciences
Commission on Global Geochemical Baselines
Special Publication
No. 2

Published by
The International Union of Geological Sciences
Commission on Global Geochemical Baselines

The Manual presents, for the first time, a comprehensive overview of the standardised geochemical methods that should be employed across the land surface of the Earth to map the distribution of chemical elements in various media. Applying these methods will produce internally consistent quality-controlled data sets for each sampling medium for multipurpose use.

The Manual provides extensive information on sampling protocols for rock, residual soil, humus, stream water, stream sediments, overbank and floodplain sediments. There are also chapters discussing sample site selection; sample preparation; quality control procedures, including the development of project reference materials; analytical methods; data management; map preparation; project management, and information on how to level existing geochemical data sets. Any applied geochemist carrying out a geochemical mapping project at any scale should find a wealth of useful information within the pages of this Manual.


Chapter 1: General Introduction
Chapter 2: Global Terrestrial Network Grid Cells, Selection of Sample Sites, and Sample Types to be Collected
   Chapter 2: Supplementary material
   • Annexe A2.1: Geodetic Levelling of Existing Geochemical Data Sets
   • Annexe A2.2: Parametric Levelling of Existing Geochemical Data Sets
Chapter 3: Sampling Methods: Introduction
Chapter 3.1: Rock Sampling
Chapter 3.2: Residual Soil and Humus Sampling
   • Annexe 3.2.1: Residual Soil and Humus Sampling: The Soils of the World
   • Annexe 3.2.2: Residual Soil and Humus Sampling: Soil Profiles
Chapter 3.3: Stream Water Sampling
Chapter 3.4: Stream Sediment Sampling
Chapter 3.5: Overbank and Floodplain Sediment Sampling
   • Annexe 3.5.1: Overbank and Floodplain Sediment Sampling: Profiles
Chapter 4: Sample Preparation and Storage
Chapter 5: Development of Reference Materials for External Quality Control
Chapter 6: Geoanalytical Methods and Requirements
Chapter 7: Quality Control Procedures
  Chapter 7: Supplementary material
Chapter 8: Data Conditioning Methods: Generating Time Independent Geochemical Data
  Chapter 8: Supplementary material
Chapter 9: Data Management and Map Production
Chapter 10: Project Management
International Union of Geological Sciences
Manual of Standard Methods
for
Establishing the Global Geochemical Reference Network

Chapter 1

General Introduction

Alecos Demetriades¹,⁴, Christopher C. Johnson²,⁴, David B. Smith⁴,
Timo Tarvainen³,⁴, Reijo Salminen³

¹ Institute of Geology and Mineral Exploration, Athens, Hellenic Republic
² GeoElementary, Derby, United Kingdom
³ Geological Survey of Finland, Espoo, Finland
⁴ IUGS Commission on Global Geochemical Baselines

It is recommended that reference to this part of the Manual should be made in the following way:

Figure 1.1 on page 6. Graph showing the relationship between selected major and trace element mean concentrations in the upper continental crust and human blood. Their similar trend indicates that there is a close relationship between the chemical composition of human blood and the materials of the upper continental crust, although there is a significant difference in magnitude. Data sources: Upper Continental Crust (Reimann et al., 2004, Table 11.1, p.105); Human blood (ALS Global, 2021). Drawn with Golden Software’s Grapher™ v20 by Alecos Demetriades, Hellenic Institute of Geology and Mineral Exploration (IGME) & IUGS Commission on Global Geochemical Baselines (IUGS-CGGB).
The program ROBCOOP4A is a compiled FORTRAN program, which can be run on 32- and 64-bit Microsoft™ Windows computers, without a compiler. It is available in two languages, English and Hellenic. As the source code is provided it can be translated to any other language. The program estimates the balanced classical and robust analysis of variance parameters (i.e., sampling, analytical, geochemical), measurement uncertainty and the expanded uncertainty factor. It can process up to 500 variables determined on 2000 samples by 4 analyses (2 for the routine and 2 for the field duplicate samples).


The ROBCOOP4A program and the test data are made available from the Software programs/ROBCOOP4A webpage.
The aim of the Global Black Soil Critical Zone Geo-ecological Survey (BASGES) is to study, in a holistic approach, the serious degradation problems that Black Soil types are facing all over the world because of several decades of intensive cultivation. Their present chemical state shall be studied by following the principles of the IUGS Commission on Global Geochemical Baselines for producing an internally consistent high quality geochemical database. The requirements are to use standardised sampling and sample preparation methods, and all samples must be analysed in the same laboratory for the same suite of determinands/parameters, following a strict quality control protocol.

GRACIAS, OBRIGADA, THANK YOU

IUGS Commission on “Global Geochemical Baselines”

Mapping the Geochemistry of the Earth’s Land Surface