



2020 to 2024

REPORT ON THE ACTIVITIES

of the

INTERNATIONAL UNION OF GEOLOGICAL SCIENCES
COMMISSION
ON
GLOBAL GEOCHEMICAL BASELINES

June 2024

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2020 to 2024 REPORT
of the
IUGS COMMISSION ON GLOBAL GEOCHEMICAL BASELINES
URL: <http://www.globalgeochemicalbaselines.eu/>

1. Introduction

On the 31st of August 2016 at the Fourth Ordinary Session of the International Union of Geological Sciences (IUGS) Council Meeting in Cape Town, the establishment of an IUGS Commission on Global Geochemical Baselines was approved.

This is a summary report of the activities of IUGS Commission on Global Geochemical Baselines (CGGB) from 2020 to 2024. A detailed description of CGGB's activities in the form of annual reports can be downloaded from the CGGB website where all reports are archived ([2020 Annual Report](#), [2021 Annual Report](#), [2022 Annual Report](#), [2023 Annual Report](#)). Further, monthly reports about current activities are reported in the [IUGS E-Bulletin](#).

2. Manual of Standard Geochemical Methods for the Global Black Soil Project

Shenyang Geological Survey (SGS) of China Geological Survey invited the CGGB to participate in the Global Black Soil Critical Zone Geological Survey (BASGES - www.blacksoils.org/). The overall aim of the project is to map the current state of black soil, and make recommendations for its sustainable use and protection for future generations. The CGGB undertook the compilation of the IUGS Standard Geochemical Methods Manual dedicated to black soil, and the planning of the geochemical sampling in countries which have this type of soil. The SGS will analyse *free of charge* all collected samples.

2.1. Publication of the Manual of Standard Geochemical Methods for the Global Black Soil Project

The compilation of the '[International Union of Geological Sciences Manual of Standard Geochemical Methods for the Global Black Soil Project](#)' (BASGES manual) was completed, and the Executive Committee of the International Union of Geological Sciences approved its publication at its 74th meeting in Busan, South Korea, on the 17th of January 2020.

The overall objective of the geochemical survey of Black Soil regions of the World is the establishment of a global Geochemical Reference Network for Black Soil, which will be used for monitoring future changes, such as the impact of intensive agriculture and global climate change on its nutritional status.

Following the approval for publication of the BASGES manual by the IUGS Executive Committee at its 74th meeting in Busan of South Korea on the 17th of January 2020, an ISBN number was acquired, and directly afterwards the report was uploaded to the Commission's website from where it can be freely downloaded. Subsequently, a Zenodo digital object identifier (doi) number was obtained.

Demetriades, A., Dai, H., Liu, K., Savin, I., Birke, M., Johnson, C.C., Argyraki, A. (Editors), 2020. [International Union of Geological Sciences Manual of Standard Geochemical Methods for the Global Black Soil Project](#). International Union of Geological Sciences, Commission on Global Geochemical Baselines, Special Publication No. 1, Athens, Hellas, 107 pages, 49 figures, 4 Tables, and 4 Appendices, ISBN: 978-618-85049-0-5; <https://doi.org/10.5281/zenodo.7267967>.

2.2. Workshops on Global Black Soil Critical Zone Geo-ecological Survey

- **2021, 19th of May the 4th BASGES Workshop**, organised by the Shenyang Geological Survey of China Geological Survey, was virtual due to the Covid 19 pandemic. Two presentations were delivered by CGGB members. “[International Union of Geological Sciences Manual of Standard Geochemical Methods for the Global Black Soil Project](#)” by Alecos Demetriades, Dai Huimin, Liu Kai, Igor Savin, Manfred Birke, Christopher C. Johnson and Ariadne Argyraki, and “**First glimpse of the geochemistry of European Black Soil by using the [GEMAS agricultural and grazing land soil data sets](#)**” by Alecos Demetriades, Manfred Birke, Anna Ladenberger, Philippe Négrel, Martiya Sadeghi, Edith Haslinger, Alan Mann and The GEMAS Project Team.
- **2022, 7th December, 5th Workshop** on the Global Black Soil Critical Zone Geo-ecological Survey (BASGES) – IGCP 665 project was organised by the Shenyang Geological Survey of China Geological Survey. One presentation was delivered virtually by Alecos Demetriades (Chair of CGGB’s Sampling Committee), as a follow-up of the [International Union of Geological Sciences Manual of Standard Geochemical Methods for the Global Black Soil Project](#),
- **2023, 18th and 19th of December**. The [IGCP Project 665 - Sustainable Use of Black Soil Critical Zone](#) ended in 2023, and the China IGCP Committee organised a two-day seminar with the title “*The 2023 Academic Seminar of Chinese IGCP projects*” was hosted by the Chinese Academy of Geological Sciences, Beijing. [Two Black Soil project presentations were delivered](#). The first with the title “*Land Resources Evolution Mechanism and Sustainable Use in Global Black Soil Critical Zone*” was delivered in Chinese by Liu Kai, and the second was a recorded presentation by Alecos Demetriades (Chair of CGGB’s Sampling Committee) entitled “*Global Black Soil Geochemistry: 2017 to 2023*”.

3. Publication of the Manual of Standard Methods for establishing the Global Geochemical Reference Network

The “[International Union of Geological Sciences Manual of Standard Methods for Establishing the Global Geochemical Reference Network](#)” was published in June 2022 following the mandate to the Commission from the International Union of Geological Sciences (IUGS) to set standards for establishing the Global Geochemical Reference Network. It 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 sediment, 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.*

The Manual of Standard Methods is truly an international effort, and the IUGS-CGGB would like to thank all the contributors, reviewers and providers of material for their engagement and dedication (51 contributors from 25 countries, 23 reviewers from 13 countries and 10 colleagues from 5 countries that provided material).

The IUGS Executive Committee at its 77th meeting in Paris (16-18 March 2022) unanimously approved the publication of this Manual as a formal IUGS Publication for the IUGS 60th anniversary celebration. Afterwards, an ISBN number was acquired, and the report was uploaded to the Commission's website from where it can be freely downloaded. Subsequently, a Zenodo digital object identifier (doi) number was obtained.

Demetriades, A., Johnson, C.C., Smith, D.B., Ladenberger, A., Adánez Sanjuan, P., Argyraki, A., Stouraiti, C., Caritat, P. de, Knights, K.V., Prieto Rincón, G. & Simubali, G.N. (Editors), 2022. [*International Union of Geological Sciences Manual of Standard Methods for Establishing the Global Geochemical Reference Network*](#). IUGS Commission on Global Geochemical Baselines, Athens, Hellenic Republic, Special Publication, 2, xlv, 515 pages, 375 figures, 35 Tables, 5 Annexes and 1 Appendix, ISBN: 978-618-85049-1-2; <https://doi.org/10.5281/zenodo.7307696>.

4. Two additional publications

4.1. R-scripts for the generation of random sampling sites

The Global Geochemical Reference Network consists of 19,833 grid cells of 160x160 km that cover the whole globe. The land surface of the Earth is covered by 7356 grid cells (Global Terrestrial Network, GTN), and the marine surface by 12,477 grid cells (Global Marine Network, GMN). Planning the sampling campaigns in both realms requires the generation of random sampling points within each of the 160x160 km grid cell. For this purpose, three R-scripts are made available for the generation of 5-, 8- and 16-random sampling points within each 160x160 km grid cell. The three R-scripts can be used to generate random sampling points within any other size rectangular grid cell. The following publication provides the R-scripts, instructions for their use, and the format of the input and output files:

He, J. & Geng, X., 2022. [*R-scripts for Generation of 5, 8 and 16 Random Sampling Points Within Predefined Rectangles*](#). IUGS Commission on Global Geochemical Baselines, Athens, Hellenic Republic, Special Publication, 3, vi, 14 pp., 5 Figures, 3 Appendices, Supplementary material, ISBN: 978-618-85049-2-9; <https://doi.org/10.5281/zenodo.7307202>

4.2. ROBCOOP4A.EXE

The program [*ROBCOOP4A*](#) can be used to estimate 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). As the source code is provided, the program can be translated into other languages. The current version is available in English and Hellenic languages. In 2023, it was translated into Spanish, but its publication was withheld because a new version of the (balanced robust ANOVA) is being compiled in order to add the script for unbalanced robust ANOVA. It is expected that this work will be completed in 2024, and the English, Hellenic and Spanish versions published.

The [e-book](#) and [software programmes](#) can be downloaded from the Commission's Publications webpage.

Vassiliades, E., 2002. [Program ROBCOOP4A for Estimation of Balanced Classical and Robust Analysis of Variance: Instructions for Use and Source Code](https://doi.org/10.5281/zenodo.7307388). IUGS Commission on Global Geochemical Baselines, Athens, Hellenic Republic, Special Publication, 4, vi, 42 pp., 12 Figures, 4 Tables, 2 Appendices, Supplementary material, ISBN: 978-618-85049-3-6; <https://doi.org/10.5281/zenodo.7307388>

5. Conferences 2021 to 2024

The CGGB promoted the Global Geochemical Baselines project and, since 2022, the IUGS Manual of Standard Methods, by participating in conferences, either as participants or organisers of dedicated sessions:

- **2021, 4th to 9th July**, *Goldschmidt Conference* (Virtual). The IUGS Commission on Global Geochemical Baselines (CGGB) together with the [Geochemistry Expert Group](#) (GEG) of EuroGeoSurveys organised a session entitled “[Geochemical mapping at all scales for all reasons](#)” under Theme 12 “*Environmental Geochemistry and Human Health*”. The keynote lecture “[Geochemical mapping applications to forensics and intelligence](#)” delivered by Patrice de Caritat (Geoscience Australia), CGGB Steering Committee member, drew large attention from the press media covering the conference, resulting in interviews and articles in National Geographic and Forbes.
- **2022, 11th February and 8th March** (Virtual), as part of the UN International Day of Women and Girls in Science and [International Women’s Day](#), Anna Ladenberger (CGGB’s 1st Co-chair) was interviewed about her experience in working as an applied geochemist and the major challenges that female scientists have to face when working in the field under difficult conditions and at remote regions (<https://www.iugs.org/scges>).
- **2022, 22nd March**, on the occasion of the virtual *IUGS60 event for the World Water Day*, Alecos Demetriades (CGGB’s Chair of Sampling Committee) was invited and presented the work done by the [EuroGeoSurveys Geochemistry Expert Group](#) (CGGB’s European section) related to water studies and health.
- **2022, 17th to the 19th August**, framed within the 150th Anniversary of the Swedish Geological Society Conference (Uppsala), the [FOREGS Geochemical Atlas of Europe](#) celebrated its 25th anniversary, a poster was presented with the title ‘*The FOREGS Geochemical Baselines Project – 25 years of European-wide geochemical mapping*’ by Timo Tarvainen, Reijo Salminen, Alecos Demetriades, Tarja Hatakka, Anna Ladenberger, Kaj Lax and the FOREGS Project Team.
- **2022, 19th to the 23th September**, on the occasion of the ASGMI conference “Geochemistry for Social Development”, organised by the Geological Survey of Colombia, Anna Ladenberger (CGGB’s 1st Co-Chair) delivered an invited lecture ‘*Geochemical mapping in Europe: Geochemistry Expert Group EGS contribution to more sustainable resources management*’. The organiser was Gloria Prieto (CGGB’s 1st Deputy Chair), who also delivered a presentation in Spanish ‘*Minería de Datos Geoquímicos en mapeo geoquímico multipropósito: Ejemplo - Atlas Geoquímico Colombia versión 2020*’ (‘*Geochemical Data Mining in multipurpose geochemical mapping: Example - Geochemical Atlas Colombia version 2020*’) with co-authors Juan Fernando Jimenez and Olger Mendoza.
- **2022, 17th to the 19th October**, *16th International Conference of the Geological Society of Greece*, University of Patras, Hellenic Republic. The [Manual](#) was presented by Alecos

Demetriades (Chair of CGGB's Sampling Committee), as an invited lecture at the "Geochemistry, Mineralogy, Petrology and Volcanology" session.

- **2022, 25th of November**, Alecos Demetriades (Chair of CGGB's Sampling Committee) presented, as part of the [SEGH Live Fellows seminars](#), the "[International Union of Geological Sciences Manual of Standard Methods for Establishing the Global Geochemical Reference Network](#)".
- **2023, 9th to the 14th of July**, *Goldschmidt conference*, Lyon, France. The session entitled "[Novel geochemical and mapping methods at global to local scales with applications in environmental sciences, food safety, ecology, archeology and paleontology](#)" under Theme 12 "*Environmental Geochemistry and Human Health*" was chaired by Anna Ladenberger (CGGB's 1st Co-chair) together with conveners from Italy, Canada and the USA. The session comprised 23 oral presentations and 14 posters. Paula Adánez (CGGB's Scientific Secretary) introduced the audience to the [IUGS Manual of Standard Methods](#) with the oral presentation [A manual of standard methods for establishing the global geochemical reference network](#).
- **2023, 4th July**, *SEGH 2023 conference*, Athens, Hellenic Republic. Alecos Demetriades (CGGB's Chair of Sampling Committee) delivered a keynote presentation entitled "[Standard Methods for Establishing the Global Geochemical Reference Network](#)" as part of Session 4 "*Global databases for geochemistry and beyond*".
- **2024, 12th to 14th August**, *Joint Conference of ISEH ICEPH & ISEG*, Galway, Ireland. A session is organised by CGGB and EGS-GEG with the title "*Geochemical mapping at all scales: evidence from soil, sediment, water and plants*". Alecos Demetriades (CGGB's Chair of Sampling Committee) is an invited keynote speaker and will be presenting the '[IUGS Manual of Standard Methods for Establishing the Global Geochemical Reference Network](#)'.
- **2024, 27th August**, *37th International Geological Congress*, Busan (South Korea). The CGGB is organising the 4th Arthur Darnley Symposium with the title '*Challenges and Opportunities of Global-Scale Geochemical Mapping*', which is [Session 1 under Topic 14: 'Low Temperature Geochemistry'](#). In total, 19 abstracts were submitted.

6. Seminars/Workshops

- **2021, 18th November**. The Commission organised an online training workshop on "[Extracting, visualising and interpreting structure in geochemical data through compositional data analysis \(CoDa\)](#)". Lectures were delivered by Prof. Eric Grunsky and Prof. Michael Greenacre, both renowned experts in multivariate statistical analysis of geochemical data. The three-hour short course examined the compositional nature of large geochemical data sets and application of logratio analysis to geochemical data with the intention of extracting, visualising and interpreting their internal structure and correlations. Statistical and graphical tools and applications of predictive geochemical mapping in the geospatial domain were demonstrated through different case studies. There were 397 participants registered from 60 countries and online attendance reached a maximum of 191 during the live session.
- **2022, 10th of October**. On the occasion of the *IUGS Earth Science Festival*, the CGGB organised a virtual event with the title '[A planetary health check on Global Geochemical Baselines. Assessing the geochemistry of life's most vital resources](#)'. The [first part](#) of the event comprised two invited talks given by Prof. Hassina Mouri about the impact of water

quality on human health, and Prof. Mark Macklin gave an overview of the impacts of metal mining on river systems using floodplain sediments. In the [second part](#), speakers from the IUGS Commission on Global Geochemical Baselines presented the concept of Global Geochemical Baseline studies and the '[International Union of Geological Sciences Manual of Standard Methods for Establishing the Global Geochemical Reference Network](#)', as well as examples of applications.

- **2023, 2nd to 6th July.** *38th International Conference on Geochemistry and Health, Athens, Hellenic Republic.* The Commission organised and sponsored a two-day pre-conference workshop "*Applied geochemical methods described in the [International Union of Geological Sciences Manual of Standard Methods for Establishing the Global Geochemical Reference Network](#)*" on Saturday and Sunday, 1st and 2nd of July 2023. It was hosted by the Department of Geology and Geoenvironment of the [National and Kapodistrian University of Athens](#), Hellenic Republic. The SEGH Organising Committee Chair, Professor Ariadne Argyraki, is also the Commission's Public Relations and Finance Officer and a Steering Committee member. The first day was devoted to classroom lectures with hands-on exercises (31 participants). On the second day, the sampling methods were demonstrated in the field. In total, there were 21 participants in the field training course. Tutors were Alecos Demetriades, Hatakka Tarja, Ariadne Argyraki, Stefano Albanese, Alexandros Liakopoulos, Matteo Serra and Konstantina Tsoulou.
- **2023, 8th November.** A webinar on "*Geochemical Mapping in Latin America and the Caribbean - Geochemical Knowledge for Societal Use*" was organised by the IUGS Commission on Global Geochemical Baselines (IUGS-CGGB) and the ASGMI ([Asociación de Servicios de Geología y Minería Iberoamericanos](#)) [Geochemistry Expert Group](#) (ASGMI-GECEOQ). Over 100 participants from Latin America, the Caribbean, Europe, and Africa participated in the webinar. The webinar emphasised the importance of using standardised methodologies to increase geochemical knowledge of the Earth on a global, continental, national and local scale to satisfy the urgent need for information to be used (i) in the planning of each territory in harmony with the natural environment, (ii) for the well-being of society, and (iii) to monitor the continuous changes that occur on planet Earth. The webinar was organised by Gloria Prieto (CGGB's 1st Deputy Chair), who also presented in Spanish the "[Manual of Standard Methods for Establishing the Global Geochemical Reference Network](#)".
- **2024, 1st July, XI Congreso Geológico de España,** Ávila, Spain. A short workshop is organised with the title: "*Fases y protocolos a seguir para una red de referencia geoquímica global*" where the '[IUGS Manual of Standard Methods for Establishing the Global Geochemical Reference Network](#)' will be presented and discussed. A hard copy of the IUGS Manual of Standard Methods will be available for the attendees, and the five Periodic Table posters of the [FOREGS Geochemical Atlas of Europe](#) will be displayed. The tutors are Paula Adánez Sanjuán (CGGB's Scientific Secretary), Iván Martín Méndez (CGGB's Sampling Committee's Deputy Chair) and María João Batista (CGGB's incoming Steering Committee Deputy Chair 2024-2028).
- **2024, 30th - 31st August & 1st September, 37th International Geological Congress,** Busan (South Korea). [Workshop 21 with the title 'International Union of Geological Sciences Manual of Standard Methods for Establishing the Global Geochemical Reference Network'](#) is organised by the CGGB. The first two days will be devoted to lectures and hands-on exercises, and on the third day, the methods of sampling rock, residual soil, stream water, stream sediment, overbank sediment and floodplain sediment will be demonstrated in the field. The tutors are Alecos Demetriades, Maria João Batista, Ariadne

Argyraki, Youngsook Huh, Jong-Sik Ryu, Anna Ladenberger, Paula Adánez-Sanjuan and Iván Martín-Méndez.

7. Publications

The following three publications are in chronological order.

Demetriades, A., 2021. *Geochemical Mapping*. In: D. Alderton and S.A. Elias (Editors), *Encyclopaedia of Geology* (2nd edition). vol. 6, 267–280. United Kingdom: Academic Press. <https://dx.doi.org/10.1016/B978-0-08-102908-4.00059-X>.

Ladenberger, A. and Knights, K., 2022. *International Union of Geological Sciences Manual of Standard Methods for Establishing the Global Geochemical Reference Network*. Explore No. 196, p. 27. (<https://www.appliedgeochemists.org/sites/default/files/documents/Explore%20issues/EXPL-ORE196-September2022.pdf>).

Demetriades, A., 2024. *Applied geochemistry - The how and why*. Chapter 7.1 In: Vol. 7, How we Know, A. Shahar (Editor), In: *Treatise on Geochemistry*, 3rd Edition, Elsevier, 72 pp. <https://doi.org/10.1016/B978-0-323-99762-1.00004-8>.

The 1st and 3rd publications complement the IUGS Manual of Standard Methods. In fact, the three publications provide professionals, teachers and early-career researchers in applied geochemistry with important tools to plan their studies and surveys at any mapping scale effectively.

8. Participation in IUGS Executive Committee's Open Session Meeting

A CGGB Steering Committee member participated in the open sessions of the following IUGS Executive Committee meetings and reported the activities of the previous year, and the planned work for the next fiscal year:

- **2021, 22nd to 24th February** – 76th meeting, Virtual.
- **2022, 16th to 18th March** – 77th meeting, Paris, France.
- **2023, 14th to 17th February** – 78th meeting Belfast, Northern Ireland, UK.
- **2024, 19th to 21th February** – 79th meeting, Nairobi, Kenya.

9. Annual Business Meeting

The CGGB annual meetings were organised jointly with the [EuroGeoSurveys Geochemistry Expert Group](#) and the ASGMI ([Asociación de Servicios de Geología y Minería Iberoamericanos](#)) Geochemistry Group (ASGMI-GEGEOQ), and were hosted by the Geological Surveys or Universities of each country:

- **2020**, The planned joint annual business meeting of the IUGS Commission on Global Geochemical Baselines and EuroGeoSurveys Geochemistry Expert Group in Athens (Hellenic Republic) on the 5th and 6th of November 2020 was cancelled because of the Covid-19 pandemic.
- **2021, 30th November to 1st December**. The joint annual business meeting was held virtually due to the Covid-19 pandemic restrictions.

- 2022, 13th to 15th October. Athens, Hellenic Republic.
- 2023, 5th to 7th October, Naples, Italy.

10. Assistance to members and workshop participants

10.1. Assistance to members during the Covid-19 pandemic (2021)

This year due to the continued Covid-19 pandemic there were a few requests for assistance by Commission members, *e.g.*, (i) Department of Geochemistry and Environment of the [Hellenic Survey of Mining and Mineral Exploration](#) for the planning and execution of a regional soil geochemical baseline orientation survey, and (ii) [Geological Survey of India](#) (Bengaluru) for the interpretation of urban geochemistry results.

10.2. Assistance to the Geochemistry Group of the Asociación de Servicios Geológicos de Geología y Minería Iberoamericanos (ASGMI) (2023)

The Geochemistry Group of the ASGMI at their meetings in 2023 decided to start the planning of the continental-scale geochemical mapping of Latin American countries by initially using available data from each country. ASGMI has compiled a general inventory of the existing geochemical data sets for participating country, which are included in the ASGMI Geochemical Manual entitled “[Manual de Metodologías Geoquímicas de Países Iberoamericanos: Información Geoquímica para la Sociedad](#)” (in Spanish). Each country must thoroughly review the available geochemical data for inclusion in the proposed geochemical map based on the agreed unit cell size, sample media, analytical methods, *etc.* This first Latin America and the Iberian Peninsula Atlas aims to draw attention to the importance of geochemistry at the continental-scale and to open new frontiers of knowledge as achieved in Europe with the FOREGS Geochemical Atlas of Europe, the first multinational and multi-sample media continental-scale project, which produced harmonised geochemical data sets for 26 European countries. In the future, the ASGMI Group hopes to carry out global-scale geochemical mapping according to the instructions and specifications of the recently published “[International Union of Geological Sciences Manual of Standard Methods for Establishing the Global Geochemical Reference Network](#)”.

The Group contacted Alecos Demetriades (CGGB’s Chair of the Sampling Committee) for assistance, *i.e.*, the provision of (i) the shape file of the Latin American Global Terrestrial Network grid cells of 160x160 km, and (ii) the Excel files of 5, 8 and 16 random points for future purposes.

11. CGGB on social media (2020-2024)

Constant updates of all Commission’s activities as well as links to related topics of other organisations are uploaded on the social media pages of CGGB (Twitter: @CGGB_IUGS and Facebook: @CGGBIUGS). A steady increase in follower numbers has been noted in the last four years, reaching 149 (+47) followers on Twitter, and 764 (+300) followers on Facebook. Recently, in 2023, the Commission has launched a page in Linked In (<https://www.linkedin.com/company/cggb-iugs/>), which has already attracted 78 followers.

12. Google Analytics and Zenodo statistics

Google Analytics has updated its platform for the collection of data, and has sent a new code that was added to every website page by the CGGB’s Web hosting company at no cost. The 2023 update of Google Analytics provides statistics of user visits for each web page of the Commission’s website. It is impressive that 834 users have visited the web page of the “[International Union of Geological Sciences Manual of Standard Methods for Establishing the](#)

[Global Geochemical Reference Network](#)” from June 2022 to December 2023. Further, from the 9th of November 2022 to the 31st of December 2023, a total of 242 users downloaded the Manual from the Zenodo website. An additional 49 downloads were recorded until the 25th of June 2024.

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