



Rio Piscinas (Montevicchio, Sardegna). Photographer: G. De Giudici

GEOCHEM NEWSLETTER

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Letter from the President

Orlando Vaselli

Dear Friends and Colleagues,

This GeochemNewsletter n. 20 marks the end of the summer 2025 and we are ready to go back to our institutional and research commitments. I think that this issue had the largest contributions ever and I am glad about it since it indicates that the activity of our members is increasing as well as the events sponsored by the Society. Before going into the details of each contribution, let me express my congratulations to Linda Zaniboni who, during the 2025 IMWA (International Mine Water Association) that was held in Braga (Portugal) from the 6th to the 11th of July, 2025, was awarded with one of the five prizes for the best student presentations and posters. Well done, Linda!

Following the chronological order of the events that have characterized the last few months, we start with the *Summer School on in-situ measurements and sampling of volcanic gases* that was held at Vulcano (Aeolian Islands) from the 9th to the 14th of June. It was a very successful School as more than 160 (participants and teachers) attended this event. Rebecca Biagi, Martina Ferrari and Francesca Amico provided a report on this School, highlighting the number of the fluid geochemical, micro- and biological, atmospheric chemical and volcanological activities that thrilled the participants. The Summer School attracts people from many countries worldwide. This implies and requires a strong effort by the organizers (Rebecca Biagi, Sergio Calabrese, Lorenza Li Vigni, Guendalina Pecoraino, Antonio Randazzo, Franco Tassi, Francesco Tripodi and Stefania Venturi) to keep this event occurring every year.

From the 16th to the 21st of June, 2025, Cagliari hosted the 18th *International Symposium on Water-Rock Interaction* and the 15th *International Symposium on Applied Isotope Geochemistry*, patronized by our Society. Giovanni De Giudici (the deus ex-machina of

this important international event) illustrated the most important and notable points of these joint symposiums. The success was incredibly good despite some defections by the U.S.A. researchers due to the recent Trumps' policy. I could attend this event and the quality of the organization was "top". I would like to point out that a post-congress geothermal-geochemical field-trip at Larderello and Mt. Amiata was held and organized by Federica Meloni and myself with the collaboration of Alessandro Lenzi and Giorgio Simoni (ENEL-GreenPower) and Daniele Rappuoli (President of the National Park Museum of the Mt. Amiata Mines). A couple of weeks after the Summer School of Vulcano and about a week after the Cagliari congress, the 5th edition of CAMGEO ("*Sampling and Analysis of Geological Matrices*") took place at the Department of Earth, Environmental, and Resource Sciences (DiSTAR) of the University of Naples Federico II, organized under the auspices of the Italian Society of Geochemistry (So.Ge.I.) from the 1st to the 4th of July. Salvatore Dominech and Stefano Albanese described the main points of this School that this year had as the main target: *Contaminated Sites and Environmental Risk Assessment*. Members of the Society and other experts from CNR, INGV and regional environmental agencies (ARPAC, ARPAS), and the industrial sector had interesting lectures that were appreciated by the 21 participants who attended the School. With respect to the previous editions of CAMGEO, we missed practical experiences in the field, due to logistic issues, that were partly offset by a visit to the SIN (Sites of National Interest) "*Napoli Orientale*", an area contaminated by hydrocarbons and, currently, under remediation, and the "*Laghetti di Castelvoturno*". The 6th edition of CAMGEO is planned in 2027, and in-situ practices will definitively be included, as it was in the past.

The last but not the least is the report by the editors Maurizio Barbieri, Elisabetta Dore and Nicolas Greggio on the very first Special Issue of the Society, published by Environmental Geochemistry and Health (Springer), which resulted by the Session of Environmental Geochemistry of the 2nd Congress of the Italian Society of Geochemistry that was held in Perugia in July 2024. Seven papers were published which is a good result although I would have expected a larger number of contributors to this journal that has a relatively good impact factor (3.8) but, as a first experience in this respect, it was a more than acceptable achievement. Hopefully, for the next congress, that will be held in Ravenna (end of June – early July 2026. The final dates are still to be defined), we may have the opportunity of another Special Issue similar to that of the Perugia congress. Many thanks to Maurizio Barbieri, Elisabetta Dore and Nicolas Greggio for all the efforts they put in publishing this Special Issue and to all the contributors.

This newsletter hosts the episode n. 10 of "R" and I wish to thank Caterina Gozzi for being so available to render her experience on this programming language for statistical computing and data visualization to our community. This new episode is related to Introduction to Compositional Data Analysis.

There are two other contributions. The first one is by Lorenzo Chemeri (LC) who provided an up-to-date of the followers of our socials (Instagram, Facebook, LinkedIn and Twitter). LC (who is gratefully acknowledged) evidenced the increasing number (e.g. up to 45 % for Instagram with respect to 2024) of followers. Only, X (former Twitter) showed a decreasing interest, likely because is less competitive with respect to other platforms or the "Musk" effect has not yet produced the expected results.



Letter from the President

Orlando Vaselli

Eventually, there is a call for submitting article to the Special Issue of the Journal of Geochemical Exploration titled: "*Biogeochemical Frontiers in Transitional Environments: Where Land Meets Sea*" which is mostly focused on Transitional Environments (TEs). Salvatore Dominech, Stefano Albanese and Shouye Yang are the editors of this Special Issue that I hope it will collect several adhesions from our members. The deadline for the submission has been fixed on the 31st of January, 2026.

We are a few days away from the last event organized by the Society for this year that will be held on the 7th to the 8th of September. This is a two-days meeting dedicated to Mercury (as element) and titled *Mercury, from a requested to a banned element*. The first day (at 2 pm) the more than 40 participants will meet at the Siele Mine where several presentations on the mining activity in the Mt. Amiata area by a scientific, social and archeometallurgical points of view are given. This day will be concluded with a visit to the former mining area of Siele. The day after, the participants will be reconveyed at Abbadia Salvatore where the Park Mining Museum, belonging to

the National Park Museum of the Mt. Amiata Mines, will host a full day of presentations by experts from universities, research centers and regional environmental agencies, as reported in the final program of this meeting. This event is financially supported by the National Park Museum of the Mt. Amiata Mines and the Italian Society of Geochemistry. This event is free-of-charge and, similarly to what happens for the Vulcano School, the participants are responsible for their accommodation and travel expenses. Coffee- and lunch-breaks, gadgets, t-shirts and so forth will instead be offered by the two public organizers. Daniele Rappuoli, Federica Meloni, Stefano Covelli and Elena Pavoni are the members of the organizing committee along with myself.

It is to be reminded that Padua, from the 16th to the 18th of September, will host the SIMP (Italian Society of Mineralogy and Petrology) and SGI (Italian Society of Geology) Joint Congress which has as a target *The Geosciences and the Challenges of the 21st Century*. Our community will be attending this joint congress with numerous oral and poster presentations.

I do conclude this letter with the events that will be organized by the So.Ge.I. The Summer School of Vulcano is a must and it will be replicated in 2026. The most important event is undoubtedly the 3rd Congress of the Italian Society of Geochemistry in Ravenna. There are several ideas that are flourishing for possible new events but concretely there are no specific activities still programmed. In the next newsletter and/or by email I will keep you posted.

Stefania Venturi is acknowledged for her precious work since she is handling all the newsletter issues published so far. Jacopo Cabassi has the incredible merit to tirelessly assemble the list of publications of our members. From the last issue of this newsletter up to now, 107 articles have been published. The publications are sorted by Scopus, independently by the impact factor of the journal. If there are publications that are not quoted by Scopus but are of international relevance, you are kindly asked to send the citations (or the Digital Object Identifier: doi) to my e-mail address. Thus, they can be included in the next issue.

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IL MERCURIO DA ELEMENTO «RICERCATO» A ELEMENTO «BANDITO»

7 Settembre ex miniera del Siele
8 Settembre Parco Museo Minerario Abbadia
S. Salvatore

IL PROGRAMMA

DOMENICA 7 SETTEMBRE

- 14:00 - 14:30 Registrazione presso l'area mineraria dismessa del Siele
- 14:45 - 15:15 Saluti
- 15:15 - 15:45 Il censimento dei giacimenti mercuriferi del Parco Nazionale (**P. Garofalo**)
- 15:45 - 16:15 Le imprese minerarie amiatine tra mutamento economico, sociale e paesaggistico (**M. Fabbrini**)
- 16:15 - 16:45 Materiali per una storia del paesaggio storico-produttivo del Monte Amiata.
Il censimento del patrimonio archeominerario del Parco Nazionale (**L. Dallai & V. Volpi**)
- Coffee break
- 17:15 - 18:00 La bonifica dell'ex-area mineraria del Siele (**D. Rappuoli**)

LUNEDÌ 8 SETTEMBRE

- 08:30 - 09:00 Registrazione presso il Parco Museo Minerario di Abbadia San Salvatore
- 09:00 - 09:30 Introduzione alla geochemica del mercurio e fonti di emissione naturali ed antropiche (**J. Cabassi**)
- 09:30 - 10:00 Il mercurio gassoso nelle aree contaminate da attività minerarie (**P. Higuera**)
- 10:00 - 10:30 Monitoraggio e valutazione dell'esposizione e dei rischi da suoli contaminati da mercurio (**A. Vecchio**)
- 10:30 - 11:00 Problematiche ambientali legate al mercurio in ambiente minerario (**V. Rimondi**)
- Coffee break
- 11:30 - 12:00 Gli isotopi del mercurio quale strumento per tracciare i processi biogeochimici del metallo (**P. Costagliola**)
- 12:00 - 12:30 Scambi all'interfaccia acqua-aria e suolo-aria (**F. Floreani**)
- 12:30 - 13:00 La speciazione del mercurio nei suoli (**F. Meloni**)
- Lunch break
- 14:00 - 14:30 I giacimenti minerari a mercurio della Toscana meridionale (**P. Garofalo**)
- 14:30 - 15:00 Almadén, la culla mondiale del mercurio (**P. Higuera**)
- 15:00 - 15:30 Il mercurio nei sedimenti costieri del Nord Adriatico: dal Golfo di Trieste alla Laguna di Marano e Grado (**S. Covelli**)
- 15:30 - 16:00 Processi di rimobilizzazione e trasformazione del mercurio nei sedimenti e possibili strategie di mitigazione (**E. Pavoni**)
- Coffee break
- 16:30 - 17:00 Contaminazione da mercurio negli ambienti costieri del Nord Adriatico: evidenze lungo la catena trofica (**A. Acquavita**)
- 17:00 - 17:20 La collezione mineralogica Bertelli (**L. Bertelli**)
- 17:20 - 17:45 Discussione e chiusura
- 18:00 - 19:15 Visita all'area mineraria dismessa di Abbadia San Salvatore (**D. Rappuoli**)
- 20:00 - 23:00 Cena sociale

L'iscrizione è gratuita ed aperta fino al 10 agosto 2025!

L'ingresso è limitato ad un massimo di 50 persone!

Il modulo di iscrizione è disponibile qui: <https://forms.gle/GeCzMor7tT2DCeXQ7>

COMITATO ORGANIZZATORE

Daniele Rappuoli - Parco Nazionale Miniere dell'Amiata
Orlando Vaselli - Università di Firenze
Federica Meloni - Università di Firenze
Stefano Covelli - Università di Trieste
Elena Pavoni - Università di Trieste



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Members' Activities

Vulcano Summer School 2025

on in situ measurements and sampling of volcanic gases

June 9-13, 2025 - Vulcano Island, Aeolian Archipelago (Italy)

Rebecca Biagi, Martina Ferrari, Francesca Amico

Once again, the stunning Vulcano Island set the scene for a week of science, sunshine, and a healthy dose of sulfur during the *International Vulcano Summer School on in situ measurements and sampling of volcanic gases*. Held from June 9 to 13, this year's edition brought together an exceptional 98 students and 53 lecturers from 9 countries, representing over 40 universities and research institutions (Figs. 1 and 2). From Italy to Romania, Chile to Turkey, Mexico to Germany, the Aeolian Islands briefly became a melting pot of languages, disciplines, and scientific curiosity!

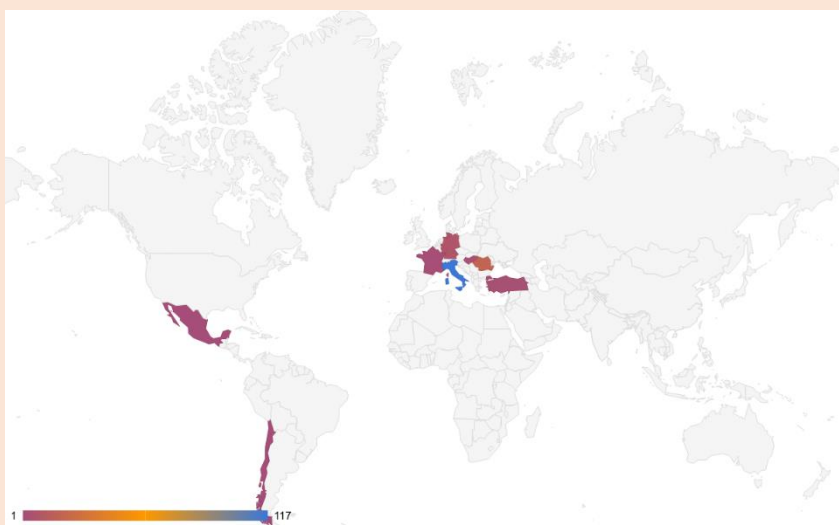


Fig. 1 World map of the participants at the Vulcano Summer School 2025.

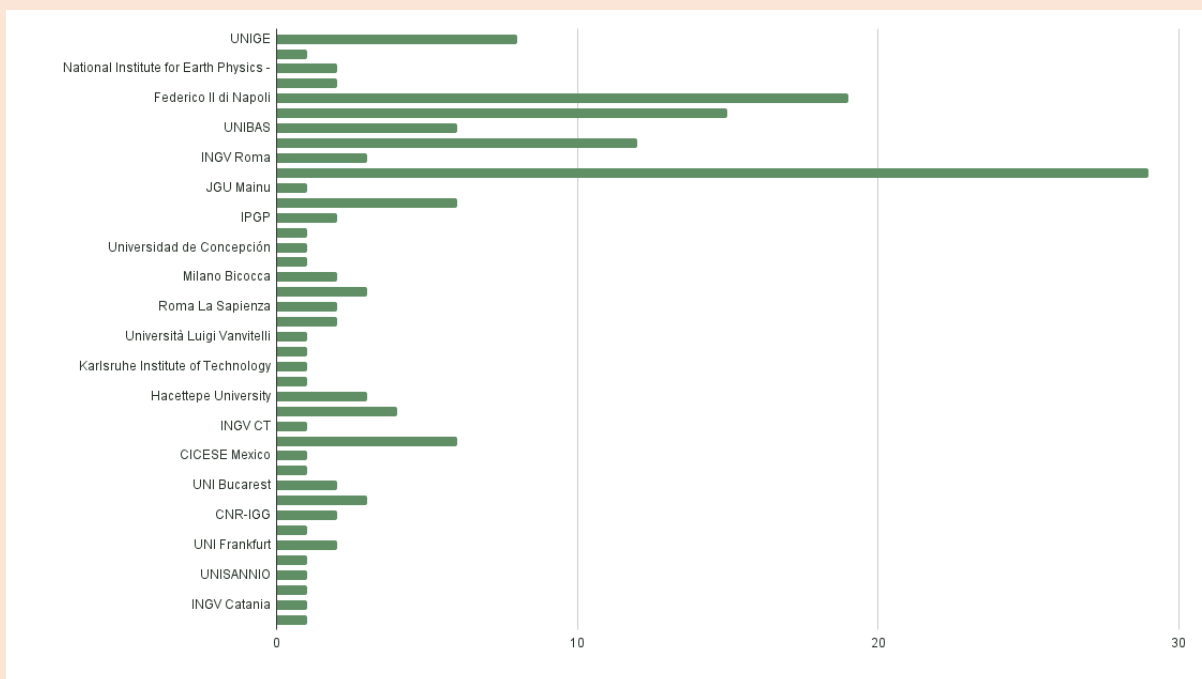


Fig. 2 Affiliation chart.



The school was organized by the Universities of Florence (Prof. Franco Tassi, Dr. Rebecca Biagi, Dr. Stefania Venturi) and Palermo (Prof. Sergio Calabrese, Dr. Lorenza Li Vigni, Dr. Francesco Tripodi) and the Italian National Institute of Geophysics and Volcanology (INGV Rome, Dr. Antonio Randazzo; INGV Palermo, Dr. Giovannella Pecoraino), with the support of the Italian Geochemical Society (So.Ge.I.) and the IAVCEI Commission on the Chemistry of Volcanic Gases (CCVG).

What made this school so special was not just the landscape (though the sunrise we saw from the crater-top did help; Fig. 3), but the truly multidisciplinary spirit of the program. The week was designed for those studying (or dreaming of studying) the complex world of volcanoes from every scientific point of view:

- geochemists analyzing fluid emissions,
- volcanologists studying eruptive history,
- environmental scientists tracking air and water quality,
- microbiologists hunting for life in extreme conditions,
- and even the engineers...thinking about energy, sensors, and geothermal resources.

Every lecture blended theory with hands-on experience, transforming the island into a living laboratory. This was not a course where you just sit and take notes...it was *learning by doing*: with your boots in the mud, your hands on the instruments, and your head full of questions.

Curious what a week like that looks like? Here is a day-by-day look at some of the Summer School's most memorable moments!

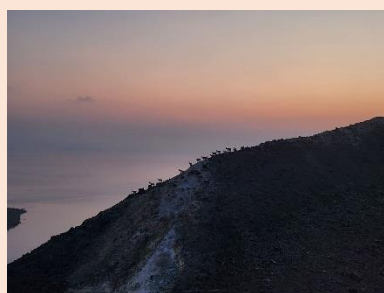


Fig. 3 Sunrise from Vulcano summit.

Tuesday and Thursday: 8 angles on volcanic research

On Tuesday and Thursday, students rotated through 8 hands-on sessions at Baia di Levante (Fig. 4), each led by a team of researchers. Divided into small international groups named after volcanoes (Team Stromboli! Team Kilauea! Team Santorini!), students tackled the following activities:

- **Air quality monitoring:** learn to measure and interpret atmospheric pollutants in volcanic and hydrothermal areas.
- **Groundwater and seawater sampling:** techniques for collecting and analyzing water in volcanic environments.
- **Fumarole gas sampling:** approaches for sampling high-temperature gases directly from fumaroles (safely and efficiently).
- **Diffuse soil gas and soil sampling:** measure diffuse gas emissions and assess gas and soil chemistry.
- **Microbiology:** sample and analyze extremophile microorganisms thriving in hot, acidic, and sulfidic environments.
- **Multigas techniques:** use portable gas analyzers to monitor volcanic emissions in real-time.
- **INGV monitoring station:** get a behind-the-scenes look at how Italy's volcanoes are watched 24/7 by remote sensing techniques.
- **Scuba sampling:** dive into volcanic waters for underwater gas and microbial sampling.



Fig. 4 Hands-on activities at Baia di Levante.

Wednesday: on the crater rim

On Wednesday, the entire group hiked to the summit of Vulcano, exploring the spectacular high-temperature fumaroles that ring the crater rim (Fig. 5). With field notebooks in hand, gas masks on face, and backpacks full of sampling gear, students learned how to work in extreme conditions and got a firsthand look at the impressive and dynamic power of an active volcanic system.



Fig. 5 Activities at the summit of Vulcano.

Thursday night: Pizza, certificates... and dancing under the stars

Thursday night was the traditional social dinner, where pizza was (eventually!) served, certificates were handed out, and the atmosphere warmed up (Fig. 6). The delayed food did not stop anyone from celebrating; by the time the music started, the tables had become a dance floor!



Fig. 6 Certificate award ceremony.

Friday: a volcanic grand finale

The week ended with a spectacular boat trip to Panarea and Stromboli. Students explored underwater fumaroles of Panarea, swam in turquoise waters, and watched Stromboli's dramatic eruptions from the sea...a natural fireworks show that marked the perfect end to an unforgettable week.



More than a field school: a growing community

Beyond the activities, what truly stands out is the international and interdisciplinary network created during the school (Fig. 7). The wide range of backgrounds, from geochemistry to volcanology, and from environmental science to microbiology, fostered rich discussions and unexpected connections.

And the numbers speak for themselves: over 9 countries represented (Fig. 1); more than 40 institutions and research centers (Fig. 2); a mix of bachelor's, master's, PhD students, and early-career researchers...and new collaborations already taking shape!

This is not just a summer school...it is a launchpad for future research, partnerships, and ideas.

Ready to join us next year?

If you are a student, early-career researcher, or simply passionate about volcanic gases and field science, this is the place to be. The dates for the 2026 edition will be announced soon...keep an eye on the official website and social media channels of the So.Ge.I.

Don't miss the chance to be part of this growing global community and take part in one of the most exciting scientific adventures in the heart of the Mediterranean Sea!

Stay tuned...we will see you on the island!



Fig. 7 Participants at the Vulcano Summer School 2025.



Report on the WRI18-AIG15 (IAGC3) Congress

Cagliari, June 16-21, 2025

Giovanni De Giudici

The WRI18-AIG15 (IAGC3) congress was held from June 16 to 21, 2025, at the University Citadel in Monserrato, Cagliari (<https://www.unica-wri-18.it/>). The event was organized by the Department of Chemical and Geological Sciences of the University of Cagliari, with the support of a team of over twenty young researchers. The General Secretary of the Congress was Giovanni De Giudici.

The congress welcomed approximately 300 registered participants from 22 countries across five continents, highlighting its international significance. A total of 308 scientific contributions were submitted and compiled into a digital volume published by UNICAPRESS, accessible at the following link: <https://unicapress.unica.it/index.php/unicapress/catalog/view/978-88-3312-187-1/978-88-3312-187-1/941-1>

The scientific program featured:

- 22 thematic sessions
- 7 plenary lectures
- 3 pre-congress thematic workshops
- 1 pre-congress field excursion to Mount Etna
- 1 post-congress excursion to the Larderello–Amiata geothermal area
- 7 mid-conference scientific excursions



One of the plenary lectures

We wish to express our sincere gratitude to the Italian Society of Geochemistry (So.Ge.I.) for its patronage and for the active involvement of its members as organizers, convenors, and speakers.

Special thanks also go to So.Ge.I. for awarding four grants to young SoGel members, which were conferred to Eduardo Di Marcantonio (Unlocking Stable Isotopes for PFAs compounds: a new CSIA method), Francesca Amico (Linking hydrothermal fluid geochemistry and microbial community patterns in Nisyros Island, Greece), Filippo Brugnone (A new approach for studies of atmospheric deposition: boron and strontium isotopic fingerprints in rainwater from urban, industriale, rural, and volcanic areas of Sicily, Italy) e Federica Meloni (Integrated approach (CoDA and machine learning) for determining geochemical baseline values in soils from decommissioned mining areas), in support of their participation in the congress.



Post-congress field-trip at Etna Volcano

The Organizing Committee extends its heartfelt appreciation to So.Ge.I. for the unwavering support provided from the earliest stages of planning.



Post-congress field-trip at Larderello-Mt. Amiata



The 5th CAMGEO School - Sampling and Analysis of Geological Matrices

Salvatore Dominech and Stefano Albanese

The fifth edition of the CAMGEO Summer School, “*Sampling and Analysis of Geological Matrices: Contaminated Sites and Environmental Risk Assessment*”, was held from **1 to 4 July 2025** in Naples (Italy), hosted by the Department of Earth, Environmental, and Resource Sciences (**DiSTAR**) of the University of Naples Federico II and organized under the auspices of the Italian Society of Geochemistry (**So.Ge.I.**). The school aimed to provide young researchers, PhD students, professionals, and technical staff with the opportunity to expand their knowledge of geochemical approaches to environmental challenges. The program, coordinated by a scientific boarding including members from the University of Naples Federico II, **CNR-IGG**, **ARPAC**, the *University of Florence*, and the *University of Genoa*, offered an interdisciplinary perspective on contaminated sites and environmental risk assessment. Lectures were delivered by experts affiliated with

universities across Italy, national research institutes such as **INGV** and **CNR**, regional environmental agencies (**ARPAC**, **ARPAS**), and the industrial sector, ensuring a wide-ranging view that bridged academic, institutional, and applied expertise.

The main themes focused on the sampling and characterization of different geological matrices, water, soils, and gases, with particular attention from environmental protection agencies to the protocols and regulations governing sampling in contaminated settings. Discussions addressed potentially toxic elements (**PTEs**) in areas with high environmental impact, such as abandoned mines and sites affected by hydrocarbon pollution, as well as emerging contaminants including **PFAS** and **KEU**.

These topics were closely linked to broader reflections on sustainability and circular economy perspectives, with an emphasis on how waste can be reinterpreted as a resource to support environmental management and remediation. Specific sessions also examined the environmental and health risks associated with naturally occurring gases that are difficult to detect, such as **Radon** and **CO₂**. Significant attention was devoted to the analysis of geospatial data, the estimation of geochemical background values, the application of numerical geochemical models, and the use of statistical and geostatistical approaches for environmental risk assessment.

Field activities were a highlight of the school and were divided into two complementary excursions. The first excursion took place at the **SIN** (Site of National Interest) “*Napoli Orientale*”, which includes approximately 38 hectares formerly occupied by **Q8** (Kuwait Raffinazione e Chimica, part of Kuwait Petroleum Italia). These areas comprise an ex-refinery and petrochemical complex, which has been transformed into a logistics hub for the storage, reception, and distribution of energy products. The remediation plan involves excavating and treating approximately **1 million tons of contaminated soil**, aimed at facilitating the urban regeneration of Naples’ eastern district. Participants were welcomed directly by the company’s managing director, the head of the remediation works, and the project engineer. They introduced the group to the basic safety rules of operating within such a large remediation site, presented the equipment and strategies adopted for soil and groundwater reclamation, and discussed the enormous logistical and financial challenges associated with recovery and disposal of contaminated materials.



Fig. 1 Visit to the Q8 remediation site within the SIN “*Napoli Orientale*”



After a working lunch on site, the group moved to “Lagheti di Castelvoturno”, where they observed the contrasting situation of unmanaged, contaminated sites. Here, students saw firsthand how the absence of structured oversight often makes environmental analysis, remediation, and monitoring far more complex and protracted. The experience highlighted the challenges of applying theoretical approaches in real-world contexts and suggested directions for future editions of the school, such as including guided sampling activities of soils and waters in cooperation with local authorities, to strengthen the understanding of best practices and regulatory frameworks.

The event also brought together participants from a broad network of Italian universities, including Catania, Palermo, Potenza, Camerino, Chieti, Urbino, Pavia, Padova, Torino, Ferrara, Firenze, as well as Naples, fostering **exchange** and **collaboration** across institutions. The CAMGEO Summer School once again confirmed its role as a key training ground for the next generation of geochemists and environmental scientists, providing an interdisciplinary platform that bridges academic research, institutional expertise, and applied methodologies.



Fig. 2 Presentations delivered during the training sessions at DiSTAR.



Fig. 3 Participants receiving an overview of the safety regulations of the remediation project at the Q8 site within the SIN ‘Napoli Orientale.



Special Issue on the “2nd Italian Geochemical Society Congress - Environmental Geochemistry Session” published on Environmental Geochemistry and Health (EGH)

Editors: Elisabetta Dore (University of Cagliari), Maurizio Barbieri (University of Rome “La Sapienza”), Nicolas Greggio (University of Bologna)

Introduction

The Special Issue published on Environmental Geochemistry and Health (Springer) is the scientific outcome of the “2nd Congress of the Italian Society of Geochemistry (Environmental Geochemistry Session)”, that was held in Perugia in July 2024. On that occasion, the session dedicated to environmental geochemistry, coordinated by Prof. E. Dore (University of Cagliari), Prof. M. Barbieri (University of Rome “La Sapienza”) and Dr. N. Greggio (University of Bologna), offered a lively debate among experts from various universities, research centers and national institutions, highlighting the variety and importance of the approaches that currently characterize this branch of geochemistry.

Environmental geochemistry can indeed be considered a bridging discipline since it investigates the distribution and mobility of chemical elements and compounds in natural and anthropically-affected ecosystems, with a special focus on Potentially Toxic Elements (PTEs), monitoring methodologies, and the expected consequences for human and environmental health. This Special Issue is a collection of seven high-quality papers that reflect the emerging research trends, providing an up-to-date snapshot of the state of the art in Italy and abroad.

Overview

The papers collection evidences three major lines of investigation which intertwine and complement each other. The first one is: *Distribution and mobility of potentially toxic elements in various environmental matrices*. This is a main issue and concerns the presence and behavior of PTEs in soils, sediments, and waters. It is not only matter of acquiring very precise concentrations even at very low contents but studies are aimed at distinguishing natural from anthropogenic sources by determining geochemical background levels, understand PTEs mobility, and assess their environmental and human health risks. The second line of investigation emerging from the collection refers to *Innovative and low-cost methods for environmental geochemical monitoring*. Alongside detailed geochemical studies, the collection offers practical solutions to make monitoring more accessible. Simple, low-cost techniques, though effective, applied to atmospheric particulate matter and greenhouse gases, demonstrate that high-quality data can be obtained even in case of resource-limited funds, thus expanding the spatial and temporal coverage of environmental monitoring.

Eventually, the last, but not the least, line of investigation includes *Isotopic Applications for Tracing Geochemical Processes*. Using stable isotopes is a



Link to the Special Issue:
<https://link.springer.com/collectons/cgjdjfhjb>

well-established and a common thread throughout. Isotopic fractionation allows to distinguish the different sources of contamination and to reconstruct the chemical weathering processes occurring in soil and sediments linked to water-rock interaction. This approach, already consolidated in some fields, is here applied to complex case studies, providing new interpretative keys.



The seven papers

PTEs and their mobility in sediments and soil

Two papers deal with the distribution of PTEs in mining sites. Meloni et al. (2025) analyze stream sediments from the Hg-district of Mt. Amiata (Tuscany) to understand whether toxic elements are deriving from geogenic processes or they are associated with the legacy of mining activities. This study outlines a complex picture where natural and human influences are intertwined with direct implications for the management of river basins still affected by the Hg-rich ore deposits.

A similar approach, though in a completely different context, is that adopted by Fornasaro et al (2025) in Uzbekistan. In this paper, the focus is on the Chirchik-Akhangaran Basin, which is a crucial river basin for agricultural and industrial activities. The analysis of sediments reveals notably critical issues related to the presence of heavy metals, highlighting the urgent need for mitigation and monitoring strategies.

A particularly interesting case is that of thallium (Tl), an often overlooked toxic element. Barago et al. (2025) investigate its mobility in the tailings of a decommissioned Zn-Pb mining area in the Friulian Alps (NE Italy). The results show that thallium, though still little considered, may represent a persistent environmental threat and this work emphasizes the need to more systematically include this element in risk assessments.

Another key contribution is from Sicily, where Lo Medico et al. (2025) define the background values of uncontaminated soils. These reference values allow to define a more precise distinction between anthropogenic and geogenic anomalies. This is a crucial step: without reliable background values, any risk assessment is inevitably incomplete.

Low-cost methods for atmospheric monitoring

Air quality is the topic of two distinct

studies. Ferrari et al. (2025) test a low-cost approach for monitoring greenhouse gases and atmospheric particulate in the Greve River Valley (Florence province). This study demonstrates that simple tools such as fixed stations, if used rigorously and integrated with mobile stations, can provide robust and useful data for understanding urban and rural dynamics. This strategy not only expands monitoring capacity across large and diverse areas but it also offers a sustainable and affordable alternative to traditional monitoring stations.

The paper by Fantini et al. (2025) focuses on urban areas close to or within hydrothermal sites, where natural gas releases are combined with anthropogenic emissions in the Tivoli area (Rome). As also shown in the paper by Ferrari et al. (2025), traditional approaches for measuring CO₂, CH₄, SO₂, and H₂S, as well as δ¹³C-CO₂ and δ¹³C-CH₄, prove to be valuable and reliable. Despite resolution limitations, they however offer a remarkable snapshot of air quality that is essential for protecting the health of local communities. Fantini et al. (2025) conclude their study recommending an integrated approach able to combine mobile stations for periodic mapping integrated with low-cost instruments deployed in strategic points close to potential sources and progressively further away.

Stable isotopes as geochemical tracers

The Special Issue ends with the interesting manuscript by Natali et al. (2025), who apply sulfur and oxygen isotopes to dissolved sulfate in the groundwater systems of the Apuan Alps (northern Tuscany) to distinguish between waters stemming from acid mine drainage and those deriving from the dissolution of evaporite rocks. This approach offers a powerful diagnostic tool for water resource management in complex areas of high environmental value.

Final remarks

This papers collection indicates that environmental geochemistry is a well-developed field of research, capable of combining analytical rigor and applicative approaches. From the analysis of contaminated sediments to air monitoring, including isotopes and background values, the seven manuscripts show a coherent mosaic of sampling, analytical methods and results that support the concluding remarks.

A common thread is the focus at local scale, which becomes a tool for understanding broader geochemical processes. The case studies - from the Alps to Mt. Amiata, from Sicily to Uzbekistan - show that environmental geochemistry always has a dual significance: specific to the territory but universal for the processes it reveals.

At the same time, the need for growing greater interdisciplinary integration emerges. Geochemistry indeed interacts with ecotoxicology, water resource management, and land-use planning. It is no longer a discipline confined to the study of minerals, rocks and soil, but a tool for interpreting and managing the environmental complexity of our time. Finally, the most important take-home message of this Special Issue is the social importance and impact that environmental geochemistry has. Understanding how chemical elements and compounds distribute, move and interact is not a simple theoretical exercise since it means to protect the health of communities, to preserve ecosystems and to support the decision of policy-makers.

Consequently, this collection is not a simple special issue resulting from a congress since it is an invitation to keep going along the path of an increasingly open and shared scientific research, capable of engaging with the real problems of our society.



R-Corner

Caterina Gozzi

Introduction to Compositional Data Analysis

Introduction

In the previous R Corner, we introduced the issue of the interdependence among chemical components in the context of classical PCA, when the compositional nature of geochemical data is not taken into consideration. Given the critical importance of the properties of compositional data in geochemical analysis, in this *R Corner* we take a closer

look at the theory of Compositional Data Analysis (CoDA) and at the possible solutions for getting started with this type of analysis.

While interest in CoDA has historically been driven mainly by researchers in geosciences, its recognition and application are increasingly expanding to other fields, such as ecology, economics, health sciences and social sciences. Currently, the CoDA-Association (<https://www.coda-association.org>) is the international organization dedicated to connecting scientists working on compositional data modeling and fostering its application across various fields.

What are Compositional Data?

Compositional data are strictly positive values representing proportions of a whole (e.g., percentages), where the sum of their components is constrained to a constant (e.g., 100) (Aitchison, 1986). An increase in one part necessarily causes a decrease in the others, whether or not there is a genetic link between them. Due to this constrained geometry, they pertain to a different sample space, named *simplex* S^D (Pawlowsky-Glahn and Egozcue, 2001), where the rules of the Euclidean geometry cannot be applied without potential misrepresentations (Egozcue and Pawlowsky-Glahn, 2005). In fact, this compositional nature makes such data unsuitable for traditional statistical analysis in its *raw* form. Standard techniques designed for real random variables, especially those involving correlations or covariances, may produce spurious results with compositional data (Chayes, 1960). Particularly, neglecting this aspect can lead to problems such as erroneous computation of compositional distances, compositional incoherence, invalid statistical inference, spurious correlations, and ultimately misleading interpretations of environmental processes (Fig. 1).

How to Analyze Compositional Data?

A key feature of these data is that their components have no real meaning without a specific reference. For example, water geochemical composition is usually expressed as the concentration of dissolved ions in mg/L, where the measurement of an ion in milligrams (mg) only becomes meaningful when associated with a liter (L) (Egozcue et al., 2024). In CoDA, references are found in the other components or “parts”, and the focus is on the dimensionless ratios between these parts, derived through specific data transformations. This approach, also known as “working in coordinates” moves compositional data into an unconstrained real coordinate space, typically using log-ratio transformations (e.g., the additive (alr), the centered (clr) and the isometric log-ratio transformations). After data transformation, all standard statistical tools can be applied without the risk of biased results, since the transformed data no longer suffer from the constant-sum constraint. The new coordinates allow for the analysis of the entire chemical composition under investigation, either with respect to the data barycenter (clr) or by comparing groups of elements against other selected groups (ilr). This enables a more holistic interpretation in which relative variations are more relevant than absolute values (e.g., Buccianti & Gozzi, 2021).

An alternative strategy is the so-called “stay in the simplex” approach, which consists in analyzing compositional data directly in the *simplex*, respecting the inherent geometry and constraints of compositions by using the specific operations of the Aitchison geometry, such as perturbation, powering, inner product and norm (Aitchison, 1992). Among these, the perturbation operator represents a very effective tool to explore the evolution of a chemical composition with respect to selected benchmarks or pristine states. It provides insights into how the current composition has been achieved, also allowing the interpretation of the relative contributions of individual variables (Gozzi & Buccianti, 2024).

In the next *R Corner*, we will explore in more detail the main R packages now available for performing CoDA in R, focusing on the key data transformations and their geochemical interpretation.

Download and install R and R Studio



R is completely free software that can be used on Linux, Windows and Mac operating systems. Visit <https://www.r-project.org> and follow the instructions to download the version of R compatible with your system.



R Studio provides an integrated environment for R with numerous features to improve the user experience and make using R easier. After installing R, you can download and install R Studio for free from <http://www.rstudio.com/>.

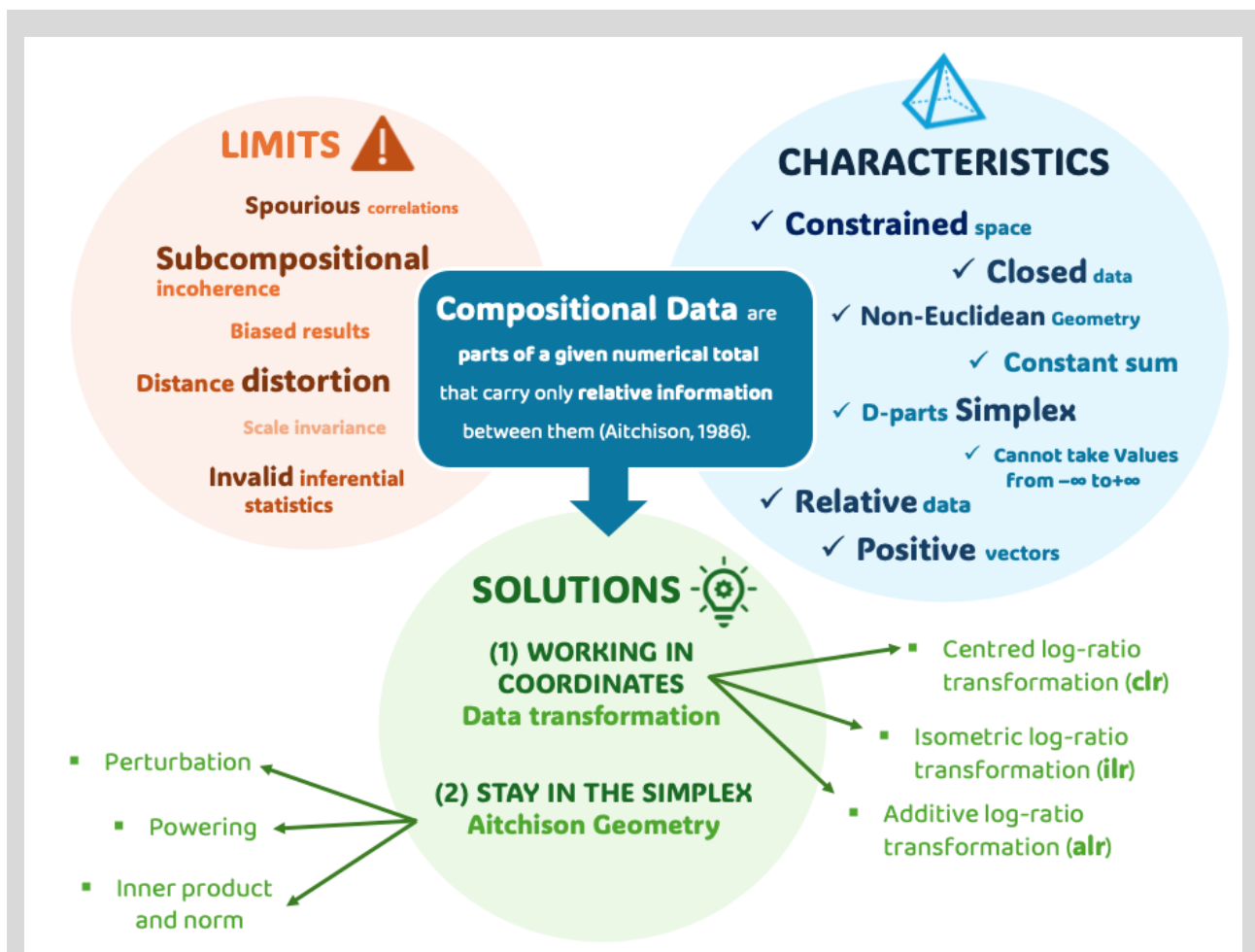


Fig. 1 Graphical summary of the key concepts of Compositional Data Analysis.

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So.Ge.I. on Social Media

Lorenzo Chemeri

The Italian Society of Geochemistry (So.Ge.I.) is present on four social platforms: Instagram, Facebook, LinkedIn and Twitter. The contents that we shared are generally focused on the research activities carried out by our members from in-field sampling activities to the attendance of national and international conferences. On average, we share one post per week, depending on the content availability. The So.Ge.I. members can contact us to share their activities and research on our channels.

On Instagram, the So.Ge.I. page (@societageochimica_it) has 585 followers and the number of followers increased of ~45 % with respect to the last year. The page also records an increase in the average likes for post (90 in 2025 vs. 50 in 2024) and in the engagement rate (ER), currently our ER is 16.3 % (11 % in 2024) and it is 8% higher if compared to similar pages. Over the last 90 days, our Instagram page reached more than 2.400 accounts our contents had more than

20.000 views and our page was visited more than 500 times. On Facebook, we currently have 1.135 followers (+3% vs. 2024) and in the last 90 days, our content was viewed by more than 6.000 accounts. As evidenced during last year report, Instagram is the preferred social platform for users below 35 years old representing more than 70 % of the total audience while Facebook is mainly reaching users with an age above 35 years old (~60 %).

On X (former Twitter), our page (@SocietaGe) has 87 followers showing a slight decrease if compared to 2024 and average view for post between 45 and 50. Finally, on LinkedIn the Italian Society of Geochemistry page has 948 followers (+28 % vs. 2024) with more than a thousand profile visits and ~ 40.000 interactions. In general, over the last two years (2023-2025), So.Ge.I. channels have shown a positive trend in both the number of followers and interactions with the content offered.

These statistical numbers are very important for the Society and for our discipline. Consequently, I hope that you can keep sending your contributions related to field-works, congresses, schools and so forth to show the large variety of activities our members are attending.

You are kindly invited to submit your contents to lorenzo.chemeri@uniurb.it

Events and Opportunities



Special Issues

► ***Biogeochemical Frontiers in Transitional Environments:
Where Land Meets Sea***

Journal of Geochemical Exploration (IF 3.3)

[Website](#)

Deadline for manuscript submissions: **31 January 2026**





Members' Publications

List of Members' Publications

referred to the period April 30 – September 3, 2025

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