3rd International Students Conference on

MEDICAL GEOLOGY & ENVIRONMENTAL HEALTH

EUROPE 2024

BOOK OF ABSTRACTS

Third International Student Conference on Medical Geology and Environmental Health (Europe edition)

26th to 29th November 2024

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Welcoming message

We are pleased to announce the Proceedings of the Third International Student Conference on Medical Geology and Environmental Health – European edition (ISCMGEH-Europe), a virtual event specifically designed to encourage undergraduate and postgraduate students to share their research in the fields of Medical Geology and Environmental Health. The first Latin American edition (2021) brought together a consortium of Senior Academics and Researchers in Medical Geology, Environmental Geochemistry and Health, creating an international virtual platform for students to present their research findings. The 2022 edition was devoted to the African Continent. The 2024 ISCMGEH-Europe edition aimed to repeat the success of the previous virtual events, by bridging students with experts in their fields of research, encouraging a steady growth and sharing of knowledge, experiences, and scientific advances.

The advantages of this virtual conference are the low funding necessary for its organization, and removing the financial burden on students, as they do not need to travel or pay any registration fees to participate in an international scientific event. This series of virtual conferences includes several benefits:

• Providing students with a convenient opportunity to showcase their projects and research.

• Offering a comfortable venue to practice writing and speaking English; essential skills for professional development.

• Allowing students, faculty, and others to learn of complimentary research being conducted within their region and to foster future collaboration.

• Receiving constructive feedback on their research projects from knowledgeable attendees, and senior experts.

• Fostering networking with other students and with established researchers in the region.

• Providing tangible encouragement and awards for outstanding student research projects.

• Posting their abstracts on several accessible, respected organizational platforms for web visibility.

• Best presentations awarded with a one-year free membership in cooperating organizations and a special gift kindly provided by Springer.

The cooperating organizations will benefit by stimulating interest and membership in their organization, and increasing awareness of regional medical geology/environmental health issues. In short, the International Student Conferences on Medical Geology and Environmental Health presents a win-win opportunity for all participants.

Message from the Conference Chairs

It is with great enthusiasm and pride that we celebrate the success of the 3rd International Students Conference on Medical Geology and Environmental Health – Europe edition, virtually held between 26th and 29th November, 2024. This event represented an extraordinary opportunity to unite students, researchers, and professionals from diverse fields to share knowledge, foster collaboration, and inspire innovation.

Different activities were organized during the Conference that included specific sessions dedicated to Organic, Inorganic and Microbial Contaminants in Medical Geology and Environmental Health; Climate change and Public Health; Emerging Contaminants: Challenges and Impacts; Developments in Environmental Chemistry, Geochemistry, and Biogeochemistry; and Geo-Health Policy, Litigation and Social Impact.

We have fostered 5 extraordinary keynote talks securing for the students a wide range of topics covered during the Conference. For that, we denote our most sincere appreciation to Dr. Lucie Seauzéat (France), Dr. Andreas Gondikas (Greece); Dr. Katerina Kouli (Greece), Dr. Vendula Smolíková (Belgium) and Dr. Jose Centeno (United States of America), for their commitment and enthusiastic participation.

Highly experienced Researchers and Professors conducted 2 workshops to improve and consolidate students' knowledge in the field. Specifically, a workshop on "*Shared Vocabulary: Communication Between Geo-Health Scientists*", a topic that has garnered significant interest from our participants, was delivered by Prof. Robert B. Finkelman, to face challenges and bridging communication gaps between the geological and health sciences. Dr. Alecos Demetriades, a reputed Scientist with expertise in Applied Geochemistry, delivered the second workshop on "*Preparing manuscripts for publication in international journals*", which we believe unraveled many questions about the publication procedures of sound scientific manuscripts in peer-reviewed journals. To both, we acknowledge their insightful contribution to the Conference.

Undoubtedly, the students were the stars of the Conference, and 39 presentations were delivered during the four days. We are extremely pleased with the high quality of the presentations, the diversity of topics shown, as well as the sense of commitment and responsibility demonstrated by all participants. During the four days of the Conference, approximately 60 people from countries such as Italy, Greece, Portugal, Spain, Germany, Denmark, Slovenia, Poland, Slovakia, United Kingdom, France, Armenia, and Croatia, attended and participated in the event. The abstracts contained in this Book reflect the dedication, creativity, and passion of the students who came together to contribute to the advancement of their respective disciplines. The presentations and

discussions throughout the congress were a source of inspiration and a platform for forging valuable connections.

We extend our heartfelt gratitude to all the supporters who contributed to this event. We would like to acknowledge the patronage of Università degli Studi di Cagliari (UNICA), National and Kapodistrian University of Athens (NKUA), Geological Survey of Slovenia (GeoZS), Centro de Química Estrutural (CQE), Departamento de Engenharia Química (DEQ) of Instituto Superior Técnico (IST), Associação do Instituto Superior Técnico para a Investigação e Desenvolvimento (IST-ID), Institute of Molecular Sciences (IMS), Fundação para a Ciência e Tecnologia (FCT), International Environmental Health Sciences Consortium (IEHSC), International Union of Geological Sciences (IUGS) and the Commission on Global Geochemical Baselines of the International Union of Geological Sciences (IUGS-CGGB), Slovenian Geological Society (SGS), Society for Environmental Geochemistry and Health (SEGH), and International Medical Geology Association (IMGA). Thank you for your commitment to empowering the next generation of thinkers and leaders. We would also like to acknowledge the Springer sponsorship, in the person of Dr. Robert Doe who kindly provided the prizes for the best presentations and a subscription of the e-book "Practical Applications of Medical Geology".

Our last recognition, but not the least, goes to the members of the Scientific Committee, particularly the Organizing Committee, for their efforts, endurance, resilience and commitment during the preparation of this event. Our sincere gratitude to the dedication of Early Career Researchers Artemis Kontomichalou and Matteo Serra for their organizational and leading skills that allowed this event to be a success.

We hope this congress has given you new insights, meaningful collaborations, and unforgettable memories.

Warm regards,

The Conference Chairs,

Dr. Carlos E. Monteiro

Prof. Elena Alvareda

Message from the President of SEGH

It is with great pleasure that I address the 3rd International Student Conference on Medical Geology and Environmental Health – European edition (ISCMGEH-Europe), on behalf of the Society for Environmental Geochemistry and Health (SEGH). This highly successful event stands as a powerful example of how collaboration between SEGH and the International Medical Geology Association (IMGA) can drive meaningful progress in understanding the complex connections between environmental factors and human health. The remarkable contributions presented in this Book of Abstracts reflect the creativity, dedication, and promising future of emerging researchers in our field. I encourage you to explore these innovative ideas, engage in stimulating discussions, and continue fostering the collaborations that will shape a healthier, more sustainable future for all.

Ariadne Argyraki

SEGH President

Message from the President of IMGA

On behalf of the International Association of Medical Geology (IMGA), I extend my heartfelt congratulations on the successful execution of the 3rd International Student Conference on Medical Geology and Environmental Health (ISCMGEH)! This event has brought together an inspiring group of students, fostering knowledge exchange, and collaboration in the fields of medical geology and environmental health.

The conference has provided an excellent networking opportunity for students engaged in the rapidly growing fields of medical geology and environmental health. Those who presented gained invaluable experience attending an international conference while minimizing financial costs. Students are our future, and the future development of medical geology and environmental health relies on you!

I commend the organizers for their dedication and hard work in creating a platform that not only showcases the latest advancements but also promotes inclusivity and dialogue among participants.

May the connections and ideas cultivated here continue to inspire progress, and may this conference serve as a steppingstone toward even greater achievements in the years to come. Once again, congratulations on this remarkable accomplishment, and I look forward to the continued success of future ISCMGEH conferences!

Chair, IMGA
December 12, 2024 in Galway

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Conference Agenda

3RD INTERNATIONAL STUDENTS CONFERENCE ON MEDICAL GEOLOGY & ENVIRONMENTAL HEALTH

Conference Schedule

26 – 29 November 2024

For all Zoom meeting links go to:
segh.net/iscmgeh-europe

TUESDAY – 26 NOVEMBER	*Direct meeting link*
Time (CET)	**Event**
13 : 30 – 13 : 45	Introduction *Chairs: Dr. Carlos E. Monteiro, Prof. Elena Alvareda*
Session 1 : Organic, Inorganic and Microbial Contaminants in Medical Geology and Environmental Health *Chair: Dr. Jerry Olajide-Kayode*	
13 : 45 – 14 : 15	**Session 1 Keynote:** *"Health impact of chronic volcanic ash exposure: New constraints from a multi-isotopic approach"* - Dr Lucie Seauzéat
14 : 15 – 14 : 30	*"How many ICD diagnoses are affected by the content of Ca and Mg in drinking water in Slovakia"* Nina Beňová
14 : 30 – 14 : 45	*"Assessment of Water Quality in Emergency Supply Wells: A Case Study from Kraków"* Patrycja Wisińska
14 : 45 – 15 : 00	*"Effects of PTE-Rich Basalt and Biochar on Soil Cr, Cu, Ni, and Zn Bioavailability"* Jennifer Newell
15 : 00 – 15 : 15	*"Preliminary results of the soil geochemical baseline pilot study in Hellas"* Artemis Kontomichalou
15 : 15 – 15 : 30	**Break**

TUESDAY – 26 NOVEMBER	
Time (CET)	**Event**
Chair: Dr. Ines Tomašek	**Session 1**
15 : 30 – 15 : 45	*"Contamination by Metallic Xenobiotics in Agro-Food Crops Along roadways in the Ferrara Area (Italy): Comparative Elemental Analysis"* Marcello Bigoni
15 : 45 – 16 : 00	*"Physicochemical characterisation of Sinabung volcanic ash for the assessment of respiratory health hazard"* Charlotte L. R. Gold-Taylor
16 : 00 – 16 : 15	*"Scoping Study of Potential Health Risks Arising from Trace Elements in Soils of the Platt Fields Market Garden, Manchester, UK"* Farah T. Ahmed
16 : 15 – 16 : 30	*"Biomarker Responses to Selenium and Mercury Exposure: Insights from a Controlled Fish Consumption Study"* Adna Alilović
16 : 30 – 17 : 00	**Break**
Chair: Dr. Carlos E. Monteiro	**Session 1**
17 : 00 – 17 : 15	*"Aligning groundwater remediation with contaminant distribution: Geospatial analysis from eastern India"* Ajmal Roshan
17 : 15 – 17 : 30	*"Prenatal Exposure to Arsenic in Drinking Water and Type 1 Diabetes"* Thoranna H Gilbertsdottir
17 : 30 – 17 : 45	*"Environmental geochemical study of surface water, soil and river sediment along the Asopos river basin, Greece"* Ioannis Kritikos
17 : 45 – 18 : 00	*"Speciation of mercury in forest soils after fire and assessment of potential human health effects"* Mary Gogoli
18 : 00 – 18 : 15	*"Occupational and environmental exposure of overhead powerline workers and environmental effects of aerial networks"* S. Poursanidou

WEDNESDAY – 27 NOVEMBER	*Direct meeting link*
Time (CET)	**Event**
13 : 30 – 13 : 45	Introduction *Chairs: Dr. Carlos E. Monteiro, Prof. Elena Alvareda*
Session 3 : Emerging Contaminants: Challenges and Impacts *Chair: Prof. Ariadne Argyraki*	
13 : 45 – 14 : 15	**Session 3 Keynote:** *"Tackling the issue of micro- and nano-plastics in the marine environment through monitoring, training early career researchers, and enabling citizen science"* - Dr Andreas Gondikas
14 : 15 – 14 : 30	*"Hidden Dangers: The Health Risks of Microplastic Pollution"* Nikos Klioumis
14 : 30 – 14 : 45	*"PFAS and Public Health: Insights from the Skyros Project"* Gerasimina Theodora Zapanti
14 : 45 – 15 : 00	*"Separation and Recovery of Natural & Anthropogenic Organic Polymers in soils of Attica, Greece"* Stefania Koutsourea
15 : 00 – 15 : 15	**Break**
Session 3 *Chair: Dr. Martin Gaberšek*	
15 : 15 – 15 : 30	*"Isotope enriched mercury as a methodology to assess methylation potential"* Beatriz Malcata Martins
15 : 30 – 15 : 45	*"IMPOSE: Investigating Mercury and organic Pollutants carried by micrOplastics in the Scheldt Estuary to manage future contamination"* Sybrien Lievens
15 : 45 – 16 : 00	*"Effect-Direct Assessment of AhR-active Compounds in Suspended Particulate Matter in Effluent-Dominated Urban River"* Yiqi Su

WEDNESDAY – 27 NOVEMBER	
Time (CET)	**Event**
16 : 00 – 16 : 30	**Session 2 Keynote :** *"Pollen Chronicles: Past vegetation dynamics and socio-environmental challenges"* Dr Katerina Kouli
16 : 30 – 16 : 45	**Break**
16 : 45 – 18 : 15	**Workshop** *Shared Vocabulary: Communication Between Geo-Health Scientists* Dr Robert B. Finkelman

THURSDAY – 28 NOVEMBER *Direct meeting link*	
Time (CET)	**Event**
13 : 30 – 13 : 45	Introduction *Chairs: Dr. Carlos E. Monteiro, Prof. Elena Alvareda*
Session 4 : Developments in environmental chemistry, geochemistry, and biogeochemistry *Chair: Dr. Melina Abdou*	
13 : 45 – 14 : 00	*"Using exposure load to examine the burden of multiple chemicals in men and lactating women"* Janko Stankić
14 : 00 – 14 : 15	*"Monitoring of trace elements in soils of the South Shetland Islands, Antarctica"* Henrique Zilhão
14 : 15 – 14 : 30	*"Determination of Temporal Changes in Mercury Concentrations for Tagus and Guadiana Saltmarsh Areas"* Inês Rico
14 : 30 – 14 : 45	*"Utilising signal transformation for the simultaneous voltammetric analysis of palladium and nickel"* Maria Jeremias
14 : 45 – 15 : 00	*"Potentially toxic elements geochemical mapping and background assessment of the Mercogliano municipality (Avellino, Italy) soils "* Alessio De Falco
15 : 00 – 15 : 30	**Session 4 Keynote :** *"Advancing Environmental Monitoring: Alternative Approaches for Assessing Bioavailable Trace Elements in Impacted Environments."* - Dr Vendula Smolíková
15 : 30 – 15 : 45	**Break**
Session 4 *Chair: Dr. Carlos E. Monteiro*	
15 : 45 – 16 : 00	*"Antropigene: first environmental application of the geochemical gene to identify natural background and contaminations"* Lucia Rita Pacifico

THURSDAY – 28 NOVEMBER	
Time (CET)	**Event**
16 : 00 – 16 : 15	*"Analytical techniques used for determination of REEs in natural water samples"* Piotr Dzień
16 : 15 – 16 : 30	*"Evaluation of Acid-Volatile Sulphides towards Trace Elements in Sediments"* Emi Chapuis
16 : 30 – 16 : 45	*"Nickel Concentrations Associated to Acid Volatile Sulphides extracted from Two Different Estuarine Sediment Cores of the Tagus Estuary, Portugal"* André Veiga Fernandes
16 : 45 – 17 : 15	**Break**
Chair: Dr. Carlos E. Monteiro	**Session 4**
17 : 15 – 17 : 30	*"Use of Eutectic Solvents in Sample Preparation for Palladium Environmental Analysis: a Preliminary Assessment"* Pietro Civa
17 : 30 – 17 : 45	*"Fluxes of Mercury and Methylmercury in Thermokarst Lakes"* Silvia Buriac
17 : 45 – 18 : 00	*"Assessing the rhizosphere effect of Halimione portulacoides on mercury concentration and bacterial diversity in saltmarsh sediments (Tagus Estuary, Lisbon)"* Vicente Guerreiro
18 : 00 – 18 : 15	*"Geochemical characterization and identification of potential origin of some chemical elements in soils of Gegharkunik region, Armenia"* Zhenya Poghosyan

FRIDAY – 29 NOVEMBER *Direct meeting link*	
Time (CET)	**Event**
13 : 30 – 13 : 45	Introduction *Chairs: Dr. Carlos E. Monteiro, Prof. Elena Alvareda*
Session 2 : Climate Change and Public Health *Chair: Prof. Elena Alvareda*	
13 : 45 – 14 : 00	*«Variability of greenhouse gases (CO_2, CH_4 and N_2O) in Ria Formosa Coastal Lagoon, south Portugal"* Cátia Correia
Session 5 : Geo-health policy, litigation and social impact *Chair: Prof. Elena Alvareda*	
14 : 00 – 14 : 15	*"Toxicology research of heavy metals in cosmetics in antiquity"* Myrsini Ifigeneia Samothraki
14 : 15 – 14 : 30	*"Identifying Impurities in BBQ Briquettes Through Organic Petrography"* Maria Georgaki
Session 6 : General Session *Chair: Prof. Elena Alvareda*	
14 : 30 – 14 : 45	*"Caenorhabditis elegans Exposed to Environmentally Relevant Concentrations of Oxamyl Showed Morphological Alterations, Developmental Delay and ROS Increase"* Carlos Marques
14 :45 – 15 : 00	*"A new Tier 1 semiquantitative environmental risk tool for the European extractive sector"* Humberto Serrano-García
15 : 00 – 15 : 15	*"Influence of Initial Concentration on Hg(II) Sorption Efficiency on Natural and Modified Zeolite"* Antonija Jurić
15 : 15 – 15 : 45	**Session 5 Keynote :** *"The Emerging Discipline of Medical Geology – Integrating Environmental Science, Public Health and Earth Science."* Dr Jose Centeno

FRIDAY – 29 NOVEMBER	
Time (CET)	**Event**
15 : 45 – 16 : 15	**Break**
16 : 15 – 18 : 00	**Workshop** *Preparing manuscripts for publication in international journals* Dr Alecos (Alexandros) Demetriades
18 : 00 – 18 : 15	Closing and Awards

Keynote Speakers

Dr Lucie Sauzéat

IRD researcher, Laboratoire Magmas et Volcans/Institute de Génétique, Reproduction et Développement; Université Clermont Auvergne, France)

"Health impact of chronic volcanic ash exposure: New constraints from a multi-isotopic approach"

Dr. Lucie Sauzéat is a geologist by training, specializing in isotope geochemistry. Her research focuses on quantifying chemical and isotopic variabilities in a wide range of samples, from geogenic materials to organic tissues, to better understand various geological, environmental, and biological processes. These broad research themes, spanning from the deep Earth to living organisms, have enabled her to acquire interdisciplinary knowledge and develop strong expertise in isotope geochemistry, as well as in the emerging field of isotope metallomics. Dr. Sauzéat's current research interests are deeply rooted in a sustainable science approach and lie at the intersection of human health and environmental risks. Her work centers on identifying and quantifying metallomic and physiological deregulations caused by long-term exposure to natural environmental pollutants, such as metal-rich volcanic particles, which are recognized as significant health risks. This research is supported by cutting-edge holistic approaches that combine in-vivo biological experiments with innovative multi-isotope analyses and organ-specific multi-OMICS techniques, including histological, metabolomic, proteomic, and transcriptomic measurements.

Dr Andreas Gondikas

Postdoctoral Researcher, Department of Geology and Geoenvironment, National and Kapodistrian University of Athens, Greece

"Tackling the issue of micro and nanoplastics in the marine environment through monitoring, training early career researchers, and enabling citizen science"

Dr. Andreas Gondikas is a researcher and project manager at the National and Kapodistrian University of Athens, Department of Geology and Geoenvironment, with expertise in environmental nanometrology. He holds a chemical engineering degree (National Technical University of Athens, 2004), a Masters' in engineering management (Duke University, 2006), and a PhD in civil & environmental engineering (Duke University, 2012). Since May 2012 he has been working on a series of projects, funded by the European Commission or national foundations and received the "rising star in environmental nanosciences" award in 2017. Since 2020, he is a member of the sailing4science initiative and in 2021, initiated the "Microplastics workshop for early career researchers: Best practices and expert insights" with three colleagues from Switzerland, Germany, and Sweden.

Dr Katerina Kouli

Professor, Section of Historical Geology and Palaeontology, Department of Geology and Geoenvironment, National and Kapodistrian University of Athens

Pollen Chronicles: Past vegetation dynamics and socio-environmental challenges

Dr Katerina Kouli is Professor of Palaeontology-Palaeobotany-Geoarchaeology at the Department of Geology and Geoenvironment NKUA with expertise on the study of pollen and non pollen palynomorphs from terrestrial and marine deposits. Dr Kouli's research focuses on reconstructing palaeovegetation and its response to Quaternary climatic variations, as well as the environmental pressure of past human communities. As a member of the IODP Exp. 381: Corinth Active Rift Development Science group and is actively involved in the ICDP-SCOPSCO (Scientific Collaboration On Past Speciation Conditions in lake Ohrid) palynology group, she is participating in the study of two of the longest and most continuous palaeovegetation archives in the Balkans. As part of her current research activities, Dr Kouli is conducting palynological analysis of Holocene deposits to assess the complex relationship between vegetation and past socio-environmental changes.

Dr Vendula Smolíková

FWO Fellow, AMGC; Department of Chemistry, Vrije Universiteit Brussel, Belgium

"Advancing Environmental Monitoring: Alternative Approaches for Assessing Bioavailable Trace Elements in Impacted Environments."

Dr. Smolikova's research revolves around the challenges of environmental pollution by trace elements, focusing on their sources, monitoring, geochemical cycling, and bioavailability. In her work, she combines both active and passive sampling approaches, with a particular emphasis on the Diffusive Gradients in Thin-films (DGT) technique. This technique provides information about the potential bioavailability of toxic contaminants but also essential nutrients, gives an insight into the colloidal transport of trace elements which can be beneficial for remediation strategies of industrially impacted environments, and enables better evaluation of the ecotoxicological status of ecosystems.

Jose A. Centeno, PhD, FRSC*

University of Puerto Rico at Mayaguez, Department of Chemistry
Center for Chemical Sensors/Chemical Imaging and Surface Analysis Center
University of Maryland School of Medicine
Division of Occupational and Environmental Medicine

"The Emerging Discipline of Medical Geology – Integrating Environmental Science, Public Health and Earth Science."

Dr. Jose A. Centeno is widely known for his work on toxicology and environmental sciences, and as a leader of the discipline of medical geology. He has a diverse professional background having worked for the US Armed Forces Institute of Pathology as the Director of the Biophysical Toxicology and Depleted Uranium Lab, and with the US Food and Drug Administration as Senior Manager and Director of the Division of Biology, Chemistry and Materials Science, in addition to experience as a consultant and as a college professor. Dr. Centeno is co-founding member International Medical Geology Association, and the Director of the International Environmental & Health Sciences Consortium. He is a Fellow of the Royal Society of Chemistry (FRSC); Honorary Academician, Royal Academy of Medicine and Surgery, Andalucía Oriental, Spain, and he was recently appointed as Endowment Chair on Medical Geology and Director of the "Jose A. Centeno International Center on Medical Geology Research" at Nasarawa State University, Keffi, Nigeria. He is the author and/or co-author of over nearly 300 publications and has been invited to speak in more than 50 countries. Internationally, he has served as Regional Officer for the International Union of Geological Sciences and its Commission on Geosciences for Environmental Management (2005), as Senior Advisor for the IUGS-International Year of Planet Earth (2007-2009), and as invited speaker at the US Academy of Sciences, Swedish Academies of Sciences and the Academia Sinica, Taiwan, China. He serves on the Editorial Board of two scientific journals, as Associate Editor of the book on Essentials of Medical Geology (1st Edition 2005, 2nd Edition 2013), and is the founder of the International Medical Geology Conference Series (MEDGEO).

Student Presenter Abstracts

How many ICD diagnoses are affected by the hardness of drinking water in Slovakia?

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Introductory The impact of Ca and Mg in drinking water on cardiovascular diseases (CVD) has been known for nearly seventy years (Kobayashi, 1957) and confirmed globally, including in Slovakia, by various authors (Catling et al., 2005; Jiang et al., 2016; Gianfredi et al., 2017; Rapant et al., 2017). Recent studies also link low-hardness water to oncological diseases and diabetes mellitus (Yang et al., 1998; Naumann et al., 2017). This study aims to assess the effect of Ca and Mg levels in drinking water on all diagnoses listed in the International Classification of Diseases (ICD).

Methods The Health Indicators (HI) database for Slovak municipalities (1984–2008) was used for this evaluation (Rapant et al., 2017). Two groups were created based on water hardness: "Soft" water (SW) and "Hard" water (HW). Using the International Classification of Diseases (ICD), the first 18 diagnostic groups out of a total of 21 were analyzed. The study compares the number of deaths and relative mortality in SW and HW groups.

Results and Interpretation The results align with global knowledge of oncological, cardiovascular diseases, and diabetes, but similar data for other diagnoses (nervous, urinal and reproductive system, infectious, digestive, and respiratory diseases) were obtained. Specifically, Epilepsy, Cerebral palsy, and Down syndrome were significantly higher in areas with soft water.

Conclusions The study demonstrates that Ca and Mg levels in drinking water impact more diagnoses than previously known. Mortality related to the digestive, respiratory, nervous, urinary, and reproductive systems, as well as infectious diseases, has not been linked to Ca and Mg levels in global literature. Overall, drinking water hardness notably affects many more diagnoses in terms of the ICD than previously assumed.

Acknowledgements: The contribution is supported by the LIFE (LIFE 17 ENV/SK/000036).

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Yang, C. Y., Cheng, M. F., Tsai, S. S., Hsieh, Y. L. (1998) Calcium, magnesium, and nitrate in drinking water and gastric cancer mortality. Japanese journal of cancer
Research, 89, 124–130.

Assessment of Water Quality in Emergency Supply Wells: A Case Study from Kraków

Patrycja Wisińska[1], Anna Szczepaniec[1] and Marta Kusy[1]

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The problem of surface and groundwater pollution by contaminants of emerging concern (CECs) and products of their transformation is being investigated more and more, globally, due to the risk they pose to the water-soil environment and potentially human health.

In the present study, Kraków was selected as a research polygon, because in this city 331 emergency water supply wells are located which serve as a temporary water supply for the population in case of long drinking water interruption. Some of these wells exist in peripheral parts of the city and/or rural areas.

As part of the conducted research, an inventory of available wells was made, their technical condition was verified, and the presence or absence of water was confirmed. In the field, in situ, temperature, pH, and electrical conductivity of the water were measured, and samples were collected for detailed laboratory analysis. Water samples from all functioning wells were analyzed for the concentrations of major ions and selected potentially toxic elements. Additionally, in selected samples, the concentrations of selected compounds of the perfluoroalkyl and polyfluoroalkyl substances groups (PFAS) including perfluorooctanoic acid (PFOA), as well as pharmaceuticals and personal care products (PPCPs), were determined.

Water collected from the studied wells was characterized by a large range of measured electrical conductivity values, which is related to the varying amounts of dissolved substances and mineralization. Laboratory analysis showed that the studied water samples contained compounds from the PFAS and PFOA groups at concentrations ranging from tenths of a nanogram per liter to several nanograms per litre. Other substances from the PPCPs group, such as carbamazepine and metformin, were also found.

Effects of PTE-Rich Basalt and Biochar on Soil Cr, Cu, Ni, and Zn Bioavailability

Jennifer Newell[1], Siobhan F. Cox[1], and Rory Doherty[1]

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Organic and inorganic soil amendments are increasingly utilised in urban remediation projects to improve soil quality and element-cycling processes, such as carbon sequestration. However, some soil amendments contain moderate potentially toxic element (PTE) concentrations that offset any beneficial effects on introduction to the soil. This study set out to determine whether the application of Cr and Ni-rich basalt and Cu and Zn-rich biochar alter soil bioavailable concentrations and plant total concentrations in an urban community garden.

Soil bioavailability was assessed using field plots amended with four treatments (control; locally sourced basalt 40 t/ha; digestate biochar 33 t/ha; and combined basalt and biochar), and seeded with red clover (Trifolium pratense) or hyper-accumulating mustard (Brassica juncea). Bioavailability was assessed using EDTA-acid extraction of soils, and acid-microwave digestion of clover and mustard plants, with ICP-MS analysis to determine available concentrations. ANOVA and T-tests were used confirm significant differences in concentrations between treatments.

This study confirmed no significant differences in soil EDTA-extracted bioavailable concentrations between amended and control treatments for all PTEs. This would infer that adding basalt and biochar under the present study conditions would not increase PTE exposure risks. Despite the elevated Cu concentrations in biochar, Cu concentrations were significantly lower in clover and mustard grown in biochar-amended plots, compared to control. This would imply that the remediation potential of biochar is greater than the Cu input, likely due to different Cu species' mobility within both the biochar and soil. No significant differences were observed for other PTEs.

Ultimately, the increased PTE input from basalt and biochar soil amendments has minimal impact on PTE bioavailability, and thus contamination exposure risk. As such, these amendments may be used safely in urban remediation projects.

Acknowledgements:

The authors acknowledge the funds of European Union's Horizon 2020 UPSURGE project under Grant number 101003818; and an EPSRC PhD studentship.

Preliminary results of the soil geochemical baseline pilot study in Hellas

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Exposure to naturally occurring and diffused anthropogenic background concentrations of Potentially Toxic Elements (PTEs) might be associated to human and ecosystem health risks. In such instances, rigorous geochemical evaluation is essential to estimate risk-based soil screening values. Here we provide geochemical and magnetic susceptibility (MS) data from a regional soil dataset in Greece as a worked example, supporting risk assessors and managers with evidence to facilitate informed decisions for setting remedial goals.

Top-soil (0-20 cm) samples were collected from 117 locations on a 5 km x 5 km grid within an area of about 2500 km^2 by following and appropriately adjusting the guidance of the recently published International Union of Geological Sciences Manual or Standard Methods for Establishing the Global Geochemical Reference Network. Dried, sieved (<2mm) and pulverised soil samples were analysed by Inductively Coupled Plasma-Atomic Emission Spectroscopy / Inductively Coupled Plasma-Mass Spectrometry following aqua regia dissolution. The study focused on the elements: As, Sb, Cd, Co, Cr, Cu, Pb, Ni, Tl, V, Zn, Mn, Fe. Volume-specific MS was measured at low (470 Hz) and high frequency (4700 Hz) using an MS3 Bartington Instrument, equipped with a dual frequency MS2B sensor.

The combined results of multivariate statistical analysis of aqua regia data, MS data and spatial mapping confirmed the effects of weathering of mafic and ultramafic rocks and the presence of mineralised zones with high concentrations of specific elements. Samples with anomalous concentrations were further evaluated by mineralogical analysis and leaching tests (modified BCR sequential extraction and dilute nitric acid leach). It was found that in over 90% of the sample's concentrations are consistent with background. The results could be incorporated into site-specific risk-based cleanup levels within spatial domains of elevated PTE concentrations considering the background for setting realistic remedial goals.

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Contamination by Metallic Xenobiotics in Agro-Food Crops Along Roadways in the Ferrara Area (Italy): Comparative Elemental Analysis

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The development of road networks has significantly increased environmental pollution, notably through the contamination of agricultural soils by metallic xenobiotics [1]. This issue poses significant concerns to food safety and human health, as heavy metals can bioaccumulate in agro-food crops and subsequently be transferred through the food chain [2]. In the province of Ferrara (Italy), where an extensive roadway network intersects agricultural zones, assessing the impact of metal contamination — specifically lead, cadmium, chromium, and nickel — becomes critically important.

The study aimed to assess concentrations of Cr, Ni, V, Pb, Cu, and Cd in soils and asparagus, with a focus on comparing areas located near major roadways to those farther away in regions such as Malborghetto, Bosco Mesola, Mesola, Jolanda di Savoia, Borgo Manara, and Comacchio. The elemental composition of the soil was initially screened using XRF for preliminary analysis, followed by ICP-MS for accurate quantification. Concurrently, asparagus samples were analyzed with ICP-MS to determine the extent of heavy metal accumulation in plant tissues.

The concentrations of V, Cr, Ni, Cd, Pb, and Cu in soil and asparagus samples were evaluated against current regulatory standards in Italy, specifically DM 46/2019 and Reg. (UE) 2023/915, for asparagus. This European regulation shows the limit for Cd (0,05 mg/Kg), and for Pb (0,1 mg/Kg), for other metals were considered literature reference values. Pb concentrations were below these limits in both soils and asparagus, with minimal variation in soils and greater variability in asparagus, likely due to varietal differences. Similarly, Cd levels were below legal thresholds, although higher concentrations were observed in asparagus from Malborghetto. The concentrations of Cr, Ni, and V noted in Ferrara soils are well documented in the literature [3]. However, Ni levels in all asparagus samples exceeded EFSA (European Food Safety Authority) recommended limits of 0.40 mg/kg. These findings underscore the importance of continuous monitoring of heavy metals to safeguard food safety and enhance the resilience of the agricultural sector.

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Physicochemical characterisation of Sinabung volcanic ash for the assessment of respiratory health hazard

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A significant health concern associated with volcanic eruptions is the inhalation of ash, the acute effects of which include wheezing, coughing, and bronchitis. There is raised concern for ash generated from the collapse of a lava dome, or from explosions which disturb a dome, which may contain cristobalite, a form of crystalline silica. In some industrial settings inhalation of crystalline silica has been found to cause silicosis and lung cancer. Sinabung volcano in Sumatra, Indonesia, began erupting in August 2010 with lava domes forming from 2013. Ash from this volcano had not previously been analysed for human respiratory health hazard.

Analyses were performed on 12 samples of volcanic ash using International Volcanic Health Hazard Network standardised protocols. The physicochemical properties assessed included bulk composition by X-ray fluorescence, particle size distribution by laser diffractometry, crystalline silica content by X-ray diffraction, qualitative particle shape by scanning electron microscopy, and particle composition by energy-dispersive X-ray spectroscopy.

The ash was found to be basaltic-andesitic to andesitic in composition and contained a substantial quantity of inhalable and respirable particles (respectively, up to 23.2 vol.% <10 µm and up to 9.1 vol.% <4 µm). Ash particles were observed to be mainly angular to sub-angular and blocky. Fibrous particles were observed in all samples analysed however, these were not high in number (<0.1 num.%) and did not appear to show elemental compositions of concern with most particles being identified as silicates. All samples contained crystalline silica in the form of cristobalite, varying in quantity from 1.3 – 4.5 wt.%. Quartz, another polymorph of crystalline silica, ranged from none detected to 2.8 wt.%.

These data indicate that the primary concern is the high percentage of inhalable and respirable ash particles. Mitigation measures, such as the use of N95/FFP2 masks, could be implemented to reduce community exposure during future eruptions.

Scoping Study of Potential Health Risks Arising from Trace Elements in Soils of the Platt Fields Market Garden, Manchester, UK

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A community garden is land cultivated by a group of people individually or collectively. They range from tiny wildlife gardens to fruit & vegetable plots on housing estates, schools & public parks. Platt Fields Market Garden (PFMG) is a community market garden based in Platt Fields Park, Manchester, managed by Manchester Urban Diggers (MUD), a non-profit charity that grows fruits, herbs & vegetables in the garden throughout the year as well as selling and supplying their products to local people & restaurants. Given the industrial heritage of Manchester, the question arises as to whether or not the soils in PFMG might or might not give rise to detrimental health risks of concern. To address this, soil samples (n = 61) were collected from the PFMG site and analysed by Portable X-ray fluorescence (PXRF). The method was validated by using a CRM (WQB-3: Great Lake Sediment). Potential health risks arising from the trace elements (TEs) Pb, As, Hg, Cr, Ni, Mn, Mo, Cu and Zn in soil were assessed for both adults and children for oral, dermal and inhalation exposure pathways using plausible conservative default receptor and soil exposure values and the U.S. EPA health risk modelling approach for both carcinogenic risks (lifetime probability of cancer) and non-carcinogenic risks (Hazard Quotient (HQ) and Hazard Index (HI)). TE concentrations were found to be better (lower) than UK guidelines for allotment soils with the exception of Pb (all samples) and As and Hg (a few samples). Lifetime cancer risks for Pb, As and Ni were all found to be within the widely used considered-to-be-tolerable range of 10^{-4} to 10^{-6}. All HQ values were less than 1.0 except for As for ingestion and Hg for skin contact, both for children. HI for adults was better (lower) than the guide value of 1.0, however, for children the HI was greater than 1.0 for both oral (HI_{ing} = 2.6) and dermal (HI_{derm} = 1.2) exposure pathways. The results suggest minimal health risks arising from PFMG soil exposure. This assessment ideally requires further soil analyses as well as more realistic exposure data. Lastly, the calculated health risks do not consider exposure via food grown at the site – this will be focus of future work.

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Biomarker Responses to Selenium and Mercury Exposure: Insights from a Controlled Fish Consumption Study

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Fish and seafood consumption is the predominant source of general population mercury (Hg) exposure. Nonetheless, marine fish is also rich source of selenium (Se), which could potentially provide a natural defence against mercury. However, there have not yet been any controlled feeding studies in humans that would explore the intriguing interplay between Hg and Se.

In this study, 10 volunteers were exposed to Hg and Se through controlled fish consumption. Additional 6 individuals served as controls, consuming no fish or seafood. Each volunteer in the experimental group consumed five tuna steaks over five consecutive days. Total Hg (THg), methylmercury (MeHg), and Se were measured in tuna steaks, and participants' blood, plasma, erythrocytes, hair, and urine, before and after tuna consumption, with weekly measurements for 13 weeks.

The initial Hg and Se concentrations in biological samples varied across participants. However, all experimental group members displayed similar trends in whole blood THg and MeHg: a linear increase during fish consumption, peaking the day after the final steak, followed by biphasic first-order elimination. Maximum THg and MeHg concentrations were strongly positively correlated with the dose of THg and MeHg per kilogram of body weight. Se concentrations in whole blood showed a slight, variable increase after consumption, with no clear correlation to Se dose per kilogram of body weight. Plasma Se followed a trend similar to plasma Hg, peaking simultaneously and decreasing toward the study's conclusion.

Erythrocyte THg and MeHg reflected the whole blood trends, while Se levels in erythrocytes increased post-consumption and remained elevated throughout the study. Urinary Se followed a pattern similar to erythrocyte Hg, but this did not align with THg urinary excretion trends. Despite ongoing research, the interactions between Se and Hg in biological systems remain incompletely understood, and further investigation is needed to clarify the complex dynamics involved.

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Aligning groundwater remediation with contaminant distribution: Geospatial analysis from eastern India

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Elevated concentrations of naturally occurring groundwater arsenic (As) are observed in parts of the eastern Indian state of Bihar. Studies to visualise the spatial distribution of government installed As remediation units in the study area and if they are optimally located are limited. We compare the distribution between As remediation units and the distribution of As in Bihar's groundwater, noting the majority of remediation units are co-located along river Ganges[1,2].

Public domain lists of As remediation units implemented by Government of Bihar[3] were manually digitized and converted to maps. Groundwater As concentration data from Richards et al., (2020)[4] was used for preparing a map of groundwater As distribution for Bihar using Inverse Distance Weighted (IDW) interpolation. All maps were made using ArcGIS Pro (version 3.1.3).

Comparing the distribution of installed remediation units and the groundwater As revealed that there are districts with no to very few units, yet 10-50% of the groundwaters have reported As concentrations greater than the national regulatory or WHO drinking water provisional guideline value - 10 µg/L. Conversely, there are regions having high remediation unit coverage but no samples from a representative sampling campaign observing elevated concentrations. Possible reasons for this mis-match could be non-representative distribution of groundwater data, prior sampling, antecedent infrastructure and phased manner of policy roll-out by administrative area[2].

The work shows that there are regions in Bihar where remediation interventions are needed to achieve better water security and public health goals but which are currently underserved. There is a need for the remediation interventions to be optimally placed to align better with the contaminant distribution in the underlying groundwater. The importance of broad-scale, representative sampling to inform the prioritisation of the installation of groundwater arsenic remediation units[5] is emphasized.

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Prenatal Exposure to Arsenic in Drinking Water and Type 1 Diabetes

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Arsenic, a metalloid element substantially distributed throughout the Earth's crust, can either be found in organic or inorganic forms, the latter commonly known for being toxic to humans[1]. Inorganic arsenic *(iAs*) is a prevalent drinking water contaminant, which has led the World Health Organization (WHO) to establish a guideline value of 10 µg/L *iAs* in drinking water[2]. However, recent evidence indicates that chronic low *iAs* exposure (<10 µg/L) may be linked with the development of diabetes[3]. Therefore, this study aims to explore the association between prenatal drinking water *iAs* exposure and type 1 diabetes (T1D) in a population exposed to low levels of *iAs*.

This follow-up study links prenatal *iAs* exposure from household drinking water with information on T1D diagnoses from The Danish National Patient Registry and The Danish National Prescription Registry. All singleton births from 2002-2012, located from The Danish Medical Birth Registry, living in a household using a public water supply, were included. Cox proportional hazards models were used with age as underlying time scale and adjusted for sex, calendar year, mother's age, smoking status and BMI.

A total of 563,871 births were included. Preliminary results show an association between prenatal *iAs* drinking water exposure and T1D. In adjusted models using <1 µg/L as reference, a monotonically increasing association was observed: 1-5 µg/L (HR=1.10, 95%CI: 0.98-1.24), 5-10 µg/L (1.32, 0.91-1.92) and ≥10 µg/L (2.04, 1.15-3.61).

This is the first study, to our knowledge, to assess the association of prenatal arsenic exposure on T1D. We found prenatal drinking water *iAs* exposure to increase risk of T1D in public supply users at relatively low levels, even under the WHO's guidelines, indicating that *iAs* might be an important modifiable risk factor for diabetes.

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Environmental Geochemical Study of Surface Water, Soil and River Sediment along the Asopos River Basin, Greece.

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In recent decades, industrial activity in Greece has significantly increased to meet the demands of a rapidly evolving society. However, this development has led to environmental degradation, primarily due to the discharge of industrial waste into rivers and seas. One notable example is the Asopos river basin, particularly in the area surrounding the industrial zone of Oinofyta. This study aims to assess the potential contamination of water, soil, and river sediment thoughtout the Asopos river basin, focusing on metal(loids) concentrations because of the extensive industrial activity.

A total of 15 surface water samples along the river course and 3 wastewater samples from pipelines discharging directly into the river were collected (Fig. 1). Additionally, river sediment and adjacent soil samples were collected at the same sites as the surface water samples. The solid samples were analyzed using the EPA method 3050B to determine concentrations of Cd, Cr, Cu, Fe, Mn, Ni, Pb and Zn. Chemical analyses of waters included the determination of major cations, anions, nutrients and metal(loids).

Despite significant industrial activity, the concentration of chemical parameters in water samples was below European Union limits for drinking water. A differentiation in hydrogeochemistry was observed before and after the industrial zone, with notable changes in conductivity, Cl^-, PO_4^{3-}, NH_4^+, Na^+ and K^+. The geology of the region including ultramafic rocks plays a significant role in the distribution of Cr, Fe, Mn and Ni in soil and sediment samples. We found a limited influence of industrial and agricultural activities on soil and sediment geochemistry, deduced by isolated samples with elevated Cd, Cu, Pb and Zn contents. We conclude that anthropogenic geochemical influences are more pronounced for surface water compared to soil and sediment in a heavily industrialized river basin[1] (Fig.1).

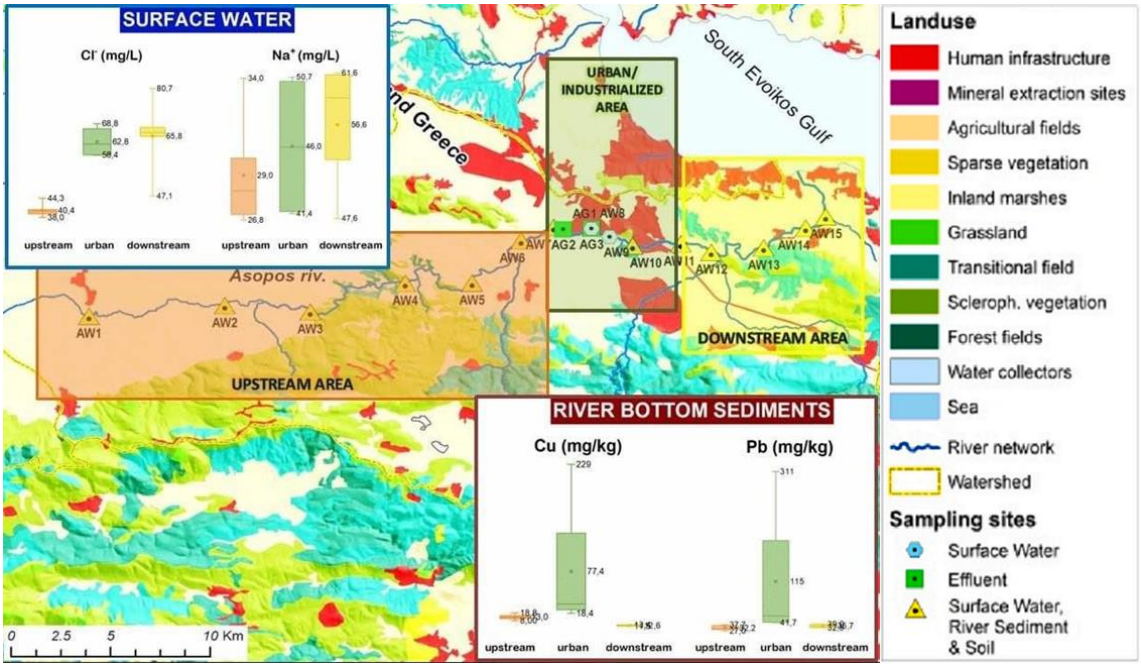

Figure 1: Graphical abstract

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Speciation of mercury in forest soils after fire and estimation of potential human health risks

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This study assessed the effect of the 2021 forest fire in North Evia, which affected approximately 500 km^2, on mercury distribution in top and subsoils. The impact on the Soil Quality and Properties as well as on the groundwater chemical composition of the affected area was also studied from the same scientific team (Stathopoulou et al., 2023, Megremi et al., 2024).[1,2]

A six-step Sequential Selective Extraction method was employed to the soil samples, separating water-soluble (H_2O), "stomach acid" extractable (CH_3COOH), organically complexed (KOH), strongly complexed (HNO_3), residual (aqua regia), and total Mercury (HNO_3-HCl-HF).[3] Between each step, the solid residue was rinsed with water while the liquid extract was stored -till analysis - after the addition of BrCl.

Total Mercury exhibited higher concentrations in all post-fire topsoils (minimum by 50%) compared to unburned subsoils (regarded as baseline values), indicating an impact of forest fires on Hg levels. This is also pointed out by the strong positive correlation (0,756) between Hg and organic carbon.

The fractions with the largest percentages for the topsoils were that of organically complexed and strongly complexed Hg, accounting for 31% & 16% in K, 21% & 44% in S, 38% & 26% in V. The fraction with the lowest percentage was that of water-soluble Hg, with values up to 2% in topsoils, (K for Krioneritis, S for Simia, V for Vasilika, B for Boutas). The subsoil percentages had a great variety at each sampling point and not at all the uniformity of the topsoils. This is another evidence of the effect of fire on soil properties.

Regarding the first two extractable fractions, a comparison was made with the most relevant existing regulations.[4,5] In all cases the values were below the limits of the European legislation, and thus they are not regarded as direct health or environmental risks. The International Union of Geological Sciences is soon finalizing the International Geochemical Atlas, which will be a great asset in estimating indirect long-term effects.[6]

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Hidden Dangers: The Health Risks of Microplastic Pollution

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Introduction: Microplastic pollution has gained significant attention as an emerging threat to both the environment and human health. The term "microplastics" refers to plastic particles less than 5 mm in size, which are increasingly being detected in water, food, and the air we breathe. These particles enter the human body through various sources, including marine environments, food supplies, and even bottled water. [1] The widespread use of plastics, driven by their low production costs and durability, contributes to this environmental hazard. [2] However, despite these benefits, the potential dangers to human health from microplastic ingestion are becoming more apparent, prompting the need for research to understand their full impact. For example, microplastics have been linked to various health issues, including endocrine disruption and cardiovascular problems. [3]

Methods: A literature review of peer-reviewed studies was conducted to assess the impact of microplastic ingestion on human health. The studies focused on exposure through the marine environment, water, and food. Data from different regions, demographics, and lifestyles were analyzed to understand exposure variations. Statistical analysis was performed using SPSS to evaluate the health impacts of microplastic ingestion.

Results: The findings show that microplastic ingestion primarily occurs through the marine environment, water, and food, with fish, shellfish, tap water, and bottled water being significant sources. Ingestion rates vary by geographic location, social class, lifestyle, and diet, with seafood consumers at higher risk. Discrepancies between studies are attributed to differences in methods and sample sizes. Health impacts are broad, affecting the endocrine, circulatory, immune, reproductive, and respiratory systems, though the exact mechanisms remain unclear, necessitating further research

Conclusions: This study highlights the widespread nature of microplastic pollution and its potential health risks, though the exact effects of ingestion remain unclear. More research is needed to determine which size, type, and concentration of microplastics pose the greatest risk. The lack of standardized methods for measuring ingestion complicates conclusions. Future research should focus on addressing these gaps to better guide efforts in reducing human exposure to microplastics. The findings call for action from both policymakers and researchers.

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PFAS and Public Health: Insights from the Skyros Project

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Introduction: Per- and polyfluoroalkyl substances (PFAS) are added to consumer products to provide waterproof, grease-resistant, and non-stick qualities. [1] Their introduction into the food chain and water systems has led to their presence in food and water supplies, posing chemical risks through dietary exposure. [2] Due to their persistence and harmful effects, PFAS have become a global issue. [3] Increased awareness of the risks associated with environmental contaminants often leads to shifts in public perception, prompting political, economic, and regulatory changes. [4]

Methods: The research took place during the "Skyros Project" Summer Academy, which included the "Chemical Ambassadors" mini training under the 'Life ChemBee' program. This program targets individuals interested in the environment and public health, aiming to expand their knowledge in these fields. All participants from the July 2024 session completed an online questionnaire via Microsoft Forms. The 19-question survey assessed their knowledge of PFAS and other toxic chemicals, as well as their impact on health.

Results: The study's participants were highly educated, with 60% holding postgraduate or doctoral degrees and 40% having completed higher education. Awareness of PFAS was limited, with only 4% recognizing PFAS alongside other harmful substances like PCBs, asbestos, and dioxins. This suggests a high level of education but mixed awareness of the health risks posed by toxic chemicals.

Conclusion: This research underscores the importance of continued education and public health initiatives focused on environmental toxins like PFAS. Increased awareness not only influences individual choices but also catalyzes political and regulatory changes, which are essential to addressing the global issue of chemical pollution. We would welcome the opportunity to present these findings in further detail and discuss their implications for future public health and environmental policies.

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Separation and Recovery of Natural & Anthropogenic Organic Polymers in soils of Attica, Greece

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Microplastics (MPs), with an estimated 300k tons released yearly in the EU, present significant monitoring challenges due to their small size, complex composition, and lack of standardized sampling and analysis methods[1]. Most research has focused on marine environments, leaving soil contamination less explored. MPs in soils, known for their high adsorption capacity, can bind contaminants like metals, contributing to environmental dispersion.

This study analyzed soil samples from the Attica region in Greece (0-20 cm and 20-40 cm depths) to assess MP recovery methods. Spiking experiments were conducted with cryomilled polymers, 20 ± 5 particles of each type (PE, PS, PET, PVC and car tire particles), and various reagents were tested for organic particle degradation, including Strand solution ($NaClO/KOH)^2$, KOH, H2O2, and porcine pancreatic enzymes. For mineral removal, supersaturated NaCl and ZnCl2 solutions were used for density separation, followed by filtration to retain MPs. A multi-method approach involving optical microscopy, FTIR, and Raman spectroscopy was employed to identify and characterize MPs.

Chlorine solutions effectively extracted lighter plastics like polyethylene (PE) and polystyrene (PS), while denser MPs such as PVC and PET were also recovered. However, KOH and Strand solutions were less effective in breaking down organic aggregates. Based on the extraction results from Table 1, samples treated with zinc chloride showed consistent particle recovery but had a deviation of 5-20 particles. Optical and FTIR analyses differed by 16 particles. Similar discrepancies were observed for samples treated with sodium chloride, raising concerns about the accuracy of visual microplastic identification.

Table 1. Total particles measured either with optical microscopy or with FTIR's software.

Identification Method	**Treatment Method (Pre-treatment/ Density separation)**	**Total identified particles**
Optical Microscopy	H_2O_2 / $ZnCl_2$	125 ± 5
Optical Microscopy	Enzymes/ $ZnCl_2$	120 ± 5
FTIR Measurement	Enzymes/ $ZnCl_2$	104
Optical Microscopy	H_2O_2/ NaCl	45 ± 5
Optical Microscopy	Enzymes/ NaCl	170 ± 5

Continued research using FTIR analysis is crucial for accurately quantifying MPs, particularly in soil samples with unknown contamination levels. This study provides a foundation for improving recovery methods, highlighting the need for standardized protocols in soil MP analysis.

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Isotope enriched mercury as a methodology to assess methylation potential: Application in environmental samples of the Canadian Subarctic

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Mercury (Hg) is a toxic element that can enter the ecosystems through natural or anthropogenic sources, with long-range transport leading to its accumulation in remote Arctic and Subarctic regions[1]. Permafrost soils have accumulated Hg over time[2], but the accelerated Arctic warming is releasing these stored contaminants and providing the ideal conditions for microbial methylating communities, the main responsible for the formation of methylmercury (MMHg) – a neurotoxin that bioaccumulates and biomagnifies in food webs[1,3]. This work intents to understand the impact of permafrost thaw on Hg biogeochemical cycles, specifically in thermokarst lakes formed due to the degradation of permafrost.

The methods used were designed to assess the methylation potential of the water column of two thermokarst lakes (SAS1A and SAS2A) in Kuujjuarapik, in the Canadian Subarctic, during the winter and summer of 2022. Incubation experiments were conducted using a field spike solution with isotope enriched Hg. Specifically, the field spike contained inorganic Hg (^{200}Hg(II)) to track methylation and organic Hg (MM^{198}Hg) to track demethylation.

Results showed seasonal variability in the concentration of THg and MMHg in the water column of SAS1A but not in SAS2A. Nevertheless, both lakes showed higher methylation potential in the winter than in summer. Results showed that between 0.01-0.78% of Hg was methylated in 24h in summer increasing to 0.13-7.62% in winter.

This work demonstrates the utility of using isotope enriched Hg to assess the methylation potential of different environmental compartments revealing their ability to produce MMHg. While the study sites are not contaminated, the release of Hg from permafrost and atmospheric transport can lead to high levels of Hg and potentially increase the concentration of MMHg in the area, affecting the local flora and fauna and Indigenous Communities.

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IMPOSE: Investigating Mercury and organic Pollutants carried by micrOplastics in the Scheldt Estuary to manage future contamination

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Worldwide applications of plastics have led to an extensive production over the last decades and this, however, comes at an unforeseen cost: 150 million tons of plastic ending up in the oceans affecting all aquatic ecosystems[1]. Once in the environment, plastic waste breaks down into smaller particles that can enter the food web. These microplastics (MPs) (size range between 1 µm and 5 mm) are considered as emerging contaminants due to their persistence and ability to transport other co-existing organic and inorganic pollutants. This leads to a dangerous mixture effect with yet unknown health impacts[2]. It is crucial to study microplastics as transport and transformation vectors because the accumulation of plastic materials is rapidly increasing worldwide, only intensifying the risks associated with their interactions.

An interesting study area that forms an important gateway to MP pollution for European coastal waters and is known for its heavy contamination by pollutants is the Scheldt estuary, located on the border of Belgium and the Netherlands. The pollution state of the estuary will be established focusing on the presence of microplastics, mercury and oestrogen active substances (EAS) (e.g. oestradiol). To understand their interaction with one another, laboratory experiments will be conducted on commercial MPs, including ageing with heat activated potassium persulfate, biofilm formation using filtered surface water and adsorption experiments. Classical analytical techniques, such as Fourier Transform Infrared spectroscopy (FTIR) and Raman, will be compared to more innovative techniques, such as Scanning Transmission X-ray Microscopy (STXM)[3].

Preliminary microscopic results of the ageing experiment showed that their surface changed, making them look more like microplastics found in the environment.

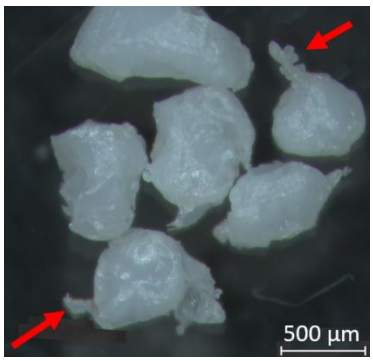

Figure 1. Artificial ageing is faster than natural ageing. After 20 days performing advanced oxidation processes with heat activated potassium persulfate, the surface of 500 µm PET MPs changed morphologically.

My study will help us better understand the mercury cycle and how MPs affect the behaviour of EAS in aquatic environments. These insights will be crucial for developing more

effective environmental risk assessments and informing future policies aimed at mitigating MP contamination in aquatic ecosystems.

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Effect-Direct Assessment of AhR-active Compounds in Suspended Particulate Matter in Effluent-Dominated Urban River: A Zenne River Case Study

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The Zenne River (Belgium) was polluted by the discharge of untreated or inadequately treated wastewater from urban and industrial sources for years[1,2]. The presence of suspended particulate matter (SPM) in the river can serve as a reservoir for persistent pollutants. Among these contaminants, those can activate the aryl hydrocarbon receptor (AhR) is of particular concern. The well-known AhR-ligands includes polycyclic aromatic compounds (PACs), dioxins, and polychlorinated biphenyls (PCBs)[3]. Therefore, this study aimed to screen the AhR-active compounds in SPM from the Zenne River and the adjacent Brussels-North wastewater treatment plant (WWTP-N).

Seasonally sampling campaign was carried in 2023. In total, 16 SPM samples (0.3 mm to 5 mm) was collected from both the influent and effluent of the WWTP-N, as well as from upstream and downstream locations of the Zenne River. The fraction of PAC was extracted from SPM with ultrasonic extraction using toluene/methanol (4:1, v/v). Thereafter, 8 of highest PAC samples were extracted for dioxins and PCBs fraction using US EPA Method 4435. The effect-direct bioassay AhR-CALUX (Chemically Activated Luciferase gene eXpression) was used to screen the potency of PACs and dioxin-like compounds of SPM samples.

The results showed that the level of PACs in SPM was the highest (average: 19.3 μg BaP eq/L), the potency of dioxin and PCBs were much lower, with average value of 0.08 and 0.002 TCDD eq/L), respectively. Zenne River downstream has higher level of PACs compared to upstream, indicating the impact of WWTP-N discharge. However, the concentration of PACs at downstream was even higher than effluent water, suggesting that there would be other co-factors influencing the final total activity, since CALUX bioassay also provides mixture effects.

The study concludes that PACs are the dominant AhR-active compounds in the Zenne River, with downstream concentrations exceeding effluent levels, indicating additional sources and complex mixture effects influencing overall toxicity.

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Using exposure load to examine the burden of multiple chemicals in men and lactating women

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Exposure Load (EL) is a metric for evaluating multi-chemical exposure. This study utilizes data from the first Slovene Human Biomonitoring programme, focusing on lactating primiparous women and men.

The EL values were calculated from measurement values of selected chemicals for a certain individual and sums up the number of chemicals with measured values above the selected thresholds: the limit of detection/quantification, 50th and 90th percentile. Total EL and separate ELs for chemical groups were calculated. Nonparametric testing was used to examine differences in EL based on study area, sex, age and smoking status, biserial correlation was used to determine the impact of individual chemicals on the EL and linear regression (bivariate and multivariate) was used to find determinants from the participants' data on their life style, dietary habits and residential environment and create predictive models.

The nonparametric testing identified participants from urban areas, men, older participants and smokers as population groups with higher EL. Biserial correlation showed the highest impact on EL for phthalates and PAHs. The most important determinants from questionnaire data included seafood consumption, consumption of certain locally and non-locally sourced foods and wood burning in rural areas (all positive). Multiple regression models were created for total and phthalate EL at the 50th percentile. Higher EL in urban areas rather than in potentially contaminated areas could be due to the increased awareness of the local inhabitants about environmental pollution and higher seafood consumption in urban areas. Higher ELs in men in comparison to women could be due to lifestyle and partially also physiology differences, particularly because participating women were in the lactating period. Exposure through food-contact plastic packaging was present regardless of food origin.

The metric holds promise for use in the identification of population groups particularly at risk of high exposure and the contributing factors.

Geochemical characterization and identification of the potential origin of some chemical elements in soils of Gegharkunik region, Armenia

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Soil pollution is a global concern[1]. This study aims to determine the geochemical characteristics of soils in the Gegharkunik region (Armenia) (5351 km[2]) and identify the origin of chemical elements in the region's soils.

The contents of As, Ba, Fe, Pb, Co, Mn, Mo, Cu, V, Ti, Zn, Cr, Ca, and K were determined in 171 soil samples using an XRF. The k-means clustering and principal component analysis (PCA) revealed the grouping features of the studied elements.

The results showed that the mean contents of Cr and As exceeded the Armenian MAC by 1.74 and 1.54 times, respectively. Comparatively high coefficients of variation (>60%) were observed for Cr (166%), Ca (127%), As (66.4%) and Cu (73.2%), indicating their heterogeneous origin. Combining clustering and PCA allows the identification of 3 geochemical associations. It was found that the formation of group I is conditioned by Ca, which is spatially correlated with alluvial, diluvial, and proluvial sediments, travertines, and fulvous forest carbonized and mountain meadow black soils formed on these parent materials. Group II, represented by the V, Ti, K, As, Zn, Cu, Co, Fe, Mn, Pb, and Ba is widespread throughout most of the region. Several elements in group II (V, Mn, Ti, Ca, Co, Fe) are inherited from the local geological base, with Ba being typical of K-bearing minerals. Cr represents group III and occupies the region's eastern part, between the Shorzha chromite[2] and Sotk gold mines. These areas are characterized by dunite-harzburgite formations[2]. The hyperbazites associated with these formations are host rocks for chromite minerals[3]. The highest MAC values for Cr are also located in the eastern part of the region.

These results indicate that the local geological basis and historical mining activities conditioned the spatial distribution of the studied elements in the region.

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Determination of Temporal Changes in Mercury Concentrations for Tagus and Guadiana Saltmarsh Areas

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Mercury (Hg) dynamics in estuarine sediments have been extensively studied, yet the processes driving temporal changes in mercury concentrations and speciation remain less understood in historically contaminated regions. The Tagus estuary has been impacted by anthropogenic Hg inputs, particularly in Barreiro, Cala Norte and Alcochete, while the Castro Marim area, in the Guadiana estuary, is naturally influenced by the nearby pyrite belt and serves as a reference site. This study investigates the spatial and temporal distribution of total mercury (THg) and monomethyl mercury (MMHg) concentrations in sediment cores from these regions, with a focus on identifying historical trends and the current status of mercury cycling.

Sediment cores were analyzed to quantify THg and MMHg concentrations. THg was quantified using atomic absorption spectrometry (AMA-254), while MMHg was quantified using a Tekran 2700 system, following EPA Method 1630. MMHg/THg ratios were calculated to assess methylation efficiency. Results show distinct patterns of mercury accumulation between vegetated and non-vegetated areas. In Alcochete, non-vegetated sediments showed higher MMHg concentrations, up to 3.27 ng/g, and THg levels, up to 0.71 µg/g, while vegetated areas exhibited lower Hg concentrations. The MMHg/THg ratios indicated more efficient methylation in surface layers, decreasing with depth. In Barreiro and Cala Norte, similar trends were observed, with vegetated sites generally exhibiting higher MMHg concentrations and MMHg/THg ratios than non-vegetated areas, suggesting enhanced methylation in these environments. Conversely, non-vegetated areas showed more pronounced THg concentrations. Castro Marim exhibited lower overall Hg concentrations compared to Tagus sites, with MMHg levels up to 2.28 ng/g and THg up to 0.40 µg/g in the vegetated core.

Overall, the Tagus estuary exhibited higher mercury concentrations and more varied methylation patterns across its sites. In contrast, Castro Marim, despite lower overall mercury levels, still displayed evidence of ongoing methylation processes, particularly in vegetated sediments.

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Utilising Signal Transformation for the Simultaneous Voltammetric Analysis of Palladium and Nickel

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Environmental concerns emerge even when palladium (Pd), a crucial element for technological applications, is used in trace amounts. The concentrations of Pd in aquatic environments can range from 0.04 ng/L [1] to 3.2 µg/L, with wastewaters exhibiting the highest levels [2]. In wastewaters, nickel (Ni) concentrations can reach up to 16 µg/L [3], categorizing it as a priority contaminant. Additionally, Ni is the main interferent when assessing palladium through voltammetry, a cost-effective method for metal analysis.

In this study, Pd determination was explored while simultaneously monitoring Ni using stripping voltammetry. This was performed by optimizing the pH and adjusting the concentration of dimethylglyoxime (DMG) that forms complexes with metals investigated. To improve the sensitivity of the determination, square wave voltammetry combined with second derivative signal transformation was employed. The experimental conditions were optimized regarding electrolyte composition, frequency (Hz), deposition time (t_d), and deposition potential (E_d).

An increase in DMG concentration enhanced Ni sensitivity without affecting the Pd signal. In addition, a decrease in pH did not affect Pd peak but resulted in a decreased of Ni signal. Thus, it was possible to manage Ni interference in Pd determination. The optimal conditions for the simultaneous determination of Pd and Ni were achieved with a frequency of 25 Hz, a deposition potential (E_d) of -0.2 V, and a deposition time (t_d) of 180 seconds. The limits of detection (LOD) were found to be 0.02 µg/L for Pd and 0.20 µg/L for Ni. The improved method was applied to environmental matrices such as wastewaters and road dust, as well as in reference materials for which the recoveries were higher than 80%.

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Potentially toxic elements geochemical mapping and background assessment of the Mercogliano municipality (Avellino, Italy) soils.

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A geochemical prospecting campaign was carried out on the topsoil of the municipality of Mercogliano (Avellino, Italy). The study was aimed at the definition of geochemical patterns for potentially toxic elements (PTEs) and the assessment of their specific background values[1] and related contamination degrees. Specifically, a total of 40 topsoil samples were collected across the study area based on a regular grid. At each site, the sampling activities consisted of collecting soil about 10-15 cm from the ground surface. The analyses of PTEs were entrusted to a commercial laboratory (Lifeanalytics srl) following sample preparation at the Environmental Geochemistry Lab (Department of Earth, Environmental and Resources Sciences at University of Naples Federico II). Statistical analysis was performed and local background values for PTEs were determined based on the Upper Tolerance Limit (UTL) with 95% confidence and 90% coverage coefficient (95UTL90) and the Upper Prediction Limit (UPL) at 95% (95UPL) retaining the most conservative values for each element. Discrete (point-based) and continuous distribution (interpolated) maps were generated, respectively, for each geochemical variable. A map of Cumulative Contamination Index (CCI)[2] was also generated using the assessed background values as a reference.

The results highlighted the presence of markedly high Tl and Be values diffusely overcoming national guidelines (1 mg/kg for Tl; 2 mg/kg for Be). In contrast, Cu presents a few hotspots with concentrations higher than national guidelines (120 mg/kg).

These outcomes confirm that the volcanic soils featuring the area naturally influence the concentrations of Tl and Be which also resemble the regional background values assessed by De Vivo et al. (2021). The CCI map showed how contamination of the study area only relies on the anthropogenic contamination produced by Cu demonstrating that the use of environmental guidelines established at the national level can be often inadequate.

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Anthropigene: first environmental application of the geochemical gene to identify natural background and contamination: The Campania region case study (Southern Italy).

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The determination of the natural geochemical background is crucial for differentiating natural concentrations of chemical elements from anomalies resulting from anthropogenic activities, thereby enhancing environmental monitoring and sustainable resource management. This study introduces the *Antropigene*, a new tool derived from the concept of the *geochemical gene*[1], applied for the first time in an environmental context to characterise urban and agricultural contamination in the Campania region of Southern Italy.

To construct a geochemical gene, five key steps are proposed: selection of elements, determination of reference values, spectral line and codes, calculation of similarity, and sequence of elements[1,2,3]. Following this methodology, the *Antropigene* was developed by analysing over 3,000 topsoil samples from the Campania region and selecting indicator elements specific to various contamination types: lead (Pb), zinc (Zn), mercury (Hg), antimony (Sb), and gold (Au) for urban pollution, alongside arsenic (As), copper (Cu), potassium (K), sodium (Na), and phosphorus (P) for agricultural contamination. A unique geochemical code was calculated for each sample based on the contamination type examined, and final maps of contamination patterns within the study area were produced, revealing distinct spatial distributions linked to both urban and agricultural impacts.

Preliminary results show that the urban gene identifies anomalies corresponding to the main urban areas in the region, while the agricultural gene highlights zones designated for cultivation, particularly vineyards on the island of Ischia and in the Phlegraean Fields area, as well as the Sarno Basin, known for its intensive agricultural production. Furthermore, through the calculation of similarity among the genetic codes of the samples, a more accurate distinction was made between anthropogenic anomalies and samples related to the natural background. The latter were subsequently used to determine specific background values for each geological context.

This new approach demonstrated a faster and more practical method, as it considers the association of chemical elements related to specific contaminations, providing a comprehensive understanding of anomalies and enabling better identification of background samples compared to conventional methods. The *Antropigene* could serve as a valuable tool for environmental monitoring and the management of natural resources, contributing to a deeper understanding of geochemical dynamics and large-scale anthropogenic influences.

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Analytical Techniques Used for Determination of REE in Natural Water Samples

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Rare earth elements (REE) represent a group of 17 metals, including 15 lanthanides (La-Lu) as well as scandium (Sc) and yttrium (Y) [1]. Due to their specific chemical and physical properties, these elements are often used in environmental studies as indicators of various processes and phenomena occurring in nature, including aquatic environmental research. However, REE occurs in water in very low concentrations, ranging from a few to several hundred ng/L, which significantly limits the laboratory techniques available for their determination [2].

Using the Scopus and Web of Science database, a review of the literature published over the last several years was conducted to identify the most commonly used laboratory methods and to compare their analytical capabilities and limitations. The ultralow concentrations of REE in natural water samples often do not allow for direct measurement, even when using the most sensitive methods (ICP-MS, NAA), thus various analytical techniques for sample preparation/preconcentration of the analyte were also compared.

It was found that the most commonly used analytical techniques for REE determination are spectroscopic methods ICP-MS (*inductively coupled plasma mass spectrometry*) and ICP-OES (*inductively coupled plasma optical emission spectrometry*), with ICP-MS in various configurations being the dominant technique. To a lesser extent, methods such as NAA (*neutron activation analysis*), XRF (*X-ray fluorescence***)**, and AAS (*atomic absorption spectroscopy*) are also used. Furthermore, it was found that the most commonly employed methods for sample preconcentration and separation of REE from the original water matrix are techniques based on solid-phase extraction, using a wide range of active materials. Liquid-liquid extraction and co-precipitation methods are used to a lesser extent. Achieved preconcentration factors typically range from a few to several times, but the highest reported values reach up to 400-500 times [3].

A comparison of results from recent publications does not provide a clear answer regarding the optimal technique and methodology for determining REE in environmental water samples. The collected data suggest that for the most common water types with typical matrices, the use of ICP-MS with online sample preconcentration using SPE appears to be the most suitable methodology for REE measurement.

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Evaluation of Acid-Volatile Sulphides towards Trace Elements in Sediments

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Acid Volatile Sulphides (AVS) in anoxic environments play a critical role in metal mobility and bioavailability in sediments [1]. This research, conducted as part of the project SPECS, aimed to develop and validate a procedure for extracting AVS and the Simultaneously Extracted Metals (SEM), such as priority pollutants (e.g., nickel (Ni)) and the platinum-group elements (PGEs) [2], contributing to improving their current knowledge in the environment. Additionally, the procedure was applied in the extraction of AVS-SEM from fresh sediment samples.

The apparatus was built using plastic materials to address the issues associated with traditional glass and metal systems. Briefly, about 0.25 g of fresh sediment was put into 10 mL solution of HCl 1.0 M, purged with N2 for 20 min, and the AVS trapped in a separate tube containing NaOH 1.0 M. The procedure was validated through recovery tests using a standard solution of sodium sulphide and procedural blanks. Then, extractions were done using fresh sediment samples collected from vegetated and non-vegetated cores in the Rosário salt marsh, in the Tagus Estuary. Concentrations of AVS were determined by differential pulse cathodic stripping voltammetry (DPCSV) using the standard addition method. Despite some minor leakage issues identified and fixed, the apparatus demonstrated an average recovery rate of 93 ± 21 % (n=5), which is comparable to other purge-and-trap systems [2, 3]. The limit of detection (LOD) was 2.1 µg/g of AVS in sediments.

Analysis of the Rosário salt marsh sediments revealed that AVS concentrations varied with depth, between the LOD (2.1 µg/g) and 738 µg/g, with the highest concentrations found in deeper layers. Though average values were similar for both sediment cores (108 µg/g in the vegetated and 124 µg/g in the non-vegetated), median values of concentrations revealed lower AVS levels in the vegetated core (9.7 µg/g) than in non-vegetated (95.6 µg/g). This observation highlights the role of plants in the oxidation of sulphides due to oxygen released by the roots. Additionally, AVS concentrations were higher in surface layers of the non-vegetated core than in vegetated, the latter with AVS levels below LOD until 14-cm depth. In these preliminary results, no significant correlation was observed between AVS and metal concentrations.

The newly developed extraction apparatus proved to be reliable for AVS-SEM analysis, though further improvements and testing are recommended. Future work should focus on enhancing the system's robustness and in investigating the interactions between AVS and other metals in detail. This is urgently needed considering the context of a changing climate.

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Nickel Concentrations Associated to Acid Volatile Sulphides extracted from Two Different Estuarine Sediment Cores of the Tagus Estuary, Portugal

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Estuaries are critical zones for monitoring pollution since they are often impacted by human activities. Nickel (Ni) is a priority pollutant capable of accumulating in estuarine sediments. Therefore, this study aimed to investigate Ni fractionation in vegetated and non-vegetated sediments of Rosário saltmarsh, in the Tagus Estuary, focusing on Ni concentrations linked to Acid Volatile Sulphides (AVS) to better understand its possible bioavailability [1].

A homemade system was built in the laboratory to extract simultaneously the metal and AVS, as shown in Figure 1. About 0.25 g of fresh sediment was put into 10 mL solution of HCl 1.0 M, purged with N_2 for 20 min, and the AVS collected in a separate tube (NaOH 1.0 M). Analytical control of the procedures was done using blanks and standard solutions of Ni. Concentrations of Ni were determined by cathodic stripping voltammetry using a three-electrode configuration with the static mercury drop electrode (SMDE) as working electrode [2]. The recovery of Ni from spiked solutions (n=3) was 128±19%, indicating cross-contamination issues and thus samples were corrected for the blank values obtained in each measurement. The limit of detection for Ni was 0.36 µg/g for the typical sediment mass weighted.

The median value of Ni concentration was higher in the vegetated core (1.46 µg/g) than in non-vegetated (0.88 µg/g). Additionally, Ni concentrations were higher in surface layers of the vegetated core than in non-vegetated, suggesting that roots plays a key role in its retention in sediments. On the other hand, the concentration of sulphides was higher in the deeper layers of the vegetated core than in the surface layers, and no clear correlation between Ni and sulphides could be observed. Further investigation is needed to reassess the relationships between AVS and Ni and their ecological impact in the context of climate change.

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Use of Eutectic Solvents in Sample Preparation for Palladium Environmental Analysis: a Preliminary Assessment

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Palladium (Pd) is a platinum-group element with vast technological applications but mainly in catalytic converters of cars and industries. Its concentration has been increasing in several environmental compartments, including in the aquatic media, and robust analytical methods for its quantification at ultra-trace levels are needed. The major bottlenecks on Pd determination are the high analytical limits of detection (LOD) and interferences faced during the analysis, usually done by atomic spectrometry and voltammetry. Deep Eutectic Solvents (DES) is a new generation of solvents with excellent features that has emerged as a green alternative for trace analysis and recovery.

In this context, we assessed a DES selective for Pd composed of methyltrioctylammonium chloride (Aliquat 366) and hexanoic acid [1], using two different ratios, for investigating its applicability in Pd environmental analysis using voltammetry. With this method, the main interference is caused by Nickel (Ni). Batch experiments were done at least in duplicate before the voltametric analysis, solutions were prepared as schematized in Figure 1. Reproducibility of square wave voltammetry (SWV) during analysis was ensured by three consecutive measurements and the LOD was 0.2 µg/L Pd.

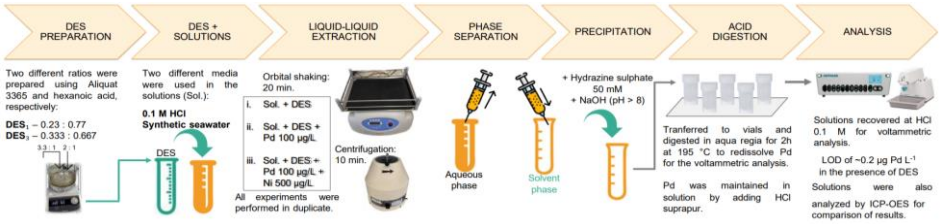

Figure 1. Scheme of the steps of the experiment, from DES preparation until the voltametric analysis.

In the aqueous phase, no signal of Pd was detected in all experimental conditions, whereas Pd was found in the solvent phase. Thus, the estimated extraction efficacy (%) of DES toward Pd was 99.8%, and the real extraction efficacies ranged between 60 and 100%. Conversely, the simultaneously monitoring of Ni in the experiment confirmed the high selectivity of the DES toward Pd, with Ni remaining in the aqueous phase. The data obtained for the solvent phase show that in average 82% of Pd is transferred into DES_1, and 93% into DES_3.

This work paves the way for innovative approaches to sample preparation and improvement of the analytical determination of Pd in environmental samples, particularly in aqueous matrices.

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Assessing the rhizosphere effect of *Halimione portulacoides* on mercury concentration and bacterial diversity in saltmarsh sediments (Tagus Estuary, Lisbon)

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Tagus Estuary is known to contain high levels of mercury (Hg), due to past industry activities. Given the high microbial activity observed in saltmarsh ecosystems and the pivotal role of plant-bacteria interactions in Hg cycling in the Tagus Estuary[1], this study evaluates the seasonal influence and the impact of *H. portulacoides* on the mercury content and bacterial communities of rhizosphere sediments.

Vegetated sediment and root samples were collected, in winter and spring seasons, in an area colonized by *H. portulacoides* and compared with sediments without plants. Mercury and methylmercury (MeHg) were quantified in vegetated (rhizosphere) and non-vegetated sediments and in *H. portulacoides* roots. Cultivation of aerobic, heterotrophic bacteria from vegetated and non-vegetated sediments was conducted for quantification of Colony Forming Units (CFU)/g. From these cultures 59 aerobic bacteria were isolated, tested for inorganic mercury (Hg^{2+}) resistance, and identified through 16S rRNA gene sequencing.

Results in sediments and roots showed high values, with contents of Hg and MeHg above normal values for unpolluted soil and water[2]. Concentrations of Hg and MeHg ranged from (0,130 ± 0,015) µg/g to (3,121 ± 0,108) µg/g and from (0,8 ± 0,02) ng/g to (27 ± 1) ng/g, respectively. In terms of CFUs/g, spring stood out with higher numbers, which might indicate the influence of temperature in bacterial abundance. Halotolerant, typical saltmarsh bacteria, such as *Vibrio spartinae*, were isolated from the rhizosphere of *H. portulacoides*. Regarding mercury resistance, a clear difference was identified, with a higher percentage of rhizosphere bacteria presenting signs of resistance, some of which affiliated with the genera *Vibrio* and *Microbulbifer*, compared to unvegetated sediment bacteria.

In conclusion, this study reveals higher MeHg content in plant roots than in rhizosphere and bulk sediments, suggesting that areas colonized by *H. portulacoides* may be hotspots for the recruitment of Hg-methylating bacteria in saltmarsh ecosystems.

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Monitoring of trace elements in soils of the South Shetland Islands, Antarctica

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The South Shetland Islands (SSI) in the Western Antarctica Peninsula region is one of the most accessible places of the Antarctic to study the continent ice-free areas. They represent less than 0.5% of the continent, sustaining almost all its ecological diversity. The geographical location of the SSI makes it one of the most visited places in Antarctica and, its small ice-free areas comprise an elevated number of scientific research stations, creating some of the most anthropogenically pressured sites in Antarctica. Simultaneously, the SSI are in an area of discontinuous permafrost that is close to its climatic boundary, meaning that permafrost degradation seems an inevitability.

The chemical characterization of Antarctic soils, namely trace element content, is therefore a valuable variable to study the human footprint, understand natural geochemical variability and monitor environmental changes in the light of climate change scenarios, like permafrost degradation.

To evaluate the presence of As, Cd, Cu, Cr, Hg, Ni, Pb and Zn samples were collected in different islands: King George (KGI), Deception (DI) and Livingston Islands (LI). Samples were collected from surface soils and in depth to evaluate if permafrost degradation may have an impact in trace element remobilization.

In KGI, average concentrations (μg g^{-1}) were: As:7.3±4.2; Cd:0.23±0.02; Cu:106±34; Cr:37±14; Hg:0.012±0.007; Ni:18±8; Pb:8.1±6.7; Zn:81±23.

In DI, average concentrations (μg g^{-1}) were: As:3.3±2.6; Cd:0.30±0.07; Cu:63±15; Cr:29±21; Hg:0.048±0.038; Ni:14±6; Pb:4.7±0.9; Zn:110±13.

In LI, average concentrations (μg g^{-1}) were: As:4.0±1.5; Cu:56±6; Cr:37±12; Ni:19±6; Pb:14±12; Zn:119±28.

Concentrations don't seem to indicate significant anthropogenic contamination, however, in LI, a location with concentrations of Pb:548 μg g^{-1}, As:15 μg g^{-1} and Cd:3.4 μg g^{-1} could possibly be explained by human presence. On the other hand, high values of Hg found in DI are attributed to its volcanic activity, revealing the importance of monitoring one of the most pristine locations of Earth.

Variability of greenhouse gases (CO_2, CH_4 and N_2O) in Ria Formosa Coastal Lagoon, south Portugal

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Coastal lagoons are highly productive ecosystems affected by anthropogenic pressures and climate change. The coastal lagoon Ria Formosa (southern Portugal) has been studied in terms of greenhouse gases (pCO_2, N_2O and CH_4). These parameters help to understand the environmental dynamics of greenhouse gases and to what extent this ecosystem acts as a source or sink of these gases.

The seasonal variability of partial pressure of CO_2 (pCO_2) and concentrations of methane (CH_4) and nitrous oxide (N_2O) were assessed hourly over complete tidal cycles with 24 h sampling at both edges of Ria Formosa (Site 1 and Site 2). pCO_2 was calculated from total alkalinity (TA) and pH, while N_2O and CH_4 were measured by gas chromatography. Fluxes of gases across the air-water interface were estimated from Fick law.

Site 1 had the highest values of both pCO_2 and N_2O, while Site 2 had the highest concentrations of CH_4. However, the overall variability of greenhouse gases was higher at Site 2 than at Site 1. Daily variations were observed to be antiphase with the tidal height at both stations, with highest concentrations during ebb to low tide, suggesting that the coastal lagoon exports CO_2, CH_4 and N_2O to the adjacent coastal ocean.

Changes in greenhouse gas concentrations were influenced by several environmental factors (e.g. salinity, temperature, gas reactivity, exchange with the atmosphere) as well as biological processes (photosynthesis and respiration), which are apparently different at the two sites. Positive fluxes of pCO_2 and CH_4 indicate that the study areas acted as a source of these gases to the atmosphere. However, the fluxes of N_2O were negative, except during the summer campaign, indicating that Ria Formosa can be also a sink for this greenhouse gas.

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Toxicology research of heavy metals in cosmetics in antiquity

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Since ancient times, cosmetics have been a way of expression, an element of culture, as well as an exemplar of scientific development in the field of health. People used cosmetics in order to disguise themselves while hunting or for survival purposes, as well as to surpass diseases and make a statement [1]. This study aims in assessing the dermal bioaccessibility of potentially toxic elements present in common minerals used as the cosmetics in ancient times. For this purpose the most known minerals for cosmetic use were selected, such as, galena (PbS), cerussite ($PbCO_3$), malachite ($Cu_2(OH)_2CO_3$) and orpiment (As_2S_3), for their contains in Pb, Cu, and As.

The procedure that was followed, included the determination of the pseudototal concentration of the metals through aqua regia digestion of the minerals and leaching tests using an artificial sweat extractant[2] .

The results showed that the dermal bioaccesibility of Pb from galena was 0.63% and from cerussite was 2.03%. The respective bioaccessibility of Cu from malachite was 0.15% and from orpiment 0.35%. These values show that the bioaccessible amount of metals through skin is very low compared to the total amount. However, these values account for 2012 mg/L of Pb from galena and 2299 mg/L from cerussite, 696 mg/L Cu from malachite and 1963 mg/L As from orpiment in the sweat extract (Figure 1). The respective German toxicity limits of these metals in cosmetics are 2 mg/L of Pb and 0.5 mg/L of As [3] .

Based on the German toxicity limits the minerals used for grooming in the previous centuries, contained elevated concentrations of hazardous metals, exceeding the regulatory limits that have been set in our days, causing various health issues, such as cardiovascular diseases, neurologic defects and cancer.

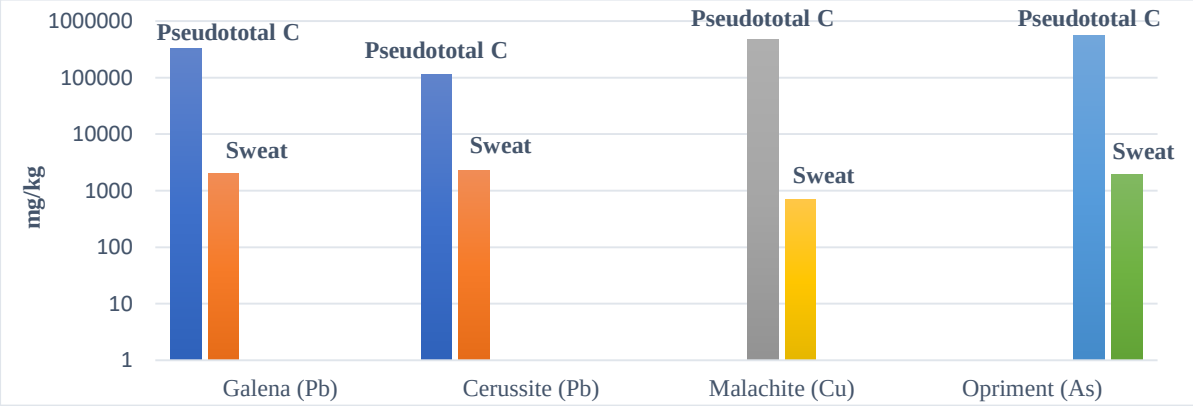

Figure 1: Comparison of pseudototal concentration of the metals with concentration from artificial sweat extractant for each mineral.

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Identifying Impurities in BBQ Briquettes Through Organic Petrography

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Charcoal was an important energy source for centuries, and still remains today one of the major fuels. Nowadays, charcoal is used mostly for cooking purposes, in the form of lumps, as well as processed in the form of briquettes. Charcoal briquettes are formed by compressing charcoal particles together with a suitable binder, such as starch mixed with water. The weak point of charcoal production is that it is largely unregulated, resulting in maleficent raw material management, inefficient production yield and purity control, harmful emissions, and low charcoal quality. Based on the European standard EN 1860-2 (2005) the moisture and the ash yield of the dry charcoal briquettes shall not exceed 8 wt% and 18 wt%, respectively, and the total inadmissible additions identified under the microscope, should not exceed 1 vol%. The main purpose of this study is to investigate the quality of charcoal briquettes from the Greek market.

Nine samples were purchased from various vendors in Patras and examined according to the EN 1860-2 (2005) standard. For each sample proximate and mineralogical analyses, as well as incident light microscopy were conducted to assess their quality.

The petrographic analysis reveals that the impurity content (e.g. raw biomass, plastic, fossil fuel particles) exceeds 1 vol% and that four (out of the nine) samples consist almost exclusively of coal particles.

In light of the above and the public health hazards that are posed by using grill fuel of questionable quality, the need for effective and reliable quality control methods is urgent. The petrographic analysis of charcoal briquettes proved being the most appropriate technique.

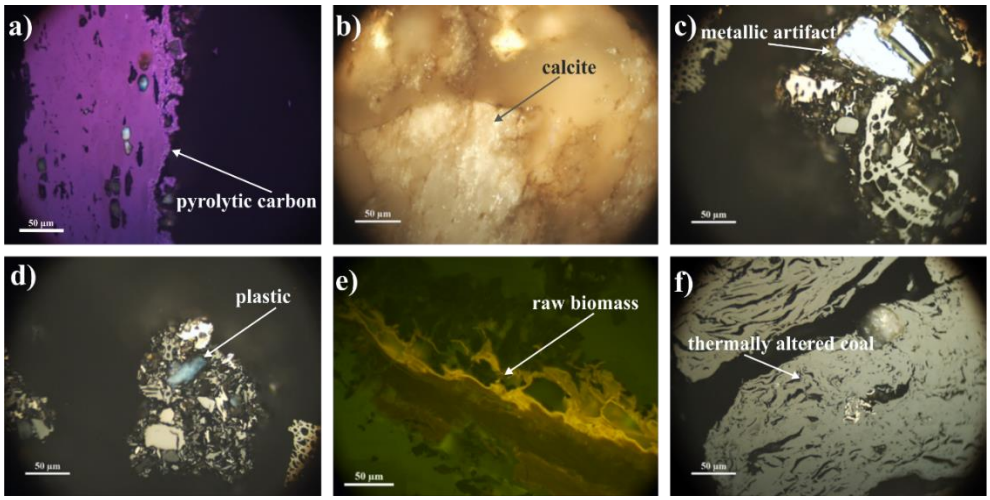

Figure 1. Photomicrographs (a-f) of various inadmissible additions in barbecue charcoal briquettes from Greek market.

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Caenorhabditis elegans Exposed to Environmentally Relevant Concentrations of Oxamyl Showed Morphological Alterations, Developmental Delay and ROS Increase

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The consequences of the industrialized world have caught the overall attention due to the association of environmental contaminants with deleterious effects that span from ecosystem balance to human health, standing as key players in the aetiology of several pathologies. Pesticides are among the contaminants that raise more concern, due to their ubiquitousness in environmental compartments and increasingly excessive use. Oxamyl, a carbamate and one of the most used systemic insecticides, raises ecological and food safety concerns, while the European Food Safety Authority has officially made its classification as a relevant water contaminant. Thus, it is critical to study the potential impact that this pesticide poses as a toxic contaminant, considering its deleterious effects both on environmental and human health. Moreover, oxamyl is pointed as a potential neurotoxicant, holding an inhibitory effect on the acetylcholinesterase activity.

This study aimed to evaluate the neurotoxicity of environmentally relevant concentrations of oxamyl, using *Caenorhabditis elegans* as the model organism to access systemic neurodegeneration and developmental impairments. To tackle this objective, we evaluated cholinergic neurodegeneration, using confocal microscopy, and oxidative stress through the 2',7'-dichlorofluorescein reactive oxygen species (ROS) method. Additionally, lethality as well as morphologic and developmental endpoints were assessed using a stereomicroscope and video analysis using WormLab 3.1 (MBF Bioscience, USA). Our results revealed a dose-dependent developmental delay and morphological changes, specifically on animals' size. Furthermore, there was a significant ROS elevation in oxamyl-treated groups (150, 300 and 500 µg mL^{-1}). No significant differences were observed for neurodegeneration.

In conclusion, oxamyl proved to be toxic to *C. elegans*, causing noticeable developmental alterations up to 48 h post-exposure and inducing a pro-oxidant state, a hallmark of pathophysiological alterations frequently associated with neurological impairment. These findings raise concerns about the potential impacts of oxamyl on humans and other organisms.

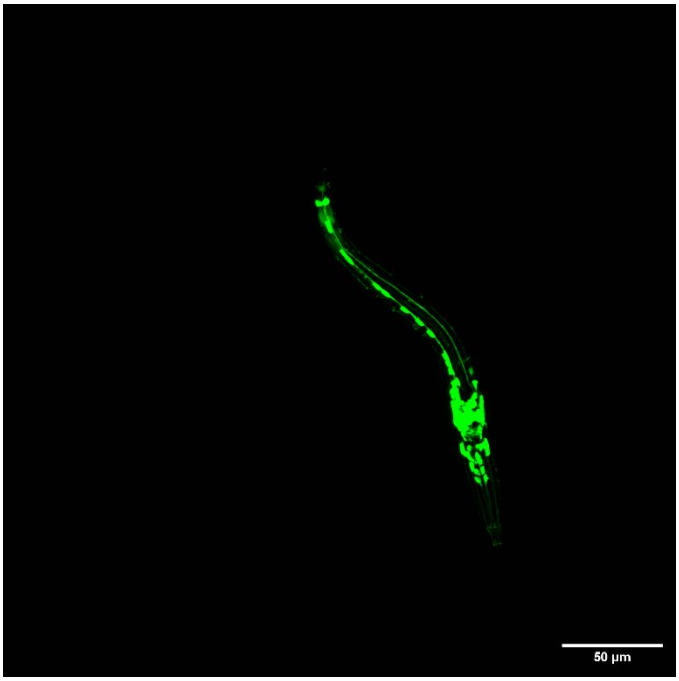

Figure 1. Green fluorescence protein (GFP) expression pattern in cholinergic neurons of transgenic LX929 strain of *C. elegans* from control group.

Acknowledgements:

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A new Tier 1 Semi-quantitative Environmental Risk Tool for the European Extractive Sector

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Mining activity generates numerous risks associated with both the mining operations themselves and their interaction with the environment[1]. Often, a first identification of the conceptual models applicable generically to each site and a preliminary assessment of the potential risks is necessary[2]. This first phase (Tier 1) would correspond to the Screening level whereby the assessor uses basic tools based on conservative assumptions (i.e., maximum reasonable exposure), requiring low information demands (point data and default parameter values)[3].

A Tier 1 tool has been developed in Visual Basic to assess the level of risk to human health and ecosystems from contaminants, adapted to the Mining & Quarrying sector. The model is divided into different stages and uses several environmental quality criteria to perform a semi-quantitative assessment in the screening phase. Five possible exposure scenarios (two on-site and three off-site) and two types of potential receptors (human health and ecosystems) have been considered.

Once the exposure scenario and the potential receptor have been identified, the tool will assess the risk based on four successive decision criteria: the assessment of the hazard of the pollutant, the quantity of the pollutant stored in the facility, the sensitivity of the receptor, and the potential for migration. Depending on the parameters selected, each criterion will store a numerical value from 1 to 4. The risk estimation is based on the calculation of the geometric mean of the values of the four criteria and the tool will return a risk class (Low, Moderate, High, or Very high).

In conclusion, the Tier 1 tool provides an efficient method for preliminary risk assessment in the mining sector, identifying potential impacts on health and ecosystems. With a structured approach and low data requirements, it allows for early identification of potential risks to guide a more detailed evaluation (Tier 2).

Acknowledgements: This work has benefited from financial support by the EU-funded ROTATE–CIRCULAR ECOLOGICAL ESSENTIAL & CRITICAL RAW MATERIALS [Grant Agreement ID: 101058651].

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Influence of Initial Concentration on Hg(II) Sorption Efficiency on Natural and Modified Zeolite

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The aim of this paper is to examine the possibility of using natural zeolite clinoptilolite (NZ) originating from the Vranjska Banja deposit, Serbia, as well as its modified form (MZ) for the remediation of mercury-contaminated environments. For these purposes, a two-step modification of NZ was performed with 1 mol/L $Fe(NO_3)_3 \times 9H_2O$ for 2 hours at 100 °C, and then with 1 mol/L $Na_2S \times 9H_2O$ for 4 hours at 150 °C. Physico-chemical characterization revealed an increase in the amount of iron by 2.5 times and sulphur by 12 times.

The SEM-EDS analysis confirmed the deposition of iron sulphide species on the zeolite surface. The XRPD analysis revealed a slight loss of crystallinity as a result of desilication, i.e. treatment in an alkaline medium, which also leads to an increase in negative charge. The increase in the negative charge of MZ compared to NZ was confirmed by determining the zeta potential. Testing of the sorption efficiency of NZ and MZ for the removal of Hg(II) was carried out at optimal pH = 2 and solid/liquid ratio = 10 g/L and at different initial concentrations of Hg(II) in the range 0.461-14.099 mmol/L. Unlike NZ, which has a maximum Hg(II) removal efficiency of 76% at c_o = 0.461 mmol/L, MZ in a wide concentration range (0.461 - 8.826 mmol/L) shows a removal efficiency of > 90%. The obtained maximum sorption capacity of NZ was 0.282 mmol Hg/g, and of MZ 0.966 mmol Hg/g.

Almost 3.5-fold higher sorption capacity of MZ justifies modification method. Therefore, obtained results clearly indicate that the newly formed active sites containing iron sulphide species as well as the increase in the net negative charge are responsible for the significantly improved sorption properties. Ultimately, the obtained results completely justify the implementation of the modification procedure and suggest the possible application of MZ for the remediation of mercury-contaminated environments.

Future Conferences

2026 The International Student Conference on Medical Geology and Environmental Health: Middle East

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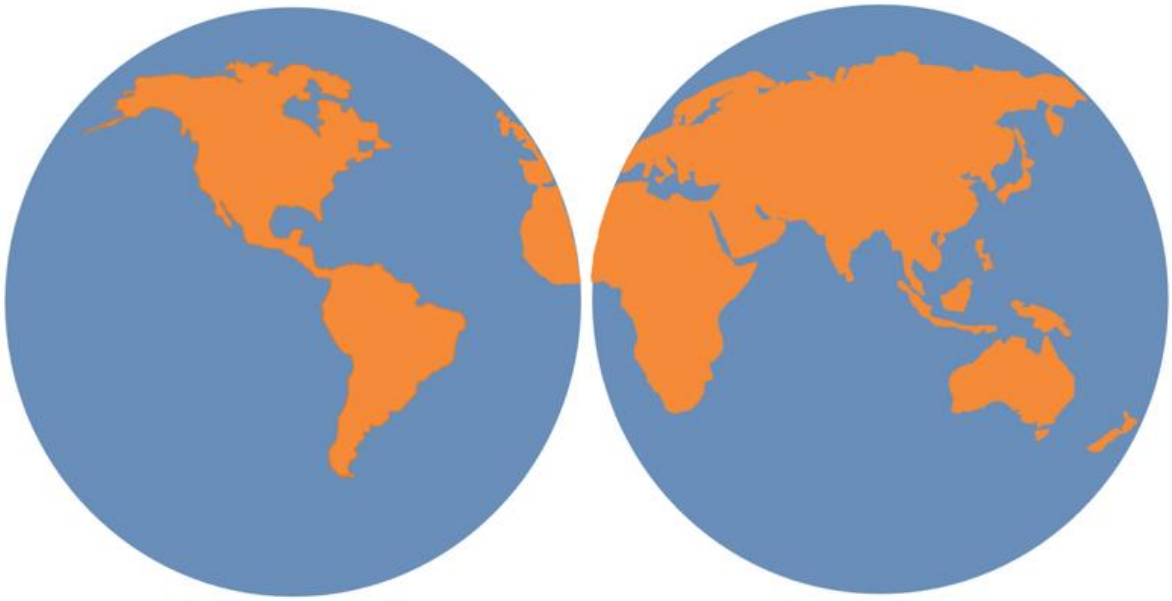


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