



THE ATHENS INSTITUTE FOR EDUCATION AND RESEARCH

Abstract Book

**11th Annual International Conference on
Geology & Earth Science
15-18 July 2024, Athens, Greece**

**Edited by
Nadhir Al-Ansari & Olga Gkounta**

2024

Abstracts
11th Annual International
Conference on Geology & Earth
Science
15-18 July 2024, Athens, Greece

Edited by
Nadhir Al-Ansari & Olga Gkounta

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Preface

This book includes the abstracts of all the papers presented at the 11th Annual International Conference on Geology & Earth Science (15-18 July 2024), organized by the Athens Institute for Education and Research (ATINER).

A full conference program can be found before the relevant abstracts. In accordance with ATINER's Publication Policy, the papers presented during this conference will be considered for inclusion in one of ATINER's many publications only after a blind peer review process.

The purpose of this abstract book is to provide members of ATINER and other academics around the world with a resource through which they can discover colleagues and additional research relevant to their own work. This purpose is in congruence with the overall mission of the association. ATINER was established in 1995 as an independent academic organization with the mission to become a forum where academics and researchers from all over the world can meet to exchange ideas on their research and consider the future developments of their fields of study.

To facilitate the communication, a new references section includes all the abstract books published as part of this conference (Table 1). I invite the readers to access these abstract books –these are available for free– and compare how the themes of the conference have evolved over the years. According to ATINER's mission, the presenters in these conferences are coming from many different countries, presenting various topics.

Table 1. *Publication of Books of Abstracts of Proceedings, 2014-2024*

Year	Papers	Countries	References
2024	46	25	Al-Ansari and Gkounta (2024)
2023	35	23	Al-Ansari and Gkounta (2023)
2022	34	23	Uddin and Gkounta (2022)
2021	11	10	Papanikos (2021)
2020	8	6	Papanikos (2020)
2019	29	18	Papanikos (2019)
2018	25	17	Papanikos (2018)
2017	18	14	Papanikos (2017)
2016	26	19	Papanikos (2016)
2015	31	17	Papanikos (2015)
2014	19	12	Papanikos (2014)

It is our hope that through ATINER's conferences and publications, Athens will become a place where academics and researchers from all over the world can regularly meet to discuss the developments of their disciplines and present their work. Since 1995, ATINER has organized more than 400 international conferences and has published over 200 books. Academically, the institute is organized into 6 divisions and 37 units. Each unit organizes at least one annual conference and undertakes various small and large research projects.

For each of these events, the involvement of multiple parties is crucial. I would like to thank all the participants, the members of the organizing and academic committees, and most importantly the administration staff of ATINER for putting this conference and its subsequent publications together.

Gregory T. Papanikos
President

Editors' Note

These abstracts provide a vital means to the dissemination of scholarly inquiry in the field of Geology & Earth Science. The breadth and depth of research approaches and topics represented in this book underscores the diversity of the conference.

ATINER's mission is to bring together academics from all corners of the world in order to engage with each other, brainstorm, exchange ideas, be inspired by one another, and once they are back in their institutions and countries to implement what they have acquired. The 11th Annual International Conference on Geology & Earth Science accomplished this goal by bringing together academics and scholars from 25 different countries (Canada, Chile, China, Colombia, France, Georgia, Germany, Guyana, India, Iraq, Italy, Jordan, Luxembourg, New Zealand, Peru, Poland, Portugal, Russia, South Africa, Sweden, Taiwan, Thailand, Türkiye, UK, USA), which brought in the conference the perspectives of many different country approaches and realities in the field.

Publishing this book can help that spirit of engaged scholarship continue into the future. With our joint efforts, the next editions of this conference will be even better. We hope that this abstract book as a whole will be both of interest and of value to the reading audience.

Nadhir Al-Ansari & Olga Gkounta
Editors

11th Annual International Conference on Geology & Earth Science, 15-18 July 2024, Athens, Greece

Organizing & Scientific Committee

All ATINER's conferences are organized by the Academic Council. This conference has been organized with the assistance of the following academic members of ATINER, who contributed by reviewing the submitted abstracts and papers.

1. Gregory T. Papanikos, President, ATINER & Honorary Professor, University of Stirling, U.K.
2. Haiduke Sarafian, Head, Natural Sciences Unit & Professor of Physics and Endowed Chair of John T. and Paige S. Smith Professor of Science, Pennsylvania State University, USA.
3. Evangelia Kotsikorou, Deputy Head, Natural Sciences Unit, ATINER & Associate Professor, The University of Texas Rio Grande Valley, USA.
4. Nadhir Al-Ansari, Head, Environment Unit, ATINER & Professor, Lulea University of Technology, Sweden.

FINAL CONFERENCE PROGRAM

11th Annual International Conference on Geology & Earth Science,
15-18 July 2024, Athens, Greece

PROGRAM

08.30-09.00

Registration

09:00-09:30

Opening and Welcoming Remarks:

- Gregory T. Papanikos, President, Athens Institute.

09:30-11:00 Session 1

Moderator: Hemmat Safwat, Deputy Director, Engineering Division, Athens Institute.

1. **Nadhir Al-Ansari**, Professor, Lulea University of Technology, Sweden.
Varoujan Sissakian, Chief Researcher, Komar University of Science and Technology, Iraq.
Title: Geohydro-politics of Water Resources in Iraq.
Title: Novel Ferrate (VI) Technology in Water and Wastewater Treatment.
2. **Teodoro Georgiadis**, Senior Research Associate, CNR - IBE, Italy.
Letizia Cremonini, Researcher, CNR - IBE, Italy.
Marianna Nardino, Researcher, CNR - IBE, Italy.
Daniela Famulari, Researcher, CNR - IBE, Italy.
Cristina Siligardi, Professor, UNIMORE, Italy.
Erika Iveth Cedillo Gonzalez, Researcher, UNIMORE, Italy.
Title: A Methodological Proposal for the Characterization of Building Heritage from the Second Twentieth Century for Renovation Purposes.
3. **Jeng-Wei Tsai**, Professor, National Pingtung University of Science and Technology/Graduate Institute of Bioresources, Taiwan.
Title: Optical Properties of Dissolved Organic Matter as Indicators for Assessing Heavy Metal Speciation in Mangrove-Dominated Estuarine Ecosystems.

11:00-13:00 Session 2

Moderator: Nadhir Al-Ansari, Professor, Lulea University of Technology, Sweden.

1. **Adina Raducan**, Head, Department of Analytical and Physical Chemistry, University of Bucharest, Romania.
Petruta Oancea, Associate Professor, University of Bucharest, Romania.
Mirabela Soare, PhD Student, University of Bucharest, Romania.
Maria Balan, Student, University of Bucharest, Romania.
Title: Oxidation of Epirubicin by Chemical, Photochemical and Enzymatic Methods. A Comparative Study.
2. **Zhuo Li**, Professor, Tongji University, China.
Title: Lanthanide MOF-Based Surface Molecularly Imprinted Polymers Radiometric Fluorescence Probe for Visual Detection of Perfluorooctanoic Acid with a Smartphone-Assisted Portable Device.
3. **Kanoktip Boonkerd**, Associate Professor, Chulalongkorn University, Thailand.
Janyarak Trakuldeea, Graduate Student, Chulalongkorn University, Thailand.
Apinya Krainoi, PhD Student, Chulalongkorn University, Thailand.
Title: Development of Environmentally Friendly Bio-based Composite for Using as Water Swellable Rubber.
4. **Joanna Klimowicz**, Associate Professor, Warsaw University of Technology, Poland.
Elżbieta Dagny Ryńska, Professor, Warsaw University of Technology, Poland.
Title: Steps to Implement Green Technologies in the Construction Industry. Case Study: Poland.
5. **Sirilux Poompradub**, Associate Professor, Chulalongkorn University, Thailand.
Title: Composite Materials for Carbon Capture and Utilization.

13:00-15:00 Session 3

Moderator: Olga Gkounta, Researcher, Athens Institute.

1. **Xi Jiang**, Professor, Queen Mary University of London, UK.
Title: Insight into Pollutant Formation of Carbon-free Fuel (Ammonia/Hydrogen) Combustion Utilisation.
2. **Joanna Jedruszkiewicz**, Assistant Professor, University of Lodz, Poland.
Piotr Piotrowski, Assistant Professor, University of Lodz, Poland.
Joanna Wibig, Professor, University of Lodz, Poland.
Title: The Relation between Atmospheric Circulation and Heat, Cold Wave Formation in Poland. The Role of the Arctic Amplification.
3. **Carmelia Mariana Balanica Dragomir**, Associate Professor, "Dunărea de Jos" University of Galați, Romania.
Title: Green Taxes and Their Impact on Romanian's Economy Compared to Investments for Air and Climate Protection.
4. **Alin Ionut Scarlat**, Scientific Researcher, University of Bucharest, INCAS – National Institute for Aerospace Research "Elie Carafoli", Romania.
Alexandru Tudor, Scientific Researcher, University of Bucharest, INCAS – National Institute for Aerospace Research "Elie Carafoli", Romania.
Gabriela Iorga, Lecturer, University of Bucharest, Romania.
Title: Evolution of Greenhouse Gas Emissions in Romania: A Regional Analysis from 1990 to 2021.
5. **Alexandru Tudor**, Scientific Researcher, University of Bucharest, INCAS – National Institute for Aerospace Research "Elie Carafoli", Romania.
Alin Ionut Scarlat, Scientific Researcher, University of Bucharest, INCAS – National Institute for Aerospace Research "Elie Carafoli", Romania.
Gabriela Iorga, Lecturer, University of Bucharest, Romania.
Title: Understanding the Dynamics of Greenhouse Gas Emissions in Romania within the European and Global Context.
6. **Pritibala Mastakar**, Professor, Gokhale Institute of Politics and Economics, India.
Title: Drinking Water Contamination at Mahabaleshwar, Maharashtra, India due to Equine Waste: A Case Study in Environmental Risk Management.

15:00-15:30 Lunch

15:30-17:30 Session 4

Moderator: Carmelia Mariana Balanica Dragomir, Associate Professor, "Dunărea de Jos" University of Galați, Romania.

1. **Yasar Selman Gultekin**, Associate Professor, Düzce University, Türkiye.
Pınar Gültekin, Associate Professor, Düzce University, Türkiye.
Title: Evaluation of Ecosystem Services and Potential of Social Innovation in Marginalised Mountainous Areas of Western Black Sea Region.
2. **Deniz Gerçek**, Associate Professor, Izmir Institute of Technology, Turkey.
Title: Assessment of the Trending Change of Climate Conditions in Relation to the Environmental Degradation: The Case of İzmir and Karaburun Peninsula.
3. **Daniel Soto**, Assistant Professor, Pontifical Catholic University of Chile, Chile.
Title: Can Selective Harvest Improve the Stand Structural Complexity and Productivity along a Precipitation Gradient in Temperate Patagonian Forests?
4. **Weihua Zhang**, Research Scientist, Radiation Protection Bureau of Health Canada.
Title: Monitoring of Anthropogenic Radioactivity in the Atmosphere in the Arctic.
5. **Pınar Gultekin**, Associate Professor, Düzce University Türkiye.
Yasar Selman Gultekin, Associate Professor, Düzce University, Türkiye.
Ari Ar Seher, Master Student, Düzce University Department of Interdisciplinary Ecotourism Türkiye.
Title: A New Marketing Way of Beekeeping Api-Tourism: An Example of Düzce Api-Tourism Route.

17:30-19:30 Session 5

Moderator: Deniz Gerçek, Associate Professor, Izmir Institute of Technology, Turkey.

1. **Savitri Jetoo**, Postdoctoral Fellow and Adjunct Professor, McMaster University, Canada.
Title: Governance of Climate Resilient Migration.
2. **Marat Abzalov**, Consulting Geologist, MASSA Geoservices, Australia and Geological Institute, KSC, Russian Academy of Sciences, Russia.
Title: Surficial Uranium Deposits in Central Jordan: Geology and Exploration Models.
3. **Hemmat Safwat**, Deputy Director, Engineering Division, Athens Institute & Director, Energy Consultant, Greece.
Title: Avoiding and Limiting the Uncontrolled Emissions of CO₂ - Strategies and Considerations for the Net Zero Era.
4. **Wang Zhen**, Senior Engineer, Research Institute of Petroleum Exploration & Development, PetroChina, China.
Title: Application of Horizontal Wells to Achieve Breakthrough of Carbonate Tight Oil Production in the Precaspian Basin.
5. **Al-Hasan Abdulwahid**, PhD Student, University of Otago, New Zealand.
Jonathan Leaver, Associate Professor, Unitec Institute of Technology, New Zealand.
Michael Jack, Associate Professor, University of Otago, New Zealand.
Title: How Decision-Making Processes Shape the Future of Hydrogen Vehicle Adoption.
6. **Paulo Vasconcelos**, Researcher, Transdisciplinary Research Centre Culture, Space and Memory, University of Porto, Portugal.
Title: Environmental Impacts of the Pulp Industry in Portugal (1954-1979).

20:30-22:30

Athenian Early Evening Symposium (includes in order of appearance: continuous academic discussions, dinner, wine/water, music)

Tuesday 16 July 2024

08:00-09:30 Session 6

Moderator: Marc Welgemoed, Head, Department of Criminal & Procedural Law, Nelson Mandela University, South Africa.

1. **Gaetan Balan**, Associate Professor, Lyon Catholic University, France.
Title: Insular States and Sea Level Rising: A Climate Change Perspective.
2. **Gabriele Redigonda**, PhD Candidate, University of Florence, Italy.
Title: Monitoring GHG Emissions: Legal Reflections on the Use of New (Space) Technologies.
3. **Binghan Li**, Postgraduate Student, Southwest Petroleum University, China.
Title: Climate Change Litigation and Causation: Joining Law and Climate Science.

09:30-11:30 Session 7

Moderator: Antonio Lira, Professor, Pontificia Universidad Catolica del Peru (PUCP), Peru.

1. **Meredith Metcalf**, Professor, Eastern Connecticut State University, USA.
Title: Evaluation of Arsenic Contamination in Groundwater from Historical Agricultural Practices in the Northeastern United States.
2. **Hardy Pundt**, Professor, Harz University of Applied Studies, Germany.
Nawras Shatnawi, Professor, Al Balqa University Applied Sciences, Jordan.
Andrea Heilmann, Professor, Harz University of Applied Studies, Germany.
Hiba Al-Kharabsheh, Professor, Al Balqa University Applied Sciences, Jordan.
Title: Rainwater Harvesting in Arid Regions: An Integrative Approach Aiming at Adapting to Climate Change.
3. **Helen Kavvadia**, Adjunct Professor and Researcher, ESSCA School of Management and University of Luxembourg, Luxembourg.
Title: Bold or Bond: Understanding the European Investment Bank's Pivot into a Climate Bank.

4. **Michal Kaczmarczyk**, Assistant Professor, AGH University of Krakow, Poland.
Title: Effect of the Building's Energy Demand Calculation Methodology on the Proper Assessment of Its Environmental Impact.
5. **Paul Bovitz**, Principal Ecologist, Kleinfelder, Inc., USA.
Title: Sources of Uncertainty in Ecological Risk Assessment.
6. **Angela Hernandez Moreno**, Researcher, Patagonian Ecosystems Investigation Research Center, Chile.
Title: Patagonian Temperate Forest Landscape Post Fire: Ecosystem Structure and Functions Loss or Recovery.

11:30-13:30 Session 8

Moderator: Weihua Zhang, Research Scientist, Radiation Protection Bureau of Health Canada.

1. **Antonio Lira**, Professor, Pontificia Universidad Catolica del Peru (PUCP), Peru.
Title: Electrostatic Theory on the Generation of Seismic Lights.
2. **Yongxia Sun**, Professor, Institute of Nuclear Chemistry and Technology (INCT), Poland.
Title: Degradation of Chloroquine in Aqueous Solution by Electron Beam (EB) Advanced Oxidation/Reduction Process and EB-Catalytic Process.
3. **Nodar Poporadze**, Professor, Georgian Technical University, Georgia.
Title: Vardzia Historical-Architectural Museum-Reserve.
4. **Petruta Oancea**, Assistant Professor, University of Bucharest, Romania.
Adina Raducan, Head, Department of Analytical and Physical Chemistry, University of Bucharest, Romania.
Dragos Baltag, Student, University of Bucharest, Romania.
Title: Photocatalytic Degradation of Orange G by TiO₂ Supported on Activated Carbon from Spent Coffee Grounds.
5. **Wesley Mathis**, PhD Student, Utah State University, USA.
Title: Trust in Public Trust Lands: Analyzing Stakeholder Perceptions of the Bear Lake Comprehensive Management Plan and its Kairoi.
6. **Juan Mejia-Fragoso**, MSc Student, Industrial University of Santander, Colombia.
Rocio Bernal-Olaya, Professor, Industrial University of Santander, Colombia.
José Sanabria-Gómez, Industrial University of Santander, Colombia.
Title: Identification of a Potential Geothermal Resource in Colombia through the Application of Geoelectric Methods at the Aguas de Vichy Spring in the Municipality of San Andrés, Santander.

13:30-14:30 Lunch

14:30-16:30 Session 9

Moderator: Yongxia Sun, Professor, Institute of Nuclear Chemistry and Technology (INCT), Poland.

1. **Nana Bolashvili**, Director, Institute of Geography, Tbilisi State University, Georgia.
Title: Natural Freezers of Georgia.
2. **Shaylyn Lewis**, Graduate Student, Dalhousie University, Canada.
Title: The Development of a Sustainable Amphiphilic Antibiofouling Solution.
3. **Giorgi Beridze**, Senior Scientist, Alexandre Janelidze Institute of Geology, Tbilisi State University, Georgia.
Title: Rankings of Shorelines of Georgian Black Sea Sector according to the Ecological Sensitivity Index (ESI).
4. **Tamara Tsutsunava**, Principal Scientist, Alexandre Janelidze Institute of Geology, Tbilisi State University, Georgia.
Title: Allochthonous Metamorphic Complex of the Loki Crystalline Massif (Lesser Caucasus, Georgia): New Insights from the Structure, Mineralogical Composition and Regional Metamorphism.
5. **Milena Baiduri**, Epidemiologist, National Center for Disease Control and Public Health, Georgia.
Title: Blood Lead Concentration and Exposure Changes in Parallel of Public Health Interventions in Georgian Children.
6. **Brij Tewari**, Professor, University of Guyana, Guyana.

Dale Edwards, Graduate Student, University of Guyana, Guyana.

Title: Novel Ferrate (VI) Technology in Water and Wastewater Treatment.

7. **Isaac Rampedi**, Associate Professor, University of Johannesburg, South Africa.

Title: Survey on the Waste Management Practices of Small Businesses in the Selected Townships of the Gauteng Province in South Africa.

17:30-20:30 Session 10

Old and New-An Educational Urban Walk

The urban walk ticket is not included as part of your registration fee. It includes transportation costs and the cost to enter the Parthenon and the other monuments on the Acropolis Hill. The urban walk tour includes the broader area of Athens. Among other sites, it includes: Zappion, Syntagma Square, Temple of Olympian Zeus, Ancient Roman Agora and on Acropolis Hill: the Propylaea, the Temple of Athena Nike, the Erechtheion, and the Parthenon. The program of the tour may be adjusted, if there is a need beyond our control. This is a private event organized by ATINER exclusively for the conference participants.

21:00-22:30

Ancient Greek Dinner

Wednesday 17 July 2024
An Educational Visit to Selected Islands
or Mycenae Visit

Thursday 18 July 2024
Visiting the Oracle of Delphi

Friday 19 July 2024
Visiting the Ancient Corinth and Cape Sounion

Marat Abzalov

Consulting Geologist, MASSA Geoservices, Australia and Geological
Institute, KSC, Russian Academy of Sciences, Russia

Surficial Uranium Deposits in Central Jordan: Geology and Exploration Models

The uranium mineralisation in central Jordan is hosted by the weathered chalk and marls and concentrated in a narrow layer, distributed close to the topographic surface. This mineralisation has many common characteristics with the conventional surficial-type uranium. However, the detailed studies have shown that this mineralisation exhibit close spatial relationship with pyrometamorphic marbles that are hosted by unmetamorphosed marls, chalks and limestones. The marbles are varicoloured, commonly brown, greenish, reddish, white and locally black. They are cut by hydrothermal veins and have experienced different degrees of low temperature alterations. A unique feature of these rocks is the widespread distribution of high- and ultra-high temperature (up to 1500°C) low-pressure metamorphic mineral assemblages including spurrite, wollastonite, ellastadite, diopside and garnet. The contacts of marble with the unmetamorphosed host sequence are sharp, although contact outlines are often irregular.

The formation of marbles in central Jordan is commonly explained by pyrometamorphism, either caused by the burning of bituminous marls, or alternatively, by the combustion of the deep reservoirs of hydrocarbon gases relating. The pyrometamorphic marbles cut by the paramagmatic dykes. These dykes are similar to the rocks found in the in Israel and Palestine, where they also associate with high-temperature metamorphic rocks and interpreted as paralavas formed as a result of the host rocks melting during high-temperature combustion metamorphism.

Close spatial relationship of uranium in central Jordan with the pyrometamorphic rocks suggests that this is a special type of surficial uranium mineralisation which has resulted from the interplay of the different processes, where combustion metamorphism has played a very important role in facilitating leaching of uranium from the host rocks. The liberated uranium was eventually redistributed by supergene processes towards the surface, where uranium minerals were precipitated along the contact between saprolite and fresh to weakly weathered rocks. This mineralization should not be confused with calcrete-hosted surficial uranium mineralisation and neither with

the syndimentary accumulations of uranium in the phosphorite beds,
the latter also present in Jordan.

Al-Hasan Abdulwahid

PhD Student, University of Otago, New Zealand

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How Decision-Making Processes Shape the Future of Hydrogen Vehicle Adoption

In New Zealand, heavy vehicles, comprising 4% of the total vehicle fleet, disproportionately contribute to road emissions, accounting for 25% of the overall transport emissions. This environmental challenge is poised to intensify over the next three decades, underscoring the critical need for sustainable alternatives. Hydrogen fuel cell vehicles present a promising solution for decarbonizing heavy transport. However, barriers such as elevated capital costs and insufficient hydrogen infrastructure hinder their widespread adoption. This study leverages the UniSyD_NZ system dynamics based national energy model to examine the potential of hydrogen-diesel dual fuel heavy vehicles (DFVs) in effectively addressing these challenges and accelerating the integration of hydrogen fuel cell vehicles into New Zealand's diverse vehicle fleet. The UniSyD_NZ model endogenously conducts a comparative analysis of various vehicle technologies. The proportion of any single vehicle technology in the fleet is determined by a nested multinomial logit algorithm that uses a well calibrated utility function. This function includes capital and maintenance costs, fuel cost and availability, and vehicle range. The results underscore the transformative impact of employing hydrogen-diesel dual fuel vehicles, not only bolstering fuel availability for all hydrogen-powered vehicles but also serving as a strategic bridge between conventional diesel heavy vehicles and the emergence of hydrogen fuel cell heavy vehicles. This research offers insights into navigating the impediments obstructing the widespread adoption of hydrogen fuel cell heavy vehicles and provides valuable guidance for policymakers and industry stakeholders committed to steering New Zealand's transportation sector toward a sustainable and low-emission future.

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Geohydro-politics of Water Resources in Iraq

Iraq is in the Middle East which is considered as an arid to semi-arid area region. Iraq relies in its water resources on the Tigris and Euphrates Rivers and their tributaries. The country is located at the lower part of the catchment area of these rivers. The long term average annual flows that enter Iraq from these rivers is about 30 BCM: from the Euphrates 22.2 BCM, from the Tigris 24.78BCM, in addition to 7BCM from its tributaries and side valleys between Iraq and Iran. Recently, the flows of these rivers have been decreasing due to climate change and hydrological projects established in the upper parts of the catchment in Turkey and Iran. Forecasts indicate that precipitation will decrease by 15-25% during this century which means that the flow of the Tigris and Euphrates Rivers will be reduced by 29-73% that will cause also a grave depletion of ground water resources. Turkey is trying to finish building 22 dams and 19 hydropower stations. Iran has already built 12 dams and diverted the flow of some tributaries inside Iran and blocked all the valleys that contribute water from its land to Iraq. For these reasons, Iraq is experiencing shortages in its water resources and there is some sort of friction and conflict between riparian countries within the Tigris and Euphrates basins as each country tries to secure the biggest share in these water resources. In this factors that have been considered as affecting the hydro politics within the Tigris and Euphrates Rivers basins the basin are: Water scarcity, Climate change and Hydrological projects, Population growth rate, Energy issues, Water mismanagement, Economic changes, Expansions of projects and technologies, Political issues, International water laws and Public awareness. To solve the problem of water scarcity in Iraq the following must be done:

- A. Reach fair water sharing agreements with Riparian Parties
- B. Develop Long-term Strategy that should take care of:
Rehabilitation of dams, barrages & pump stations, Improve the efficiency of diversion and supply and reducing water losses, Use of Nonconventional Water Resources, Modernization of Irrigation methods using suitable modern techniques,

developing and carrying out public awareness programs and
establishing an agenda for training.

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**Blood Lead Concentration and Exposure Changes in
Parallel of Public Health Interventions in Georgian
Children**

Background: Lead exposure remains a significant public health concern, especially for young children. In recent years, Georgia has seen a significant increase in lead contamination reports. The National Multiple Indicator Cluster Survey (MICS-2018) showed, that in 41% of children from 2 to 7 years of age, BLC exceeded action level (5 µg/dL). These findings were followed by a series of public health interventions led by National Center for Disease Control and Public Health (NCDC), including direct communication with families and a state-funded clinical follow-up program established in 2019. Parallel to this, several public health interventions and research activities were implemented by NCDC and supported by international donor organizations, such as UNICEF, UK Health Security Agency, and Pure Earth, an international non-profit organization focused on solving pollution problems. Although the state-funded programme analysis conducted in 2020 revealed a decrease in BLC among children in the MICS-2018 survey within the first six months of programme intervention initiation, identifying the lead (Pb) source is critical for more effective public health interventions. In addition to elevated BLC in children, we found the lead level to be higher than the permitted level, mainly in spices, dust, soil and paint. In 2023, NCDC, with the collaboration of the UK Health Security Agency and Pure Earth, started a lead source identification pilot project in Poti with the component to build capacity in the NCDC laboratory to conduct lead isotope ratio analysis. In the presented abstract we aim to assess the direction of BLC changes

among children in the city of Poti. Poti is a city in Samegrelo region, which ranked the second highest region affected by elevated BLC in the MICS-2018 study.

Methods: In this project we investigated 63 randomly selected 2- to 7-year-old children. We measured BLC by inductively coupled plasma-mass spectrometry (ICP-MS). We performed statistical analysis using STATA 18 and calculated mean, SD and 95% CI for BLC. To compare our findings with the MICS – 2018 results we used a two sample t-test.

Results: The mean BLC level in the 63 children in the 2023 Poti study was 2.49 $\mu\text{g}/\text{dL}$ with 95%CI (1.96 – 3.02). Only in two children did the BLC exceed the action level. The mean BLC level among 39 randomly selected children who had participated in MICS -2018 from Poti was 9.21 $\mu\text{g}/\text{dL}$ 95%CI (7.40 – 11.01). The observed decrease between mean BLC (6.72 $\mu\text{g}/\text{dL}$) is statistically significant ($p < 0.001$). We also noticed a decrease in lead level in spices. Only 2.3% (3/130) of spice samples exceeded the permitted lead level (5 $\mu\text{g}/\text{kg}$).

Conclusions: Initial analysis shows BLCs decrease among the children of Poti. There is a need for a larger, more representative, countrywide study to evaluate the national BLC reduction effects of public health interventions. Continued research, monitoring, and robust laboratory methods based on isotope ratio analysis, targeted interventions, and collaboration between international and national agencies across interested sectors will be crucial in achieving the goal of reducing lead poisoning and ensuring the well-being of children and communities in Georgia.

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Insular States and Sea Level Rising: A Climate Change Perspective

Insular states are especially threatened by the sea level rise risk, most notably the archipelagic states of the Pacific. The transformation of territories and the questioning concerning their own international boundaries constitute a modern challenge for the Law of the Sea and the International Public Law. During this presentation, we will start by examining the advisory opinion n°31, the *Request for an Advisory Opinion submitted by the Commission of Small Island States on Climate Change and International Law*.

This Advisory Opinion exposes the specific risks and threats posed by climate change on the insular States regarding their flooding or submersion risk. This threat also concerns the cultural legacy of all states potentially threatened by the same natural phenomena resulting from climate change. We will develop how the international law might provide legal frameworks to protect or relocate the cultural legacies of this insular states in accordance of the UNESCO definition of cultural legacy.

In a second part, we will focus on the potential legal solutions to support the insulars states into managing this threat and protecting their own population. We will especially propose to discuss international agreements between states about the evacuation of a national population in case of massive flooding. We will examine this potential legal framework through the example of the agreement between Tuvalu and the Government of Australia. This type of international agreements exists regarding Tuvalu's serious preoccupation of the sea level rising up to an existential threat against the State and all its components. We will try to adopt an inclusive legal approach to determine the consequences of the phenomenon of the sea rising as a threat against the very existence of a State and the consequences of its disappearance, such as is forecast in the case of Tuvalu.

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Green Taxes and Their Impact on Romanian's Economy Compared to Investments for Air and Climate Protection

Climate changes are more and more evident and their effect is increasingly extensive, and in the current context the environmental taxes may become a key factor in ensuring the sustainable development for the entire society. Green taxes originate from the tax system utilized in public accounting and consist in compulsory expenditures that are collected through public governments or European Union bodies. This article presents a medium-term analysis of the main categories of environmental taxes, their evolution compared to the investments for air and climate protection, as a percentage of GDP, made in Romania. Environmental taxes represent an important instrument of environmental policy, which is included in the category of economic instruments for environmental protection, pollution control and natural resource management. Four main categories of environmental taxes: energy taxes (including transport fuels); transport taxes (excluding transport fuels); pollution taxes and resource taxes are collected in Romania, yearly. The data used in this study provides from the National Institute of Statistics. During 2006-2020, in Romania the highest percentage is represented by energy taxes 88%, in second place are taxes for transports 10% and in the third and fourth places with insignificant percentages (about 1%) are the taxes for resources and for pollution. From the four categories of environmental taxes, it can be seen that resource taxes have a decreasing trend from 51.6 million euros in 2006 to 3.84 million euros in 2020, while energy taxes, transport taxes and pollution taxes have an increasing trend. Energy taxes vary from 1174.5 million euros to 3753.2 million euros, transport taxes almost tripled in the analyzed period from 100.5 million euros to 298.42 million euros and pollution taxes had a value of 5.3 million euros in 2006, 5.2 million euros in 2019 and only in 2020 this tax was 3.84 million euros.

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Natural Freezers of Georgia

In many countries of the world, there are natural phenomena "freezers", where ice appears in the summer, and its thickness is greater, the higher the temperature. In winter, on the contrary, the colder it is outside, the warmer it is in the "freezer". This unusual phenomenon is still not scientifically substantiated, so the population often calls it "mystical" caves.

Such natural freezers were described in Georgia as early as the 18th century. In the work (Vakhushti Bagrationi, 1745), Vakhushti tells about the aspects of practical use of natural freezers. In particular, in the hot summer, ice was cut into boulders and sent to the king's palace for various needs, it was used to store food products for the army, etc.

Freezers can be found in different parts of Georgia. They are of different origin and shape. The existing scientific researches about the natural freezers in the territory of Georgia are mainly descriptive in nature. Unfortunately, very few people know about the existence of these natural phenomena. Most of the freezers we visited were collapsed, filled with debris and difficult to access. It is necessary to urgently register them in order to preserve these wonders for future generations.

Very interesting is the natural freezer in Tetrtskaro municipality, in Ktsia-Khrami valley, 2.5-3 km from the village, Kldeisi.

The opening location of the freezer is located on the southern slope of the Bedeni plateau. It is built from Upper Pliocene dolerite lavas, in giant lava rocks with a volume of 30-40 m³, formed as a result of tectonic or gravitational processes. There are many narrow holes opening here. One of them, a rather narrow (0.5-1 m) and low passage 10-12 m long, ends with a narrow "hall" 2-2.5 m high, behind which a narrow window leads to a chamber with an area of 3-4m², where Thick layers of ice (0.4-0.5m) are formed. Narrow passages between boulders allow the accumulation of cold winter air masses. Additionally, water vapour condenses here, mixing the warm air coming in from outside and the cold air trapped between the holes in the summer, which in turn creates crystal clear ice blocks on the bottom of the freezer and ice crystals on the walls due to the low temperatures.

During our expedition (August 5, 2009) the air temperature at the entrance was 17.4⁰C. In the middle section, 7 m from the entrance - 7.2⁰C, and where ice forms - 1.0⁰C.

In summer, ice is also found in other holes between boulders, of which there are many. Condensation and melt water drain at a distance of 0.5 km from the freezer, is called “glacial spring” with a temperature of 6.0°C.

It is assumed that the conditions for ice formation in natural freezers depend on the topography and climatic features of the place. The disruption of one of the components changes the natural rhythm of ice formation and contributing factors, due to which this rare creation of nature loses its appearance and there is a danger of destruction of the monument.

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Rankings of Shorelines of Georgian Black Sea Sector according to the Ecological Sensitivity Index (ESI)

In Georgian Black Sea coastal area the evaluation of the ecological sensitivity of the environment to oil pollution has practical environmental significance. The relevance of the issue is due to the risks of oil and oil products appearing in the marine environment during the transportation and operation of the oil pipelines.

We ranked the coastline of the Black Sea Georgian sector according to the Environmental Sensitivity Index (ESI) scale, using international methods (Gundlach and Hayes, 1978). The ranking is based on the following factors: relief, landscape category, substrate composition and grain size, geomorphological peculiarities of shores, along-shore movement of solid sediment, coastal ecosystems diversity, wetlands, surface water bodies, etc.

As a result of research, we have identified 7 main classes with corresponding subclasses:

1. ESI1.1A - Exposed rocky shores; 1C - Exposed rocky cliffs with a boulder-talus base: the extreme southern part of the Georgian coast, rocky shores near Sarpi; 1B - Exposed, solid man-made structures: the Chorokhi River mouth, the coastal strip of Tsikhisdziri and Mtsvane Kontskhi. The Rioni River mouth (at the lighthouse), Shekvetili water area, village Ureki at the Tskaltminda River mouth;
2. ESI3.3A - Fine- to medium-grained sand beaches - north of the Supsa River mouth;

3. ESI4. Coarse-grained sand beaches - from Kulevi to Anaklia inclusive;
4. ESI 5. Mixed sand and gravel beaches - Kobuleti-Shekviteli and Anaklia shore strip;
5. ESI6.6A - Gravel beaches (granules and pebbles); 6B - Riprap Gravel Beaches (cobble and boulders) - the southern and northern beaches of the Chorokhi River mouth, from Sarpi to Batumi;
6. ESI8.8A - Sheltered scarps in bedrock, mud, or clay Sheltered rocky shores (impermeable) - Tsikhisdziri district and Mtsvane Kontskhi; 8B - Sheltered, solid man-made structures sheltered rocky shores (permeable) - Batumi and Poti ports, Batumi Coast Guard Marina;
7. ESI10.10A - Salt- and brackish-water marshes; 10B - Freshwater marshes; 10C - Swamps - Wetlands of Kolkheti plain between Anaklia and Kobuleti; Surrounding wetlands of Paliastomi Lake, Nabada and Churia.

On the basis of the conducted studies, it will be possible to assess the sustainability of the environment against pollution, as well as predict the behavior of polluting agents.

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Development of Environmentally Friendly Bio-based Composite for Using as Water Swellable Rubber

One of the biggest problems facing humans nowadays is global warming. The rapid growth of population and industry releases a tremendous amount of carbon dioxide, thus accelerating the greenhouse effect. One way to achieve the reduction in CO₂ emissions is to use bio-based materials. Water swellable rubber (WSR) is a functional polymer that expands its volume up to 1.5 times its original size by absorbing surrounding water. It has been widely used as sealants and caulks, water blocking materials in auto-motive and construction industries, oil and gas fields, etc. Effective WSR can be obtained by using hydrophilic synthetic rubber such as chloroprene rubber. However, not only cost-cutting but also environmental purposes, several rubber researchers have replaced the synthetic hydrophilic rubber with natural rubber. It was reported that the natural rubber product emits carbon dioxide 80% less than the petroleum-based synthetic rubber product. However, intrinsically, natural rubber is hydrophobic, thus having extremely low water absorption. Basically, to improve water absorbability of natural rubber, water absorbent filler is needed. Nevertheless, the dispersion of hydrophilic particles in the hydrophobic NR affected the poor interaction between them, which led to the migration of hydrophilic particles to the water phase. Therefore, in the present work, we proposed an effective method to prepare water-swellable natural rubber composite.

Paul Bovitz

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Sources of Uncertainty in Ecological Risk Assessment

Ecological risk assessments are used for decision making regarding releasing new products to market as well as remedial action required to address contamination at legacy sites. Uncertainty analysis is considered a key part of the process but assessments seldom address uncertainty quantitatively. Key sources of uncertainty include:

- Sampling and analytical variability (soil/sediment matrix, lab error),
- Choice of “Indicator” Species as Target Receptors for Different Exposure Pathways,
- Sample size
- Modeling inputs, including assumptions of linearity, use of data from surrogate species.

Toxicity testing where employed brings its own set of assumptions and interpretation that are subject to uncertainty. These include:

- Use of single organism
- Correlation (or lack thereof) with Contaminants of Concern
- Contaminant mixtures
- Reference area selection.

Bioaccumulation and Food Chain Modeling involve assumptions and uncertainty including:

- Linear assumption of bioaccumulation versus reality
 - a. Model inputs such as:
 - b. Home range
 - c. Dietary percentages
 - d. Literature data on effects
 - e. Use of No Observed Adverse Effects Level (NOAEL) or Lowest Observed Adverse Effects Level (LOAEL) as a decision point.
 - f. Individual or Population Impacts

The variability associated with these inputs was assessed using test runs of different food chain modeling scenarios to quantitatively

evaluating results and conclusions drawing. Results and conclusions drawn from ecological risk assessments may vary widely depending on the choice of assumptions, degree of variability and whether or not empirical data are used as part of the assessment.

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**A Methodological Proposal for the Characterization of
Building Heritage from the Second Twentieth Century for
Renovation Purposes**

With the signing of the SECAPs, European cities and municipalities are taking steps to respond to an energy problem deriving from the demand for summer air conditioning which, since the early 2000s, has exceeded the demand for winter heating. Sustainable urban regeneration requires action by applying an integrated approach between the sectors and professional figures involved, following the principles of sustainable development. Sustainable construction focuses on reducing the environmental impact of the building industry through the use of renewable and recyclable materials, reducing energy consumption and embodied energy of building materials. The recycling and reuse of waste materials can lead to energy savings, cost reductions, potentially improved products, and reduced waste generation-related hazards to the environment. However, an important consideration when using green construction materials as alternative raw materials is having a thorough understanding of their chemical, mineralogical, and physical properties. This knowledge is essential to ensure that recycled materials can be effectively integrated into materials production without negatively impacting the final product quality or production efficiency. Moreover, energy consumption has dramatically increased in buildings over the past decade due to population growth, more time spent indoors, increased demand for building functions and indoor environmental quality, and global climate change. Nevertheless, significant energy savings can be achieved in buildings if they are properly designed, constructed and operated. For this reason, building energy efficiency can provide key

solutions to energy shortages, carbon emissions and their serious threat to our living environment. The building and construction industry plays a vital aspect in development, but it also has a significant impact on the environment by consuming huge quantities of non-renewable natural resources and producing emissions that contribute to environmental degradation. Surface treatments are of strategic importance in the multiple sectors engaged in the ecological transition process, both in terms of accumulation and savings of energy. We present here processes developing existing materials, and analysis of historical manufacture, which are substantial to ensure the maintenance of that heritage recognized, experienced and enjoyed by the people living a given territory. Further, we present the state of the art on the processes for the development of ink-jet printed cool colors tiles for restoration of historical buildings. Combining the advantages of highly reflective engobes with the use of pigments with potential solar reflective property can constitute a good strategy to develop cool color tiles for historical building restoration purposes.

This study was funded by Ecosystem for Sustainable Transition in Emilia-Romagna (Ecosister). Progetto PNRR Programma di Ricerca e Innovazione – CODE ECS0000003 NextGenerationEU, Piano Nazionale di Ripresa e Resilienza (PNRR) – Missione 4 Componente 2.

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Assessment of the Trending Change of Climate Conditions in Relation to the Environmental Degradation: The Case of İzmir and Karaburun Peninsula

Climate Change, the biggest challenge of our era, has impacts highly variable and uneven across the globe. Confirming this fact, projections suggest that the Mediterranean basin is expected to face significant impacts from climate change, showcasing the region as a critical concern. The climatic changes in the region are characterized by a shift of the Mediterranean climate towards aridity, i.e., 'aridification' that is characterized by an increment in annual average temperature with an associated decrease in annual precipitation. Study area including İzmir and the Karaburun Peninsula located in the western Aegean region of Turkey is undergoing a significant land use and land cover change, a trending increase of annual temperatures, with combined aridity and water scarcity particularly in the peninsula.

This study aims to support understanding of the relationship between climatic indicators, namely temperature and precipitation, and environmental degradation characterized by land use land cover change, growth, urbanization, etc. The method includes analysis of long term climatic records (1970-2022) that are available at four meteorological stations in the study area and the analysis with indicators that spatially represent the characteristics in the close proximity of the stations. First objective of the method is to reveal whether there is a pattern of change in temperature and precipitation in the long term. Second objective is, using GIS capabilities, to explore how the change in local climate is related to the environmental degradation indicators, e.g., land use/land cover, building intensity, population density conducting correlation and regression analyses. The dataset used for the study is primarily sourced from global platforms that serve open data, e.g. Copernicus Programme (land use/land cover, urban atlas, GHS), Landsat imagery (spectral indices).

The findings of this study will shed light on the key factors influencing the rise in temperatures and the pattern of precipitation. Based on the empirical evidence, recommendations will be provided on how to intervene and mitigate the impacts of these changes. In the long run, these local interventions are expected to have an impact on our overall efforts in combating climate change and related disasters.

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A New Marketing Way of Beekeeping Api-Tourism: An Example of Düzce Api-Tourism Route

Beekeeping, a culture that emerged with the integration of nature and humans, is an important agricultural occupation that does not cause resource consumption and even contributes to the ecosystem through pollination. Api-Tourism, on the other hand, is an alternative tourism understanding and practice that puts the "bee" at its center, from beekeeping to bee products, and places nature, culture and history around it. Countries where api-tourism is developed and has examples of successful practices are Poland, Germany, Czechia, Lithuania, Ukraine and Spain. These countries have developed dynamically in terms of investment and promotion of api-tourism. In Slovenia api-tourism is recognized as a strategic national product. In some regions of Turkey where apiculture is important, bee museums, bee houses, bee worlds, honey forests and research and development centers have been established by universities, municipalities and beekeeper associations. In this study, an api-tourism route proposal was developed in Düzce, which has a very high potential in terms of beekeeping and apitourism. Within the scope of the study, interviews were held with beekeeping stakeholders such as Provincial Directorate of Agriculture-Forestry, Düzce Municipality, Düzce University, beekeepers, tour operators, etc., and the api-tourism route was created in sustainable beekeeping activities with a participatory approach.

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Evaluation of Ecosystem Services and Potential of Social Innovation in Marginalised Mountainous Areas of Western Black Sea Region

Mountain ecosystems have vital resources that provide important benefits to a large part of the world's population. Mountains provide many ecosystem services that are essential for ecological processes, including global and local climate regulation, air quality regulation, pollination, food, non-wood forest products, timber, freshwater, renewable energy, recreation and tourism, and cultural diversity. Human well-being depends on ecosystem services in mountainous areas. Ecosystem services contribute to the well-being of local communities and the achievement of the UN Sustainable Development Goals. Social innovation is needed to minimize the negative impacts of time and anthropogenic influences on mountain ecosystems, to adapt to the challenges of climate change, to achieve sustainable use of natural resources and for social welfare. Social innovation is "the process of bringing a new and sustainable solution to a local/regional problem, led by a local actor with a high awareness of the development potential of that region, in cooperation with all relevant stakeholders in the region.

In this study, the regulation, provisioning and cultural ecosystem services provided by mountainous areas in the Western Black Sea Region were investigated. The factors threatening mountain ecosystems were examined and the effects of changes caused by social, cultural and economic uses in the area on ecosystem services were determined. In the first stage of the study, natural, social, cultural, economic data, maps and climate data were obtained. In line with these data, the ecosystem services provided by mountainous areas were defined and the potential of the research area in terms of ecosystem services was determined. In the second stage, field observations were made in the field study and examples of ecosystem services offered by the area were photographed. Interviews with local actors during the field studies identified possible social innovations that could be realized in the study area and aimed to increase the capacity of the mountain community of

the Western Black Sea Region to transform social and economic challenges into opportunities by utilizing ecosystem services.

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**Patagonian Temperate Forest Landscape Post Fire:
Ecosystem Structure and Functions Loss or Recovery**

Chilean Patagonia Temperate Forest Landscape (PTFL) experienced extent fires between 1930 – 60 decades, were burned around 3 million hectares to open up agriculture and livestock land. Despite extensive fires and large old-growth temperate forest (OGTF) losses, the PTFL still contains the largest extent of temperate forest in Latin America. Which is important considering that global temperate forests cover around 16% of the world's forests, and despite their small extent it plays a key role in biodiversity conservation. However, despite their ecological importance, although more than 70 years have passed since the fires in the Patagonia ended, there is still no empirical knowledge about the ecological effects of past fires on the PTFL. Therefore, the objective of this work is to evaluate the effect of past fires on the structure and multiple functions of the PTFL. Coyhaique Province (1,231,910 ha), Chilean Patagonia, was selected as the study area. The landscape structure was evaluated through changes in land cover after fires, using Landsat images from 1984, 2000 and 2018 years. The ecosystem functions of carbon stock, water storage and availability, and habitat quality were mapped using soil data and spatial indices after fires. The results showed that the OGTF lost ~32,600 ha while the secondary forest increased more than ~69,000 ha. The carbon stock function increased 3.6% between 1984-2018. Water storage showed a slight reduction, with OGTF having the greatest capacity in this function. Water availability increased slightly, highlighting the importance of glaciers, lakes, and wetlands. While OGTF, secondary forest and steppe showed improved habitat quality for key Patagonian mammal species. In conclusion, the high rate of forest recovery in previously burned areas is highlighted, a landscape-scale process exceptional in the southern hemisphere temperate forests. Ecosystem functions do not yet show a clear pattern, but a priori it is observed that although there is recovery of several ecosystem functions, these do not replace the amount generated by the OGTF that were burned in past fires. Even so, the relevance of natural covers to provide the evaluated functions is highlighted. These results highlight that after more than 70 years since fires ended, there are still fire footprints on the western Patagonia Forest Landscape, but also is one of few examples of forest recovery at

the landscape level in world temperate regions. Furthermore, it is important that despite the extensive past fires, a large proportion of old-growth forests are still conserved.

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The Relation between Atmospheric Circulation and Heat, Cold Wave Formation in Poland: The Role of the Arctic Amplification

The European climate has become warmer on an unprecedented scale in the last decades. Heat wave events are more frequent, severe, and longest-lasting, whereas cold waves are less common and milder. Also, Poland is facing much warmer conditions during the summer, especially in central and southern parts, where the maximum temperature has increased considerably. In the 21st century, heat waves in Poland are more frequent and last longer, but so far, no changes in their intensity have been observed. Winters in Poland become milder with the decreasing annual number of cold wave days. These changes are related to shifts in the atmospheric circulation. Most heat and cold waves are associated with the blocking system on the Polish territory or its neighbourhood. During the warm spells, the centers of high-pressure systems are located in Scandinavia, Central Eastern Europe or south of Poland. During the cold spells, these centers are primarily situated in Scandinavia but also further toward Iceland or as a well-developed ridge of the Siberian High. What is more interesting is that in the last two decades, a significant increase in the frequency of the blocking systems on the Greenland and East Arctic-Siberia region (known as Greenland and Ural blocking) was noticed during both heat waves in summer and cold waves in winter. These changes are highly related to sea ice cover shortage, which is the most pronounced in the Svalbard-Barents and Kara Seas region and along the western and eastern Greenland coastline. At the same time, these regions are characterized by a considerable increase in sea surface temperature and latent heat fluxes. The research was founded by NCN grant no. 2019/33/B/ST10/01136.

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Governance of Climate Resilient Migration

Human beings survive environmental changes in a variety of ways including by migrating to more resilient areas. In the face of climate change, out-migration is a common strategy for the vulnerable population who flee high risk areas for less climate risky urban areas with more socio-economic opportunities. New waves of urban migration to climate resilient areas are impacting pre-existing socio-economic vulnerabilities and triggering hardships for individuals resettling to these areas. Inclusive planning with migrants and community stakeholders is necessary to proactively prepare and plan for climate induced migrations in order to achieve just and resilient outcomes. This paper examines the understudied area of whether climate in-migration can facilitate the adaptation to the consequences of climate change by both host communities and climate migrants. It questions whether evolving climate adaptation and resilience strategies can address socioeconomic vulnerabilities in host communities whilst maintaining the resilience of the natural resources in the host community.

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Insight into Pollutant Formation of Carbon-free Fuel (Ammonia/Hydrogen) Combustion Utilisation

Ammonia and hydrogen are both zero-carbon energy carriers that can be used as alternatives of fossil fuels, while ammonia-hydrogen co-firing can overcome some disadvantages of ammonia or hydrogen burning. However, the production of nitrogen oxides (NO_x , including NO and NO_2) and nitrous oxide (N_2O) in the combustion of these alternative fuels needs to be understood so that the NO_x and N_2O emissions can be minimized. In this study, the chemical mechanisms underlying the generation of NO , NO_2 , and N_2O were revealed at the atomic scale using reactive molecular dynamics combined with machine learning enhanced force field.

Neural network potential-based molecular investigation of ammonia combustion was conducted. The influence of adding hydrogen and varying equivalence ratios on ammonia combustion was elucidated. It was found that co-firing with hydrogen and reducing equivalence ratio both promote the formation of NO and NO_2 in ammonia combustion. Adding hydrogen aids in reducing the production of N_2O , contrary to lowering the equivalence ratio.

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Effect of the Building's Energy Demand Calculation Methodology on the Proper Assessment of Its Environmental Impact

Energy-intensive processes are most often identified in the industrial sector and are indicated to stimulate a negative impact on the natural environment. The residential building sector and the associated energy demand resulting from ensuring broadly understood comfort of use are an equally important element in shaping the natural environment. This results directly from the energy demand for buildings and the related use of energy carriers, including fossil fuels. However, at the stage of building operation, not only the quality and quantity of energy carriers used but also the type and efficiency of energy systems have an extremely important impact. Importantly, issues in the residential building sector and technological aspects of energy systems are included in a certain legal framework that allows for the energy assessment of a building, primarily in the form of energy performance certificates. This, in turn, implies carrying out analyses regarding the impact of the facility's use on the natural environment at the stage of its operation. The basic parameters to be assessed are the demand for usable energy, final energy and primary energy. In turn, one of the main indicators determining the demand for primary energy is the nonrenewable primary energy input rate. As a utilitarian value, it does not result from technical aspects related to the building and its energy demand, and does not affect operating costs. However, it determines the energy class of the building. Therefore, the basic question is whether the primary energy demand indicator is appropriate for assessing residential buildings in the context of their impact on the natural environment at the stage of operation. To answer this question, analyses were carried out on the applied methodology for energy assessment of residential buildings and the methodology to determine the impact of residential buildings on the natural environment during operation. The research was carried out for an existing residential building in multivariate modeling of heat sources and the type of energy carriers used for central heating and hot tap water purposes. Calculations of pollutants emissions into the atmosphere were made on a local and global scale. The obtained results were analysed and correlated with each other in relation to the demand

for the final and primary energy, allowing the thesis of the presented research problem to be verified.

Helen Kavvadia

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Bold or Bond: Understanding the European Investment Bank's Pivot into a Climate Bank

Synchronised and in concordance with the European Union's Green Deal, the European Investment Bank (EIB) proclaimed its turn into a 'Climate Bank' in November 2019. Thereafter, the bank pledged to double its climate lending to 50% by 2025. Conversely, the bank has not committed to any green borrowing targets, despite being the pioneer and largest issuer in outstanding green bonds.

The proceeds of green bonds are ring-fenced for climate-related investment and strictly monitored. For its climate orientation the EIB could have easily and 'silently' increased further its green borrowing, for on-lending its green-borrowing to climate-related projects, under capital markets' scrutiny and oversight. Instead the EIB privileged a bold public announcement, associated exclusively with lending-related targets and milestones. The question that arises is why did the EIB opt for the bold over the 'silent' climate metamorphosis. Drawing on the resource dependence theory, the paper examines why the EIB based its climate future on its lending instead of the borrowing side.

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Athens, Greece: Abstract Book

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&

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**Steps to Implement Green Technologies in the
Construction Industry - Case Study: Poland**

NOT AVAILABLE

Shaylyn Lewis

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The Development of a Sustainable Amphiphilic Antibiofouling Solution

All maritime-faring folk face the common challenge of biofouling, which is the attachment and accumulation of organisms on submerged surfaces. Biofouling costs marine industries, such as the Navy, shipping/transport, aquaculture, and fisheries, hundreds of millions of dollars annually. The majority of these costs are due to increased fuel usage caused by the additional drag on ship hulls that biofouling creates, which ultimately increases overall carbon emissions, contributing to the effects of climate change. As a result, biofouling remedies have been implemented ever since there have been vessels to apply them to. Throughout history, many antibiofouling solutions with varying mechanisms, effectiveness, and consequences have been created. Of these, the most popular and effective solutions typically contain toxic compounds (e.g., copper, mercury, arsenic, tributyltin (TBT)), which have created environmental concerns of their own (e.g., TBT was banned in 2008 due to deleterious effects on invertebrates). Therefore, the need for novel antibiofouling solutions is still relevant, as no single product has been able to counter all the components of biofouling while also preventing environmental harm.

The purpose of this study is to develop an antibiofouling solution that is sustainable in production, environmentally benign, and cost-effective. Three naturally derived chemicals with antibiofouling properties were chosen as active ingredients for the novel amphiphilic antibiofouling solution: chitosan, capsaicin, and polydimethylsiloxane (PDMS). Three solutions were produced with varying concentrations of chitosan (50:1, 100:1, and 200:1) while the concentrations of capsaicin and PDMS remained the same. The solutions' antibiofouling abilities were tested using a bacterial assay (paper disc diffusion) and a proteinaceous analogue test (egg white test), where the solutions were compared to a control and among one another. The results showed that this novel combination was not effective as an antibiofouling solution. Further research is needed to conclusively determine if these chemicals should not be investigated as antibiofouling solutions. Despite the innovative approach and the use of chitosan, capsaicin, and polydimethylsiloxane (PDMS) in varying concentrations, the experimental results did not support the efficacy of these combinations as viable antibiofouling agents. The lack of success underscores the complexity of developing effective antibiofouling solutions that are both efficient and environmentally

benign. Consequently, this study highlights the need for continued research and exploration into alternative substances and strategies. It is crucial that future efforts not only focus on the immediate effectiveness of antibiofouling solutions but also their long-term impact on marine ecosystems and their compatibility with sustainable maritime practices. The journey toward finding an optimal solution to biofouling is far from over, and the pursuit of innovative and ecologically responsible approaches remains as relevant and urgent as ever.

Binghan Li

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&

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Climate Change Litigation and Causation: Joining Law and Climate Science

Climate change litigation has attracted renewed interest as a government tool to mitigate climate change globally. However, a key challenge in the climate change litigation is to assess the factual basis of causation. The reason is that, on the one hand, the causes of climate change are still scientifically uncertain. On the other hand, it is a challenge lies in that how attribution science interacts with the legal admissibility of evidence has to be legally admissible in order to be considered in a trial. It is well known that while evidence has to be legally admissible in order to be considered in a trial, it has to be reliable in order for the court to arrive at a legally correct conclusion.

Currently, China is establishing the climate change litigation regime in order to achieve the “Dual Carbon Target”. Undoubtedly, China's trials will also face the similar challenge in determining causation relationships. Hence, conducting empirical research on existing international climate change litigation cases can provide guidance for the establishment of China's climate change litigation system and the enhancement of its evidentiary standards.

The first contribution of this article is to identify commonalities of successful cases in the specific area of causation evidences by analyzing individual cases and evidence of these claims. In addition, this article will also assess the scientific and legal bases for establishing causation and evaluate judicial treatment of scientific evidence in unsuccessful lawsuits. It is concluded that greater appreciation and exploitation of existing methodologies in attribution science could address obstacles to causation and improve the prospects of litigation as a route to compensation for losses, regulatory action, and emission reductions by defendants seeking to limit legal liability.

The second contribution of this article is to summarize the issue of legal causation and judicial treatment of scientific evidence based on China's existing environmental litigation cases. We find that the evidence presented by the plaintiff is generally difficult to meet the proof standard that there is a risk of triggering climate change and causing harm, making it difficult for the court to support the plaintiff's claim.

Last, to maximize the chances of establishing causation in the courts, we suggest that plaintiffs should ensure that (1) cases filed concern impacts that are demonstrably attributable to climate change, and (2) that evidence submitted to the courts clearly substantiates the alleged relationship between defendants' emissions and plaintiffs' losses. As to the court, we suggest that (1) the court should allow individuals with specialized knowledge to testify, and (2) the court shall accept research reports from authoritative international organizations as evidence in litigation.

Zhuo Li

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Lanthanide MOF-Based Surface Molecularly Imprinted Polymers Radiometric Fluorescence Probe for Visual Detection of Perfluorooctanoic Acid with a Smartphone- Assisted Portable Device

Perfluorooctanoic acid (PFOA) poses a threat to the environment and human health due to its persistence, bioaccumulation, and reproductive toxicity. Herein, a lanthanide metal-organic framework (MOF) - based surface molecularly imprinted polymers (MIPs) radiometric fluorescence probe (Eu/Tb-MOF@MIPs) and a smartphone-assisted portable device sensing platform were developed for the detection of PFOA with high sensitivity and selectivity in real water samples. Eu/Tb-MOF not only exhibits excellent fluorescence sensing properties but also provides a significantly large specific surface area for MIPs. Molecular dynamics (MD) was employed to simulate the polymerization process of MIPs, revealing that the formation of multiple recognition sites was attributed to the establishment of hydrogen bonds between functional monomers and templates. The probe showed a good linear relationship with PFOA concentration in the range of 0.02-2.8 μM , by giving the limit of detection (LOD) of 0.98 nM. Additionally, the fluorescence response basing on the smartphone-assisted portable device showed a clear color change from orange to purple under a 310 nm UV lamp. The red-green-blue (RGB) values analysis demonstrated a linear relationship of 0.1-2.8 μM PFOA with the LOD of 3.26 nM. The developed probe and portable device sensing platform exhibits substantial potential for on-site detecting PFOA in practical applications and provide a reliable strategy for the intelligent identification of important targets in water environmental samples.

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Electrostatic Theory on the Generation of Seismic Lights

In the last years, not only have videos of seismic lights been recorded in various countries - Mexico (September 7, 2021), Ecuador (April 16, 2016), Mexico (September 8, 2017) and Peru (September 15, August 2007) - , but also clear evidence of a temporal correlation between seismic lights and earthquake accelerations has been found. Likewise, theories have been developed that have tried to explain the origin of seismic lights; however, they have had inconsistencies with the observed experimental data. In this work, an electrostatic theory is presented that is based on the separation of electric charge during the fracturing of the rock in the earth's crust and the induction of surface charges prior to the electric discharge in the atmosphere. Likewise, based on the theory presented here, a calculation is made of the underlying electrical charge in the crust, necessary for the generation of seismic lights. The charge found is of the order of magnitude of the electrostatic charges that form in clouds before a lightning strike.

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Drinking Water Contamination at Mahabaleshwar, Maharashtra, India due to Equine Waste: A Case Study in Environmental Risk Management

Water contamination poses high health risks and is a critical issue for health risk assessment globally. The present research on the health risk management of contaminated drinking water in Mahabaleshwar focuses on diseases caused by water pollution, particularly of zoonotic origin, an area where not much scientific research is documented. It assesses the health risk to citizens, especially vulnerable populations like children, due to the presence of faecal coliform bacteria and Rotavirus in drinking water sources, in Mahabaleshwar, a prominent and popular tourist destination with horse-related activities. It investigates empirically the correlation between horse excreta and water contamination, assessing pollution channels, extent, and health risks using both primary and secondary data along with scientific laboratory assessments. Prior research indicates that mismanagement of horse waste can cause environmental contamination, particularly of ground and surface water, through bacteria and viruses, particularly Rotavirus, Salmonella, and E. coli bacteria, and nitrogen, phosphorus, and organic matter release. However, its effects on human health remain under explored. This study fills this gap by applying risk management principles to assess hazard exposure in a tourism-dependent location, where horse excreta is a major contaminant. The risk exposure increases further due to a high floating tourist population in addition to the resident population. Ensuring resident and tourist safety necessitates the distancing and separation of drinking water sources from the sources of contamination. Relocating horse-related activities for better commercial returns to horse owners and an efficient horse manure collection and waste processing system that can provide biogas and electricity to the horse owners are strategies with a better outcome for all stakeholders. Findings hold the key to robust risk management strategies for safeguarding health, and the environment, and can serve as a model for similar destinations in India and abroad.

(290 WORDS) Water contamination poses high health risks and is a critical issue for health risk assessment globally. The present research on the health risk management of contaminated drinking water in Mahabaleshwar focuses on diseases caused by water pollution, particularly of zoonotic origin, an area where not much scientific research is documented. It assesses the health risk to citizens, especially vulnerable populations like children, due to the presence of faecal coliform bacteria and Rotavirus in drinking water sources, in Mahabaleshwar, a prominent and popular tourist destination with horse-related activities. It investigates empirically the correlation between horse excreta and water contamination, assessing pollution channels, extent, and health risks using both primary and secondary data along with scientific laboratory assessments. Prior research indicates that mismanagement of horse waste can cause environmental contamination, particularly of ground and surface water, through bacteria and viruses, particularly Rotavirus, Salmonella, and E. coli bacteria, and nitrogen, phosphorus, and organic matter release. However, its effects on human health remain under explored. This study fills this gap by applying risk management principles to assess hazard exposure in a tourism-dependent location, where horse excreta is a major contaminant. The risk exposure increases further due to a high floating tourist population in addition to the resident population. Ensuring resident and tourist safety necessitates the distancing and separation of drinking water sources from the sources of contamination. Relocating horse-related activities for better commercial returns to horse owners and an efficient horse manure collection and waste processing system that can provide biogas and electricity to the horse owners are strategies with a better outcome for all stakeholders. Findings hold the key to robust risk management strategies for safeguarding health, and the environment, and can serve as a model for similar destinations in India and abroad.

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**Trust in Public Trust Lands:
Analyzing Stakeholder Perceptions of the Bear Lake
Comprehensive Management Plan and its Kairoi**

One of the challenges of environmental policy in the United States and other countries that manage public lands is the failure to satisfy exigencies (demands) that are constantly shifting. Government employees and natural resource managers who serve the public, spend years researching and developing policies/strategies to solve complex social and ecological problems. However, in the time it takes to produce a plan, the original exigencies that demanded the production of a policy often change, disappear, or are challenged by new and unanticipated exigencies, both ecological and political. The result of such complications is usually a policy that either fails to consider important shifts in the physical and political climate of a region, or in attempting to be dynamic, fails to provide clear objectives. Both scenarios limit the trust that affected stakeholders have in an agency's ability to manage public lands, especially if policy makers and stakeholders develop divergent interpretations of a policy's exigence. And without stakeholder buy-in, an agency's ability to sustainably manage natural resources is limited.

My proposed presentations offers a rhetorical model that natural resource managers and policy makers can follow to iteratively (re)evaluate the exigency of the policies they draft *and* ensure that their evaluation of the exigency involves local stakeholder knowledge in ways that foster engagement and common understanding.

My model draws on already existing rhetorical models for adaptive natural resource management (NRM) presented by Druschke and Hychka, but my modifications to the model are based on a rhetorical analysis of Utah's 2022 iteration of the Bear Lake Comprehensive Management Plan (CMP). Drawing on Lynda Olman's description of kairos as stemming from ancient Greek concepts of climate and Kenneth Walkers's practice of pluriversal rhetoric "as an ecological...system that functions across entangled" physical and political locales, I interviewed both CMP designers and stakeholders, tracing their perception of the kairoi (physical and political events in time and space) that affected their perception of the CMP's exigence. Specifically, I examined points of divergence in policy makers' and stakeholders' perceptions.

Ultimately, the model my presentation proposes, invites NRM policy makers to recognize and pause when the exigences for local policy are

altered by broader regional and national kairoi. As an example, I will highlight how the COVID-19 pandemic and the catastrophic shrinking of the nearby Great Salt Lake affected stakeholders' perceptions of the intent behind the Bear Lake CMP. My model also invites policy makers to develop an "interpretive plan" (a rhetorical strategy most often used by parks and museums to engage the public) in order to guide deliverable content and establish common ground with stakeholders when the exigencies change, thus maintaining stakeholder trust.

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&

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Identification of a Potential Geothermal Resource in Colombia through the Application of Geoelectric Methods at the Aguas de Vichy Spring in the Municipality of San Andrés, Santander

The Aguas de Vichy thermal spring (SAN-001), as identified by the Colombian Geological Service (SGC), emerges as a potential geothermal resource. However, it lacks subsurface information or detailed studies. Geochemical analyses indicate high salinity, an elevated reservoir temperature, and substantial energy capacity. The geological setting of the area is characterized by north-south (N-S) and northeast-southwest (NE-SW) faults, Cretaceous and Precambrian rocks, and a Quaternary aquifer where the springs emerge. This study presents the first subsurface imaging of the geothermal system and examines the hypothesis of an inferred fault parallel to the Guaca River as the main channel for transporting geothermal fluids to the springs.

Forward modeling was employed to establish potential distributions of the resistivity and chargeability anomalies based on the initial hypothesis. Three Electrical Resistivity Tomography (ERT) transects around the fault map trace were conducted, two of which were complemented by the induced polarization (IP) method. Two of the ERT transects traverse the fault and revealed resistivity values ranging from near zero to over 1500 ohm-meters ($\Omega \cdot m$), with a similar distribution pattern. Low resistivity areas possibly indicate the presence of clay, the accumulation of groundwater, and geothermal saline fluids; with the lowest values being more pronounced adjacent to the inferred fault trace and at the profile's boundaries. High resistivity anomalies appear at depths of 5 to 10 meters, defining a possible lower boundary of the Quaternary deposit and expected aquifer within. The third ERT, located within the quaternary deposit but not intersecting the fault, showed slightly higher baseline resistivities, suggesting a reduced influence of geothermal water. It displays a discontinuous horizontal distribution of ERT anomalies which suggest a laterally discontinuous deposit and hence aquifer. IP findings show low chargeability values, which suggest the

presence of groundwater and geothermal saline fluids in a small pocket adjacent to the fault. Interestingly, the upper layer of the inverted section, thought to be an aquifer from the resistivity, displays high chargeability values suggesting a clay deposit instead.

The inverted sections support the presence of a fluid-circulating geothermal system with low resistivity, and low chargeability zones around the fault trace, confirming the viability of the initial hypothesis. However, further research is suggested to clarify the geological and structural uncertainty. The results obtained reveal a potential energy resource that requires further understanding and encourages continued research into geothermal energy within the Santander department.

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&

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Evaluation of Arsenic Contamination in Groundwater from Historical Agricultural Practices in the Northeastern United States

Recent studies by the USGS and our research team have indicated that arsenic contamination of domestic wells is widespread across Connecticut and other states within the northeast (USA). Although the source of the arsenic has been thought to be geogenic, our work has shown that a statistically significant spatial correlation exists between contaminated wells and former orchards which were likely sprayed with a lead arsenate pesticide prior to the 1970's. Field work in Connecticut confirmed that orchards sprayed with lead arsenate can still retain elevated levels of arsenic which can continue to act as a source of groundwater contamination. The USGS has identified Weston as having the highest occurrence of arsenic contaminated wells than any other town in the State. Thus, in cooperation with several local and state agencies, we have conducted a detailed hydrogeologic study of the arsenic contamination in Weston. Our study assessed the relationship between arsenic contamination and historical orchards while accounting for hydrogeologic conditions. The study entailed the compiling, digitizing, and analyzing of well completion reports (1600), water quality reports for arsenic (481), historical imagery on the location and extent of orchards, and existing synthesized hydrogeologic information. Our analyses show there is a correlation of arsenic contaminated bedrock wells with nearby orchard sites and wells having shallow depth to groundwater and shallow depth to bedrock. With respect to the bedrock lithology, one rock type had a higher frequency of contaminated wells, but this rock formation also had a much higher prevalence of historic orchards. Results of this work suggest that regulatory authorities and local health officials should develop a plan to address the risk of arsenic contamination in relation to property history and location and begin a dialogue among stakeholders (including the public) to determine how current and former orchard sites can be treated to help mitigate the problem.

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Photocatalytic Degradation of Orange G by TiO₂ Supported on Activated Carbon from Spent Coffee Grounds

Azo dyes, characterized by the presence of one or more azo groups, represent about 60–70% of all synthetic dyes produced worldwide. Previous studies have shown that these compounds are recalcitrant, very stable and difficult to degrade by classical chemical methods. Since conventional treatment technologies cannot effectively degrade and mineralize azo dyes, semiconductor photocatalysis has been commonly applied for advanced degradation of these toxic pollutants.

Spent coffee grounds can be used as a template for the preparation of titania-based materials, so their use in combination with the modified TiO₂ by impregnation or doping with sensitizers or transitional metals, can lead to creating a better photocatalyst in terms of activity, stability, and reusability.

Our main target was an azo dye, Orange G, present in textile wastewater, and monitored as one of the most recalcitrant synthetic dyes because it needs high energies to degrade.

Catalysts based on TiO₂ modified with various transition metals such as Fe, Co and Ni and TiO₂ supported on biochar from coffee grounds in the presence of UV and solar radiation were tested as an alternative to classical chemical processes. These transition metals (Fe, Co, Ni) modified TiO₂ catalysts were synthesized by the impregnation method to obtain a metal loading of 5 wt%.

To achieve a good comparison for catalytic efficiency, photolysis processes using UV and visible light were first tested. They have not achieved remarkable results and we can consider them as negligible.

From processing the kinetic data, it is concluded that the UV photolysis and all photocatalytic processes of OG obeys an apparent first-order kinetics.

As compared with photolysis under irradiation with UV light the degree of Orange G decolorization increases by 3.5 times in the presence of 5%Fe/TiO₂ and 2.2 times in the presence of 25% TiO₂/SCG. Under

irradiation with sunlight, only the 5%Fe/TiO₂ composite was able to degrade Orange G, the degree of decolorization being 18% after 2 h exposure to sun.

These catalysts represent an environmental friendly method for azo dyes containing wastewaters treatment.

Sirilux Poompradub

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Composite Materials for Carbon Capture and Utilization

Carbon overload in the atmosphere is mainly due to the burning of fossil fuels such as coal, oil, gas and forests. Therefore, reducing the amount of CO₂ in the air is a serious route to solve the global warming issue. This therefore brings the needs to capture and store CO₂ which is currently a hot topic for environmental scientists and engineers. In this research, an eco-friendly material from natural rubber (NR) for CO₂ capture was developed. The NR foam was prepared by using either an overhead stirrer or cake mixer, designated as OS or CM, respectively. To enhance the adsorption capacity and selectivity for CO₂ of the solid sorbents, they were filled with the amine-modified silica. The CO₂ adsorption for each sorbent material was carried by using a stainless steel reactor under an ambient temperature and pressure. The CO₂ adsorption capacity of the solid sorbents increased when the mixed gas flow rate was increased from 75 to 100 mL/min. The CO₂ adsorption capacity of the CM foam was higher than that of the OS foam due to the high number of pores per cell able to capture more CO₂. The regeneration and mechanism for CO₂ adsorption by the different NR foams were also investigated. Finally, the knowledge obtained from this research provides the challenge information to develop high performance solid sorbent to play a role in solving the CO₂ capture problem and benefit to many researchers who are interested in CO₂ reduction and utilization.

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Vardzia Historical-Architectural Museum-Reserve

The territory of Georgia is characterized by rock-carved cities and church-monasteries. One of the most outstanding and important complexes is the Vardzia Historical-Architectural Museum-Reserve from the 12th century, consisting of hundreds of large and small halls. The number of visitors to the museum-reserve increases every year, so it is necessary to protect both the visitors and the monument itself from erosion, avalanches, and other phenomena.

In previous decades, fragmented research was conducted on this monument. Since 2015, we have been conducting comprehensive laboratory research (mineralogical, lithological, chemical, hydrogeological, and engineering geological) directly on the territory of the historical monument.

The Vardzia Complex was carved into middle- and late Miocene volcanic sedimentary tuffs, tuff-breccias, and tuff lavas. Studying their essence, mineralogical, chemical, and physico-mechanical characteristics, considering the current situation, is crucial for slowing down the subsequent weathering process and damage to the rock formations. The monument is directly exposed to the open space - in a natural microclimate (external relief and depressions). The complex geological and tectonic structure of the historical monument and the surrounding area, combined with relief and climatic conditions over centuries, has led to the development of hazardous geological phenomena such as weathering, fracturing, gravitational, seismic, and to a lesser extent, erosion processes, resulting in complex changes in the rock formations, often manifested in crushing, splitting, and rockfalls. This sometimes brings sad and undesirable results.

The damage and weathering of the building rocks of the monastery complex and the adjacent territory are natural processes. Completely protecting the site, stopping existing damage, and conducting restoration work are very difficult processes to implement in practice. The situation is complicated by the complex relief of the research area. It is particularly difficult to fully protect those territories that are directly exposed to the

influence of open space – natural microclimate (external relief and caves), since one of the main provoking factors is precisely the microclimate where these processes occur.

It is particularly important to study the current state of individual boulders and small massive rocks with complex geodynamic conditions and safety issues in their manifestation. Comprehensive protection and the development of measures for their reinforcement or neutralization are crucial to ensure environmental safety.

For this purpose, we conduct detailed field geological work, comprehensive laboratory research, and monitoring, which allow us to identify hazardous areas and individual boulders for which corresponding deactivation (prevention) measures and activities are developed.

However, the complete protection of the Vardzia Complex, the cessation of existing damage, and the implementation of restoration work are very complex processes requiring a lot of time, experience, and funds. Nevertheless, the mitigation of existing processes and the correct identification of triggering factors allow for the protection of visitors and the environment.

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Rainwater Harvesting in Arid Regions: An Integrative Approach Aiming at Adapting to Climate Change

In complex problem-settings, the inclusion of data from different sectors is necessary to identify dependencies between sectoral needs and challenges. Neglecting such dependencies can lead to wrong or even false decisions on how to solve the problem. However, whereas the providers of data know, in which sectoral context “their” data have been collected, the users of open, web-based data sources provided by others do often not have the opportunity to evaluate the usability of data for their specific purposes, even if metadata is not available. Moreover, the stored data available via the Internet may face problems of redundancy, mixtures with other information, and incompleteness regarding a specific purpose. On the other hand, the inclusion of different datasets from different sources is a must in a field such as climate change adaptation, because the above-mentioned dependencies between sectors are obvious: water management, for instance, concerns the balance of precipitation and discharge including processes like surface runoff, interflow, groundwater runoff, and others. These processes are strongly dependent from land cover, land use (e. g. agriculture, urban settling), sealing of ground surfaces, and more. Additionally, water management has also to take into account withdrawal of water, especially for the provision of water for households as well as industrial and agricultural production. Creating a complete water balance for a region is a suitable example for the necessity to integrate spatial data from various sources aiming at producing reliable numbers. Sharing information is therefore a necessity and requires the collaboration of different sectors. Finding consensus on measures how to ensure water provision under a changing climate must be based on collaboratively developed decisions.

Within the framework of this paper, a new initiative conducted by project teams in Jordan and Germany is introduced. Being situated in two geographically different regions, specific problems of water management

are the central topic of the initiative. "RAIN-GIS" is currently at its starting point and faces mainly two challenges. The first challenge concerns the necessity of an integrative, holistic approach to solve problems of water provision in arid regions. The second challenge is that the holistic approach only works if a network-based coordination of partners from different sectors is envisaged. These challenges should be seen in front of the background that societal and cultural aspects can have influence on climate change adaptation measures as well.

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Oxidation of Epirubicin by Chemical, Photochemical and Enzymatic Methods: A Comparative Study

Epirubicin is an anthracycline drug used in combination with other medications to treat breast cancer in patients who have had surgery to remove the tumor; together with other anticancer drugs, is continuously released into the environment through effluents from sewage treatment facilities and septic tanks. Due to their potential accumulation in waters, they are considered as “pseudo-persistent” pollutants, with high risk to aquatic flora and fauna.

We tested several environmentally friendly methods for epirubicin oxidative degradation: chemical oxidation with bicarbonate activated peroxide and Co bicarbonate activated peroxide in the presence of surfactants, photochemical oxidation with dissolved oxygen, and enzymatic oxidation with peroxidase and hydrogen peroxide.

The oxidative degradation of epirubicin was monitored spectrophotometrically, at 480 nm, where epirubicin has a maximum absorption. For each oxidative method, from the kinetic curves absorbance *vs.* time, the kinetic parameters were estimated, and the optimum experimental conditions were assessed.

For the optimum conditions, the degradation degrees were compared among all the methods; the Co bicarbonate activated peroxide in the presence of cationic surfactant oxidation is the fastest, but very good results were obtained also for enzymatic and photochemical oxidation. All proposed methods can be considered as green methods, with minimum environmental impact since sodium bicarbonate and hydrogen peroxide do not enhance water contamination, and the concentration of cobalt used in chemical oxidation is in line with national standards for wastewater and municipal and industrial effluents.

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Survey on the Waste Management Practices of Small Businesses in the Selected Townships of the Gauteng Province in South Africa

Most small businesses in the townships of South Africa are small-scale enterprises found along streets, taxi ranks, and certain demarcated areas. The businesses employ fewer than 5 employees on a full-time or part-time basis. While many studies have investigated their commercial viability, very few studies have investigated the waste management issues associated with small businesses in the South African townships. This is despite their contribution to environmental pollution in areas where some of them are located and their potential to play an active role in waste recycling and the emergence of the circular economy. This paper investigated waste management practices of small businesses in the selected townships of Gauteng province in South Africa. Surveys were conducted by means of questionnaire-administered interviews and primary data were analyzed by descriptive and inferential statistics. Results indicated that most businesses generated wastes in the form of plastics (59-75%), cardboards (31-61%), and food remains (21-37%). Approximately 64-68% of small businesses relied on the municipality for waste collection and disposal. By contrast, 10-20% of businesses gave away their recyclable materials to informal waste reclaimers while only a few were recycling (7-14%) or reusing (6-12%) their wastes, respectively. The survey found a significant association between the formality of businesses and certain types of wastes that they were generating, namely, office paper, glass, metals, food items, and other waste materials. Based on these findings, some recommendations are suggested for improving existing waste management practices and maximizing waste reduction efforts in the townships.

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Monitoring GHG Emissions: Legal Reflections on the Use of New (Space) Technologies

International law plays a vital role in coordinating the necessarily global response to climate change. Since its adoption, the United Nations Framework Convention on Climate Change (UNFCCC) has established a structured mechanisms for its state parties to periodically meet and agree on joint climate actions. The Kyoto Protocol and the Paris Agreements were subsequently adopted within this framework and their provisions, together with the UNFCCC, have shaped the existing international climate change regime. 2024 signs a turning point for international climate change law. Indeed, on the one hand States are requested for the first time to submit the new biennial transparency report pursuant to the Paris Agreement, while the process for the evaluation of the achievements towards the objectives set by the Convention (*global stocktake*) is also meeting its first milestone.

In order for states to comply with their climate change law obligations (*reporting* activities, mainly conducted through *bottom-up* approaches) and for third-party verifiers and expert teams to check national submissions (*review* process, primarily adopting *top-down* approaches), advanced observation and measurement capabilities are required. Similarly, the emission trading mechanisms established first by the Kyoto Protocol and then by the Paris Agreement (Art. 6), as well as at the level of the European Union, crucially rely on certification technologies as to allow the trade of carbon credits. Voluntary carbon markets are currently emerging and require analogous certification mechanisms. Therefore, the development of an advanced monitoring mechanism is considered of paramount importance, as also acknowledged by the Conference of the Parties (COP) in many instances.

Building on the role explicitly recognized by the UNFCCC to scientific and technical knowledge in the work of its Secretary and the COP, coupled with the primacy given to the outcomes of the work of the IPCC in assessing the state of the climate, this paper will investigate the role that newly available technologies, especially space-based, can play at the service of international climate change law. In particular, the impact of high-quality data on the capacity of states to comply with their obligations will be assessed, as well as the issues arising from the contrast between the adoption of an external *top-down* approach, typical of satellite observational technologies, and the principle of state sovereignty,

including on natural resources. Moreover, the disruptive potential of advanced monitoring tools for the development of international climate change law will be addressed, including the possible evolution of states' obligations.

Finally, the need for cooperation to combat climate change, as mentioned by the UNFCCC in its Preamble in contrast with the principle of sovereignty, will lead to several reflections concerning the role of existing and developing multilateral monitoring mechanisms within the international climate change regulatory framework.

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**Avoiding and Limiting the Uncontrolled Emissions of CO₂
- Strategies and Considerations for the Net Zero Era**

The paper addresses the central issue of combating global warming through minimizing CO₂ emissions in the atmosphere. Because the issue is global, it requires multi levels of effort in all countries. Under the auspices of the UN, the COP conferences have provided overall guidelines for goals and actions for the countries. These have to be translated in country plans, and in some instances, there could be regional coordination amongst group of countries, e.g. the EU. The country plan aims to set under the Net Zero 2030 and 2050 targets. The country plan focuses on the development and growth of the economy through securing the needed clean energy under the energy transition / decarbonization over a relatively short time span.

The energy needs of heating and electricity for the various sectors of the economy, i.e. Industrial, Commercial, Residential and Transport should be addressed. The paper underlines Energy Savings in the first place, and outlines strategies to adopt new schemes that replace existing ways

producing (uncontrolled) CO₂. The new schemes, fall under two categories:

- I) Avoiding CO₂ emissions, solar and wind Renewable Energy “RE”, and hydrogenation. These are primarily geared to the supply of electricity to the electrical grid. These schemes are accompanied with energy storage and digitization to accommodate the intermittent RE. Under I), Green Hydrogen is to replace fossil fuels in heating applications and as a form of energy storage. This requires addressing the transport of Hydrogen. For onshore transport, electrical (battery) vehicles, and Hydrogen engines are being used. These require filling stations that are being installed.
- II) Limiting CO₂ emissions, continue to use less polluting fossil fuels i.e. Natural Gas, together with carbon Capture and Storage. For aviation transport, Sustainable Aviation Fuel (SAF) a derivative of Hydrogen is being developed. For marine, variations of carbon capture together with LNG are being developed.

For each country, encouraging which new schemes to reach environmental targets involves complex economic optimizations

considering different scenarios. The paper outlines the scenarios and the considerations that enter in the selection process. The discussions of the considerations address the locations of the facilities and its impact. The discussions cover the perspectives of stake holders, e.g. Investors, Developers, Financial Institutions, Licensing Agencies. The Risks associated with new technologies particularly for large scale projects are underlined.

For the Environmental specialist understanding the large picture is vital to conducting his/her demanding tasks under new regimes with different uncertainties. The author hopes that the paper helps in this regard.

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**Evolution of Greenhouse Gas Emissions in Romania:
A Regional Analysis from 1990 to 2021**

The impact of greenhouse gas emissions on climate is a major global concern. This study focuses on three of the most important greenhouse gases: carbon dioxide, methane, and nitrous oxide. Their evolution is analyzed from 1990 to 2021 across different macro-regions of Romania. Data used in the analysis are sourced from the EDGAR (Emissions Database for Global Atmospheric Research, <https://edgar.jrc.ec.europa.eu/>) database and presented by sectors of activity, providing a detailed perspective on each sector's contribution to total greenhouse gas emissions.

Changes in GHGs emissions are determined by a series of variables, including time and spatial variations, long-term trends and many other factors. To understand these changes, advanced statistical methods are an essential tool. Therefore, the temporal variation of GHGs emissions time series was analyzed using Change Point Analysis in order to detect a significant change in the levels of CO₂, CH₄, N₂O. There were found the dominant change-points in GHGs time series temporal variation. Some minor change points were also identified. All detected change points are significant at 99% level. Further on, the temporal trend analysis for detecting and estimating a monotonic annual trend of GHGs levels was performed using the non-parametric Mann-Kendall's test and Sen's method.

These complementary techniques offer a profound insight into the data, allowing us to better understand the complexity of GHGs emissions at both national and regional scale in Romania and identify more efficient strategies for reducing their impact.

The results highlight significant differences between the macro-regions of Romania regarding CO₂, CH₄ and N₂O emissions. Additionally, periods of growth or decline in emissions were identified, which may be linked to factors such as industrialization, changes in

agricultural practices, or the various degrees of implementation of environmental policies.

Overall, findings of present study contribute to a better understanding of the evolution of greenhouse gas emissions in Romania over the past three decades and highlight the emission trends both regionally and nationally. More importantly, the results clarify the contributions from different activity sectors at regional scale and enhance our understanding in their long-term trends at regional scale. Present results can also serve as a basis for developing more efficient policies to reduce GHGs emissions in order to adapt to future climate changes.

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Can Selective Harvest Improve the Stand Structural Complexity and Productivity along a Precipitation Gradient in Temperate Patagonian Forests?

Increasing forest structural complexity is becoming a more common goal in forest management worldwide because the resulting forests are hypothesized to be more adapted to novel disturbances and conditions triggered by global change. However, the lack of empirical quantification of forest structural complexity clouds its implementation. Here, we present results from sampling 40 1-ha permanent plots (20 treated, i.e., harvested and 20 controls, i.e., unharvested). These plots are aligned along a precipitation gradient (i.e., 320-2500mm of Mean annual precipitation: MAP) in temperate deciduous old-growth forests in the western Chilean Patagonia. All treated plots were harvested at least 30 years ago (max 70 years ago) through selective cuttings - a partial disturbance that removed between 5 and 20 m² ha⁻¹ of basal area. Terrestrial laser scanning (TLS) was used to quantify the stand structural complexity index (SSCI) based on fractal analysis, and sentinel images were processed to obtain the Enhanced Vegetation Index (EVI: a proxy of above-ground net primary productivity). Both variables were related as fixed variables: precipitation (continuous variable) and management (binary variable: 1 as treated and 0 as unharvested plots) and precipitation sites (two plots nested (treated and unharvested) to the same precipitation site) as a random variable through a generalized mixed-effect model. We hypothesized that the independent variables are driven by an interaction between MAP and harvesting, where harvesting improves SSCI and EVI on mesic and wet sites. In contrast, on dry sites, where is highlighted no recovery trends at the drier conditions (i.e. < ~600-700mm of MAP), and stronger recovery trends in mesic and wet sites (i.e. >700- 800mm of MAP). These means in mesic to wet sites harvesting increased the SSCI and EVI (i.e., dense vertical canopy packing). These results provide insights necessary to implement management aimed to increase structural complexity in forests through low- to medium-intensity partial overstory disturbances, such as single-tree selection and irregular shelterwood cuttings. Last, we discuss the role of precipitation as a prime variable to refine site-specific management operations that encourage more resilient and productive forests in times of global change.

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Degradation of Chloroquine in Aqueous Solution by Electron Beam (EB) Advanced Oxidation/Reduction Process and EB-Catalytic Process

Chloroquine (CQ) is widely used as an antimalarial and anti-inflammatory drug. It is excreted into the environment through the kidneys and feces. CQ is a quinolone derivative, it is recalcitrant, persistent, toxic, carcinogenic and teratogenic. The conventional wastewater treatment plants (WWTPs) are insufficient to eliminate it, resulting in its presence in water and soil.

Electron beam, as an advanced oxidation/reduction process, can generate oxidation species (OH radicals) and reduction species (hydrated electrons, H atoms) in situ, these oxidizing/reducing species react with organic pollutants and cause their degradation.

In this work, the degradation of chloroquine in aqueous solutions using electron beam and EB catalytic processes was studied. It is found that at 0.5 kGy (1kGy=1 kJ/kg) absorbed dose, with catalytic addition (0.2 g/L) , CQ removal efficiency was increased by 14% for the inlet concentration of CQ being 125 mg/L, from 37.6% to 51.7%; with increasing the absorbed dose to 1 kGy, catalyst still showed a positive effect on the degradation of CQ. However, as dose further increasing, degradation of CQ was mainly dominant by EB, there is no difference in the degradation of CQ between EB and catalytic EB, about 79% CQ was decomposed at 4 kGy dose without/with addition of catalyst. The possible degradation pathway of CQ was discussed.

This work is financed by the Polish Ministry of Education and Science (statutory task no. III.4), the IAEA Coordinated Research Project (contract no. 23165/R0).

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Novel Ferrate (VI) Technology in Water and Wastewater Treatment

In recent years, there has been increasing concern about widespread occurrence of endocrine-disrupting chemicals pharmaceuticals and personal care products in the aquatic environment. A wide range of coagulants and oxidants / disinfectants can be used for water and wastewater treatment. The most common oxidants/ disinfectants used are chlorine dioxide, ozone, chlorine and sodium hypochlorite and coagulants used include ferric chloride, ferric sulfate, aluminum sulfate. The most effective water treatment chemical reagent should ideally be able to remove colloidal materials, heavy metals, partially degrade and oxidize the organic and inorganic impurities and disinfect microorganism. A potential chemical reagent meets these criteria is green chemical (ferrate(VI) salts). It is an environmental friendly treatment chemical, which will not produce any harmful by-products in the treatment process. Ferrate (VI) ions are reduced to ferric III ions or ferric hydroxide and generates a coagulant in a single dosing and mixing unit process. Ferrate is an emerging water treatment chemical that can be used as an oxidant, coagulant and disinfectants [1-3].

In the present work potassium, calcium and strontium ferrate were synthesized, purified and characterized by spectral studies. Water samples were collected from GUYSUCO (ECD), DDL(ECD), Lodge (Georgetown) and UG (ECD), Guyana. The water quality parameters used to examine water quality, pre and post treatment were turbidity, pH color, iron content, total solids, microbiological studies of total and fecal coliform. The pre and post treatment procedure were useful to determine treatment potential of synthesized ferrates. Potassium ferrate is found to be more stable and effective in water treatment in comparison to other ferrates studied.

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**Optical Properties of Dissolved Organic Matter as
Indicators for Assessing Heavy Metal Speciation in
Mangrove-Dominated Estuarine Ecosystems**

Dissolved organic matter (DOM) could alleviate metal toxicity to aquatic organisms by reducing metal bioavailability through the formation of DOM-metal aggregations. The origin and compositions of DOM are sensitive to watershed planetary cover and land use, which may alter the DOM-metal binding and toxicity in aquatic environment. However, the current knowledge of whether the speciation of metals in estuaries dominated by mangrove by changing the DOM characteristics is limited. In situ water quality sonde and discrete field samplings were conducted to inspect the linkage between the optical properties of DOM and metals speciation between sites near and far away from mangroves in an estuarial lagoon. Chemical properties of DOM samples were analyzed using ultraviolet-visible absorbance and fluorescence spectroscopy with excitation emission matrixparallel factor analysis. Results showed that autochthonous activities were the primary DOM source in both study sites (fluorescence index (FI) > 1.9 [range, 2.3–3.1]); however, terrestrial signatures, including DOM aromaticity (SUVA₂₅₄) and humification (HIX), were 21–35% higher near the mangroves. Soluble metal was predominant in both sites among all the study metals (range, 53.6% to 80.4%); however, the offshore site showed 11.1% to 23.8% higher dissolved fractions of all metals. We found that spatial differences in the sources of DOM (FI) and the degree of autochthonous labile DOM (BIX and β/α) were powerful proxy that link DOM properties to metal speciation with and without the effect of mangrove, respectively. Our results support the idea that mangrove forests show a promising potential to rule the heavy metal speciation, as reflected by the DOM origin and quality entering the coastal ecosystems. This study

highlights the necessity of assessing aquatic metal toxicology at landscape-scale by considering the nearby land cover properties. This is particularly true when assessing site-specific exposure risks and when considering the circumstances of environmental and climate changes.

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**Allochthonous Metamorphic Complex of the Loki
Crystalline Massif (Lesser Caucasus, Georgia):
New Insights from the Structure, Mineralogical
Composition and Regional Metamorphism**

The Loki crystalline massif is exposed in the Lesser Caucasus, which is a component of the Caucasus - a complex mountain system located between the Euroasiatic and Afro-Arabian plates and representing a link of the Alpine-Himalayan collisional mobile belt. The massif represents a large anticlinal structure with pre-Alpine crystalline basement exposed in its core. The massif is composed of autochthonous Devonian gneissose quartz-diorites (by U-Pb $370 \pm 59-35$ Ma), Upper Paleozoic granites (by K-Ar 327 ± 6 Ma) and allochthonous Lower Paleozoic metamorphic complex. The latter is represented by the tectonic plates of different composition and age with tectonic contacts between them. The complex consists of Sapharło, Lok-Jandari, Moshevani, Upper Gorastskali (ophiolite) tectonic plates and Lower Gorastskali mélangé. It was considered that all five plates of the metamorphic complex differ from each other in the degree of metamorphism and inner structure. Regional metamorphism of the Lok-Jandari and Sapharło plates corresponds to the green schist facies entire temperature spectrum; the level of metamorphism of the rocks of the Moshevani tectonic plate was established by mineral parageneses corresponding to the high-temperature staurolite-biotite-andalusite subfacies of the staurolite facies. The complex rocks, except for ophiolites, presumably were metamorphosed during the Caledonian orogeny, and

were overthrust on the autochthonous (quartz-diorites) rocks during the Bretonian orogeny. Later, possibly during Early Cimmerian (Indosinian) orogeny, they underwent intensive tectonics.

Recently, new data accumulation requires reconsidering certain petrological issues, including the composition and metamorphism degree of the metamorphic complex of the Loki massif. The above authors conducted a detailed study of the rocks from all tectonic plates. Applied methodology included GPS system-based mapping, microscopic study of thin sections and EMPA of minerals. According to the data received, the key mineral associations of the regional metamorphism of tectonic plates' rocks and degree of their metamorphism were established; the contours of the plates and the character of the contacts between them were clarified. Special attention was paid to the study of the rocks of Sapharlo, Lok-Jandari and Moshevani tectonic plates, represented mainly by metapelites and, to a lesser extent, metabasites. Based on the study it was stated that these three tectonic plates represent one entire plate. According to the new data, the regional metamorphism of all three plates rocks corresponds to the P-T conditions of the greenschist facies and the low-temperature part of the epidote-amphibolite facies. This is confirmed by the following: key mineral assemblages; the presence of initial stratigraphic sequence preserved in the main part of the metamorphic rocks of the massif; the predominantly submeridional nature of the schistosity strike in metamorphites in all three plates outcrops; recording of intense tectonic processes within the tectonic plates themselves; absence of high-temperature minerals in metamorphites.

In addition, it can be concluded that the Sapharlo, Lok-Jandari and Moshevani tectonic plates of the Loki crystalline massif allochthonous metamorphic complex represent one stratified tectonic plate, and the complex itself is compound of only three tectonic plates: metapelite, ophiolite and melange.

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**Understanding the Dynamics of Greenhouse Gas
Emissions in Romania within the European and Global
Context**

Dissolved organic matter (DOM) could alleviate metal toxicity to aquatic organisms by reducing metal bioavailability through the formation of DOM-metal aggregations. The origin and compositions of DOM are sensitive to watershed planetary cover and land use, which may alter the DOM-metal binding and toxicity in aquatic environment. However, the current knowledge of whether the speciation of metals in estuaries dominated by mangrove by changing the DOM characteristics is limited. In situ water quality sonde and discrete field samplings were conducted to inspect the linkage between the optical properties of DOM and metals speciation between sites near and far away from mangroves in an estuarial lagoon. Chemical properties of DOM samples were analyzed using ultraviolet-visible absorbance and fluorescence spectroscopy with excitation emission matrixparallel factor analysis. Results showed that autochthonous activities were the primary DOM source in both study sites (fluorescence index (FI) > 1.9 [range, 2.3–3.1]); however, terrestrial signatures, including DOM aromaticity (SUVA₂₅₄) and humidification (HIX), were 21–35% higher near the mangroves. Soluble metal was predominant in both sites among all the study metals (range, 53.6% to 80.4%); however, the offshore site showed 11.1% to 23.8% higher dissolved fractions of all metals. We found that spatial differences in the sources of DOM (FI) and the degree of autochthonous labile DOM (BIX and β/α) were powerful proxy that link DOM properties to metal speciation with and without the effect of mangrove, respectively. Our results support the idea that mangrove forests show a promising potential to rule the heavy metal speciation, as reflected by the DOM origin and quality entering the coastal ecosystems. This study highlights the necessity of assessing aquatic metal toxicology at landscape-scale by considering the nearby land cover properties. This is

particularly true when assessing site-specific exposure risks and when considering the circumstances of environmental and climate changes.

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Environmental Impacts of the Pulp Industry in Portugal (1954-1979)

With this article, we aim to highlight the main consequences of the functioning of the pulp industry, that is, the effects of the paper and pulp production process on the environment, public hygiene, and health. In Portugal, after the mid-1950s, a pioneering worldwide project was developed, which, through the use and transformation of the eucalyptus species using the sulphate process (kraft process), brought about a profound change in the manufacturing of pulp and paper in the country.

Suppose living systems in the environment interact continuously with their respective physical, biotic, and material surroundings. In that case, we seek to present, from a historical perspective, the environmental aspects in various categories, describing the main environmental impacts associated with planting or using eucalyptus, including those resulting from the paper pulp manufacturing process.

Based on the archives at the National Archive of Torre do Tombo, where we have information about legal proceedings against companies in this forestry subsector, we highlight the main environmental impacts of this industrial activity. In this regard, documentation referring to legal proceedings initiated by local populations and fishermen's associations against companies in the pulp industry will be our primary case study.

Simultaneously, we will analyse the planning and support provided by the Central Services of Public Administration during the Salazar dictatorship period (1933-1974) regarding afforestation projects such as the one that took place in the Serra de Ossa, Alto Alentejo, forming the largest continuous area with eucalyptus occupation in Portuguese territory. Thus, we seek to delve into what the transformation of the landscape with the sole use of a forest species meant, such as the loss of biodiversity, and what implications this choice had for human communities and water resources in the region.

Using the bibliography and scientific publications on this subject, we will synthesise a description of the environmental problems related to cellulose production or the pressure on the desertification of rural areas.

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Monitoring of Anthropogenic Radioactivity in the Atmosphere in the Arctic

Traces of radionuclide contamination are found throughout the Arctic environment. These anthropogenic radionuclides originate from industry processes, nuclear accident and weapon testing. These radioactive levels are extremely low, comparable to the atmospheric activity concentrations of natural radionuclides. When natural radioactivity is considered, representing an average dose of 1.8 mSv per year, exposure to these anthropogenic radionuclides is not of concern at all. In many ways, the Arctic is an indicator zone for known and new pollutants. Researchers and authorities are concerned about high concentrations of certain types of pollutants measured in the Arctic. The atmosphere is one of most important transportation routes for pollutants to the Arctic. Monitoring anthropogenic radionuclide levels in the Arctic ambient atmosphere remains a core part of the AMAP.

Trends in activity concentrations in the atmosphere provide information on the spatiotemporal migration and distribution of radionuclides in the environment. Identifying those compartments that delay release into the atmosphere from secondary sources when conditions change is another major goal of the AMAP monitoring programs. In the event of any other contamination in the future, it is important to maintain up-to date understanding of the status of anthropogenic radionuclide contamination in the atmosphere. This article updates and expands on the information provided since 2013 on the sources of major radionuclides in the Arctic atmosphere, such as ^{137}Cs , ^{133}Xe and ^3H . The possibility of their atmospheric activity concentration as tracers is also discussed to provide information on air exchange between the Arctic and other lower latitudes of the world. This will improve our understanding of migration of pollutants to the Arctic and the impact of climate change on the Arctic.

In this presentation, the Arctic radioactive aerosol monitoring network is briefly described. Over a decade of monitoring results have shown background levels of ^{137}Cs in Arctic air ranging from 0.01 to 1.50 $\mu\text{Bq}/\text{m}^3$. The daily monitoring stations have sufficient sensitivity and temporal resolution to detect ^{137}Cs brought to the atmosphere due to resuspension in local soil and reemissions from biomass burning. These observations can be used as tracers for atmospheric processes. The ^{133}Xe measurements obtained at Yellowknife, Resolute and Spitsbergen could support other research into how air pollution problems arise across intercontinental distances. It will help develop and improve models capable of predicting the long-distance transport and deposition of polluting gases in the Arctic. In the late 1990s or early 2000s, ^3H concentrations in rainwater collected at Pelkosenniemi in Finnish Lapland reached natural background levels, typically around 1-2 Bq/L/month. Its seasonal cycle is caused by annual rainfall and solar radiation patterns consistent with other cosmogenic radionuclides.

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Implications for Hydrocarbon Migration from Depth: Salt Tectonics Analog Modelling in the Southern Margin of the Precaspian Basin

The Precaspian Basin is located in the north and northern margin of the Caspian Sea, and extends in east-west direction with a near elliptical outline. It has a length of about 1000 km, a maximum width of 650 km, and an area of about 58×10^4 km². The Precaspian Basin is one of the most petroliferous regions in the world. The thickest sedimentary rocks in this basin is about 22 km, and there are abundant oil and gas resources in subsalt strata. 85% of the proven oil and gas reserves found in the basin are distributed in the Carboniferous subsalt carbonate strata, and the formation and distribution of oil and gas are obviously controlled by tectonic and sedimentary evolution of the Precaspian Basin during the late Paleozoic period.

The process of reservoir formation is actually the process of oil and gas repulsion, and physical simulation experiments can elucidate the secondary transport process and mechanism of oil in the rock and its accumulation process in the trap. The Astrakhan-Aktyubinsk uplift zone in the Precaspian Basin is an extremely favorable hydrocarbon accumulation zone. This experiment is designed to simulate the oil transport and accumulation process in the salt tectonics-related reservoirs using a two-dimensional simulation device, to establish a model of oil and gas formation in the study area of the southern margin of the Precaspian Basin, and to point out the favorable formation location. Through the whole experiment we concluded that firstly, the salt evaporite layer in the Kungurian stage is a cap layer for subsalt oil and gas reservoirs, which provides favorable conditions for subsalt oil and gas accumulation and reservoir formation. Secondly, the subsalt fault in the southern part of the basin plays a channel and control role for the transport and accumulation of subsalt oil and gas. After the oil enters the fault, it is mainly transported upward by buoyancy, which accelerates the secondary transport rate of oil, while the sparing property of the fault controls the transport path of oil and gas. In addition, the interlayer inhomogeneity of the reservoir plays a key role in the oil-water distribution and oil-bearing saturation in the reservoir. Due to the interstratigraphic inhomogeneity, it can make the Bashkirian Formation with high permeability a good oil formation, while the

Famennian Formation with relatively low permeability a poor oil formation or even a water formation. Combining with the stratigraphic characteristics of the southern edge of the basin, we have a further understanding of the oil and gas formation pattern in the area.

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