GEOEARTH-2025

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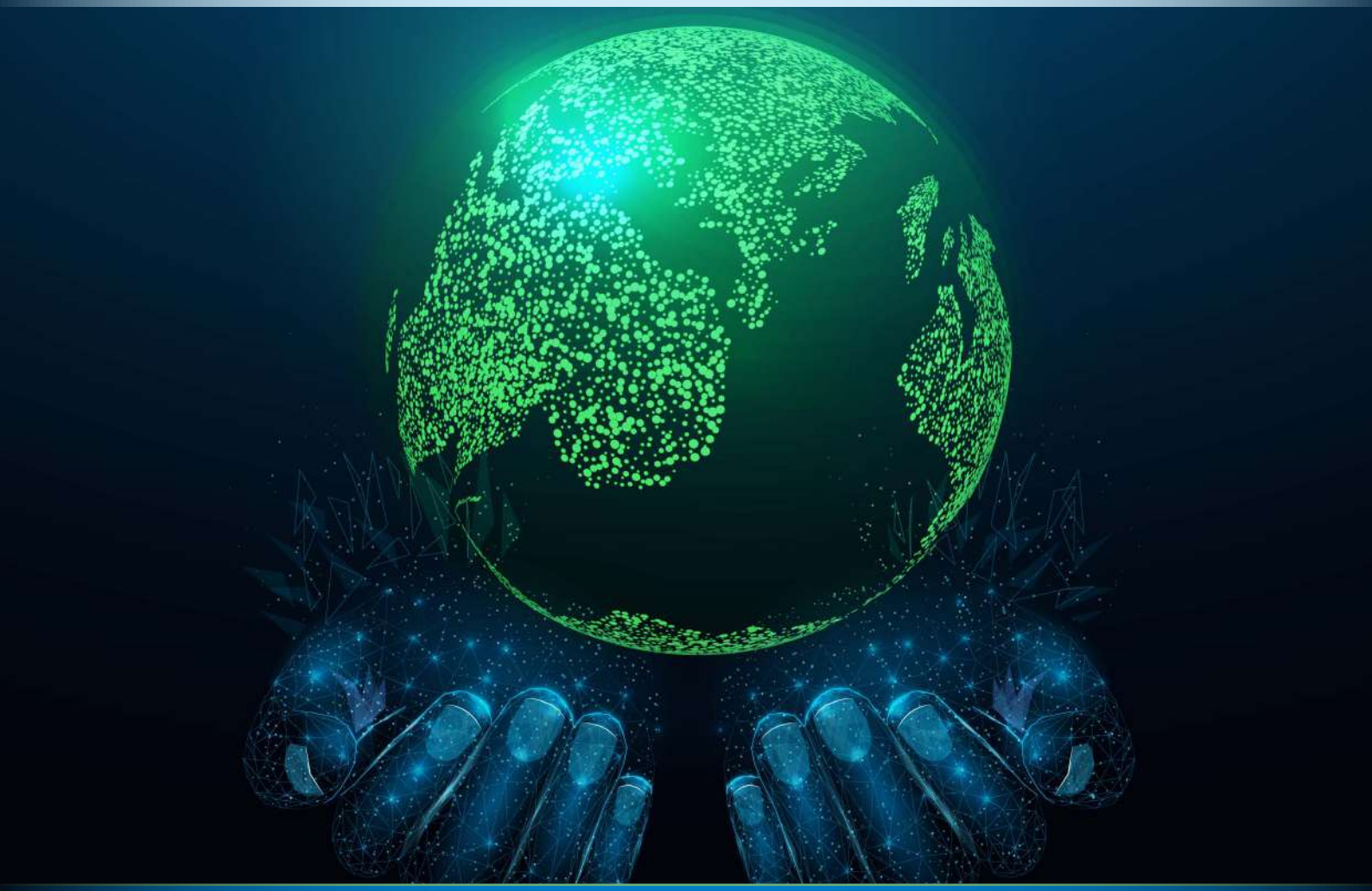
6th Edition of World Congress on

GEOLOGY & EARTHSCIENCE

September 29-30, 2025 at Berlin, Germany



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6th Edition of World Congress on
GEOLOGY & EARTHSCIENCE
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Scientific Program		
Day 1- September 29, 2025		
Meeting Hall- Conference 1		
Registrations Open (08:00-08:45)		
Welcome Ceremony (08:45-09:00)		
Moderator: **Lisa Bithell Kirk,** *Montana State University, USA*		
Keynote Talks		
Rajesh Kalra, *SLB (Schlumberger), Colombia*	**09:00-09:30**	Advanced 3D Seismic Techniques: De-Risking Prospects from Deepwater Andaman and Sub-Basalt Basins to Carbon Capture and Storage (CCS) Projects
Johann Hohenegger, *Vienna University, Austria*	**09:30-10:00**	The ecological species concept allows for comparisons between contemporary and fossil species
Lawrence Haar, *The University of Brighton, UK*	**10:00-10:30**	Derivatives and the Management of Geo-Political Risk in Petroleum Markets
Group Photo & Refreshment Break (10:30-10:50)		

Technical Session-I

Session Themes: **Geo-Technical Engineering**
Remote sensing and GIS
Ore & Mineral Geology
New Technologies and Applications of Earth Science

Session Chairs:

Rajesh Kalra, *SLB (Schlumberger), Colombia*
Lawrence Haar, *The University of Brighton, UK*

Jean-Jacques Ponciano, *Mainz University of Applied Sciences, i3mainz Germany*	**10:50-11:10**	Enhancing Geospatial Data Integration and Completeness through Semantic Web and Linked Open Data
Erick Baziw, *Baziw Consulting Engineers Ltd, Canada*	**11:10-11:30**	The requirement of implementing Fermat's principle of least time in geotechnical DST site characterization
Franco Pavese, *Italy*	**11:30-11:50**	Quantitative Analysis of Colour Maps as A Poweful Alternative to Analysis of Numerical Databases of Earth's Surface Climate Parameters
Lauro Bucio, *Instituto de Fisica, Universidad Nacional Autonoma de Mexico, Mexico*	**11:50-12:10**	Animations, Videos And 3D Models For Improving The Perception Of Space Group Symmetry In Crystalline Minerals
Oya Cengiz, *University of Suleyman Demirel, Turkey*	**12:10-12:30**	Mineralogical and geochemical properties of placer ilmenite-rutile occurrences in the Koseler region (Gordes-Manisa, Turkiye)
Cristiano Tolomei, *Istituto Nazionale di Geofisica e Vulcanologia, Italy*	**12:30-12:50**	A multidisciplinary approach to investigate the impact of urban development on the activation of a paleolandslide: a focus on the Pissouri (Cyprus) case.

Ferhat Cavit, *ITU, Turkiye*	**12:50-13:10**	Stable isotopes composition and their implications regarding the geological fluid sources of the volcanic-hosted zinc-lead sulfide ore deposit, Kirazliyayla, NW Turkiye)

Lunch Break @ Restaurant 13:10-14:00

Technical Session-II

Session Themes: **Environmental Geo-sciences**
Climatology and Meteorology
Geophysics & Geochemistry
Volcanology and Geothermal Research

Session Chairs:

Franco Pavese, *Italy*
Jacek Galas, *Tele and Radio Research Institute, Poland*

Alexander Khain, *The Hebrew University of Jerusalem, Israel*	**14:00-14:20**	Do we describe cloud-aerosol interaction correctly?
Mariola Marszalek, *AGH University of Krakow, Poland*	**14:20-14:40**	Rare Minerals in Salt Efflorescence on Weathered Sandstone Tors in The Stone Town Nature Reserve, Ciezkowice (Outer Carpathians, Poland)
Imaneh Goli, *University of Liege, Belgium*	**14:40-15:00**	Toward tenure security: The relationship between women's land ownership, formal land title documents and their empowerment
Jacek Galas, *Tele and Radio Research Institute, Poland*	**15:00-15:20**	Process monitoring and operational control in the flotation process supported by AI methods
Yusheng Jiang, *China University of Mining and Technology - Beijing, China*	**15:20-15:40**	Field Testing of Vibration Characteristics and Propagation Induced by Double-shield TBM Construction in Urban Areas

Refreshment Break @ (15:40-15:55)		
Jasminka Alijagic, *Geological Survey of Slovenia, Slovenia*	**15:55-16:15**	Application of advanced soil mapping technique through different case studies
Zhijun Du, *Ocean University of China, China*	**16:15-16:35**	Deep Leaning Inversion of Marine Controlled Source Electromagnetic Data Using Convolutional Neural Network
Wolfgang Wehr & Oliver Buchmann, *Erfurt University of Applied Sciences, Germany*	**16:35-16:55**	CO2 content in Puerto Naos after the volcanic eruption on the island of La Palma-recalculation with artificial intelligence
Ariuntogos Munkhjargal, *Mongolian University of Science and Technology, Mongolia*	**16:55-17:15**	Facies analysis from a Late Devonian island arc setting of the Baruunhuurai Terrane, Mongolia
Panel Discussions & End of the Day		

Day 2- September 30, 2025

Meeting Hall- Conference 1

Moderator:
Lisa Bithell Kirk, *Montana State University, USA*

Keynote Talks

Krzysztof Wozniak, *University of Warsaw, Poland*	**09:30-10:00**	Experimental quantitative charge density redistributions in minerals exhibiting pressure induced phase transitions
Lorraine Tighe, *Esri, USA*	**10:00-10:30**	Integrating State-Level Geologic Mapping into the National Framework: The Role of ArcGIS in Advancing the National Geologic Map Database (NGMDB)
Sergio Cappucci, *ENEA Casaccia Research Centre, Italy*	**10:30-11:00**	Anthropogenic sediment management and impact of human activities in coastal areas

Refreshment Break @ (11:00-11:20)

Technical Session-III

Session Themes: **Environmental Geo-sciences**
Structural Geology & Rock Mechanics
Geoarchaeology & Forensic Geology
Geological Hazards & Geological Risk Assessment

Session Chairs:

Lorraine Tighe, *Esri, USA*
Sergio Cappucci, *ENEA Casaccia Research Centre, Italy*

Patrick Jenny, *ETH Zurich, Switzerland*	**11:20-11:40**	Fracture Displacement Basis Function (FDBF) Framework for Fast Geomechanical Simulations
Lisa Bithell Kirk, *Montana State University, USA*	**11:40-12:00**	Selenate bioreduction in a large in situ field trial

Pauline Mbatha, *University of Helsinki, Finland*	**12:00-12:20**	Proboscidean post-cranial morphometrics and ecomorphology and their utility in reconstructing past environments
Zakaria SAADI, *Autorite de surete nucleaire et de radioprotection(ASNR), France*	**12:20-12:40**	Impact of entry pressure and hysteresis on the evaluation of two-phase gas migration in a deep geological disposal of radioactive waste
Tadeusz Chmielewski, *Poland*	**12:40-13:00**	A proposal for the classification of maximum wind speeds in Poland

Lunch Break @ Restaurant 13:00-14:00

Technical session- IV

Session Themes: Environmental Geo-sciences
Geological Hazards & Geological Risk Assessment

Session Chairs:

Patrick Jenny, *ETH Zurich, Switzerland*
Ilya Prutkin, *Jena University, Germany*

Raquel Fernanda Gerlach, *University of Sao Paulo, Brazil*	**14:00-14:20**	Dental Enamel: the rocky dental tissue of vertebrates
Ilya Prutkin, Jena *University, Germany*	**14:20-14:40**	3D geological interpretation of gravitational and magnetic anomalies based on advanced nonlinear inversion
Abdelmajid Kouraich, *Sultan Moulay Slimane University, Morocco*	**14:40-15:00**	Metallogenic Expressions and Geochemical Contrasts of Silver-Bearing Galena in the Sidi Ahmed and Iguer Oujna Veins (Tighza District, Central Morocco)

Ali. I. M. Ismail, *National Research Centre, Egypt*	**15:00-15:20**	Mechanical-mineralogical properties and crack propagation of Sharm El Sheikh-Dahab Road, South Sinai, Egypt
Cheng-Yu Ku, *National Taiwan Ocean University, Taiwan*	**15:20-15:40**	AI-Driven Liquefaction Susceptibility Mapping for Offshore Wind Farms
Refreshment Break @ (15:40-15:55)		
Elnara Seyidova, *Nakhchivan State University, Azerbaijan*	**15:55-16:15**	Geological Development Features and Application Directions of Rock Salt Deposits In The Nakhchivan Autonomous Republic
Nkumbesone Makoley ESSONE, *University of Douala, Cameroon*	**16:15-16:35**	Topographic variation and suburbanization currents: a comparative analysis of the south western and the north eastern fringes of dschang, cameroon
		Panel Discussions & End of the Conference

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VIRTUAL SESSION DAY 1 & DAY 2

6th Edition of World Congress on
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TIME ZONE: CENTRAL EUROPEAN TIME(GERMANY TIME)

zoom

Join Zoom Meeting

Meeting ID: 817 3054 9782
Pass code: 922319

Day 1- September 29, 2025		
Virtual Presentations (Time Zone: CET)		
Kithsiri Perera, *USQ, Australia*	**10:00-10:20**	The impact of greenery changes on human-elephant conflict in Sri Lanka: a model-based assessment using satellite imagery
Weizhen Tian, *Southwest Petroleum University, China*	**10:20-10:40**	Multi-phase Evolution of Strike-Slip Faults in the Central Sichuan Basin, SW China
Xueqing Xu, *Shanghai Astronomical Observatory, China*	**10:40-11:00**	Continental and oceanic AAM contributions to Chandler Wobble with the amplitude attenuation from 2012 to 2022
Yoshiaki Hisada, *Kogakuin University, Japan*	**11:00-11:20**	Building Damage Caused by Fault Displacement in Recent Fault Zone Earthquakes and Effective Measures
Yunfeng Zhao, *The Second Monitoring and Application Center, China Earthquake Administration, China*	**11:20-11:40**	Prediction of MS 6.9 Menyuan and MS 6.8 Luding earthquakes in 2022 based on gravity data
Xudong Liang, *State Key Laboratory of Severe Weather Meteorological Science and Technology, CAMS, China*	**11:40-12:00**	High resolution wind fields observed by Doppler radar network
Wenhai Shi, *Chang'an University, China*	**12:00-12:20**	A modified CSLE for soil loss prediction under different vegetation patterns at slope scale in China
Mohit Kumar, *Indian Meteorological Department, India*	**12:20-12:40**	Inter-seasonal variation of rainfall microphysics as observed over New Delhi, India

Anatoly V. Vershinina, *Lomonosov Moscow State University, Russia*	**12:40-13:00**	Full-Waveform Seismic Modeling Based on Digital Geological Model Using Spectral Element Method
Chaouki Khalfi, *University of Gabes, Tunisia*	**13:00-13:20**	In-situ tectonic stress characterization based on well logs and drilling data in the Tunisian Oriental Platform: A new result that enhances the coverage of high-quality data in North Africa
Anna Fijalkowska Mader, *Polish geological Institute – National research Institute, Poland*	**13:20-13:40**	Climatic changes during the Triassic in the eastern part of the German Basin based on palynological evidence
Huimin Kong, *Institute of Disaster Prevention, China*	**13:40-14:00**	Numerical Simulation of Pre-Seismic and Coseismic Continuous Response of Water Level to the 2014 Ludian MS6.5 Earthquake: A Case Study of Huize Well
James Curran, *UK*	**14:00-14:20**	Natural sequestration of carbon dioxide is in decline: climate change will accelerate
Christopher Burn, *Carleton University, Canada*	**14:20-14:40**	Prognosis, based on field observations, of key issues emanating from permafrost instability
Mario German Trujillo-Vela, *Universidad Surcolombiana, Colombia*	**14:40-15:00**	Towards a unified classification framework for debris-flow mathematical models
Esperanza Lopez-Vazquez, *Universidad Autónoma del Estado de Morelos, Mexico*	**15:00-15:20**	Social Construction of Volcanic Risk Perception from an Intergenerational Perspective
Ralph Kahn, *Lab for Atmospheric & Space Physics, University of Colorado Boulder, USA*	**15:20-15:40**	Dust Plume Microphysical-Property Evolution During Trans-Atlantic Transport

Zeev Reches, *USA*	**15:40-16:00**	Energy dissipation, fault dilation, and rock strength of experimental rock failure
Anne Wein, *US Geological Survey, USA*	**16:00-16:20**	Long-term Communication of Aftershock Forecasts: the Canterbury Earthquake Sequence in New Zealand
Mark J. Kimsey, *Intermountain Forestry Cooperative (University of Idaho), USA*	**16:20-16:40**	Geologic influence on forest health, nutrition, and productivity
Kevin Cunningham, *US Geological Survey, USA*	**16:40-17:00**	Formation of vertical columnar seismic structures and seafloor depressions by groundwater discharge in the offshore southeastern Florida, USA
Goodluck Ofoegbu, *GNO Modeling Research LLC, USA*	**17:00-17:20**	Fracture-based continuum modeling for the analysis of mechanical and hydrological processes in geologic media and examples
		Day-1 Virtual Concludes

Day 2- September 30, 2025		
Time Zone: CET (Berlin Time)		
Phillip Lawrence, *Crown Institute of Higher Educ, Australia*	**10:00-10:20**	The Importance of the 1862 Companies Act, The Day the World Changed
Robert Thomas Pidgeon, *Curtin University, Australia*	**10:20-10:40**	Incorporation of incompatible elements in radiation damaged zircon by interaction with ground waters in the weathering environment
Mingliang Kang, *Sun Yat-sen University, China*	**10:40-11:00**	Reductive immobilization of U and Se-79 under nuclear waste repository conditions
Lihong Song Yan Yi, *Leshan Normal University, China*	**11:00-11:20**	Differential effects of climate and litter quality on soil fauna-mediated litter decomposition across size classes
Mazova Raissa Khaimovna, *Nizhny Novgorod State Technical University, Russia*	**11:20-11:40**	A tsunami in Antarctica caused by the collapse of the Thwaites Glacier
Masahiro Shiba, *Japan*	**11:40-12:00**	Depositional process and palaeogeography of the Ogasa Group, Pleistocene series on the Pacific coast of central Japan
Emiema Soosai, *Fisheries college and research institute, India*	**12:00-12:20**	Acceptability and Shelf Life Evaluation of Surimi Gel-Based Fish Bait under Refrigerated and Ambient Storage
Andrzej Staniek, *Central Mining Institute, Poland*	**12:20-12:40**	On the way to improve safety in building and mining industry - monitoring of rock bolt support systems
Aladdin Nasibov, *Azerbaijan State Oil and Industry University, Azerbaijan*	**12:40-13:00**	Seismic Inverse Modeling and Attribute Analysis of Complex Structures in North Absheron Region

Maria D. Kamitsou, *University of Patras, Greece*	**13:00-13:20**	A Contribution towards a More Sustainable Cement: Synergy of Mill Scales, Greek Wet Fly Ash, Conventional Raw Materials and Clinkering Temperature
Ali Harlin, *Technical Research Centre VTT, Finland*	**13:20-13:40**	Next Generation of Polyolefin Plastics: Improving Sustainability with Existing and Novel Feedstock Base
Michel Lang, *INRAE, France*	**13:40-14:10**	Use of historical information on past floods over the last few centuries to assess extreme floods. Case studies on three French and German Rivers
Gary Rollefson, *Whitman College, Germany*	**14:10-14:30**	Deceiving appearances: Neolithic game boards or what?
Herbert Huppert, *Cambridge University, UK*	**14:30-14:50**	Keynote: Buoyant granular column collapses
Mochi Liao, *University of Illinois Urbana-Champaignm, USA*	**14:50-15:10**	A high-resolution dataset of extreme orographic Quantitative Precipitation Estimates (QPE) constrained to water budget closure for historical floods in the Appalachian Mountains
Alec Feinberg, *Northeastern University, USA*	**15:10-15:30**	Time Left Estimates to Critical Feedback/Loops: Proposed Annual Solar Geoengineering Pathways as CO2 Goals Falter
Boris Amusin, *USA*	**15:30-15:50**	Critical Analysis of Rock Mass Classification for the Design of Underground Constructions
Alec Feinberg, *Northeastern University, USA*	**15:50-16:10**	Solar Geoengineering Likely up to 14 Times More Efficient than CDR: Issues in Climate Forcing and Governance
Mengli Zhang, *Colorado School of Mines, USA*	**16:10-16:30**	Low-cost and high-resolution geophysical data acquisition using ergodic survey design

Stephen Kaffka, *University of California, USA*	**16:30-16:50**	Agriculture, Water Quality, and Public Policy in the Upper Klamath Basin of Oregon and California
Petr Chylek, *Los Alamos National Laboratory, USA*	**16:50-17:10**	Climate Models and the US Southwestern Precipitation in 1900-2100
Kristin Boye, *SLAC, USA*	**17:10-17:30**	Importance of alluvial aquifer small-scale physio-geochemical heterogeneities for environmentally relevant exports
Lorne Arnold, *University of Washington Tacoma , USA*	**17:30-17:50**	Seismically-induced failure mechanisms in massive rock slopes

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BOOK OF ABSTRACTS

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KEYNOTE PRESENTATIONS - DAY-1

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Advanced 3D Seismic Techniques: De-Risking Prospects from Deepwater Andaman and Sub-Basalt Basins to Carbon Capture and Storage (CCS) Projects

Rajesh Kalra[1]*, Roberto Fainstein[2] (Late), and Srinivas Chandrashekar[3]

[1]SLB (formerly Schlumberger), Bogota Office, Colombia.
[2]Ex-Honorary Professor, University of Coimbra, Geoscience Center, Coimbra, Portugal.
[3]Ex-Oil and Natural Gas Corporation Ltd. (ONGCL), Mumbai, Maharashtra, India.

As the energy industry is evolving to meet the dual challenges of resource exploration and sustainable carbon management, advanced 3D seismic technologies are proving to be of utmost importance in tackling geological complexities. From conventional oil and gas exploration in frontier deepwater basins, like Andaman Sea, to challenging sub-basalt areas and Carbon Capture and Storage (CCS) projects, recent advancements in 3D seismic survey technologies are reshaping subsurface imaging and de-risking of complex geological environments. This study reviews the applicability of recent past seismic exploration efforts and key field examples across these three domains.

The deepwater Andaman Basin presents unique challenges, including tectonic complexity, volcanic intrusions, and stratigraphic uncertainties. Advanced techniques such as 2D Over-Under, which enhances signal-to-noise ratios in complex environments; and 3D DISCover, which integrates high-resolution imaging; pre-stack depth migration (PSDM) and Full-Waveform Inversion (FWI) processing workflows have significantly improved subsurface imaging, thereby reducing exploration and drilling risks.

In sub-basalt basins, challenges are posed by high-density and heterogeneous basalt layers which result in scattering and attenuation of seismic signals. Like in the Andaman Basin, long-offset acquisition and 3D DISCover, have added value to legacy datasets, enabling enhanced imaging of Mesozoic sediments in India's coastal regions.

For modern CCS applications and projects, advances in machine learning-based seismic processing, multi-azimuth acquisition, broadband and passive seismic are enhancing imaging resolution and reservoir monitoring. Time-lapse (4D) seismic monitoring is used for tracking CO_2 plume migration, validating predictive models, and detecting potential leakage pathways. Projects like Sleipner (North Sea), Gorgon (Australia), and Tomakomai (Japan) have demonstrated the effectiveness of 4D seismic in managing CO_2 containment.

As global energy demands shift toward sustainability, the integration of advanced seismic techniques will enable more precise subsurface imaging, reduce geological uncertainties, and ensure safer carbon storage, thereby playing a pivotal role in both resource exploration and environmental space.

Biography:

Dr. Rajesh Kalra has been working with SLB (Schlumberger) for 28 years and is currently assigned in South America. Rajesh holds Doctorate from Indian Institute of Technology, Bombay (India), Masters from Leicester University (UK) and Master of Technology degree in Applied Geophysics from Kurukshetra University (India). During his career with SLB, he has performed in various roles & capacities ranging from Technical, Learning & Development, Human Resources, Sales & Marketing, Information Technology and Operations globally. He has several known publications in conferences and reputed journals at international level. In the past, he has also participated as one of the scientific team members in Antarctic Scientific Expeditions twice. His current areas of interest have been in seismic techniques in deepwater sub-basalt exploration and utilization of exploration data in the field of decarbonization initiatives.

The ecological species concept allows for comparisons between contemporary and fossil species

Johann Hohenegger*

Vienna University, Austria

The classification of species has been a subject of extensive scientific discourse, with various frameworks proposed to encapsulate the complexities of biodiversity. Traditional methodologies, such as the biological species concept, emphasize reproductive isolation, while molecular genetic techniques focus on shared DNA sequences. Morphological characteristics, influenced by environmental pressures and developmental processes, provide a crucial link between an organism and its ecological context, offering an additional perspective alongside genetic and reproductive criteria.

Morphologically homogeneous groups, whether current populations or fossil paleo-populations, should be classified as ecological species irrespective of their molecular genetic similarity in living forms. Six models have been developed to define ecological species, both extant and extinct, utilizing morphological traits. Ecological species are essential for tracing evolutionary trends and specialization within the fossil record.

Foraminifera, single-celled marine organisms notable for their intricate life cycles involving both asexual and sexual reproduction across haploid and diploid generations, serve as exemplary subjects. Their complex shells and ecological versatility render them invaluable for investigating evolutionary and environmental changes.

This research highlights defining ecological species to bridge paleontological data with modern ecology, especially when genetic information is missing but morphological traits offer evolutionary insights.

Biography:

Johann Hohenegger is a retired professor from the Institute of Paleontology at Vienna University, Austria. He earned both his undergraduate and postgraduate degrees from the same University. With over 160 refereed publications, his primary research interests encompass population dynamics, taphonomy, carbonate production of larger foraminifera, species recognition in current and historical environments, morphometrics, morphogenetic programs and their phylogenetic implications relative to molecular genetic trees, as well as morphocoenoclines along environmental gradients and their relevance in deciphering paleoenvironmental conditions. His work also extends to integrated stratigraphy and paleoenvironmental analysis in the Neogene of the Paratethys (Central Europe), with a focus on astronomical cycles and spatial distributions on micro- and macroscale levels. Presently, he is involved in research on pollution effects in Brazilian Bays, using foraminifera as indicators.

Professor Hohenegger began his scientific career by researching Late Paleozoic to Early Jurassic foraminifera. He has dedicated substantial periods of time to Japan, contributing to the Sesoko Marine Laboratory at Ryukyu University, Kagoshima University Museum, Kyoto University Museum, and the Yukawa Institute for Theoretical Physics, Kyoto University. At Vienna University, he provided foundational instruction for earth science students, covering subjects such as geostatistics, biology, micropaleontology, and biostratigraphy. Since 2010, Professor Hohenegger has been delivering lectures on ecology, taphonomy, community analysis, and larger foraminifera at the International Summer School on Foraminifera in Urbino, Italy.

Derivatives and the Management of Geo-Political Risk in Petroleum Markets

Lawrence Haar[1]*, Rob Hayward[2] and Andros Gregoriou[3]

[1]Dr Lawrence Haar is Senior Lecturer in Finance Brighton Business School - The University of Brighton.
[2]Dr Rob Hayward is a Principal Lecturer in Finance Brighton Business School – The University of Brighton.
[3]Dr Andros Gregoriou is a Professor of Finance, Liverpool Business School – Liverpool John Moores University.

The issue of petroleum market insecurity as may arise from geo-political events is a perennial concern. The rise of modern industrial economies and global conflicts have made secure supply paramount. Although instances of actual disruption are exceptional, the perception exists that geo-political risks are a threat to secure supply especially since petroleum markets evolved from relying upon bi-lateral contracts between oil-major and exporting countries, to become a traded commodity. In this research we show the role of futures and options, derivatives, in managing risk during extreme conditions challenging the view that historic concerns of supply disruption are warranted. Though the utility of futures and options markets in managing 'day-to-day' firm level exposure is acknowledged, concerns remain that derivative markets cannot handle either the risks associated with historic geo-political shocks or yield macro benefits. Using data from various Exchanges on trader intentions, commercial and non-commercial activity, positioning is statistically related to both volatility and price level. Faced with the spectre of price instability and stochastic volatility, positions are taken to mitigate exposure while yielding social benefits in stabilising markets. Further, notwithstanding perceptions of insecurity, using option theory, we show that market participants attached a low probability to illiquidity or price extrema during episodes of geo-political risk. Finally, we address the extent to which the specifications of option models present a limitation to managing the risks associated with exogenous perturbations. Our analysis and findings support the argument that the existence of geo-political risk is manageable and concerns over market insecurity, are exaggerated.

Key Words: Geo-Political Risk, Energy Security, Risk Management, Derivatives

Biography:

Dr Lawrence Haar is a Senior Lecturer in Finance with Brighton University School of Business and Law. Preceding his academic career, Dr Haar had a twenty-five-year career which included BP North America, Rand Mines in South Africa and the German energy group, RWE and major banks where he applied his knowledge of commodity markets to risk management. As a Risk Officer for commodities, he was a Director and Managing Director with the following institutions: Bear Stearns-JPM, Credit Suisse and UniCredit. He has as well worked in Saudi Arabia for ARAMCO and been a Director in Audit Assurance for Deloitte.

Through his peer-reviewed research, he regularly appears in academic journals, such as International Review of Financial Analysis, Risks, Energy Policy, Energy Strategy Review and publications of the Institute for Economic Affairs as well as the CATO Institute. He also appears in the financial press, including the Petroleum Economist. He was on the Editorial Board for the Journal Energy Policy and is presently an Editor for the journal Economic Affairs published by the Institute for Economic Affairs and Wiley. He has appeared numerous times on various BBC stations, France24, Capital FM and GBTV discussing energy markets and energy policies. On occasion he is involved in consultancy work, most recently for Ezz Steel in Cairo, Egypt and as well been an expert witness for the UK's Crown Prosecution Services He has a PhD in Financial Economics from the University of Surrey, a Masters from Brown University and a Bachelors from New York University.

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SPEAKER PRESENTATIONS | DAY 1

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Enhancing Geospatial Data Integration and Completeness through Semantic Web and Linked Open Data

Claire Ponciano [1], Falk Würriehausen [2], Markus Schaffert [1], Hartmut Müller [1], and ***Jean-Jacques Ponciano[1]**

[1] Mainz University of Applied Sciences, i3mainz, Lucy-Hillebrand-Straße 2, 55128 Mainz, Germany
[2] Federal Agency for Cartography and Geodesy, Richard-Strauss-Allee 11, 60598 Frankfurt, Germany

This paper investigates methods for improving the integration and completeness of heterogeneous geospatial datasets using Semantic Web technologies and Linked Open Data. Interoperability issues, fragmented data sources, and incomplete datasets remain persistent challenges in the geospatial domain—often exacerbated by proprietary formats and lack of coordination among stakeholders. To address these, we propose an ontology-based approach built on the principles of knowledge representation and reasoning. By leveraging the Universal Spatial Knowledge Base (USKB) and rule-based inference mechanisms, our method facilitates semantic interoperability and supports completeness analysis across diverse data sources. As a demonstration of this approach, we present SPALOD (Spatial Data Management with Semantic Web Technology and Linked Open Data), a platform designed to integrate and manage complex geospatial datasets. SPALOD illustrates how semantic reasoning can ensure consistent data quality, enhance interoperability, and enable seamless integration across systems. Our results underline the feasibility and impact of semantic-enriched data management strategies in the geospatial context, offering a scalable solution for harmonizing and enriching spatial information about bicycle network.

Biography:

Dr. Jean-Jacques Ponciano obtained his PhD in Computer Science in 2019 from Université Jean Monnet, Saint-Étienne. He is a senior researcher at i3mainz, University of Applied Sciences Mainz. His work focuses on the intersection of semantics, 3D point cloud processing, and artificial intelligence. He specializes in the automatic and unsupervised structuring of 3D point clouds through semantic segmentation and classification. Dr. Ponciano also leads applied research projects as CEO of GeoVast3D and co-founder of ShinAI, advancing AI-driven solutions in fields ranging from geospatial data integration to medical imaging. His contributions aim to bridge raw data and meaningful knowledge through intelligent automation, and he regularly publishes in peer-reviewed journals across computer vision, geoinformatics, and knowledge engineering.

The requirement of implementing Fermat's principle of least time in geotechnical DST site characterization

Erick Baziw*

Baziw Consulting Engineers Ltd., Canada

Downhole Seismic Testing (DST) such as Seismic Cone Penetration Testing (SCPT) is a widely used geotechnical technique for estimating low-strain in-situ interval velocities and absorption values. The in-situ interval velocities form the core (Shear Modulus (G), Poisson's Ratio (μ) and Young's modulus (E)) of mathematical theorems to describe the elasticity/plasticity of soils and they are used to predict the soil response to imposed loads. The horizontally polarized shear wave is also an important parameter for evaluating liquefaction potential due to fact that it is influenced by many of the variables that influence liquefaction. Estimates of low-strain absorption values are very important for predicting and assessing ground amplification during earthquakes. The low-strain absorption estimates also provide for a reference of laboratory tests such as the resonant column test. When processing DST data sets the majority of investigators assume the seismic source waves in DST travel in straight lines (the so-called Straight Ray Assumption (SRA)). The SRA is an inaccurate assumption. Source wave trajectories adhere to Fermat's principle of least time. This means that the raypath travels along the trajectory that minimizes the travel time between points. This paper outlines algorithms which estimate DST interval velocities and absorption values by implementing Fermat's principle of least time. Test bed simulations and case histories are also outlined which demonstrate the importance of implementing Fermat's principle when processing DST data sets.

Biography:

Dr. Erick Baziw received the B.A.Sc. degree in geophysics engineering, the M. A. Sc. degree in geotechnical engineering, and the Ph.D. degree in seismic signal processing from the University of British Columbia. He has been the Managing Director of Baziw Consulting Engineers Ltd. since 1997. Erick is a Registered Professional Engineer in the disciplines of geophysics and software engineering. He is also a senior member of IEEE. Erick's research interests are focused on the design of data acquisition, signal processing and optimal estimation systems for geotechnical and geophysical site characterization. He has published various papers in peer reviewed journals such as IEEE Transactions on Geoscience and Remote Sensing, IEEE Geoscience and Remote Sensing Letters, Pure and Applied Geophysics, Canadian Geotechnical Journal, ASTM International - Geotechnical Testing Journal, Soils and Rocks Journal, and International Journal of Geosciences.

Quantitative Analysis of Colour Maps as A Poweful Alternative to Analysis of Numerical Databases of Earth's Surface Climate Parameters

Franco Pavese*

Independent Scientist, Italy

Global numerical parameters are recently preferred in scientific fields evaluating Earth surface features, namely in climate evolution. However, their synthetic nature may miss full understanding of the complexity of the issue they intend to qualify. The presentation intends to illustrate the fact that the intended aim can better be reached by adding assistance provided by the evaluation of maps, especially in the case of Earth's parameters, a method already common in Spatial Big Data evaluation. Additionally, a unique feature comes with their use: the fact that the map graphical representation is intrinsically mediating a parameter that is always associated to each data of experimental origin, datum uncertainty, so representing a kind of alternative way to model the numerical database, namely when in view of forecast. Especially when maps illustrate a great variety of local situations, the visual (i.e., geometrical) examination offered by maps often allows superior information with respect to numerical databases, so allowing a more reliable and full evaluation of the evolution, typically in time. Quantitative evaluation is additionally possible nowadays with the technique of pixel counting on proportional-surface map types: it allows the scientist interested to check by her own the quality and correctness of the literature analysis results, otherwise impossible due to the very complex manipulation to which the original data have been subjected for publication, generally not available to the readers of the published papers. Cases are reported to exemplify these statements concerning GMST, snow coverage and ground green coverage.

Biography:

Dr. Franco Pavese, born in 1942, got his Full University Degree in Engineering at the Poli¬tecnico of Torino, Italy on 1966. Scientist with Consiglio Nazionale delle Ricerche (CNR) since July 1967 at Istituto di Metrologia "G.Colonnetti" (IMGC) (became INRIM—National Institute for Research in Metrology—since 2006). Research Director in Metrology since 1990. Responsible during 30 years for the Italian temperature Standards for the ITS-90 below 0 °C. Retired since 2009, with several functions still active (his experimental activities ended in 2018), in particular within IMEKO, from which he got a Distinguished Service Award in 2024.

He was the Italian Representative within BIPM CCT and responsible of scientific projects with National Laboratories in 30 Countries in all Continents. Author, alone or with several co-authors, of 229 full international scientific papers on Journals, plus 93 international conference papers and 22 books, book chapters or monographs, in English.

He had a very good citation rate compared with scientists in the metrological field: in 2022 he got from the ScholarGTP ranking Organisation a Life-Carrier Certificate for being within the first 20 among their World database of 40,000 scientists in Metrology.

Animations, Videos And 3d Models for Improving the Perception of Space Group Symmetry in Crystalline Minerals

Lauro Bucio*

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Animations, videos and 3D models have been designed in our laboratory to improve the perception of space group symmetry and the action of symmetry operators on several cases of crystal structures of all kinds. In this contribution, selected minerals such as montmorillonite, kaolinite 1A, calcite, hydroxyapatite, among others, will be considered for illustrating the use of the resources specifically designed for the perception of three-dimensional symmetry in crystals. In all the cases, it has emphasized the relationship between the asymmetric unit, the list of symmetry operations and their corresponding positions generated by symmetry, the schematic diagrams given in the International Tables for Crystallography Vol. A[1], as well as the generation of a fragment of the crystal structure. These resources have been developed as a response of changes occurring at present in the way in which humans interact. Virtual communication with diverse types of audiences required us to learn a little bit about certain facts on the visual perception by the human brain. As time went by, we realized that we should direct our interest towards the problem of improve the symmetry perception experimenting with visual resources. The experiences in the academic community, stimulate us to address the use of the resources to other kind of audiences different that the academic. Particularly to a someone being non-expert, but with certain interest on the science concerning crystals and their symmetry properties.

References: (1) International Tables for Crystallography, Volume A, Space-group symmetry. Edited by Mois I. Aroyo. Wiley, 2016.

Biography:

Dr. Bucio obtained his BSc and PhD (Physics) from the National Autonomous University of Mexico (UNAM). He is a full researcher at the Institute of Physics of UNAM since 2004. He was president of the Mexican Society of Crystallography from 2004 to 2007. He is a member of the International Centre for Diffraction Data and has been Representative of Mexico in the Assemblies of the International Union of Crystallography. Currently, his research is focused on the study of low crystallinity phases by X-ray diffraction. He is mainly interested in relating crystal structures by its space group symmetry, as well as thermal stability and degradation of natural materials and pharmaceuticals by thermogravimetry. He has published various papers in peer reviewed journals.

Mineralogical and geochemical properties of placer ilmenite-rutile occurrences in the Köseler region (Gördes-Manisa, Türkiye)

Kayhan Işık & **Oya Cengiz***

Süleyman Demirel University Department of Geological Engineering Isparta / Türkiye.

Ilmenite-rutile occur in important amounts within Quaternary detrital sediments, and quartz veins which cut down the Palaeozoic gneisses and migmatites in the Menderes Massif on the Neoproterozoic Pan-African Belt, the west of Türkiye. This study investigates the mineralogical composition and element content of placer ilmenite-rutile formations and to reveal the formation temperature of ilmenite-rutile related to titanium source rock. As a result of erosion, transport and accumulation of ilmenite-rutile- bearing quartz veins in the gneiss and migmatites outcropped around Köseler village, the placer ilmenite-rutile occur in terraces, recent fluvial-alluvial and slope debris deposits. The ilmenite-rutile grains in the placers have grain sizes ranging from mm fractions to 5–6 cm. The mineral paragenesis of these placers consists of ilmenite-rutile, quartz, muscovite, dravite, distenite. Based on the results of ore microscopy and EPMA, rutile grains coexist with ilmenite. Ilmenite's replacement is exhibited along the discontinuities in rutile. The average major-oxide contents of ilmenite-rutile samples were 76.49 wt.% TiO_2, 22.12 wt.% Fe_2O_3, 0.98 wt.% SiO_2, 0.39 wt.% Al_2O_3. The samples have average values Nb of 643 ppm, V of 1145 ppm, Cr of 410 ppm, W of 66 ppm, Ta of 48 ppm, Zr of 71 ppm, Sn of 38 ppm, and Hf of 3 ppm. Based on these data, ilmenite-rutile represent hydrothermal origin, derived from the mantle and show a semi-chondritic Nb/Ta ratio. The oxygen isotope results have values between 1-1.4 ‰ for rutile and -1.3 ‰ to -2.6 ‰ for quartz. The negative values of samples represent high temperature conditions and/or hydrothermal fluid interaction. Based on the Zr values in rutile thermometer results, the formation temperature of ilmenite-rutile-bearing quartz veins were found to be at average temperatures of 534 ± 50°C and 538 ± 20°C. The temperatures indicate that ilmenite-rutile- bearing quartz veins may be in a temperature range between pegmatitic and/or hydrothermal stages.

Biography:

Dr. Oya Cengiz obtained her BSc (Geology) from the University of Akdeniz and her PhD (Geology) from the University of Süleyman Demirel. Her PhD research was based on the investigation for the origin, mineralogy and geochemistry in the South Türkiye Sultandağ barite deposits. She currently lectures ore deposits and geochemistry at the University of Süleyman Demirel. Her area of interest is Stable Isotopes, Hydrothermal Alteration, Geochemistry of Metallic and Industrial Raw Materials. She has published various papers in peer reviewed journals such as Earth and Planetary Science Letters, Journal of Asian Earth Sciences, Journal of the Geological Society of India, Journal of African Earth Sciences, Minerals (MDPI), Geochemistry.

A multidisciplinary approach to investigate the impact of urban development on the activation of a paleolandslide: a focus on the Pissouri (Cyprus) case.

C. Tolomei[1]*, P. Tzampoglou[2,3], D. Loukidis[3], E. Karlas[3] N. Svigkas[1], N. Koulermou[4] , A. Anastasiades[2], C. Loupasakis[5]

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This study presents the case of reactivation of a paleolandslide in southwestern Cyprus due to the expansion of a community in an area covered by high plasticity marls. The landslide first noticed in 2011, takes place in an area with only 7° ground inclination and affects more than 100 residential buildings. Building damages and ground surface ruptures have been thoroughly mapped through fieldwork campaigns, while piezometric measurements reveal the presence of a shallow phreatic water table. Remote sensing results, from the multi-temporal InSAR (Interferometric Synthetic Aperture Radar, MT-InSAR) technique using data acquired from different SAR sensors operating in L- and C-Band, were evaluated in conjunction with the available geological, geotechnical, and hydrogeological data. Moreover, the finite element method was employed to perform a back analysis of the current instability to examine possible failure mechanism scenarios and the role of potential triggering factors. Based on the remote sensing data, the field surveys, and the results of back analyses, it can be discerned that the paleolandslide has been almost fully reactivated, with the main cause being the rising of the phreatic water table due to long-term infiltration of wastewater from the soak pits of the residential developments. Intense rainfall periods in the course of the last 10 years contributed to the acceleration of the ground motion. According to the back analysis results, the slip surface follows the bedding planes of weak marl horizons with a residual friction angle of around 10°. Finally, analyzing the MT-InSAR outcomes in the wider area of

southwestern Cyprus reveals several locations of notable ground motion due to active landslides. Hence, landslides located in SW Cyprus are the object of a deeper investigation using the nowadays available classification and a multidisciplinary approach aiming at mitigating possible hazards.

Biography:

Dr. C. Tolomei received a Bachelor's in Engineering, specializing in Remote Sensing, in 1998 at Sapienza University of Rome. Since 2000 he has been a researcher at the Istituto Nazionale di Geofisica e Vulcanologia in Rome, as a member of the Remote Sensing Laboratory. His research interests mainly concern the production of ground deformation maps retrieved by SAR interferometry, both classical and multi-temporal techniques (e.g. Persistent Scatterers Interferometry and Small Baseline Subset, SBAS). Such products are applied for monitoring service purposes and as input for modeling many phenomena and hazard assessment and risk mitigation (i.e., causative faults, magma intrusion, subsidence, landslides, etc.). He has been involved in numerous national and international projects, he also participated in the scientific and technical training of young researchers. He published more than 70 scientific papers in ISI journals on various topics in geophysics and volcanology.

Stable isotopes composition and their implications regarding the geological fluid sources of the volcanic-hosted zinc-lead sulfide ore deposit, Kirazlıyayla, NW Türkiye)

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The Kirazlıyayla ore deposit is an epi-mesothermal Zn-Pb±Cu deposit hosted by intensively altered intermediate extrusive rocks, cutting through the meta-sedimentary Karakaya complex. Stockwork, crosscutting quartz, and veinlets in different alteration zones are the major network of coarse-grain sulfide bearing minerals. The main objective of this study is to determine the origin of the hydrothermal fluid in the Kirazlıyayla Zn-Pb±Cu deposit. Sphalerite, galena, pyrite, chalcopyrite, and quartz-rich ore samples from the open pit mine site were collected for sulfur and oxygen isotope analysis. The sulfur isotope values of galena, chalcopyrite, and sphalerite show a relatively narrow range, respectively: 0.70 to 0.90 $‰_{VCDT}$, 2.21 to 2.30 $‰_{VCDT}$, and 1.80 to 2.00 $‰_{VCDT}$. The pyrite, on the other hand, has a rather high sulfur isotope value of 6.80 $‰_{VCDT}$ (δ^{34}SPy > δ^{34}SCp > δ^{34}SSp > δ^{34}SGn). The sulfides' δ^{34}S showed an average value of 2.13 $‰_{VCDT}$, with a range of 0.7 to 6.8 $‰_{VCDT}$. Variations in δ^{34}S values suggest that pyrite, chalcopyrite, galena, and sphalerite are in equilibrium sequence. The research area's igneous rock composition offers indications of a consistent sulfur source with a magmatic fingerprint. Intermediate and high-sulfidation ore minerals exhibit diversity in sulfur isotope composition. Quartz has $\delta^{18}{}_{OVSMOW}$ values ranging from 11.9 to 12.7 $‰_{VSMOW}$, and the calculated oxygen isotopic compositions of hydrothermal fluid range from 10.8 to 11.5 $‰_{VSMOW}$, indicating the magmatic origin for the hydrothermal fluids. Based on alteration patterns and sulfur isotope ratios that are near zero, along with mineralization hosted by volcanic rocks, the Kirazlıyayla mineralization is a product of an Eocene volcanogenic system (volcanics associated and volcanic hosted) and shares similar features with other mineralization found in western Türkiye.

Biography:

Dr. Ferhat Cavit obtained his both BSc and MSc (Mineral Exploration-Mining Engineering Department) from the Islamic Azad University, Iran, and his PhD (Ore Deposits and Geochemistry-Geological Engineering Department) from the Istanbul Technical University, Türkiye. His MSc research was based on geostatistical modeling of geochemical anomalies, NW Iran and his PhD research was based on the geochemistry, mineralogy, and genesis of the zinc-lead sulfide ore deposit, NW Türkiye. Since 2018, he has been working for the Delta Group-Meyra Mining Company, Türkiye as R&D executive. His area of interest is geochemical exploration, data analysis, mineralogy, and geostatistics on Zn-Pb-Cu sulfide ore deposits.

Do we describe cloud-aerosol interaction correctly?

Alexander Khain*, B. Lynn[1], E. Gavze[1], Y. Arieli[2] and I. Koren[2]

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[2]*Weizmann Institute of Science*

Cloud-Aerosol interaction is a critical topic in atmospheric science. Many numerical studies focus on one-way interactions, examining how aerosols affect the dynamics and microphysics of individual clouds and cloud systems. In this study, we investigate the behaviour of small cumulus (Cu) clouds and a mesoscale convective system (a squall line), incorporating two-way cloud-aerosol interactions. Small cumulus clouds are simulated using a 10-meter resolution Large Eddy Simulation (LES) within the System for Atmospheric Modelling (SAM). The MCS is simulated using the Weather Research and Forecasting (WRF) model. These models utilize warm-phase and mixed-phase spectral bin microphysics, respectively. In both scenarios, we show that clouds serve as powerful sources of aerosols at higher altitudes. Small cumulus clouds are not separated by clean skies but are instead surrounded by air containing significant aerosol concentrations. Similarly, aerosol concentrations around an MCS (e.g., squall lines) increase over areas extending several hundred kilometres from the squall line. The evaporation of larger cloud droplets obtained by collisions leads to the release of large aerosols, including giant cloud condensation nuclei (GCCN). Thus, clouds even polluted ones can produce GCCN in the upper atmosphere. The re-entrainment of the released aerosols into their parent clouds increases drop concentration, as well as snow, graupel, and particularly hail mass contents through the riming process. Consequently, intensity of convection has increased.

We discuss the potential role of two-way interactions specifically the impact of considering the aerosol budget—in the development and evolution of cloud fields.

Biography:

Dr. Alexander P. Khain is Professor in the Institute of Earth Science at the Hebrew University of Jerusalem. H is a renowned leading expert in developing cloud and cloud-resolving models with precise microphysics in orders to investigate the physics of clouds and precipitation. He has participated in several American, European, and Asian international research projects where his advanced microphysical schemes were widely used to investigate natural and anthropogenic aerosol effects and relations between microphysics and atmospheric dynamics. He has published four books on cellular convection in the moist atmosphere, tropical cyclones and their interaction with ocean, physical processes in clouds and cloud modeling, and approximately 200 academic papers on cloud physics, cloud-aerosol interaction, and numerical modeling of clouds, storms and hurricanes.

Rare Minerals in Salt Efflorescence on Weathered Sandstone Tors in The Stone Town Nature Reserve, Ciężkowice (Outer Carpathians, Poland)

Mariola Marszałek*

AGH University of Krakow, Faculty of Geology, Geophysics and Environmental Protection, al. Mickiewicza 30, 30-059 Kraków, Poland

This work presents the mineralogical and geochemical characteristics of pickeringite, alunogen, and hydromagnesite, identified in salt efflorescences from the Stone Town Nature Reserve in Ciężkowice (Outer Carpathians, Poland), based on SEM-EDS, XRPD, STA, EPMA, and RS analyses, and discusses their possible origins.

The study area encompasses a variety of sandstone tors exposed on Skała Hill (Rock Hill), extending from its summit down into the Biała River Valley. Several types of salt efflorescences have been identified on the sandstone walls, distinguished by their distribution, the composition of the parent sandstones, and local environmental conditions. The mineral composition of the efflorescences also shows seasonal changes depending on the prevailing atmospheric conditions. Laboratory analyses have allowed for the identification of several sulfate minerals of various hydration, including pickeringite, hexahydrite, pentahydrite, alunogen, gypsum, K-alum, and syngenite. Efflorescences rich in rare minerals – alunogen $Al_2(SO_4)_3{\cdot}17H_2O$ and pickeringite $MgAl_2(SO_4)_4{\cdot}22H_2O$ – were encountered exclusively in a niche protected from rain on the Ratusz ("Town Hall") tor. The crystallization of these minerals is influenced by the presence of weatherable pyrite, low environmental pH, moderate atmospheric humidity, and the summer season, as well as the tor's position at the valley bottom, directly above the Biała River floodplain and within a sheltered microenvironment. However, in early spring (April), at about 12°C, hydromagnesite $Mg_5[(CO_3)_4(OH)_2]{\cdot}4H_2O$ becomes the predominant component of the efflorescences on this tor, with hexahydrite and gypsum occurring as minor phases. The occurrence of hydromagnesite, which crystallizes under a clearly alkaline pH, in contrast to the precipitation of pickeringite and alunogen in acidic environments, indicates significant variability in environmental parameters driven by seasonal weather changes. During periods of strongly acidic conditions, pickeringite and alunogen form. However, when acid sulfate-bearing solutions are diluted by rainfall, snow and fog, these phases become unstable and dissolve, while rising pH levels stabilize other phases, such as hydromagnesite.

Biography:

Dr. Mariola Marszałek obtained her MSc (Chemistry) from the AGH University of Krakow (Poland) and her PhD (Earth Sciences, Geology) from the same university. Her PhD research focused on the mineralogical and geochemical aspects of stone deterioration processes in monuments exposed to air pollution. She currently lectures in mineralogy, chemistry, and geochemistry at the AGH University of Krakow. Her area of interest is rock and building material weathering in various environments, secondary mineral assemblages and their characteristics, the composition of black crusts on historic buildings as natural indicators of air pollution, and advanced research techniques. She has published various papers in peer-reviewed journals (e.g. Earth Surface Processes and Landforms, Environmental Science and Pollution Research, Minerals, Geology, Geophysics & Environment, Geological Quarterly, Sustainability, Quaternary International, Journal of Raman Spectroscopy, International Journal of Architectural Heritage).

Toward tenure security: The relationship between women's land ownership, formal land title documents and their empowerment

Imaneh Goli*

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Respect for land rights for women, as a key strategy to promote their development and empowerment as well as improving their welfare, has been considered in today's societies. However, there have been few empirical studies to back up this statement. Therefore, the primary goal of this research was to find out whether or not women may increase their authority through economic tenure security, legal tenure security, household characteristic, or de facto tenure security. In this regard, the survey data collected in 2021 from 28 villages of Mazandaran province (Northern Iran) were analyzed. The study highlights the significance of de facto tenure security as the most crucial among the four qualities assessed. It's important to note, however, that possessing land titles doesn't necessarily guarantee de facto tenure security. Despite this distinction, the study reveals a meaningful correlation, suggesting that women with land titles are more likely to experience higher levels of empowerment. Official certification, resolution of tenure disputes, increased agricultural income, and the impact of regional urbanization all play an important role in empowering rural women, which usually results in better economic outcomes for them. According to the results, it is evident that the legal registration of women's land ownership correlates with enhanced women's empowerment within rural communities. Land ownership provides women with the means to generate income, make independent choices, and actively participate in various aspects of social and economic life. The findings of this study underscore potential shortcomings in gender neutrality within land interventions, emphasizing the necessity for incorporating gender considerations into research and land-use planning. The practitioners and policymakers may utilize the study's findings to invest in programs that include components of land tenure security and increase women's economic empowerment.

Biography:

Dr. Imaneh Goli obtained her PhD in agricultural development. She is currently a postdoctoral candidate at University of Liège in Belgium. She has published about 25 journal articles with + 200 citations and h-index of 9. Her main focus is on agricultural land use change, agroecology, and the impacts of climate change on small-scale farmers, contributing significantly to the fields of environmental sustainability and rural development.

Process monitoring and operational control in the flotation process supported by AI methods

Jacek Galas[1*], Dariusz Litwin1, Kamil Radziak[1], Wiesław Małkiński[1], Marcin Karliński[1], Adam Czyżewski[1], Narcyz Błocki[1], Michał Kozielski[2], Dominik Borys[2], Dariusz Foszcz[3], Damian Krawczykowski[3], Daniel Saramak[3], Łukasz Pałka[4], Marcin Czekajło[4], Ewelina Kasińska-Pilut[4], Adam Klinkowski[4].

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[2]Sieć Badawcza Łukasiewicz – Instytutem Sztucznej Inteligencji i Cyberbezpieczeństwa, ul. Leopolda 31, 40-189 Katowice,
[3]AGH, al. Mickiewicza 30,30-059 Kraków,
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Although Copper occurs in natural ore deposits around the world, the ore enrichment process is a highly complex collection of procedures. The ore is enriched by a process called froth flotation where unwanted material, i.e. gangue, sinks to the bottom and is finally removed. The flotation process is a crucial part in this production chain. Its effectiveness can be related to many factors, namely: the lithological composition of the ore, chemical properties of reagents, and operational parameters. Conventional monitoring and control methods are insufficient, especially in maintaining optimal process conditions, maximizing recovery and minimizing costs. Therefore, our team has launched an initiative to harness AI-based solutions to optimize the flotation process directly at the ore enrichment plant. The involvement of AI in monitoring and control of the flotation process should provide significant operational and economic benefits to the Plant.

Biography:

Jacek Galas received M.Sc. degree from the Warsaw University (1976) and Ph.D. - the Warsaw University of Technology (1992). From 1976 to 2019 he was with the Maksymilian Pluta Institute of Applied Optics where he was involved in the multidisciplinary research projects in the field of image processing and analysis, Machine Learning techniques in biology, medicine, and industry. Currently he is with Łukasiewicz Research Network–Tele and Radio Research Institute and is mainly involved in the EU project on the mining industry. His field of interests concerns advanced sensors for the mining industry and applications of Artificial Intelligence techniques for control of the industrial technological processes.

Field Testing of Vibration Characteristics and Propagation Induced by Double-shield TBM Construction in Urban Areas

Yusheng Jiang*, Chenflong Liu and Xing Yang

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As urbanization grows, subway systems are essential for efficient and eco-friendly transportation of cities. The double-shield tunnel boring machine (DS-TBM) offers significant efficiency improvements over traditional methods, especially in hard rockmass. However, the vibrations resulted in its operation could give big influence on resident's comfort and ground structures. This study monitors the vibration characteristics and its propagation in Qingdao Metro Line 4 project in China, which employs a double shield universal compacting tunnel boring machine (DSUC-TBM) with a 6.3 m excavation diameter. We investigate two geological conditions: intact rockmass and jointed rockmass, including areas affected by fault zones. A detailed vibration monitoring plan was created, focusing on the time-domain and frequency-domain characteristics of vibration acceleration, using advanced low-frequency sensors and dynamic signal acquisition. Key findings include: 1) Vibration levels from the DSUC-TBM rise significantly before the cutterhead reaches the monitoring location, peaking between 20 mm/s² and 200 mm/s², with rapid attenuation afterward. Higher vibration accelerations correlate with more weathered rock. 2) In intact rockmass, construction affects buildings within 20 m in front, 9 m behind, and 12 m on each side of the cutterhead, with human comfort impacted up to 21 m in front and 10 m behind. In fracture zones, these distances change slightly, affecting comfort up to 25 m in front and 8 m behind. 3) Vibration and noise impact varies by time, extending to 40 m in front at night and reducing to 20 m during the day. This study highlights concerns with DS-TBM tunneling and sets the stage for future research on enhancing urban safety and comfort. The results aim to guide engineering practices in subway expansion, ensuring public well-being.

Biography:

Dr. Prof. Yusheng Jiang obtained his PhD (Mine construction engineering) from China University of Mining and Technology. He currently lectures on tunnel engineering and urban underground space engineering at the China University of Mining and Technology-Beijing. His area of interest include Shield and TBM tunnel engineering technology, Metro tunnel technical consulting and risk control, Urban underground space engineering, and Numerical simulation of geotechnical engineering. He has published numerous papers in peer-reviewed journals, including Tunnelling and Underground Space Technology, Construction and Building Materials, and Acta Geotechnica.

Dr. Chenglong Liu obtained his PhD (Geological and Geotechnical Engineering) from China University of Mining & Technology-Beijing. And now is concentrating on Metro Construction Engineering consulting works in Qing Dao Metro.

Dr. Candidate Xing Yang would get his PhD in this June from China University of Mining & Technology-Beijing on Civil Engineering.

Application of advanced soil mapping technique through different case studies

Alijagić Jasminka* & Robert Šajn

Geological Survey of Slovenia, Slovenia

This study presents an innovative approach to creating realistic soil prediction maps that illustrate the spatial distribution of particular chemicals through the evaluation and comparison of advanced modelling techniques. For this purpose, several case studies were selected based on the following selection criteria: a) intensive metal ore mining and metallurgical processing; b) unique geomorphological features; and c) uniform geological settings.

Soil measurements, together with geospatial data obtained from DEM, land cover data and remote sensing, are included in the spatial distribution mapping using an advanced predictive modelling technique. In order to simultaneously reconstruct the different processes that influenced the entire study area the novel approach had been applied. This comprehensive approach not only represents an innovation in contamination mapping, but the developed predictive models also help to reconstruct the main distribution pathways, estimate the actual size of the affected area and improve data interpretation. The outcomes can support more informed decision-making regarding land use and environmental management in areas impacted by mining activities.

Biography:

Dr. Jasminka Alijagić obtained her BSc (Chemistry for Multi Branches Study) and MSc (Geology) from the Masaryk University in Brno, Czech Republic and her PhD (Environmental Science) from the University of Nova Gorica, Slovenia. She works for Geological Survey of Slovenia, at department Mineral Resources and Geochemistry. Her PhD research was related to improving soil distribution models using advanced modelling methods such as polynomial regression and artificial intelligence (Multilayer Perceptron). She currently works on sediment risk assessment applied to contaminated sediments management as well as developing modelling techniques using quality and quantity components. Her area of interest is statistical data processing, data visualization, mapping, mining and environmental impacts. She has published various papers.

Deep Leaning Inversion of Marine Controlled Source Electromagnetic Data Using Convolutional Neural Network

Zhijun Du*, Pan Li & Yuguo Li

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This paper explores the application of machine learning (ML) techniques, specifically deep learning (DL), to the inverse problem of marine controlled-source electromagnetic (CSEM) data. A novel approach is proposed that combines the convolutional neural network (CNN) and recurrent neural network (RNN) to reconstruct electrical resistivity variation beneath the seafloor from CSEM data. The approach leverages the strengths of the two neural networks, where CNNs are employed for feature recognition and classification, while RNNs capture contextual information in sequential data. We apply the method for 1D inversion of a large number of resistive targets distributed at varying depths, exhibiting different levels of electromagnetic structural complexity. Next, we extend the proposed DL-based inversion to map higher-dimensional resistive targets to investigate its ability to resolve subsurface structural lateral variations. For this purpose, we combine multimodal learning (MML) into DL inversion and propose a novel MML-Unet method for conducting 2D inversion of frequency-domain marine CSEM data. The EM data possess multiple characteristic attributes, with frequency being a primary parameter. The MML-Unet method effectively extracts and leverages unique frequency-dependent features, establishing end-to-end mapping relationships that enhance data complementarity. We evaluate the accuracy of MML-Unet through several synthetic scenarios and apply the method to field data acquired in a geologically complex region of the South China Sea. Results from both numerical simulations and field data processing consistently demonstrate that DL-based inversions reliably reconstruct subsurface resistivity structures. Furthermore, the ability to integrate multi-sourced geophysical datasets is essential for performing geophysical joint inversion, and this study indicates that MML-Unet has broad application prospects in joint inversion in the field of geophysics.

Biography:

Zhijun Du received his PhD from the University of Trieste, Italy. He was formerly the Principal Geophysicist at PGS and is currently an Adjunct Professor of Marine Geophysics at the School of Marine Geosciences, Ocean University of China. With 25 years of experience in the field of geophysics, he is deeply immersed in academic and research. He has won the “EAGE Best Project Award” in 2009, the “SEG Best Paper Award” in 2010, the “ASEG-PESA Best Poster Petroleum Award” in 2015, and the “Special Merit Award” for E&P Engineering Innovation in 2015.

CO_2 content in Puerto Naos after the volcanic eruption on the island of La Palma-recalculation with artificial intelligence

Wolfgang Wehr[1]* and Roger P. Frey[2]

[1]Professor of geotechnical engineering, University of applied sciences, Erfurt, Germany
[2]Puerto Naos, La Palma, Spain

CO_2 measurements on the ground floor of a building from 2022 to 2024 were combined with meteorological data and analysed using artificial intelligence. Neural networks from the field of machine learning were used.

After training the neural networks, a high level of accuracy was achieved in both the training and the prediction (test). A correlation matrix was used to identify the most important parameters influencing the radon content.

Wind speed, wind gusts and wind direction have the greatest influence on the CO_2 values: the more wind, the lower the gas values. An evaluation over the course of the day revealed maximum gas levels at night, when air temperatures are at their lowest. Northern winds lead to the highest gas values due to suction effects.

Biography:

Prof. Dr.-Ing. M.Sc. Wolfgang Jimmy Wehr studied Civil Engineering from 1984 to 1992 at Braunschweig University in Germany, Grenoble University (INPG) in France, and Heriot-Watt University in Edinburgh, Scotland. He earned his Ph.D. between 1992 and 1998 in Karlsruhe, Germany, under the supervision of Prof. Gudehus, focusing on the topic of sand anchors without grout. From 1998 to 2015, he gained extensive professional experience, working as a site and design manager in the overseas division of Keller Grundbau GmbH, Germany, then as Head of the Research and Development division at Keller Holding GmbH, and later as Director of the Technical Corporate Services division within the same company. Alongside his industry career, he has also held academic roles from 2009 to 2025, serving as a senior lecturer in geotechnical engineering at Dresden University and as a professor in geotechnical engineering at the Erfurt University of Applied Sciences.

Facies analysis from a Late Devonian island arc setting of the Baruunhuurai Terrane, Mongolia

A.Munkhjargal [a,b]*, P. Königshof [a], J.A.Waters [c], A. Nazik [d], C. Crônier [e], Brett Roelofs [f], S.Gonchigdorj [a], S.K.Carmichael [c]

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[d]*Faculty of Engineering Department, Cukurova University, Mithat Özsan Bulvari, TR-01330 Adana, Turkey*
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[f]*School of Molecular and Life Sciences, Curtin University, Perth, WA, Australia.*

The mid-Palaeozoic is characterized by numerous significant events, predominantly documented in hemipelagic to pelagic settings, while shallow-water records remain underrepresented. To improve our understanding of Late Devonian palaeoenvironments, we investigated an isolated ecosystem within shallow-water/neritic facies at the Hushoot Shiveetiin Gol site, located in the Baruunhuurai Terrane of the Central Asian Orogenic Belt (CAOB). Spanning the Famennian to the Lower Mississippian, the section is composed primarily of siliciclastic rocks, interspersed with thin calcareous and volcaniclastic layers.

Conodont biostratigraphy indicates a range from the Palmatolepis minuta minuta Zone to at least the Palmatolepis rugosa trachytera Zone, although several zones are missing due to hiatuses typical of the facies setting. Comparative lithological analyses suggest that the thick sandstones in the uppermost section represent Lower Mississippian deposits. Eight facies' types were identified, reflecting palaeoenvironments ranging from shallow intertidal to open marine conditions.

The facies were influenced by coeval subaerial volcanism, resulting in extensive pyroclastic deposits that impacted faunal distribution, abundance, and diversity. Brachiopods and microvertebrates exhibit limited diversity, with the latter abundant only in specific layers. In contrast, ostracods display remarkable diversity and abundance across much of the section. Similarly, the crinoid fauna ranks as the most diverse Palaeozoic assemblage recorded in Mongolia. Trilobites from the Late Devonian deposits include both endemic and cosmopolitan species, highlighting the palaeobiological significance of the site.

Keywords: Baruunhuurai Terrane, CAOB, Late Devonian, biostratigraphy, volcanism

Biography:

Dr. Ariuntogos Munkhjargal holds a BSc in Geology from the Mongolian University of Science and Technology and a PhD in Geology from Goethe University of Frankfurt. She is currently a researcher at the Research Center for Stratigraphy and Palaeontology, School of Mining and Geology, Mongolian University of Science and Technology. Her PhD research focused on the stratigraphy and sedimentology of mid-Palaeozoic strata in southern Mongolia. Her academic interests encompass sedimentology, stratigraphy, palaeontology, and applications of differential equations in geological studies. Since 2020, Dr. Munkhjargal has published extensively in peer-reviewed journals, contributing significantly to the field.

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KEYNOTE PRESENTATIONS - DAY-2

6th Edition of World Congress on
GEOLOGY & EARTHSCIENCE
September 29-30, 2025 at Berlin, Germany

Experimental quantitative charge density redistributions in minerals exhibiting pressure induced phase transitions

K. Wozniak[1]*, A. Huć[1,2], P. Rejnhard[1] & R. Gajda[1]

[1]Department of Chemistry, [2]Department of Geology, University of Warsaw, Poland,

Calcite ($CaCO_3$) is one of the primary carriers of carbon in geochemical reservoirs. Carbonate rocks serve as hosts to various natural resources, including ores, oil, and gas, and are transported deep into the deep mantle at subduction zones. We traced a reversible phase transformation of Calcite-I to Calcite-II, from R-3c to $P2_1/c$ space group symmetry at pressure ranging from 0.85 GPa to 2.07 GPa. The reversible phase transition takes place at 1.5GPa. It involves twinning of crystals into two domains. The decrease of pressure removed twinning in all crystals which regained the quality suitable for multipole modelling. Will present detailed changes of electron density at atoms including changes of their shape, charge and volume under pressure and deconvolution of EoS into atomic EoSs.

Natrochalcite is rare mineral possesses H3O2- units forming one of the shortest hydrogen bond (HB) reported so far in inorganic compounds. High pressure conditions can lead to the formation of an extremely short single-well HB in natrochalcite and to the phase transition connected with symmetry lowering above 2 GPa. It crystallizes in the monoclinic space group C2/m. In this contribution, we will present details of changes of H- bonding in this mineral as a function of pressure as well as analyse variation of electronic parameters. Authors acknowledge a financial support within the Polish National Science Centre (NCN) OPUS21 grant number DEC- 2021/41/B/ST4/03010

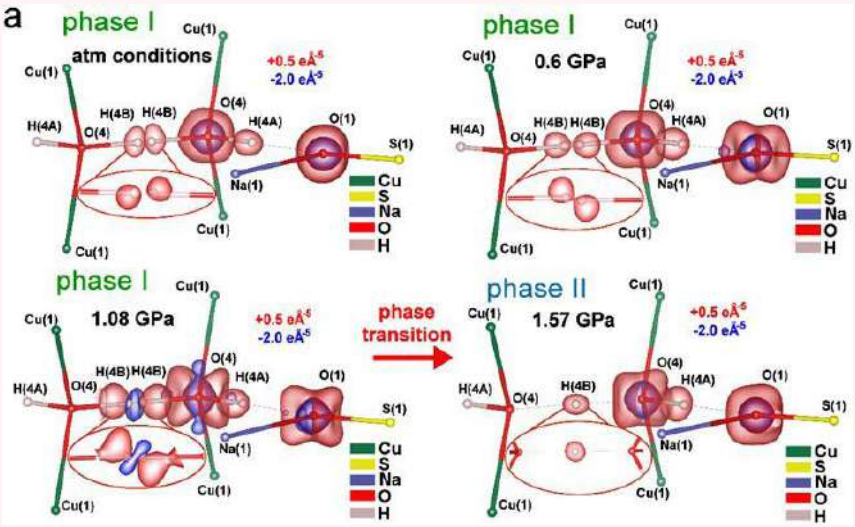

Fig.1. *Redistribution (changes of concentration and depletion) of electron density in the key H-bond in natrochalcite as function of increasing pressure. Maps of negative Laplacian of electron density.*

Biography:

Prof. Krzysztof Woźniak obtained his PhD (Chemistry) from the University of Warsaw (Poland). Postdoc and sabbatical stay at Cambridge University. 1992- PhD: "On Influence of H-Bonding on Properties of Molecules"; 1998 – Habilitation: "On Weak Interactions in Organic Solids. Head of: Crystallographic Lab., Structural Research Laboratory both at Chem. Deptm. Univ. of Warsaw (UW) and Lab. for Structural and Biochemical Research at the UW Bio. Chem. Centre and CryoEM and Electron Diffraction Facility at the UW Center for New Techn. Since 2002 Full professor. Fellow of the Chemistry Europe. Scientific interests: Quantum Crystallography such as Hirshfeld Atom Refinement (HAR), experimental wavefunction fitting, experimental charge density investigations, in particular applications of these approaches in high pressure research of minerals, ices, phase transitions in minerals under pressure and VT, hydrogen storage materials and superconductivity.

Integrating State-Level Geologic Mapping into the National Framework: The Role of ArcGIS in Advancing the National Geologic Map Database (NGMDB)

Lorraine Tighe

[1]*Director, Earth Sciences Solutions, Esri, Redland CA, USA*

This study explores the critical role that ArcGIS technologies play in advancing the goals of the National Geologic Map Database (NGMDB), focusing on how more than 30 U.S. state geological surveys are using these tools to standardize, share, and enhance access to geologic map data. Drawing on qualitative insights from state-level implementations, the study examines four key areas: data standardization, platform integration, workflow optimization, and public accessibility. The analysis highlights how states are not only adopting ArcGIS to streamline data management and visualization but also leading innovative efforts in public engagement and cross-agency collaboration. Together, these contributions are shaping a more unified, interactive, and future-ready national geologic data infrastructure.

Biography:

Dr. Lorraine Tighe is a geoscientist and thought leader with over 20 years of experience advancing Earth science through innovative mapping technologies. As Director of Earth Sciences Solutions at Esri, she leads national initiatives that integrate geologic, topographic, and natural resource data using GIS and Earth observation tools. With a Ph.D. in Earth Sciences (Physics), an M.Sc. in Remote Sensing, and a B.Sc. in Physics and Geology, Dr. Tighe brings deep scientific expertise to her mission of promoting sustainability through geospatial thinking. She is internationally recognized for her expertise in Synthetic Aperture Radar (SAR), 3D terrain modeling, and the application of GIS in open science. Dr. Tighe is co-editor of Addressing Earth's Challenges: GIS for Earth Scientists and a contributing author to the ASPRS DEM User's Manual. Her work empowers geologists, researchers, and policymakers to better understand and manage Earth's dynamic systems through cutting-edge geospatial solutions.

Anthropogenic sediment management and impact of human activities in coastal areas

Sergio Cappucci*

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Sediment can be used to create or restore beaches and to renew wetlands and other coastal habitats. Such activities are considered beneficial uses of sediment and represent a key strategy of adaptation to Relative Sea Level Rise (RSLR), enhanced by climate change. In the present study, we describe a straightforward and highly replicable methodology to assess the anthropogenic sediment budget within a coastal system, specifically selected in a partially natural and highly urbanized coastal area, characterized by erosion and accretion processes. In the Northern Tuscany littoral cell (Italy), the anthropogenic sediment budget has been calculated as an algebraic sum of sediment inputs, outputs, and transfer (m^3) within a 40-year time interval (1980–2020), implementing the methodological approach proposed by Cappucci et al. (2011).

Sediment management strongly influences the sediment budget and, even if its evaluation is crucial to assess the efficiency of a coastal management policy, it is often difficult to quantify the anthropogenic contribution to sedimentary processes. Different types of intervention are carried out by a variety of competent authorities over time (Municipalities, Marinas, Port Authorities), and the correct accountability of the sediment budget is no longer known or possible for the scientific community.

In some cases, like in the Northern Tuscany littoral cell, sedimentation is concentrated in a convergent zone and updrift of port structures, which have determined a series of actions, from offshore dumping and disposal into confined facilities (sediment output), to bypassing and redistribution interventions (sediment transfer); conversely, river mouths and coastal areas protected by groins and barriers are subjected to severe erosion and coastline retreat, resulting in many beach nourishments (sediment input). The majority of coastal protection interventions were carried out to redistribute sand from one site to another within the study area (2,949,800 m^3), while the sediment input (1,011,000 m^3) almost matched the sediment output (1,254,900 m^3) in the considered time interval. A negative anthropogenic sediment budget (243,900 m^3) is documented here.

Other case studies will presented in order to discuss different methodological approaches to understand evolutionary processes under variable climate conditions and preserve coastal habitats.

Biography:

Researcher from 2003 he is senior scientist at ENEA. Expert at the Ministry of the Environment from 2004-2008, he is Temporary Professor at the University of Sassari and other Institutions since 2003. Author of several publications (H index: 13; patents: 2), he has participated and coordinated national and international research projects. After obtaining his Laurea at “La Sapienza” the University of Rome on the design of pipeline on Sable Island Bank (Canada) and his Ph.D. at the University of Southampton (UK) on Venice Lagoon, He obtained a Master on Waste Management (2019), a MSc (II Academic level) on Environmental Law (2021) and the habilitation as Associate Professor of Applied Geology and Geomorphology (2023). He is investigating the Anthropocene, the sustainable development and related environmental issues on management of biomasses.

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SPEAKER PRESENTATIONS | DAY 2

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Fracture Displacement Basis Function (FDBF) Framework for Fast Geomechanical Simulations

Giulia Conti[1], Stephan Mattha[2] and **Patrick Jenny[1]***

[1] ETH Zürich, Switzerland
[2] North Eastern University (NEU), China

Predicting what permeability enhancements are feasible in fractured rocks and any accompanying seismic activity is challenging. Geomechanical simulations are computationally expensive, since they require discretizations which well resolve the matrix and all embedded fractures. Yet, such simulations are of high practical relevance for capturing the complexity of fractured reservoirs and for quantifying frictional sliding and tensile opening, e.g. in EGS, during CO_2 injection and during oil and gas exploration.

Here, we model associated deformations by assuming that the rock matrix is homogeneous with linear elastic behavior and that the slip and opening profiles of failing isolated fractures are elliptic with a linear relationship between maximum slip and induced stress. We employ such simplified single-fracture slip and opening solutions as basis functions to predict displacement fields by superposition. Overall stresses are obtained by mapping the basis functions to the fracture ensemble of interest. This stress field combines far-field- and all slip-induced stresses, whereas maximum slip and tensile opening along each fracture are computed based on local force balance constraints.

We demonstrate the methods predictive capability for single-, parallel-, and intersecting fractures, and for fracture networks. Importantly, our approach allows to dramatically reduce the number of degrees of freedom as compared to an element-based mechanics simulation of the same model. It also allows calculations of displacement and stress fields as simple superposition of precalculated basis functions. This opens the door for coupled mechanics, flow and transport simulations of realistic reservoirs with huge numbers of fractures.

Biography:

Patrick Jenny received his PhD in Computational Fluid Dynamics (CFD) from ETH Zurich. His research was mainly about developing numerical algorithms to solve the compressible Navier- Stokes-Fourier system for reactive flow with applications to studies of thermoacoustic instabilities. Then he spent two and a half years as a postdocdoral reasearcher at Cornell University, where he worked on Probability Density Function (PDF) methods for turbulent reactive flow simulations. Afterwards he joined the reservoir simulation and optimization research group of Chevron in San Ramon, California, where he worked on the company's next generation oil reservoir simulator project. Since May 2003 Patrick Jenny is part of the faculty at the Institute of Fluid Dynamics at ETH Zurich. His main research focus are multiscale problems related to porous and fractured media, turbulent flows and rarefied gas dynamics.

Selenate bioreduction in a large in situ field trial

M. Jim Hendry [a], **Lisa Kirk [b*]**, Jeff Warner [c,1], Shannon Shaw [d], Brent M. Peyton [e] and Erin Schmelinga, S. Lee Barbour [f]

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[b] *Enviromin, a division of RESPEC, 524 Professional Drive, Bozeman, MT 59715, USA; lisa.kirk@respec.com*
[c] *Canadian Light Source Inc., University of Saskatchewan, 101 Perimeter Road, Saskatoon, SK S7N 0X4, Canada*
[d] *SRK Consulting, 1066 W. Hastings St., Vancouver, BC V6E 3X2, Canada*
[e] *Department of Chemical and Biological Engineering, Center for Biofilm Engineering, 305 Cobleigh Hall, Montana State University, Bozeman, MT, USA*
[f] *Department of Civil and Geological Engineering, University of Saskatchewan, 57 Campus Drive, Saskatoon, SK S7N 5A9, Canada*

Removing selenium (Se) from mine effluent is a common challenge. A long-term, in situ experiment was conducted to bioremediate large volumes (up to 7500 mcL /d) of Se(VI)-contaminated water (mean 87 µg L) by injecting the water into a saturated waste rock fill (SRF) at a coal mining operation in Elk Valley, British Columbia, Canada. To stimulate/ maintain biofilm growth in the SRF, labile organic carbon (methanol) and nutrients were added to the water prior to its injection. A conservative tracer (Br) was also added to track the migration of injected water across the SRF, identify wells with minimal dilution and used to quantify the extent of bioreduction. The evolution of the Se species through the SRF was monitored in time and space for 201 d. Selenium concentrations of <3.8 µg L 1 were attained in monitoring wells located 38 m from the injection wells after 114 to 141 d of operation. Concentrations of Se species in water samples from complementary long-term (351–498 d) column experiments using influent Se(VI) concentrations of 1.0 mg L 1 were consistent with the results of the in situ experiment. Solid samples collected at the completion of the column experiments confirmed the presence of indigenous Se-reducing bacteria and that the sequestered Se was present as insoluble Se(0), likely in Se-S ring compounds. Based on the success of this ongoing bioremediation experiment, this technology is being applied at other mine sites.

Biography:

Dr. Lisa Kirk is Principal Biogeochemist and Manager of Enviromin, Inc., a division of RESPEC specializing in the geomicrobiology and environmental geochemistry of mine waste and mine-affected water. Dr. Kirk has more than 40 years of experience in biogeochemistry and design of in situ waste and water treatment bioreactors, with particular focus on management of nitrate, selenium, arsenic, mercury, nickel and sulfur in mine affected water. Dr. Kirk earned dual BA degrees from the University of Pennsylvania in Geology and Environmental Science. She then completed an M.S. in Aqueous Geochemistry at the University of Colorado and a Ph.D. in Ecology and Environment at Montana State University. She serves as an Affiliate Professor in the Montana State University Chemical and Biological Engineering Department.

Proboscidean post-cranial morphometrics and ecomorphology and their utility in reconstructing past environments

Pauline Mbete Mbatha

Doctoral Researcher, at the University of Helsinki, Finland.
Supervisors: Assistant Professor Juha Saarinen, Academy Professor Jukka Jernvall, University of Helsinki, Finland; Dr. William J. Sander, PhD, Museum of Paleontology, University of Michigan

I explore key post-cranial features that can be used to differentiate and identify new bones, podials, and metapodials of proboscideans, in particular true elephants of genera Elephas, Loxodonta, Mummuthus, and Palaeoloxodon. Understanding of the post-cranial differences in morphology and morphometrics between recent and fossil proboscidean taxa is currently lacking. Therefore, expansion of ecometric analyses of limb bones for proboscideans will be very important. This process will involve establishing morphometric criteria from extant and skeletal fossils collections in Africa and Europe for the post-cranial differences of these genera, which could be applied to identifying partial skeletons and isolated post-cranial bone specimens. Ultimately, understanding the post-cranial differences between proboscidean taxa serves as an important starting point for understanding how such post-cranial traits in proboscideans can be used in paleo-environmental reconstruction and how such traits serve as adaptations to move in different environments (e.g. forest elephants moving in closed environments vs “savanna’’elephants moving in open environments). This project will also involve description of a very important complete skeleton of c.f Elephas recki from Koobi Fora area 123, stored at Turkana Basin Institute facilities, in a comparative framework with other elephant fossils from Koobi Fora, Ileret, West Turkana, and Omo (Ethiopia). This study will be highly valuable because it will lay out a foundation for future work on potential ecometric value of proboscidean post-cranial bones. Additionally, this project could also inform us about habitat needs of extant elephants for conservation efforts. Our study at Area 123 indicates that Elephas atavus was more similar in relative limb bone proportions to Elephas maximus than to Loxodonta africana (although being intermediate in ulna proportions, suggesting perhaps intermediate locomotory adaptations).

Impact of entry pressure and hysteresis on the evaluation of two-phase gas migration in a deep geological disposal of radioactive waste

Zakaria Saâdi*

Autorité de sûreté nucléaire et de radioprotection (ASNR), PSE-ENV/SPDR/UEMIS, F-92260, Fontenay-aux-Roses, France.

Hydraulic characterization of clay-based materials and their representation by the adequate mathematical models is crucial for the safety of a deep geological disposal facility of high-level radioactive waste (HLW), hosted in a clay rock and backfilled with engineered barrier system (EBS) materials (bentonite, cement, backfill…) during the period of the post-closure phase. An adequate characterization can help to study efficiently the EBS performance with regards to the gas generated by metals corrosion within the repository (from HLW disposal cells and concrete rebars in drifts) and therefore to prevent hydraulic fracturing of the host rock and transport of released radionuclides to the environment. Here, I present examples of the major challenges that we are faced with worldwide for such a characterization by considering gas and water entry pressures, and hysteresis in hydraulic properties of these porous materials and their impact on two phase flow modelling. An example for the simulation of hydrogen migration in a small repository of 100 HLW disposal cells during the post-closure phase is also presented. It demonstrates that the hydrogen pressure build-up within and around the repository is highly underestimated when neglecting only gas entry pressure. Finally, some preventive solutions are presented to help alleviate the risk of hydraulic fracturing of the clay host rock following the higher gas pressures generated within the backfilled drifts.

Biography:

PhD and Habilitation to Supervise Research (HDR); Fluid Mechanics - Hydraulics-Hydrogeology from Ibn Tofaïl University (Kenitra, Morocco) - Joseph-Fourier University (Grenoble, France) - Paul-Sabatier University (Toulouse, France)

BSc (Fluid Mechanics - Hydraulics-Hydrogeology) from Ibn Tofaïl University (Kenitra, Morocco).

Dr. Zakaria SAADI obtained his PhD in the field of fluid mechanics applied to surface and subsurface hydraulics and hydrology from Ibn Toaïl University (Kenitra, Morocco), under a joint supervision with Joseph-Fourier University (Grenoble, France). He also obtained his HDR (habilitate) in the same field from Paul-Sabatier University (Toulouse, France); Has an in-depth knowledge of the principles/theories in the fields of soil and rock physics, agronomy, geosciences, geochemistry, catchment hydrology, as well as a deep understanding of multiphase flow processes and contaminant transport, formulations of mathematical problems and their applications.

After a rich postdoctoral research experience in different French institutes (IFP, INRA-e, CNRS), he joined the Institut de Radioprotection et de Sûreté Nucléaire in 2010 as a 'risk control assessment officer' to study radon transport from the geosphere to the environment. Currently, he works on transient hydraulic-gas phenomena in a deep geological repository for radioactive waste.

He published more than 20 publications in peer reviewed journals in the fields of mathematical and numerical modelling of transport phenomena related to geosciences.

A proposal for the classification of maximum wind speeds in Poland

Tadeusz Chmielewski*

Opole University of Technology, Opole ul. Katowicka 48; 45-061 Opole, Poland

The paper deals with the existing classifications of maximum wind speeds in Poland and their descriptions of their effects. At the beginning two extreme wind storms and their wind damage, i.e. the tornado in Poland of August 15, 2008 [3] and the derecho in Poland of August 11-12, 2017 [5] will be shortly presented. Next two recent classifications developed by the Institute of Meteorology and Water Management in Warsaw [2] and by Lorenc [1] are introduced. Their strong and weak points are briefly described. Shown in Table 3 is the data series for 37 annual maximum gust wind speeds (arranged in increasing order) measured at all meteorological stations between 1971 and 2007. The data are plotted on the Gumbel probability paper as shown in Figs. 1 and 2. The regression line is drawn by eye in Fig. 1 and by the method of least-squares in Fig. 2. Based on the measured and estimated wind speeds (taken from existing literature), the authors suggest new classifications for the strongest winds that may occur in Poland, as presented in Tables 4 and 5. In the future, Poland is going to construct some important structures, such as a central air terminal and some nuclear power plants, so knowledge about the strongest winds in our country is very important for engineers who will design these types of structures. In this case, the information given in Section 4 of the ISO 1382 standard [8] for identifying hazards, estimating, evaluating, and treating risk may be applied.

Highlights:

- The existing classifications of maximum wind speeds in Poland and their descriptions of their effects are presented.
- Their strong and weak points are briefly described.
- The data series for 37 annual maximum gust wind speeds (arranged in increasing order) measured at all meteorological stations between 1971 and 2007and plotted on the Gumbel probability are given.
- Based on the measured and estimated wind speeds (taken from existing literature), the authors suggest new classifications for strong and extreme winds that may occur in Poland, as presented in Tables 4 and 5.
- the information given in Section 4 of the ISO 1382 standard [8] for identifying hazards, estimating, evaluating, and treating risk for new design structures may be applied.

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Biography:

Dr. obtained his M.Sc (Civil Engineering) in 1964 from the Gdansk University of Technology and his PhD (Civil Engineering) and also D.Sc. from the same University. Post helds: Gdańsk University of Technology: assistant and assistant professor 1964-1973. Opole University of Technology: assistant professor 1973-1989, full professor 1989- 2015. Fellowships: US Gowernment Scholar-University of California, Berkeley 1976/77, DAAD, 2months Gottingen, Aachen, Bochum, Japanese Gov. Research Award, 2 month Tsukuba 1997.

Dental Enamel: the rocky dental tissue of vertebrates

Raquel F. Gerlach*, Gregoire Jean Francois Demets#, Natalia Macedo-Ribeiro*, Jonas Tostes-Figueiredo* and Sergio R. P. Line**

**Department of Basic and Oral Biology, FORP/USP, University of Sao Paulo, Ribeirao Preto, SP, Brazil; #Department of Chemistry, FFCLRP-USP, University of Sao Paulo, Ribeirao Preto, SP, Brazil;*
***Faculty of Dentistry of Piracicaba, State University of Campinas, FOP-UNICAMP, Piracicaba, SP, Brazil.*

This study presents a wide description of the evolution of calcified tissues in animals, with the intention to both appreciate the necessary molecular developments that enabled the appearance of the skeleton in vertebrates, and also bridge the gap between geology and biological sciences, since hard tissues in animals can exhibit important clues on the type of soil and the geological background. This study also explores the chemical and physical features of dental enamel (which is 96% mineral by weight, with a density of 2.95), comparing it with various calcium phosphate-rich minerals. Vertebrate calcified tissue hydroxyapatite is compared to hydroxyapatite found in rocks regarding macro and microscopic features, as well as regarding the reported trace elements found, water and organic matter. The evolutionary history of vertebrates is intrinsically linked to the development of a skeleton. This hard structure became the site to which muscles adhere, enabling contraction (and movement from other parts of the body towards a stationary point). At the same time, since the early origins, the skeleton became the main storage site for essential elements that are less abundant in the environment, such as Calcium and Phosphorus. Thus, the skeleton is an essential macro- and micronutrient storage compartment, whose importance is only now being realized, due to the exquisite difficulty in determining the precise amount of elements with accuracy. The development of a storage tissue with hydroxyapatite was the key to allow vertebrates to depend less on the immediate environment: animals could now move to forage, and could also carry the necessary elements inside their very bones to whatever place they went to. Hydroxyapatite of dental enamel also preserves fossil biological material (peptides) that last much longer than DNA, giving scientists the opportunity to obtain biological evidence carved in rock.

Biography:

Dr. Gerlach obtained her BSc (Oral Biology) and her PhD (Cell Biology) from the from the State University of Campinas (UNICAMP), Brazil. She also worked at the National Cancer Institute, one of the National Health Institutes (NCI/NIH), Bethesda, MD, USA. Her research has focused on the amounts of Pb in the most mineralized tissue of vertebrates (dental enamel) and how mixtures of metals impact the activity of matrix metalloproteinases. Currently, she studies how minerals in teeth reflect different types of soil. She lectures Histology and Dental Enamel at University of Sao Paulo, Campus of Ribeirao Preto, SP, Brazil. Her interest is to try to link changes in metal mixtures with changes in dental enamel, and to try to obtain information on the amount of essential metals available to the cells prior to the current era. She has published more than 150 papers in peer reviewed journals.

3D geological interpretation of gravitational and magnetic anomalies based on advanced nonlinear inversion

Ilya Prutkin*

Jena University, Germany

Usual strategies by interpretation of gravity and magnetic data are direct modeling or inversion for density distribution in lower half-space. In both cases, the number of unknowns much exceeds the number of observations; therefore, the solution is extremely non-unique and unstable. One can claim that the model does not contradict to observed data, however one should bear in mind that there are a lot of other interpretations, which substantially differ from the given one. We invert gravity and magnetic data for topography of a contact surface or geometry of a restricted body, then the solution is unique, moreover, with reasonable regularization we obtain the stable solution. With these advanced solution, we can exclude some geological hypotheses and chose the most substantiated geological interpretation.

All steps of our approach are demonstrated in 3D geological interpretation of gravitational and magnetic data for the Thuringian Basin, Germany. First, we separate sources in depth into shallow, intermediate and deep ones. Our numerical experiments with medium wavelengths reveal that if we explain negative anomalies with the topography of near-surface layers, the obtained solution is not supported by borehole data. These negative anomalies are thus explained by restricted bodies (granitic intrusions) at the depths from 4 down to 10 km. These bodies are located above a density interface with topography at the depth of approximately 10 km. Both the shape of restricted bodies and topography of the contact surface are found using our 3D nonlinear inversion algorithms. The 3D inversion of magnetic data (at short wavelengths) allows investigating a detailed structure of the upper boundary of the crystalline basement: two uplifts are found. By using the residual negative anomalies, we further study the salt tectonics, showing that geometry of a salt pillow with a thickness of approximately 200 m closely agrees with borehole data.

Biography:

Dr. Prutkin obtained his MSc (Applied Mathematics) from the Ural State University, PhD and DSc (Geophysics) from the Institute of the Earth's Physics (Moscow). Till 2003 – Institute of Geophysics, Ural Dept. of Russian Acad. Sci. From 2003 - Bochum University, 3D inversion of gravity data for Moho topography in the Hellenic subduction zone. 2004-2008 - TU Delft, precise geoid determination based on special Cauchy problem solution. 2009 - the Ohio State University, joint inversion of gravity gradiometer and magnetic data for Southern Ohio. 2009-2014 - Jena University, joint 3D inversion of gravity and magnetic data in the Thuringian Basin. His area of interest is 3D inversion of gravity, magnetic or EM data with his original algorithms and computer programs.

Metallogenic Expressions and Geochemical Contrasts of Silver-Bearing Galena in the Sidi Ahmed and Iguer Oujna Veins (Tighza District, Central Morocco)

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The Tighza polymetallic district (central Hercynian massif, Morocco) is known for its galena–sphalerite–silver veins, hosted in Ordovician and Silurian rocks. Among the most representative veins, those of Sidi Ahmed (West) and Iguer Oujna (East) exhibit contrasting morphologies and metallogenic expressions, despite being linked to the same multiphase hydrothermal system. The Sidi Ahmed vein, recognized to a depth of over 600 m, is hosted within Upper Ordovician shales and sandstones. It features a paragenesis dominated by galena–sphalerite within an ankerite and calcite gangue, overprinted by late-stage silicification. This vein exhibits banded, brecciated, and colloform textures. Secondary mineralization occurs in late fractures, associated with arsenopyrite and pyrite. In contrast, the Iguer Oujnavein, narrower but well-developed in depth (up to 400 m), is characterized by a single hydrothermal stage of siderite–galena–sphalerite type, with accessory pyrite, barite, and chalcopyrite. The gangue is dominated by siderite, often altered to a quartz–mica assemblage. This vein shows high variability in mineralization intensity, likely due to the complexity of hydrothermal events. The presence of tourmaline and white mica suggests a local magmatic influence. Geochemical analysis of galena from the Sidi Ahmed and Iguer Oujna deposits reveals contrasting compositions, reflecting distinct formation conditions. At Sidi Ahmed, the galena is weakly silver-bearing, with silver mainly incorporated through substitution in the crystal lattice, along with some silver-rich accessory phases. Conversely, the galena from Iguer Oujna shows marked chemical variability, with intra-crystalline zoning in Ag and Sb, indicating multiple hydrothermal pulses. Silver is present both in dissolved form and as micrometric inclusions, giving this deposit a more complex geochemical signature, dominated by a strong Ag–Sb correlation.

Keywords: silver-bearing galena, polymetallic, Sidi Ahmed, Iguer Oujna, Tighza, central Morocco

Mechanical-mineralogical properties and crack propagation of Sharm El Sheikh-Dahab Road, South Sinai, Egypt

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The weathered materials under consideration is subjected to instability, such as localized sinking and slip failure as well as massive primary and long-term settlement when subjected to even moderate load increase. It is therefore understandable that, constructions and buildings on these types of aggregates are often avoided being due to the settlement behaviour. From a construction point of view, the weathered aggregates are unfavorable as building ground and construction material.

Representative samples (made up of a composite taken from numerous locations in the site) may be taken from the location. The samples were tested for compliance with the grain size distribution and engineering properties (swelling, shrinkage and settlement). Also the parent rocks were tested for petrological characteristics.

Suitable geotechnical design parameters and construction techniques needed to be found for this type of ground condition. It is, therefore, necessary to expand our knowledge on the engineering or mechanical properties of these types of aggregates and mechanically improved to reduce the settlement because they change into soil due to the dynamic action and the change in water content even underneath Sharm El Sheikh-Dahab Road.

Keywords: Differential settlement, Swelling, Shrinkage, Road Cracks, Sharm El Sheikh-Dahab Road

Biography:

Dr. Ali I. M. Ismail obtained his BSc (Geology) from the University of Mansoura University, Egypt and his PhD (Geology) from Technical University Clausthal, Germany. His PhD research was based on the application of stabilizers on the improvement of road base. He is currently Professor of engineering geology and head of Geological Sciences Department at National Research Centre, Egypt. He has participated in international and national projects as principal investigator (PI). His area of interest is Engineering and Physical, Geotechnical Properties of soil and rocks. He has published various papers in peer reviewed journals.

AI-Driven Liquefaction Susceptibility Mapping for Offshore Wind Farms

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Soil liquefaction is a major concern for offshore wind farm development in seismically active Taiwan. This study presents an artificial neural network (ANN) model trained on synthetic data based on NCEER parameters to assess liquefaction susceptibility. Among six machine learning models, the ANN achieved the highest accuracy—100% on 112 cases—while maintaining over 91% accuracy using fewer input variables. Integrated with GIS, the model was applied to 120 offshore borehole logs from western Taiwan. Results show that six of twelve wind farm sites have high liquefaction potential across all depths, with SPT-N identified as the most critical factor.

Soil liquefaction poses a significant hazard to offshore wind farm development, particularly in seismically active regions such as Taiwan. To address this challenge, this study develops an artificial neural network (ANN) model to evaluate liquefaction susceptibility based on synthetic datasets generated from the well-established NCEER (National Center for Earthquake Engineering Research) parameters. The performance of the ANN model was compared against five other machine learning algorithms. Among these, the ANN demonstrated the highest predictive capability, achieving 100% classification accuracy on a benchmark dataset of 112 cases. Notably, the model maintained strong performance—exceeding 91% accuracy—even when using a reduced set of input variables, highlighting its robustness and efficiency.

To translate these capabilities into practical assessment tools, the trained ANN model was integrated with a geographic information system (GIS) platform. This allowed for spatial analysis and visualization of liquefaction risk across offshore regions. The model was subsequently applied to 120 borehole logs from the western coastal area of Taiwan, a key location for planned offshore wind energy infrastructure. The results revealed that six out of twelve proposed wind farm sites exhibit high liquefaction potential throughout their entire depth profiles. Among the input features evaluated, the standard penetration test blow count (SPT-N) emerged as the most influential factor in determining liquefaction susceptibility.

The study demonstrates the effectiveness of AI-driven approaches, particularly ANN-GIS integration, in providing accurate and spatially informed risk assessments for offshore geotechnical planning. These findings offer critical insights for infrastructure design, risk mitigation, and sustainable energy development in earthquake-prone marine environments.

Biography:

Prof. Cheng-Yu Ku is Vice President and Distinguished Professor at National Taiwan Ocean University (NTOU), where he also leads the Center for Ocean Engineering and Technology. His research focuses on geotechnical engineering, particularly the integration of artificial intelligence in hazard mitigation and infrastructure resilience. Prof. Ku has received multiple honors, including first prize at the 2010 Rock Mechanics Symposium, the National Science Council's Outstanding Young Scholar Research Award in 2011, and NTOU's Outstanding Social Service Award. He has authored over 300 publications, with more than 80 appearing in SCI-indexed journals. He serves on the editorial boards of Scientific Reports (Nature Portfolio), Applied Sciences, and the Journal of Marine Science and Technology, and frequently guest-edits special issues in top journals. According to ResearchGate metrics, Prof. Ku ranks in the top 8% of researchers worldwide and the top 5% in civil engineering, reflecting his strong international academic influence.

Geological Development Features and Application Directions of Rock Salt Deposits in The Nakhchivan Autonomous Republic

Elnara Seyidova[1*]

[1] *Nakhchivan State University, Nakhchivan, Azerbaijan*

This submission provides a scientific analysis of the geological structure, genetic origin, and mineral composition characteristics of the Duzdagh, Nehram, and Sust rock salt deposits located in the Nakhchivan Autonomous Republic. The research findings indicate that both deposits belong to the Sarmatian stage of the Neogene period and are part of evaporite complexes formed mainly as a result of intensive evaporation in lagoon-type water basins. The main deposit under exploitation and the focus of our study, the Duzdagh deposit, has an anticlinal structure and consists of 11 primary salt layers. These layers mainly consist of Miocene-aged rocks, and the salt strata extend at an angle of approximately 15° in the northeast direction. The NaCl content in this deposit is 97.7%. Small amounts of $CaCl_2$, MgCl, $CaSO_4$, K_2SO_4, and Na_2SO_4 salts are also found in its composition. The moisture content is close to 1%. The Nehram deposit, on the other hand, has a more complex geological structure and is manifested in the form of a periclinal anticline structure. The Nehram rock salt deposit is located within the sediments of the Karagan horizon. The bed-like rock salt layer varies in thickness from 43 to 92 meters and is not uniform in composition. Thin layers of clay, aleurolite, anhydrite, and gypsum are observed between the salt layers. The thickness of the salt layers ranges from a few millimeters to up to 7 meters, with the total thickness reaching up to 40 meters in some sections. The extracted rock salt here is of lower quality — the sodium chloride (NaCl) content ranges between 78–82%, while the amount of insoluble residues varies between 11–17%.

The Sust deposit also belongs to the group of ancient sedimentary rocks and extends in a northeastern direction at an angle of 15–17°. Its composition consists of 98.8% sodium chloride (NaCl), with minor amounts of mixed salts also observed.

The formation of all three deposits was significantly influenced by the region's tectonic activity, climatic conditions, and lithological-metamorphic factors. It has been determined that the Duzdagh and Sust deposits possess more favorable technogenic conditions for exploitation, while the Nehram deposit holds high scientific value due to its geochemical diversity. Overall, these deposits form a scientific-practical foundation for the rational use of Nakhchivan's natural resources, the study of regional geodynamic processes, and the development of the salt industry.

Biography:

I am Dr. Enara Seyidova. I obtained my Bachelor's degree in Geography from Nakhchivan State University. I completed my Master's studies in Physical Geography and earned my PhD in the Teaching of Geography at the same university. My PhD research focused on the systematization of environmental protection activities in geography education. I currently lecture on Ecology and Environmental Protection. At present, I am working on my doctoral dissertation entitled "Priority Directions of Economic Development in the Nakhchivan Autonomous Republic: Socio-demographic and Ecological Aspects." I have published several articles in peer-reviewed journals with impact factors.

Topographic variation and suburbanization currents: a comparative analysis of the south western and the north eastern fringes of dschang, Cameroon

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Suburbanization a facet of the development and extension of cities characterized by suburban zones at the detriment of the Central Business District. Evidence on the human triggers of this process exists, that of physical factors has received less literature attention. Closing the research gap, this paper uses the case of Dschang to analyse patterns of topographic differences as precursor of variations in suburbanization. Using the northern and southern borders of Dschang, relief data was collected through satellite imagery and field georeferencing (GPS, Garmin 65 to generate topographic data and Landsat imagery 2022 to generate data on land use/land cover). Data on differential trends of suburbanisation in the northern and southern borders were gathered through field observations. Altitude, slope gradient and land uses were

quantitative data collected while the perception that influence the growth of suburbia represented qualitative data. The results of the qualitative and quantitative data analyses showed that the truncated relief in the south western part characterized by the escarpment is a strong impediment to suburbanization due to limited technology. This has contributed to a truncated suburbanization and a high risk of environmental hazards as some urban dwellers continue to settle in rugged and non-constructible zones toward the south western part of Dschang. It's established that southern western part is characterized by sparse settlements and rangelands while the north-eastern fringe is dominated by growth poles leap-frogging north-eastward. The study recommends stringent planning and control of land use in the suburban to avoid future anarchy.

Keywords: Suburbanization currents; comparative study; borders; western highlands and Dschang.

Biography:

Nkumbesone Makoley Essone (PhD.) is an Associate Professor of Geography in the University of Douala. He is also the Chief of Service for Programs at the Directorate of Academic Affairs and Cooperation (DAAC), at the University of Douala. He is a member of the African society of Geographers (ASG), Cheikh Anta Diop Academy Society, several research Laboratories and research groups. He is a specialist in Urban Studies and has authored and Co- authored extensively in several international peer review journals.

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Seismic Inverse Modeling and Attribute Analysis of Complex Structures in North Absheron Region

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Azerbaijan State Oil and Industry University, Azerbaijan

This study presents a seismic inverse modeling approach to quantitatively interpret complex geological structures in the North Absheron region. Utilizing 2D seismic data, the research aims to enhance subsurface characterization and predict reservoir distribution by integrating seismic attribute analysis with geological evaluations. During the evaluation, particular attention was given to the tectonically complex structure of the region, where multiple high-angle faults (20–25°) disrupted the continuity of reflectors. Orthogonal and longitudinal seismic profiles were used to overcome correlation challenges, especially in the fold and flank zones of the structure. Seismic interpretation was supported by borehole and well-log data, and previous seismic survey results from neighboring areas. To address these complexities, seismic data were processed using advanced inverse modeling techniques, focusing on attributes such as RMS Amplitude, Variance, and Chaos. These attributes were analyzed to identify anomalies that indicate the potential of hydrocarbon reservoirs and to identify structural features like unconformities and fault planes. For instance, high RMS amplitude zones corresponded with sand-rich facies, while low amplitude areas indicated clay-rich sediments. Chaos attribute analysis revealed zones of structural complexity, identified the faulted regions and potential migration pathways. Seismic inversion and attribute analysis confirmed a four-element uplift structure within the Cretaceous deposits of the North Absheron region. Additionally, the study indicated that, along with the Maikop sediments, the Mesozoic deposits also have significant hydrocarbon potential.

Biography:

Aladdin Nasibov obtained his BSc in Geophysics from the University of Strasbourg and his MSc in Petroleum Exploration from the Azerbaijan State Oil and Industry University. He has previously worked on seismic interpretation and geological modeling projects with a focus on oil and gas exploration. His research interests include seismic attribute analysis, numerical methods, seismic data processing, and seismic inverse problems. He is currently a final-year PhD student at Azerbaijan State Oil and Industry University. His PhD research focuses on the application of mathematical modeling to solving inverse seismic problems in complex geological structures. He has authored several papers published in peer-reviewed Web of Science and Scopus-indexed journals.

Next Generation of Polyolefin Plastics: Improving Sustainability with Existing and Novel Feedstock Base

Alexander Reznichenko and **Ali Harlin***

Technical Research Centre VTT, Finland

This study presents an overview of existing and emerging olefin production technologies, comparing them from the standpoint of carbon intensity, efficiency, feedstock type and availability. Olefins are indispensable feedstock for manufacture of polyolefin plastics and other base chemicals. Current methods of olefin production are associated with significant CO_2 emissions and almost entirely rely of fossil feedstock. To assess potential alternatives, the technical and economic maturity of six principal olefin production routes are compared in this paper. Coal, oil and gas, biomass, recycled plastic as well as carbon capture and storage and carbon capture and utilization technologies are considered. We conclude that broader adoption of biomass based "green" feedstock and introduction of recycled plastic-based olefins may lead to reduced carbon footprint, however adoption of best available technologies and introduction of electro cracking to existing fossil-based olefin manufacture process can be the way to achieve highest impact most rapidly. Adoption of Power-to-X approaches to olefins starting from biogenic or atmospheric CO_2 and renewable H_2 can lead to ultimately carbon–neutral olefins in the long term, however substantial development and additional regulatory incentives are necessary to make the solution economically viable. Most viable short-term improvements in CO_2 emissions of olefin production will be achieved by discouraging coal-based production and improving efficiency of oil and gas-based processes. Gradual incorporation of green and recycled feedstock to existing olefin production assets will allow us to achieve substantial improvements in carbon efficiency in longer term.

Biography:

Prof Harlin is a material scientist and VTT research professor in the field of bioeconomy. His responsibilities include bio-based materials and industrial application thereof. His group is developing new methods and products, which are targeting for industrial application of materials, produced using renewable raw materials to generate new, sustainable value chains and to reduce our dependency on oil and the carbon footprint of consumption. He has as well leading role in research strategies in the field of lignocellulose. Working in the area of Bio-based materials and has previously acted as Professor at Tampere University of Technology, now docent of same, and adjunct Professor at Lappeenranta University of Technology. He has previously worked in industry with Borealis and Nokia-Maillefer and is inventor of several patents e.g. Borstar technology, and has been involved with several start-ups, recently Infinited Fiber Company Ltd.

Climatic changes during the Triassic in the eastern part of the German Basin based on palynological evidence

Anna Fijałkowska-Mader*

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Based on quantitative and qualitative analyses of the Triassic miospores assemblages from different regions of Poland climatic changes have been documented. Two different palynological methods were applied in this study – Visscher's and Van der Zwan's[1] method and Sporomorph Ecogroup (SEG) model of Abbink[2] and Abbink et al.[3] – to obtain palaeoclimatic and palaeoenvironmetal premises. The first method is based on the quantitative ratio of hygrophytic (mainly spores of hygrophytic plants) and xerophytic elements (mainly pollen of xerophytic plants). The SEG method, connecting dispersed spores and pollen with the floristic palaeocommunites occupied determined ecological niches, indirectly also provides climatic premises.

Xerophytic elements, dominated in the palynomorph spectra of the Triassic deposits from Poland, reflecting subtropical, warm, dry climate during most of the Triassic period. Significant numbers of hygrophytic elements, indicating temporary more humid phases, occurred in the late Olenekian, Ladinian, the middle-late Carnian, late Norian and in the Rhaetian. These pluvial periods, with the most scientifically recognized Carnian Pluvial Event (CPE), were associated with the influence of the Tethys Ocean and global tectonic processes.

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Biography:

Dr. hab. assistant professor Anna Mader obtained her BSc (Geology) from the Jagiellonian University of Kraków i and his PhD (Geology) from the Polish Geological Institute-NRI, where she completed her habilitation and received position of the assistant professor. Her professional career is connected with the Holy Cross Branch of the Polish Geological Institute. She has wide area of interest: stratigraphy, palynology, paleoclimate, paleoenvironment, paleoecology, petroarcheology, geoeducation, geotourism, geoparks. She has published various papers in peer reviewed journals. Her scientific achievements include, among others, the development of palynostratigraphy of the Devonian, Permian and Triassic deposits in Poland, determination of the Late Permian and Triassic climate and environment in Poland based of microfloristic offsets or cooperation in developing a network of geoparks in the Holy Cross Mountains (Poland).

Long-term Communication of Aftershock Forecasts: The Canterbury Earthquake Sequence in New Zealand

Anne M. Wein*,

U.S. Geological Survey, U.S.A; Sara K. McBride, U.S. Geological Survey, U.S.A; Julia S. Becker, Massey University, New Zealand; Annemarie Christophersen, GNS Science, New Zealand; Emma E. H. Doyle, Massey University, New Zealand; Matthew C. Gerstenberger, GNS Science, New Zealand; Sally H. Potter, Canary Innovations, New Zealand

During the 2010-16 Canterbury Earthquake Sequence in New Zealand, social and physical scientists collaborated to explore aftershock forecast communication in the long-term (e.g., over six years). A 2013 study identified aftershock forecast information needs to be various formats (e.g., text, tables, graphics) and channels (e.g., website, media, in-person) for different decision-makers; simple and accessible messages that incorporate local/regional context; preparedness advice and empathetic messaging; coordinated messages from trusted agencies and communicators; and access to progressively more technical information for those who seek it. Eight months after the 2016 M5.7 Valentine's Day aftershock, we held workshops with emergency managers, public health officials, and members of the public in Christchurch, New Zealand. We analyzed discussions about participants' experiences of the aftershock, information needs and aftershock scenario feedback for time dynamics of risk perceptions, earthquake preparedness, coping with uncertainty, trust in scientific sources, and information needs.

Key findings are: 1. divergent earthquake experiences revealed empathetic communication response needs for some new and re-traumatized residents and technical information (e.g., sequence behavior, earthquake sources) needs for others; 2. understanding aftershock sequence behavior is foundational to sense-making when large aftershocks occur; 3. strategic earthquake sequence updates from the trusted science agency and local agencies could serve as important reminders for earthquake preparedness and response coordination; 4. communication of aftershock forecast uncertainty could aid with the credibility of scientific information and living with uncertainty, and 5. inclusion of impact information and preparedness advice in aftershock scenarios could link to actionable information. Consideration of the dynamic contexts inform long-term communication of aftershock forecasts before a large earthquake; soon after the mainshock; in between damaging earthquakes; and following a damaging aftershock. Further research topics include effects of shifting risk perceptions on decisions; information and communications to maintain preparedness and coping with uncertainty; and development of impact-based forecasts.

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Critical Analysis of Rock Mass Classification for the Design of Underground Constructions

Boris Amusin*,

Dr. Sci., P.E. New York, USA

The contradictions observed in Rock Mass Classification (RMC) systems often arise from using plausible yet unreliable hypotheses that lack sufficient empirical validation. This study analyzes five geomechanical hypotheses and proposes a design solution based on the theoretical experimental method (TEM). The interaction mechanism between support structures and the rock mass is simulated using an axisymmetric visco-elastic-plastic model, accounting for post-failure rock deformations. For practical design, the author introduces corrective empirical and semi-analytical factors that incorporate additional geomechanical and technological considerations, such as the timing and distance of support installation relative to the tunnel face, the tunnel's orientation to rock stratification, proximity effects from adjacent excavations, and the presence of rubblework behind the support. The validity of the proposed methodology is confirmed through a comparative analysis of predicted displacements and support loads against field measurements.

Biography:

Boris Amusin, PhD, Doctor of Science Expert in underground engineering with a PhD in Subway Station Design and a Doctorate in Geomechanics. Authored 100+ publications (4 monographs, 73 papers), 14 USSR Mining Regulations, and 12 inventions (including a US patent). Awarded the USSR VDNH Silver Medal for the "TUNNEL" program. Presented at 24 international conferences. Designed a coal extraction system in Australia (invited by Prof. Lama) and taught geomechanics as a Visiting Professor at the Henry Krumb School of Mines, Columbia University. Licensed Professional Engineer (structural). Now retired but actively contributing to research and knowledge sharing.

In-situ tectonic stress characterization based on well logs and drilling data in the Tunisian Oriental Platform: A new result that enhances the coverage of high-quality data in North Africa.

Chaouki Khalfi[1, 2]*, Riadh Ahmadi[1] and Mustapha Meghraoui[3]

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[2]*Preparatory School for Engineer Studies of Gabes, University of Gabes, Tunisia*
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Conventional tectonic study techniques, such as tectonic outcrop and focal mechanism studies, are the most useful methods for characterizing in-situ stress in terms of orientation. However, the tectonic stress state determined appears to be relatively inaccurate, as the orientation error can exceed the tolerance. Consequently, the analysis and interpretation of borehole image logs and drilling data have brought as a highly effective technique over the past decade, facilitating precise characterization of in-situ stress states. The analysis, processing, and interpretation of the wellbore image logs and drilling data of four wells in the Oriental Platform of Tunisia resulted in an accurate determination of the azimuth of SHmax and the associated tectonic regime. Indeed, an azimuth of SHmax ranging between N147° and N154° was determined and deemed to be A-B raking quality. In addition, the in-situ geomechanical study determined the magnitudes of Sv, Shmin, and SHmax, which were converted to pressure gradients. The comparative study of the determined magnitudes revealed that SHmax is the largest and that Shmin is the least stress (SHmax > Sv > Shmin). Accordingly, the tectonic stress tensor types (σ1, σ2, σ3) have been assigned, and a strike-slip tectonic regime has been identified. The present work has yielded high-quality raked results that can enhance the coverage of high-quality data in North Africa and offer valuable updates to the WSM.

Keywords: SHmax, in-situ stress, tectonic regime, well data, image logs

Acceptability and Shelf Life Evaluation of Surimi Gel-Based Fish Bait under Refrigerated and Ambient Storage

Soosai Antony Emiema[1], Thangaraji Ravikumar[1], Krishnamoorthi Elavarasan[2], Neethirajan Neethiselvan[1], Fathiraja Parthiban[1], Balasubramanian Sivaraman[1] and Sangaralingam Mariappan[1]

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[2] Fish Processing Division, ICAR – Central Institute of Fisheries Technology, Cochin, Kerala 682 029, India

This study aimed to evaluate the shelf life of a surimi gel-based fish bait (SGFB) made with lizard fish surimi gel and 5% grouper bioattractant. The changes in its physio-chemical structure and microbial changes of the SGFB during the refrigerated and ambient storage were evaluated. Moisture content, water holding capacity (WHC) and folding test grades appeared to be decreasing while expressible moisture content (EMC) of SGFB showed an increasing trend as the frozen storage period extends. Total plate count (TPC) of SGFB increased significantly in ambient stored baits when compared to refrigerated stored baits. Atomic Force Microscopy (AFM) revealed the changes in baits structure during frozen storage, the baits became irregular and got loosened resulting in less smooth structure which shows that as the storage period increases, the Ra value increases and thus also increases the rigidity of the bait and hook holding capacity. Physical changes of the SGFB were evaluated and it resulted that weightloss and shrinkage (%) increased significantly in open condition than at closed condition, when baits were stored at ambient storage. While refrigerated stored baits resulted no change in it. Acceptability test of artificial baits under frozen storage showed a strong negative correlation among fishes however, bait stored in ambient temperature showed poor result as it was spoiled within 2 days. The study suggests that the even though refrigerated stored artificial fish bait showed physiochemical changes in SGFB, it doesn't show any negative impact on the acceptability rate of baits hence, surimi gel-based fish bait (SGFB) incorporated with grouper bioattractant can act as an effective artificial fish bait. However further research in open sea condition may confirm its suitability in commercial fishing.

Biography:

Ms. S.Emiema Ph.D scholar at Fisheries College and Research Institute pursuing in the Department of Fishing Technology and Fisheries Engineering. Completed my Master degree in Fishing Technology and Engineering in 2024. In my master degree, research was done in the field of Artificial fish bait development under the guidelines of Dr. T. Ravikumar, Assistant Professor, Department of Fishing Technology and Fisheries Engineering, Fisheries College and Research Institute, Thoothukudi. I have published many popular articles and two research articles.

Deceiving appearances: Neolithic game boards or what?

Gary Rollefson*

**Whitman College, Germanya*

In 1989 excavations at the Neolithic site of Ain Ghazal produced a slab of limestone measuring roughly 40 x 20 x 4 cm was recovered near a late 8th millennium BCE "apartment house". One of the surfaces bore two sub-parallel lines of circular depressions about 0.5 cm diameter chipped out with a narrow stone hammer. Clearly, the 'Ain Ghazal project joined with 17 other Neolithic sites that had produced a total of 51 game stones, and many of those sites also produced small colorful worked stones that fit those holes: obviously the gaming pieces, an assumption that had been agreed among the 18 authors who described their finds since the mid-1950s. Perhaps they were game stones, but if true, (some) people were playing with the protective mythical ancestral world, and that was probably not entirely enjoyable.

Biography:

Prof. Rollefson obtained his BA (Anthropology) at UC-Berkeley and his MA and PhD (Anthropology) from the University of Arizona. He has worked on prehistoric archaeology research since 1970, and in 1978 chose Jordan as the region for his focus that has remained to today. He started his own excavation at 'Ain Ghazal, Jordan in 1982, with newer projects in the Azraq Oasis Wetlands (1996-2008), Wadi Rum (2004-2009), the Jafr Basin (2006-7), and the Wadi al-Qattafi and Wisad Pools megasites in the Black Desert (2007-2022); he continues his Pleistocene to mid-Holocene research and writing (numerous publications). Rollefson retired from teaching at San Diego State University (1992) and Whitman College (2016) as Professor emeritus at both institutions.

Buoyant granular column collapses

Herbert E. Huppert*,

University of Cambridge, United Kingdom

We will present a study of fluid-particle interactions within complex granular-fluid systems such as particle-driven gravity currents. The dynamics of granular avalanches have similarities with natural geophysical flows, such as debris flows, landslides, and pyroclastic flows, whose instability, rheology, and deposition morphology are closely related to behaviours and particle scale dynamics of granular materials. We will discuss results obtained from coupled Lattice-Boltzmann discrete element method (LBDEM) simulations to explore the physics of buoyant granular column collapses in a subaqueous environment. We will further extend our observations and analyses to investigate the behaviour of natural flows, such as the propagation of volcanic clouds. We will indicate that the dynamics of these buoyant granular flows exhibit a similar scaling as the volcanic cloud propagation in Tonga, and the scaling transition demonstrates a regime change both within the granular system and on the boundaries between fluid and grains. This work further extends the scaling law of granular column collapses to examine the condition when particles are lighter than their ambient environment, and also to help shed light on the dynamics of similar airborne geophysical flows.

Biography:

Born in Australia, Herbert graduated from Sydney University before going to ANU in Canberra and then UCSD in California to complete his formal education. From there he transferred to Cambridge in 1968 supported by a two-year fellowship. However, he has not yet left! He was appointed the first Professor of Theoretical Geophysics and innovated the Institute of Theoretical Geophysics in Cambridge in 1989, having been elected to the Royal Society in 1987. He is keenly interested in fluid mechanics and environmental fluid mechanics in particular. He initiated with Sir Steve Sparks the subject of Geological Fluid Mechanics and has published in a number of areas, including: double-diffusive convection; solidification and melting; gravity current flows, at both low and high Reynolds number; carbon dioxide sequestration; formation of ice in the Arctic and Antarctic; turbidites and pyroclastic flows; flow of granular material; volcanic eruption dynamics; flows through coral reefs; and defense against tsunamis. He has been an author or co-author of some 300 papers with a current H number of 86 (according to Google Scholar).

Numerical Simulation of Pre-Seismic and Coseismic Continuous Response of Water Level to the 2014 Ludian MS6.5 Earthquake: A Case Study of Huize Well

Huimin Kong*[a], Hongbiao Gu [b] Haibin Wei [c]

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Groundwater is sensitive to seismic and tectonic activity. Continuous response of well water levels pre-seismic and coseismic provides further evidence for the relationship between seismic activity and changes in water level. However, quantitatively analyzing factors such as crustal stress variations, aquifer deformation, pore pressure changes, and dynamic fluctuations in well water levels from seismogenesis to seismic rupture presents challenges due to their complex nature. Additionally, research on pre-seismic and coseismic response has been separated temporally due to different physical mechanisms and research objectives. In this study, pre-seismic and coseismic response are considered as continuous processes that involve a series of physical phenomena including stress-strain-pore pressure-water level changes before and during an earthquake event. This study aims to establish quantitative relationships between these response processes and hydrogeological parameters, as well as rock mechanical properties, thereby revealing the underlying physical mechanisms governing the continuous pre- and coseismic response of well water levels. A mathematical and numerical model was developed to continuously analyze the pre- and coseismic response of well water levels based on hydraulic-mechanical coupling near fault sections using near-field earthquakes under static stress as a case study. To validate the effectiveness of the numerical model, a simulation was conducted to replicate the continuous pre- and coseismic response of Huize well water levels during the Ludian earthquake. Through the design, identification, and correction of various parameter schemes, the simulated values align closely with measured water levels for both pre- and coseismic periods. This research holds significant practical implications for earthquake monitoring.

Biography:

Dr. Huimin Kong obtained her Master of Engineering (Groundwater science and engineering) from the Beijing normal University and her PhD (Disaster Prevention and Reduction Engineering and Protective Engineering) from Institute of Engineering Mechanics, China Earthquake Administration. Her PhD research was foused on numerical simulation of pre-seismic and coseismic continuous response of well water level. She currently lectures Hydrogeochemistry at Institute of Disaster Prevention. Her area of interest is seismic subsurface fluid and environmental isotopes in hydrogeology.

Natural sequestration of carbon dioxide is in decline: climate change will accelerate

James C Curran* and Samuel A Curran

Independent Researcher, United Kingdom

Analysis of the Keeling Curve shows that the rate of natural sequestration of CO_2 from the atmosphere by the terrestrial biosphere has peaked and is now in decline. Atmospheric CO_2 concentrations will therefore rise more rapidly than previously, in proportion to annual CO_2 emissions. The effect is significant – for example, the current atmospheric increment of around +2.5ppm CO_2 per year would have been +1.9ppm CO_2, if the biosphere had maintained its 1960s growth rate. This effect will accelerate climate change and emphasises the close connection between the climate and nature emergencies.

Biography:

James Curran is retired. He has a doctorate in Meteorology and pursued an early professional career in meteorology, oceanography and hydrology, ending up as Chief Executive of the Scottish Environment Protection Agency. He is a Fellow of the Royal Society of Edinburgh, Chair of Scottish Environment LINK, and a Visiting Professor in the Centre for Sustainable Development at the University of Strathclyde, Glasgow. Professor James C Curran MBE FRSE, 15 Brooklands Avenue, Uddingston, Glasgow G71 7AT

Formation of vertical columnar seismic structures and seafloor depressions by groundwater discharge in the offshore southeastern Florida, USA

Kevin J. Cunningham[a], Sean Norgard[b], Richard L. Westcott [c], Edward Robinson[d], Harry J. Dowsett[e] and Marci M. Robinson[e]

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[b] *Sky Valley Exploration, Salt Spring Island, British Columbia V8K 2C3, Canada*
[c] *Cherokee Nation Technology Solutions, Tampa, FL 33634, USA*
[d] *Department of Geography and Geology, University of the West Indies, Mona, Jamaica*
[e] *U.S. Geological Survey, Florence Bascom Geoscience Center, Reston, VA 20192 USA.*

Vertical cross-formational fluid migration passageways within sedimentary basins can profoundly impact integrity of aquifer confinement and reservoir seal. In this study, vertical, columnar-shaped, sagging seismic structures up to 790 m in height and averaging 360-m width are characterized and their formation is hypothesized. These features are located in the karsted and drowned carbonate late-middle Miocene Miami Terrace platform and overlying deep-water Plio-Quaternary carbonate drift deposits offshore of southeastern Florida. The vertical structures are rooted in stratiform aquifers that are connected to the regional groundwater system of the Florida platform. The structures extend upward commonly along faults. Upper terminations are mainly two types, either subcircular seafloor depressions or buried in the subsurface and expressed as an upward reduction in columnar sag and mergence with undisturbed reflections. Following late-middle Miocene drowning and partial burial of the platform by the deep-water deposits, depressions along the platform top were points of origin for a second phase of column growth upward into the deep-water deposits. Deep platform cavity collapse and seafloor groundwater expulsion along the paleo-tops of the Plio-Quaternary deposits produced N-S current-parallel elongated pockmarks enhanced by bottom-current erosion. These pockmarks formed at water depths too deep to invoke near-surface meteoric karst processes, but rather were forced by cyclic sea-level falls that drove increased groundwater head gradients producing upward flow, seafloor discharge of freshened groundwater, and mixing-zone dissolution.

On upper-slope seafloor exposures of the platform a slope-parallel band of concentrated subcircular seafloor depressions occurs at water depths up to ~660 m. Here, faults and fractures produced by gravity-driven slope instability and possibly tectonics formed a network of fluid passageways that promoted upward artesian freshened groundwater discharge and mixing zone dissolution. Alternatively, depression formation was plausibly driven by early-late Miocene uplift of the platform with emersion that produced flank-margin sinkholes. Later drowning may have produced erosional sculpting of the sinkholes by bottom-current erosion.

Importance of alluvial aquifer small-scale physio-geochemical heterogeneities for environmentally relevant exports

Kristin Boye[1]*, Tristan Babey[2], Maya Engel[3], Meret Aeppli[4], Naresh Kumar[5] and Vincent Noël[1]

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[2]University of Rennes, Rennes, France
[3]Hebrew University of Jerusalem, Rehovot, Israel
[4] Swiss Federal Institute of Technology, Lausanne, Switzerland
[5]Wageningen University & Research, Wageningen, Holland

Alluvial aquifers are highly spatially heterogeneous in terms of texture, organic matter content, and resulting flow and redox dynamics. Typically, when data from such systems are interpreted and modeled, the small-scale heterogeneities (cm scale) are not accounted for. Several studies have recently suggested the need to include small-scale heterogeneities to account for large-scale observations.

Through a series of laboratory column experiments with natural alluvial aquifer sediments, we demonstrated that relatively small fine-grained lenses within a coarse-grained matrix had a significant impact on solute concentrations in downstream water. Multiple solid and aqueous phase analytical approaches coupled with reactive transport modeling revealed that the majority of solute (e.g., C, Fe, As, U) concentrations in exported water were driven by >0.6 µm organic exports from fine-grained to coarse-grained zones stimulating biogeochemical activity within the coarse-grained matrix. These results align with previous and ongoing field-scale observations and modeling studies for both aqueous and gas phase redox-related exports from soils and sediments nominally assigned as either oxic or anoxic, but exhibiting “anomalous” exports based on the overall assigned redox conditions.

Biography:

Dr. Boye obtained her B/MSc and PhD (Soil Science) from the Swedish University of Agricultural Sciences, Uppsala, Sweden. She was awarded funding to pursue a postdoc at Stanford University from the Swedish Wallenberg foundation and then transitioned into first an associate and then permanent staff scientist position at SLAC National Accelerator Laboratory. Throughout her career, Dr. Boye has developed a substantial network of scientists with different expertise and geographical homes and working locations. She has also published papers within multiple scientific journals on various environmental science related topics.

Differential effects of climate and litter quality on soil fauna-mediated litter decomposition across size classes

Lihong SONG*

Leshan Normal University, China.

Litter decomposition is significantly influenced by soil fauna, litter quality, and climate. Effects of soil fauna on litter decomposition are largely dependent on the size classes of the fauna. However, the understanding of how different soil fauna groups affect litter decomposition remains elusive. In this study, we conducted a global meta-analysis of experiments using litterbags with varying mesh sizes to quantify the contributions of mesofauna and macrofauna to litter decomposition by calculating log response ratios. Additionally, we quantitatively assessed how climatic conditions and litter quality influence the effect of these two faunal size classes on litter decomposition. Our findings demonstrated that mesofauna and macrofauna increased litter decomposition by an average of 12.25% and 22.14%, respectively. Furthermore, the relative increase in litter decomposition induced by mesofauna and macrofauna exhibited a significant statistical difference on a global scale. Specifically, in dry and temperate climatics, the effect of soil macrofauna on litter decomposition was significantly greater than that of mesofauna. Climatic conditions, particularly temperature and precipitation, were the primary factors influencing litter decomposition by both mesofauna and macrofauna. In contrast, litter quality significantly influenced decomposition only by macrofauna in dry and tropical climatic conditions. Our findings underscore that the relative increase in litter decomposition rates to mesofauna and macrofauna differed significantly on a global scale and that the climate and litter quality differentially regulate litter decomposition across faunal size classes.

Biography:

Dr. Lihong SONG obtained his PhD (Environmental Sciences) from the University of Chinese Academy of Sciences. He is previously worked for the Guizhou University in China. His PhD research was focused on the Biodiversity of testate amoebae and their indicating role in palaeohydrological reconstruction in peatland in NE China. He currently lectures soil ecology at Leshan Normal University from China. His area of interest is biodiversity and ecological function of soil fauna. She has published 20+ papers in peer reviewed journals.

A Contribution towards a More Sustainable Cement: Synergy of Mill Scales, Greek Wet Fly Ash, Conventional Raw Materials and Clinkering Temperature

Maria D. Kamitsou [1,2]

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[2] *INVALOR: Research Infrastructure for Waste Valorization and Sustainable Management, Caratheodory 1, University Campus, 26504 Patras, Greece.*

Portland cement is the most common type of cement and one of the most important ingredients in concrete. Concrete, on the other hand, is the most used building material worldwide just behind the water with an increasing usage trend in infrastructure for the upcoming years. During the production process of cement, massive CO_2 emissions are released into the environment, while large amounts of raw materials and energy are consumed. In the present study, Portland type cement was prepared in laboratory-scale by Greek Wet Fly Ash and Mill Scales, as well as conventional raw materials such as limestone, shale and lava. The experiments were conducted at 1450 °C and 1340 °C. The fired compositions were characterized by XRD, Q–XRD, optical microscopy, SEM/EDS and the concrete specimens were tested for their compressive strength. The results indicated that formation of cement clinker at lower temperatures (1340 °C) is feasible with the combined use of natural raw materials and industrial byproducts following the standard production route of cement industries. Finally, the so-obtained cement presented compressive strength values comparable to the conventional ones fired at 1450 °C.

Keywords: cement; GreekWet Fly Ash; iron lamination scales; byproducts; clinkering temperature; properties; sustainability

Biography:

I am a Materials Scientist with Ms degree in Chemistry and a PhD in Chemical Engineering from the University of Patras. I specialized in the synthesis, and characterization (chemical, mineralogical, environmental) of sustainable cement and ceramics. During my PhD studies, I trained and collaborated with TITAN SA in Drepano, Greece. I have extensive research and teaching experience; I have supervised a few diploma theses and participated in multiple research projects, including INVALOR and PHARMAMUDS. My research has resulted in 21 publications on cement and building materials, along with five on catalysis, biomaterials, and cosmetic chemistry.

Geologic influence on forest health, nutrition, and productivity

Mark J. Kimsey, Jr

Intermountain Forestry Cooperative, University of Idaho 875 Perimeter Dr, Moscow, ID USA

The growth and health of conifer forests within the Intermountain region of the western United States are significantly influenced by soil characteristics, which vary widely, being controlled by volcanism, metamorphism, and erosion/deposition. Geologic soil parent material plays a fundamental role in soil formation, determining nutrient availability, soil texture, drainage, and overall fertility. These soil factors directly impact conifer nutrition, affecting biomass partitioning, root development, and above-ground growth. In this presentation, we will explore the diverse geologic history of the Intermountain US region and the interplay between geomorphology, climate, topography, and forest management on conifer nutrition and growth. A fundamental understanding of these relationships are necessary for developing sustainable forest management plans.

Biography:

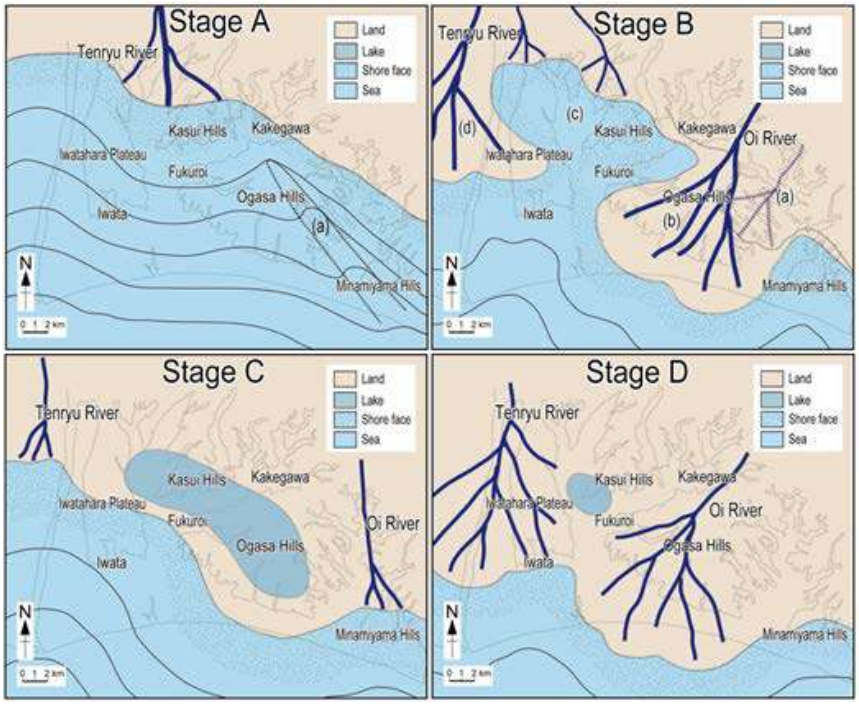
Mark Kimsey is Director of the Intermountain Forestry Cooperative and Co-Director of the National Science Foundation IUCRC Center for Advanced Forestry Systems at the University of Idaho. His professional career is centered on integrating forest science and ecology into operational forest management through applied research; collaborating regionally and nationally with forest industry to achieve practical, real-world solutions. Currently, Mark's work focuses on modeling and mapping tree and stand growth dynamics across multiple scales and regions of the United States. Kimsey enjoys teaching and mentoring the next generation of foresters through his forest sampling and measurement courses in the College of Natural Resources. Mark gives back to the forestry profession by serving as the Western US Region representative to the Society of American Foresters Forest Science and Technology Board and as the forestry representative to the Idaho Geological Mapping Advisory Committee.

Depositional process and palaeogeography of the Ogasa Group, Pleistocene series on the Pacific coast of central Japan

Masahiro Shiba

Museum of Natural and Environmental History, Shizuoka, Japan

Quaternary crustal movement of the Japanese islands caused the rapid uplift of mountain ranges and the relative subsidence of coastal and inland basins. In particular, from the Early Pleistocene, there was rapid uplift of the major mountain ranges, and in coastal areas, fan-deltas caused the burial of land shelf slopes and fan expansion. As one example, this paper presents the depositional processes of the Ogasa Group, which consists of gravelly fan-delta deposits on the Pacific coast in central Japan. The Ogasa Group divided into the Soga, Osuga, Kasui and Fukuroi Formations in ascending order. The depositional ages of these formations are estimated to be 1.78–1.19 Ma (Soga Formation), 1.19–0.91 Ma (Osuga Formation), 0.91–0.77 Ma (Kasui Formation), and after 0.77 Ma (Fukuroi Formation). The depositional processes and paleogeographical changes of the Ogasa Group can be divided into four stages as follows. Stage A: during the depositional stage of the Soga Formation, sand and mud were deposited from the shoreface to the continental slope, and at the late of this stage, the northwestward submarine channel was buried by coarse-grained sediments from the Tenryu River. Stage B: during the depositional stage of the Osuga Formation, the formation of a large fan-delta by the Oi River from the northeast, which successively advanced to the southwest, expanding the fan and extending offshore. Therefore, an inner bay was formed on its northwestern side, and sand and gravel from the Tenryu River were deposited. Stage C: during the depositional stage of the Kasui Formation, a lake was formed by sandbars formed offshore duo to the transgression. Stage D: during the subsequent deposition of the Fukuroi Formation, the fan formed by the Tenryu and Oi Rivers was thought to have expanded to the south.



Biography:

I graduated with a Master's degree in Graduate School of Oceanography, Tokai University and worked as a curator at the Tokai University Museum of Natural History, during which time I obtained a Doctor of Science degree. My PhD thesis was 'Geohistory of the Daiichi-Kashima Seamount and the Middle Cretaceous Eustacy', in which I studied marine geology, particularly sedimentology, palaeontology, sea-level change. On the other hand, the stratigraphy and geological structure of the Neogene to Quaternary system of central Japan are studied in the Fossa Magna region and the Pacific coast area of central Japan, particularly stratigraphy, biostratigraphy, sedimentology, sequence stratigraphy and geological structure.

A tsunami in Antarctica caused by the collapse of the Thwaites Glacier.

***R. Kh. Mazova[1,3],** A.D. Artemyev[1] and A. A. Baranov[2]

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[2]Institute of Earthquake Prediction Theory and Mathematical Geophysics, Russian Academy of Sciences, Moscow, 117997 Russia.
[3]P.P. Shirshov Institute of Oceanology RAS, Moscow 917435 Russia,

Among the glaciers of West Antarctica, the Thwaites Glacier located in the area of the Amundsen Sea is of special scientific interest. It is one of the largest and most unstable glaciers of the continent. Its area exceeds 190 thousand km2. In recent decades, the Thwaites Glacier has shown pronounced signs of accelerated destruction. There is an increase in the speed of ice surface movement towards the sea (Fig. 1), which exceeds 3 km per year [1]. The destruction of the Thwaites Glacier is caused by a combination of many factors, the main of which include the peculiarities of its geological structure, the impact of warm ocean water and the instability of the ice massif.

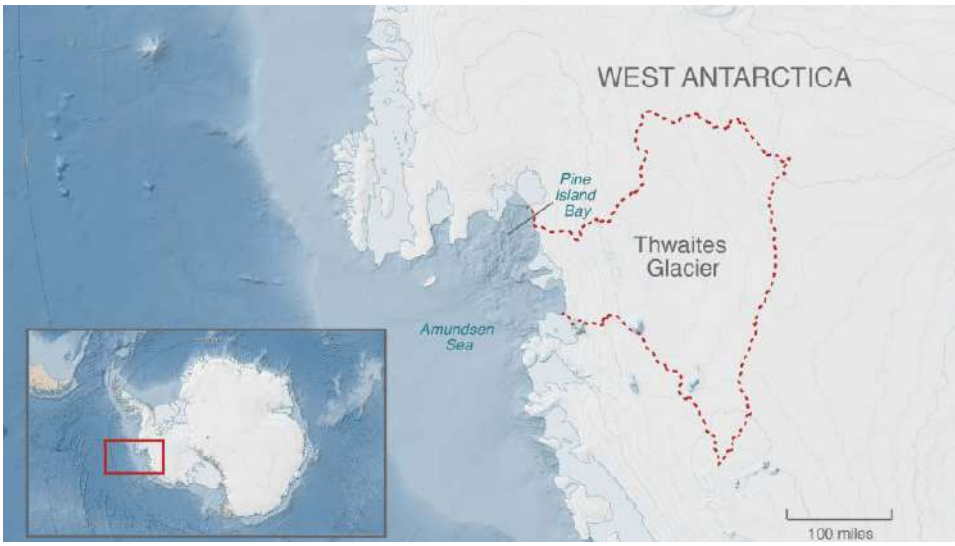

Fig.1 Location of the Thwaites Glacier in Antarctica [2]

To set the design geometric parameters, a longitudinal section of the Thwaites Glacier (Fig. 2) [2] was used, on which three zones of different stability were identified in accordance with the length of these zones.

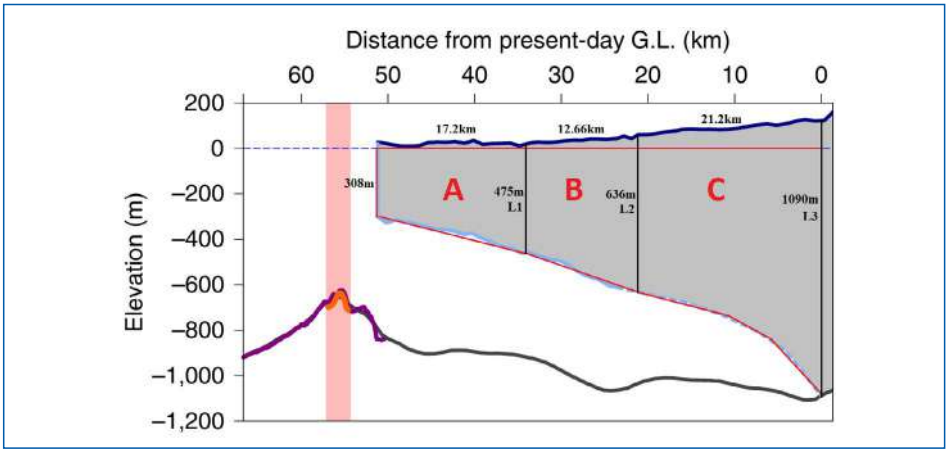

Fig.2. A cross-section of the frontal part of the Thwaites Glacier, divided into three possible fault zones (A, B, C) of different stability.

Numerical modeling of tsunami wave generation at possible collapses of underwater edge of the Thwaites Glacier is carried out, and their propagation in the Pacific Ocean is investigated. The waves characteristics of this process are obtained and the possible wave heights along the Pacific Ocean coasts are estimated. It is shown that even at the collapse of small zones of the Thwaites Glacier margin, the wave heights at some coasts of the water area under consideration can reach 30 m.

1. Lobkovsky, L.I., Baranov, A.A. & Ramazanov, M.M. Acceleration of Antarctica Glaciers at High Subglacial Heat Flow. Dokl. Earth Sc. (2024). 515, 586–591. https://doi.org/10.1134/S1028334X23603188
2. Graham A. et al. (2022), Rapid retreat of Thwaites Glacier in the pre-satellite era // Nature Geoscience. Pages 706 – 713.

Biography:

Dr. R.H. Mazova is a professor with a specialty in oceanology. She works at the Institute of Oceanology, Russian Academy of Sciences, Moscow University of Physics and Technology and Nizhny Novgorod Technical University, Russia. She lectures in mathematics, fluid and gas mechanics, and fundamentals of harmonic analysis. She has published more than 68 papers in international and Russian journals indexed in Scopus and Web of Science on the study of long wave (tsunami) generation, propagation and runup from seismic and landslide processes in various marine and oceanic areas. He has participated with papers in 36 international conferences. She is currently Vice President of the International Tsunami Hazards Community STH.

Low-cost and high-resolution geophysical data acquisition using ergodic survey design

Mengli Zhang*

Colorado School of Mines, United States

A traditional approach to improving geophysical data resolution is to increase the density of samples or sensor placement. While this method can enhance data quality, it also increases the costs significantly. However, higher resolution can be achieved without increasing the number of sensors. The newly developed ergodic sampling theory shows that the relationship between the resolution and the number of sampled data is nonlinear. Instead of placing sensors in a uniform grid, ergodic survey design uses an optimized non-uniform pattern. These non-uniform patterns can capture the similar informative measurements as the dense grid. As a result, it becomes possible to extract finer details from the same number of samples, i.e., improving the resolution without increasing the cost. Theoretical work and case studies show that ergodic geophysical survey designs can improve resolution by a factor of 2 to 10 compared to the traditional uniform sampling, all while keeping the acquisition cost constant. This approach is especially valuable for projects with limited budgets, offering a practical path to higher-resolution imaging and better decision-making in exploration and monitoring problems. In summary, ergodic sampling challenges the conventional mindset of "more sensors equal better resolution" and offers a cost-effective alternative by enhancing data quality through intelligent sampling design.

Biography:

Dr. Mengli Zhang is a Research Assistant Professor of Geophysics at the Colorado School of Mines, Co-Director of the Center for Gravity, Electrical, and Magnetic Studies (CGEM), and Principal Investigator of the Geo-Multiphysics Research Consortium. Her research centers on innovative geophysical data acquisition, multiphysics integration, and AI-enhanced interpretation to advance critical mineral and geologic hydrogen exploration. She leads several federally funded projects, including one supported by ARPA-E, and co-leads the world's first joint industry program on geologic hydrogen in collaboration with the U.S. Geological Survey. Dr. Zhang serves as an Associate Editor for the Journal of Applied Geophysics and is a frequently invited speaker at international conferences. Her work on geologic hydrogen has been featured in Financial Times, Bloomberg, New Scientist, and other global media. She is a member of AGU, GSA, and SEG.

Use of historical information on past floods over the last few centuries to assess extreme floods. Case studies on three French and German Rivers

LANG Michel*

INRAE, RIVERLY Research Unit, Lyon-Villeurbanne, France

This study presents three case studies on major rivers in France and Germany concerning the assessment of extreme floods. Historical information dating back from 1500, 1435 and 1225 (on the Rhône, Garonne and Rhine respectively) was used to extend the systematic discharge series derived from modern hydrometric networks. A Bayesian framework was used to reconstruct past flood discharges, based on flood marks, documentary sources and hydraulic expertise. A specific analysis is used to assess the uncertainties in flood discharges, which are greater in the past than in the present. A specific flood frequency model, taking account of uncertainties, shows the value and limitations of historical data. In some cases, it makes it possible to reduce the final uncertainty on extreme floods, while in other cases it is preferable to use only part of the historical data. As extreme floods by definition have a low probability of occurrence over a short period of several decades, these three case studies show how past floods can improve our knowledge of extreme floods.

Biography:

Dr. Michel Lang obtained his PhD (Hydrology) from the University of Grenoble. Since 1991, he has been working at INRAE, a French research institute, on the assessment of extreme floods using historical data, regional data and rainfall-runoff models. He has taken part in numerous projects and expert reports on design floods, at both French and European level. He published papers on historical floods, flood frequency modelling, trend detection and hydrometry.

Reductive immobilization of U and Se-79 under nuclear waste repository conditions

Mingliang Kang[1]*, Wujian Jin[1], Jingye She[1] and Yixiao Kang[1]

Sino-French Institute of Nuclear Engineering and Technology, Sun Yat-sen University, Zhuhai 519082, China

High-level radioactive waste (HLRW) is characterized by its strong radioactivity, high toxicity, long half-life, and heat generation. Its safe disposal is a global challenge. Deep geological disposal, based on the concept of multiple barriers, is internationally recognized as a permanent solution; however, no country has yet implemented final disposal. During the disposal process, which can last for tens of thousands of years, the key issue is how to prevent the release of radioactive nuclides if waste canisters fail.

HLRW mainly includes high-level liquid waste generated from spent fuel reprocessing and its vitrified forms, as well as spent fuel directly disposed of in geological repositories. In addition to uranium, spent fuel also contains various highly hazardous radioactive nuclides (such as ^{79}Se and ^{99}Tc). Oxidative dissolution of spent fuel can lead to the leaching and migration of these radioactive nuclides. Therefore, understanding the geochemical behavior of uranium and ^{79}Se under repository conditions is of great significance for the safety assessment of disposal facilities.

The Beishan granite area in Gansu and the Tamusu claystone area in Inner Mongolia are key research regions for China's HLRW repository. Our research shows that the presence of ferrous iron (mainly in the form of fluorannite mica and pyrite) in Beishan granite and Tamusu claystone enables both rock types to exhibit reductive precipitation effects on U(VI) and Se(IV). Meanwhile, the small amount of ferric iron in granite has a certain oxidizing effect on UO_2. Under the conditions of the Beishan granite and Tamusu claystone sites, the insoluble forms of UO_{2+x}(s) and $Se^0/FeSe_2$ are the most stable, which is conducive to the long-term safety of the disposal facilities[1-3].

Copper-cast iron is a widely recognized structural material for waste canisters internationally. In the oxygen-free underground environment, the corrosion of iron releases Fe^{2+} or produces magnetite (Fe_3O_4), along with the generation of hydrogen gas. Thermodynamically, magnetite can reduce U(VI) to UO_2. However, existing experiments on the reduction of U(VI) by magnetite have reported not only the formation of UO_2 but also incomplete reduction products (such as U_4O_9, U_3O_7, or U_3O_8). Our systematic study of the redox behavior of Fe_3O_4 towards U(VI)/UO_2 suggests that Fe^{3+} in magnetite and NO_3^- in groundwater are important factors that prevent the complete formation of UO_2[4].

Pyrite, the most abundant sulfide mineral on Earth, is widely present in the surrounding rock or backfill materials of disposal facilities. With Fe and S in low-valence states, pyrite can theoretically reduce U(VI) to insoluble UO_2(s) and Se(VI) to Se^0 or $FeSe_2$ under pH conditions ranging from 2 to 14. However, our previous work showed that under conventional experimental conditions, pyrite exhibited no significant reaction with U(VI) across most pH ranges and no reaction with Se(VI) at all pH levels[5]. Further research has revealed the following key mechanisms: (1) pH, As and Pb impurities in natural pyrite, and S^{2-} formed by the cleavage of Fe(II)-S bonds on the surface are important factors affecting the reactivity and products of pyrite's reduction of U(VI)[6]; (2) The γ-radiation present in disposal facilities can alter the reaction pathways between pyrite and U(VI) or Se(VI), significantly enhancing pyrite's reductive precipitation effects on U(VI)[7] and Se(VI)[8]; (3) The high temperatures generated by the heat release of waste can significantly accelerate the reduction reactions of U(VI)[9] and Se(VI)[10] by pyrite. For the first time, at temperatures of 75°C and above, we observed the complete reduction of U(VI) to the most thermodynamically stable product UO_2 by pyrite, with activation energies for the reactions between pyrite and U(VI) or Se(VI) exceeding 40 kJ/mol[9,10]. This confirms that these reactions are difficult under ambient temperature conditions.

Key Words: Pyrite, U(VI), Se(VI), γ-radiation, Temperature

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Biography:

Professor Mingliang Kang, based at Sun Yat-sen University in China, is primarily dedicated to the geological disposal of high-level radioactive waste. His research interests center on the geochemical behavior of redox-sensitive radionuclides at the water-mineral interface. Over the past five years, he has investigated how high temperatures and gamma irradiation, resulting from radioactive decay, affect the reduction of refractory Se(VI) and U(VI) by pyrite. His findings demonstrate that these conditions significantly enhance the reductive precipitation of aqueous U(VI) and Se(VI). These contributions have been published in esteemed journals such as Geochimica et Cosmochimica Acta, Chemical Geology, and Chemical Engineering Journal.

Stage IV-IRC: a high-resolution dataset of extreme orographic Quantitative Precipitation Estimates (QPE) constrained to water budget closure for historical floods in the Appalachian Mountains

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Quantitative Flood Estimation (QFE) in complex terrain remains a grand challenge in operational hydrology due to the lack of accurate high-resolution Quantitative Precipitation Estimates (QPE) for operational forecasting and model calibration. Here, we present a high-resolution (i.e. 250m, 5 minute-hourly) QPE dataset for 215 extreme (flood-producing) events from 2008 to 2024 for 26 gauged headwater basins in the Appalachian Mountains, USA. This dataset is developed by applying inverse rainfall corrections (IRC) derived from physically-based rainfall-runoff modeling (Liao and Barros, 2022 and 2023) to the Next Generation Weather Radar (NEXRAD) Stage IV analysis (4 km resolution, hourly). The corrected Stage IV analysis QPE is referred to as StageIV-IRC (Inverse Rainfall Correction). The unique advantage of this Stage-IRC QPE dataset is its agreement with ground-based rainfall measurements while achieving water budget closure at the storm-flood event scale within observational uncertainty of streamflow observations, which is the gold standard in hydrological modeling. This dataset is the first QPE dataset aiming to improve QFE in the complex terrain by reducing biases for extreme precipitation events and can be used to evaluate the skill of hydrologic models in the same basins and support model calibration. The StageIV-IRC QPE dataset is publicly available

Biography:

Dr. Liao obtained his BEng (Hydrology) from Wuhan University and his PhD (Hydrology) from Duke University. His PhD research focused on understanding and characterizing uncertainties involved in estimating extreme rainfall in global mountainous regions. He currently works as a postdoctoral researcher at the University of Illinois Urbana-Champaign. His area of interest is hydrology and hydrometeorology, incorporating AI techniques. He has published various papers in peer-reviewed journals.

Climate Models and the US Southwestern Precipitation in 1900-2100e

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The US Southwest (New Mexico, Arizona, Colorado, and Utah) precipitation during 1900-2024 decreased at an average rate of -1.16 cm per 100 years. The largest precipitation decrease occurred in the three months of February, March, and April. At the same time, the precipitation during the southwestern monsoon season (July, August, and September) was relatively stable. The ensemble mean of all CMIP6 (Coupled Model Intercomparison Project phase 6) climate models, as well as the regression model with the anthropogenic aerosol and Pacific Decadal Oscillation as predictors, project precipitation to increase in 2024-2100. This projected precipitation increase depends upon the expected decrease in the emission of anthropogenic aerosols, connected to the replacement of fossil fuel burning by renewable and nuclear energy sources. If the decrease of aerosols due to fossil burning does not occur, the precipitation is expected to continue decreasing.

The Importance of the 1862 Companies Act, The Day the World Changed

Phillip Lawrence

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This presentation is based on my 2024 article in the Anthropocene Review, where the 1862 Companies Act was proposed as the starting point of the era described as the Anthropocene, a period in the Earth's history during which human activity has significantly impacted the planet. The focus is on the newly devised structure of the corporation, a human invention that has monumentally changed many facets of the human relationship with our planet. The corporation has ancient roots dating back to the Roman era. It is modern manifestation was explicitly designed in response to the Industrial Revolution and the expansion of European states to many parts of the world, notably the British Empire. At the same time, in North America, the tense relationship between individual states of the union battled with each other to create versions of corporations based loosely on the 1862 Companies Act in the UK. In a very short time, the concept of the corporation, in its modern form, travelled around the world.

More recently, the study of the role of the corporation in society has been explored using the lens of Burrell and Morgan's 1979 Paradigms body of theory and Kuhn's paradigms theory from 1963, where the strength of the corporation as an institution remains intact regardless of incredible changes that have occurred over the past 250 years.

There is no doubt that corporations are responsible for the overwhelming damage that has been done to the Earth's ecosystem. Rather than seeking to control corporations over the past few decades, it appears that states have provided companies with greater freedom to operate as they see fit. It is evident in the amount of tax they avoid paying, the resources they are given access to, and the increasing inequality.

Biography:

Dr Phillip Lawrence studied business at the University of Technology in Sydney, UTS. After a long career in international business as a technology consultant to several of the world's largest businesses in the US, Europe, Scandinavia and Southeast Asia. Phillip then completed a Master of Management in Research exploring Ecological Modernisation Theory looking at how firms modernise and hopefully reduced their impact on the Earth's ecosystem. Phillip completed a PhD at the University of Sydney looking the interaction of business with politics the impact on the environment. More recently he is completing a Master of International Law specialising in the inability of international law to control corporations as they have escaped their home states and now operate globally.

Incorporation of incompatible elements in radiation damaged zircon by interaction with ground waters in the weathering environment

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Crystalline zircon is resistant to weathering. However, the decay of U and Th causes increasing radiation damage that breaks down the crystalline structure to an amorphous state. In the near surface weathering environment low temperature groundwater fluids can penetrate the metamict zircon resulting in loss of radiogenic Pb, gain of common Pb and the addition of other incompatible elements in cracks and the body of the zircon. The interaction of ground waters with zircon is indicated by zero-age U-Pb discordance trends, excess OH and changes in oxygen isotopes. Initially $d^{18}O$ decreases with increasing OH and with further increases in OH $d^{18}O$ becomes heavier. In solutions entering the zircon soluble elements such as Ca and Na and Fe^{2+} are transported as ions in solution. Elements such as Al^{3+} and Fe^{3+} are insoluble in the weathering environment and are transported as colloids. It is proposed that weathering fluids penetrate cracks and the metamict zircon by capillary action. Examples of weathering effects on ancient detrital zircons from a pebble conglomerate from within the weathering environment in the Jack Hills Western Australia are described. The potential addition of incompatible elements, including Fe and REE, and water to radiation damaged zircon during weathering needs to be considered in interpreting the significance of trace elements and oxygen isotopes in zircons.

Biography:

Dr R.T.Pidgeon obtained his BSc (hons) in geology from the University of Western Australia and his PhD from the Australian National University. He was a post-doctoral fellowship at the California Institute of Technology from 1965-67 and a Research Fellow at the Swiss Federal Institute of Technology (ETH) from 1967-68. From 1968-1976 he was Senior Lecturer and foundation leader of the Isotope Geology Unit of the Scottish Universities Research and Reactor Centre in East Kilbride. From 1976- 1978 he was a Senior Research Fellow in the Research School of Earth Sciences of the Australian National University and from 1978-1982 he was Director of the Nuclear Codes Section in Department of Science and the Environment of the Commonwealth Government of Australia. He was then Associate Professor and then Professor in Geoscience at Curtin University and is presently Emeritus Professor of Geology at Curtin University.

Agriculture, Water Quality, and Public Policy in the Upper Klamath Basin of Oregon and California

Stephen Kaffka[1]*, Ashok Daiwan[1] and Harry Carlson[2]

[1]Department of Plant Science, University of California, Davis (emeritus);
[2]University of California Intermountain Research and Extension Center (emeritus director)

The Upper Klamath Basin (UKB) is a high desert region straddling the California-Oregon border east of the Cascade Range. Irrigation and other agricultural practices in the region are thought to result in impaired surface water quality for anadromous fish in the Klamath River. A Total Maximum Discharge Limit (TMDL) policy regulates P in return flows to the river. A multi-year reconnaissance survey of surface water and agricultural tile drain locations was conducted, focusing on total dissolved solids, N, and P concentrations and mass transfers. Data were collected at 18 surface and 10 tile drain locations every ten days during the irrigation season (March through October) and one or two times a month during the remainder of the year. Water samples were analyzed for N, P, temperature, pH and electrical conductivity. Climate and water balance data over a multi-decade time scale were used with concentrations observed in samples to estimate transfers of salts and nutrients within the UKB. Total N increased from 2.3 mg L^{-1} on average in input waters to 4.0 mg L^{-1} in outflows at the Klamath Straits Drain. For total P (TP), input waters averaged approximately 0.27 mg L^{-1} to 0.40 mg L^{-1} over the same pathway. Atomic ratios (TN:TP) of surface water samples remained constant at approximately 10:1 throughout the system, suggesting that the amount of fine particulate matter in surface waters affected the values observed. In spring or early summer large NO_3-N values (range: 1 to 40 mg L^{-1}) were observed in shallow (1.1m) subsurface tile drains, inferring that some N from fertilizer and soil organic matter is lost in drainage. More N was removed in crop biomass, however, than was reported applied as N fertilizer in the region, but less P. Since surface waters entering the region were already enriched with N and P and return flows are small relative to river volume, it was unlikely that further reducing N and P losses from farming would make surface waters significantly less eutrophic. In recent years, a series of dams on the Klamath River have begun to be removed to favor greater use of the river by anadromous fish. Very large amounts of nutrient bearing sediments are being discharged to the river, undermining TMDL objectives. Current regulation of nutrients in return flows and overall water distribution in the UKB are the outcome of a longstanding political contest between local resource users and organized environmental interests at the state and national scale.

Biography:

Dr. Stephen Kaffka is professor emeritus of cooperative extension and specialist in the Department of Plant Sciences at the University of California, Davis. He directs the California Biomass Collaborative (http://biomass.ucdavis.edu/publications/). He has carried out agronomic research on crop production, resource use efficiency and sustainable farming practices. He has also worked on agriculture and water quality projects including the use of salt affected lands and low-quality water supplies for biomass production using salt-tolerant grasses in the San Joaquin Valley of California, and agricultural and water quality issues in the upper Klamath Basin. He has advised the California Energy Commission and its Clean Transportation Program, and has served as an ex officio member of the state's Bioenergy Interagency Work Group. He participated on the California Air Resources Board's Sustainability Standards and Indirect Land Use Change workgroups, and advisory committees on the state's low carbon fuel standard. He served as an invited reviewer of USEPA's third triennial report to congress on Biofuels and the Environment (spring 2023), was a member of a National Research Council's committee producing the report: the Renewable Fuel Standard, Potential Economic and Environmental Effects of US Fuel Policy. From 2003 to 2007 he was director of the Long-Term Research on Agricultural Systems Project at UC Davis, focused on the sustainability of farming systems in California. He supports the competitive grant program for the state's Dairy Digester Research and Development program and the Alternative Manure Management Program. Most recently has worked on alternative crops and sustainable management of dairy-forage systems in California, dairy nutrient recovery and reuse, and IPM practices in sugar beet production.

Multi-phase Evolution of Strike-Slip Faults in the Central Sichuan Basin, SW China

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[2] *PetroChinaCompanyLimited, Beijing, China.*

This study investigates the timing, evolutionary history, and genetic mechanisms of deep strike-slip faults in the central Sichuan Basin by integrating 3D seismic data and core samples with a combined approach of seismic–geological analysis and U-Pb geochronology of carbonate fault-fill cements. The results reveal that these faults began to take shape in the Late Sinian and evolved into a dextral transtensional system during the Early Cambrian. Prior to Permian sedimentation, they were overprinted by at least one episode of transpressional deformation. In the Late Permian, a structural reversal occurred, transforming the fault system into a weak sinistral transtensional regime. Only a few fault segments were selectively reactivated during the Indosinian or later tectonic phases.The evolution of these faults was strongly influenced by pre-existing structures, including extensional faults formed during the Nanhua rifting period and large NW-trending basement faults. During the terminal Sinian to Early Cambrian, the strike-slip faults functioned as oblique intra-plate transfer structures that accommodated differential extensional deformation—stronger in the north than in the south—within the Deyang–Anyue rift basin. The temporal evolution and deformation intensity of the faults are closely aligned with the tectono-stratigraphic development of the basin. Throughout subsequent tectonic stages, the fault system experienced multiple phases of inversion and selective reactivation under varying regional stress fields, reflecting a complex multi-stage tectonic history.

Biography:

Tian Weizhen is a Ph.D. candidate in Geological Resources and Geological Engineering at Southwest Petroleum University. His research focuses on the structural evolution and hydrocarbon-controlling mechanisms of strike-slip faults, with an emphasis on fault-controlled carbonate reservoirs in the deep Sichuan Basin. He has participated in multiple research projects and published more than ten academic papers. His research results have been applied in hydrocarbon exploration practice.

High resolution wind fields observed by Doppler radar network

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To retrieve wind field using Doppler radar data, a group of methods were developed for single radar, such as the techniques of VAD, VAP, VVP, etc. Another group of methods were for dual- or multi-radar, such as the techniques of ODD, EODD, MUSCAT, etc. This study presents a Co-volume scheme to retrieve 3-D horizontal wind field based on the V-IVAP method (Liang et al., 2019). By assuming the winds have first-order linear distribution within a 3-D volume, we can use the radial velocity observed by multiple radars of a radar network to retrieve volume-averaged winds, vorticity, and divergence. Because the vertical wind speed and raindrop falling speed do not affect horizontal wind retrieval by using V-IVAP, the constraint of the continuity equation that is adopted by the Dual Doppler retrieval technologies is unnecessary. Meanwhile, when using V-IVAP method with Co-volume scheme, it is feasible to retrieve wind fields from single, dual- or multi-Doppler radars in a radar network simultaneously. Cases were analyzed in this study based on the Doppler radar network of the China Meteorological Administration. For the extremely rainfall at Zhengzhou City of Henan Province on 20th July 2021, the retrieved winds reveal the evolution of a vortex, convergence, and wind shear accompanying the precipitation. For the extreme rainfall from 29th July to 1st August 2023, the winds along mountain slope were observed by the radar observations which connected to the precipitation. Wind fields from June to August in 2024 with interval of 1 hour and horizontal resolution of 3 km were retrieved in the region of Jing-Jin-Ji, and compared with the radio sounding observations. Up to now, Doppler radar wind retrieval remains a feasible way to obtain high temporal and spatial resolution 3-D horizontal wind field while the radio sounding and wind profilers are sparse.

Biography:

Dr. Xudong Liang obtained his BSc (Meteorology) from the Nanjing Institute of the Meteorology and his PhD (Meteorology) from the Institute of Atmospheric Physics/Chinese Academy of Sciences. He is previously worked as senior scientist and Deputy Director of the Shanghai Typhoon Institute and Director of the Institute of Urban Meteorology. He is senior scientist at the State Key Laboratory of Severe Weather Meteorological Science and Technique now. His PhD research was development of a model-constrained data assimilation technique. His area of interest is data assimilation, Doppler radar data analysis, and numerical methods. He has published various papers in peer reviewed journals in the fields of data assimilation, typhoon, Doppler radar wind retrieval etc.

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Liang, X. D., Y. X. Xie, J. F. Yin, Y. Luo, et al., 2019: An IVAP-based dealiasing method for radar velocity data quality control. J. Atmos. Oceanic Technol., 36: 2070-2085.

Continental and oceanic AAM contributions to Chandler Wobble with the amplitude attenuation from 2012 to 2022

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This study reconstructed the Chandler Wobble (CW) from 1962 to 2022 by combining the Eigen-oscillator excited by geophysical fluids of atmospheric and oceanic angular momentums (AAM and OAM). The mass and motion terms for the AAM are further divided with respect to the land and ocean domains. Particular attention is placed on the time span from 2012 to 2022 in relation to the observable reduction in the amplitude of the CW. Our research indicates that the main contributor to the CW induced by AAM is the mass term (i.e., the pressure variations over land). Moreover, the phase of the AAM-induced CW remains relatively stable during the interval of 1962–2022. In contrast, the phase of the OAM-induced CW exhibits a periodic variation with a cycle of approximately 20 years. This cyclic variation would modulate the overall amplitude of the CW. The noticeable amplitude deduction over the past ten years can be attributed to the evolution of the CW driven by AAM and OAM, towards a state of cancellation. These findings further reveal that the variation in the phase difference between the CW forced by AAM and OAM, may be indicative of changes in the interaction between the solid Earth, atmosphere, and ocean.

Biography:

Dr. Xueqing Xu obtained her BSc (cartography) from Wuhan University and her PhD (Geodynamics) from University of Chinese Academy of Sciences. She currently lectures Geodesy and Geodynamics at Shanghai Astronomical Observatory. Her area of interest is Global change, Data processing, Numerical methods. She has published various papers in peer reviewed journals.

Building Damage Caused by Fault Displacement in Recent Fault Zone Earthquakes and Effective Measures

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This study presents on examples of building damage caused by surface fault ruptures from past active fault zone earthquakes and effective countermeasures. Conventional fault displacement countermeasures have generally recommended avoiding active faults. However, as compared with years of building use, recurrence period of active faults is extremely long (several thousand years or more), and it is generally difficult to accurately determine in advance the location and amount of fault slip and fault types such as transverse and longitudinal displacement on the scale necessary for building design. On the other hand, earthquake-resistant technology for buildings has been advancing rapidly, and field studies of recent damaging earthquakes (e.g., the 1999 Taiwan Chi-Chi earthquake and the 2016 Kumamoto earthquake) have shown that buildings with earthquake-resistant design can significantly reduce damage even directly above a surface fault rupture. For this reason, various fault displacement measures have become available in recent years, and have been implemented in building construction and retrofitting.

Biography:

Prof. Hisada obtained his BSc and PhD (Structural Engineering) from Waseda University, Japan. He is previously worked for Department of Earth Sciences, University of Southern California as a research associate, and after working as an assistant professor at Department of Architecture, Kogakuin University, Japan, he is now a professor. He currently lectures earthquake and structural engineering at Kogakuin University. His area of interest is engineering seismology, and earthquake engineering. He has published various papers in peer reviewed journals.

Prediction of MS 6.9 Menyuan and M_S 6.8 Luding earthquakes in 2022 based on gravity data

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[2]*Innovation Academy for Precision Measurement Science and Technology, Chinese Academy of Sciences, Wuhan, China.*
[3]*University of Chinese Academy of Sciences, Beijing, China.*

In 2022, several strong earthquakes with magnitudes around 6 occurred consecutively in the western region of mainland China. The January 8th Qinghai Menyuan MS 6.9 earthquake and the September 5th Sichuan Luding MS 6.8 earthquake (both left-lateral strike-slip events) caused significant property damage, with the latter resulting in over a hundred casualties. Prior to these earthquakes, regional gravity changes were obtained based on gravity data observed by the China Earthquake Administration (CEA) in the surrounding areas near the epicenters. Combined with gravity changes observed before several other typical earthquakes, this change potentially indicated the likelihood of strong earthquakes occurring in the Qinghai Menyuan, Sichuan Luding, and nearby areas during 2021 and 2022. The actual epicenters of both earthquakes were located within 55 km of the centers of the predicted seismic hazard zones for different years. Before both earthquakes, alternating positive and negative gravity changes appeared concentrically around the epicenters. The overall gravity changes exhibited a distinct four-quadrant distribution pattern, with the rupture zone located within an area of negligible gravity change. A comparison between the pre-seismic gravity changes and the focal mechanisms of the two earthquakes reveals: the positive gravity change zones in the four-quadrant distribution correspond to the compressional zones indicated by the focal mechanisms, while the negative gravity change zones correspond to the dilatational zones. This finding contributes to the development of earthquake precursor theory[1].

[1] Zhao Y F, Zhu Y Q, Wei S C, et al. Prediction of M S 6.9 Menyuan and M S 6.8 Luding earthquakes in 2022 based on gravity data (in Chinese). Chin Sci Bull, 2023, 68: 2116–2123, doi: 10.1360/TB-2022-1055.

Biography:

Yunfeng Zhao holds a Master's degree from Chang'an University, China. He is currently pursuing a Ph.D. at the Chinese Academy of Sciences and working in China Earthquake Administration. His doctoral research focuses on gravity change analysis surrounding seismic events and the interpretation of its underlying mechanisms. His research interests center on earthquake precursor observation and research, the mechanisms of earthquake nucleation and occurrence, and related geodynamic processes. He has published various papers in peer reviewed journals.

Time Left Estimates to Critical Feedback/Loops: Proposed Annual Solar Geoengineering Pathways as CO_2 Goals Falter

Alec Feinberg*

DfRSoft Research, Northeastern University, United Statese

Feedback and feedback loop contributions to global warming (GW) are projected to increase significantly from the current 54% (loops: 29%) to 75% (loops: 56%) under faltering RCP pathways without Solar Geoengineering (SG). These projections suggest that we may not have enough time or capability to achieve necessary CO_2 reduction targets. A critical threshold, **RCPCritical**, where feedback loops surpass 50% and dominate warming, is estimated as a red flag timeframe between 2075 and 2125 without SG. At this point, reversing GW trends may become unfeasible due to tipping points risks. Current feedback levels may already be driving nonlinear acceleration in warming. Projections were supported by 3 (of 7) key data points: a no-feedback baseline from 1870, an estimated ECS range of 3.1°C–4.3°C (possibly reached by 2082), and trends that align with IPCC AR6 confidence levels. Given this, **Annual Solar Geoengineering Pathways (ASGPs)** are proposed—including Earth Brightening, Arctic-based Stratospheric Aerosol Injection (SAI), and feasible L1 sunshade systems to reduce feedback risks and extend time for CO_2 mitigation. These mild SG methods address key IPCC AR6 concerns. As of 2024, RCP2.6 targets have failed, putting RCP4.5 and RCP6 at risk. SG, though controversial, is significantly more efficient than Carbon Dioxide Removal (CDR) and has faster cooling potential via water vapor condensation. Meanwhile, CO_2 increased by +23 Gt (3 ppm) in 2024, with forest losses (+4 Gt) outpacing afforestation gains (-2 Gt), undermining CDR effectiveness. Furthermore, a noticeable planet albedo decline since 1998 must be addressed. Additionally, urbanization has contributed an estimated 13% to GW, supported by ground-based measurements and modeling, contradicting satellite albedo estimates. This supports the urgent need for urban Earth Brightening. A global ASGP strategy, led by IPCC working groups and supported by space agencies, is urgently needed to avoid reaching RCPCritical and to enhance climate sustainability.

Biography:

Dr. Feinberg obtained his Ph.D. from Northeastern University in Physics. He has provided volunteer climate physics-based research on Re-radiation Modeling for the Global Mean Earth's Energy Budget and the Albedo Advantage in GW Mitigation, the Development of Solar Geoengineering Models for Solar Radiation Modification, Annual Solar Geoengineering to Mitigate Yearly Global Warming Increase, Urbanization Heat Flux Contributions to Global Warming, Feedback Trends with Equilibrium Climate Sensitivity using Energy Rates detailing Feedback Doubling and the Urgent Need for Solar Geoengineering, and Annual Solar Geoengineering IPCC Pathways with Time Left Estimates Based on Critical Feedback/Loops. He has also provided physics-based and degradation modeling for Bell Labs Systems, The Analytical Sciences Company, NASA, Tyco Electronics, and Advanced Energy Solar Inverters.

Solar Geoengineering Likely up to 14 Times More Efficient than CDR: Issues in Climate Forcing and Governance

Alec Feinberg*

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This study introduces a steady-state, physics-based GHG Unsaturated Linear Forcing (ULF) model. By assuming linear amplification for each natural GHG, the ULF framework provides first-order, feedback-free forcing estimates. Because logarithmic saturation in standard GHG forcing formulas (e.g., AR6) tends to lower increments at higher concentrations, the ULF model is expected to give upper-bound forcing values. Surprisingly, combined ULF estimates for CO_2, CH_4, N_2O, and O_3 are ≈39% lower than the IPCC AR6 central estimates for 1750–2019, with the ULF doubling estimate for CO_2 ≈11% lower. This paradox underscores the diagnostic value of bounding models, pointing to possible discrepancies with AR6 estimates. Using this framework, solar geoengineering (SG) is found to be likely up to ≈12.6–13.8 times more efficient than carbon dioxide removal (CDR), with CDR cooling 85–93% less effective. General GHG removal is ≈60% less efficient, making SG up to 2.6 times more effective. The analysis reveals a fundamental asymmetry: Earth responds more strongly to changes in incoming shortwave radiation (albedo) than to changes in outgoing longwave radiation affected by GHGs. These findings underscore an overlooked global albedo crisis. Declining planetary albedo and urban practices such as dark pavements, roofs, and vehicles are intensifying warming, yet remain under-regulated despite cost-effective alternatives. Issues include satellite-based claims downplaying urbanization's role in warming contributions, especially given alternative studies and their UHI albedo measurement challenges. SG should therefore be viewed not as a temporary "Band-Aid" but as a premier mitigation tool. A sustained Annual SG strategy is recommended that combines surface brightening, space-based sunshading, and stratospheric aerosol injection (SAI), especially in the polar regions, offering urgent, high-leverage mitigation at a time when delays carry the greatest risks. Accordingly, the Paris Accord should be urgently expanded to include explicit albedo goals with particular attention to the Arctic and a ban on urbanization dark surfaces.

Biography:

Dr. Feinberg obtained his Ph.D. from Northeastern University in Physics. He has provided volunteer climate physics-based research on Re-radiation Modeling for the Global Mean Earth's Energy Budget and the Albedo Advantage in GW Mitigation, the Development of Solar Geoengineering Models for Solar Radiation Modification, Annual Solar Geoengineering to Mitigate Yearly Global Warming Increase, Urbanization Heat Flux Contributions to Global Warming, Feedback Trends with Equilibrium Climate Sensitivity using Energy Rates detailing Feedback Doubling and the Urgent Need for Solar Geoengineering, and Annual Solar Geoengineering IPCC Pathways with Time Left Estimates Based on Critical Feedback/Loops. He has also provided physics-based and degradation modeling for Bell Labs Systems, The Analytical Sciences Company, NASA, Tyco Electronics, and Advanced Energy Solar Inverters.

On the way to improve safety in building and mining industry - monitoring of rock bolt support systems

Andrzej C. Staniek

Central Mining Institute, Poland

One of the crucial aspects in preventing civil structures from damage is their reinforcement. In many areas it is done by installing of special support systems. It covers the area of building industry as well as mining practices. From economical point of view very efficient and robust is a rock bolt support system. It enables proper strengthening and easy access to the supported area. But what is very important here is monitoring of that support systems, namely quality control of installed rock bolts. If not properly inserted or damaged during excavation process, tremors or other circumstances they function to prevent a relevant structure or an object from collapsing is very doubtful. The problem is still present and different laboratories and scientific centers contribute and develop special techniques to control and monitor rock bolt integrity, load and quality of implementation. Though much was already done further investigations are relevant and should be continued. With that aim and to extend the diagnose scope in rock bolting the method for non-destructive identification of grouting discontinuity of rock bolts has been proposed and is still being developed. The method is based on modal analysis identification and sophisticated regression algorithms. The proposed solutions are referred to investigated different cases where rock bolt support systems are utilized. In that paper the recent results of practical implementation of the method are presented.

Biography:

Andrzej C. Staniek graduated from Silesian Technical University in 1986. Ph.D. at Central Mining Institute in 2004. Fields of research: modal analysis of mechanical structures, NDT of rock bolt support system, buildings damage detection, metrology, environmental testing.Place of work: Central Mining Institute, Katowice, Poland. Hobby: climbing, skiing, swimming.

Prognosis, based on field observations, of key issues emanating from permafrost instability

Christopher R. Burn

Carleton University, Ottawa, Ontario, Canada

Permafrost is a geologic manifestation of climate. It underlies almost 18 million km^2, or 15%, of the land area of the Northern Hemisphere and extends offshore in the continental shelves of the Arctic Ocean. Ground temperatures are rising throughout this region, and the thickness of the seasonally thawed active layer is increasing. In sedimentary terrain, the uppermost permafrost, just below the active layer, is ice- and organic-rich.

When thawed, ice-rich soil has a water content above saturation and so subsidence of the ground surface occurs above permafrost, leading to deterioration of infrastructure. Remediation is directed towards enhancing winter cooling of the ground beneath individual facilities or frequent rehabilitation of linear structures, such as roads. These activities are site-specific and planning future development will need to emphasize sites with little ground ice to lower the risk of thaw consolidation beneath foundations.

During the Holocene, the upper 3 m of permafrost terrain accumulated one third of global soil organic carbon, estimated at over 1000 billion tonnes, 125% of the atmosphere's C. Thaw depths encroaching into the organic-rich zone and higher soil temperatures have enhanced the supply of C to and respiration of soil biota. The balance will shift to net C emission by 2045. The effect on climate of enhanced emissions will depend primarily on whether C is released as CO_2 or methane. It is expected to equal emissions from a large industrial country.

Considerable attention is focused on communities experiencing accelerated coastal erosion, forcing their relocation inland, and in high mountains. Permafrost thaw creates enhanced risk from mountain geohazards throughout the world. In less developed countries, surface water resources for irrigation have been lost.

Global monitoring of permafrost change, critical for assessment of carbon emissions, has suffered from reduced scientific collaboration due to the war in Ukraine.

Biography:

Dr. Burn has led field programs on permafrost and climate change in western Arctic Canada since 1982. He has published over 200 scholarly contributions, including 125 in refereed journals and conference proceedings, and 46 book chapters. He recently retired formally as Chancellor's Professor of Geography at Carleton University. Over thirty of his former graduate students now live or work in northern Canada. In 2020–2024 he was President of the International Permafrost Association. He has been involved in the review of several development projects, including the proposed Mackenzie Gas Project and the Inuvik–Tuktoyaktuk Highway. In 2018 he was awarded the Canadian Polar Medal and in 2024 the Mentorship Medal of the Canadian Federation of Earth Sciences. He has a D.Sc. in Geography from Durham University. This paper is drawn from an international review led by Dr Burn and published by Permafrost and Periglacial Processes in 2025.

Social Construction of Volcanic Risk Perception from An Intergenerational Perspective

Esperanza López-Vázquez*[1], Elizabeth Ojeda-Rosero[2], Imke Hindrichs[1]

[1]Universidad Autónoma del Estado de Morelos, México
[2]Universidad de Nariño, Colombia

The Popocatépetl volcano, considered a high-risk volcano, is surrounded by populations that have integrated coexistence with the volcano into their culture and lifestyle. This has been transmitted through different generations since pre-Hispanic times. A qualitative research was conducted in the municipality of Tetela del Volcán in Mexico, located in a high volcanic risk zone. The main objective of this research was to analyze the social construction of the perception of volcanic risk considering the exchange of knowledge between different generations. An ethnographic and participatory study was carried out from symbolic interactionism, using elements of grounded theory and deductive elements for the analysis of information. The participants were adolescents, adults, and seniors from different social sectors. The results allowed the construction of a theoretical mapping of the processes of intergenerational construction of volcanic risk perception. It was found that different generations coexist, including adults born during the current period of volcanic activity. Also, risk perception is constructed from the integration of different dimensions. This work can help decision makers improve public policies, risk management practices, and risk communication strategies and disaster risk reduction.

Biography:

Dr. Esperanza López-Vázquez is director of the Risk Psychology and Environmental Behavior Laboratory at the Universidad Autónoma del Estado de Morelos. She was founder of the Latin American Risk Analysis Society. She is a specialist in the analysis of risk perception of people exposed to natural hazards, psychosocial responses to disaster risks and in the study of environmental behavior. She has published several papers in peer reviewed journals.

Fracture-based continuum modeling for the analysis of mechanical and hydrological processes in geologic media and examples

Goodluck I Ofoegbu*

GNO Modeling Research LLC, USA

This contribution to the conference describes fracture-based continuum modeling (FBCM) for the analysis of mechanical and hydrological processes in geologic media by modeling fractures explicitly in a continuum framework. FBCM models potential mechanical damage of geologic materials in terms of the initiation and propagation of discrete fractures. New fractures initiate as shear or tensile and thereafter, like preexisting fractures, can deform in slip mode or opening mode. Each fracture is modeled as piecewise-planar and, thus, consists of connected planar segments, each embedded in a continuum domain element. A fracture segment is implemented mathematically as a local transformation matrix used to calculate the fracture properties and behavior. Following this approach, fracturing is modeled without re-meshing. Also, fracture tip phenomena, propagation, and coalescence are not prescribed but evolve as determined by interactions among the continuum elements. The interactions are enforced through tensorial aggregation of the behavior of fractures and unfractured matter. Thus, the stress-strain relationships evolve as fractures initiate and deform. By modeling individual fracture segments in a continuum framework, FBCM combines the ease of continuum modeling with the accuracy of modeling fractures explicitly; therefore, offers significant advantages for the analysis of geology phenomena and relationships: e.g., faults and fractures; faulting and earthquakes; fractures and fluid flow; and human-induced perturbations such as in building foundations or hydraulic fracturing1. Fracture information provided by FBCM includes location, orientation (dip and dip direction), aperture, and type classification of new fractures as tensile or shear. Therefore, calculated results can be evaluated by comparing with fracture attributes from other analysis. The oral presentation will include an example from hydraulic fracturing and one from geotechnical analysis of foundations.

[1]Ofoegbu, G. I. 2024. Using fracture-based continuum modeling of coupled geomechanical hydrological processes for numerical simulation of hydraulic fracturing. Journal of Rock Mechanics and Geotechnical Engineering, 16 (5): 1582–1599. https://doi.org/10.1016/j.jrmge.2023.07.009

Biography:

Dr. Goodluck Ofoegbu obtained his BSc (Geology) from the University of Nigeria and PhD (Geological Engineering) from the University of Toronto. He previously worked for Southwest Research Institute as a Geological Engineering Specialist on assessing designs for geologic disposal of nuclear waste. His PhD research was on thermal stress analysis for steam stimulation of hydrocarbon reservoirs and modeling the constitutive behavior of sands. Dr. Ofoegbu currently operates a company that provides numerical geomechanics/geohydrology modeling to support civil, mining, and petroleum engineering analysis. His company also provides computer codes on license for such analysis. His area of interest is in modeling fractures explicitly in continuum analysis, for geomechanical-hydrological applications. He has published various papers in peer reviewed journals.

Seismically-induced failure mechanisms in massive rock slopes

Lorne Arnold[a], Joseph Wartman[b] and Mary MacLaughlin[c]

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[c]*Montana Tech, Geological Engineering, 1300 West Park Street, Butte, 59701, MT, United States*

This study presents the seismically-induced failure mechanisms and resulting failure modes in massive steep rock slopes. A dynamic implementation of the bonded particle model (BPM) for rock is used to simulate the dynamic response and initiation of fracture in the slopes. Observation of forces that develop within the model in response to wave transmission and dynamic excitation provides insight into the fundamental mechanisms at work in seismically induced rock slope failure. Five distinct mechanisms of failure initiation are identified using non-destructive simulations and confirmed with destructive simulations. Three distinct modes of rock mass movement enabled by the failure mechanisms are identified. The predominant co-seismic failure mode was a shallow, highly-disrupted cliff collapse. Cliff collapse is initiated by relatively low levels of shaking. Shallow failures are also triggered at higher levels of shaking prior to the initiation of deeper, more coherent failures in the same seismic event. The results of the numerical study agree with qualitative historical surveys of seismically-induced rock slope failure trends and provide insight into the mechanisms behind observed co-seismic rock slope behavior. The frequently observed shallow failures are triggered by high compression stresses near the cliff toe combined with shallow subhorizontal ruptures behind the cliff face. These mechanisms are not well-captured by simplified analysis methods which may lead to underprediction of shallow co-seismic events. Deeper failure surfaces from stronger shaking create a base-isolation effect, slowing further disruption in the failure mass. Slope dynamic response and damage accumulation were shown to be interdependent and complex, emphasizing the importance of further research into the interaction between rock mass strength, slope geometry, structure, and ground motion characteristics.

Biography:

Lorne Arnold, PhD, PE is an assistant professor of civil engineering at the University of Washington Tacoma. Lorne teaches classes on computational modeling, geotechnical engineering, and engineering ethics. Before moving to an academic position, Lorne spent several years practicing geotechnical engineering in the Puget Sound area. His project experience includes site exploration and characterization, foundations, deep excavation, and ground improvement engineering, geotechnical construction observation, including pile installation and testing, soil-nail and tieback installation and testing, inclinometer reading, and subgrade compaction. Lorne's research includes computational analysis methods, data analysis, and reliability-based engineering approaches. He has a particular focus on seismically-induced failure in rock slopes.

Inter-seasonal variation of rainfall microphysics as observed over New Delhi, India

Mohit Kumar

Indian Meteorological Department, Pune

This study analyzes the raindrop size distribution (RSD) characteristics over New Delhi by dividing the year into three seasons: PreM (March–May), monsoon (June–September), and PostM (October–February). Data from a Joss-Waldvogel Disdrometer, installed at IITM New Delhi, Rajendra Nagar, was used for three years(2021–2023). The observed raindrop spectra were fitted with three-parameter Gamma functions to obtain the RSD. ERA-5 and satellite data were also employed to establish atmospheric and cloud properties for the three seasons. The RSD for the monsoon season shows the highest concentration of midsize (1–3 mm diameter) drops and the highest mean rain rate. PostM has the least concentration of midsize and large (diameter >3 mm) drops. General statistics of rain integral parameters reveal high variability in rain rate (R) and mass-weighted mean diameter (D^m) values during the monsoon season. The mu-lambda scatter plots show considerable differences among the three seasons, indicating slightly distinct rainfall mechanisms in the three seasons. Z-R relations of the form $Z = aR^b$ were derived, with the highest coefficient (a) values observed for the PreM precipitation. The exponent (b) is found to be greater than unity in all three seasons. Rainfall was stratified based on rain rate. RSD gets broader with increasing R. Large drops are not found appreciably in the spectrum for R < 20 mm/h. A notable disparity between convective and stratiform RSD is evident. The values of rain integral parameters show considerable differences between the convective and stratiform regimes. A higher fraction of large drops is found for the stratiform rainfall in the PreM season compared to the other two seasons. CAPE, water vapor, surface temperature, and surface winds were higher during PreM and monsoon months compared to PostM. The distribution of differential temperature (δT) indicates that clouds with significant depth are found in PreM and monsoon seasons but are often lacking during PostM.

Energy dissipation, fault dilation, and rock strength of experimental rock failure

Ze'ev Reches[a, b] and Nadav Wetzlerc

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[b]*University of Oklahoma, Norman, OK, USA*
[c]*Geological Survey of Israel, Jerusalem, Israel*

Rock-failure is usually analyzed by using stress-based criteria with the empirical parameters of cohesion and internal friction, for example the Coulomb criterion. We developed an alternative rock failure theory that is based on two conditions: rocks fail under a critical elastic energy level, and the applied elastic strain is accommodated by shear and dilation along the faults (Reches and Wetzler, 2022). We refer to this theory as Critical Energy Fault Failure (CEFF) and demonstrated its applicability to a range of rock failure experimental configurations from uniaxial to polyaxial loadings. We present here the utilization of the energy-based CEFF theory to highlight three aspects of rock failure: A. Evaluation of the dissipated energy associated with rock faulting indicating that intact rock failure dissipates 35–55% of the available elastic energy. B. For a given normal stress, the CEFF calculated shear strength of a developing fault is smaller than the equivalent of the Coulomb shear strength. C. The predicted dilation associated with faulting of intact brittle rocks that is calculated by CEFF is supported by experimental observations. These three subjects provide important contributions for the understanding of rock failure processes.

Biography:

Dr. Ze'ev Reches studied in the Hebrew University (BSc, MSc) and Stanford University (PhD). He served as a faculty member in the Hebrew University and Oklahoma University; he is currently a Professor Emeritus. Dr. Reches research focuses on structural geology, rock-mechanics, and earthquake physics. Dr. Nadav Wetzler studied in the Hebrew University (BSc, MSc, PhD), and accomplished postdoc at UC Santa Cruz. He currently works as a seismologist in the Geological Survey of Israel. Dr Wetzler research is in theoretical and applied seismology.

Full-Waveform Seismic Modeling Based on Digital Geological Model Using Spectral Element Method

Yu.P. Ampilova, **A.V. Vershinina,** V.A. Levina, K.A. Petrovskiib

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This study presents a comprehensive approach to full-waveform seismic modeling [1,2] utilizing a digital geological model through the spectral element method (SEM), with applications in seismic exploration [4]. The research addresses the three-dimensional dynamic problem of elasticity theory, focusing on the propagation of seismic waves in heterogeneous geological media. Key features of the SEM, including high-order spatial discretization and explicit time integration [5], are compared to traditional finite element methods (FEM). The implementation of the algorithm on Nvidia GPUs using CUDA technology is explored, highlighting the efficiency of parallelization in hybrid systems. Results demonstrate the modeling of seismic wave propagation in complex geological structures, including faults and varying material properties, using a detailed digital geological model from an Arctic petroleum field. The outputs, stored in the SEG-Y format, facilitate the analysis of synthetic seismograms and wavefields, underscoring the practical significance of this research for future applications in diverse geological conditions. According to the authors, this modeling is of particular importance when studying the 4D response in the design of permanent seismic monitoring of oil and gas fields under development [3]. The findings advocate for the integration of full-waveform seismic modeling into standard seismic exploration practices, enhancing the accuracy and reliability of subsurface investigations.

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Biography:

Professor of the Chair of Computational Mechanics of the Faculty of Mechanics and Mathematics of Lomonosov Moscow State University, Doctor of Physical and Mathematical Sciences, member of the Russian National Committee on Theoretical and Applied Mechanics. Anatoly Vershinin developed methods for numerical discretization of nonlinear partial differential equations of the theory of multiple superposition of large deformations and algorithms for their parallelization on massively parallel computing systems, which formed the basis of the industrial software for structural engineering analysis CAE Fidesys (HYPERLINK "http://www.cae-fidesys.com"www.cae-fidesys.com). Anatoly Vershinin graduated with honors from the Faculty of Mechanics and Mathematics of Lomonosov Moscow State University in 2006 and has been working at the Chair of Computational Mechanics of the Faculty of Mechanics and Mathematics of Lomonosov Moscow State University since 2009.

The impact of greenery changes on human-elephant conflict in Sri Lanka: a model-based assessment using satellite imagery

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[2]Department of Engineering Technology, Faculty of Technological Studies, Uva Wellassa University, Badulla, Sri Lanka

Human-elephant conflict (HEC) is a crucial issue in elephant range countries, including Sri Lanka, due to the significant environmental and socioeconomic damages caused by the conflict. In Sri Lanka, approximately 14,897 HEC incidents have been recorded between 2015 and 2021. This study undertakes an island-wide analysis of Sri Lanka to examine the impact of greenery changes on HEC. Maps were developed with Sentinel-2 satellite imagery, while government records provided the local data of the conflict. In image analysis, the support vector machine (SVM), random forest (RF), and object-based image classifications are used to classify land cover into six categories. This classification scheme also considered the differences in the woody vegetation of Sri Lanka, consisting of forest, open forest, paddy fields, homestead gardens, and other crops. The classification accuracy of the three types of methods confirmed that the supervised classification with two machine learning algorithms, RF and SVM, delivered a higher level of precision. RF was the best classification method, with a 97.34 percent overall accuracy and a 0.94 kappa coefficient. According to the HEC data gathered from the government sources, many HEC incidents were recorded in open forests (54 percent). In comparison, 62 percent were recorded within 2 km of the forest edge. With regards to elephant deaths, 51 percent of incidents reported in Sri Lanka in 2021 were due to improvised explosive devices, electrocution, gunfire, train accidents, and toxic chemicals. Results of the study indicated that HEC coincides with the human-occupied changed landscape adjacent to forest reservations and patches. Furthermore, the management of HEC by identifying areas where elephants are most likely to conflict with humans, and the government may declare such areas as protected areas. Implementing long-term land use planning is also crucial for protecting forests and natural habitats, restoring elephant habitats, and mitigating HEC by minimizing human encroachment and promoting sustainable land use practices.

Biography:

Dr Kithsiri Perera was born in Sri Lanka and obtained a Geography special degree from the University of Colombo in 1985. After serving 4 years in the university academia, he enrolled at Chiba University, Japan, in 1989 and completed MEng and DEng in satellite remote sensing and GIS (Geographic Information Systems). After graduation, Dr Perera worked in the weather forecasting industry for 12 years in Tokyo. He joined the University of Southern Queensland in 2008 and was attached to the School of Surveying and Built Environment. Dr. Perera's teaching areas include GIS, Remote sensing, and web-based GIS. His primary research interests are in applying GIS and remote sensing for environmental management, natural disaster monitoring and mapping, land cover/land use mapping, Human-Elephant Conflict in Sri Lanka, and spatial data visualization.

Towards a unified classification framework for debris-flow mathematical models

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[b]*School of Engineering, Pontificia Universidad Javeriana, Avenue Carrera 7 No. 40-62, Bogotá 110231, Colombia.*
[c]*School of Engineering, Universidad Surcolombia, Avenue Pastrana Borrero - Carrera 1, Neiva, Colombia.*

Debris flows are complex and highly destructive natural phenomena that are composed of solid solid particles and water moving downslope. Due to the wide range of processes involved in derbis flows —such as solid-fluid interaction, erosion, and phase separation— numerous mathematical models have been developed to simulate debris flow dynamics. However, the diversity of these models makes it difficult to determine which one is most appropriate for a specific context. This presentation offers a clear and structured framework for understanding and classifying debris-flow models, aiming to support both researchers and practitioners in making informed modelling choices. The classification is based on five key aspects: phase of the models (e.g., single-phase, mixture, or multiphase), consideration of erosion, type of constitutive relationships used to describe flow behaviour, spatial dimensionality of the model, and the numerical methods employed to solve the governing equations. By comparing the main assumptions and computational trade-offs across these categories, we highlight the advantages and limitations of different modelling strategies. In addition, we introduce a practical model selection guide that incorporates dimensionless numbers and scenario-specific criteria, helping users align their modelling decisions with the scale, complexity, and data availability of their particular case. The goal of this work is not only to summarise current modelling approaches but also to provide a decision-support tool that promotes clarity, consistency, and appropriate use of mathematical models in the study and management of debris-flow hazards.

Biography:

Dr. Mario Germán Trujillo-Vela obtained his BSc in Agricultural Engineering from the Univer- sidad Surcolombiana. He completed a Master's degree in Hydrosystems in 2016, followed by a Doctorate in Engineering in 2021 from the Pontificia Universidad Javeriana. As part of his doc- toral studies, he completed two research internships under the supervision of the same professor in two different countries: the first at the University of Liverpool in the United Kingdom for one year, and the second at Westlake University in China for one year and three months. He currently lectures in Fluid Mechanics, Open-Channel Hydraulics, and Hydrology for under- graduate students in various engineering programs at the Universidad Surcolombiana. His re - search interests include mathematical modeling and numerical methods for representing natural hazardous processes such as floods and debris flows.

A modified CSLE for soil loss prediction under different vegetation patterns at slope scale in China

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Vegetation plays a fundamental role in reducing soil erosion by shielding the soil surface from raindrop impact and runoff erosion, promoting water infiltration to decrease runoff, and enhancing soil stability. Beyond the extent of vegetation cover, its spatial distribution is critical for optimizing erosion control and ensuring long-term ecological sustainability. Existing soil erosion models, such as the Chinese Soil Loss Equation (CSLE), predominantly focus on vegetation type and coverage while neglecting the spatial configuration of vegetation. This oversight can introduce uncertainties in predicting soil erosion. To overcome this shortcoming, this study proposes a new method by integrating vegetation spatial pattern indices, with particular emphasis on the mean flow path length index (MFLI), into the conventional CSLE framework. The MFLI effectively captures the positional distribution and spatial arrangement of vegetation, providing a more refined analysis of erosion dynamics at the slope scale. Using this index, a revised biological control factor (B) was developed. The proposed method was validated with data from 52 experimental plots across China and further tested with optimized parameters on five additional representative sites. Results demonstrated that the new approach substantially outperformed the conventional storm-based CSLE model, achieving model efficiencies of 0.686 and 0.636 during calibration and validation, respectively. In summary, the proposed method offers a more accurate and reliable prediction of soil erosion under diverse vegetation pattern conditions at the slope scale. By integrating spatial distribution characteristics of vegetation, it provides an improved tool for soil and water conservation, supporting more precise erosion prediction and mitigation strategies.

Biography:

Dr. Wenhai Shi, Ph.D. in Agronomy, is an Associate Professor and Master's supervisor at Chang'an University, recognized as a "Chang'an Scholar" Young Academic Backbone. He holds degrees from Xi'an University of Technology (BSc), Guangxi University (MSc), and the Institute of Soil and Water Conservation, Chinese Academy of Sciences (PhD). His research focuses on multi-scale ecohydrological processes, including rainfall–runoff responses in plateau and typical watersheds, soil erosion and conservation, slope hydrodynamics under freeze–thaw conditions, and the coupling of carbon–nitrogen cycles with hydrological processes. He has led multiple projects funded by the National Natural Science Foundation of China and the Natural Science Foundation of Shaanxi Province. Dr. Shi serves as a reviewer for over 20 international journals, including Journal of Hydrology, Catena, and Soil & Tillage Research, with publications widely recognized in ecohydrology and soil erosion modeling.

Serpentinization and Hydrogen Generation in Pyrenean Lherzolites

Charles Aubourg*, Keanu Loiseau and Isabelle Moretti

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Serpentinization in ultramafic rocks is an efficient process for generating hydrogen (H_2). In the Western Pyrenees, modeling suggests that ongoing H_2 production from serpentinization of the mantle wedge at ~10 km depth could reach ~109 kg/year of natural H2. However, in the Pyrenees, the main serpentinization phase was synchronous with Late Cretaceous rifting, affecting nearly ~10 km of mantle. Among the markers of this serpentinization, we focus on magnetite, a mineral detectable by indirect methods.

The ~40 outcrops of Pyrenean lherzolites reveal a strong heterogeneity of serpentinization at the orogenic scale. For example, the kilometer-scale bodies of lherzolites from Lherz and Saraillé exhibit degrees of serpentinization of 0–15% and 80–100%, respectively. At the kilometer scale, on the kilometer-scale bodie Turon lherzolite, geophysical investigations allowed us to map a heterogeneous distribution of magnetite. This heterogeneity is also observed at the micrometer scale, where magnetite aligns along shear planes. At all scales of observation, serpentinization thus appears as a heterogeneous process in lherzolites.

We identified a very specific and homogeneous typology of multi-micrometric clusters composed of nanometric magnetites. Their nanoscale size suggests time-limited crystallization phases. This would imply that serpentinization occurred in short, repeated episodes, triggered by localized water inputs into the system. Furthermore, our laboratory experiments show that magnetite can catalyze redox reactions, suggesting that H_2 production becomes more efficient with increasing magnetite content. Localized water influxes along shear planes may therefore explain the heterogeneous nature of past and present serpentinization processes in Pyrenean lherzolites.

Biography:

Prof. Charles obtained his B.Sc. in Geosciences and his Ph.D. at the Université Grenoble Alpes. He served as an Assistant Professor at CY Cergy Paris University (France), and for the past 15 years he has been a Full Professor at the Université de Pau et des Pays de l'Adour. His field of expertise is rock magnetism and structural geology. In recent years, his research has focused on hydrogen exploration in the Pyrenees and on serpentinization processes.

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