

ISERME 2023

International Symposium on Earth Resources Management & Environment

28th August 2023 - Colombo



PROCEEDINGS

Organised By | Department of Earth Resources Engineering
University of Moratuwa

ISERME 2023

International Symposium on Earth Resources Management & Environment

Organised by

Department of Earth Resources Engineering
Faculty of Engineering
University of Moratuwa
Sri Lanka

Technically Co-sponsored by

Division of Sustainable Resources Engineering
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Japan

28th August 2023, Colombo, Sri Lanka

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Message from the Symposium Chair

Dr SP Chaminda

Head / Senior Lecturer

Department of Earth Resources Engineering



Welcome to the 7th International Symposium on Earth Resources Management and Environment [ISERME 2023], organised by the Department of Earth Resources Engineering, University of Moratuwa, Sri Lanka and technically co-sponsored by the Faculty of Engineering, Hokkaido University, Japan.

The research culture of the Earth Resources Engineering undergraduates took a revolutionary leap in 2005 when secured the World Bank funding for Improving Relevance and Quality of Undergraduate Education [IRQUE]. Consequently, the first research conference in Earth resources was held in 2006 and continued as an annual event until 2016. In 2017 the Earth resources annual conference was upgraded to an international symposium with a memorandum of understanding, and cooperation extended by the Division of Sustainable Resources Engineering of the Faculty of Engineering, Hokkaido University, Japan. Since then, the International Symposium on Earth Resources Management and Environment [ISERME] has evolved over the years, while conducting its first ever online conference in 2021 and a hybrid version during 2022.

The scholarly advancements, conversations, and networking opportunities provided by the ISERME has been a remarkable experience for all the participants and specially for the undergraduates to pursue their academic careers in multi-disciplinary research and development, both locally and internationally. Hence, I'm grateful for the University of Moratuwa administration for permitting us to conduct the ISERME 2023 within the university premises and facilitating with logistical arrangements. We also appreciate the encouragement and guidance rendered by the Dean, Faculty of Graduate Studies, and the Director, Office of Research of the University of Moratuwa. As the Symposium Chair, I wish to extend my sincere thanks to all those who have contributed for the success of ISERME 2023 and specially to all the authors, reviewers, and sponsors, who enabled us to conduct this symposium at the highest scholarly standards. I wish you all, a productive and enjoyable symposium!

28th August 2023

Message from the Symposium Secretary

Dr (Ms) ABN Dassanayake

Senior Lecturer

Department of Earth Resources Engineering



Dear Esteemed Participants,

I warmly welcome you on behalf of the organising committee of the 7th International Symposium on Earth Resources Management and Environment (ISERME 2023), an annual event that has attracted many participants from various academic, industrial, and research backgrounds, including undergraduates, postgraduates, industry leaders, alumni, and well-wishers.

I'm pleased to welcome the distinguished guests for this symposium, Emeritus Professor UGA Puswewala, the chief guest along with Associate Professor Y Elakneswaran, the keynote speaker.

ISERME 2023 serves as a significant forum where academics, researchers, industry leaders, professionals, and alumni converge to share the latest findings and engage in constructive discussions across a diverse array of disciplines related to Mining and Earth Resources Engineering. This symposium also provides a valuable networking opportunity, fostering collaborations with organisations and individuals on both national and international levels.

We extend our deepest gratitude to our generous sponsors and supportive institutions, whose financial backing and dedication have breathed life into this event. Furthermore, I convey my heartfelt thanks to the diligent members of the organising committee for their unwavering dedication in ensuring the triumph of ISERME 2023.

As we embark on this journey of intellectual exchange and exploration, let us embrace the spirit of unity and collaboration that defines ISERME 2023. Together, we can overcome the challenges and pave the way for sustainable advancements in Mining and Earth Resources Engineering.

28th August 2023

Message from the Editorial

It is of paramount interest to foster a resilient community capable of navigating current and upcoming challenges, such as the depletion of natural resources and climatic changes, amidst the spread of pseudo-sciences. Synergistic efforts across diverse disciplines in particularly within the realm of engineering and its associated sciences are essential to conquer the above challenges and facilitate the multifaceted scholarly advancements. The International Symposium on Earth Resources Management and Environment 2023 (ISERME 2023) is a modest yet significant event that contributes to cutting-edge insights across a spectrum of fields.

The ISERME 2023 proceedings reflect the proactive approaches taken to address both current and impending scientific hurdles in the domain of earth resources. Reflecting the contributions, a notable effort has been made for advancing the objectives of sustainable development and harnessing circular economy. This is exemplified by research aimed at extracting valuable constituents, such as graphene, derivatives from coal fly ash, critical elements, and the exploration of untapped secondary resources. An equally commendable facet of the research showcases the unwavering dedication to comprehending the intricacies of ecosystems such as Bolgoda. The meticulous evaluation of its current state, coupled with the strategic deployment of monitoring techniques, indicates the commitment to a holistic environmental understanding. A range of remotely sensed data from satellite and unpiloted aerial vehicles enables forecasting and mitigating potential disasters and uncertainties. The infusion of artificial intelligence, particularly through machine learning and digital image processing has add a layer of sophistication to the above endeavours.

Overall, the symposium serves as a testament of interdisciplinary collaboration and innovative thinking. The shared insights and novel methodologies presented herein undoubtedly contribute to advancing our capacity to navigate the challenges that lie ahead. As the editorial team, we are grateful to authors, reviewers, and all contributors for elevating this collective pursuit of knowledge and solutions for a sustainable future.

28th August 2023

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Keynote Address

Assoc. Prof. Y Elakneswaran

Division of Sustainable Resources,

Graduate School of Engineering,

Hokkaido University, Japan



Geochemistry for Enhanced Oil Recovery (EOR) and Carbon Capture Storage (CCS)

This keynote speech focuses on the importance of geochemistry in addressing the challenges of improving oil recovery and carbon capture storage in reservoirs. EOR techniques have become indispensable in maximising oil production from reservoirs. Geochemistry plays a crucial role in understanding the complex interactions between injected fluids, reservoir rocks, and oil, enabling the design of effective EOR strategies. This speech will delve into the chemical EOR techniques such as low-salinity water flooding (LSWF), polymer flooding and alkaline flooding that leverage the interactions between oil, rock, and injected chemicals to optimise the oil recovery. It will showcase the various geochemical mechanisms involved in the interactions. Carbon capture storage (CCS) is an essential approach to mitigating greenhouse gas emissions. Geochemistry plays a significant role in assessing the feasibility of carbon capture and storage sites, ensuring safe and permanent storage of captured CO₂. This speech will discuss the geochemical considerations in assessing the long-term stability and containment of stored CO₂, ensuring its environmental integrity. Moreover, the importance of geochemical modelling in both EOR and CCS applications will be emphasised. It will enable the simulation and prediction of fluid-rock interactions, phase behaviour, and chemical reactions in the reservoir. Incorporating thermodynamic and kinetic reactions in the reservoir simulator makes it possible to simulate and optimise various scenarios, allowing for efficient decision-making and improved outcomes. Overall, this keynote speech provides a comprehensive overview of geochemistry's role in the advancement of EOR and CCS. By harnessing the power of geochemistry, we can advance sustainable energy production and contribute to a low-carbon future.