XVII GEOSEA 2022

LANGKAWI, MALAYSIA

Board of Geologists Malaysia
CPD APPROVED EVENT

- 17TH REGIONAL GEOSCIENCE CONGRESS OF SOUTH-EAST ASIA
- 34TH NATIONAL GEOSCIENCE CONFERENCE
- 2ND SUSTAINABLE EARTH RESOURCES ENGINEERING (SERiES 2022)
- REGIONAL COURSE ON UNESCO GLOBAL GEOPARK

17-21 OCTOBER, 2022

ADVANCE GEOSCIENCE ADVANCE ASEAN

PROGRAM WITH ABSTRACTS

ORGANIZERS

PERSATUAN GEOLOGI MALAYSIA 1967

INSTITUT GEOLOGI MALAYSIA

GEOSEA XVII MALAYSIA

JMG

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Quick Links

SERIES 2022

XVII GEOSEA 2022

Program

18th October 2022

19th October 2022

20th October 2022

A WORD FROM THE CHAIRMAN OF XVII GEOSEA 2022

On behalf of the Organizing Committee, I would like to extend our warmest welcome to all distinguished participants to the 17th Regional Geoscience Congress of Southeast Asia (XVII GEOSEA2022 or GEOSEA2022) in conjunction with the 34th National Geoscience Conference, in Langkawi, Malaysia. XVII GEOSEA2022 is jointly organized by the Geological Society of Malaysia (GSM), Department of Mineral and Geoscience Malaysia (JMG), Institute of Geology Malaysia (IGM) and the Langkawi Development Authority (LADA), with the collaboration of several Malaysian Universities - University Malaya (UM), National University of Malaysia (UKM), University Sains Malaysia (USM), University Malaysia Pahang (UMP), University Malaysia Kelantan (UMK), University Malaysia Terengganu (UMT), University Malaysia Sabah (UMS), University Technology Petronas (UTP), University Technology Malaysia (UTM), Tenaga National University (UNITEN) as well as research centre such as the UKM Langkawi Research Centre (PPL) and UKM Southeast Asia Disaster Prevention Initiative (SEADPRI-UKM)

The biennial organization of GEOSEA2022 congress is in line with the need to understand, know and research various aspects and dimensions of issue related to Geoscience and Geotechnology in the Southeast Asian region. Aspects of Geoscience and Geotechnology cover four dimensions, namely:

- Knowledge of the Earth System and the processes involved
- The use of technology in improving the quality of life
- Best practices in the use and management of the Earth's natural resources
- The use of technology to develop knowledge in the Geosciences, to develop creative and innovative solutions addressing current environmental issues.

Science and technology driven management that encompasses these four dimensions will have an impact on society, especially in the economic, environmental, health and safety spheres.

Along with these developments and challenges, GSM and IGM, as organizations that support the development and practice of the Geosciences, and the ASEAN Federation of Geoscience Organizations (AFGeO) will once again organize the 17th Regional Geoscience Congress of Southeast Asia (GEOSEA 2022) in conjunction with the 34th National Geoscience Conference (NGC 2022), the 2nd International Conference of Sustainable Earth Resources Engineering (SERiES 2022) and the Regional Course On UNESCO Global Geoparks. For this year, the Congress opens to a wider range of participation in terms of the scope of presentations, areas of expertise, as well as the number of participants from various relevant departments and institutions throughout the Southeast Asian region. This will truly be an Olympics of Geoscience Conferences.

Continued on next page

A WORD FROM THE CHAIRMAN OF XVII GEOSEA 2022 (cont. from prev.)

These proceedings contains all abstracts to be presented at GEOSEA 2022, covering the following topics:

1. Environmental Geology and Climate Change
2. Geohazard and Disaster Risk Reduction (DRR)
3. Petroleum Geology, Oil and Gas Exploration
4. Depositional Basins, Tectonic History and Magmatism
5. Engineering Geology and Geotechnology
6. Quaternary and Marine Geology
7. Hydrogeology and Water Resources
8. Geoheritage and Geotourism
9. Geophysics and Machine Learning in Geology.

All the abstracts are written by experts from various professional backgrounds, including industry, government institutions as well as academics from universities.

GEOSEA 2022 aims to be a platform for researchers in this region to establish research relationships, to discuss and share information on earth resources and environmental issues, to present research information to the public, to explore new ideas and discuss developing issues and topics. It covers various areas related to natural resources, the use of Science and Technology in sustainable development, as well as issues relating to sustainable Earth resource management and the environment, covering the processes involved, feedback from the environment and the use of various approaches and technologies to study changes to the Earth and the environment especially as it impacts the Southeast Asia region.

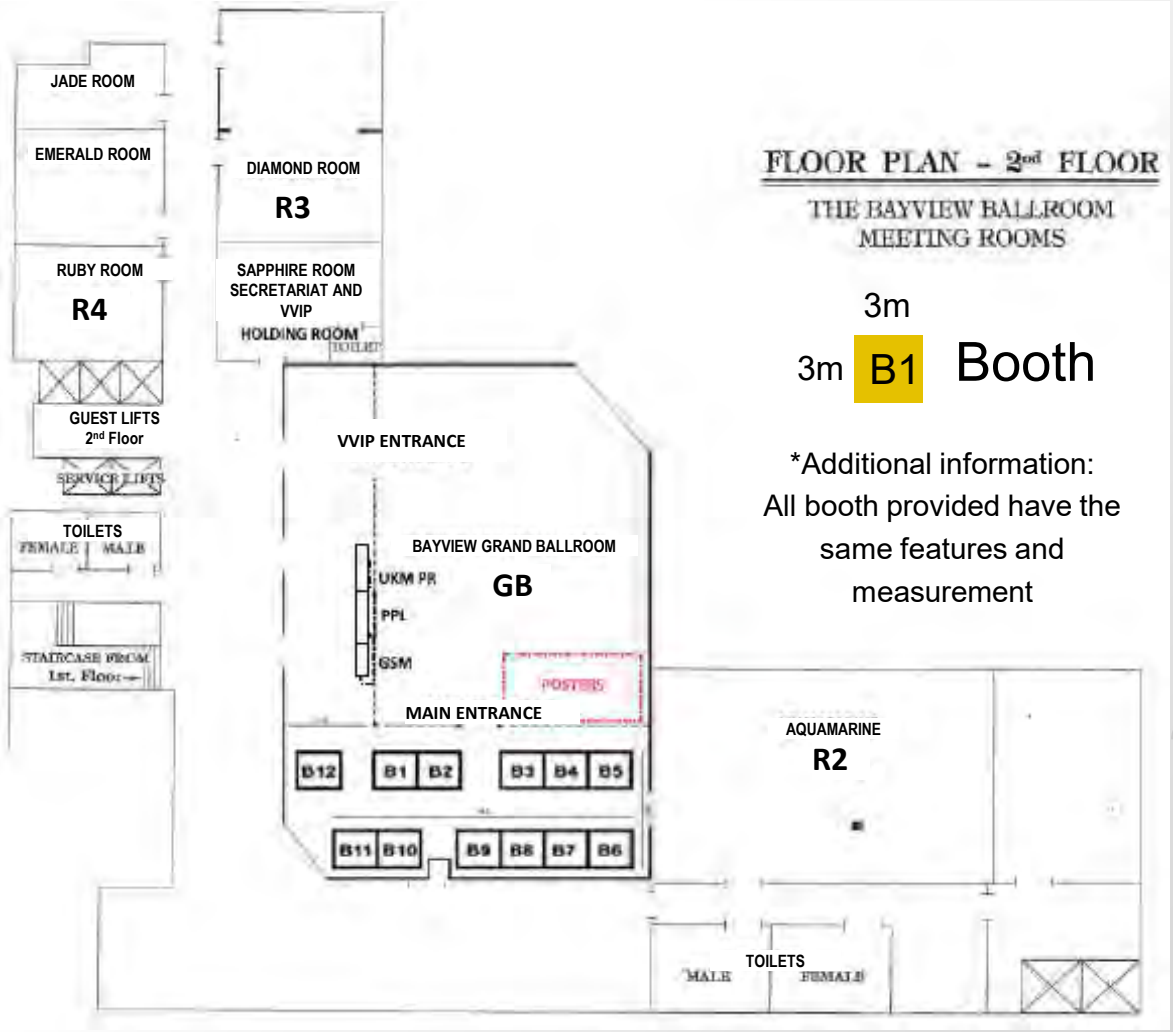
On behalf of the Organizing Committee, I would like to express my sincere appreciation for all the authors, paper reviewers, convenors, and editorial team for all the assistance and support in organizing the congress and preparing this program book.

I would also like to express my grateful thanks for the support of our sponsors and exhibitors from industry and government: Jabatan Mineral Dan Geosains Malaysia, Langkawi Development Authority (LADA), UMP-Makmal Berpusat, Agensi Nuklear Malaysia, Pahang Mining Corporation Sdn Bhd, Orogenic Resources Sdn Bhd, Geomag Engineering Sdn Bhd, GPS Land Sdn Bhd, Guideline Geo, Malaysia Smelting Corporation Bhd (MSC), TNF Energy Sdn Bhd, Geopark And Geotourism Creative Solution (GCCS), Geosoil Engineering Sdn Bhd, GeoSolution Resources (GSR), GMT Group of Companies (GMT), Geo Technology Sdn.Bhd. (GTR), UKM Langkawi Research Centre (PPL) and UKM PakarRunding for their contributions and involvement. Without all of them GEOSEA 2022 and the publication of these Proceeding would not have been possible.

Lastly, I would personally express my thankful to all Organising Committee members comprising of volunteers from industry, government agencies and universities that together worked very hard throughout the year, the endless support from my fellow council members of GSM, leaders of AFGEOs as well to all participants for your participation and contribution to the success of the GEOSEA 2022. I hope you will have wonderful time, and the most memorable and great experiences with us in Langkawi, Malaysia.

Mr. Ahmad Nizam Hasan, P.Geol. FIGM, FGS
Chairman, GEOSEA 2022 and President of the
Geological Society of Malaysia (GSM)

VENUE MAP



BOOTH	COMPANY/AGENCY
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B6	PAHANG MINING CORPORATION SDN BHD
B7	UMP-MAKMAL BERPUSAT
B8	JABATAN MINERAL DAN GEOSAINS MALAYSIA (JMG)
B9	LANGKAWI DEVELOPMENT AUTHORITY (LADA)
B10	OROGENIC RESOURCES SDN BHD
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B12	GEOPARK AND GEOTOURISM CREATIVE SOLUTION SDN BHD (GGCS)

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Geological Society of Malaysia

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14TH ASIAN REGIONAL CONFERENCE OF IAEG

KOTA KINABALU, MALAYSIA

26 FEB - 3 MAR 2024

Coming Soon

Engineering Geology Role in Disaster Risk Management

FIRST ANNOUNCEMENT

Sub - Theme

- Site Characterisation/Lab Testing and Problematic Grounds
- Geohazards (Landslides, Earthquakes, etc.)
- Engineering Geology in Wet Tropical Terrains
- Tunnelling for Infrastructures and Underground Facilities
- Marine Engineering Geology for Offshore Field Developments (Offshore Geohazards)
- New Technology in Engineering Geology (Renewable Energy)

Proposed Activities

- Oral & Poster Presentation
- Workshop & Short Courses
- YEG Activity
- IAEG Asian Country Meeting
- Field Excursion

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SEGRM

COMING SOON

GEOSCIENCE WEEK 2023

KUCHING, SARAWAK

20 – 26 FEBRUARY 2023

FORUM WITH STAKEHOLDERS & GOVERNMENT AGENCIES

SEMINAR ON GEOLOGY OF SARAWAK

GEOLOGICAL EXCURSION

CARBONATE FIELDTRIP

PROGRAM

PROGRAM 01

DAY 1 Tuesday 18TH OCTOBER 2022

	REGISTRATION AND OPENING CEREMONY – BAYVIEW GRAND BALLROOM
8:00	**REGISTRATION**
9:00	**OPENING CEREMONY**
10:30	**TEA/COFFEE BREAK**
10:45	**Distinguished Speaker - Prof. Emeritus Dato' Dr. Ibrahim Komoo** ***Debris Flow Disaster in Malaysia: Public Understanding and Policy Intervention***
11:15	**Keynote Speaker 1 - Prof. Dr. Joy Jacqueline Pereira** ***Climate Change and Disaster Risk Reduction in Southeast Asia: Obligations of Geoscience***
11:35	**Keynote Speaker 2 - Prof. Dr. Azman A Ghani** ***Granite from Peninsular Malaysia: Geochemistry, Geochronology and Tectonic Setting***
11:55	**Keynote Speaker 3 - Dr. Loke Meng Heng** ***New Developments in the Resistivity Method for Geological Mapping***
12:15	**Keynote Speaker 4 - Assoc. Prof. Dr. Shohei Matsuura** ***Reducing Geological Hazard Risk: Lessons in Transdisciplinary Approach (TDA) from Japan***
12:35	**QUESTION AND ANSWER SESSION**
13:00	**LUNCH**

PROGRAM 02

DAY 1 Tuesday 18TH OCTOBER 2022 (cont.)

	Technical Session 1 - Environmental Geology & Climate Change **AQUAMARINE**	**Technical Session 2 - Geohazards and Disaster Risk Reduction** **DIAMOND**	**Technical Session 3 - Petroleum Geology, Oil and Gas Exploration** **EMERALD**
14:00	SESSION KEYNOTE (1) **Dr.Nuraini Rahma Hanifa** *Participatory Mapping for Rapid Impact Assessment Following Geological Disasters: Lessons Learned from Indonesian Case Studies*	SESSION KEYNOTE (2) **Dr Mohamad bin Abd Manap** *Landslide Susceptibility Map Produced by Weighted Linear Combination Methods: A Case Study at Gunung Jerai, Kedah*	SESSION KEYNOTE (3) **Muhd Nur Ismail Abdul Rahman** *The Paleozoic Depositional System and Hydrocarbon Fractured Reservoir Characteristics from the Outcrop Analogue around Terengganu Coastal Area, Terengganu, Malaysia*
14:20	GEOSEA 1-2 **Rabieahtul Abu Bakar** *Disaster is Not Natural: How Do We Build Societal Resilience?*	GEOSEA 2-2 **Bailon Golutin** *Active Fault Monitoring of Seismically Active Region in Ranau, Sabah, Malaysia*	GEOSEA 3-2 **Nur Huda M Jamin** *Integrated Morphological Mapping and Quantitative Approach for the Assessment of Seabed Hazards in 'I' Field, Malay Basin*
14:40	GEOSEA 1-3 **Askury Abd Kadir** *Soil Cancer: Their Troubles and Mitigations*	GEOSEA 2-3 **Haryati Awang** *Characterisation of Debris Flow Material in Yan, Kedah*	GEOSEA 3-3 **Maman Hermana** *Optimization of Hydrocarbon Finding based on Seismic Data using Novel UTP Technology for Pre and Post-Drilling Stages*
15:00	**TEA/COFFEE BREAK**		
15:30	GEOSEA 1-4 **Navakanesh M Batmanathan** *Impact of Vertical Land Motion on the Coastal Region of Selangor*	GEOSEA 2-4 **Julius Vincent P. Umali** *Application of Weight of Evidence Analysis in Landslide and Subsidence Susceptibility Mapping in El Nido, Palawan and Del Carmen and General Luna, Surigao Del Norte, Philippines*	GEOSEA 3-4 **W Nur Safawati Bt W Mohd Zainudin** *NMR Characterization on the Petrophysical Properties of Deep Siliciclastic Reservoirs: Sarawak Basin, Malaysia*
15:50	GEOSEA 1-5 **Mohd Shafar Jefri bin Mokhatar** *The Potential of Basalt Dust in Malaysia as a New Source of Fertilizer*	GEOSEA 2-5 **Nur Syarienna Razmi** *A Study of Old Dormant Landslides in the Fraser's Hill Area, Pahang, Malaysia*	GEOSEA 3-5 **Siti Nur Fathiyah Jamaludin** *Re-Look Into Total & Tectonic Subsidence for Offshore Kudat, Nw Sabah, Malaysia*
16:10	GEOSEA 1-6 **Lin Chin Yik** *Characterizing Peat Soils and Porewater Geochemistry of Natural and Drained Peatland in South Kuala Langat Peat Swamp Forest, Selangor*	GEOSEA 2-6 **Choong Chee-Meng** *Dextral Movement Along Bentong-Raub Suture Zone in the Lojing - Pos Betau Area*	GEOSEA 3-6 **Siti Nur Fathiyah Jamaludin** *Characterization of Gas Hydrate in Fold Thrust Belt (Ftb) of Northwest Sabah*

PROGRAM 03

DAY 1 Tuesday 18TH OCTOBER 2022 (cont.)

	Technical Session 1 - Environmental Geology & Climate Change **AQUAMARINE**	**Technical Session 2 - Geohazards and Disaster Risk Reduction** **DIAMOND**	**Technical Session 3 - Petroleum Geology, Oil and Gas Exploration** **EMERALD**
16:30	GEOSEA 1-7 **Jayeola, A.O.** *Geochemical Survey and Environmental Implications of Major and Trace Elements in Soil Samples from Okemesi Area, Southwestern Nigeria*	GEOSEA 2-7 **Decibel V. Faustino-Eslava** *Reframing Models for Rainfall-Induced Landslides in the face of Non-analog Future Climates in the Philippines*	GEOSEA 3-7 (was Poster 1-4)(was 3-8) **Muhammad Aqqid Saparin** *Graptolite Studies and Its Potential for Hydrocarbon Exploration in Malaysia*
16:50	GEOSEA 1-8 **Nik Amirul Eizzat Nik Kamaruddin** *Integration of Geological Mapping and Subsurface Investigation in Exploration of Silica Rock Resources in Lojing, Gua Musang*	GEOSEA 2-8 **Ummi Nur Nasuha Abdullah Din** *A GIS Based Approach using Analytical Hierarchy Process (AHP) for Geohazard Mapping of Raub District, Pahang*	GEOSEA 3-8 (was 3-9) **Ahmad Zamzamie Ishak** *Palynology of Late Cenozoic Succession in Temana Field, Offshore Sarawak*
17:10	GEOSEA 1-9 **Muhammad Afiq Afandi Abdul Aziz** *Determination of Ion Exchange Phase of Rare Earth Element and Subsequent Extraction of Rare Earth Element from Local Ion Adsorption Clay*	GEOSEA 2-9 **Nurul Zainab binti Along** *Conceptual Framework for Creating Community Awareness on Geohazards Early Warning Signs*	GEOSEA 3-9 (was 3-10) **Abdul Halim Abdul Latiff** *Seismic Channel Features Detection using Convolutional Neural Network (CNN)*
17:30	GEOSEA 1-10 **Ahmad Zulhilmy Ahmad Yusri** *An Integration of Surface and Subsurface Geological Input for Potential Geohazard Zonation Mapping of an Urban Planning at Ex-Coal Mining Area*	GEOSEA 2-10 **Mohamad Faruq Syahmi** *Geomorfological Mapping for Landslide Risk Assessment: Case Study from Ampang Jaya*	(was 3-11)
18:00 – 22:00	**ICEBREAKER**		

PROGRAM 04

DAY 2 Wednesday 19TH OCTOBER 2022

	BAYVIEW GRAND BALLROOM
8:30	**Keynote Speaker 5 – Dato' Ir. Ts. Dr. Badhrulhisham Abdul Aziz** ***Sustainable Critical Minerals Industry through Responsible Mining and Processing***
9:00	**Keynote Speaker 6 – Dato' Dr. Mokhtar Saidin** ***Future Agenda for Geopark in Malaysia***
9:30	**AFGeO Country Report on Geoscience in Indonesia**
10:00	**TEA/COFFEE BREAK**
10:30	**AFGeO Country Report on Geoscience in Malaysia**
11:00	**AFGeO Country Report on Geoscience in Myanmar**
11:30	**AFGeO Country Report on Geoscience in the Philippines**
12:00	**AFGeO Country Report on Geoscience in Thailand**
12:30	**AFGeO Country Report on Geoscience in Vietnam**
13:00	**LUNCH**
14:00 – 17:00	**MID CONGRESS FIELD EXCURSION**

PROGRAM 05

DAY 3 Thursday 20TH OCTOBER 2022

	Technical Session 4 – Depositional Basins, Tectonic History and Magmatism AQUAMARINE	Technical Session 5 – Engineering Geology and GeoTechnology DIAMOND	Technical Session 6 – Quaternary and Marine Geology EMERALD
8:30	SESSION KEYNOTE (4) **Allagu Balaguru** *Review on Tectonic and Structural Evolution of South East Asia: Based on Seismic Stratigraphy and Paleomagnetic Data*	SESSION KEYNOTE (5) **Abdul Ghani Md Rafek** *Application of Slope Mass Rating (SMR) in Rock Slope Stability Assessment and Ranking, Kenyir Dam, Terengganu, Malaysia*	SESSION KEYNOTE (6) **Abdullah Sulaiman** *Sea Level Changes in the Straits of Malacca During Late Pleistocene to Holocene Based on Sediment Records*
8:50	GEOSEA 4-2 **Azman A. Ghani** *A-Type Granite from Besar Island Group Johor : New Granite Typology of Peninsular Malaysia and Its Tectonic Implication*	GEOSEA 5-2 **Jeremy James C. Jimenez** *Petrographic Assessment of Concrete Aggregates used in Metro Manila: Representing 100 Years of the Philippine Construction Industry*	GEOSEA 6-2 **Hasrizal bin Shaari** *Seabed Mapping Application in the 1st Phase Excavation of the Bidong Shipwreck, Malaysia*
9:10	GEOSEA 4-3 **Mohd Zahar Ibrahim** *Analysis of Rare Earth Elements (REE) using Microwave Digestion System, ETHOS UP and Inductively Coupled Plasma Mass Spectrometer (ICPMS), NexION 2000*	GEOSEA 5-3 **Dr. Abdull Halim bin Abdul** *Development of Cpt Geotechnical Properties using 2D SSPT Geotechnical Modelling Methods*	GEOSEA 6-3 **Noran Alwakhir bin Shaarani** *Introduction to the First Malaysia Seabed Sediment Map of the Melaka Strait*
9:30	GEOSEA 4-4 **Meor Hakif Amir Hassan** *Tidally-Influenced Deposits in the Carboniferous Bukit Buchu Beds, Terengganu, Malaysia*	GEOSEA 5-4 **Ismail Abd Rahim** *Discontinuity Adjustment Factor (F) of Modified Slope Mass Rating (M-SMR) for Rock Slope Engineering Purposes*	GEOSEA 6-4 **Habibah Jamil** *Mineralogy and Geochemistry of Quaternary Sediments of Southwest Johor, Malaysia*
9:50	GEOSEA 4-5 **Ledyhernando Taniou** *Geochemistry of Rare Earth Elements (REE) in the Weathered Crusts of Volcanic Rocks in the Serian Area, Sarawak, Malaysia*	GEOSEA 5-5 **Qalam A'zad Rosle** *Geological Hazard and Risk of Slope Failure in Urban Development: A Case Study in Kemensah Heights, Taman Melawati, Gombak District, Selangor Darul Ehsan*	GEOSEA 6-5 **Nor Bakhiah Baharim** *Saltwater Intrusion Mechanism in the Kuala Terengganu River*
10:10	**TEA/COFFEE BREAK, POSTER SESSION**		

PROGRAM 06

DAY 3 Thursday 20TH OCTOBER 2022 (cont.)

	Technical Session 4 – Depositional Basins, Tectonic History and Magmatism (cont.) **AQUAMARINE**	Technical Session 5 – Engineering Geology and GeoTechnology (cont.) **DIAMOND**	Technical Session 6 – Quaternary and Marine Geology (cont.) **EMERALD**
10:10	**TEA/COFFEE BREAK, POSTER SESSION**		
10:30	GEOSEA 4-6 **Askury Abd Kadir** *Magnificence Occurrences of Jerai's Pegmatite: Magmatic Differentiation Perspective*	GEOSEA 5-6 **Abdul Kadir Ahmad Akhri** *Engineering Geological Assess-ment to Determine the Cause of Cracks in Buildings at Taman Keramat Permai, Selangor Darul Ehsan*	GEOSEA 6-6 **Nor Shahidah Mohd Nazer** *Field Identification of Clay Minerals based on Desiccated Morphological Patterns*
10:50	GEOSEA 4-7 **Muhammad Aslam Md Yusof** *Natural Fracture System in Gunung Keriang, Alor Setar, Kedah*	GEOSEA 5-7 **Nor Najiha Nasrudin** *Problematic Rock Slopes in Complex Geological Terrain – Part 1: Field Mapping and Analysis*	GEOSEA 6-7 **Siti Nurnazurah Md Shaharudin** *Tidal Effects on the Seawater Intrusion on the West Coast of Papar, Sabah*
11:10	GEOSEA 4-8 **Frederick Francis Tating** *Rock Discontinuity Formation in Weathered Sandstone of the Crocker Formation in the Kota Kinabalu Area, Sabah*	GEOSEA 5-8 **Muhammad Faris Qusyairi Hamat** *Problematic Rock Slopes in Complex Geological Terrain – Part 2: Design and Mitigation*	GEOSEA 6-8 **Muhammad Noor Amin Zakariah** *Subsurface Characterization using Transient Electro-magnetic Method in Pekan, Pahang*
11:30	GEOSEA 4-9 (was 8-3) **Nurul 'Amalina binti Md Nor** *Karst and Cave Geosites in Kinta Valley National Geopark Stimulates the Geological-based Tourism*	GEOSEA 5-9 **Shaidatul Munirah Musa** *Urban Geology of Cities in Malaysia: A Private Initiative Through Internship Programme*	GEOSEA 6-9 (was 6-10) **Muhamad Firdaus Ms** *Transforming an Old Mine into a Subsurface Quarry: Case Study In Kampar, Perak*
11:50		GEOSEA 5-10 **Norsyafiqah Salimun** *Effect of Particle Size Distribution on Shear Strength of Residual Granitic Soil*	
13:00	**LUNCH**		

PROGRAM 07

DAY 3 Thursday 20TH OCTOBER 2022 (cont.)

	Technical Session 7 – Hydrology and Earth Water Resources **AQUAMARINE**	**Technical Session 8 – Geoheritage and Geotourism** **DIAMOND**	**Technical Session 9 – Geophysics and Machine Learning in Geology** **EMERALD**
14:00	SESSION KEYNOTE (7) **Mohamed Rouai** *Spot Images Remote Sensing Study of the Fractured and Karstic Tabular Middle Atlas Aquifer (Morocco)*	SESSION KEYNOTE (8) (was 8-3) **Ross Dominic D. Agot** *Geomorphological Analysis of Island Karst in the Philippines: Implications to Sustainable Tourism Development and Subsidence Hazard Assessment*	SESSION KEYNOTE (9) **Yasir Bashir** *Machine Learning Applications for Seismic Diffraction Detection and Preservation for High-Resolution Subsurface Imaging*
14:20	GEOSEA 7-2 **Mohd Khairul Nizar Shamsuddin** *MODFLOW and MIKE SHE from Hydrology and Hydrogeology Aspects: A Case Study Klang River Basin*	GEOSEA 8-2 **Mohd Shafeea Leman** *Karst Inselberg of Perlis–Kedah Coastal Plain – Its Geology and Geoheritage Significance*	GEOSEA 9-2 **Mohd Rozi Umor** *Geoelectrical Resistivity Investigations (ERI) for Subsurface Profiling and Potential Failure Area Determination at the Sultan Mahmud Dam, Tasik Kenyir, Terengganu, Malaysia*
14:40	GEOSEA 7-3 **Mohammad Muqtada Ali Khan** *Importance of Silica Geothermometry in Groundwater Studies of Shallow Aquifers in Kelantan, Malaysia*	GEOSEA 8-3 (was 4-10) **Ahmad Daniel bin Razali** *Geomorphological and Cave Mapping for Details Geosite Mapping*	GEOSEA 9-3 **Adedibu Sunny Akingboye & Andy Anderson Bery** *Geophysical Geostatistical Evaluation of Residual Soils and Bedrock Fluid Migration Systems in a Highly Varied Velocity & Resistivity Granitic Terrain: Penang Island, Peninsular Malaysia*
15:00	GEOSEA 7-4 **Zuhar Zahir Tuan Harith** *Hot Spring Distribution in Peninsular Malaysia from Gravity Data Prospective*	GEOSEA 8-4 **Tanot Unjah** *Systematic Scientific Identification and Classification of Potential Geosite at District of Gombak, Selangor Malaysia*	GEOSEA 9-4 **Muhammad Safwan Ishak** *The Application of Geographic Information System for Iron Ore Resource Estimation*
15:20	GEOSEA 7-5 **Zuhar Zahir Tuan Harith** *Potential of Hot Spring as a Source of Geothermal Power in Malaysia*	GEOSEA 8-5 **Azman A. Ghani** *Granite Magmatism History of Taiping Pluton in the Lenggong Area and its Contribution to Lenggong Geopark*	GEOSEA 9-5 **Muhammad Noor Amin Zakariah** *Subsurface Characterization of the Cenozoic Sungai Muda Basin, Kedah using the Transient Electromagnetic Method and Borehole Data*

PROGRAM 08

DAY 3 Thursday 20TH OCTOBER 2022 (cont.)

	Technical Session 7 – Hydrology and Earth Water Resources (cont.) AQUAMARINE	Technical Session 8 – Geoheritage and Geotourism (cont.) DIAMOND	Technical Session 9 – Geophysics and Machine Learning in Geology (cont.) EMERALD
15:40	GEOSEA 7-6 **Mohammad Noor Akmal Anuar** *Application of Thermal and Electrical Resistivity Tomography with Geochemistry Methods in Hydrogeothermal Exploration*	GEOSEA 8-6 **Nichole Anthony Pacle** *Siargao Island Group as a Possible UNESCO Global Geopark for the Philippines*	GEOSEA 9-6 **Faruq Syahmi Aripin** *Limitations of Terrestrial Laser Scanning for Rock Mass Characterization in Tropical Climate Region*
16:00	**TEA/COFFEE BREAK, POSTER SESSION**		
16:30	GEOSEA 7-7 **Muhamad Barzani Gasim** *The Occurrence of Saline Intrusion in Groundwater using Electrical Resistivity and Environmetric Method in Coastal Part of Terengganu, Malaysia*	GEOSEA 8-7 **Azimah Hussin** *Petrography Uniqueness of Prehistoric Stone Tools from Gua Kambing Area, Gunung Pulai, Baling*	GEOSEA 9-7 **Mohammad Noor Akmal Anuar** *Integrated Slope Failure Assesment using Multichannel Analysis Surface Wave (Masw) and Electrical Resistivity Tomography (Ert)*
16:50	GEOSEA 7-8 **Ismail Tawnie** *Managing Water Resources in Langkawi: The Viability of Underground Storage for Domestic Water Supply*	GEOSEA 8-8 **Hafzan Eva Mansor** *Significance of Geological Evolution and Geoheritage of the Aspiring Stong Geopark, Kelantan, Malaysia*	GEOSEA 9-8 **Woo Chaw Hong** *Mapping Submarine Power Cable in the Extremely Shallow Waters: A Combined Unmanned Aerial Vehicle (UAV) and Boat Survey Approach*
17:10	GEOSEA 7-9 **Zaidulkhair Jasmi** *Hydrostratigraphic Under-simplification in Structural Model Conceptualization to Boost Confidence Interval in Simulation and Environmental Sustainability Perception*	GEOSEA 8-9 **Muhammad Yaseen** *Regional Scale Geodiversity of Karakoram Highway (KKH) and Part of Central Karakoram National Park (CKNP), North Pakistan: Constrains from Geological Itinerary, Petrology and Geoconservation*	GEOSEA 9-9 **Haryati Awang** *Evaluation of Rock Slope Mapping using Terrain Laser Scanning*
17:30	GEOSEA 7-10 **Muhammad Fawwaz Zainal Abedin** *Hydrogeological Study on Alluvial Aquifer and Determination of Suitability Area for Flood-Managed Aquifer Recharge (Flood-MAR) Applications at Malacca River Basin*		GEOSEA 9-10 **Muhamad Safid Saad** *Detail Geophysical Study at Pulau Manis and 3-D Concept Model over Airborne Anomalies in the ECER Region*
18:00 – 19:00	**CLOSING CEREMONY AND PRIZE PRESENTATION (Bayview Grand Ballroom)**		

POSTERS

Poster 1-01
Sheila Rozalia Abdul Rashid
Geochemical, Mineralogical and Petrographical Differences Between Serpentinite Lens Situated Inside and Outside of Bentong-Raub Suture Zone

Poster 1-02
Hikmat Salam
Development of Tethyan Ophiolites and MeLange Complex along the India & Afghan Continental Suture: A Case Study from Northwest Pakistan

Poster 1-03
Miklós Kázmér
Hypogenic Karst in Peninsular Malaysia

Poster 1-04 (was Paper 3-7)
John Oluwadamilola Olutoki
A Comparative Study on Artificial Intelligence-Based Approaches for Reservoir Facies Classification: A Case Study of Mckee Formation, Onshore Taranaki Basin, New Zealand

Poster 1-05
Abdul Hadi Abd Rahman
The Pedawan Formation (Jurassic-Cretaceous) of Kuching Area, Kuching, Sarawak: Facies Associations, Depositional Framework and Regional Significance

Poster 1-06
Muhammad Hatta Roselee
Petrology and Geochemistry of Rhyolite at Southern Part of Ulu Sokor Gold Deposit, Kelantan, Malaysia

Poster 1-07
Mohamad Fatihi bin Abdul Patah
Rare Earth Element (REE) in Various Mineral Assemblages in Kelantan's Granitoid Rocks

Poster 1-08
Lin Chin Yik
The Effects of Salinity on Metals Mobility in Peat and Clay Samples: An Incubation Approach

Poster 1-09
Jessie Samaniego
Pollution Assessment of Potentially Toxic Elements in Marine Sediments of Honda Bay, Palawan, Philippines

Poster 1-10
Chuanqi Li
Identification of River Contaminant Sources using a Cellular Automata Model and Bayesian Mcmc Method

Poster 1-11
Rico Neil Quierrez
Vertical Distribution of Potentially Toxic Elements in the Abandoned Mercury Mine in Palawan, Philippines: Insights from Borehole Geochemistry

Poster 1-12
Faten Hanani Muhamad Hakimi
Geological Disaster Knowledge and Awareness

Poster 1-13 (was Poster 2-14)
Hardianshah Saleh
Effect Of Groundwater-soil Interaction Based On The Geoelectrical Profiles Of Peat Soil At Klias Reserve Forest, Sabah

Poster 1-14
Hareyani Zabidi
Quantitative Analysis of Granitic Intrusion Boundary and Fault Zones and Their Impact on Karstification

Poster 1-15
Kate B. Cuyno
Geology of the Bohol Island Aspiring Geopark, Philippines

Poster 2-01 (was 16)
Nur Fatin Irdina Zulhamidi
Structural Mapping of Ranau, Sabah using Remote Sensing and Other Parameters

Poster 2-02 (was 17)
Azimah Hussin
Soft Soil Problem in Muda Agricultural Development Authority (Mada) Paddy Field Area, Kedah, Malaysia

Poster 2-03 (was 18)
Thomson Galin
Active Fault Studies in the Niah Area, Sarawak, Malaysia

Poster 2-04 (was 19)
Mustapha Atta
Groundwater Modelling for Environmental Impact Assessment of a Manganese Ore Mining Site in Kelantan

Poster 2-05 (was 20)
Wan Zuhairi Wan Yaacob
Groundwater Quality Assessment at a Proposed Re-Development Project of Former Landfill Site

Poster 2-06 (was 21)
Nor Bakhiah Baharim
Demarcation of Groundwater Recharge Potential Zones in Langat Basin, Malaysia

POSTERS (cont.)

Poster 2-07 (was 22)
Aakash Deep
Spatial Distribution Mapping and Suitability Assesment of Groundwater Quality for Domestic Use in Kurukshetra District, Haryana, India

Poster 2-08 (was 23)
Rasyikin Roslan
Geotechnical Assessment and Engineering Analysis of the High-Risk Slope Tower Pole 3, Line Segari – Ayer Tawar using Innovative Monitoring Rating System (IMRS)

Poster 2-09 (was 24)
Nur Susila Md Saaid Azizan Ali
The Jerai Geopark Geosite: lost of the Aesthetic Value during the 2021 Debris Flow Tragedy

Poster 2-10 (was 25)
Rasyikin Roslan
Electrical Resistivity Test based on Geo-environmental Evaluation for Slope Risk Assessment & Implementation for Tower Pole in Kuala Krai-Gua Musang & Cameron Highland-Pahang

Poster 2-11 (was 26)
Bashillah Baharuddin
Contribution of Comprehensive Nuclear-Test-Ban Treaty (CTBT) data to Climate Change Studies and The Earth Sciences

Poster 2-12 (was 27)
Nur Iskandar Taib
3D-printed Topographic Models

Poster 2-13
A K M Eahsanul Haque
Geomodeling For Multilayered Reservoirs in New Zealand: Determining Optimum Drilling Spots

DISTINGUISHED SPEAKERS AND KEYNOTE SPEAKERS

DISTINGUISHED SPEAKER

PROF. EMERITUS DATO' DR. IBRAHIM KOMOO PHD, FIGM, FASC, DSNS, P.GEOL

DEBRIS FLOW DISASTER IN MALAYSIA: PUBLIC UNDERSTANDING AND POLICY INTERVENTION

Prof. Emeritus Dato' Dr. Ibrahim Komoo is Principal Fellow of Institute for Environment and Development, Universiti Kebangsaan Malaysia. He graduated from Universiti Kebangsaan Malaysia (UKM) in 1976 and obtained his PhD from Strathclyde University, Glasgow in 1979. He has held various management positions in Universiti Kebangsaan Malaysia (UKM): Head, Department of Geology; Director, Institute for Environment and Development (LESTARI UKM), (1998-2000 and 2001-2005); Deputy Vice Chancellor (Research and Innovation), Universiti Kebangsaan Malaysia (2005 - 2008); Founder Director/ Chair of Southeast Asia Disaster Prevention Research Institute (SEADPRI-UKM) (2008-2012)(2015-2016); Special Advisor to Minister of Higher Education, Malaysia (2011-2013); Vice Chancellor of Universiti Malaysia Terengganu (UMT) (2012-2015); Chair of Langkawi Research Centre (PPL-UKM) (2017) and Professorial Chair, Iskandar Malaysia @UTM (2017-2019).

His fields of specialization include Engineering Geology (landslide; geohazards management); Environmental Geology (geoheritage conservation; geotourism; geopark); and Sustainability Science (environmental sustainability; regional sustainable development). as a scientist, he has published more than 55 books, more than 350 scientific papers. He has also published numerous articles for public awareness in magazines and newspapers. He has served as Vice President, International Association for Engineering Geology (IAEG) (1998-2003); Coordinator, Asia Pacific Geoparks Network (APGN) (2007-2017); Vice Chair, UNESCO Global Geoparks Council; President, Geological Society of Malaysia (1998-2000); Vice President, Institute of Geology Malaysia (2000-2001); Council Member, Academy of Sciences Malaysia (ASM) (2010-2012), Head of Natural Resources and Environment Cluster of the National Council of Professors (MPN) and Chairperson, National Geopark Implementation Committee (2017-2021).

Currently, he is the Vice President, Global Geoparks Network Association (GGN); Expert/ Evaluator, UNESCO Global Geoparks; Vice Coordinator, Asia Pacific Geoparks Network (APGN); and Advisor of Langkawi UNESCO Global Geopark; Professioral Chair, Iskandar Malaysia @ Universiti Teknologi Malaysia; and Chairman, National Heritage Council, Malaysia.

ABSTRACT

Debris Flow has been a major natural disaster in Malaysia. Since 1995, the phenomenon has caused more than 540 casualties and billions of ringgit in property losses. Unfortunately, the level of understanding of communities and policy makers with regards to mechanism of debris flow is still poor. Since the impacts are mostly associated with 'flesh and mud floods', the solutions are mainly related to prevention of floods. Based on current debris flow events, this keynote presentation will highlight some of the key issues related to mechanisms and causal factors, as well as public understanding and policy intervention.

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KEYNOTE SPEAKER 1

PROF. DR. JOY JACQUELINE PEREIRA, F.A. SC.

CLIMATE CHANGE AND DISASTER RISK REDUCTION IN SOUTHEAST ASIA: OBLIGATIONS OF GEOSCIENCE

Professor Dr. Joy Jacqueline Pereira is a Principal Research Fellow at Universiti Kebangsaan Malaysia's Southeast Asia Disaster Prevention Research Initiative (SEADPRI-UKM) and Fellow of the Academy of Sciences Malaysia. She obtained her PhD from University of Malaya in 1996, Master of Science from University of Leicester in 1991 and Bachelor of Science with Honours from Universiti Kebangsaan Malaysia in 1989, specialising in the field of geoscience. Professor Pereira is Vice-Chair of the Intergovernmental Panel on Climate Change (IPCC) Working Group 2 on Impacts, Adaptation and Vulnerability. She was Coordinating Lead Author for the Asia Chapter of the IPCC Fifth Assessment Report released in March 2014; Review Editor for the 2012 IPCC Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (IPCC-SREX); and Lead Author for the IPCC-AR5 Synthesis Report. Prof. Pereira is also a Member of the United Nations Office for Disaster Risk Reduction (UNDRR) Asia-Pacific Science and Technology Advisory Group (AP-STAG). She has graduated about 40 doctoral and masters candidates through research supervision and published over 200 peer reviewed articles.

ABSTRACT

The Working Group I contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) released in 2021 stated that global temperature over the past decade was about 1.1°C warmer than in 1850-1900. The report has reconfirmed that human activities are the principal cause of climate change over this period. Every region is already affected by human-induced weather and climate extremes such as heatwaves, heavy precipitation, droughts and tropical cyclones. Global warming would reach 1.5°C as early as the next decade if effective climate actions are not in place. The Working Group II contribution to the Sixth Assessment Report of the IPCC released in early 2022 has reported that many species are reaching limits in their ability to adapt to climate change. Climate change is affecting food webs and reducing the ability of nature to provide the essential services that we depend on to survive. The report also forewarns that if global warming briefly exceeds 1.5°C in the coming decades or later (i.e. overshoot 1.5°C by more than 0.1°C and then return to or below that level again by one to several decades), many human and natural systems will face additional severe risks, compared to remaining below 1.5°C. Depending on the magnitude and duration of overshoot, some impacts will cause release of additional greenhouse gases and some will be irreversible, even if global warming is reduced. The Working Group III contribution to the Sixth Assessment Report of the IPCC released in early 2022 has reported that we are not on track to limit warming to 1.5 °C unless there are immediate and deep emissions reductions across all sectors. Limiting warming to 1.5 °C requires global greenhouse gas (GHG) emissions to peak before 2025, reduced by 43% by 2030, and methane to be reduced by 34% by 2030. The good news is that there are options available now in every sector that can at least halve emissions by 2030, including technological, economic and behavioral changes.

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KEYNOTE SPEAKER 1 (cont.)

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Climate resilient development is the process of taking actions on both climate change mitigation and adaptation together in support of sustainable development for all. Geoscience knowledge is essential for this process. For example, geoscience knowledge is critical for carbon capture and storage, development of geothermal energy, and subsurface energy storage by providing options that are viable, feasible, and safe. Geoscience knowledge is also fundamental for disaster risk reduction, to determine the extent of a hazard, exposure of assets, and vulnerability of society. Susceptibility modelling of hazards such as landslides, floods, erosion and subsidence, offers invaluable insights for understanding risk, exposure, and vulnerability to predict and lessen the impact of natural hazards as the climate changes. In addition, nationally available geoscience datasets can be leveraged to develop local-level monitoring and early warning measures under a variety of climate settings, requiring enhanced synergies between climate change adaptation and disaster risk reduction. Geoscience knowledge needs to be mainstreamed into the policy domain with respect to climate change solutions that benefit society. A major transformation is required in geoscience education, training, and continued professional development with respect to awareness, capacity building, policy engagement, strategic linkages, and transdisciplinary networking for climate change actions. Scientific leadership and partnerships with multiple stakeholders are critical to marshal geoscience knowledge, to enable equitable transitions and build resilient societies, and accelerate actions for climate resilient development. The IPCC has stressed that the potential synergies for climate actions that limit global warming to 1.5°C far outweigh the negative outcomes associated with various sustainable development goals.

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KEYNOTE SPEAKER 2

PROF. DR. AZMAN A GHANI

GRANITE FROM PENINSULAR MALAYSIA: GEOCHEMISTRY, GEOCHRONOLOGY AND TECTONIC SETTING

Prof. Dr. Azman A. Ghani is a Professor in Department of Geology, Faculty of Science, University of Malaya. He graduated with a Bachelor of Science Degree with Honors (Geology) from the University of Malaya (UM) in 1992 and obtained his PhD from the Liverpool University, Liverpool, UK (1996). He was appointed as Head of Department of Geology, UM from 2016-2018 & 2007-2009. He joined Editorial Board Warta Geology GSM from 2010 to 2022. Prof. Dr. Azman has published more than 100 publications in WOS & SCOPUS index journals. He has also supervised more than 15 postgraduate students throughout his career. His research mainly focuses about granite from South East Asia, REE in granite and granitic soils as well as volcanism in Peninsular Malaysia and Sumatera, Indonesia.

ABSTRACT

The granitic rocks of Peninsular Malaysia have traditionally been divided into two provinces, i.e., Western and Eastern provinces, which correspond to S– and I–type granite respectively. The main Western province granite is characterized by megacrystic, coarse–grained biotite muscovite primary textured granite. The two-phase variant granite is also an important unit in the Western Belt granite and occurs as heterogeneous porphyritic microgranite or aplo pegmatitic texture also known as secondary textured granite (Cobbing et al. 1992). The Western Belt granite is tin–mineralized and has been regarded as comprising exclusively S–type granites of continental collision settings. Later, Ghani and his co-workers showed that the Western Belt granite of Peninsular Malaysia displays both I- and S-type characteristics (Ghani et al., 2013a). The granite formed as a result of a continental collision between the Sibumasu and Indochina blocks after the closure of the Tethys Ocean (Mitchel 1977; Ghani et al. 2013a; Ng et al. 2015a). The Eastern Province granite of Peninsular Malaysia is arc type granitoid and consists of bimodal I–type dominated by monzogranite-granodiorite and associated dioritic-gabbroic-syenitic rocks (Ghani 2001). The Eastern Belt granites have been intruded by a series of northeast–southwest trending mafic dykes with average thicknesses ranging from 0.5 to 2 m (Haile et al. 1983; Ghani et a., 2013b; Badruldin et al. 2017). Another type of granite in Peninsular Malaysia is the A-type granite that occurs in the Besar island group (Besar, Tengah and Hujung islands) in Southeast Johor. This granite type is characterized by highly fractionated rocks of more than 76% SiO_2 (Ghani et a. 2014). The U-Pb zircon age of the granite ranges from 280 ± 1 to 281 ± 1 Ma which suggests that they are among the oldest granitic rocks in Peninsular Malaysia.

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KEYNOTE SPEAKER 2 (cont.)

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The subduction of Sibumasu and the eastward movement of Paleo-Tethys oceanic floor beneath Indochina terrane started in Early Permian (Oliver et al. 2014) The Besar granite A type magmatism (~280 Ma) may develop during this time in the back arc basin that caused by convection asthenosphere driven by the downward drag of the downgoing oceanic slab will cause a spreading and produced the back arc basin. Further subduction of Sibumasu beneath Indochina create a westward younging trend of Eastern Belt granite which indicates a westward migration of plutonic emplacement. In Triassic (~220-225 Ma) Sibumasu started to collide with Indochina and caused a crustal thickening and melting of lower crustal material mainly derived from sediments.

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KEYNOTE SPEAKER 3

DR. LOKE MENG HENG

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NEW DEVELOPMENTS IN THE RESISTIVITY METHOD FOR GEOLOGICAL MAPPING

Dr. Loke Meng Heng is a Director of Geotomo Software Sdn. Bhd, a software company producing 2-D, 3-D and 4-D inversion software for ERT (Electrical Resistivity Tomography). His field of specialisation is Exploration Geophysics (Geoelectrical Methods). He graduated from Universiti Sains Malaysia in 1979 and obtained his MSc in 1982. He obtained his PhD from the University of Birmingham (U.K.) in 1994. He was appointed as a lecturer in Universiti Sains Malaysia from 1984-1998, Assoc. Prof. from 1998-2007 and as an Adjunct Prof. in Universiti Teknologi Petronas in 2011. His research interests are in fast 2-D and 3-D inversion methods for geoelectrical data, optimization of electrode arrays for 2-D and 3-D surveys, time-lapse inversion techniques, applications of fast numerical methods and parallel programming techniques in geophysical modelling. He published more than 60 publications in reputable Journals.

ABSTRACT

The resistivity surveying method is a geophysical tool that passes a small electrical current into the ground to map the subsurface geology. The electrical resistivity is affected by the porosity, mineral and water content within the geological structures. The main factor is usually the water content and the dissolved chemicals within it that lowers the resistivity. The resistivity method is more than 100 years old. It was originally used as a 1-D tool that maps the resistivity changes with depth only. There was a major change in the 1990s where new hardware and software tools were developed that made 2-D and 3-D surveys possible to provide more realistic multi-dimensional models of the subsurface geology. The mathematical models derived from ERT (electrical resistivity tomography) surveys provide a more realistic picture of the subsurface geology. ERT surveys are now conducted in practically every country in the world as it is an inexpensive and non-intrusive means of obtaining information about the subsurface geology. It has been used to study groundwater resources, environmental pollution, mineral resources, landslides, dams, mineral deposits, geothermal resources, archaeology, soil moisture and geotechnical mapping. This paper introduces the major new developments over the past 30 years, where it has progressed from providing simple 1-D layered earth model to complex 4-D images that show changes in both space and time. The field examples include relatively low value but vital resources such as ground water in remote areas, to large mineral deposits worth billions of dollars. A number of case histories from Asia, Australia, Europe and North America are shown to illustrate the wide variety geological problems where this method has been used. Some of the limitations of the technique and other geophysical methods such as TEM that can complement it will be briefly described.

Keywords: resistivity, ERT, geological structures, multi-dimensional

Themes: GEOPHYSICS & MACHINE LEARNING IN GEOLOGY

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KEYNOTE SPEAKER 4

ASSOC. PROF. DR. SHOHEI MATSUURA

REDUCING GEOLOGICAL HAZARD RISK: LESSONS IN TRANSDISCIPLINARY APPROACH (TDA) FROM JAPANNEW DEVELOPMENTS IN THE RESISTIVITY METHOD FOR GEOLOGICAL MAPPING

Assoc. Prof. Dr Shohei Matsuura is an Expert and Associate Professor, Disaster Preparedness and Prevention Center (DPPC), Malaysia-Japan International Institute of Technology (MJIIT), Universiti Teknologi Malaysia (UTM). He obtained his Doctor of Global Environmental Studies (Disaster Risk Reduction) from Kyoto University in 2015 and Master of Arts (Environment and Development) with Merit from University of London – Kings College in 2006. He graduated from International Christian University (Liberal Arts) in 1996. He has assisted formulation for DRR research project of Japan-ASEAN Science and Technology Innovation Platform (JASTIP) with Disaster Prevention Research Institute (DPRI) of Kyoto University and JICa Partnership Program with International Research Institute for Disaster Science (IREDeS) of Tohoku University.

ABSTRACT

While technologies and methodologies for disaster risk reduction and management (DRRM), including measures against geological hazards, have advanced significantly in the last decade, the benefits to the local disaster managers and communities remain unclear. Under such circumstance, the science and technology stakeholders have been attempting to support societies build their disaster resilience though a transdisciplinary approach (TDA) that integrates cross-cutting DRRM issues and brings various stakeholders from different disciplines to work together through science to bring about a change for a safer, secure society against natural hazards.

Although the TDA is not necessarily a new concept, the transition from single discipline to TDA encourages stakeholders to co-design, co-produce, co-deliver and co-implement with aim to solve a common societal goal through scientific knowledge-based decision making. Without TDA, DRRM might continue to be predominantly conducted in a traditional framework of basic geosciences in which experts do not feel the responsibility to translate knowledge into actions. This may lead to irrational decision making based on unfairness, corruption, poor judgment or over-reliance on technology and more commonly, unnecessary overlaps in efforts, such as in utilizing financial, human, knowledge resources, which leads to lack of synergies.

In this light, several case studies that showcase good practices and the challenges in TDA will be introduced from Japan and Malaysia. The case studies are from experiences in implementing DRRM projects by the Japan International Cooperation Agency (JICA) as well as other cases that became known through a survey conducted with DRRM practitioners and researchers across the Asia-Pacific Region. Through an analysis done with these case studies, eight key elements have been identified that can be used as a guide and checklist for DRR stakeholders to effectively and efficiently implement TDA for strengthening disaster resilience of our societies.

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KEYNOTE SPEAKER 5

DATO' IR. TS. DR. BADHRULHISHAM ABDUL AZIZ

SUSTAINABLE CRITICAL MINERALS INDUSTRY THROUGH RESPONSIBLE MINING AND PROCESSING

Prof. Dato' Ir. Ts. Dr. Badhrulhisham is a Principal Consulting Fellow at Universiti Malaysia Pahang. He graduated with B.Sc. (Chemical Engineering) from Colorado State University, USa in 1986 and obtained his MSc from University of Wales (Swansea), U.K. in 1988 and Dr. Eng. (Chemical Engineering) from Kyoto University, Japan in 1994. He has held various management positions in various universities in Malaysia such as Universiti Teknologi Malaysia (Head of Chem. Eng. Dept.1995); Dean, Faculty of Chemical and Natural Resources Engineering, KUKTEM (2004); Deputy Vice Chancellor (Research and Innovation), Universiti Malaysia Pahang, UMP (2005); Senior Professor and Director, Centre of Corporate Development and Quality Management, UMP (2009); Deputy Vice Chancellor (Academic & International) UMP (2010); Senior Profesor and Dean, Faculty of Bioengineering and Technology, Universiti Malaysia Kelantan (UMK) (2017); Principal Consulting Fellow, UMP (2022) and many other positions throughout his career.

His fields of specialization include Process System Engineering focussing in Design and Operation of Batch Specialty Chemical Processes/Plants, Modeling and Simulation of Novel Chemical Processes, Modeling and Simulation of Dust Explosion, Plant Design and Operation of Rare Earth Separation and Refining Processes, Gold Processing: Alternative Environmental-friendly Solvent in Gold Extraction as well as responsible mining. He has published 14 books and more than 150 scientific papers in many reputable journals.

ABSTRACT

Mining industry contributes significantly towards economic growth and societal benefits through employment; production of consumer electronics; infrastructure; logistics; food production; energy savings; and information technology. At the same time, it could also bring detrimental effect to society and the environment, for example air and water pollution; flooding; deforestation and displaced populations. In the last few years, many countries including Malaysia has witnessed increased activities in mining throughout the country. Several large-scale projects were announced involving critical minerals such as rare earth in several states. As the new discovery of valuable minerals are welcomed especially in the aspect of economic potential, there are concerns on sustainability and at the same time, how to manage the risks associated with the mining and processing activities. One of the significant initiatives that should be the focus of this development is responsible mining and processing. This talk presents an overview on the sustainability of critical minerals industry through responsible mining and processing. With proper and appropriate framework, good practices, realistic policies, and sound implementation strategies, the critical mineral industry can be brought to the next level; taking into account the social and economic benefits with ethical consideration for the whole supply chain of the industry. Implementation of advanced technology such as novel separation techniques, internet of things (IOT) and 4th industrial revolution (IR), throughout the supply chain of mining and processing are highlighted as several key initiatives to support sustainability.

Keywords: Responsible Mining and Processing; Sustainability; Critical Minerals

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KEYNOTE SPEAKER 6

PROF. DATO' DR. MOKHTAR SAIDIN

FUTURE AGENDA FOR GEOPARK IN MALAYSIA

Prof. Dato' Dr. Mokhtar Saidin is a Professor and the Director of Centre for Global Archaeological Research Malaysia in Universiti Sains Malaysia (USM). He completed his undergraduate studies in Geology in Universiti Kebangsaan Malaysia (UKM). He obtained his Master in Art (MA) degree in Archaeology from USM and then he pursued his PhD (Archaeology) from USM with a special coursework programme at Harvard University, USA. Prof. Dato' Dr. Mokhtar Saidin and his team made significant contributions to the exploration of Bujang Valley in Kedah and Bukit Bunuh in Perak. Dated at 1.83Ma (millions of years ago), Bukit Bunuh is an open Palaeolithic site and the oldest prehistoric site in the world located out of Africa. His other contribution include the discovery of Sungai Batu, the oldest civilisation site in Southeast Asia. He has graduated about 38 doctoral and masters candidates and published over 120 peer reviewed articles.

ABSTRACT

Geopark in Malaysia started with Langkawi becoming a National Geopark in 2006 and then declared as a UNESCO Global Geopark (UGGp) in 2007. At that time Langkawi was the only UGGp in the region. Since then, a research group has been mobilized at UKM under the *Warisan Geologi Malaysia* (WGM) to consolidate the country's geological heritage data. In 2013, a Geopark Implementation Committee was established at UKM led by Y.Bhg. Prof. Emeritus Dato' Dr. Ibrahim Komoo with the expertise of geologists, biologists and cultures from universities, relevant government agencies and representatives of NGO groups. Finally in 2015 the Malaysian cabinet approved the National Geopark Program managed by the National Geopark Committee chaired by the Secretary General who is now under the Ministry of Energy and Natural Resources. Until now, Malaysia has one UGGp (Langkawi), one aspiring UGGp that has been assessed (Kinabalu), six National Geoparks (Jerai, Lembah Kinta, Mersing, Lenggong, Labuan and Sarawak Delta) and six aspiring National Geopark (Kenyir, Perlis, Stong, Lipis, Jelebu and Melaka Island). All of the National Geoparks are strengthening their governance, human capital, conservation and preservation, promotion, infrastructure, geoproduct, geotrail, geocommunity and geotourism with their respective success stories and issues and problems. Based on the report of 20 years Spain (Orus and Urqui, 2020) and China (Ding *et al*., 2020) with the UGGp which has clearly recorded still have issues in (i) their respective geocommunities where there are still those who do not understand what a geopark is, (ii) still very much in need of federal government support, (iii) still not having a complete database and (iv) a network that has not yet expanded and covers both the national, regional and global levels. Therefore, for the sake of a more sustainable future for the National Geopark, these four issues must be the focus of the country's future agenda.

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Technical Session 1

Technical Session 1

Environmental Geology & Climate Change Adaptation

GEOSEA 1-1

PARTICIPATORY MAPPING FOR RAPID IMPACT ASSESSMENT FOLLOWING GEOLOGICAL DISASTERS: LESSONS LEARNED FROM INDONESIAN CASE STUDIES

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Understanding the extent of impact following a major destructive disaster requires rapid field assessment of the impacted area. However, there are often difficulties in dispatching field team and obtaining geospatial data to cover the impacted area. To fill this gap, we exercise participatory aerial mapping approaches directly after a major disaster occurs. This study offers insights and identifies challenges and lessons from the uses of UAVs to fly above the affected areas from four major geological disasters in Indonesia; The Halmahera Earthquake 2019, Mamuju Earthquake 2021, Sumedang landslide 2021, and Semeru Volcano Eruption 2021. The mapping involves multiple participants of pilot drones, field assessors, data processors, government officials from the National Disaster Management Authority (BNPB), and universities and research institutions. The result identifies various aspects that affect the effectiveness of UAV mapping. The UAV maps have been used to assess field search and rescue (SAR) and emergency and recovery planning. This effort needs to be continued more systematically to obtain an optimal result.

Keywords: Participatory disaster mapping, UAVs, emergency assessment, geological disaster.

Themes: Environmental Geology and Climate Change

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GEOSEA 1-2

DISASTER IS NOT NATURAL: HOW DO WE BUILD SOCIETAL RESILIENCE?

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A hazard do not necessarily turn into a disaster, however, the decisions that we make as humans in many occasions influence the what turn a hazard into a disaster. Disaster is a sudden calamitous event that disrupts a functioning community and exceeds their ability to cope using own resources. Natural hazards such as earthquakes and tsunami may be of challenge to predict but there is nothing inevitable about the loss of life and economic damage they inflict. Since understanding of the hazard within the living environment be promoted towards educating the community in identifying the potential risk of disaster that they are exposed to as well as the impact on their life is uttermost importance. With increasing global surface temperatures the possibility of more droughts and increased intensity of storms will likely occur. The industrial revolution has brought about much increase in the global warming, whereby 3 degrees increment can be catastrophic. Climate change affects global temperature and precipitation patterns, thus, influence the intensity and, in some cases, the frequency of extreme environmental events, such as forest fires, hurricanes, heat waves, floods, droughts, and storms. Climatic hazards are agents of disaster as potentially hazardous atmospheric phenomena. In strengthening resilience against disaster and climate change, adaptation and risk reduction measures have to be imperatively initiated to empower vulnerable communities.

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GEOSEA 1-3

SOIL CANCER: THEIR TROUBLES AND MITIGATIONS

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The Paleozoic carbonaceous shale exposed around Gopeng, Perak is interbedded with sandstone and siltstone, which is sandwiched in between Kinta Limestone over a total thickness estimated to be about 3,000m. It deposited within deep marine environment indicated by the dissemination of reduction pyrite. The exposures at Rural Transformation Centre (RTC) Gopeng were studied whenever numbers of slope failure occurred, as well as stained road surfaces and drains, which is believed trigger by the material properties of black shale. Chemical weathering is the only factor that contributes to the change of chemical and physical properties of the carbonaceous shale which contain reduction pyrites. Acid rock drainage (ARD) is one of the environmental problems occurred and it produced by the oxidation of sulfides minerals, such as pyrite and marcasite (FeS_2). Both of these phenomena can affect the physical and chemical properties of the carbonaceous shale. ARD is found around the world both as a result of naturally occurring processes and activities associated with land disturbance such as highway construction and mining where acid-forming minerals exposed to the air and water. These acidic can cause the geologic material to dissolve and oxidize, which can cause a very serious contamination and damage of flora around the area. Acidic soil contributed by pyrite oxidation in carbonaceous shale become a very low pH (3). It is naturally transformed into a barren soil without grass and plants or soil cancer. An appropriate method needs to be implemented in order to treat the acidic soil problem. The growth of plants is important because the roots of the plant can serve as natural fiber reinforcement and will increase the resistance to slope failures. Pyrite oxidation, also referred to as pyrite disease or pyrite decay, is identified by a sulfuric acid odor, white crystalline powder, yellow sulfide powder, and/or gray to yellowish microcrystalline mass in and out of specimens. One of the important approaches to prevent pyrite oxidation is to create a surface coating on pyrite. In the study conducted, a coating of iron 8–hydroxyquinoline was formed by leaching pyrite with a 0.10M H_2O_2/0.0034 M 8-hydroxyquinoline solution; stability of the coated pyrite was tested under various pH and temperature conditions. It shown the iron 8-hydroxyquinoline coating could significantly suppress further pyrite oxidation by both chemical (H_2O_2) and biological (*Thiobacillus ferrooxidans*). Ammonium gas and ethanolamine thioglycollate treatments neutralize sulfuric acid and remove ferros-sulphate, and are reportedly effective in partly or completely removing oxidation reaction products. Calcium carbonate or limestone powder can also be utilized to treat the ARD, where the exposed black shale covers by calcium carbonate, and then cover back by layer of softwood and hardwood. These mitigation methods suggested can be implemented to enhance the growth of grass and stabilize slopes.

Keywords: cancer, carboniferous shale, ARD, mitigation

Themes: Engineering Geology/Environmental

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GEOSEA 1-4

IMPACT OF VERTICAL LAND MOTION ON THE COASTAL REGION OF SELANGOR

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Understanding the impact of Vertical Land Motion (VLM) on the coastal region remains a complex and daunting task. While the previous investigation has demonstrated plausible explanations, this study specifies subsidences along vulnerable coastlines. Herein, we have utilized multi-temporal (November 2017 – January 2022) approximation analysis to quantify terrestrial vertical land motion. The Stanford Method for Persistent Scatterers (StaMPS) is an exceptional assessment for both detection and attribution of climate change and geologic signals in relative sea-level change (RSL). The extracted information was overlaid on the Kuala Selangor inundation zones, which was estimated by selecting areas below 2m hydrologically connected to the coast. For Port Klang, a high-risk coastal zone from a past study was digitized. The derived results suggest a range from 15 to 69 mm subsidence along Port Klang, Selangor. Nevertheless, the highest change was recorded in Kuala Selangor, with a substantial change of 93mm along its coastlines. This dataset reflects the possibility of an increase in coastal threats if continuous subsidences occur. The contributing factors could be human-induced actions, localized deformation, or the impact of far-field stresses. For this study, the latter was emphasized to understand better the effects of neighboring plates on the coastal region of western peninsular Malaysia. Using the 10th July 2018 tremors, we have identified 39mm of subsidences along the coastal area of Selangor, which coincides with tide gauge information. An increase in relative sea level between February 2018 to September 2018 was observed, possibly connected to the seismic activities. However, the change in relative sea level in response to localized deformation will be established to elucidate its impact on coastal processes. Thus, coastal economic hubs such as Port Klang, Selangor will undoubtedly need to improve its coastal adaptation strategies to withstand the impacts of sea level change.

Keywords: Vertical Land Motion (VLM), Relative Sea Level (RSL), Kuala Selangor, Port Klang, Subsidence

Themes: Environmental Geology and Climate Change

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GEOSEA 1-5

The Potential of Basalt Dust in Malaysia as a New Source of Fertilizer

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About 70% of the soils in Malaysia are highly weathered, with low pH (4-5). Their mineralogy is dominated by goethite, hematite and gibbsite; the first two are called variable-charged minerals. Normally, the soils have insufficient supply of P, K, Ca and Mg for crop requirement. Currently, the price of K- and P-fertilizers at the marketplace has increased manifold; besides, they are not easily available. As such, it is time for Malaysia to look for alternative sources of the nutrients to sustain crop production (oil palm, rubber, and cocoa). Recent studies showed that basalt dust available cheaply from a quarry in Segamat, Johor, had the potential to be a new source of plant nutrients (e.g. Ca, Mg, K, P, and S). Applying it on agricultural land in the long run would partly help alleviate soil acidity problem or insufficient amount of nutrients. The crop tested in the studies were cocoa and rubber. On dissolution under moist condition in the field, the olivine in basalt releases OH^- that increases soil pH to the level dependent on the rate applied. Increase in soil pH results in increase of the cation exchange capacity (CEC) of the soils. Furthermore, the hydrolysis of SiO_4^{4-} present in the soil solutions produces silicic acid [$Si(OH)_4$] that enhances crop growth and/or production, especially cocoa. The studies indicated that land application of basalt dust would eventually change the environmental conditions in the soils. This is indicated by the enhancement of soil fertility, which is shown by the increase of soil pH, addition of extra macronutrients needed by crops and increase of the CEC of the soils. It means that the infertile and highly weathered soils in Malaysia are rejuvenated to become productive again.

Keywords: soil amelioration, fertility, silicate, agriculture, climate change, sustainable

Themes: Environmental Geology & Climate Change Adaptation

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GEOSEA 1-6

Characterizing Peat Soils and Porewater Geochemistry of Natural and Drained Peatland in South Kuala Langat Peat Swamp Forest, Selangor

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Peat swamp forest is ecologically and economically important. Coastal peat swamp forests are highly productive ecosystems with rates of primary production equal to those of tropical forests and coral reefs. Mobilization of toxic metals into the marine ecosystem became significant when the geochemical condition of the peatland is altered anthropogenically. Hence, this study aims to investigate the physical and geochemical properties of peat soils and porewater in the South Kuala Langat Peat Swamp Forest, Selangor. Two study locations were selected to compare the natural and anthropogenic influence to the peat soil – natural peat forest and drained peatland. A total of 24 samples were taken at different depths (0-150 cm) from both study locations. Our results show that the soil pH ranges from 3.15-4.34, while the porewater pH ranges from pH 2.78- 6.45. It was found that organic matter content of the soil correlates positively with moisture content ($r = +0.832$, $p<0.01$), and, negatively with bulk density ($r = -7.17$, $p<0.01$). In general, drained peat has higher concentration of nutrients and trace metals compared to natural peat. The peat swamp forest here can be classified as ombrotrophic peat as there is a lack of observable river input into the peat swamp forest system here, making it relies heavily on meteoric water as source of water and nutrients. The ombrotrophic peat here also explains the low nutrient content when the natural area was compared to the disturbed area. The porewater chemistry of the drained peat suggests minor signs of anthropogenic activities. Elevated concentration of arsenic, lead, calcium, aluminium, nickel, and magnesium ions in the porewater were found which could possibly indicate influence of fertilizers that got leached into the soil and porewater. However, further analyses are needed to acquire a conclusive answer.

Keywords: peat, anthropogenic, ion mobilization, soil nutrients, ombrotrophic, Kuala Langat Peat Forest

Themes: peat soil and porewater chemistry

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GEOSEA 1-7

GEOCHEMICAL SURVEY AND ENVIRONMENTAL IMPLICATIONS OF MAJOR AND TRACE ELEMENTS IN SOIL SAMPLES FROM THE OKEMESI AREA, SOUTHWESTERN NIGERIA.

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In environmental studies, chemical elements are often differentiated as natural based on their sources. The knowledge about their distribution in soils is thus its investigation of the environmental hazards due to chemical pollution of the soil aimed at determine the environmental implications of major elements, major oxides, trace elements and heavy metals in soil samples collected from Okemesi area Southwestern Nigeria. Ten(10) soil samples were collected and analyzed to determine the quantities of trace elements and heavy metals like Cobalt(Co), Zinc(Zn), Barium(Ba), Lead(Pb), Copper(Cu), Niobium(Nb), Zirconium(Zr), Lead(Pb), Arsenic(As), Cadmium(Cd), Yttrium(Y), Nickel(Ni), Strontium(Sr), Zircon(Zr),Beryllium(Be), Strontium(Sr)Vanadium(V), Rubidium(Rb) and Chromium(Cr). The results showed that Pb is the dominant trace element found in the soil samples having a range value of 0.98ppm - 875.00ppm and mean of 167.142ppm. Co ranged from 0.24ppm - 41.60ppm having a mean of 14.716ppm. TiO_2 values ranged from 0.40% - 0.95% having a mean of 0.548% SiO_2 values ranged from 50.42% - 54.24% having a mean of 51.998%. The low values of these Oxides may be attributed to chemical destruction under oxidizing condition during weathering. Al values ranged from 7.53w% - 8.85w% having a mean of 8.454w%. Fe and Si are the dominant major elements in the soil samples. The presence of manganese might indicate the potential of ferrous metals mineralization. The Geo-accumulation (Igeo) result indicated uncontaminated to slightly contaminated soil condition. The element distribution of the soil samples from the study area is greatly influenced by the local geology of the area.

Keywords: Aluminosilicates, Mineralization, Environmental, Okemesi

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GEOSEA 1-8

Integration of Geological Mapping and Subsurface Investigation in Exploration of Silica Rock Resources in Lojing, Gua Musang

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The study being carrying out to integrate the surface and subsurface field data for calculating resource estimation of the exposed and embedded silica rock or quartz body using the geographical information system (GIS) approach. Surface data incepted consists of field geological mapping and aerial photogrammetry survey while subsurface data is made up of vertical subsurface investigation (diamond drilling), and geophysical anomaly survey of electrical resistivity survey. These data were recorded, analysed then used as input in Geographical Information System (GIS) software of ARC GIS. For this case study, walkover scanline traversing was conducted to observe, delineate and mapped the exposed protruding silica dike body and exposed outcrops found along the track surface within the site. Aerial photogrammetry survey data is mainly utilised as base map, preliminary surficial mapping and 3D visualisation of aerial images. Total of five (5) resistivity lines were conducted to identify the potential extension and distribution of embedded silica body. Based on the resistivity results and outcrop identified during field mapping, six (6) diamond boreholes drilling being carried out. Four (4) boreholes were used to obtain the vertical extension information of the silica body, and two (2) for lateral extension. Data acquired from diamond drilling were used to generate the to produce 3D geological block model that could identify as the silica body cut-off depth for resources estimation. Then, all results that analysed and used as data set input for the *Surface Volume* function to compute the silica body volume in calculating resources estimation of the potential minable silica rock quarry.

Keywords: mining exploration, mineral resource, geographic information system, kriging.
Theme: Economic Geology, Machine Learning in Geology

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GEOSEA 1-9

Determination of Ion Exchange Phase of Rare Earth Element and Subsequent Extraction of Rare Earth Element from Local Ion Adsorption Clay

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Rare earth elements (REE) from ion adsorption clay sources are gaining much interest globally due to its simpler extraction process compared to its mineral sources' counterparts. Rare earth elements (REE) are extracted from ion adsorption clay by using in-situ leaching method with ammonium sulphate as a commonly used lixiviant. In this study, the presence of ion-exchange rare earth element phase in ion adsorption clay was identified through a sequential extraction method. The results showed that total rare earth element concentration, as well as ion-exchange rare earth phase, increased with increasing depth of the sample. A leaching test was also conducted to study the feasibility of leaching by using ammonium sulphate as a lixiviant on local ion adsorption clay sources. Results of the leaching test indicate that recovery of rare earth elements also recorded the same increment pattern with increasing depth of the sample. This is due to the increasing concentration of ion-exchange rare earth phases with increasing depth.

Keywords: rare earth element, ion adsorption clay, leaching, ammonium sulphate

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GEOSEA 1-10

An Integration of Surface and Subsurface Geological Input for Potential Geohazard Zonation Mapping for Urban Planning at Ex-coal Mining Area

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The study involving surface geological investigation is including engineering and geological terrain mapping, drone aerial photo mapping in order to identify the geological boundary and geomorphology conditions of the study area. Obtaining in-situ information and site verification to determine the probable selected location potentially expose likelyhood to the subsidence or sinkhole. The identify location then being undergone the subsurface investigation using geophysics anomaly method and drilling boreholes. Geophysics survey of Electrical Resistivity survey with 400m length used in order to obtain 60m depth of the subsurface anomalies. While the drilling borehole carrying out serve as to calibrate the Electrical Resistivity results as well as to obtain in-situ geotechnical data and samples that could identify the subsurface lithology of the area. The potential geohazard zone map was produced by using a heuristic semi-quantitative method to identify the causal factors that contribute to the potential geohazard which are type of mining activity, void structure, historical data of geohazard incident, type of Coal Seam and structural geological formation. The study also found that the triggering factor of the failure mainly due to the overdrawn of groundwater or rapid groundwater draw down. The Analytic Hierarchy Process (AHP) analysis used to obtain weighting factors and hierarchical justification of the identified causing factors. Finally, the raster calculator method is the GIS analysis used in order to produce the thematic and isopach map of potential geohazard zone of the study area. The 3D geological model produced as to explain not only the mechanism of previous failure but also being interpolate for predicting the future potential failure could reoccurance if lack or improper geological study or investigation approach being conducted.

Keywords: Geological Terrain Mapping, Electrical Resistivity Survey, borehole, Analytical Hierarchy Process (AHP), Geographical Information System (GIS), Raster Calculator

Theme: Engineering Geology, Geohazards

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Technical Session 2

Technical Session 2

Geohazards & Disaster Risk Reduction (DRR)

GEOSEA 2-1

LANDSLIDE SUSCEPTIBILITY MAP PRODUCED BY WEIGHTED LINEAR COMBINATION METHODS: A CASE STUDY AT GUNUNG JERAI, KEDAH

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Landslides is one of the most common natural disasters in the world. The aim of this paper is to use a Geographical Information System (GIS) technique for delineation of landslide susceptibility map in an area of the Gunung Jerai, Malaysia. In this study, landslide interrelated factors that influence landslide occurrences are derived from remotely sensed imagery, available maps, and associated databases. Those factors are: lithology, slope gradient, slope aspect, slope curvature, elevation, distance to lineament, distance to drainage and Topographic Wetness Index (TWI). Then the factors layers were integrated and modeled using a knowledge-driven GIS of Weighted Linear Combination to generate landslide susceptibility maps. The delineated landslide susceptibility map in the study area was categorized into four classes as Very Low, Low, Moderate, High, and Very High. Finally, the results obtained in this study were validated with the existing landslide data compiled by the JMG. The landslide susceptibility map can be useful for the preparation of effective future planning for the landslide prevention, mitigation and construction in the area by responsible agencies and local authorities.

Keywords: Landslide susceptibility, GIS, Weighted Linear Combination, Gunung Jerai, JMG
Themes: Geohazards and Disaster Risk Reduction

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GEOSEA 2-2

ACTIVE FAULT MONITORING OF A SEISMICALLY ACTIVE REGION IN RANAU, SABAH, MALAYSIA

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Ranau, Sabah has been identified as one of the most seismically active locality in Malaysia. This area has recorded more than 100 earthquakes in the past 30 years, in which the highest magnitude of about 6 Richter scale was documemted in 2015. This was the most destructive earthquake event to date, causing 18 casualties, significant environmental and infrastructures destructions and monetary loss. Based on previous studies, a total of 18 active and potentially active faults have been identified intersecting within the area with several orientations such as NNE-SSW (Ranau Fault), NE-SW (Lobou-Lobou, Serinsim, Lipasu, Luanti and Nalapak Faults), ENE-WSW (Kapuakan, Kijuhutan, Lakang, Poring, Kundasang and Kibbas Faults), NNW-SSE (Kedamaian, Kinapasan, Tarawas, Nabutan and Matupang Faults) and WNW-ESE (Mesilou Fault). The NNW – SSE trending faults are identified as right lateral strike slip while the NNE-SSW/NE-SW are normal faults and ENE-WSW/WNW-ESE are reverse fault. A total of 31 GPS/GNSS monuments have been installed to monitor the movement of the active fault segments for a duration of two years starting November 2018 to October 2020. The result shows that five faults namely Lobou-Lobou, Lipasu, Ranau, Nalapak and Luanti have shown significant movement of about 7mm to 12mm/year, hence recognized as active faults. The movement of these faults shows that they are undergoing extensional deformation, whereas the Lakang Fault, Poring Fault, Kundasang Fault and Kibbas Fault are undergoing compressional deformation. The movement of active faults show that the study area is undergoing tectonic compression in NNE-SSW direction and extension in NW-SE direction concurrently. Compression convergent is caused by approximately ENE-WSW shearing and uplifting activity of Mount Kinabalu batholith whereas extension deformation towards NW-SE is caused by the large open fold underlying Ranau area.

Keywords: tectonic, earthquake, active fault, monument, monitoring
Themes: (Engineering Geology and Geotechnology)

Return to Program

GEOSEA 2-3

CHARACTERISATION OF DEBRIS FLOW MATERIAL IN YAN, KEDAH

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Debris flow is a natural phenomenon triggered depending on several characteristics, including morphometric, geological, hydrologic and geotechnical features of the slope in the location of debris flow. This phenomenon usually occurs in mountainous areas where the sloping of the area is steep and prone to heavy rainfall deposition. In Malaysia the major triggering factor for such phenomenon being heavy rainfall for prolonged duration of time and steep slopes. The recent debris flow event in Yan, Kedah and other surrounding area of Gunung Jerai has caused major damages. It has been reported that the main cause is due to a headwater phenomenon on Gunung Jerai caused by heavy rainfall, which then turned into destructive debris flows. Due to that this research was carried out to find the engineering properties of deposits soils that were bring by debris flow. The objective of this research was to identify, classify and analyze the properties of the debris flow deposits that accumulated in various creek and river areas in Yan, Kedah. The five selected debris flow deposits where samples were collected are from Titi Hayun, Batu Hampar, Seri Perigi, Sungai Badak and Tupah. A series of laboratory tests which are sieve analysis, specific gravity, Atterberg limit test and direct shear test were conducted for these soil samples. From the results obtained, the debris flow deposits samples were classified as SM, Silty sands, and silt mixtures for Titi Hayun, Seri Perigi, Tupah and Sungai Badak and SP-SM, Poorly graded sand-Silty sands, and silt mixtures for Batu Hampar according to USCS classification. As Gunung Jerai is the main cause of the debris flow to reach down to the lower areas, the difference between classification result means that the finer soils of the debris flow deposit soils had been sedimented into deeper soil levels

Keywords: debris flow, engineering properties, soil classification, sedimentary, debris deposits
Themes: (sustainable highway, geotechnical and transportation engineering and geo informatics)

Return to Program

GEOSEA 2-4

Application of Weight of Evidence Analysis in Landslide and Subsidence Susceptibility Mapping in El Nido, Palawan and Del Carmen and General Luna, Surigao Del Norte, Philippines

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Susceptibility mapping of landslides and subsidence in the Philippines is conducted by the Mines and Geosciences Bureau (MGB) with an emphasis on field-based hazard observation. This study was employed to create a systematic approach to hazard susceptibility mapping that is more consistent and replicable to multiple users. Weights of Evidence (WOE) modeling is a statistical method that highlights trends by quantifying the relationship between dependent and independent variables through indicative weights. WOE has applications in the field of medicine, environmental sciences, and mineral potential mapping.

Hazard inventories for the municipalities of El Nido, Palawan as well as General Luna and Del Carmen, within Surigao del Norte were compiled from field assessments and historical records from MGB. Interferometric Synthetic Aperture Radar (IfSAR) data and satellite imagery were also analyzed to identify landslide and sinkhole features. The inventories were split into training and testing subsets and rasterized. Hazard conditioning factors such as slope and geology were selected and converted into thematic maps in raster format. The maps were imported into the ILWIS platform wherein the WOE operations were performed.

Analysis of resulting weights showed that karst lithology contributed the most to landslide occurrence, with factors such as steep slopes and bare soil cover also contributing to recorded landslide events. For subsidence hazard, higher sink densities promoted sinkhole development. Geology and proximity to drains and lineaments also influenced subsidence. Overall reliability of the resulting hazard models was validated using ROC curves. The landslide susceptibility maps had success rates of ~81% for both study areas, while for subsidence hazards, the study areas in Surigao del Norte had success rates of ~81%. The subsidence map of El Nido had a success rate of 91%. These indicate high reliability for the method employed for hazard susceptibility assessments and a high degree of reproducibility for future hazard susceptibility zonation.

Keywords: Weight of evidence, karst, geohazards, Philippines

Themes: Geohazards & Disaster Risk Reduction, Geoheritage & Geotourism, Environmental Geology & Climate Change

Return to Program

GEOSEA 2-5

A Study of Old Dormant Landslides in the Fraser's Hill area, Pahang, Malaysia

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Recurrence of landslides occurs more frequently in the Fraser's Hill area yearly. The old dormant landslides can be reactivated as a result of land use activities on the slope surface which has an impact on increasing the rate of water seepage and soil saturation, soil becomes loose and sensitive. The change in the morphology of slope has resulted in the sliding plane of the old dormant landslide being reactivated as the load caused by exploration activities increases. This study involves aerial photography and lineament analysis with the help of a Geographical Information System to determine an old dormant landslide zone. While, petrographic analysis is used for general geological characterization and mineral composition in granite and schist rocks in the study area. Geophysical methods such as geoelectrical resistivity and induced polarization are also used to map the subsurface profile of landslide distribution patterns. The aerial photo analysis results show three main sets of lineaments oriented North-South, North East-South West and North West-South East. A total of 128 landslide locations were recorded from January 2021 to December 2021. Petrographic analysis shows the granite rocks have a mineral composition consisting of quartz, plagioclase, alkali feldspar and biotite. In addition, other minerals such as sericite and chlorite are present due to weathering. Schist rocks contain minerals such as hornblende, biotite and muscovite. The subsurface profile using the geoelectric resistivity method shows the resistivity value of the landslide zone in the range of 30Ωm-200Ωm, bedrock is 1000Ωm-5000Ωm, weathered rock is 500Ωm-1000Ωm, silty sand is 100Ωm-500Ωm and water content is 10Ωm-100Ωm. The induced polarization method shows the subsurface profile of chargeability range for water and silty sand, which are $0ms^{-1}$-$4ms^{-1}$ and $15ms^{-1}$-$50ms^{-1}$. Generally, old dormant landslides occur in the Fraser's Hill area due to geological and geomorphological conditions reinforced by anthropogenic and natural factors.

Keywords: old dormant landslides, petrographic, geoelectrical resistivity, induced polarization

Themes: Geohazards and Disaster Risk Reduction

Return to Program

GEOSEA 2-6

DEXTRAL MOVEMENT ALONG BENTONG-RAUB SUTURE ZONE IN THE LOJING - POS BETAU AREA

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Numerous of secondary structures (strike-slip and reverse faults) have been reported in individual localities of Bentong-Raub Suture Zone. To date, there is no detailed discussion on the overall structural development in the wider region of the suture zone. Thus, the current study is conducted in Lojing area and extend to Pos Betau area at regional-scale and outcrop-scale to discuss above mentioned issue. ~N-S striking dextral structures with steeply to vertical dipping have consistently been observed in various lithologies within and at the edge of suture zone. The dextral movement are occurred in both brittle and ductile conditions. The brittle dextral movement is observed in amphibolite schist, limestone and andesite; whilst the ductile movement is found in schistosed granite (next to suture) and mélange. The amphibolite schist and limestone show clear slickensides which indicated a brittle dextral N-S strike-slip faulting. The andesite was cut by a set of conjugate fractures/faults (N-S and ENE-WSW striking). Some of the ~N-S fractures of the andesites exhibited a dextral shear movement, and the ENE-WSW fractures showed sinistral shear movement. The C-S fabric occurs in the schistosed granite in Lojing area, and the C-plane is striking in NNW-SSE direction. The mélange composes of muddy matrix and sandstone clasts, where some of the sandstone clasts were deformed into sigmoidal-shaped under the ductile N-S dextral movement. Schistosed granite and andesite have dated with K-Ar method, and yielded 100Ma and 91Ma respectively. It is suggested that the regional dextral movement of Bentong-Raub Suture Zone should have occurred in Late Cretaceous or younger time.

Keywords: Bentong-Raub Suture Zone, brittle, ductile, dextral, faults, Lojing
Themes: DEPOSITIONAL BASINS, TECTONIC HISTORY & MAGMATISM

Return to Program

GEOSEA 2-7

Reframing Models for Rainfall-induced Landslides in the face of Non-analog Future Climates in the Philippines

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In most global climate change models, the Southeast Asian Region will be experiencing, by the end of the 21st century, accelerated climate change of factorial combinations that are still unclear at this time and would likely give rise to climates that are so much unlike the present. What is definite about these non-analog climates is that air temperatures are rising, leading to increasing temperature events that affect the global water balance, that eventually result to extreme water-related extreme events. In the Philippines, downscaled global models predict intensified tropical cyclones and rainfall rates in the near future. The frequency of cyclones may not change too much, but the number of extreme rainfall events will likely increase. Such forecasts should be considered in how we look at the potential changes in the occurrence of rainfall-related disasters. We present here results of our work on establishing rainfall-landslide thresholds for different terranes in the Philippines. In particular, data from the volcanic terrane of the Southern Luzon Region, and the mineralized Benguet Province are discussed. Results of the work are integrated with the regionally downscaled climate change projections developed by the Philippine Atmospheric, Geophysical, and Astronomical Services Administration to provide scenarios on how future slope failure statistics may change. It is hoped that results of the work would influence other determinants of disaster risk and more planning initiatives towards a more future-proofed direction.

Keywords: rainfall-induced landslides, landslide thresholds, Philippines, non-analog climate
Theme: Geohazards and disaster risk reduction

Return to Program

GEOSEA 2-8

A GIS BASED APPROACH USING ANALYTICAL HIERARCHY PROCESS (AHP) FOR GEOHAZARD MAPPING OF RAUB DISTRICT, PAHANG

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Geohazards are often defined as the events related to the geological state and processes that pose potential risks to people, properties, and the environment. The study being conducted for PLAN MALAYSIA@ PAHANG for Rancangan Tempatan Daerah Raub Pahang 2035 as part of the main subject matter. The occurrence of geohazard, especially landslides, is a natural disaster phenomenon that has a large impact on the socioeconomics of the population in a country. The study of using Analytical Hierarchy Process (AHP) method combined with a Geographical Information System (GIS) approach in order to produce geohazard map for Raub District. This study employed a heuristic approach based on three main methodologies which are analysis to identify criteria that contribute to landslide, expert judgement to provide weightage, and raster overlay analysis to produce maps. Seven parameters for main criteria were selected which are slope gradient, Stream Power Index (SPI), elevation, rainfall intensity, land use, soil type and lithology. A set of relative weights were assigned to each inducing factor and computed through pairwise comparison matrix derived from expert judgment. The potential geohazard zones was classified into five zones namely very low, low, moderate, high, and very high hazard. The method of AHP found as simple and effective technique used in producing the geohazard zoning map for regional base study with limited topographical survey dataset, multi criterium parameter to consider and preliminary outcome usage of town planning.

Keywords: Landslides, Analytical Hierarchy Process (AHP), Geographical Information System (GIS)

Theme: Geohazards & Disaster Risk Reduction

Return to Program

GEOSEA 2-9

Conceptual Framework for Creating Community Awareness on Geohazards Early Warning Signs

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Geohazards, such as mudslides, landslides, etc., are natural disasters that put lives and local communities at great risk and disrupt life activities, especially those in mountainous areas. Residents in such areas co-exist with characteristics such as concealed threats that occur without warning. Awareness and availability of geohazard early warning signs (EWS) are essential to community-based disaster risk management. EWS includes embedding sensor technologies to produce sirens when the geohazards are about to occur, especially when changes happen in the community, such as heavy rains, river water becoming turbid quickly, and animals in that area acting in unusual ways. Therefore, this paper presents a conceptual framework for creating EWS awareness for communities facing geohazards through a literature review.

Keywords: geohazards, community awareness, community-based disaster risk management, awareness strategy
Themes: (geohazards and disaster risk reduction)

Return to Program

GEOSEA 2-10

GEOMORPHOLOGICAL MAPPING FOR LANDSLIDE RISK ASSESSMENT: CASE STUDY FROM AMPANG JAYA

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Landslide and slope failure in Bukit Antarabangsa have been a controversial issue since the Tragedy of Highland Tower in 1993, followed by Taman Hillview (2002) and Taman Bukit Mewah (2008). The tragedies cause damage to the properties, casualties, and economic loss. After the recent landslide in Taman Kelab Ukay (2020), a state-funded study was conducted to assess landslide vulnerability and risk in Bukit Antarabangsa named PREVENT-LANDSLIDE. In landslide risk assessment, geological and geomorphological mapping is the key to identifying and interpreting the potential geological hazards based on the expression of key features related to the process. This mapping activity is conducted to determine the parameters which will be used in the geospatial analysis. Based on the mapping, the granite and schist in Bukit Antarabangsa shows ranges of weathering between Grade III to Grade V. The topography is highly influenced by the the weathering profile and the geological structures. Sub-catchment analysis is conducted to identify the topographical and hydrological pattern associated with the characteristics of potential geological hazards namely channelized catchment, topographic depression, and open hillslope. The potential landslide mapping is also interpreted based on the topographic pattern and characterized into two zone, i.e. potential initiation zone, and potential transportation and depositional zone. A total number of 149 slope inventories has been catalogue and 89 potential landslides have been identified. Based on the mapping activities, subsurface investigation, and discontinuity survey, three areas have been selected to construct engineering geological maps and models due to engineering concerns. The model and map serve to provide output for further landslide risk assessment, planning for future development, and anticipation of potential geological hazards.

Keywords: geomorphology, geomorphological mapping, landslide hazard, landslide risk, disaster risk reduction, engineering geomorphology

Themes: Geohazards & Disaster Risk Reduction

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Technical Session 3

Technical Session 3

Petroleum Geology, Oil & Gas Exploration

GEOSEA 3-1 (was 3-2)

The Paleozoic Depositional System and Hydrocarbon Fractured Reservoir Characteristics from the Outcrop Analogue around the Terengganu Coastal Area, Terengganu, Malaysia

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Siliciclastic sedimentary rocks are the oldest sediment reported in East Malaysia as they were deposited and distributed along the Eastern Belt during the Paleozoic time. The less revised data of Paleozoic sedimentology and stratigraphy around the Eastern Belt drives a new geological perspective to document the area of interest. Due to heavy granite emplacement during Late Triassic, the Paleozoic sediment in the Eastern Belt experienced the metamorphism process on high- and low-grade scales with intense tectonic activity and multiphase deformations, making it impossible to identify the significant sedimentary structure and fossils through the outcrop. However, some outcrops with good fossils recorded in mudstone bedding can be used to represent the nearer outcrop. This study covers the Terengganu coastal area with good meta-sediment outcrop exposure. Facies analysis is used to identify the depositional environment of the Paleozoic sediment in the study area through sedimentary structure and fossils as the best parameter. While mega fractured from lineation, joint, and fault can be used to resemble the fractured reservoir analogue onshore, including its behavior (i.e., connectivity) and pattern, porosity and permeability are suitable for evaluating the hydrocarbon property. Modelling of fracture on the outcrop using larger scale tracing and principal stress leads to the connection of fractured evidence and how much hydrocarbon can be trapped in the opening rock; hence, the fractured evolution stage will be determined. JMicroVision *software* is used to evaluate microstructure patterns between grains in a rock, in which the depositional system model in line with the availability of the Paleozoic outcrop as a fractured reservoir can be constructed. This study improves the sedimentological aspect of the Eastern Belt sedimentary basin and concludes that the meta-sediment outcrop analogue in East Malaysia is not only compatible to trap hydrocarbon, but it also serves as a good and potential reservoir.

Keywords: The Paleozoic, Eastern Belt, East Coast, Facies, Reservoir, Hydrocarbon

Return to Program

GEOSEA 3-2

Integrated Morphological Mapping and Quantitative Approach for the Assessment of Seabed Hazards in 'I' Field, Malay Basin

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Seabed morphology with the presence of submarine channels, marine slopes, pockmarks, fluid, and gas seepages can be potential hazards to the offshore marine development activities such as the oil and gas explorations, seabed mineral resources mining and submarine cable installations. The purpose of this study is to assess the seabed hazard risk in the 'I' field, Malay Basin Malaysia. 3D seismic data of 'I' field was used to delineate the geological and morphological features on the seabed and mapped into the seabed surface maps with the aid of volume attributes to enhance the image visualization. These identified features were set as variables with their weightage of hazard score levels were designed. The application of statistical software of SPSS was integrated with the hazard score levels to produce a seabed hazard risk map of the study area. The result of the seabed hazard assessment shows that the presence of submarine channels posed the main potential hazard risk between intermediate to high hazard level in which it was also integrated with the other variables of steep dip of surface morphology, increasing depth and presence of gas in porous sand.

Keywords: Seabed Hazards, quantitative analysis, seabed hazard maps, seabed morphology.

Themes: Petroleum Geology, Oil & Gas theme

Return to Program

GEOSEA 3-3 (was 3-10)

Optimization of Hydrocarbon Finding based on Seismic Data using Novel UTP Technology for Pre and Post-drilling Stages

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Discovering the optimal prospect for successful hydrocarbon exploration is still considered challenging work although new technology is being introduced continuously. Identification of potential hydrocarbon accumulation in the targeted reservoir leads to keeping the success rate of oil and gas exploration are always low. causing ineffective/high cost for the company to cover unsuccessful well drilling. Optimization of finding the best hydrocarbon indication becomes more important to reduce the cost, especially in the Volatile, Uncertainty, Complexity, and Ambiguity (VUCA) world. Universiti Teknologi PETRONAS (UTP) had developed a tool for optimizing hydrocarbon accumulation identification during both pre and post-drilling exploration stages based on seismic data to assist in identifying the potential well-drilling location. A novel attribute based on the seismic attenuation concept has been developed which can be used as a direct hydrocarbon indicator in the pre-drilling stage or as the main contributing input in utilizing unsupervised and supervised artificial intelligence/machine learning technology in quantifying reservoir properties and finding hydrocarbon accumulation during post-drilling stages. The method has been tested from the model to real data in various basins in different regions. The results showed that the technology consistently improved the hydrocarbon finding and reservoir properties prediction. The examples of the result of implementing this technology in different data sets will be presented. Not only useful for hydrocarbon finding but also this technology can potentially be used as a tool for reservoir monitoring through seismic time-lapse monitoring in such Enhanced Oil/Gas Recovery or Carbon Capture and Storage (CCS) monitoring cases.

Keywords: Hydrocarbon exploration, pre/post-drilling, seismic data, artificial intelligence, machine learning, reservoir properties

Themes: Petroleum Geology, Oil & Gas

Return to Program

GEOSEA 3-4

NMR Characterization on the Petrophysical Properties of Deep Siliciclastic Reservoirs: Sarawak Basin, Malaysia

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Beta Deep ST1 well results have confirmed hydrocarbon potential in deep reservoirs, which have a relatively low permeability and are not fully characterized regionally in West Baram Delta areas. The conventional core analysis is conducted with limited SCAL plugs as per standard lab-test practices. The aim of this research is to predict the petrophysical properties of the complex deep reservoirs using NMR T2 distribution.

Nuclear Magnetic Resonance (NMR) is a well-logging method that is used to characterize the reservoir including pore distribution and fluid type determination in pores by using porosity parameters. Porosity determination is important for predicting the quality of the reservoir. The T2 cutoff value is the intercept between the cumulative T2 distribution under the two conditions (saturated and desaturated), which is the cutoff between bound and free fluid. The permeability estimation using NMR is strongly influenced by the porosity and T2 cut off as shown in Timur Coates and SDR permeability equation. Reservoir characterization using NMR is influenced by the determination of the T2 cutoff value. All NMR T2 measurements for 25 core samples were performed with the Oxford Instruments GeoSpec-2 NMR spectrometer operating at 2.15 MHz with a 75 mm probe at ambient conditions and 35^{o}C.

Based on laboratory core analysis on 25 samples, we found that brine porosity is close to helium porosity with the correlation coefficient of 0.9796, whereas NMR porosity tends to be higher with the correlation coefficient of 0.8664. The discrepancy between helium porosity and NMR porosity highly likely due to NMR measuring the fluid within the sample, whereas helium porosity is a measure of the accessible pore space, in particular for samples containing isolated pores, clays, and bitumen or asphaltenes. The T2 cut-off value is an important input parameter for evaluating complicated reservoirs using the NMR methods, the accuracy of the acquired T2 cut-off value determines the reliability of the predicted formation evaluation such as Swirr, permeability, and pore types from the NMR log. A fixed value of 33 ms and 92 ms are frequently defined as the T2 cut off for sandstone and carbonate, respectively. However, a few studies reported that 33 ms is not always reasonable T2 cut off, especially for low permeability to tight sandstone reservoirs. It is observed from this study, the low permeability samples have T2 cut off value ranges from 11.958 to 20.973 ms. The permeability estimation of NMR is performed by two models in which Timur-Coates equation (K_{tc}) is more sensitive to the variation of fluid type in the pore than the Schlumberger Doll Research (SDR) approach (K_{SDR}).

The NMR characterization method can accurately evaluate the petrophysical characteristics of the deep reservoir, hence the results of our study may be applied to improve deep reservoir identification and evaluation using NMR logs.

Keywords: Core Analysis, Nuclear Magnetic Resonance, Deep Reservoir

Themes: (Core Analysis)

Return to Program

GEOSEA 3-5

Re-look into Total & Tectonic Subsidence for Offshore Kudat, NW Sabah, Malaysia

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The offshore of NW Sabah, particularly within the off coast of Kudat Peninsula develops several complex sedimentary basins, resulted from the extension and collisional tectonics. Present-day, this area has been known to store various natural resources including the oil and gas that were trapped within the Miocene sedimentary basins. Many exploration wells were drilled within the offshore of NW Sabah. Most of the wells encounter hydrocarbon reserves but not all the wells are able to produce economical amount of the hydrocarbons. Taking this issue into account, a fundamental study on the basin subsidence analysis was conducted for eight wells located in off coast of Kudat Peninsula. The aim of this study is to re-look on the basin growth history and the relation with various geological events that impacted the area and the timing of potential hydrocarbon accumulation. The subsidence analysis was conducted and visualized using the Matlab-based modular open-source tool, BasinVis 2.0. It focuses on the quantitative analysis relies primarily on the decompaction and back-stripping of stratigraphy units to their original thickness during the depositional period. The decompaction and back-stripping techniques considers different initial porosity, compaction coefficient, grain densities and paleo-water depth (estimated from the paleo-environment). The subsidence analysis is compensated to average mean paleo-sea level determined from the latest smooth sea-level curve. The generated total and tectonic subsidence results were then visualized as geo-history model and subsidence maps. The general subsidence patterns for the analyzed wells are showing concave-up pattern for the southern wells indicative for strong foreland basin influence. While the wells located in the northern part of the study area have stronger uplift, particularly in the boundary of Sabah-Palawan. The southern Palawan area was uplifted and eroded and becoming the sedimentary source for the offshore Kudat. Overall, this study distinguishes the total and tectonic subsidence rates in sedimentary basins within off coast of Kudat and to visualize the tectonic subsidence at different geological time. Unfortunately, limited data restricted the analysis on the hydrocarbon generation in the basin. With additional geochemical data, better controls on the paleo-environment and additional information of deeper/older formations, a more sophisticated basin subsidence analysis and petroleum system modeling will help to improve the geo-history of this area.

Keywords: basin subsidence; sedimentary subsidence; tectonic subsidence; decompaction; BasinVis
Themes: Petroleum Geology, Oil & Gas Exploration

Return to Program

GEOSEA 3-6

CHARACTERIZATION OF GAS HYDRATE IN THE FOLD THRUST BELT (FTB) OF NORTHWEST SABAH

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NW Sabah is part of the larger foreland basin system that mostly covers the deep-water section in offshore Sabah. This aea has been proven as prolific hydrocarbon reservoirs and has good potential to produce more in the future. It also serves as an ideal location for the generation and trapping of the natural gas hydrate because of the leaky thermogenically-sourced reservoirs in Stage IVE sediments. However, up-to-date, there was no economical exploration on the gas hydrates resource in deep-water system in offshore NW Sabah. It is due to the complex geological structure in the study area and the risks of geological hazards that come along with exploration of the gas hydrates. This study aims to evaluate the gas hydrate system including its morpho-tectonic features according to different conditions in the subsurface of NW Sabah especially within the NW Sabah Fold Thrust Belt (FTB). The presence of gas hydrate is detected using Bottom Simulating Reflector (BSR) by interpreting regional seismic lines, covering regions from Dangerous Grounds, NW Sabah Trough, East Baram Delta Toe Thrust, and Lower Tertiary Thrust Sheet. The gas hydrate system with its expulsion path was modelled with important features such as fluid escape pipes, free gas zone (FGZ), gas hydrate stability zone (GHSZ), pockmarks, different type of faults, anticlines, as well as important seismic units. The distribution of BSR and gas hydrate in NW Sabah is found to be concentrated in the front of the major Thrust Sheets which is characterized by compressional tectonics. Some of the BSR is also found outside of the area, which is affected by the presence of listric faults. The movement of the gas hydrates from its source (interpreted from Stage IV E sediments) are govern by the fluid escape pipes that were bounded by the listric faults and anticlinal structures. In conclusion, this study had re-assessed the morphology of the gas hydrates system in NW Sabah and a simple 2D model has been produced along with BSR distribution map to emulate the migration pathways of the gas hydrates in the study area.

Keywords: gas hydrates; BSR; foreland basin; fold-thrust-belt; NW Sabah; green energy; tectonic

Themes: Petroleum Geology, Oil & Gas Exploration

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GEOSEA 3-7 (was 3-8)(Was Poster 1-4)

GRAPTOLITE STUDIES AND ITS POTENTIAL FOR HYDROCARBON EXPLORATION IN MALAYSIA

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The strata of the Peninsular Malaysia were first assigned by Scrivenor in 1931 inside the "Geology of Malaya" and at that time recognised the rocks to be no older than the Carboniferous age. In 1955, C.R. Jones managed to split open a slab of black shale previously considered to be Triassic in age on Pulau Tanjung Dendang and revealed a profusion of graptolite fossils. Subsequently, more graptolites were found in the nearby Pulau Langgun where a more complete succession was well exposed. The graptolite-bearing strata found are the two detrital successions interbedded with shelf limestone, which are now called the Tanjung Dendang Formation and Timah Tasoh Formation. In the late 1950s and early 1960s, systematic mapping by other geologists in the states of Kedah, Perak, and Pahang led to the discovery of further graptolite localities. By the time Jones left Malaysia in 1966, material from 145 localities had been found and around 125 graptolite species had been described. The graptolites provided important information to date several horizons within the lower Palaeozoic and thus corrected the supposed Carboniferous age of the Peninsular Malaysia strata. More recently, a restudy of the Peninsular Malaysia graptolite fossils had been done to further refine the biostratigraphy with high-resolution photographs of the graptolites to be stored in a database. Graptolite has been proven to be an excellent rock age indicator for hydrocarbon survey in many places including the North America, China and Saudi Arabia. The presence of graptolites can be used to study palaeoproductivity for palaeoenvironment analysis. Graptolite reflectance has also been recognised as a useful proxy of thermal maturity for vitrinite-scarce lower Palaeozoic source rocks. There are also researches made by others to relate the pore structure of graptolite periderms and its contribution to gas storage.

Keywords: Graptolites, hydrocarbon, biostratigraphy, reflectance, maturity, lower Palaeozoic, Malaysia

Themes: Petroleum geology, oil & gas exploration.

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GEOSEA 3-8 (was 3-9)

PALYNOLOGY OF LATE CENOZOIC SUCCESSION IN TEMANA FIELD, OFFSHORE SARAWAK

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Palynological records in Late Cenozoic succession from two Temana wells were evaluated for identification of palynomorph assemblages, biostratigraphic correlation and age dating, as well as paleoenvironment and paleoclimate interpretation. Main objectives of this study are to determine the stratigraphic position of Temana reservoir interval and determine its environment of deposition. The dataset comprising terrestrial-derived pollen and spores were digitized from old reports, grouped according to vegetation type and re-evaluated for its abundance and diversity. Three major local palynomorph assemblages were identified from the two wells. These are:

1) TP-1 zone dated as Oligocene is characterized by abundant *Florschuetzia trilobata* and dominant montane and seasonal elements such as *Picea*, *Tsuga* and *Pinus*,
2) Early to Middle Miocene-aged TP-2 zone dominated by Kerapah *Casuarina* type pollen and regular presence of Rhizophoraceae mangrove, which can be further differentiated into TP-2a and TP-2b subzones based on appearance of *Florschuetzia levipoli* in the latter, and
3) TP-3 zone that occurs above an angular unconformity is dated as at least Late Miocene to Pliocene and marked by high percentage of rainforest Rubiaceae pollen and minor increase in seasonal element represented by grass Gramineae pollen.

The paleoenvironment is interpreted as marginal marine with brackish water condition as reflected by the dominant mangrove pollen group such as *Florschuetzia* genus and Rhizophoraceae throughout majority of the succession. The hinterland-derived pollen displays temporal variation which reflects cyclical paleoclimate trend from seasonally dry climate in the Oligocene to warm and everwet climate marked by the growth of Kerapah peat swamp during Early to Middle Miocene. This is later succeeded by a prolonged humid climate characterized by rainforest vegetation with possible intermittent seasonal and dry climate reflecting sea level fluctuations since Late Miocene to Pliocene.

Keywords: palynology, Sarawak, Late Cenozoic, marginal marine, paleoclimate

Themes: Petroleum geology, oil & gas exploration

Return to Program

GEOSEA 3-9 (was Poster 1-13)

SEISMIC CHANNEL FEATURES DETECTION USING A CONVOLUTIONAL NEURAL NETWORK (CNN)

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Channel interpretation plays an important role in gaining information about fluvial reservoirs' hydrocarbon traps. However, this manual interpretation step in seismic data is a time-consuming task due to the complexity of seismic data. Many recent studies show tremendous success in using Deep Learning methods to interpret the geological features automatically to address this issue. Hence, this paper is focused on building the Deep Learning model to detect channel features in seismic data. The dataset consists of seismic data as the input and ground truth as the output. To generate the ground truth that correlated with seismic data, we extracted the seismic attributes based on amplitude to highlight the presence of the channels. We also ran the principal component for multi-attribute analysis and clustered the features into two labels, channel, and non-channels. Then, we train and test the model with Convolutional Neural Network using U-Net architecture. Finally, we evaluate the prediction result with Intersection over Union (IoU) and confusion metrics. We applied this workflow to the Angsi Field in Malay Basin which interpreted as a meandering fluvial environment. It has been observed the detection of channel features on seismic data shows a good result in detecting main point bar channels and consistent with the manual interpretation. The proposed workflow can save the time and resources to interpret channel features on seismic data by reducing a week of work into 2 hours of model building and implementation. This model could help the interpreter focus on the task that needs human expertise and help the model do better detection and prediction.

Keywords: CNN, channel interpretation, deep learning, Malay Basin

Themes: Petroleum Geology, Oil and Gas Exploration

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GEOSEA 3-10

Return to Program

Technical Session 4

Technical Session 4

Depositional Basins, Tectonic History & Magmatism

GEOSEA 4-1

Review on Tectonic and Structural Evolution of SE Asia: Based on Seismic Stratigraphy and Paleomagnetic Data

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The interaction of the three major lithospheric plates of Eurasia, Indo-Australia and Pacific-Philippines makes the South East Asian region to be one of the most complexly evolved areas. The NW Borneo margin is centrally located. The plate tectonic evolution of the region and the tectono-stratigraphic architecture of the margin have been revised. The regionally consistent history during Cenozoic times derived from the most recently revised onshore-offshore seismic stratigraphy, well logs, biostratigraphy and paleomagnetic data, which shows Late Eocene to Early Miocene South China Sea Ocean floor spreading started ~32Ma with ~E-W spreading center, ridge jump at 25Ma with spreading center then ~NE-SW until 20.5Ma when spreading ended. The Early Eocene extension was due to Indo-China extrusion. The subduction of Proto SCS began in Mid-Eocene when Celebes Sea started to open. These subduction and slab pull effect of the Proto-South China Sea subsequently caused seafloor spreading (32-20.5Ma) and resulting in the formation of the South China Sea. During Late Eocene the attenuated continental crust entered the subduction zone and collided within NW Sarawak (Lupar Suture). The Luconia Continental Block is bounded by Tinjar SSF to the east against the Dangerous Ground. This continental collision and orogenesis referred as Sarawak Orogeny, which created the Rajang Group regional Late Eocene Unconformity (LEU) and caused 35 degrees CCW rotation of Borneo. Following this, the subduction ceased in Sarawak but continued in Sabah. Subduction continued and ceased by Early Miocene (20.5Ma) when the Dangerous Ground subsequently collided against NW Borneo and also caused additional 10 degrees CCW rotation of Borneo. This continental collision and orogenesis referred as Sabah Orogeny, which created the Crocker Group regional Base Miocene Unconformity (BMU). This collision ended the PSCS subduction and opening of SCS. Thus, the Middle Eocene to Early Miocene oblique southeasterly dipping subduction of the PSCS is directly associated with the Rajang-Crocker accretionary complex. Following this collision, regional subsidence and deposition continued until the Base Middle Miocene collision of the Reed Bank Continental Blocks at NW Borneo or may link to the collision of Australia against Sulawesi, Indonesia, which caused a regional NW trending SSF and transpressional movement across Borneo. This regional deformational event aged 15.5Ma and referred as the Deep Regional Unconformity (DRU). Following this a regional transtentional extensional event occurred due to change of regional stress orientation with a N-S trending transtentional fault movements, which caused regional NW-SE trending extension. This is a very significant seismic event which has an angular unconformity surface dominated by extensional and growth faults aged now as 12Ma and referred as the Middle Miocene Unconformity (MMU). This extensional event followed by a major transgression and flooding with the onset of major carbonate growth in Central Luconia. This followed by deposition untill another regional deformation during the Late Miocene, which referred as the Shallow Regional Unconformity (SRU, 8.6Ma). This prominent unconformity in Sabah coincides with intrusion of Mount Kinabalu (7-8Ma) with significant regional uplift and erosion. Following this, deposition continued till Pleistocene with post-collisional pulses of regional compression and associated SSF movements which indicated by several ongoing earthquake activity in this region.

Keywords: Tectonics, Events, Timing, Unconformity, Borneo, SEAsia.

Themes: DEPOSITIONAL BASINS, TECTONIC HISTORY & MAGMATISM

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GEOSEA 4-2

A-TYPE GRANITE FROM THE BESAR ISLAND GROUP JOHOR : NEW GRANITE TYPOLOGY OF PENINSULAR MALAYSIA AND ITS TECTONIC IMPLICATION

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The A-type granite occurs in the Besar island group (Besar, Tengah and Hujung islands) in Southeast Johor characterized by highly fractionated rocks of more than 76% SiO_2. U-Pb zircon age of the granite ranges from 280 ± 1 to 281 ± 1 Ma which suggested that they are among the oldest granitic rocks in Peninsular Malaysia (Ghani et al. 2014). The granite intruded into the Carboniferous metasediment which consists of an interbedded sequence of quartzite and phyllite. The granitic rock has been intruded by 0.3 to 0.5 m thick mafic dykes. The main granite can be classified as syenogranite according to QAP classification and consists of (on average %) K-feldspar (40%), plagioclase (20%), quartz (35%), biotite (<5%), amphibole, and a trace of apatite and zircon.The texture of the main Besar granite is characterized by shallow level emplacement as evidenced by abundant granophyric intergrowth. Quartz in the granophyric texture displays various shapes from rounded elongate to square to worm-like to tiny rounded shapes. The main Besar A-type granite is characterised by highly felsic granitic, weakly peraluminous (average ACNK=1.02) and high alkali content (8.32 to 8.60%). The granite also has high Ga, FeT/MgO and low P, Sr, Ti, CaO and Nb. The Besar magma yield a temperature ranging from 793 to 806ºC which is consistent with high-temperature partial melting of a felsic infracrustal source. The spider diagram plot for the Besar granite show a similar pattern with other A type granite elsewhere. The Besar granite has negative anomalies for Ba, Nb, Sr, P, Zr, Eu and Ti, and positive anomalies for Th, Ce, U,K, Pb, La, Nd and Sm consistent with the patterns for A–type granites. The Besar A type granite is consistent with high temperature partial melting of a felsic infracrustal source which is taken as one of the mechanisms to produce A–type magma (Ghani et al. 2014). Several petrotectonic models for A-type granites have been proposed including (1) extensive fractional crystallization from mantle-derived mafic magmas; (2) interaction of mantle-derived magmas and overlying crustal rocks; (3) anatexis of middle or lower crustal source rocks and (4) metasomatism of granitic magmas. The occurrence of the A-type granite in Peninsular Malaysia can be related to the extensional back-arc basin in the Indochina terrane during the earliest Permian time. The subduction of Sibumasu and the eastward movement of Paleo-Tethys oceanic floor beneath Indochina terrane started in Early Permian and this will cause early magmatism along the eastern margin of the volcanic arc also generally known as back arc region. At the same time (earliest Permian), the convection asthenosphere driven by the downward drag of the downgoing oceanic slab will cause a spreading and produced the back arc basin behind the magmatic arc. Regional extension occurs when continental lithosphere breaks in response to long-lived mantle perturbations when the hot mantle rises and erodes continental lithosphere, leading to full-scale rifting. The extension will cause the hot asthenosphere rises, undergoes decompression melting and induces melting in the overlying continental crust. Both regional extensional regimes have been proposed as likely tectonic regimes for A-type granites and related rocks. The Besar granite A type magmatism may develop during this time in the back arc basin that caused by convection asthenosphere driven by the downward drag of the downgoing oceanic slab will cause a spreading and produced the back arc basin.

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GEOSEA 4-3

Analysis of Rare Earth Elements (REE) using a Microwave Digestion System, ETHOS UP and Inductively Coupled Plasma Mass Spectrometer (ICPMS), NexION 2000

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Fused Bead – Laser Ablation sample digestion is a method used in the Laboratory Services Branch, Technical Services Division which has been proven to produce quality analytical results. However, this method was found to be unable to perform analysis at a fast rate. This paper describes the use of the Microwave Digestion System as an alternative method of digestion of geological samples, into solution and subsequently, the determination of REE concentrations is measured with the use of ICPMS. Analysis of Nine (9) Certified Reference Materials (CRM) from various types of geological samples found that 98% of the analyses were in the recovery range of 80% - 120%, and only 2% of the results fell out of this range. These results show that the Microwave Digestion System method can be used as an alternative method to the Fused Bead - Laser Ablation method.

Keywords: Rare Earth Elements, ICPMS, Microwave Digestion System, Geological Samples

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GEOSEA 4-4

TIDALLY-INFLUENCED DEPOSITS IN THE CARBONIFEROUS BUKIT BUCHU BEDS, TERENGGANU, MALAYSIA

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The Bukit Buchu beds is a thick siliciclastic sedimentary rock succession exposed at Bukit Buchu, Terengganu (Tang et al., 2021). The unit is rich in marine fossils of Early Carboniferous (Visean) age and has been correlated to the age-equivalent Charu Formation (Idris and Zaki, 1986, Tang et al., 2021). We here report the presence of sedimentary facies indicative of significant tidal influence near the top (Eastern side) of the succession. Four facies were identified from a 25 m thick logged section: (1) dm-thick, fine grained, cross-bedded sandstone with mud draped foresets; (2) flaser-bedded facies with mud lenses encapsulated in rippled sandstone; (3) interbedded dm-thick sandstone with lenticular bedded intervals, and; (4) thick rhythmic laminated mudstone. Current-generated bedforms, mud drapes, heterolithic bedding and thick rhyhmites are consistent with a tidally-influenced setting with periodic alternations of higher energy bedload and lower energy slackwater deposition. The logged section forms a fining upwards succession which resembles shallowing upward tidal channel and tidal flat successions of modern tide-influenced coasts. The degree of bioturbation is low and is in the form of small and simple trace fossils in the mud drapes. This suggests a stressed, possibly brackish water environment. The identification of possible tidal channel and tidal flat deposits in the Bukit Buchu sedimentary succession provides a glimpse of the depositional conditions of the Carboniferous of East Malaya which was shallow marine, with significant tidal influence.

Keywords: Carboniferous, Bukit Buchu beds, Terengganu, Tidal, Sedimentology

Themes: Depositional Basins, Tectonic History & Magmatism

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GEOSEA 4-5

Geochemistry of Rare Earth Elements (REE) in the Weathered Crusts of Volcanic Rocks in the Serian Area, Sarawak, Malaysia

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Geochemistry of the rare earth element (REE) in the weathered crusts volcanic rocks in Riih Serian, Sarawak were determined to investigate the potential for REE resources. The parentrock is ranging from trachyandesitic to andesitic in compositions with moderate REE contents 322 ppm. In this study, REE and bulk chemical compositions were determined using the laser ablation with inductively coupled plasma mass spectrometry (LA-ICP-MS) and x-ray fluorescence (XRF). The chondrite-normalized REE patterns of the parent volcanic rocks reveals fractionation of light rare earth element (LREE) compared to heavy rare earth element (HREE) together with a distinct negative Eu anomaly and a weak negative Ce anomaly. Whereas the weathered crusts are characterized by negative Eu and no significant Ce anomalies respectively with higher REE contents up to 1433 ppm with an average of 613 ppm. The result of this study suggest that the majority of REE in the weathered crusts tend to be enriched in LREE relative to the parent material.

Keywords: rare earth element, Serian Volcanic, geochemistry, weathered crust.

Themes: Economic Geology

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GEOSEA 4-6

Magnificence Occurrences of Jerai's Pegmatite: Magmatic Differentiation Perspective

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Geology of southern part of G. Jerai complex along the Sg Batu Pahat display a marvelous geological features. The origin of the G. Jerai deduced from the crustal thickening after the collision of Sibumasu with Indochina plate during Mid–Triassic, where the thick sequence of Cambrian clastic sedimentary rocks uplifted by granite intrusion. There are two distinctive lithologies present in G. Jerai, which are metasedimentary rock of Jerai Formation and granite. Sg. Batu Pahat is synonym to Candi Bukit Batu Pahat is the most well-known ancient Hindu temple found in Bujang Valley. These archaeological artifacts reveal that there was a Hindu-Buddhist polity here more than 2535 years old. Lithologically, it is mainly composed of fine-grained leucogranite which was cut by series of pegmatite dykes at different episodes. The magnetic differentiation process is the most prominent, where the highly evolved leucogranite intruded at an exceptional high level. It contains high felsic with two mica minerals. The spectacular pegmatite dykes intruded into granite striking to 030^{o} and 340^{o} with the thickness ranges from 0.8 to 4.5m. Extra-large muscovite flakes are the most magnificence mineral in pegmatite together with euhedral six-sided crystals of tourmaline. Garnet (grossularite) are also present as an accessory mineral. There are less fractures identified from the entire outcrop, which is generally massive and solid. However, one of the pegmatite dyke striking to 030^{o} has been sheared during plastic deformation, and shifted to the left or sinistral movement. Series of exfoliation fractures formed in granite due to unloading mechanism. This sub-horizontal fractures utilized by the ancient Hindu-Buddhist polity to chisel out rock slabs for Hindu temple construction in the vicinity of Bujang Valley. For geotourism element, there are a few activities for tourist. Along the river itself, tourists are able to traverse upstream for observing spectacular waterfalls and several sizes of potholes. The prismatic large crystal of tourmaline and extremely large flakes of muscovite are the main interest for mineral collector. Hence, the integrated activities should be emplaced and might attract more tourist to spend time there. The cultural and scientific values along Sg. Batu Pahat will definitely support the initiative to develop Jerai Inspiring Geopark in future endeavor.

Keywords: pegmatite, Jerai Formation, geotourism, tourmaline

Theme: Depositional basin, tectonic history & magmatism

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GEOSEA 4-7

NATURAL FRACTURE SYSTEM IN GUNUNG KERIANG, ALOR SETAR, KEDAH

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Gunung Keriang is one of the limestone hills in the NW part of Peninsular Malaysia. It is the southward extension of Permian-Triassic Kodiang Formation in the Western Belt. The fracture network of the limestone has controlled the karst morphology of Gunung Keriang. These fractures are also associated with the geohazard e.g. rock fall, which potentially threaten to the nearby residents and cave visitors. Thus, the fracture study of the limestone is crucial for the karst development and geohazard analysis. The regional- and local-scale of the fracture studies have conducted in Gunung Keriang. The regional fracture study was analyzed negative lineaments of the hill extracted from satellite images. Meanwhile, local fracture study was conducted at the selected outcrops in the Gunung Keriang to obtain the structural orientations and characterisation. From the field observation, the limestone are well-bedded and they are gently dipping towards SW and SE directions. The fractures are common and occurred systematically at regional- and local-scale. The systematic fracture sets are grouped according to their strike directions, which are NW-SE, N-S and NE-SW directions. At the regional-scale, the average lengths of the fracture sets (negative lineaments) are 148m (NW-SE set), 123m (N-S set) and 103m (NE-SW set); whereas the average fracture spacing are 92m (NW-SE set), 81m (N-S set) and 73m (NE-SW set). Similar fracture sets have been observed in the local outcrops. All the fracture sets are steeply to vertical dipping. The fractures have the spacing of 10-30cm in the visited outcrops. The fractures were experienced different degrees of infilling (with calcite) and dissolution. No clear cross-cutting relationship has shown in the regional view and local outcrops, however the regional NW-SE fractures have longer averaged length could be the younger fractures.

Keywords: Deformation, Fracture, Gunung Keriang, Structures

Themes: DEPOSITIONAL BASINS, TECTONIC HISTORY & MAGMATISM

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GEOSEA 4-8 (was 4-9)

Rock Discontinuity Formation in Weathered Sandstone of the Crocker Formation in the Kota Kinabalu Area, Sabah

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Formation of mechanical discontinuities such as joint plane is one of the main effects of weathering in rock masses. The effect is well known in most rock types, but their mechanism and variation especially in sedimentary rock (sandstone) in a tropical environment are often poorly understood. This paper will provide some insight into the discontinuity formation process in the thick-bedded sandstone of the Crocker Formation in Kota Kinabalu area, Sabah, Malaysia. It shows that discontinuity spacing decreases with higher weathering grades as expected. Three main discontinuity sets are formed and discontinuity spacings are reduced in thick-bedded sandstone due to weathering. The discontinuity formation is related to weathering and governed by the predefined planes of weakness inherited during early stages of rock formation and the past and present three-dimensional stress fields. New insight on the mechanism of rock discontinuities formation as consequences of ongoing weathering in rock masses may be beneficial in predicting the behavior and its slope stability implication on rock cut slope.

Keywords: Sandstone, Discontinuity, Weathering effect, Joint spacing, Joint Formation, Integral discontinuity

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GEOSEA 4-9

KARST AND CAVE GEOSITES IN KINTA VALLEY NATIONAL GEOPARK STIMULATES THE GEOLOGICAL-BASED TOURISM

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Gunung Masoorat Geoarchaeological Site and Taman Saikat Karst Geosite in Ipoh, Perak which is located in the Kinta district have been chosen as new geosites in the Kinta Valley National Geopark in the year 2021. Their distinctive uniqueness especially the natural landscapes and karst features; the discovery of animal teeth fossils, supported by the existence of biodiversity and the history of iron ore mining have given the speciality to these geosites as tourist attractions. This speciality has the potential to boost the socio-economic wellbeing of the local community through recreational activities, geotourism and ecotourism activities in the areas. The geological and natural beauty of these geosites has enlightened the local authority i.e. the Ipoh City Council in taking the opportunity to improve the socio-economics of the locals through the appointment of local operators to manage the area, namely Rymba Management & Leisure Sdn. Bhd. and KF Realty Management Sdn. Bhd at the Gunung Masoorat Geoarchaeological Site and Taman Saikat Karst Geosite respectively. Moreover, the geological-based tourism could provide education and awareness to the visitors and the public about the importance of appreciating and preserving the natural heritage in their areas.
Keywords: Geopark, Geosite, Karst and Geotourism

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GEOSEA 4-10

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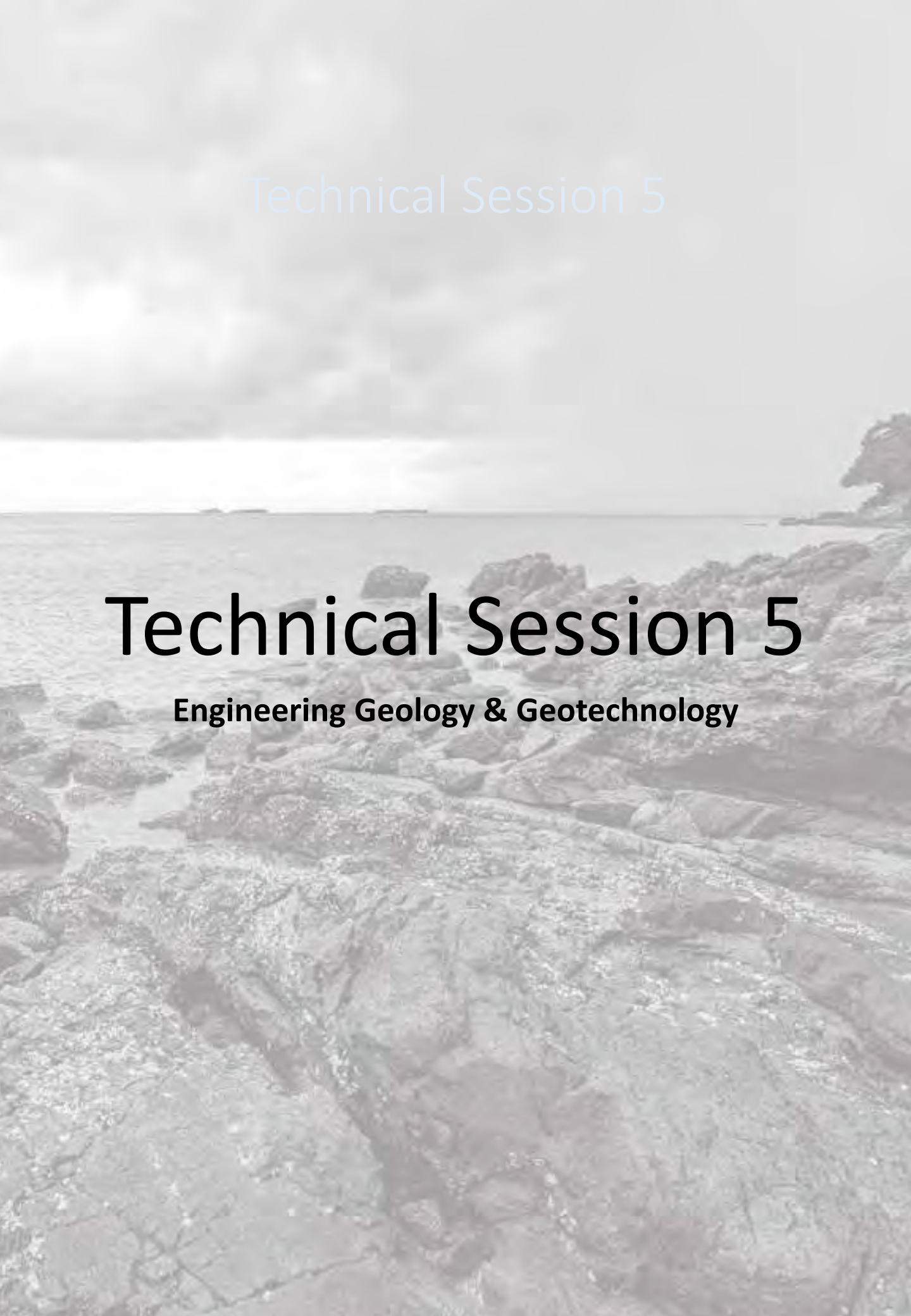

Technical Session 5

Engineering Geology & Geotechnology

GEOSEA 5-1

Application of Slope Mass Rating (SMR) in Rock Slope Stability Assessment and Ranking, Kenyir Dam, Terengganu, Malaysia

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The Kenyir Dam is a hydroelectricity generating dam that has been in operation for over 30 years. It is located in Ulu Trengganu, with a medium to coarse grain granite as the bedrock. This granite has been intruded by dolerite dykes at several locations. Many steep rock slopes were cut during the construction of the dam. As part of an overall safety and stability assessment, the stability of the cut rock slopes was conducted, applying the Slope Mass Rating, SMR methodology. This approach enable a classification of investigated cut slopes into five classes from "very good" implying the probability of failure is very low, "good" with low probability of failure, followed by "moderate", "high" and "very high". Two examples are presented here to illustrate the effectiveness of this methodology. For the spillway rock slopes, the majority are in the "high" and "very high" probability of failure class. For the rock slopes on the northern side, downstream of the dam, the majority are again in the "very high" and "high" probability of failure classes. These results provide input for a focussed mitigation of the cut rock slope stability at the dam site.

Keywords: Slope Mass Rating, rock slope stability, Kenyir Dam

Return to Program

GEOSEA 5-2

Petrographic Assessment of Concrete Aggregates used in Metro Manila: Representing 100 Years of the Philippine Construction Industry

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The Philippines' reliance on the use of concrete as construction materials for its built environment is evident in its numerous critical buildings and lifeline infrastructures. Concrete, considered a man-made rock, is generally composed of around 70% aggregates bound together with cement, water and in some cases, additives. Since aggregates comprise majority of the concrete mix, the primary performance of these products is largely controlled by their composition and characteristics. The Philippines, being situated in a highly active geologic zone, natural hazards are a regular occurrence potentially leading to damaged structures and high casualties. The quality and durability of the built environment should be a priority. As the government embarks on ensuring resilience of built environment, petrographic examination of concrete structures around Metro Manila was conducted in various concrete lifeline facilities representing different construction dates to document existing construction practices in the recent century at the nation's capital. Distinctions in construction practices were noticeable, particularly in the types of aggregates used. In structures built from the early 1900s to the 1970s, river gravel and sand make up most of the natural aggregate materials. River gravel is characterized to have rounded and smoothened surfaces and lead to poor adhesion with the cement paste. The heterogeneity of aggregates properties also leads to non-uniformed performance of river gravel aggregates, particularly, the lack of control in aggregate sizing which can lead to issues like gap grading. Concrete structures constructed from the late 1970s to the present used crushed rocks marketed as basalt and sand from lahar deposits and rivers. Comparably, the crushed rocks aggregates are more homogeneous and are angular in shape. However, issues in adhesion may still be observed in some concrete products due to chloritization of aggregate surfaces and by improper construction practices in most cases. The aggregates used in contemporary concrete are also predisposed to alkali-silica reaction or concrete cancer due to presence of reactive silica, particularly in the sand fraction. Petrographic examination of Philippine concrete aggregates highlights the strengths and weaknesses of the varying aggregate sources and can aid in proper aggregate selection leading to the assurance of safe and resilient infrastructure.

Keywords: Petrography, Aggregates, Concrete, Construction
Themes: Engineering Geology and Geotechnology

Return to Program

GEOSEA 5-3

DEVELOPMENT OF CPT GEOTECHNICAL PROPERTIES USING 2D SSPT GEOTECHNICAL MODELLING METHODS

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A Cone Penetration Test (CPT) is a geotechnical testing method that examines a soil parameter that influences the soil layer's cone resistance (Qc) and skin friction (fs). Current evaluation methods do not provide a better solution for predicting several geotechnical parameters such as strain, shear strain, poison rotation, shear modulus, stress, shear stress, elastic modulus, modulus, and the rates of soil consolidation or subduction for each layer. Each of their methods properly measures the soil's cone resistance and skin friction. In this study, a new approach model is proposed in which a single value of Qc or fs is used to forecast numerous geotechnical parameters of a soil layer. The research technique centered on the creation of elastic consolidation and Mohr circle geotechnical properties using 2D SSPT Geotechnical Modeling. As a significant outcome, the holistic geotechnical parameters of the soil layer were discovered.

Keywords: CPT, Geotechnical parameters, SSPT Geotechnical modelling, soil layer, skin friction, Mohr circle, shear

Themes: (Geophysics & Machine Learning In Geology)

Return to Program

GEOSEA 5-4

Discontinuity Adjustment Factor (F) of Modified Slope Mass Rating (M-SMR) for Rock Slope Engineering Purposes

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Rock mass classifications form the backbone of the empirical design and are widely employed in rock engineering, for determining support requirements. Slope Mass Rating (SMR) (Romana, 1985) is a modification of Rock Mass Rating (RMR) (Bieniawski, 1973) and was developed specifically for slope stability evaluation. The Modified Slope Mass Rating (M-SMR) is then proposed by introducing the method for SMR's parameter and sub-parameter calculation. The SMR was working well for rock mass quality and stability evaluation but the rating value of parallelism, F1 sub-parameter for toppling failure is overestimated or not pretty good. Then, this study was conducted by applying the new approach of adjustment factor (NAAF)the in M-SMR system. The methodologies include desk study, field study, laboratory analysis, and data analysis. The literature review was conducted as a desk study, discontinuity survey, slope mapping for field study, Tilt test for laboratory analysis, and Kinematic analysis and, M-SMR parameters calculation (including F1) for data analysis. The result shows that the parallelism between intersection line or discontinuities dip direction and slope dip direction (F1) rating value by NAAF in M-SMR is more convincing.

Keywords: Discontinuity adjustment factors (F), Parallelism sub-parameter (F1), Modified Slope Mass Rating (M-SMR), Mode of failure, Stability analysis.

Return to Program

GEOSEA 5-5

Geological Hazard and Risk of Slope Failure in Urban Development: A Case Study in Kemensah Heights, Taman Melawati, Gombak District, Selangor Darul Ehsan

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The event of slope failure in Kemensah Heights indicates the increase in geological incidence involving slopes in settlement areas within the municipality. Basic knowledge of geology specifically urban geology is important in understanding local physical changes from the aspects of the surface and sub-surface as well as the degradation of local geological conditions with time. The initial geomorphological conditions and changes made by local anthropogenic activities unknowingly have created an unstable condition and consequently resulted in slope failure. This situation is further complicated by the lack of awareness and exposure to the importance of conducting proper frequent maintenance work on slopes within their premises. The Authorities also need to play a role through their jurisdictions to ensure owners of premises perform their maintenance work. In the event of a geological incident of slope failure, the significant impact is the at-time safety status of the premises and the need for the owner to vacate. Meanwhile, geological forensic investigations and periodic monitoring are carried out to identify the current level of stability to be used as a basis for decision-making by the District Disaster Management Committee regarding the safety of premises and the appropriate actions needed. The occurrence of this geological incident as in slope failures also involves high financial costs, especially to the owners of premises, and limits the comprehensive and permanent repair work with the mitigation measures, at only a temporary level. The role of the authorities or stakeholders in the repair and mitigation works is also limited to the area of land lots legally owned as well as the constraints of financial allocation.

Keywords: Anthropogenic, Urban Geologi, Geological Disaster-Slope Failure, Geological Degradation With Time, Stake Holders Roles, Control Measures (Routine Inspection and Geological Assessment-Maintenance workCommunity Awareness-Financial Issues-Legal Requirements.

Return to Program

GEOSEA 5-6

ENGINEERING GEOLOGICAL ASSESSMENT TO DETERMINE THE CAUSE OF CRACKS IN BUILDINGS AT TAMAN KERAMAT PERMAI, SELANGOR DARUL EHSAN

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In April 2019, there was a report from residents of Taman Keramat Permai observed cracks ranges from 3mm to 10mm were formed along their four-storey building. A special geological and geotechnical team was formed to investigate the potential of geomorphological, geological, and geotechnical constraints that could contribute to the building cracks. Preliminary studies were done by using airborne images from 1966, topographical map from 1986 and Google Earth while walkover mapping was conducted surrounding 50m radius of the study area. Subsurface investigations were done by drilling boreholes at the edge of every corner of the building while electrical resistivity line was conducted along the building perimeter as to correlate with the surface finding to determine the extent of the subsurface condition. Prior to site investigation and mapping, the assessment found that the building was originally built at the edge of a ridge and on a fill platform using bakau pile. The soil profile generated from boreholes and resistivity also shows thick fill material and highly weathered material with a lot of water suggesting the soil has become weaker before the building start showing some movements. Therefore, it could be concluded that geomorphological, geological and geotechnical constraints does contribute to the building cracks.

Keywords: engineering geology, slope failure, electrical resistivity

Theme: Engineering Geology, Geophysical Investigation

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GEOSEA 5-7

Problematic Rock Slopes in Complex Geological Terrain – Part 1: Field Mapping and Analysis

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In rock slope stability assessment, it is crucial to identify and comprehend the geological features to reduce the level of uncertainty and accurately anticipate the engineering geological issues. The newly constructed federal road connecting Felda Aring 4 to Felda Aring 6 is one of the road sections connecting Ipoh to Kuala Terengganu through Cameron Highlands, Gua Musang, and Kuala Berang. This particular section has undergone numerous engineering issues during its construction which are largely related to the geological complexity. The road is located in the middle and eastern part of Semantan Forearc Basin where the transition of deep water to shallow water depositional zone together with extrusion of igneous rock can be observed based on the type of lithology found in the area (interbedding sandstone and calcareous mudstone, limestone lenses, metamorphed turbidite facies, and andesite). The complexity is also contributed by the tectonic structures that are further defined by the presents of calcites in the joint forming calcite veins. Detail engineering geology assessment were conducted at seven slopes to understand the geological conditions, determine the rock slope stability, and recommending mitigation works. The geological data was recorded by conducting the geological mapping, discontinuity mapping, photogrammetry survey, and terrestrial laser scanning (TLS) survey. The data is further analysed using kinematic analysis, slope mass rating (SMR), and limit equilibrium modelling (LEM). Based on the analysis, it is determined that three slopes need to be stabilized immediately. The LEM result shows that multiple planar and wedge fails when simulated in the worst-case scenario, where the sensitivity analysis indicated that there is only a marginal range of the factor of safety (FOS) value above the requirement for non-engineered slope. Geotechnical and geomechanics parameters were extracted from the analysis to propose the best mitigation for each slope. This subject will be discussed in Part 2.

Keywords: rock slope stability, SMR, TLS, LEM

Themes: Engineering Geology & Geotechnology

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GEOSEA 5-8

PROBLEMATIC ROCK SLOPES IN COMPLEX GEOLOGICAL TERRAIN – PART 2: DESIGN AND MITIGATION

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Designing rock slope mitigations is a very delicate process as it requires thorough understanding of geological conditions including geomechanics characteristics and parameters. Rock slope mitigations design with high uncertainties may leads to underdesign or overdesign where subsequently could cause economic loss or fatality. Part 1 of this subject has discussed in detail of the systematic engineering geological assessment of rock slope in the newly constructed federal road section in Gua Musang, Kelantan. The analysis conducted was able to determine the mechanics of the potential rock slope failure and factor of safety of recent rock slope failure. Geological structures as well as the geomorphological processes are other factors contribute to the rock slope failure incident. Multiple design approaches were taken to overcome the issues where each slope exhibit different failure behaviour. Based on the analysis, the direction and inclination of the potential planar and wedge are determined together with the driving forces and stresses acting on the rock mass. With this information, the design must be able to strengthen the rock slope by increasing the resistance (shear strength and tensil strength) of the rock mass depending on the direction and inclination of the structures. Geomechanics behaviour of the rock slope failure, either block failure or mass failure, must also be considered to determine the best course of action. Combination of multiple mitigation such as soil nails, rock bolts, guniting, stone pithing with geotextile liner, and rectification of drainage are used in the design to stabilized, rectify, and strengthen the slope. Therefore, integrating the rock slope engineering design and detail engineering geological assessment is the best approach for rock slope mitigation.

Keywords: rock slope design, rock engineering, geotechnical engineering, rock slope mitigation

Themes: Engineering Geology & Geotechnology

Return to Program

GEOSEA 5-9

URBAN GEOLOGY OF CITIES IN MALAYSIA: A PRIVATE INITIATIVE THROUGH INTERNSHIP PROGRAMME

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Most Geological Programme and Departments in local universities have industry intership programme. Every year, GMT Group (GMT) received interns from various universities all over Malaysia. GMT has started an initiative or project called 'Urban Geology of Cities in Malaysia' since 2020 as part of training on report writing skills. The initiative is to document on urban geological aspects of all cities in Malaysia. The idea for this initiative/project was mooted after the Geology of the Cities of the World series championed by the Association of Environmental and Engineering Geologists (AEG). The purpose of the Geology of the Cities of the World series is to convey to practitioners, graduate students, university faculty, planners, engineers, developers, and government officials background information useful for discovering and highlighting geological issues unique to a city and in some cases its metropolitan area. The series benefits include the sharing of information about specific geological issues, the use of references for looking for information that may be applicable to similar problems in a different setting, and contacts in other cities with those working on similar problems in an urban or other setting. To-date, GMT had completed five cities in Malaysia namely; Kuala Lumpur, Penang, Ipoh, Kota Bahru and Kuala Terengganu. The paper will have comprises of few chapters. One of the chapters shall cover geological aspects including tectonic and regional geologic setting, geomorphology, quaternary geology, stratigraphy, paleontology, bedrock geology, structural geology. One of the chapters shall cover on natural resources including surface and groundwater resources (including all basins in the city), non-metallic resources, clays, sands and gravels, building stone and others. Another chapter will be on natural hazards including the most prominent natural hazards that affect the city such as fooding, landslides/debris flows, earthquakes/tsunami or any other hazard provide significant threat to the city. Other natural hazards such as nutrition poor soils, collapsing soils, or sea level rise shall also be included. Chapter on environmental issues shall be on what natural or human caused environmental problems are present in the city and what is being done to remediate them? The development of properties that may have had an environmental problem before. Topics on identification, assessment and mitigation of naturally occurring environmental hazards such as mercury, arsenic, lead, copper, or asbestos could also be touched should available. Impact of sea level rise of climate change if it affects the city should also be highlighted. Chapter on significant engineering projects shall be included to describe a few representative and unique engineering projects and how they relate to the geology of the city or a nearby area. Infrastructure examples usually make a great subject for interest so few examples from the view point of a geologist should be good. The final chapter shall be on concluding remarks or final statement. This should be closing statement for the paper that shows possibly the impact of the geology has had on the city and its development and possibly it's future.

Keywords: urban geology, cities, initiative, internship

Themes: Engineering Geology or Geological Hazards or Disaster Risk Reduction

Return to Program

GEOSEA 5-10

Effect of Particle Size Distribution on Shear Strength of Residual Granitic Soil

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Granitic residual soil is commonly found in the hilly and mountainous areas in Peninsular Malaysia. Many slope failures are reported in this area due to deep tropical weathering, heavy rainfall, and steep terrain. Numerous research had been done to study the mechanical behavior of granitic residual soil, but the effect of particle size distribution is limitedly studied. In this study, sieve analysis and direct shear box test are used to determine the influence of the different percentages of fine gravel on the cohesion and friction angle of granitic residual soil collected from the Segari hill located nearby Lumut, Perak. The geotechnical properties of the soil also depend on the weathering grade of the natural rock. The sample collected is classified as grade IV and has well-graded distribution. The soil which further divided into four categories with different percentages of fine and coarse particles. The result shows that the friction angle increases as the sandy particles increase but decreases in cohesion. It is also evident that the percentage of fine gravel particles is one of the key roles in controlling the shear strength parameters. It is hoped that by understanding the influence of particle size distribution on the shear strength parameters of granitic residual soil, we can make a better evaluation in designing slope hazard mitigation.

Keywords: shear strength, residual soil, particle gradation

Themes: Engineering Geology and Geotechnology

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Technical Session 6

Technical Session 6

Quaternary & Marine Geology

GEOSEA 6-1

SEA LEVEL CHANGES IN THE STRAITS OF MALACCA DURING THE LATE PLEISTOCENE TO HOLOCENE BASED ON SEDIMENT RECORDS

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The sea-level rise following the Last Glacial Maximum (LGM) is the most important event in shaping present-day continental shelves. Understanding how LGM-Holocene sea level behaved and its subsequent effects on the development of seabed and coastal landforms constitute the basis for understanding and forecasting of future sea level trends. The study is important and critical especially in addressing the future sea level rise in Malaysiamanagement of the seabed and coastal resources. The aim of this study is to reconstruct the paleo-sea level environmental changes in the Straits of Malacca using sediment characteristics and geochemical records and their potential use in establishing the sea level index points and constructing a new relative sea level (RSL) curve during the Late Pleistocene-Holocene epoch. A total of fifteen (15) sediment cores from three (3) different regions of the Straits of Malacca were selected and analysed for grain size, carbonate and organic contents, geochemical elements (major, minor, trace and REEs) and radiocarbon dating (C14). The results indicate the sedimentation rates in the northern region (offshore Perlis) is 0.33-0.50 mm/year, middle region (offshore Kedah and Penang) is 0.01-2.00 mm/year and southern region (offshore Perak and Selangor) are higher of 0.50-6.96 mm/year during late Pleistocene to Holocene epoch. The distribution of sediment characteristics such as grain size, organic and carbonate contents showed that the transportation of sediments in Straits of Malacca and their behaviour is dependent to the source of sediment, current circulations and rate of sea level rise. The distribution of major, minor, trace and REEs elements showed different patterns with strong correlations indicating different types of sediment lithologies deposited in different environments. The rates of Relative Sea Level Rise (RSLR) are identified in this study, indicating that between 15,470 to 6,985 cal year BP, the Straits of Malacca was inundated with rate of sea level rise between 2.10 mm/year to 25.95 mm/year during late Pleistocene to Holocene period. In conclusion, given the importance for the Straits of Malacca as a far-field region, the paleo sea level rate found could serve as a strong base-line data for future sea level forecasting and modelling and its implications in Malaysia.

Keywords: Paleo Sea Level, Straits of Malacca, Sediment Characteristics, Geochemical, Last Glacial Maximum (LGM)

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GEOSEA 6-2

SEABED MAPPING APPLICATION IN THE 1ST PHASE EXCAVATION OF THE BIDONG SHIPWRECK, MALAYSIA

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The development of underwater archeology research in Malaysia is not aggressive compared to other ASEAN country i.e., Indonesia, Thailand, Vietnam, and the Philippines. In the past decade, underwater archeology in Malaysia has been dominated by commercial salvage specialists. It is certain that Malaysia has not been exposed to various basic issues and problems in developing this field. However, the discovery of the Bidong Shipwreck in 2012 has given new hope to ensure that underwater archeological research in Malaysia will develop dynamically. This study presents the application of seabed mapping which was significantly contributed to the success of the excavation of artifacts from the Bidong Shipwreck. The Bidong shipwreck is located ~2 and ~30 nautical miles from Pulau Bidong and Kuala Terengganu at water depth of 18 meters. The shipwreck lies within National Heritage Protected Zone of 1 nm x 1 nm gazetted by the National Heritage Department (JWN). A Klein 4900 Side Scan Sonar system was used in 2017 to determine the location of Bidong Shipwreck. The sonar image clearly shows a group of differently sized objects with sharp edges. The area distribution of the Bidong shipwreck artifacts was estimated within ~500 m^2. The sonar images obtained also enable the identification of possible shape of the Bidong Shipwreck. Based on the excavation record, 366 artefacts consisting of various sizes of ceramic vases and sherds were successfully salvaged from the site of Bidong Shipwreck. The success of the Bidong Shipwreck excavation implies that underwater survey and seabed mapping is significant in scientific excavation. Therefore, this project provides a guideline for entities which involve in future underwater excavation activities in Malaysian waters to proceed with seabed mapping technique.

Keywords: Marine Geoscience, Seabed, Thai Ceramics, East Coast Peninsular Malaysia, Underwater Cultural Heritage

Themes: Geophysics and Machine Learning in Geology

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GEOSEA 6-3

Introduction to the First Malaysian Seabed Sediment Map of the Melaka Strait

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Seabed Sediment Map of the Straits of Melaka, Malaysia is the first map published in the country by the Department of Mineral and Geoscience Malaysia (JMG). This map is the result of a compilation of all available sediment data and marine geophysical survey data (1979 - 2019), especially those from the National Offshore Sand Resources Study in the Straits of Malacca. Apart from that, sediment, geophysical and current data from the National Hydrographic Center (PHN), National Water Research Institute of Malaysia (NAHRIM) and the National Petroleum Limited (Petronas) were also used in the preparation of this map. The Universiti Malaysia Terengganu (UMT) and Universiti Kebangsaan Malaysia (UKM) also contributed several information and data on seabed sediments. This map generally shows the spatial distribution of the seabed sediments in the Malaysian Waters of Melaka Straits. The sediments are classified following the Modified Folk Classification Diagram (1954), which divides sediments into 9 classes according to the proportions of sand, gravel and mud present. In addition to sediment information, this map also displays seabed depth (bathymetry), the direction of movement and current speed, physiography as well as hydrographic information. The Sediment Map that has been produced with a scale of 1: 1,300,000 covers the entire Malaysian waters of the Straits of Melaka. To obtain a clearer display of information, this map is published together with 5 pieces of larger scaled maps of 1: 400,000. The Sediment Map that has been produced for the very first time is highly important and useful in providing the seabed sediments spatial distribution information of the country. From an economic perspective, it can help in the supply of basic information on the existence of seabed sediment resources which in turn can generate national economic income. In addition, this sediment map can also be used as a proxy in helping to maintain the sovereignty of the country's territorial waters.

Keywords: seabed sediment

Return to Program

GEOSEA 6-4

Mineralogy and Geochemistry of Quaternary Sediments of Southwest Johor, Malaysia

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The study aims to give insight on the nature of soils resulted from the sedimentation during Quaternary age at the southwestern Johor, as less attention are given to the soil origin and its nature. The objectives are to characterize the nature, soil composition, mineralogy and geochemistry of the soils. The study found that coastal areas of the southwest Johore are covered with unconsolidated marine sediments, constitutes silt, sandy silt, silty sand and muddy sand sediments contributed to the silt loam, silty clay loam, loam, silty clay and sandy loam soil textures. In general, the soil colour changed from 10YR to GLEY towards the deeper soil profile due to repeated shallow water table (0.5-1.0 meter) fluctuation. The soils are acidic in nature (pH 3-5), low in organic matters content (1-10%), and the clay size sediment fraction (<2 µm) constitutes kaolinite, illite, and montmorillonite. The soils are dominated by SiO_2 (53-64%) and Al_2O_3 (16-35%), reflecting the above mention minerals, followed by Fe_2O_3 (3-7%), K_2O (1-5%), MgO (0.7-3%), TiO_2 (0.7-0.9%), CaO (0.2-1.5%), Na_2O (0.2-0.9%) and MnO (<0.5%). The trace element content in soils in the decreasing following order are Ba (200-400 mg/kg), Rb (40-142 mg/kg), V (70-150 mg/kg), Cr (55-100 mg/kg), Sr (30-120 mg/kg), Zn (40-60 mg/kg), Pb (30-50 mg/kg), Ni (18-50 mg/kg), As (17-26 mg/kg) and Cu (1-13 mg/kg).

Keywords: Quaternary sediments, Johor, Mineralogy, Geochemistry

Themes: (Quaternary and Marine Geology)

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GEOSEA 6-5

SALTWATER INTRUSION MECHANISM IN KUALA TERENGGANU RIVER

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Saltwater intrusion is one of the major threats to the coastal community. Tidal and climate variations that can influence the saltwater intrusion phenomenon in an estuary as the saltwater from the sea tends to penetrate the river due to its density difference. The aim of this study is to investigate the saltwater intrusion at the Kuala Terengganu River. Physical parameters such as salinity, pH, total dissolved solids (TDS), conductivity (EC), and dissolved oxygen (DO) were measured directly by using AQUAREAD multiparameter. Furthermore, Pearson's correlation coefficient was applied to the datasets for finding the relationship between pairs of variables. The Inverse Distance Weighted (IDW) approach was used in producing the spatial distribution map of salinity value in Kuala Terengganu River by using ArcGIS software. Based on the result obtained from this study, during high tide, the highest value of salinity is at ST8 (27.41 PSU) while at ST1 (19.28 PSU) during low tide. Salinity also shows a strong positive correlation with TDS (r=0.975) and between EC and TDS during low tide with the value of r=0.974, respectively. Meanwhile, pH shows a strong negative correlation with DO (r = -0.545) during low tide. There were indications of seawater intrusion up until 5.098 km from the river mouth during high water tide. This study shows that tidal contributed to the saltwater intrusion in the river system. Thus, a long-term monitoring program must be conducted to understand the relationship of the influence of climate change on the saltwater intrusion phenomenon to ensure the sustainability of coastal communities.

Keywords: Saltwater Intrusion, Inverse Distance Weighted, Tidal

Themes: (most relevant themes from the conference tracks)
Environmental Geology & Climate Change Adaptation

Return to Program

GEOSEA 6-6

Field Identification of Clay Minerals based on Desiccated Crack Morphological Pattern

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Clays are common constituents of soils and have been controlling its engineering behaviour with the presence of water. Clay particles are very much lesser in size as compared to silt and sand and they cannot be identified at the field by ordinary optical or physical methods. Therefore a novel qualitative method has been developed based on the crack morphological pattern of dried soil under desiccated conditions. Kaolinite, illite, vermiculite and montmorillonite-rich soils sieved at 0.0075 mm were used in the simulation and initially mixed with distilled water at twice liquid limit to form slurry mixtures. The mixtures were then placed in a petri-dish and leave to air-dry under controlled room temperature for 1 week. The results showed that all soils formed quadrilateral to pentagonal-shaped crack pattern forming an angularised and sub-angularised angles at 60° - 90° intersection. Kaolinite-rich soil and illite-rich soil have a more angularised polygon pattern with smooth-linear sides whereas montmorillonite-rich soil shows a more sub-angularised pattern with undulated-wavy sides. All these 3 clay soils showed high number of crack segments with Illite being the highest, followed by Kaolinite and lastly Montmorillonite-rich soil. Vermiculite-rich soil has less significant polygon patterns due to low number of crack segments. Regularised crack patterns are more pronounced in low to moderate plasticity clay minerals (Kaolinite and Illite) than the high plasticity clay minerals (Montmorillonite and Vermiculite). It can be deduced that soils exhibit distinguish morphological pattern with different clay minerals and therefore may be used to identify type of clay minerals presence in each soil. This provides practical and quick identification of clay minerals without the use of robuts tools and technology in the laboratory.

Keywords: clay minerals, desiccated crack, kaolinite, illite, montmorillonite, vermiculate

Themes: Engineering Geology and Geotechnical

Return to Program

GEOSEA 6-7

TIDAL EFFECTS ON THE SEAWATER INTRUSION ON THE WEST COAST OF PAPAR, SABAH

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Salinization is a source of coastal aquifer contamination that deteriorates groundwater aquifer quality, which at worst can have a severe influence on the socioeconomic and environmental systems. The aim of the current study is to provide knowledge of the relationship between the tidal and seawater intrusion interfaces in the coastal aquifers. The monitoring programme was designed based on tidal patterns using the time-lapse Electrical Resistivity Imaging 2-Dimensional (ERI) at one fixed station. Sixteen survey lines with a total length of 160 m were carried in April, May, September and October 2021. Schlumberger and Wenner configurations was used to enhance the interpretation of the subsurface characterisation of Papar, Sabah. The lowest value resistivity value between 0 – 4.0 Ω m interpreted as seawater intrusion at depth 5.1 m, the resistivity value between 4.1 – 20.0 Ω m as the soil is saturated with the freshwater, and the highest resistivity value of 20.1 – 200 Ω is the clay and sand mix. The results suggested that the study area consists of an unconfined aquifer. The subsurface imaging profiles using the Time-Lapse ERI results showed that the changes of saltwater interface zone are controlled by the tidal patterns. This work will facilitate the water management to monitor the sustainability of the groundwater resources, especially in the coastal zone, besides being together to achieve the Sustainable Development Goal (SGD) Number 6, to ensure the availability and sustainable management of water and sanitation for all.

Keywords: time-lapse, Electrical Resistivity Imaging 2-Dimensional (ERI), Tidal, Seawater Intrusion Interface

Themes: (most relevant themes from the conference tracks) Marine Geology

Return to Program

GEOSEA 6-8

Subsurface Characterization using Transient Electromagnetic Method in Pekan, Pahang

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The Pekan, Pahang coastal plain represents one of the largest coastal deposits in Malaysia. Also known as Pahang River Delta, it consists of complex morphology and facies due to the influence of various types of wave, tidal and river propagation. Throughout the years, there were many efforts taken to study the Quaternary sediments found in Pekan such as aerial photographs, topographic maps, well correlation and some geophysical approaches. However most of them are small scale, discreted area and localized subsurface characterization. Therefore, the propose of this study is to characterize the subsurface especially the Quaternary sediment and the basement of Pekan by using transient electromagnetic method (TEM). The 173 station of TEM were conducted in Pekan Pahang using the TerraTEM equipment by Monex Geoscope with 50 x 50 m transmitter (Tx) and receiver (Rx) loops, and 1km spacing. An apparent conductivity model was than constructed by using oasis montaj before correlating it with 30 well data. The TEM results indicate the presence of three zones which are low (<40 mS-m), moderate (41-100 mS-m) and high (>100 mS-m) conductivities. Each subsurface level showed the decreasing of conductivity value from East to West indicating the affect of saline water from the South China Sea. Besides, based on the depth slices and surface map constructed, the basement trend of Pekan appeared to be increasing in depth as it approaches the coastline with a maximum depth of 150 m. The wide data coverage of electromagnetic have successfully confirmed the geometry of the Pekan basement where the top basement of Pekan is dipping towards the East. Moreover, two depressions on the basement of Pekan were also mapped, which was most likely to be caused by the shifting of the Sungai Pahang.

Keywords: Transient electromagnetic, subsurface characterization, basement modelling.

Themes: Quaternary and Marine Geology

Return to Program

GEOSEA 6-9 (was 6-10)

TRANSFORMING AN OLD MINE INTO A SUBSURFACE QUARRY: CASE STUDY IN KAMPAR, PERAK

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A massive subsurface limestone rock is a major rock type in Kinta Valley formation. This subsurface rock mostly were overlain by old tin mines trailing material. A preliminary assessment has been conducted with an objective to evaluate the mineral deposit and its quality of old mine trailing material and subsurface limestone; and produced a suitability conceptual assessment of Mine Plan. A percussion drilling and diamond core drilling methods were used to obtain the soil and rock core samples. Each depth of overburden material sample were collected and 20m depth of hard rock were drilled to obtain the core sample. The soil and rock core were logged and described visually. The selected soil sample were sent to the accredited laboratory to perform ICP-AES and gravimetric analyses methods, while geochemical analysis using XRF and LOI methods were performed on selected core samples. The high purity of 98.6% $CaCO_3$ and small number of MgO with LOI given range between 42%-44%. The resource estimate from block modelling for 20m of limestone drill core yield 24,140,072.5 tons material sitting to be utilize. Once geological data and quality model for the deposit has been validated, the information can be used by quarry engineer to design a systematic mine planning. The geological information will provide information of lithology type presence in the deposit, the structural formation and water table information. Quality model will help to understand overall quality distribution of the deposit. All those data obtained ultimately help the quarry engineer to produce an optimize final pit design according to the probable or proven reserved; the cost or budget to meet market supply and demand; predict or projecting ahead a quality changes of the deposit based on quality model; and to develop sustainable and safe quarry environment.

Keywords: Kinta Valley, old mine, subsurface limestone, resource estimation, quarry, Mine Plan

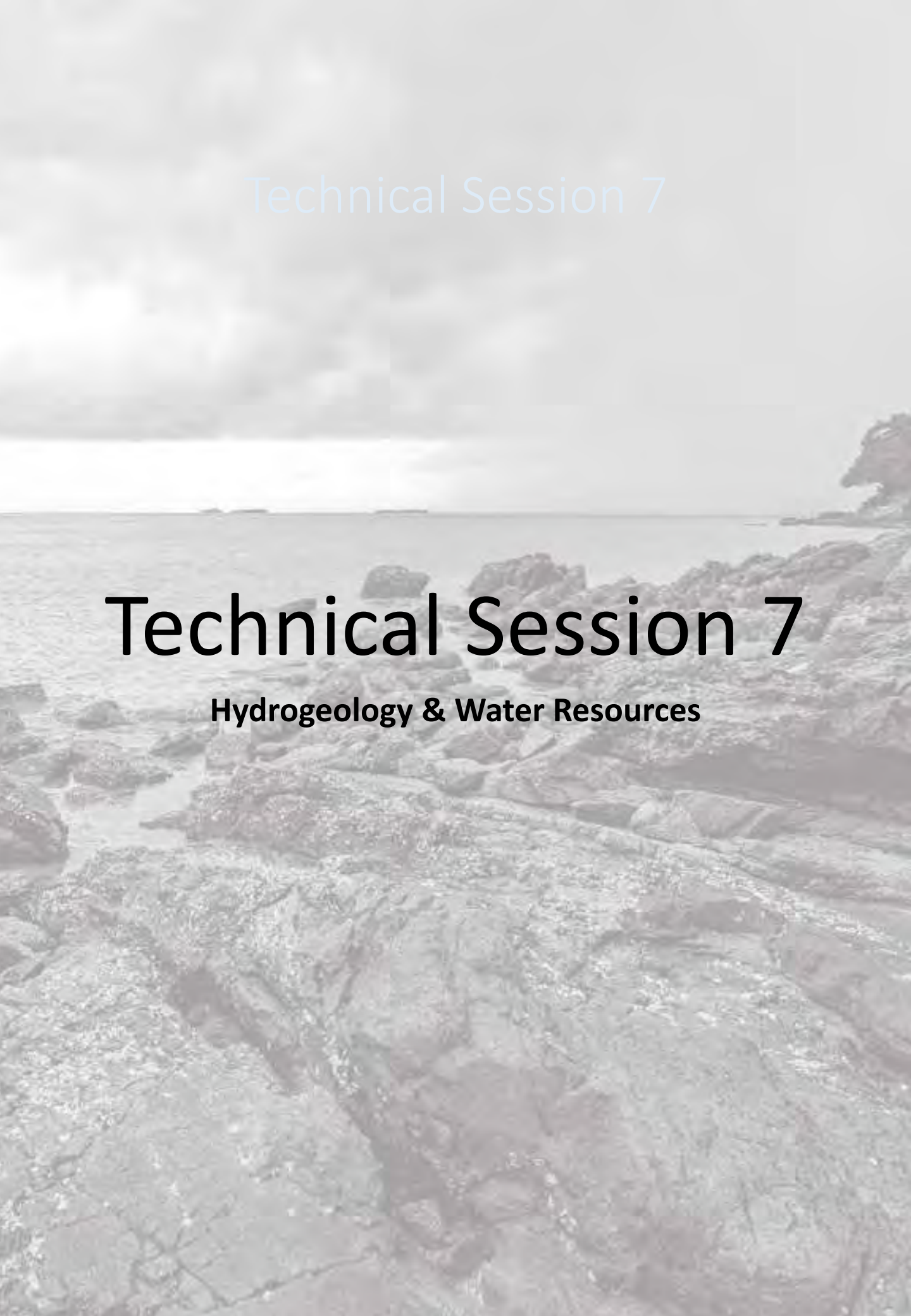
Themes: Economic Geology & Mineral Processing

Return to Program

GEOSEA 6-10

Return to Program

Technical Session 7



Technical Session 7

Hydrogeology & Water Resources

GEOSEA 7-1

SPOT IMAGES REMOTE SENSING STUDY OF THE FRACTURED AND KARSTIC TABULAR MIDDLE ATLAS AQUIFER (MOROCCO)

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In fractured aquifers such as the tabular Liasic reservoir of Middle Atlas (northern Morocco), geological fracturing plays significant role in feeding patterns and governing water flows. The knowledge of the geometry of fractures and their connectivity is essential for a better characterization of the discontinuous reservoir and the assessment of water resources. The use of remote sensing techniques helped us to have the latest information, to easily cover a large surface and to quantify fracture networks.

We used VHR, VIRHR multispectral and GHR panchromatic Spot images. Several techniques like enhancement and sharpness optimization and different filtering have been applied in order to extract a new fracturing map, which was validated by a cross-analysis with various cartographic inventories of the study area and with a field survey. The statistical and 2D spatial analysis of the resulting data, based on the fractures azimuth and length, showed heterogeneous and high clustering fracturing which is predominated by NE-SW and NW-SE directions.

The application of the fractal geometry and power-law statistics has led to describe and to quantify the spatial distribution of fracture networks related to the scale and to determine the characteristic fracture lengths specific for the studied reservoir. The obtained results from the surface using imagery could be extrapolated, under some precautions, to the whole reservoir and to the deep aquifer beneath the Sais basin.

The used remote sensing techniques have been very useful for this case study in order to characterize and modeling this important aquifer and to contribute to protect water resources in the region.

Keywords: Remote sensing; Spot images; fracture networks; clustering; fractal, Middle Atlas aquifer, Morocco.
Themes: Remote sensing, hydrogeology, discontinuous reservoir.

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GEOSEA 7-2

MODFLOW AND MIKE SHE FROM HYDROLOGY AND HYDROGEOLOGY ASPECTS : A CASE STUDY IN THE KLANG RIVER BASIN

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Due to the urbanization and development, the water supply situation in Klang river basin has been challenge and subjected risk of inadequate supply. Therefore, sustainable use and management of water especially groundwater resources thru groundwater modelling has been useful for water resources management, decisions making. and required water allocation during droughts. Recently, there are a number of modelling software popular to simulate groundwater flow. In this paper two modelling software MODFLOW and MIKE SHE from hydrology and hydrogeology aspects were used to develop two individual groundwater models and a comparison of these model's output is presented based on case study at Klang River basin. These two modelling software were developed and calibrated using hydrology and hydrogeology data. Each groundwater model has its own advantages and disadvantages. As such this study is intended to compare these two models and identify the suitability of the model for simulating the groundwater resource of the study area.

Keywords: Groundwater Modelling, MODFLOW, MIKE SHE, MODFLOW, Klang River Basin

Return to Program

GEOSEA 7-3

Importance of Silica Geothermometry in Groundwater Studies of Shallow Aquifers in Kelantan, Malaysia

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The spatial and temporal distribution of silica concentration in shallow quaternary aquifers in parts of Kelantan, Malaysia were determined to assess the groundwater and surface-water interaction, to evaluate the depths, residence time duration of groundwater and to narrow down the possible sources of groundwater contamination. 29 groundwater samples were collected each during pre-monsoon and post-monsoon.The concentration of silica ranged from 6.3 mg/l to 23.4 mg/l for pre-season (2016) and 6.2 mg/l to 23.5 mg/l for post-season (2016). As per the silica geo-thermometry based on chalcedony equation, the range of temperature estimated from 3.09°C to 37.61°C during pre-monsoon and 0.90°C to 37.79°C for post-monsoon which under normal geothermal conditions would correspond to a depth range of 0.02 km to 0.32 km during pre-monsoon and 0.01 km to 0.32 km for post-monsoon by considering an average heat flow of 30 °C/km. These shallow depths (below 0.32 km) of groundwater circulation are pretty reasonable for such deficient silica concentrations. Such low Silica levels reflect minimal involvement of anthropogenic activities and small residence time of groundwater in terms of rock-water interaction. These low silica values also show that the water in the area is of recent meteoric and through inflow from surface water.

Keywords: Silica concentration, shallow aquifers, Kelantan, Malaysia.

Themes: Hydrogeology & Water resources

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GEOSEA 7-4

HOT SPRING DISTRIBUTION IN PENINSULAR MALAYSIA FROM A GRAVITY DATA PROSPECTIVE

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This study aims to understand what are the main controllers of the hot water alignment in Peninsular Malaysia. The presence of hot springs in the NNW-SSE direction across Peninsular Malaysia is a rather unique phenomenon. Usually such a presence can be attributed to the presence of a large fractures or faults system. However, the presence of a significant fault is not clearly visible based on the lineation of the digital elevation model (DEM). The observation of the fractures system in Ulu Slim and Sungai Kelah hot springs show the fractures system is in the direction of NNE-SSW, different from the main orientation of the hot springs. There is also an opinion that the presence of this alignment is controlled by the western belt granite. However, the presence of hot springs only on the left side of the granite range is quite interesting to understand. Is the heat source of this granite rock concentrated only on the left side of the granite range? In addition to the presence of a heat source, the presence of water is also very important for the existence of hot springs. Generally the water from the surface will seep into the subsurface through faults and fractures and be heated in the area of the high heat source before moving back to the surface as a hot spring. The high rainfall distribution on both sides of the range provides an even potential catchment area on both sides, and this cannot explain the existence of this alignment. Digital Elevation Model (DEM) data, as well as satellite gravity were used systematically in this study. Observations of the satellite gravity map show there is a series of low anomaly gravity along the left side of the granite range. This alignment coincides with the distribution of such hot springs. Usually, the existence of low gravity anomaly is associated with the presence of a “basin" and the presence of a basin adjacent to the heat source can cause the water inside it to be heated and subsequently this hot water will flow out through cracks to the surface as hot spring.

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GEOSEA 7-5

POTENTIAL OF HOT SPRINGS AS A SOURCE OF GEOTHERMAL POWER IN MALAYSIA

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There are over 60 hot spring locations in Peninsular Malaysia. Based on surface temperature observations, the heat of the water coming out is in the range of 50°C-80°C. There are several locations where the heat is recorded above 90°C. The existence of abundant hot springs in Peninsular Malaysia proves that there is a high heat source below the surface these hot springs. The main question is what is the approximate temperature of the source of such heat, as well as what is its depth. This study used the existence of Hydrogen gas as a temperature estimator. The existence of hydrogen gas can be obtained through various means, among which is the dissociation of water molecules (water splitting). The energy needed to cut the H-O-H bond can comes from various energy sources, among them: electrical energy (electrical current), thermal (heat), or light (electromagnetic radiation). In the area of hot springs, the existence of hydrogen gas bubbles that come out along with hot water is likely to originate from the heating (thermal) process. The breakdown of water molecules through the Thermochemical process requires high heat (500–2000°C). The value of hydrogen gas readings in some hot water locations shows readings that exceed 150ppm. The high existence of hydrogen gas in this hot spring area indicates that the temperature at the splitting point is above 500°C. Taking into account the average temperature gradient of 35°C/km, the depth required to reach such temperature is beyond 14km deep. The source of heat at a shallow depth is more potential than the deep depth to be developed as a Geothermal Power Plant. Geophysical studies of megnatotelluriic (MT) and 2D electrical resistance conducted in some locations only confirm the presence of a fractured zone that is a conduit for hot water to move out to the surface. However, the exact depth of the source of the heat source is deep has not yet been accurately determined. Detailed studies need to be done to determine the source of heat to ensure that the hot spring area has the potential to be developed as a Geothermal Power Plant in Malaysia.

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GEOSEA 7-6

Application of Thermal and Electrical Resistivity Tomography with Geochemistry Methods in Hydrogeothermal Exploration

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The new discovery of Sungai Rangkap and Rawang hot springs is evidence of an active geothermal system deep beneath the surface. Subsurface geological mapping of this area was done by using Electrical Resistivity Tomography (ERT) and Induced Polarisation (IP) methods with Wenner-Schlumberger electrode arrays. To determine the surface temperature and pH value of hot springs, the thermography techniques of Forward Looking Infrared (FLIR) and in-situ thermometer reading were used. The geochemistry of hot springs water undergoes Induced Coupled Plasma (ICP), spectrophotometer UV and titration methods. This area is situated at the contact zone of Kuala Lumpur Limestone, the Kenny Hills Formation, and granite batholith. The ERT survey data reflects that the basis of the geothermal system within this area consists of four different lithological zones. First, water saturated zones with sand and silt with low resistivity (100 ohm-m). Second, moderate resistivity of (100-1000 ohm-m) for clay-dominated soil. Third, high resistivity of (1000–1500 ohm-m) in the fractured zone or weathered limestone, and fourth, 1500 ohm-m in the fresh limestone zone at 20-meter depth. Hot springs on the riverbank have phyllite rock, a neutral pH (pH7), and a surface temperature of 38.9–40.2 °C. The cation concentrations of calcium (31.2 mg/L), silica (29 mg/L), sodium (9.91 mg/L), and potassium (2.32 mg/L) are relatively higher than the anions of bicarbonate, sulfate, and chlorine. Sungai Rangkap hot springs migrated to the surface via the N-S fault trend. This hot spring is a magnesium bicarbonate water type with relatively low sulfate, indicating it originated from a non-volcanic source. A tube well has been dug to a depth of 36 meters. It shows that this pure limestone geothermal reservoir could hold a maximum capacity of up to 2.19m^3/h.

Keywords: Electrical Resistivity Tomography, Hot Springs

Theme: Hydrogeology & Water Resources

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GEOSEA 7-7

THE OCCURRENCE OF SALINE INTRUSION USING ELECTRICAL RESISTIVITY AND ENVIRONMETRIC METHOD IN COASTAL OF TERENGGANU, MALAYSIAN PENINSULAR

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A phenomenon of saline intrusion occurs when a total amount of fresh groundwater was over extracted through the shallow well by different human activities in the Terengganu coastal aquifers and resulted in the decline of groundwater levels.. The objective of this electrical resistivity study is to understand the delineation of fresh-saline interface condition under the earth's surface. Vertical electrical soundings were carried out at four wells that are namely: Kemaman1, Terengganu2, Marang2 and Besut3 that located along the East Coast of Terengganu. Water samples were extracted from each well using Eijelkamp Advanced Peristaltic Pump instrument. Eleven water quality parameters of water samples were analyzed in-situ and through laboratory works. The eleven water quality data were analyzed using Principal Component Analysis (PCA) to define the possible sources of category and then further analyzed by using Agglomerative Hierarchical Clustering (AHC). The four electrical resistivity profiles (section L1, section L2, section L3 and section L4) were interpreted qualitatively and quantitatively. Parameter distance, depth to water level, EC, TDS, SAL, and pH listed under VF1 were linked to saline water contamination. The results of the study revealed that Besut3 as cluster 1, highly intruded by saltwater intrusion, Terengganu2 was clustered as cluster 2 representing the moderately intruded, while Marang2 and Kemaman1 were clustered as cluster 3 and interpreted as the least intruded.

Keywords: East Coast of Terengganu, Coastal aquifers; Saline water contamination; Electrical Resistivity; Principal Component Analysis

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GEOSEA 7-8

MANAGING WATER RESOURCES IN LANGKAWI – THE VIABILITY OF UNDERGROUND STORAGE FOR DOMESTIC WATER SUPPLY

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In support of Sustainable Development Goal 6, Malaysia will conserve and manage its water resources to ensure adequate and safe water for all (including the environment). Malaysia has a climate of high humidity, high temperature, and abundant rainfall. Surface water supplies about 97% of the country's total water needs while groundwater accounts for the rest. Climate change has had an impact on water resources in all regions around the world. Groundwater is naturally protected from the Earth's surface, and therefore, the climatic effect on groundwater is usually low and very slow. However, as part of a hydrological cycle, groundwater will certainly be affected by long-term climate change. Managed Aquifer Recharge (MAR), consists of water management methods that recharge an aquifer using either surface or underground recharge techniques. The stored water is available for use in dry years when surface water supplies may be low. This paper will discuss the R&D initiative especially the feasibility of the underground dam in Langkawi, Malaysia, and strategy to ensure groundwater resources can be used conjunctively with surface water for its sustainability.

Keywords: Groundwater; Managed Aquifer Recharge; Underground Dam, Conjunctive Use

Themes: Hydrogeology & Water Resources

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GEOSEA 7-9

HYDROSTRATIGRAPHIC UNDERSIMPLIFICATION IN STRUCTURAL MODEL CONCEPTUALIZATION TO BOOST CONFIDENCE INTERVAL IN SIMULATION AND ENVIRONMENTAL SUSTAINABILITY PERCEPTION

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Numerous non-governmental groups and individuals are concerned about environmental impacts due to groundwater activity in a current explored area and a new basin area for assessment and development plan. Those concerns, for instance, unsustainable groundwater withdrawal, poor basin management and enforcement that straightforwardly perceived to cause sinkhole, subsidence, and lowering soil water levels, are by no means attached with scientific evidence to support the arguments. This paper aims to address a method of sub-surface data interpolation and correlation to construct an undersimplified structural model near to realistic conditions on a 3-D view. The provisioned 3-D data is then ready for modeling software inversion and calibration phase in the flow simulation. The synthesisation of the top surface and sub-surface layers with geospatial information had demanded big data consisting of geological logs, pumping test logs, climate information, in-situ site monitoring, and raw raster data processing and analysing. Analyses on vertical geology sequence, screen depth and intake, hydraulic parameter range, and the hydrologic transaction are being considered in the construction. Respective layers have been set with the respective initial water level. From the top surface to the bottom base, the inversed horizontal layers generated five property zones that carried authentically different hydraulic properties, features, and behaviours. The confined aquifer is identified in the second property zone, underlain by the first top property zone and overlain by the aquitard and aquiclude. The calibration on the undersimplified model could achieve a higher confidence interval result. The statistical result is the output to conduct the best decision making in sustainable aquifer management. Hence, the benefit of this study could contribute to disclaiming any senseless concerns about groundwater activity as it has the potential to prosper socioeconomic growth in an area.

Keywords: environmental impacts, undersimplified structural model, interpolation and correlation, synthesisation, property zones, confidence interval, aquifer management, socioeconomic growth

Themes: Hydrogeology & Earth Water Resources, Geohazard & Disaster Risk Reduction

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GEOSEA 7-10

HYDROGEOLOGICAL STUDY ON ALLUVIAL AQUIFER AND DETERMINATION OF SUITABILITY AREA FOR FLOOD-MANAGED AQUIFER RECHARGE (FLOOD-MAR) APPLICATIONS AT MALACCA RIVER BASIN

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A hydrogeological study on the alluvial aquifer of the Malacca River Basin was conducted covering an area of 614.575 km^2. This study was carried out to identify the potential of Flood-Managed Aquifer Recharge (Flood-MAR) applications in improving the capacity of water supply resources in the study area which is often threatened by drought and flood disasters. The objectives of the study were to characterise the alluvial aquifers, assess water quality and identify water facies classifications and also determine the suitable areas for Flood-MAR applications. The aquifer system in the study area is divided into two layers, namely aquifer-1 (main aquifer) and aquifer-2. The aquifer layers consist of sand, clayey SAND and silty SAND. Groundwater discharge that can be extracted from a well range from 0.5 m^3/hour to 18.0 m^3/hour. The laboratory analysis results showed that groundwater resources in the study area did not fully comply with the standards set by the Ministry of Health Malaysia (MOH) and the Department of Environment (DOE). The results of geographic information system (GIS) analysis integrated with the analytic hierarchy process (AHP) method have successfully determined a suitable area for the implementation of Flood-MAR application in the study area. The concept of the Flood-MAR application method such as the aquifer storage and recovery (ASR) is proposed to be developed in the study area in the future.

Keywords: Flood-Managed Aquifer Recharge (Flood-MAR), analytic hierarchy process (AHP), aquifer storage and recovery (ASR)

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Technical Session 8

Technical Session 8

Geoheritage & Geotourism

GEOSEA 8-1 (was 8-3)

GEOMORPHOLOGICAL ANALYSIS OF ISLAND KARST IN THE PHILIPPINES: IMPLICATIONS TO SUSTAINABLE TOURISM DEVELOPMENT AND SUBSIDENCE HAZARD ASSESSMENT

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Understanding the complex evolution and hazard susceptibility of karst landscapes remains a challenge in the Philippines. Rapid development due to the booming tourism industry poses a threat to the fragile karst environment. The Climate-responsive Karst Management for Sustainable Tourism (PhilKarst) Program of the Mines and Geosciences Bureau (MGB) aims to understand the effects of natural and anthropogenic factors in the development and degradation of karst systems in key tourist destinations of the country. This paper discusses the detailed geomorphological analysis of notable karst terrains in Palawan (El Nido) and Siargao Island, Surigao del Norte (General Luna and Del Carmen).

Using topographic maps and Interferometric Synthetic Aperture and Radar (IfSAR) Digital Elevation Model (DEM), sinkholes were delineated, and morphometric parameters such as slope, relief, topographic position index (TPI), and sinkhole morphometry (e.g. density, percent area, circularity index, eccentricity index) were calculated through ArcGIS 10.6.1. Inventory of karst features (i.e. caves, sinkholes, towers, cone hills), landslides, and hydrogeological features (i.e. springs, wells) were also conducted through field surveys.

Results show contrasts in geomorphometric parameters among the study sites indicating their different stages in karst evolution. To date, there are 54 sinkholes identified in El Nido that are distributed mainly in the karst tower-valley zones of the Permian and Jurassic limestone, while there are 281 sinkholes in the cockpit and reef terrace zones of Miocene and Plio-Pleistocene limestone in Siargao Island. Sinkhole occurrence also increases near lineaments (100 – 500 m) and natural streams (40 – 80 m). While dissolution of limestone is the primary process that drives karstification in the two sites, tectonic evolution, geologic structures, and hydrological processes also affect the development and spatial distribution of different karst features. In addition, land conversion and heavy development can exacerbate the subsidence hazard and environmental problems in karst tourism areas.

Keywords: tropical karst geomorphology, morphometric analysis, subsidence, Philippines

Themes: Geohazard & Disaster Risk Reduction, Environmental Geology & Climate Change, Geoheritage & Geotourism

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GEOSEA 8-2

KARST INSELBERG OF THE PERLIS–KEDAH COASTAL PLAIN – ITS GEOLOGY AND GEOHERITAGE SIGNIFICANCE.

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Alluvial sediments and marine clay formed vast coastal areas in the northwest of Peninsular Malaysia known as the Kedah-Perlis coastal plain. The plain is part of the famous rice bowl of Malaysia. Raise beautifully above this paddy plain are numerous isolated karst towers or karst inselbergs with various sizes, heights and shapes producing an enchanting scenic view around this coastal plain. This unique karst inselberg landscape gives a very high aesthetic value as well as scientific values for the proposed Perlis Geopark. Perlis karst inselbergs are made up of limestones of the Ordovician Setul Formation in the west and the Permian-Triassic Chuping Formation in the east, while the bulk of the bedrocks underlying the coastal plain sediments are made up of mudstone of the Carboniferous-Early Permian Kubang Pasu Formation. Evidences of high level sea notches with *Lithophaga* burrows and shell deposits show that during the Holocene Period a large portion of this vast coastal plain area was submerged under the higher sea-level. Hence, most of Perlis karst inselbergs were once forming an island karst archipelago prior to become terrestrial karst hills as seen today. Each karst inselberg has their own uniqueness in terms of geodiversity, biodiversity and cultural diversity that greatly enhanced their heritage value to make Perlis Geopark a unique geopark in this region.

Keywords: inselberg, karst hill, coastal plain, ancient sea level, Perlis

Themes:
- Geoheritage & geotourism
- Quaternary and marine geology
- Environmental geology

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GEOSEA 8-3 (was 4-8)

GEOMORPHOLOGICAL AND CAVE MAPPING FOR DETAILS GEOSITE MAPPING

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In 2017, Perak State has declared Kinta Valley as National Geopark. The Kinta Valley is rich in unique Karst hills that have a variety of heritage of mining history, geological history and natural landscape diversity. Most of these Karst hills are located in Ipoh and suitable for geotourism. Detail geosite mapping is one of the important aspects to fulfil the geosite requirement. It includes the geomorphological and cave mapping. The objective of the Karst geomorphological mapping is to determine karst characteristics that support geosite values and determine the geosite delineation while the cave mapping and geoheritage features are to determine the value of heritage from the aspects of importance (unique, rare, common). This study integrated the manual mapping method with the assist of the new remote sensing technologies which are Mobile Laser Scanner and Drone Photogrammetry. This integrated method is more representable of limestone morphology from inside to outside of the limestone. The orthophoto and 3 dimensions (3D) were generated from the aerial photos captured by the drone. It is used to assist in identifying the geomorphological features. The mobile laser scanner provides geo-referenced high density 3D point clouds. The system consists of 3D laser scanner, GNSS, IMU and camera. The collected data was used to measure the cave passage and morphology. Geomorphological mapping exercise identified four prominent karst landforms, namely Mogote Hill, Karst Ridge, Cave and Doline Lake. All four of these landforms were mapped and described in detail. The karst system has unique ecstatic karst morphology features which is now starting to slowly vanish due to natural causes and human activities. The geosite mapping is importance for better understanding the karst morphology processes and features. The detail mapping using the latest technology at the karst area in Kinta Valley need to be conducted and stored in geographic information system for monitoring and preservation.

Keywords: Orthophoto, Mobile Laser Scanning, geomorphology, cave mapping, geosite

Themes: Geology and Geotechnology

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GEOSEA 8-4

Systematic Scientific Identification and Classification of Potential Geosite at District of Gombak, Selangor Malaysia

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Scientific significant of potential geosite have been derived from geological narrative and quantitative evaluation. This study will further explore the geological narrative that consist of geological evolution of the Earth made of sedimentary or stratigraphy, igneous, tectonic and morphology evolution. Each of the site are representative of the geological evolution of the area and there are twenty-five potential geosite have been identified in this area. Based on the list, eight of it is a representative of sedimentary or stratigraphy evolution, six are the records of tectonic evolution, seven are tectonic evident, two igneous evolutions and another four of morphological evolution. This method solely on the scientific of geology without considering the aesthetic, cultural and recreational value. Later all the potential site is describing and compared using the literature material to an equivalence standard significance represented at the state, national and regional level. This study assisted in preparing document for geopark and geotourism component accordingly.

Keywords : geological narrative, geological site, scientifically significant

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GEOSEA 8-5

GRANITE MAGMATIC HISTORY OF TAIPING PLUTON IN LENGGONG AREA AND ITS CONTRIBUTION TO LENGGONG GEOPARK

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The Taiping Unit of the Bintang batholith consists of coarse-grained megacrystic hornblende biotite granite with a distinct porphyritic texture. The Taiping granite is one of the few amphibole-bearing granites occur in the Western Belt of Peninsular Malaysia. The Taiping granite typically have porphyritic texture comprising low–Al biotite + titanite ± actinolitic hornblende. The granite is melanocratic, due to a high percentage of mafic components and characterized by euhedral to subhedral K-feldspar phenocrysts that are up to 6 cm in length. They contain a diverse type of microgranitoid enclaves, that contain amphibole, clinopyroxene and biotite. Mafic-felsic composite dykes cut the granitic boulder in Bukit Bunuh suggest that the enclave magma originate from mafic magma source which is unrelated to the host granite magma. The felsic dyke has irregular thickness and show a deflected boundary against the K feldspar phenocrysts. This deflection suggests that both felsic dyke and the host rock are in liquid the interaction. Mafic microgranular enclave in the granite show synplutonic texture which suggest that the granitic and enclave magma is in the liquid form during the interaction. Two possible sources of the mafic magma are the intrusion of mafic source (also heat source?) into the granitic magma chamber or dispersion of early crystallized mafic by convection current in the magma chamber. The porphyritic texture is 2 stages of magma cooling, the slow cooling and crystallizing magma within the Earth's crust forming large phenocrysts and then sudden rising of the magma up to the earth's surface cause the remaining liquid to crystallize rapidly and form smaller crystals. During the uprise of the magma, the early formed phenocrysts will flow along with the residual liquid. Phenocrysts matric ratio suggests that the uprising occurs when the magma is already 30 to 40% crystallized. The size of K feldspar phenocrysts suggest that at the time of crystallization there is still sufficient space and melt that allowing the crystal to grow. The Taiping granite exposed surrounding the Lenggong area preserved the magmatic history from the magma generation, magma evolution, and interaction between the highly evolved magma and the host rock. Thus the area can be an excellent field laboratory for granite study especially for earth scientist. Apart from that many of the granite in this area form a beautiful waterfall for recreation. In BGS memoir, John Cobbing (Cobbing et al. 1992) stated that the Taiping granite is the most unusual rock in the Main Range granite. Features like the association of hornblende and clinopyroxene, the abundance of mafic microgranular enclave and synplutonic dyke only occur in the Taiping granite and are not found in other Western Belt granite.

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GEOSEA 8-6

SIARGAO ISLAND GROUP AS A POSSIBLE UNESCO GLOBAL GEOPARK FOR THE PHILIPPINES

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UNESCO Global Geoparks have become important tourism landmarks not only because of the economic development these markers will invite but also the sustainability aspect it will promote in the community. These geoparks are described as singular but unified geographical areas with international geological significance. The areas must be managed with a holistic approach towards protection, conservation, education and must adhere to the sustainable goals set by the UN. In the Philippines, there is no identified UNESCO Global Geoparks yet- only national geological monuments such as the Ilocos Norte Sand Dunes, Hundred Islands in Pangasinan, etc. Back in November 2018, the provincial government of Bohol submitted its application dossier for the Bohol Island to be considered in becoming part of the UNESCO Global Geopark network. This year, the provincial government of Surigao del Norte, alongside Caraga State University, is jumpstarting its campaign for the Siargao Island Group to become the second aspiring UNESCO Global Geopark of the Philippines. The team conducted its preliminary geological and geomorphological mapping of the island, discussing the magnificent karst environment of the area and emphasizing its global significance. Several geosites were identified based on these activities that can be highlighted for geotourism such as the Magpopongko Rock Pools, Tayangban Cave, Danjug Cave, Hagukan Dive, Maasin River, among others. Possible economic development ventures were also accentuated while promoting the sustainability and proper management of the area. This preliminary campaign will not only help elevate the overall tourism of the island but also help in coming up with more robust tourism development and environment management plans for the local government units.

Keywords: Siargao Island Group, UNESCO Global Geopark, geomorphology, karst environment

Theme: Geoheritage and Geotourism

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GEOSEA 8-7

PETROGRAPHY UNIQUENESS OF PREHISTORIC STONE TOOLS FROM GUA KAMBING AREA, GUNUNG PULAI, BALING

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Gua Kambing in the area of Gunung Pulai, Baling , Kedah is a prehistoric site that was once inhabited by the people of Prehistoric Times. The discovery of artifacts and archaeological ecofacs in this limestone cave area confirms the opinion that this cave was once a placement area that became a place of self-protection of Prehistoric peoples from the threat of wild animals and also weather changes. In terms of its geology, the Gua Kambing in the Gunung Pulai area is related to limestone facies of the Baling group and it consists of a layer of limestone with thickness from few mm to more than 1600 m. The limestone around the Gua Kambing have grayish apperance , thickly layered, massive and showed signs of metamorphosed and undergoes recrys-talization proces. Among the archaeological artifacts found in the Gua Kambing are stone tools, some fragments of earthen pottery, ceramic fragments and ecofacs such as snail hooks and fragments of animal bones. The discovery of the stone tool provides physical evidence that it was employed in the Hoabinhian and Neolithic cultures as a saddle stone, batting stone, repeh tool, cobble bifas and unifas axe, furnace, pressing device, and chisel. Petrography evidence also shows that the stone tools were originally made of several types of rocks, namely quartzite, sandstone, syis-quartz-mica rocks, muddy sandstones and also hornfels rocks. Snail grafts found at this archaeo-logical site are believed to be from the hoabinhian era and have a chronometric age of 13,240 +/- 40 BP..

Keywords: Stone tools, petrography, hoabinhian, Gua Kambing

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GEOSEA 8-8

Significance of Geological Evolution and Geoheritage of the Aspiring Stong Geopark, Kelantan, Malaysia

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The Aspiring Stong Geopark is located in Jeli and Dabong districts, Kelantan consist more than 25 potential geoheritage sites (including karsts, e.g. Gunung Reng and Gua Ikan Karst Complex; waterfalls, e.g. Lata Chenai and Lata Renyok; and hot springs, e.g. Jeli Hot Spring). The geological evolution processes are depicted by geological history from: i. Carboniferous – Permian (i.e. Mangga Fm. and Taku Schist); ii. Permian – Trias (Gua Musang Fm.); iii. Triassic (Kemahang Granite); iv. Triassic – Cretaceous (Stong Migmatite Complex); and v. Recent (alluvium) covering a minimum 101-Ma timespan. The potential geoheritage sites in the Aspiring Stong Geopark are representative of five (5) geological frameworks or geologic evolution events. These include sedimentation of shallow marine deposits, igneous intrusion, tectonic activities and metamorfism, denudation (i.e. weathering, erosion, development of karst topography and other geomorphological landscapes), and ended by deposition of Quaternary sediments/continental deposits. The geological evolution and processes are thus significantly provide evidences of separation, and drift of Sibumasu during Early Permian, and East Malaya blocks during Devonian towards north Gondwana. Most of the geoheritage sites also portray significant biodiversity, natural attractions, and geotourism values. Their geotourism values constitute expressions of both natural resources and geological processes that acted out in the formation of the country's natural scenery. Other than their geological relevance, the areas are also potentially used as key pieces in the country's national tourism strategies as their geotourism values may be highly useful in the sustainable promotion of the territory and in the benefit of the population and geoconservation.

Keywords: Aspiring Stong Geopark, geological evolution, geopark potential, geotourism

Themes: Geoheritage

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GEOSEA 8-9

Regional Scale Geodiversity of the Karakoram Highway (KKH) and part of Central Karakoram National Park (CKNP), North Pakistan: Constrains from Geological Itinerary, Petrology and Geoconservation

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This study was conducted on the first detailed preliminary geoheritage as-sessment of KKH and part of CKNP areas based on multiple evidences in-cluding detailed fieldwork, Petrology (Petrography, Geochemistry) of the selected rocks exposed along the traverses and the potentially geoconservation. Five key geosites were pro-posed for detailed geoheritage assessments i.e. 1) Geomorphological Site, 2) Tectonic zones, 3) Mineralogical sites, 4) Geo-visiting sites, 5) Archaeologi-cal site. These geosites are analyzed based on a different procedures adopted by Kubalikova (2013) for the appraisal of the selected sites, where five sig-nificant criteria i.e. scientific (intrinsic) values, educational values, economi-cal values, conservation values and added (cultural, ecological and aesthetic) values were considered. The result reveals that all the proposed geosites have values greater than sixty percent out of their total calculations and can be as-sumed as top potential for geoturism. From the critical observation it is as-sumed that most of the proposed geosites have the highest values (based on scientific values). Based on the result, certain policies are proposed which can help to improve Geotourism along KKH and the CKNP and can raise wakefulness about the geoheritage values among the scholars, general visi-tors and the local residents in and around KKH/CKNP.

Keywords: Geoheritage, Petrology, CKNP, KKH, Northern Pakistan

Themes: (most relevant themes from the conference tracks) Geoheritage & Geotourism, Depositional Basins, Tectonic History & Magmatism

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GEOSEA 8-10

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Technical Session 9

Technical Session 9

Geophysics & Machine Learning in Geology

GEOSEA 9-1

Machine Learning Applications for Seismic Diffraction Detection and Preservation for High-Resolution Subsurface Imaging

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With the development of artificial intelligence (AI) the geophysical community realized the significance of ML in leveraging emerging technologies to upgrade geophysical workflows. Specifically, the seismic Imaging for the small-scale feature in complex subsurface geology such as Carbonate is not easy to capture because of propagated waves affected by heterogeneous properties of objects in the subsurface. The most challenging part of designing a machine learning-based application is not only the building algorithm but also preparing the data that will be used for training and evaluation. In this research, we use a convolutional neural network (CNNs) to prepare a very large number of examples from real seismic diffractions and generalize the results. If one has not provided the multiple shapes of diffraction data, then the prediction of ML will be not accurate or even ML not able to detect the pattern of diffraction in the data. After the learning, our machine, detection of the target is the crucial part that compares with the target and searches for the specific signature in the given data. Further, we feed it with data in the form of the image and feature. Which can pass through the learning algorithm to predict the target. The idea of ML is to get the difference between your prediction and the target as closely as much possible. This leads to the better preservation of diffraction amplitude in laterally varying velocity conditions. ML destruction is used for diffraction data separation as the conventional filtering techniques mix the diffraction amplitudes when there is a single or series of diffractions. Finally, the implementation of the proposed method has been proven on carbonate field data from Sarawak Basin for steeply dipping Carbonate Build-up.

Keywords: Seismic imaging, Diffraction, Machine learning, Reflection, Carbonate

Themes: (most relevant themes from the conference tracks)

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GEOSEA 9-2

GEOELECTRICAL RESISTIVITY INVESTIGATIONS (ERI) FOR SUBSURFACE PROFILING AND POTENTIAL FAILURE AREA DETERMINATION AT THE SULTAN MAHMUD DAM, TASIK KENYIR, TERENGGANU, MALAYSIA

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Geoelectrical Resistivity Investigations (ERI) survey were conducted at the Sultan Mahmud Dam, Lake Kenyir Terengganu to determine the subsurface profiles in the study area. This study was also carried out to determine the areas that have a high potential for failure when a disaster such as an earthquake or flood strikes. There were 18 survey lines conducted at this dam, namely 2 survey lines that were conducted on the right abutment near the spillway, while 6 survey lines were conducted on the downstream embankment slopes and 10 survey lines were along the slopes near the left abutment. The results of the survey at the right abutment showed that the subsurface profile in this area is dominated by granite. However, in the downstream part near the spillway, it was found that there is a rock zone with a high water content up to a depth of 5.0 m. ERI results on the downstream slope of the main embankment showed that there is a zone of high water content near the spillway. This interpretation is based on a survey at the R13 line near the crest of the embankment which shows that the high water zone is interpreted to be near the spillway. While at the bottom of the main slope of the embankment, it was found that the high water content zone was interpreted to be at a depth of 10 m. This high water zone is around 40 m long and is interpreted as the groundwater zone of the original Terengganu River before construction. ERI results on the left abutment show that the upper layer consists of granite residual soil around 5.0 m thickness at some locations. In some hillsides, granite has been exposed on the surface. From the survey it was found that there were faults that caused rock and soil collapses in some places. This study has succeeded in determining the location with a high potential for failure in the event of a disaster around the dam. Mitigation measures have been proposed for areas that have been identified as having the potential to fail.

Keywords: Sultan Mahmud Dam, Tasik Kenyir, Electrical Resistivity Investigation

Themes: (most relevant themes from the conference tracks)

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GEOSEA 9-3

Geophysical–Geostatistical Evaluation of Residual Soils and Bedrock Fluid Migration Systems in a Highly Varied Velocity–Resistivity Granitic Terrain: Penang Island, Peninsular Malaysia

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Multi-dimensional seismic P-wave velocity (Vp) and electrical resistivity measurements with borehole and core drillings were performed at four different locations, covering the sediment parts of Penang Island, Malaysia. A comprehensive geostatistical analysis of the derived velocity-resistivity, rock quality designation (RQD) of cored rock masses, and N-value results followed for insights into near-surface lithological characteristics and tectonic discontinuities aiding fluid migrations in the area. The velocity-resistivity measurements with multi-station intervals produced contrasting residual soil and bedrock anomalies with highly varied values in the southern part (200 to >4000 m/s and >100 to >2000 Ωm) compared to the western, eastern, and northern sections (50 to <4000 m/s and <50 to <2000 Ωm) of the area. These geophysical variations in relation to borehole logs are attributable to sharp changes in residual clay/silt (high quantity) to silty sand probably produced by the weathering of the Balik Pulau, Sungai Ara, and Jelutong granites in the western, eastern, and northern parts, respectively. The Batu Maung granite in the South Penang Pluton produced residual sandy soil (with little silt). This southern section also had resistive boulders and bedrock at near and surface depths, with pervasive fractures extending to depths >35 m. However, the bedrocks in the other sections have suffered intense weathering, as evident from the overburden cover of not less than 30 m thick. Thus, the deep-weathered troughs and penetrative fractures act as the fluid migration systems enhanced by paleo-stress regimes and residual soil water retention. Furthermore, geostatistical modeling provided excellent correlations between Vp and other parameters: resistivity, RQD, and N-values, with prediction accuracy between >80% and 96%. These were statistically significant in determining velocity-resistivity variations, rock mass quality, and planes of weakness. The residual soils at <2 m had N-values of 7–17, then increased to >35 at depths of 8 m in the eastern to northern parts. The southern part had a remarkable bedrock mass quality with RQD of >75–100% at >16 m depths, except for fractured bedrock.

Keywords: Geotomographic imaging; velocity-resistivity modeling; geostatistics; residual soils; bedrock fluid migration systems; tropical granitic terrain; Penang Malaysia

Themes: (Geophysics & Machine Learning in Geology)

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GEOSEA 9-4

APPLICATION OF GEOGRAPHIC INFORMATION SYSTEM FOR IRON ORE RESOURCE ESTIMATION

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Resource estimation calculation techniques have been upgraded over the past couple of years, thereby improving the resource estimates. This study showing the application of kriging techniques for measuring mineral resources using geographic information systems. The resources estimation calculation requires the information of surface elevation, field mapping result, magnetic survey mapping and result of subsurface investigation. All of this information were analysed using geostatistical approach. In this case study, the magnetic survey was conducted to identify the potential iron ore deposition. There are 192 number of magnetic data collected within the study area then were plotted and contoured using kriging. Based on the results of magnetic survey showing the presence of iron ore in the study area. Fifty (50) numbers of trial pit were excavated within the study area to verify the occurrences of iron ore deposit. The information from the trial pit exploration also being plotted to generate the isopach maps using kriging method. Finally, all of the results were analysed using ArcGIS software to come out with a block model that were used for the resources estimation calculation.

Keywords: mining exploration, mineral resource, geographic information system, kriging.
Theme: Economic Geology, Machine Learning in Geology

Return to Program

GEOSEA 9-5

Subsurface Characterization of the Cenozoic Sungai Muda Basin, Kedah using the Transient Electromagnetic Method and Borehole Data

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Sungai Muda Basin is known as one of the leading groundwater reserves in Malaysia which comprises a thick Quaternary deposit overlaying mostly granitic rock and a couple of Paleozoic-Mesozoic sedimentary formations. While the surface geology of the Sungai Muda Basin is well-studied, the subsurface geology remains both poorly mapped and understood due to the discrete and small scope of investigations. Hence we used transient electromagnetic (TEM) soundings coupled with 39 boreholes data to characterize the subsurface conditions of this Cenozoic basin and its basement attributes. A total of 98 TEM stations were carried out in Sungai Muda Basin vicinity using the ABEM WalkTEM 2 machine with a 40 x 40m and a 10 x 10m transmitter loop (Tx) and receiver loop (Rx), respectively. The TEM station interval varied and scattered from 1km to 2km allowing the mapping and modeling of the vast scale of Sungai Muda Basin. The raw data of TEM was first processed to produce an inverse-sounding model using SPIA software before the 3D model was constructed by Oasis Montaj Software. With the average depth of investigation of the inverted TEM data and the borehole logs being around 170 m and 80 m, respectively, the joint interpretation of these two data generates a number of geo-electrical resistivity profiles and depth slices covering the basin. Based on the depth slices and profiles, the distribution of the Quaternary alluvium revealed an uneven bedrock surface but gradually thickened while approaching Malacca Street's sea on the Western side. The low resistivity zones ranging from 10-100 ohm.m was interpreted as water-saturated zones or possible groundwater distribution and was believed to be controlled by deep-structure-like water barrier such as faults.

Keywords: Transient electromagnetic, subsurface characterization, basement modelling and groundwater.

Themes: Geophysics & Machine Learning in Geology

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GEOSEA 9-6

LIMITATIONS OF TERRESTRIAL LASER SCANNING FOR ROCK MASS CHARACTERIZATION IN TROPICAL CLIMATE REGION

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Recent developments in remote sensing technology allows rock mass characterization of rock slopes using Terrestrial Laser Scanner (TLS). The application of this method is mainly to develop accurate 3D profile of the slope and capturing rock mass parameters remotely yet safely from distance. However, there are limitations that should be taken into considerations. Some of the limitations are occlusion, truncation, censoring and orientation bias. Moreover, the presence of thick vegetation cover on slope faces and high intensity of weathering in the tropical climate region make it more difficult to obtain accurate reading which may also result in under-characterization and over-characterization of discontinuities properties of the rock slope. Due to these limitations, rock mass characterization from TLS point clouds often need to be verified with traditional scanline method. The situation may somewhat different for temperate climate region with minor vegetation covers and moderate to low weathering intensity, where the rock mass parameters are all preserved. Case studies showed the relationship between Digital Terrain Model (DTM) and the quality of the point cloud visualization from 4 study areas with different types of rock and degree of weathering. Understanding the limitations from TLS acquisition is compulsory if one to use the method in rock mass characterization or rock slope stability assessment. Ignoring this limitation may result in false interpretation.

Keywords: Terrestrial Laser Scanning, digital terrain model, Tropical Climate, weathering

Themes: (Geotechnology)

Return to Program

GEOSEA 9-7

Integrated Slope Failure Assesment using Multichannel Analysis Surface Wave (MASW) and Electrical Resistivity Tomography (ERT)

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After a series of heavy rainfalls in Bukit Hattamas, Cheras, a small landslide of weathered granite hills has happened near a dormant electrical tower, closing the access route to the upward. This occurrence has prompted the authorities to intervene swiftly to prevent grid line structural failure. As far as soil investigation surveys are concerned, it is impossible to obtain borehole analysis and determine soil strength. In this study, a Non-Destructive Testing strategy was developed to detect the weak zone based on the water table level and soil strength conditions utilising Multichannel Analysis Surface Wave (MASW) and Electrical Resistivity Tomography as part of an integrated geophysical method (ERT). One survey line is utilised redundantly using PASI Seismograph employing a 23-meter cable with a 1-meter spacing array, moveout every 1 metre, and a 1-meter offset, and ABEM LS system by Schlumberger protocol, 100-meter array employing 2 cables with a 2.5-meter spacing. The range of ERT values represents the saturated zone. 0–400 ohm.m is a mixture of clay and silt, 800–3000 ohm.m is weathered soil or thick material, and 2000 ohm.m is granitic bedrock at an altitude of 127.5 m. MASW 1 results are classified into four wave velocity categories: 0-200 m/s soil condition between soft and firm, 200-300 m/s stiff to extremely stiff, 300-400 m/s for hard soil, and a 400 m/s boundary between soil and rock. Correlation of MASW 1 and computed SPT-V values aids in subsurface mapping of very soft to hard material, hence aiding engineers in designing the appropriate soil strengthening mitigation.

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GEOSEA 9-8

Mapping Submarine Power Cable in Extremely Shallow Waters: A Combined Unmanned Aerial Vehicle (UAV) and Boat Survey Approach

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The conventional marine magnetometer method may face some restrictions in the extremely shallow water tidal plain, where tides and currents play important roles in influencing the survey operation. This paper presents a new approach and innovative method to map the submarine power cables in the extremely shallow waters. The cables are normally buried under the seabed in the near-shore area to prevent any damage due to anchoring or fishing activities. The survey was conducted by flying an unmanned aerial vehicle (UAV) with a fluxgate magnetometer mounted to its landing gears, over the area where water depth is shallower than 5m. In deeper water area, the fluxgate magnetometer was installed in front of a boat. The magnetic data from UAV and boat was processed and magnetic anomalies caused by electromagnetic field from the submarine cables can be identified. The survey has successfully detected and mapped five submarine power cables within the survey area.

Keywords: Submarine cable detection, unmanned aerial vehicle, fluxgate magnetometer.

Themes: Quaternary & Marine Geology

Return to Program

GEOSEA 9-9

EVALUATION OF ROCK SLOPE MAPPING USING TERRAIN LASER SCANNING

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The growth of tranportations industries throughout Malaysia has increased the use of highways and roads year after year. This development involves the blasting and excavation of large rock bodies, which could lead to rock slope instability. The ripping and blasting in rock mass is one of the factor that initiates crush zones, that could cause discontinuity and fracture in rock. In rock slope, discontinuity orientation is the main control for the potential slope failures. The mapping of discontinuity build upon the collection of rock data from fieldwork and important component of the rock mass quality assessment. However, conventional discontinuity mapping is rather time consuming, and in areas of high steep-faced rock slope, scanline field mapping are limited. Due to this limitations, a new technology in remote sensing called as Terrain Laser Scanning (TLS) has become as a part of solution to the conventional scanline mapping. This research focused on using the TLS on evaluating the discontinuity mapping on large rock slope. A large granite slope in Sri Jaya-Gambang, Pahang, was chosen as a case study. Discontinuity mapped from TLS survey was verified with discontinuity mapping in the field through the scanline method, where kinematic analysis of the slope was then carried out. TLS survey and scanline method identified a major discontinuity sets with dip direction ~250°, although scanline mapping can only identify three sets of discontinuities, whereas TLS identifies five set of discontinuities. Kinematic analysis from both TLS and scanline mapping indicate significant potential for toppling failure, with higher potential of planar failure identified from TLS discontinuity data.The results proved that TLS is a reliable method for carrying out slope stability analysis.

Keywords: Rock slope stability, Discontinuity, Terrestrial Laser Scanning, TLS, Kinematic analysis

Themes: Geohazard & Disaster Risk Reduction

Return to Program

GEOSEA 9-10

A Detailed Geophysical Study of Pulau Manis and 3-D Concept Model over Airborne Anomalies in the ECER Region

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The detailed geophysical study at Pulau Manis, Pahang and the 3-D concept modelling over airborne anomalies in the ECER region can be regarded as the first follow-up survey to the Airborne Geophysical Survey carried out within the ECER region in 2016. This project was conducted to identify potential mineral anomalies and followed up with a ground geophysical survey and drilling. The ground magnetic data supported the high quality and accuracy of the aeromagnetic data. The magnetization models derived from inversion of the ground magnetic data, substantially overlapped with the models derived from inversion of the aeromagnetic data. The ground magnetic model shows a slightly shallower top surface of the body for the North and Centre bodies. The only slight difference was the top surface of the South body where the aeromagnetic model showed shallower depth as compared to the ground model. This may be due to the slightly different magnetic susceptibility values used for both models for the South body. Nine resistivity / IP lines of 800m in length were run over the three modelled bodies, which defined the resistivity and IP values over the bodies to depths up to 140m. Low resistivity with moderate IP values was seen over the hematite-rich iron areas. Combining the magnetic modelling results with the resistivity results, three new boreholes (BH-5, BH-6, and BH 7) were proposed at the center of each body for further investigation, especially to confirm the position of the modelled North, Centre and South bodies.
Keywords : Airborne magnetic, ground magnetic, 3-D model and mineral exploration.

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Posters

Poster 1-01

GEOCHEMICAL, MINERALOGICAL AND PETROGRAPHICAL DIFFERENCES BETWEEN SERPENTINITE LENSES SITUATED INSIDE AND OUTSIDE OF THE BENTONG-RAUB SUTURE ZONE

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Numerous regional researchers agreed that serpentinite or other ultrabasic bodies that lie within the suture zone are a part of Bentong-Raub ophiolite. However, in some current reports, it is observed that there are serpentinite or ultrabasic lenses that lie outside of the suture zone such as in Jenderam Hill, Selangor, and Gerik, Perak. This paper objectively intrigued about the differences between these reported metabasic bodies. A total of five samples were taken from different localities namely Lojing, Bentong, Batu Malim, and Felda Bukit Rokan which resided inside the Bentong-Raub suture, and from Jenderam Hill situated outside the suture zone. All samples were subjected to geochemical, mineralogical, and petrographical analyses using X-ray fluorescence, X-ray diffraction, and a 30 µm thin section. The whole-rock geochemistry of all samples supported an ultrabasic type of rock with every sample originating from picrobasalt except samples from Felda Bukit Rokan and Jenderam Hill. Samples from Lojing, Felda Bukit Rokan, and Jenderam Hill supported tholeiite-type of magma, and samples from Bentong and Batu Malim ranges from tholeiite to calc-alkaline but mainly due to high serpentinization. Nevertheless, the Jenderam Hill sample favored continental origin meanwhile other suture samples were within island arc to ocean floor settings. The sample from Jenderam Hill shows mineralogical and petrological differences with all samples within the suture zone. Neither of the Jenderam Hill samples shows any serpentinization nor notable fabric as the samples that were taken from the suture. In terms of major and trace composition, the Jenderam Hill samples show quite a similarity with some samples from Felda Bukit Rokan because of the presence of plagioclase, quartz, and oxides minerals. This research addressed that the samples from Jenderam Hill may not be a part of any ophiolitic bodies as the suture does but as one of the foreign ultrabasic lenses.

Keywords: serpentinite, ultrabasic bodies, Bentong-Raub suture zone, ophiolite

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Poster 1-02

Development of Tethyan Ophiolites and Mélange Complexes along the Indian–Afghan Continental Suture: A Case Study from NW Pakistan

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Tethyan ophiolites and mélange complexes have played major role in tectonic evolution of the Indian–Afghan continental suture. Highly dismembered ophiolites and sedimentary mélange exposed across the north Waziristan, NW Pakistan, are one of a series of ophiolite–mélange complexes running along Indian–Afghan collision zone. This paper aims to document the development and origin of ophiolite and mélange complex at the western margin of Indian plate. Petrographic studies of the igneous rocks reveal that it is a complete ophiolite suite with peridotites and harzburgites at the base, followed by gabbro and dolerites in the middle, pillow basalts and chert on the top. The sedimentary sequence includes submarine gravity flows and accretionary complex where the dominant lithologies are turbidites, radiolarite and interbedded shale. The presence of late Cretaceous radiolarians (i.e *Stichomitra communis* Squinabol) and planktonic foraminifera (*Rodotruncana Calcarata*) in the samples collected from the turbidites implies Campanian age for the sedimentary sequence. Here we interpret from the field observations that the ophiolite package makes highest thrust–nappe system over the sedimentary units. This implies that the Tethyan ophiolites emplacement and onset of collision started during late Cretaceous. Subsequent obduction of the entire ophiolite–sedimentary rock sequences over late Paleocene Lockhart Formation of Indian margin records final collision event. Local deformation in the area shows that post collisional continued crash of India under Asia resulted in tectonic extrusion, dismembering and dislocating the entire rock mass into patches of chaotic rock mixture. This study illustrates that the mixture of fragmented ophiolite, turbidite and radiolarite forms a typical hybrid mélange of ophiolitic–sedimentary origin, and the formation of ophiolite–hybrid mélange along the Indian–Afghan suture is the result of at least two tectonic events in a subduction–accretion setting.

Keywords: Tethyan ophiolites, India–Afghan collision, hybrid mélange,

Themes: Tectonic history, depositional basins.

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Poster 1-03

HYPOGENIC KARST IN PENINSULAR MALAYSIA

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Widespread features of hypogenic karst were identified in caves in the northern part of Peninsular Malaysia (Perlis, Kedah and Perak). Host rock is Paleozoic to Triassic compact limestone. Cavities are arranged in a vertical succession of their origin:

- Phreatic (below groundwater level): scallops, pendants, keels, windows, discharge slots, rift conduits.
- Epiphreatic (at groundwater level): notches, ledges, lateral niches, corrosion tables.
- Vadose (above groundwater level): ceiling niches, cupolas. Additionally, rainwater percolating downwards produced various dissolution features on any of the older features.

A rich variety of cavity fillings were deposited in the vadose zone: speleothems (stalactites, stalagmites, flowstone, travertine), sediments of the Late Pliocene-Early Pleistocene, tin-bearing Old Alluvium, and Pleistocene-Holocene Young Alluvium, plus several generations of paleosoils. We suggest that fossil hypogenic karst is the surface evidence for ongoing hypogenic processes in depth, also marked by sulphurous thermal springs on the surface.

Keywords: cave formation, Peninsular Malaysia, karst, morphology

Themes: Geoheritage & Geotourism, Quaternary and Marine Geology, Environmental Geology

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Poster 1-04 (was GEOSEA 3-7)

A Comparative Study on Artificial Intelligence-based Approaches for Reservoir Facies Classification: A Case Study of the Mckee Formation, Onshore Taranaki Basin, New Zealand

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Well-log analysis remains an essential component of reservoir characterization. Among its primary objectives is to estimate petroleum reserves via lithofacies classification. In order to understand the hydrocarbon potential and depositional and digenetic history of unconventional resources at a regional scale, quantitative lithofacies modelling remains very important. The conventional approaches for conducting this analysis involve a semi-automated process, allowing human experts to perform the classification task via interpreting graphs of curves. However, the large data dimensionality and complex heterogeneous nature of unconventional mudstone reservoirs increase the challenge of lithofacies interpretation by conventional qualitative methods. Several studies over the years have contributed to investigating this problem from a unique perspective, such as a comparison among classification methods, reservoirs with heterogeneity, and data from different wells. However, not enough attention is given to comparatively studying existing machine learning-based approaches. This study presents a comparative study on three machine learning-based and three deep learning-based lithofacies classification methods using well log data obtained from the Mckee formation, onshore Taranaki Basin, New Zealand.

Keyword: facies classification, machine learning, supervised learning, deep learning.

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Poster 1-05

THE PEDAWAN FORMATION (JURASSIC-CRETACEOUS) OF THE KUCHING AREA, KUCHING, SARAWAK: FACIES ASSOCIATIONS, DEPOSITIONAL FRAMEWORK AND REGIONAL SIGNIFICANCE

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The Late Jurassic–Cretaceous Pedawan Formation is widely exposed in Kuching area, West Sarawak. Facies analysis was conducted on fourteen (14) outcrops in Serian, fourteen (14) outcrops in Siburan and six (6) outcrops in Matang, Kuching. In Serian, sandstone-rich successions (Figure 1) are common and formed five (5) environmentally distinct facies associations. These are: (i) deep-marine lobe axis; (ii) deep-marine lobe off-axis; (iii) deep marine lobe fringe; (iv) deep-marine distal fringe, and; (v) deep-marine basin plain system. Facies succession trends in Serian outlines a south-to-north submarine lobe morphology with sand-rich axial lobe facies in the south and medium-to-thin bedded turbidites lobe margin deposits in the north. In the Siburan area (Figure 2), mud-dominated successions with well-developed soft sediment deformation structures (SSDS) dominates. Lithofacies associations identified are: i) Slope–cohesive flow deposits and slump structures, ii) Canyon floor debrites and turbidites, iii) Turbidite channels, iv) Lobe fringe sandstone with thick mudstone, and v) Basin plain thin mudstone-sandstone interbeds. The facies associations support an interpretation of lobe margin subenvironments. The SSDs developed through the liquefaction of soft sediment. These are products of rapid deposition, or larger-scale deformation due to instability created by earthquakes. In Matang area, muddy thin-bedded turbidites and associated facies were recorded (Figure 3). Six lithofacies were identified: (i) Structureless sandstone, (ii) Parallel laminated sandstone, (iii) Parallel laminated and rippled sandstone, (iv) Interbedded sandstone–mudstone, (v) Slumped and chaotic deposits, and (vi) Structureless-to-parallel laminated sandstone. The facies associations are interpreted as lobe margin deposits. They represent the uppermost and partly the youngest Pedawan Formation interval, which lies unconformably below the Kayan Formation (Cretaceous to Lower Eocene). The facies associations characteristics, depositional environment and distribution of the Pedawan Formation raise several questions concerning the geological evolution of Sarawak: i) What was the relationship between the Jurassic-Cretaceous Pedawan sea and the Rajang Sea (where the Late Cretaceous-Middle Eocene Rajang Group turbidites were deposited)?; ii) What was the origin of the Lupar Line, the boundary between the Kuching Zone and the Sibu Zone (Rajang Fold-thrust belt)?; iii) What kind of tectonic processes deformed the Pedawan Formation and the Rajang Group rocks?

Keywords: Pedawan Formation, Kucing area, Sarawak, Rajang Group, deep marine basins
Themes: Sedimentary geology, Geology of Sarawak

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Poster 1-06

Petrology and Geochemistry of the Rhyolite at the Southern Part of the Ulu Sokor Gold Deposit, Kelantan, Malaysia

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Abstract

The Ulu Sokor gold deposit is located in the Kelantan state which lies on the Central Belt of Peninsular Malaysia. This belt consists of deep to shallow marine clastic sediments and limestone with predominantly abundannce of intermediate to felsic volcanic and volcaniclastic rocks. It has undergone low grade metamorphism and it was mainly formed during Permo-Triassic activities. Phyllite covers most of the deposit area and is interbedded mainly with rhyolitic crystal tuff, slate, shale, and less commonly with Permian limestone. Research on igenous rock is limited in this particular area and therefore this presence research shows the characteristic of this rock in term of geochemical as well as petrographic. The classification of the igneous rock in this particular area is characterized as volcanic type which restricted based on rhyolite composition. Addition from the hand speciment, it shows strong porphyritic texture with very less common aphanitic texture. Based on the petrography study, the phenocryst generally comprises of plagioclase, K-feldspar, quartz with minor biotite. According to geochemical studies, this area consists of typical type of volcanic arc environment which is based on the relationship between the collision of Sibumasu Block and East Malaya Block. The geochemical features include the enrichment in LILEs relative to HFSEs, and restricted calc-alkaline to shoshonitic rock formation, which indicate volcanic arc setting. The trace and major elements from the geochemistry of the volcanic rocks support the volcanic arc setting.

Keywords: Geochemistry, Petrography, Porphyritic rhyolite, Ulu Sokor, Volcanic rock

Theme: Basin and Magmatism

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Poster 1-07

RARE EARTH ELEMENTS (REE) IN VARIOUS MINERAL ASSEMBLAGES IN KELANTAN'S GRANITOID ROCKS

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Peninsular Malaysia is distributed into three parallel belts (Western, Central and Eastern). One of Peninsular Malaysia's states, Kelantan, is regarded as special since it has all three belts, where each belt is divided into several groups, including the Western Belt (Main Range Granite), Central Belt (Jeli Granite, Kemahang Granite, Noring Granite, Kenerong Leucogranite, Berangkat Tonalite, Senting Granite), and Eastern Belt (Boundary Range Granite). Rare earth element (REE) are associated with alkaline igneous, carbonatites as well as in sedimentary rocks. However there is a number of REE deposits in association with granitic rocks and their related igneous bodies.The rare earth element (REE) or also called rare earth metal are set of seventeen metallic elements include the elements of the lanthanide series known as Lanthanum group or Light Rare Earth Element (LREE) and Terbium group or Heavy Rare Earth Element (HREE). Because of its unique chemical and physical characteristics, REE has been acknowledged as valuable mineral that are used in many modern industries, including electronics, green technology, and petroleum. Since they are commercially sold as an oxide form, REE is also known as rare earth oxide. In this study, the distribution of granitoid rocks with different mineral assemblages in Kelantan is investigated and a thorough examination of the mineral composition by petrographic analysis, X-Ray Diffraction (XRD) analysis as well as Inductively coupled plasma mass spectrometry (ICP MS) to investigate the concentration of REE in various mineral assemblages in Kelantan's granitoid rocks. From the results,the Petrographic analysis showed relative abundances of minerals that indicate their nomenclature based on their mineral assemblage. As well as for XRD analysis showed relative abundances of mineral assemblage in the samples that were in broad agreement with the correlation of high/low concentration of REE. In order to investigate this relationship further, the statistical analysis utilised was Pearson Correlation because the data was nominal. Basically, Pearson correlation coefficient, *r*, indicates how far away all these data points are to this line of best fit and the result can be represent as positive or negative relationship. Results of statistical analysis indicate that, Granitoids with high anorthoclase concentrations, low plagioclase and calcite concentrations had higher HREE concentrations. While for LREE, when granitoids had high concentrations of plagioclase and opaque minerals but low concentrations of anorthoclase and calcite, the concentration of LREE increased. As granitoid rocks are widely exposed in Kelantan as well as Malaysia, these findings would provide some background information for developing a more in-depth analysis of REE potential throughout Malaysia.

Keywords: REE, Granitoids, Petrography, XRD, ICP-MS, Pearson Correlation
Themes: (Geochemistry)

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Poster 1-08 (W

THE EFFECTS OF SALINITY ON METALS' MOBILITY IN PEAT AND CLAY SAMPLES: AN INCUBATION APPROACH

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Saltwater intrusion can pose significant threats to the structure and ecology of coastal peatlands. In particular, the salinization process alters the biogeochemical cycling of critical elements (e.g. carbon, nitrogen, phosphorus, and sulphur), disrupting important ecosystem functions such as peatland carbon storage. Seawater intrusion can influence microbial activity, changing metals mobility in peatland environment. To understand how the metals behave in the peat system as a result of seawater intrusion and different metabolic activity of microbes, this experiment investigates the effects of salinity and different electron donors (acetate and formate) using the incubation method on peat and clay soil. The soil was incubated for five weeks with varying seawater strength (0%, 10%, 20%, 30%, 50%, 60%, 70%, 90%, and 100%). Aqueous phase samples were collected and measured for pH, metals and salinity before and after the incubation. The results show that the salinity of the water samples gradually decreases over the course of incubation. After incubation, peat soil shows a decrease in dissolved metals concentration compare to clay soil samples. Such a drop in metals concentration is more significant in peat samples treated with sodium acetate as compared to sodium formate. Peat samples zero salinity show higher metals release compared to samples with full strength seawater. Nevertheless, clay samples (regardless of salinity) show an increasing trend in most of the measured metals over the course of the incubation experiments. For peat samples treated with acetate, a higher salinity sample (100%) is associated with a lower K, Ca, Mg, Fe, Mn, Al, Mn, Zn, Se, and Cr metals compare to other percentage of salinity. Similar pattern can be seen in clay samples with salinity less than 50%. In conclusion, high salinity and microbial activity favours the metals immobilization in the studied soil samples.

Keywords: sea level rise; saltwater intrusion; peatland soil; dissolved organic carbon, acid sulfate soil
as 2-13)

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Poster 1-09

Pollution Assessment of Potentially Toxic Elements in Marine Sediments of Honda Bay, Palawan, Philippines

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Previous studies of the abandoned mercury mine in Palawan, Philippines, which is situated 3 km inland of Honda Bay, assessed with high ecological and human health risks of mercury and other potentially toxic elements (PTEs) released in the local environment This study assessed the environmental quality of the marine sediments impacted by the erosion of mine wastes from the mining abandoned mine site. Concentrations of mercury (Hg) and other PTEs specifically, arsenic (As), cobalt (Co), copper (Cu), manganese (Mn), nickel (Ni), and zinc (Zn) were measured in marine sediment samples of Honda Bay from two point of interest sites: Honda Bay Wharf area and Tagburos River mouth. Eighteen (18) samples were analyzed using direct mercury analyzer (Milestone DMA-80) for Hg concentrations and twenty (20) samples analyzed using portable X-ray Fluorescence spectrometer (Sciaps X-300) for other PTEs concentrations. Results showed that the concentrations of Hg, As, Co, Cu, Mn, Ni and Zn in marine sediments in Honda Bay wharf area are 1-9.7 mg kg^{-1}, 2-15 mg kg^{-1}, 51-219 mg kg^{-1}, 3-26 mg kg^{-1}, 142-672 mg kg^{-1}, 54-594 mg kg^{-1}, 2-39 mg kg^{-1}, respectively, while 1-12.67 mg kg^{-1}, 14-219 mg kg^{-1}, 3-26 mg kg^{-1}, 23-672 mg kg^{-1}, 3-594 mg kg^{-1} and 2-39 mg kg^{-1}, respectively in Tagburos River mouth. Enrichment factors (EF) describe the wharf area to have minimal enrichment of Zn, moderate enrichment of Cu and Mn, significant enrichment of As, very high enrichment of Co and Ni, and extreme enrichment of Hg. Tagburos River Mouth has minimal enrichment of Zn, moderate enrichment of Mn, significant enrichment of Cu and Ni, very high enrichment of As, and extreme enrichment of Co and Hg. Calculated index of geoaccumulation (I_{geo}) describes Honda Bay Wharf Area to be moderately contaminated by Co and Ni, and both sites are extremely contaminated by Hg.

Keywords: marine pollution, mercury, potentially toxic element, abandoned mine

Themes: Environmental Geology and Climate Change

Return to Program

Poster 1-10

IDENTIFICATION OF RIVER CONTAMINANT SOURCES USING A CELLULAR AUTOMATA MODEL AND BAYESIAN MCMC METHOD

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Identification of contaminant sources in rivers is crucial to river protection and emergency response. A methodology combing Bayesian inference with the contaminant transport model based on Cellular Automata (CA) is proposed to identify unknown sources of river pollutions in this paper. The efficiency and accuracy of the forward transport model greatly affect the computational efficiency of the Bayesian inference. Therefore, a cellular automata-based contaminant transport model is developed to efficiently simulate the concentration change of pollutant rivers in a specific space-time. Markov Chain Monte Carlo (MCMC) method is applied to get the posterior probability distribution of the location, time release and magnitude of contaminant source. The Metropolis-Hasting (M-H) method is used to sample in order to form Markov chains. A real case study derived from the publicly documented Fen River is tested using the proposed methodology. The results indicated that the proposed methodology is an effective way and may be used to identify the locations and release histories of river contaminant sources.

Keywords: Contaminant Source identification, Bayesian inference, MCMC, Cellular automata, River pollution

Themes: (most relevant themes from the conference tracks) Enviromental and Water Resources

Return to Program

Poster 1-11

VERTICAL DISTRIBUTION OF POTENTIALLY TOXIC ELEMENTS IN THE ABANDONED MERCURY MINE IN PALAWAN, PHILIPPINES: INSIGHTS FROM BOREHOLE GEOCHEMISTRY

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The abandoned mercury mine in Palawan, Philippines, operated by the Palawan Quicksilver Mine, Inc. (PQMI) from 1953 to 1976, was characterized with high ecological and health risks due to its exposed heavy metal-laden soil and mine wastes in the vicinity. In this study, eight boreholes were drilled within the vicinity of the abandoned mine with varying depths of 20-52 m to determine the vertical distribution of mercury and other potentially toxic elements deposited in the soil. Collected core samples were analyzed using a portable X-ray Fluorescence spectrometer (Sciaps X-200) to determine the concentration of mercury (Hg), arsenic (As), cadmium (Cd), chromium (Cr), iron (Fe), and lead (Pb). Measured concentration ranges from 1-124 mg kg^{-1} of Hg, 1-13 mg kg^{-1} of As, 1-3 mg kg^{-1} of Cd, 190-12,491 mg kg^{-1} of Cr, 1.2 -23.5 % Fe, 148-11,153 mg kg^{-1} of Ni and 1-4 mg kg^{-1} of Pb. Vertical concentration profiles show general trend of decreasing Fe, Ni, and Cr with respect to depth, while As, Cd, and Pb plots are with consistent low values all throughout. Mercury concentrations show distinct peaks on the first (0-3m) layers in several boreholes (5, 6 and 7) which suggest that these areas were dumped with mine wastes or served as tailing disposal areas during mine operation. Mercury peak at the 27-30 m interval of Borehole 6 corresponds to a vein that is described to host mercury mineralization. Mine waste calcines, ultramafic rocks, and marine sediment layers are also distinctive in Borehole 8 which demonstrates the historical changes of Honda Bay wharf. Correlation analysis determined Hg to be positively correlated with Cr and Fe, negatively correlated with Cd, Pb, and As, and showed no correlation with Ni. Meanwhile, Fe, Ni, and Cr are strongly correlated with each other mainly because of the ultramafic terrane of the area.

Keywords: mercury, abandoned mines, potentially toxic elements, geochemistry
Themes: Environmental Geology and Climate Change

Return to Program

Poster 1-12

GEOLOGICAL DISASTER KNOWLEDGE AND AWARENESS

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Understanding geological disasters have become necessary, particularly after destructive events such as the 2015 Ranau Earthquake and the 2021 Yan Debris Flow. It is challenging to combat these hazards, especially if it occurs in areas that are considered safe and stable. In facing such inevitable forces, the vulnerable communities must keep abreast of geological conditions in and around their locality. Thus, our motivation was to equip Youth and Young Professionals (YYP) with geological disaster knowledge and disseminate such information to the local communities with the help of trained YYP members from various educational backgrounds. It involves understanding the basic concepts of disaster and disaster risk, geological hazards, and risk reduction methods utilized to combat such calamities. The efforts to escalate their engagement in disaster-related activities have been channeled through Training of Trainers (ToT) on geological disaster, development of disaster risk reduction modules, and experiential learning at school. Some of the initiatives at the school levels include hazard identification, body mapping, disaster board game, and learning geology using play-doh and volcano science kits. These approaches may be able to improve community capacity towards disaster resilience and awareness for better preparedness when facing unavoidable risks. Nevertheless, we do believe such engagements can be further enhanced with the assistance of scientific communities and government authorities. In the spirit of understanding and disseminating awareness, we, as the frontrunners of this generation, are hoping to establish disaster-resilient communities in the near future and building resilience is one of the best responses to emerging natural hazards.

Keywords: Geological Disaster; Disaster Risk; Disaster Resilience; Youth and Young Professionals (YYP)

Themes: Environmental Geology and Climate Change

Return to Program

Poster 1-13 (was Poster 2-14)

EFFECT OF GROUNDWATER-SOIL INTERACTION BASED ON THE GEOELECTRICAL PROFILES OF PEAT SOIL AT KLIAS RESERVE FOREST, SABAH

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The carbon stock capacity influenced by the existence of peat soil that controls the trace element adsorption capability as well as the groundwater-soil interaction. The groundwater system highly influence by porosity and permability alongside with microstructure. The relationship of these factors by were investigated based on the sample within Alluvium Quaternary deposits at the Klias Peninsular, Sabah which mainly comprises of 3,630ha of peat soil. Total of 9 geoelectric surveys line and of 18 peat soil core samples were acquired to perform subsurface profile analysis. The Wenner and Schlumberger configuration of geoelectrical surveys show the groundwater table ranging from 0.25m to 1.5m. Peat soil layer typically indicated by wide range of resistivity value (15 Ωm to 500 Ωm) with thickness varies up to 6 m. Clay layer typically indicated by 3 Ωm to 60 Ωm with thichness ranging up from 6 to 28 m. The physical properties of peat sample indicates an acidic pH value (3-5), moisture content (93.80% to 1080.53%) and organic matter (7.75% to 101.70%). Texture of peat soil profile indicate broad range from peat to silty clay. Correlation among the data shows that the accumulation of organic matter mostly at low pH value (3 to 4.5). High moisture content which is affected by the rising of the water table will increase the accumulation of the organic content as well as carbon stored capacity for the peat soil. The acquired information from peat soil at Klias Reserve Forest shows the absorption of trace metals capacity affected by the interaction of groundwater-soil. This situation gives an indication on carbon stock and sequestration potential could potentially influence by the groundwater table changes.

Keywords: physico-chemical, geoelectric, peat, carbon stock.

Themes: Environmental geology and climate change.

Return to Program

Poster 1-14

QUANTITATIVE ANALYSIS OF GRANITIC INTRUSION BOUNDARY AND FAULT ZONES AND THEIR IMPACT ON KARSTIFICATION

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Karst environment exhibit unique features that are continually exploited, such as show caves and natural parks, and hosts very significant natural resources. Karstic environment covers 20% of the Earth's surface and supplies 20-25% of groundwater for drinking water. In Malaysia, carbonate rock is continuously quarrying for the production of aggregate resources, dimension stone, and raw materials for cement industries, part of urban development infrastructure and could be foreseen as future potential of high quality natural water. But, nonetheless geohazards occurrences in karst environment is profoundly distinct from other natural settings. The frailty of karst environments of peculiar geological and hydrological features such as caves and sinkholes make it highly vulnerable to a variation of different geological hazards (or geohazards). In particular, like collapse sinkholes, they can pose environmental problems related to pollution, because they provide a point where polluted surface runoff can directly flow into surface and ground water. With their complex and unique characteristics, karst aquifers are very different from other aquifers. Physical and chemical processes together with tectonic movements in limestone, dolomite and other soluble rocks have formed well-linked fissure systems in karst massifs, with dimensions varying from micrometres to several meters. Water is stored and circulates through the cavities, also crossing topographic watersheds, which therefore have little significance for karst aquifers. This study offers an analysis of the field mapping and lab characterizations of petrographic and mineralogical variability of karstified limestone at two different geological settings, the granitic intrusion boundary/aureole zone and fault zone.

Keywords: limestone, aureole, fault zones, karst, Kuala Lumpur, Ipoh

Themes: (ENVIRONMENTAL GEOLOGY & CLIMATE CHANGE)

Return to Program

Poster 1-15

GEOLOGY OF THE BOHOL ISLAND ASPIRING GEOPARK, PHILIPPINES

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Bohol Island Aspiring Geopark showcases several unique geologic features formed from the dynamic interactions of geological processes from the Jurassic Period to the Pliocene Epoch. Located at the central portion of the Philippine Mobile Belt, which was formed from the relative movements of Philippine Sea Plate to the East, Eurasian Plate to the West, and Indo-Australian Plate to the South, Bohol is composed of igneous, sedimentary, and metamorphic rocks. The oldest rock in Bohol is the Cretaceous Alicia Schist followed by Late Cretaceous-Paleocene Bohol Ophiolite, volcanic and clastic Early to Middle Eocene Ubay Formation, Late Eocene to Late Oligocene Jetafe Andesite, Talibon Diorite, and Jagna Andesite, Early Oligocene Ilihan Shale, Early – Middle Miocene Wahig Formation, Late Middle Miocene Carmen Formation, Late Miocene Sierra Bullones Limestone, and Pliocene Maribojoc Formation.

Folds and thrust faults in the island caused the emplacement of ophiolite which brought the Jurassic Alicia Schist. The National Geological Monument Chocolate Hills, formed from the dissolution of underlying limestone, is composed of 1268 smooth, uniformly shaped conical isolated hills covering approximately 140 square kilometers within the towns of Sagbayan, Batuan, and Carmen. Limestone dissolution also formed other karst features such as the Hinagdanan Cave in Dauis, Cagongcagong Cave System in Alicia, Trinidad Cave System, and Cave Pools in Anda. The North Bohol Fault, which caused the 7.2 magnitude earthquake in October 2013, formed one of the most unique geoheritage sites in the Philippines - the Loon-Maribojoc Uplifted Terrace. The latest addition to the National Geological Monument, it boasts of a recently-formed landform with an uplift of 1.5 meters and a 50-meter movement of coastline seaward, and the Inabanga Rupture Site with a fault scarp 2-5 meter vertical displacement that stretches for 2 kilometers. Similar geologic events in the past also led to the formation of the Baclayon Ancient Uplifted Marine Terraces, Alicia Panoramic Park, Can-umantad Falls and Canawa Cold Spring in Candijay, Lamanok Island in Anda, and the Danajon Double Barrier Reef.

Keywords: Bohol Island, Geopark, Geoheritage
Themes: Geoheritage and Geotourism

Return to Program

Poster 2-01

STRUCTURAL MAPPING OF RANAU, SABAH USING REMOTE SENSING AND OTHER PARAMETERS

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The tectonic of Sabah is still uncertain despite its susceptibility to seismic activities. This prospective study was designed to identify geological structures in the Ranau using optical and radar satellite images and integrate the findings with subsurface parameters such as gravity. The lineaments extracted from radar satellite image and two optical satellite images namely ALOS PALSAR and Landsat 8 respectively, were utilized for the band rationing process. Three different band ratios; bands 6/7, bands 6/5, and bands 4/2 are employed to map different minerals content; clay minerals, iron-bearing minerals, and oxidation of iron-bearing sulphides. Then, subsurface interpretation was accomplished to provide further geological interpretation. From the lineament extraction method, it is found that the lineaments show three different orientations which include N-S, NW-SE, and NE-SW. The lineaments are denser in the north-western part of the Ranau earthquake which may indicate compressional activity. The three different band ratios are mapped into a single RGB composite bands map. This combination enhanced the spectral differences of each lithology unit for easier identification. It shows the content of iron-bearing minerals is higher in the northern part of Mount Kinabalu while the surrounding area is displayed with higher clay minerals content with a little distinction on the shade of the colour, which marks the different lithology. The Bouguer anomaly gravity map strengthens the idea of the possibility that the earthquake was the product of the ruptured, blind fault in the subsurface. It can be concluded, through this gravity method, three possible subsurface faults were identified on the west side of Ranau and found to encircle the earthquake. This study establishes a qualitative framework for detecting geological structures using satellite images and satellite-derived gravity data that is beneficial in earthquake studies. Further investigation on ground rate movement prior to earthquake events will be conducted.

Keywords: earthquake, active faults, seismicity, geomagnetic, gravity

Themes: Geohazards and Disaster Risk Reduction

Return to Program

Poster 2-02

SOFT SOIL PROBLEM IN THE MUDA AGRICULTURAL DEVELOPMENT AUTHORITY (MADA) PADDY FIELD AREA, KEDAH, MALAYSIA

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Soft soils is a long-standing problem faced by farmers in the paddy cultivation area. This problem has affected almost 8,000 hectares of paddy fields in the Muda Agricultural Development Authority (MADA) area and its had an alarming effect on the production of paddy yields. This soft soils inhibits the trafficability of machinery especially during the process of field preparation and harvesting of paddy yields. A good paddy field overlaid by soil with the ability to accommodate the movement of facilitation machinery that have the ground bearing capacity of the cone index exceeding 3.0 kg/cm2 . The paddy field loses its bearing strength whenever there is a prolonged wet condition phenomenon or too short drying period that is triggered by weather uncertainty. This paper was written with the aim of detailing the phenomenon of soft soils that occurs, in the area of MADA paddy cultivation as well as identifying the appropriate causes and methods to overcome this problem. The results of this study show that there are several causes that have been identified as well as knowing the methods that are related to the problem. Among the approaches that can be done are the use of low-pressure machinery, improvement of the existing drainage system, underground drainage as well as treatment of the soil which includes physical treatment and treatment of alternative materials.

Keywords: Soft soils, Paddy Field , Traficcability, Cone Index

Themes: (DRR)

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Poster 2-03

ACTIVE FAULT STUDIES IN THE NIAH AREA, SARAWAK, MALAYSIA

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The Active Fault and Earthquake Risk Area Mapping of the Niah area was one of the projects implemented to identify the presence of an active fault, to create an inventory and also a mechanism to study and monitor the geological structures to guarantee the availability of information when needed. Although the locality is located in a stable area, some seismic events were recorded. This paper presents the results of the project. The work involved the study of previous information available, remote sensing studies, field observations and geophysical studies. The major faults in the area have been characterised. Installation of GPS monuments the relevant maps were the final outputs of the project.

Keywords: fault mapping, fault characterisation, 2D-resistivity, Tubau Fault

Return to Program

Poster 2-04

GROUNDWATER MODELLING FOR ENVIRONMENTAL IMPACT ASSESSMENT OF MANGANESE ORE MINING SITES IN KELANTAN

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In the field of hydrogeology, groundwater modelling offers a reliable tool to describe the conditions and to predict the adverse environmental consequences on the receiving groundwater regime and also ideal for suggesting remedial strategies. As part of the EIA for the proposed manganese ore mining operations in Kelantan, a groundwater flow modelling simulation in conjunction with a baseline study was used to asses the sensitivity of the receiving groundwater environment. The significant environmental impacts on the groundwater envisaged during the pre-construction, construction and post construction phases of the project are: (i) alteration on aquifer recharge in terms of groundwater flow and levels, (ii) groundwater quality and contaminnat movement. Based on the overall assessment the sight presented no significant impacts on the receiving hydrogeolocal regime. The identified impacts on the groundwater regime were considered "medium". Mitigation measure such as: implementing buffer zones close to sensitive receptors (iii), minimizing depth of excavation and (iv) comprehensive groundwater level and quality monitoring were recommended to minimize negative impacts on the hydrogeological regime.

Keywords: Groundwater Modelling, Environmental Impact Assessment (EIA), Groundwater Management, Langkawi Malaysia, Mitigation, GEOSEA, Kelantan.

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Poster 2-05

GROUNDWATER QUALITY ASSESSMENT AT A PROPOSED RE-DEVELOPMENT PROJECT OF A FORMER LANDFILL SITE

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Re-development of an abandoned and closed landfill site is essential to provide new land for development. This paper highlights the groundwater quality assessment at a proposed re-development project of a former landfill site in Malaysia. The main objectives of the study are to assess the groundwater quality and to determine the presence of any potential contaminants. A total of 33 boreholes were constructed comprising of 18 deep boreholes and 15 shallow boreholes. The maximum depth of Deep Borehole (DBH) was 80 m for Shallow Boreholes (SBH) was 25 m. The geology of the site is consisting of limestone. The borehole data (% RQD) suggested that the limestone is classified as a good aquifer with high fracture density. A total of thirty (30) groundwater samples were collected and chemically analysed. A Piper plot indicates that most of the groundwater samples represent $CaHCO_3$ type of water. Some samples fall in the field of mixed Ca-SO_4. Very few samples represent mixed $CaNaHCO_3$ facies. The groundwater quality results indicated that the concentrations of certain groundwater parameters or elements in groundwater exceeded the Environmental Standards. BOD, COD, ammonia, boron, manganese, iron, arsenic, magnesium, sodium, Total coliform and Total E. Coli exceeded the Environmental Standards. The groundwater study concludes that the groundwater quality was already contaminated by leachate produced from the abandoned landfill. There is a potential threat from this contaminated water to human health and the environment. Several options shall be selected to minimize the impact to groundwater such as (i) limit the infiltration of water through the landfill cover by providing impermeable clay cover and (ii) extract the leachate / polluted groundwater from the landfill and treat the groundwater according to Environmental Standards.

Keywords: Landfill, Groundwater, Piper diagram, Water quality, Boreholes (4 to 8 keywords)

Themes: (most relevant themes from the conference tracks) ; HYDROGEOLOGY & EARTH WATER RESOURCES

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Poster 2-06

Demarcation of Groundwater Recharge Potential Zones in the Langat Basin, Malaysia

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Hydrogeological characteristic is one of the main factors contributing to the river basin's water recharge. The main objectives of this study are to identify the hydrogeological characteristics of the Langat Basin and to produce groundwater recharge potential zone maps. This study used a Geographical Information System (GIS) and Remote Sensing approach to delineate potential artificial recharge sites in Langat Basin. Eight parameters that influence groundwater recharge were evaluated: geomorphology, land use/land cover, lithology, geology, slope, drainage density, lineament density, and rainfall. The integration of data technique was carried out using a weighted linear combination method using remote sensing and GIS. The thematic map of each weighted parameter was produced accordingly. The result shows that the groundwater potential zone of the study area is qualitatively classified into five zones: very low, low, medium, high, and very high. The results show that the upper part of Langat Basin which is located at Hulu Langat and Teluk Panglima Garang is characterized by a very high potential zone whereas the lower part consists of a medium potential zone located in Cheras and Dengkil. In comparison, the result shows that very low groundwater potential recharge is located at Mantin and Nilai. Almost all alluvial plains have a high potential for groundwater occurrence. Meanwhile, the river terraces and water bodies with alluvium have excellent groundwater recharge potential, while the areas under forest cover tend to have good groundwater recharge potential. One of the main factors for river basin management is assessing hydrogeological characteristics.

Keywords: groundwater potential zone, geographical information system (GIS), remote sensing

Themes: Hydrogeology

Return to Program

Poster 2-07

Spatial Distribution Mapping and Suitability Assesment of Groundwater quality for Domestic Use in Kurukshetra District, Haryana, India

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The Kurukshetra district in Haryana state of India relies heavily on groundwater to fullfil its household needs. For sustainable management of groundwater, its quality must be assessed in terms of suitability for the domestic needs. The current study has analysed pre-monsoon geochemical data of groundwater samples of the area for year 2020. The geographic information system was used to create spatial distribution maps for hydrogen ion concentration (pH), total dissolved solids (TDS), electrical conductivity (EC), sodium adsorption ratio (SAR), and residual sodium carbonate (RSC). The study area was divided into different groundwater quality zones for domestic use as per Bureau of Indian Standards (BIS) and World Health Organisation (WHO) norms.On the basis of GIS analysis of the groundwater quality parameters for domestic purpose, in case of pH, an area of 1253 km^2 falls in desirable zone and 448.3 km^2area in zone of non desirable. An area of 1604.56 km^2 falls in desirable zone but rest area 79.44 km^2 in permissible zone as per TDS distribution. The EC shows an area of 1678.47 km^2 as good zone, whereas 4.5 km^2 area in permissible and of 0.2 km^2 area in doubtful zone. As per SAR, the entire district falls in low zone value under 10 mg/l whereas RSC distribution indicates an area 1579.34 km^2 is covered by suitable zone and rest area of the district falls in marginal zone. It shows that maximum area of the district falls in suitable to permissible zone. Further the present study will describe integrated map for suitability evaluation for domestic purpose in detail .

Keywords**:** GIS,Spatial Distribution ,Groundwater quality, Domestic, Kurukshetra , India

Themes: Hydrogeology & Water Resources

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Poster 2-08

GEOTECHNICAL ASSESSMENT AND ENGINEERING ANALYSIS OF THE HIGH-RISK SLOPE TOWER POLE 3, LINE SEGARI – AYER TAWAR USING INNOVATIVE MONITORING RATING SYSTEM (IMRS)

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Tower pole in Malaysia were built through various land use and topography. There are some cases where these tower poles were built in hilly areas. One of the problems with tower pole in the hilly areas is the slope failures. Slope failures are major natural hazards that occur in Malaysia under the influence of heavy rainfall and deforestation. In order to maintain the quality of tower pole for the country, it is essential to monitor the stability of these tower pole regularly. Current technique of the inspection and monitoring are inefficient and not cost effective. Therefore, in the present study, we proposed an improvised technique namely Innovative Monitoring Rating System (IMRS). IMRS has few advantages over the current technique, for example it can determine the physical and mechanical properties of the on-site materials including subsurface information, type of soil and rock, the value of SPT-N and RQD, and groundwater based on resistivity and seismic. With the information, the security risk management can be recommended and can be planned appropriately. Tower pole 3, Line Segari - Ayer Tawar, was the first example selected to explore the geophysics and engineering analysis using IMRS. The present result shows that IMRS improve the efficiency of current slope monitoring procedure, with the ability to evaluate the surface and subsurface materials. Therefore, it is proposed that IMRS technique is appropriate in evaluating the geotechnical properties and appropriated security risk management can be recommended.

Keywords: Innovative Monitoring Rating System (IMRS), landslide, slope movement, tower pole.

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Poster 2-09

THE JERAI GEOPARK GEOSITE: LOSS OF AESTHETIC VALUE AFTER THE 2021 DEBRIS FLOW TRAGEDY

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The opportunity for the Jerai Geopark to become a UNESCO GLOBAL GEOPARK is very bright. Apart from geosites already certified at the international level, Geosites of Sungai Batu and Sungai Batu Pahat, already equipped with complete facilities should also be exposed to the world so that the wisdom of civilization in Old Kedah, as well as the production of various mining metals from previous civilizations kept within, can be made known.

There are two more international geosite opportunities within Jerai Geopark. The geological disaster that occurred in Jerai Geopark in 2021, has been appropriately managed by various parties. This event that caused the loss of the aesthetic value of two main geosites namely Titi Hayun-Putri Mandi and Sungai Batu Hampar also increased the scientific value of the geosite to international level. Actions taken by the related agencies to rescue and overcome the disaster risk by installing early warning systems have transformed the area into a live museum for the Jerai Geopark community, an advantage that no other geopark has. Jerai Geopark also has an international geosite, the Tsunami Beach Geosite, which has geodisaster scientific, cultural and static value.

Jerai Geopark is a very dynamic coastal Geopark that needs to be restored and preserved and its knowledge celebrated globally. Various activities have been carried out for the past eight years until the 2nd national revalidation process. The certification of Jerai geopark as a national geopark is a piece of wonderful news that needs to be shared with all levels of society. Hence, Jerai Geopark is the pride of Kedah and the nation of Malaysia. The community development of the Jerai Geopark has been carried out at various levels producing new income for many of the members. This agenda should be the main vision of the state in obtaining new job opportunities in various geotourism sectors. The criteria possessed by this Jerai Geopark area are more than enough to make it an Aspiring Jerai Unesco Global Geopark.

Keywords: Jerai National Geopark, international geosites, Unesco Global Geopark

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Poster 2-10

GEO-ENVIRONMENTAL EVALUATION BASED ON ELECTRICAL RESISTIVITY ANALYSIS AND ITS IMPLEMENTATION FOR UTILITY TOWER POLE SITING IN THE KUALA KRAI-GUA MUSANG, KELANTAN AND CAMERON HIGHLANDS, PAHANG AREAS

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There are cases in Malaysia where the towers pole was built and this may change the stability of the subsurface ground around the area. Due to the concerns on the stability of these towers pole and the natural hazards that come with it, it is very important to monitor these towers. Then, the geo-environment must be duly considered when planning and carrying out remedial measures that are designed to protect the environment. Therefore, it is necessary to evaluate transmission towers situated at geomorphologically hilly and unstable environments regularly to prevent unforeseen situations from happening. The aim of the study is to conduct the risk assessment of two transmission towers: Kuala Krai, Kelantan and Cameron Highland, Pahang. The scope of the investigation is to determine the subsurface soundness and stability that may put the tower substructure at risk since the towers are sitting on the highland near the slope edge. It is also observed that there is a sign of the slope instability at the areas. This paper describes the use of Electrical Resistivity Test as a tool to evaluate slope and implementation of electrical transmission tower in a geomorphologically hilly and unstable environment. This technique has been applied to the case study conducted at the Kuala Krai-Gua Musang and Cameron Highland-Pahang lines to examine the subsurface soundness and stability that may put the tower substructure at risk. Both towers are sitting on the highland near the slope edge. The resistivity images are recorded in the form of 2 dimensional axes, where y-axis is the depth below ground level and x-axis is the length of survey line where the electrodes were buried. The process of interpretation of resistivity image was based on the standard table of resistivity index for different materials. Result is discussed in the term of type of materials subsurface in relation to the resistivity index.

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Poster 2-11

CONTRIBUTION OF COMPREHENSIVE NUCLEAR-TEST-BAN TREATY (CTBT) DATA TO CLIMATE CHANGE STUDIES AND THE EARTH SCIENCES

Bashillah Baharuddin[1], Mohd Fauzi bin Haris [2], Dr. Mohamad Syazwan bin Mohd Sanusi[3], Norita binti Md. Norwawi[2], Mohd Hafez bin Mohd Isa[2]

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CTBT stands for The Comprehensive Nuclear-Test-Ban Treaty (CTBT), which is a Treaty banning all nuclear explosions - everywhere, by everyone. The Treaty also helps prevent human suffering and environmental damages caused by nuclear testing. Under the treaty, The International Monitoring System (IMS) facilities were developed to monitor and detect nuclear explosion use four different technologies to look for signs of nuclear explosions.[1] seismic to detect shockwaves in the earth and register thousands of earthquakes and mining explosions yearly [2] hydroacoustic to detect acoustic signals in the oceans. [3] Infrasound detects low-frequency sound waves with a network of 60 stations. [4] Radionuclide to detect radionuclide particles and a noble gas. Radionuclides provide the "smoking gun" evidence for a nuclear explosion. Many types of radionuclides, for example, cosmogenic radionuclides, are being used in environmental research, particularly on climate change. Currently, in Malaysia, there is a study using cosmogenic radionuclides that use Beryllium-7 (Be-7) for rain prediction and how this information may contribute to the preservation and conservation of geopark due to climate change. The study demonstrated that the lower the concentration of Be-7, the higher the chance of precipitation intensification. Climate change that leads to erosion is among the challenges in preserving and conserving nature features and geo-heritage. For example, the Cliffs of Fundy UNESCO Global Geopark's boundaries lost a significant portion of its area due to coastal erosion. Factors related to climate change, such as more frequent and intense rainstorms, can exacerbate erosion. A study used Be-7 data from 2018 to 2022, and Langkawi Island was selected for this event. The Be-7 data were retrieved from the CTBT Radionuclide monitoring station in Thailand because it is nearest to Langkawi Island. Later in future work, a study on sediment transport will be carried out. Sediment transports studies of a place and helps provide information on geopark ecosystem sustainability. The primary data input collected in this study is the activity level of the radiotracers in sediments and the granulometric classes of sediments. The database of activity levels of U-238, Th-232, and K-40 of igneous bodies and rock weathering products for Peninsular Malaysia is used to investigate the correlation between downhill and uphill radiotracer activity. These environmental databases are also essential to serve as climate change fingerprint data, a piece of important information for nature preservation and conservation study such as geo-heritage.

Keywords: climate change, geo-heritage, seismic, radionuclide, rain prediction, sediment transport

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Poster 2-12

3D-Printed Topographic Models

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The 3D printed model presented below was created using NASA's SRTM (Shuttle RADAR Topography Mission) data, which was processed using BlueMarbleGeogaphic's Global Mapper® software to produce a STL file. STL files contain 3D meshes, which consist of adjoining triangles representing surfaces and enclosed volumes. This was then imported into AutoDesk 123D Design, which is a 3D CAD package. The 3D model must then be oriented so that its base is horizontal, and the model (initially full scale) must be reduced to a manageable size (to fit on the printer's bed – in this case, a scale of 5mm = 1km was chosen). A 3mm rectangular base was added to the bottom of the model, and details such as the scale, labels and directional arrow were added. Another STL file was then created in the 3D CAD software, and imported into Ultimaker Cura 5.0, which is a "Slicer". A slicer translates 3D models into machine instructions, which control the movements of the 3D printer's tool head. This model was printed using 0.4mm lines, 0.2mm layer height, and used 74 grams of PLA (polylactic acid) filament, taking 7 hours and 13 minutes. For 3D topography models, we use 30% infill, 3 wall layers, 4 top layers and 3 bottom layers. The printer used was an Artillery Sidewinder X2, which costs approximately RM1800, and the cost of the filament was approximately RM5.

Keywords: 3D model, 3D Printing, SRTM, Topography

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Poster 2-13

GEOMODELING FOR MULTILAYERED RESERVOIRS IN NEW ZEALAND: DETERMINING OPTIMUM DRILLING SPOTS

[1*]Dr. A K M Eahsanul Haque, [2]Dr. Numair Ahmed Siddiqui and [3]Sharif Imran Hasan

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The Taranaki Basin is the most significant petroliferous basin of New Zealand and the Maui Gas Field is the largest gas field sitting on the Southern Taranaki Basin (STB) with a spatial closure of 150 km^2 and 3D seismic coverage of 1500 km^2. This study focuses particularly on seismic interpretation, followed by structural-facies-petrophysical, future well locations and static volumetric estimations using artificial neural networking (ANN) and a blended training image for comprehensive assessment on the prospective geobodies responsible for containing natural gas in the subsurface. Two major reservoirs of the field; Mangahewa and Farewell Formation visualize that marginal marine (MM) is interpreted to be the most dominant facies association in the Mangahewa facies model, having 64% of the depositional facies associated with this environment. Structural, facies and petrophysical combined represent a ground-breaking scenario of volumetric uncertainty cases in which the possibility for a reserves growth of about 103 Bcf of gas considering P50 probability on simulation run #17 for the gas field.

Keywords: 3D geomodeling, Maui Gas Field, paleoshoreline reconstruction, volumetric uncertainty

Themes: (Oil and Gas)

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SERIES2022

2ND INTERNATIONAL CONFERENCE OF SUSTAINABLE EARTH RESOURCES ENGINEERING 2022

18 - 20 OCTOBER 2022

LANGKAWI, MALAYSIA

"EXPLORING FUTURE SUSTAINABLE EARTH RESOURCES AND ENGINEERING TECHNOLOGIES"

PROGRAM & ABSTRACT BOOK

FEATURING XVII GEOSEA 2022

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SERiES 2022 Quick Links

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PREFACE

A warm welcome to all delegates of the 2nd International Conference of Sustainable Earth Resources Engineering 2022 (SERiES22) to the beautiful Pulau Langkawi!

The SERiES22 conference is proudly hosted by the Centre for Sustainability of Ecosystem and Earth Resources (Pusat ALAM), Universiti Malaysia Pahang. Formerly known as Conference for Malaysian Rare Earth Technology (COMRET) in 2015, the conference expanded in 2020 to encourage worldwide participation and to reach out to other scientific communities concerned with the geotechnical study, water, coastal and offshore engineering, structure and materials evaluation, mining exploration, mineral processing, metallurgical advancement and green technology. The conference has evolved from focusing on Malaysian min -ing and mineral processing into an international meeting place to share the foundation, techniques, advancement and application of earth resources and sustainability approach in wider range of fields. At SERiES22, experts with different engineering background, will present and discuss promising results of their research and experience. The theme for this year "Exploring future sustainable earth resources and engineering technology" were chosen as means of bringing together the many orientations of engineering research and teaching, and providing a basis for discussion of issues arising across the engineering community.

Interest in this conference is growing. We have with us, 97 abstracts and scientific articles, from 7 countries around the world. About 58% of them attended the conference for the first time with more than half of them are young researchers. The accepted talks will be delivered in the Bayview Hotel as well as video presentation. The first and second day of conference will start with plenary lectures and keynote lecture~~r~~s from experts from various fields. In addition to the presentation by participants and invited speakers, this conference also offers ice-breaking session and field visit. Both activities organized to encourage participants to connect, share and discuss with each other in a relax environment.

It has been both a privilege and a pleasure to serve as chairman of SERIES22. Our warmest thanks go to the many individuals and organizations that have helped with this year's conference. We are very grateful to the Malaysia Smelting Corporation Berhad, Pahang Mining Corporation and Central Laboratory Universiti Malaysia Pahang for their sponsorship and organizational help. PKNP Mineral Industries Sdn Bhd, MO Sg Temau Mines Sdn Bhd, Tin Board, Gadang Works Sdn Bhd, Capital Education & Skill Development (M) Sdn Bhd, MXC Elevator Sdn Bhd, Peat Organic (M) Sdn Bhd , UMP Advanced, Thahera Water Tech Sdn Bhd, Permula Sdn. Bhd and Hasuno Sdn Bhd for their support and contributions. Special thanks to GEOSEA 2022 team member for their effort in making this joint conference a success. Many thanks also to the SERIES22 committee and to all the invisible volunteers that worked hard at making SERIES22 a success. Finally, we want to thank the authors, the presenters and the participants and invite them all to fully enjoy the diverse landscape, numerous sights, and excellent tourist facilities Langkawi has to offer.

Associate Prof. Dr Mohd Fakhrurrazi Ishak

Chairman
2nd International Conference of Sustainable Earth Resources Engineering 2022 (SERiES22)

SERIES2022

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SERiES 2022 Program01

PARALLEL SESSION 1 (18 October 2022) 2.00 PM - 3.00 PM BAYVIEW GRAND BALLROOM				
NO.	**NAME**	**GEOSEA ID**	**TITLE**	**CATEGORY**
1	Komsoon Somprasong (Keynote Session)	SERiES22-08	Modeling of Fugitive Dust Migration in Deep Mining-pit During Atmospheric Inversion Incident: A Case Study of Mae Moh Mine	SUSTAINABLE MINING AND MINERAL PROCESSING
2	Mohd Syahrir Mohd Rozi	SERiES22-02	Acid Mine Drainage in Bukit Besi: A Development of AMD Active Treatment at Pilot Plant Scale	
3	Muhammad Irman Khalif Ahmad Aminuddin	SERiES22-60	Petrography & Geochemistry of Metapsammite and Metagranite Rocks from Luk Ulo Complex, Central Java, Indonesia	
4	Norinsafrina Mustaffa Kamal	SERiES22-01	Adsorptive Removal of Manganese (Ii) Ion from Aqueous Solution using Alginate-synthetic Calcium Carbonate Beads	
5	Komsoon Somprasong	SERiES22-05	Development of Image Analysis-based Size Detection System for Compact-scale Quarries	
6	Thitinan Hutayanon	SERiES22-07	Application of Integrated Spatial Analysis in the Monitoring of Reclamation Area of Coal Mine	

PARALLEL SESSION 2 (18 October 2022) 3.00 PM - 5.00 PM BAYVIEW GRAND BALLROOM				
No.	**Name**	**Paper Id**	**Title**	**Category**
1	Jacqueline Isabella Anak Gisen (Keynote Session)	SERiES22-66	Alternative Approach for The Determination of Streamflow Discharge Using Swat Model and Remote Sensing Databases in The Kuantan River	ENVIRONMENTAL AND WATER RESOURCES
2	Shirline Leong Ai Lin	SERiES22-65	Evaluation of Alternative Approach For Missing Rainfall Data Filling In Kuantan River Basin	
3	Fatihah Binti Azmi	SERiES22-49	Baseline Study on Application of Precipitated Calcium Carbonate as An Alternative in Water Treatment	
4	Mohammed Abdulqawi Ahmed Mohammed	SERiES22-81	Oily Sludge Treatment Methods: Current Trends Review	
5	Siti Salwa Mohammad Shirajuddin	SERiES22-84	Parametric Studies on Radiation Grafting of Tripropylene Glycol Diacrylate Onto Waste Tire Dust	
6	Saiedatul Akmal Mohamed Sedek	SERiES22-74	Downregulation of Quorum Sensing in Biofilm Producing Water-Borne Pathogen, Pseudomonas Aeruginosa, by Fatty Acid Methyl Esters	
7	Azilah Aziz	SERiES22-90	Extraction of Coffee Oil From Spent Coffee Ground by Soxhlet Extraction	GREEN TECHNOLOGY AND SUSTAINABILITY
8	Nurul Najwa Abd Malek	SERiES22-104	New Magnetic Schiff's Base-Chitosan-Glyoxal/Fly Ash/Fe3o4 Biocomposite For The Removal Of Anionic Azo Dye: An Optimized Process	
9	Aizuddin Abdul Rahman	SERiES22-103	Influence of Washing Pre-Treatment on Whole Empty Fruit Bunches	

PARALLEL SESSION 3 (19 October 2022) 10.30 AM - 12.30 PM AQUAMARINE				
NO.	NAME	GEOSEA ID	TITLE	CATEGORY
1	Mohd Fakhrurrazi Ishak (Keynote Session)	SERiES22-16	The Comparison Between Soil Suction Contours with Electrical Resistivity Mapping (E.R.M) at Pahang Matriculation College, Malaysia	SUSTAINABLE HIGHWAYS, GEOTECHNICAL AND TRANSPORTATION ENGINEERING AND GEO-INFORMATICS
2	Nor Hazwani Ahmad @ Shafei	SERiES22-10	Key Construction 4.0 Technologies for Sustainable and Resilient Organizations	
3	Nurol Huda Dahalan	SERiES22-11	Key Indicators for Public Evaluation of Environmental Management Plan Performance in Road Construction Projects	
4	Muhammad Syamsul Imran Zaini	SERiES22-36	Stabilization of Problematic Soil by Utilizing Silica Fume, Eggshell Ash and Lime	
5	Nur Syahirah Syuhadah Zakaria	SERiES22-88	Soil Water Characteristic Curve (SWCC) of Lime-laterite Stabilised Soil as a Clay-liner Design	
6	Ku Esyra Hani Ku Ishak	SERiES22-47	A Comparative Study on the Effect of Chemical Additives on Clinker Grinding	SUSTAINABLE STRUCTURES AND MATERIALS
7	Mohammad I Ai Biajawi	SERiES22-105	Utilization of Palm Kernel Shell as Cement Replacement Materials in Concrete: A Review	

PARALLEL SESSION 4 (20 October 2022) 8.00 AM - 9.30 AM BAYVIEW GRAND BALLROOM				
NO.	NAME	GEOSEA ID	TITLE	CATEGORY
1	Mohd Shaiful Zaidi Mat Desa (Keynote Session)	SERiES22-59	The Effect of Annealing Temperature on Mechanical Properties and Microstructure of Steel Grade Ss 400	SUSTAINABLE STRUCTURES AND MATERIALS
2	Noor Suraya Romali	SERiES22-21	The Application of Coconut Waste as Green Roof Materials for Stormwater Quality Improvement.	
3	Khairul Anuar Shahid	SERiES22-23	Temperature Assessment of Palm Oil Clinker as Drainage Layer in Extensive Green Roof System Under Tropical Climatic Condition	
4	Nabil Usamah	SERiES22-89	Characterization and Selection of Testing Beam Material for Active Vibration Cancellation Studies	
5	Roslizayati Razali	SERiES22-96	Effect of Wetting Drying Condition in Soil Water Characteristic Curve (SWCC) for Lime- Treated Laterite	
6	Norshakila Abdul Wahab	SERiES22-97	The Compressibility Characteristics of Cement-treated Laterite Soil Under Saturated and Unsaturated Conditions	

PARALLEL SESSION 5 (20 October 2022) 10.30 AM - 12.30 PM BAYVIEW GRAND BALLROOM				
NO.	**NAME**	**GEOSEA ID**	**TITLE**	**CATEGORY**
1	Nurul Ain Jabit	SERiES22-86	A Comparative Study on Effect of Leaching Reagents for Aluminium and Rare Earth Extraction from Ion Adsorption Clay	**SUSTAINABLE MINING AND MINERAL PROCESSING**
2	Tanapon Khunin	SERiES22-15	Evaluation of Image Analysis-based Size Distribution System in Compact Scale Aggregate Plant	
3	Abdul Hafidz Yusoff	SERiES22-102	Rare Earth Element Geochemistry of Kelantan and Pahang River Fluvial Sediments	
3	Pirat Jaroonpattanapong	SERiES22-19	Application of Artificial Neural Network in Predicting a Muck Pile Height of Blasted Milestone	
5	Siti Noraishah Ismail	SERiES22-31	Safety Culture and Safety Education in Mining Industry: Issues and Challenges	
7	Siti Madiha Husna Suhaimi	SERiES22-56	Influence of Extractant Concentration in Aliquat 336-polymer Inclusion Membranes (A336-pims) for Gold Extraction from Aurocyanide Solution	
8	Nazirah Awang Husain	SERiES22-58	Preliminary Study on the Efficiency of Bioleaching Process in Gold Extraction.	
9	Mohd Zaid Md Sharif	SERiES22-03	Recovery of Rare Earth Elements from Malaysian Acid Mine Drainage	
10	Syarifah Aminah Ismail	SERiES22-04	Upgrading of High Purity Silica from Silica Rock by Leaching Process: Optical Application	
11	Muhammad Afiq Afandi Abdul Aziz	SERiES22-09	Enhancing Ion – Exchange Leaching of Rare Earth Element from Local Ion Adsorption Clay Sources by using Commercial Surfactant	

PARALLEL SESSION 6 (20 October 2022) 2.00 PM - 3.00 PM BAYVIEW GRAND BALLROOM				
NO.	**NAME**	**GEOSEA ID**	**TITLE**	**CATEGORY**
1	Amal Najihah Muhamad Nor (Keynote Session)	SERiES22-68	Predicting Land Use Changes and Ecological Network in 2035 at Tasek Chini-bera Forest Complex, Pahang, Peninsular Malaysia for Conservation Planning	ENVIRONMENTAL AND WATER RESOURCES
2	Harlinda Hamid	SERiES22-48	Oleochemical Wastewater as Synbiotic Plant Nutrient Enhancer	
3	Noor Suraya Romali	SERiES22-30	Flood Vulnerability Assessment: Evaluation of Social and Economic Indicators in Sungai Lembing, Pahang	
4	Suhana binti Alias	SERiES22-51	Selection of Experimental Domain using Two-level Factorial Design to Determine Extract Yield Via Mae	
5	Adil Hussein	SERiES22-28	One-stop Integration System for Bioelectricity Generation, Wastewater Treatment, CO_2 Sequestration and Biomass Production	

PARALLEL SESSION 7 (20 October 2022) 4.00 PM - 5.30 PM BAYVIEW GRAND BALLROOM				
NO.	**NAME**	**GEOSEA ID**	**TITLE**	**CATEGORY**
1	Mohd Zulkifli Mohamad Noor (Keynote Session)	SERiES22-25	The Foam Stability for Enhance Oil Recovery using ZNO and NiZnFeO Nanoparticles in Oil/Water Interaction Contact	GREEN TECHNOLOGY AND SUSTAINABILITY
2	Zatul Iffah Mohd Arshad	SERiES22-20	Screening for Fermentation Condition of Garbage Enzyme for Dye Decolorization Application	
3	Yee Mei Tan	SERiES22-12	Well Buiding: Alternative Concepts and Features for Office Building	
4	Muhammad Amiruddin Azman	SERiES22-34	Effect of Time Taken for the Optimization of Prebiotic Syrup Production by Enzymatic Reaction	
5	Huei Ruey Ong	SERiES22-52	Effect of Bio-based Nanosilica on Single Empty Fruit Bunch Fibre	
6	Istikamah Subuki	SERiES22-62	Synthesis of Colored Smoke Bomb with Potassium Nitrate (KNO_3) as the Oxidizer	
7	Nurul Qistina	SERiES22-67	Effect of Different Concentration Polyethylene Glycol on Polysulfone Membrane in Filtration Process	
8	Fadiatul Hasinah Muhammad	SERiES22-100	AC Conductivity by Quantum Mechanical Tunnelling and Dielectric Properties of Hexanoyl Chitosan/PVC-NAI-MPIml Electrolyte For Application in Dye Sensitized Solar Cells	
9	Nur Fathin Ruslan	SERiES22-18	Sustainable Bioethanol Production by Solid State Fermentation: A Systematic Review	
10	Siti Rudhziah Che Balian	SERiES22-95	Nanohybrid Polymer Electrolytes Based on Seaweed Kappa-Carrageenan for Potential Application in Energy Storage Devices	

VIDEO PARTICIPANTS

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1	Afiqah R. Radzi	SERiES22-06	Factors Affecting Workplace Well-being: Infrastructure Construction Projects	SUSTAINABLE HIGHWAY, GEOTECHNICAL AND TRANSPORTATION ENGINEERING AND GEO-INFORMATICS
2	Mazen Omar	SERiES22-14	Key Competencies for Identifying Construction Activities That Produce Recyclable Materials	
3	Muhammad Farhan Zolkepli	SERiES22-17	Tree Induced Suction and Comparison Between Numerical Model and Field Monitoring	
4	Muhammad Farhan Zolkepli	SERiES22-26	Suction Variation of a Single Mature Tree on Top of Tropical Residual Soil	
5	Muhammad Syamsul Imran Zaini	SERiES22-35	Experimental Investigation on the Aggregate Stability of Bauxite Against Liquefaction Risk by Utilizing Gypsum and Vermicompost	
6	Muhammad Syamsul Imran Zaini	SERiES22-37	Ground Improvement of Soft Kaolin Clay Reinforced with Encapsulated Bottom Ash Columns	
7	Muhammad Syamsul Imran Zaini	SERiES22-41	Stabilization of Slope Via Alstonia Angustiloba Tree with the Influence of Tree Water Uptake	
8	Harith Najmi Abd Rashid	SERiES22-75	Landslide Susceptibility Mapping and Assessment in Sabah Malaysia: A Comparative Technique of Gis-Based Statistical Models and Holistic Environmental Factors	SUSTAINABLE MINING AND MINERAL PROCESSING
9	Faten Albtoush	SERiES22-98	Factors Affecting Cost Overruns in Construction Projects From a Stakeholder Perspective	
10	Riskaviana Kurniawati	SERiES22-27	The Future of Sustainable Mining in Indonesia: Sustainable Mining Fund Concept	
11	Noorul Iqhlima Najwa Ismail	SERiES22-42	Effect of Large Range Porosity to Soil Characterization of Lateritic Bauxite Soil in Kuantan	
12	Mazrul Nizam Abu Seman	SERiES22-50	Separation of Lanthanum using Flat Sheet Supported Liquid Membranes Fabricated at Different Conditions	
13	Siti Zaniza Tohar	SERiES22-69	Chemical Weathering of S-type Granite and Mineralogy Characteristic of Ion-adsorption Type REE Deposit in Nilai-Semenyih Saprolite Horizon	
14	Siti Zaniza Tohar	SERiES22-70	BCR Leaching Procedure to Evaluate the Mobilization Behavior of Ion Adsorption Type REE Deposit in I-type Granite Weathering Profiles	
15	Farouq Ahmat	SERiES22-71	Feasibility Study Recovery of Lanthanum, Cerium, Praseodymium, Neodymium, and Yttrium from Malaysia Saprolite by HDEHP-HCl Cascade Fractional Solvent Extraction	
16	Mohd Aizudin Abdul Aziz	SERiES22-72	Technospheric Mining of Rare Earth from Tin Mining Waste	

VIDEO PARTICIPANTS (cont.)

NO.	NAME	GEOSEA ID	TITLE	CATEGORY
17	Muhammad Mazmirul Abd Rahman	SERiES22-22	Sensitivity Analysis and Application of Xbeach at Cherok Paloh Beach, Pahang, Malaysia	ENVIRONMENTAL AND WATER RESOURCES
18	Moh Sholichin	SERiES22-38	Multi Analysis of Water Quality Index and Pollution Load Capacity at Sutami Reservoir, East East Java Indonesia	
19	Chuanqi Li	SERiES22-40	Identification of River Contaminant Sources using a Cellular Automata Model and Bayesian Mcmc Method	
20	Mohd Amirul Mukmin bin Abdullah	SERiES22-43	Traceable of Bmim Bf4 on Water Spinach Germination and Growth	
21	Sajjad Al-Amshawee	SERiES22-44	Electrodialysis Membrane Desalination for Water and Wastewater Treatment: Diagonal Membrane Spacers with a 45° Spacer-bulk Attack Angle	
22	Sajjad Al-Amshawee	SERiES22-45	Electrodialysis Membrane Technology for Water and Wastewater Processing: Application of Ladder-type (90°) Membrane Spacers to Impact Solution Concentration and Flow Dynamics	
23	Sajjad Al-Amshawee	SERiES22-46	Irregular Flow Attack Angles of Membrane Spacers Positioned in Electrodialysis Membrane Technology for Water and Wastewater Processing: A Systematic Review	
24	Hoang Bích	SERiES22-54	Utilization of Rice Husk as a Material for Production of Activated Carbon for Environmental Treatment: A Review	
25	Che Ku Mohammad Faizal bin Che Ku Yahya	SERiES22-80	An Evaluation of Natural Disinfectant for the Treatment of Fungal Contamination in Drinking Water Distribution System	
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SERIES2022

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SERiES22-01

ADSORPTIVE REMOVAL OF MANGANESE (II) ION FROM AQUEOUS SOLUTION USING ALGINATE-SYNTHETIC CALCIUM CARBONATE BEADS

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Mining effluent with high heavy metal load from mining sectors often end up polluting receiving nearby water bodies i.e. surface and subsurface water. The trend of using low-cost beads for removal of metal has been observed in recent years. This work focuses on development of adsorbent beads using cheap materials for the metal remediation. This study tested alginate-synthetic calcium carbonate beads for the removal of manganese (II) ions from aqueous solution. The experimental work was performed at initial concentration of 0.5-20 mg/L for a contact period of 120 minutes and at constant adsorbent dose of 0.01 g/mL. The element was analyzed with ICP-OES. FESEM was used to study the surface morphology of the synthesized beads. Langmuir and Freundlich isotherm models were plotted to determine the equilibrium adsorption isotherm.

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SERiES22-02

ACID MINE DRAINAGE IN BUKIT BESI: A DEVELOPMENT OF AMD ACTIVE TREATMENT AT PILOT PLANT SCALE

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The iron ore mining industry is one of the mineral industries that generates the country's economy. A source from Department of Statistics Malaysia indicates that GDP from mining in Malaysia increased to RM 24066 Million in the first quarter of 2022 from RM 23619 Million in the fourth quarter of 2021. However, despite the activities that boost the country's industrial growth, the active operation of iron ore mines in Bukit Besi also contributes to environmental pollution, especially acidic effluent outflows from mines. This acidic effluent is known as acid mine drainage (AMD). AMD is known for its characteristics of having a low pH reading (less than 4.5) and a high solubility content of heavy metals. Based on the baseline study conducted on water samples from the Bukit Besi area, the pH recorded was below 3.0 and the content of heavy metals such as Fe, Mn and Al are very high and exceeds the permissible effluent limit. Therefore, a pilot plant scale AMD treatment study was conducted to help the industry to reduce the heavy metal content in discharged effluents to protect the environment and further establish the concept of sustainable mining. The study was conducted entirely by the Mineral Research Centre, which is the research division of the Department of Mineral and Geoscience Malaysia.

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SERiES22-03

RECOVERY OF RARE EARTH ELEMENT FROM MALAYSIAN ACID MINE DRAINAGE

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Recovery of rare earth element from acid mine drainage has been extensively explored worldwide as it can be potential alternative sources in the future. Malaysian acid mine drainage was previously considered as liability to the industry's environment and overhead cost could be new potential asset for the country soon. The main objective of this work was to conduct preliminary study on recovery process of rare earth element from Malaysian acid mine drainage. AMD is sampled from iron ore areas which containing significant amount of pyrite and contained 1.84 ppm of total rare earth elements, 61.71 ppm Fe, 49.53 ppm Al and 35.62 ppm Mn. The pH value of acid mine drainage was controlled in narrow-range by using sodium hydroxide solution to conduct selective precipitation process. Selective precipitation of acid mine drainage from pH range of raw sample till pH above 12 was conducted in this study. Further separation process of precipitated rare earth element was conducted via re-dissolution and oxalic acid precipitation process in this study. A simple process flow for recovery of Malaysia acid mine drainage was developed as baseline study in order to enhance the recovery efficiency in the future.

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SERiES22-04

UPGRADING OF HIGH PURITY SILICA FROM SILICA ROCK BY LEACHING METHOD: OPTICAL APPLICATION

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The objective of this work is to increase the quality of silica rock from grade C (SiO_2=98.75%) to grade A (SiO_2 = 99.8%) instead fulfil of high spec product. This silica rock contains 98.75% SiO_2, 0.410% Fe_2O_3, 0.1750 % Al_2O_3 and 0.067% TiO_2. Fe_2O3 has been reduced to less than 0.008% for product class B and 0.002% for product class A complied with the requirement of MS701:1981. In this method, variables of acid were studied on the removal of impurity from silica rock using leaching process with constant temperature 60˚C and constant speed of agitation 150rpm. The obtained material was characterized using X-Ray Fluorescence (XRF), Ultraviolet-Visible absorbance (UV-Vis) and Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP-AES). The result of the sulphuric acid (H2SO4) application shows the highest recovery of 99.85% SiO_2 and a significant reduction of the amounts of undesirable impurities present in silica rock such as Al, Cr, Ti and Fe. In comparison, oxalic ($C_2H_2O_4$) and citric acid ($C_6H_8O_7$) as organic acids were used and $C_6H_8O_7$ was effective in improving the purity of SiO_2 where 99.53% purity was successfully achieved at 0.25M acid concentration.

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SERiES22-05

DEVELOPMENT OF IMAGE ANALYSIS-BASED SIZE DETECTION SYSTEM FOR COMPACT-SCALE QUARRIES

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Quarries are defined as important upstream manufacturing for the development of Thailand, especially for the construction of the infrastructures such as the advanced transportation system. According to the databased from the Department of Primary Industries and Mine (DPIM), there are 318 quarries in Thailand, which can be classified into three sizes based on their capacities. Small-scale quarries, containing more than 50% of the market share in the limestone and granite productions, are now facing disruption by novel monitoring technologies, which will be consecutively regulated as standards for practices by the government. This circumstance can cause concerns about the alternation of their conventional practice, currently used in their crushing plant. Now, various application of image analyzing technology takes the role in many application for manufacturing processes, including size classification of raw material and products. With these competitive technologies, the cost of the adaptation of conventional methods is currently affordable. In this study, the Fuzzy C-means clustering was assigned as the main algorithm in the size classification of the raw material at the primary crusher of the plant and then further developed as a size detection system with compact investment. The results from the pilot operation demonstrate that the developed system contains the accuracy of both separation and segmentation for all sizes of the particle at 96.91 % with an 8-15 second computing period which can be applied for the prevention of oversized rock in the crushing system.

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SERiES22-06

FACTORS AFFECTING WORKPLACE WELL-BEING: INFRASTRUCTURE CONSTRUCTION PROJECTS

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A construction site is a notoriously dangerous place to work. However, the construction industry always focuses on the more visible physical hazards while mental well-being is left to the side. Creating a physically and psychologically secure workplace can assist construction workers in achieving a good work-life balance, leading to better well-being. Thus, this study explores the factors affecting workplace well-being in infrastructure construction projects. This study aims to investigate the critical factors for workplace well-being in infrastructure construction projects. Data from twenty-one semi-structured interviews with construction industry professionals in Malaysia and a systematic literature review will be used to develop a potential list of factors. Then, the factors will be used to create a survey and distribute it to industry professionals. The collected data will be analyzed using mean score ranking, normalization, the Kruskal-Wallis test, overlap analysis, and factor analysis. This study will contribute to the body of knowledge by identifying the critical factors for improving workplace well-being. The study findings allow researchers and practitioners to develop strategies to promote workplace well-being in infrastructure construction projects.

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SERiES22-07

Application of Integrated Spatial Analysis in the Monitoring of Reclamation Area of Coal Mine

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Reclamation, defined as one of important processes in mining, is commonly conducted to regain the value of the land after natural resources extraction. The process involves many activities such as reforestation, remediation, and land transformation. Even supposing that those processes can be monitored, thus some of the progress in those activities cannot be numerically evaluated, especially for reforestation. Mae Moh mine, the largest coal mine in the Southeast Asia, is in the early state of reclamation where large scale of reforestation must be accomplished. However, the monitoring and evaluation on the improvement of those area are based on manual field observation which is time consuming and inefficient. In a purpose of subsiding the conventional method, integrated spatial technology was assigned as the main tool in defining the effective indirect method for monitoring and evaluation of the reforested area. In this study the remote sensing techniques, based on satellite-images and multispectral-UAV, were compared to define the most appropriate data collecting method which will be assigned as the main tool for gathering the data over the reforestation area of Giant crepe-myrtle, Cork Tree, Laza wood and teak. These collected data were further analyzed into NDVI and used as dependent variable for linear regression with significant parameters, affecting the growth of the reforested species. The results of the study defined that the suitable collecting method is the multispectral-UAV which can give %RSD of NDVI range from 16.58 to 40.75. In accordance with analysis, the RMSE of the regression modeling for each species ranged from 0.752 to 0.912 which can determine the feasibility in assigning the model for the indirect monitoring scheme for the reclamation.

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SERiES22-08

MODELING OF FUGITIVE DUST MIGRATION IN DEEP MINING-PIT DURING ATMOSPHERIC INVERSION INCIDENT: A CASE STUDY OF MAE MOH MINE

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Opencast coal mining has been considered as one of the core industries, serving the energy security of Thailand. In keeping with the expanding of the demand in electricity, the pit of the Mae Moh mine, the largest lignite mine in the Southeastern Asia, will reach approximately 600 m from the surface. Despite the increasing of the depth, numerous challenges in environmental issue from air quality have been concerned. One of the definite adverse is the atmospheric inversion which can initiates the trapping of dust particles from the operations at the ground surface, causing negative effects to the operators. This study aimed to forecast the concentration and the dispersion of TSP and PM10 from mine operation in 2022 and 2032, based on both primary and secondary data in 2019, using CALMET and CALPUFF application. The results indicated that the correlation (R) and RMSE (R2) between the simulated and actual concentration at the monitoring stations for TSP were 0.83 and 0.64 individually, while the simulation of PM10 were 0.69 and 0.41 in turn. The evaluation of the simulated results of TSP were conducted during January 2022 and the comparison between the simulated content and the observed concentration was 0.180 mg/m3 and 0.91 mg/m3 respectively. Along with the simulation, the concentration of both particle size will not exceed the acceptable level of the world Health Organization (WHO) and the dispersion will be contingent with the local wind direction of the area.

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SERiES22-09

ENHANCING ION – EXCHANGE LEACHING OF RARE EARTH ELEMENT FROM LOCAL ION ADSORPTION CLAY SOURCES BY USING COMMERCIAL SURFACTANT

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Rare earth elements (REE) from ion adsorption clay sources are gaining much interest globally due to its simpler extraction process compared to its mineral sources' counterpart. Rare earth elements (REE) are extracted from ion adsorption clay by using ion-exchange leaching process with ammonium sulphate as commonly used lixiviant. In this study, ion exchange leaching process is enhanced by utilizing commercial surfactant, sodium lauryl sulfate (SLS) to mitigate issues such as high lixiviant consumption, high operating period as well as low leaching efficiency associated with current ion exchange leaching process. The effect of surfactant concentration on leaching efficiency, leaching kinetics and permeability coefficient was studied. Experimental works performed indicate that addition of 0.03 wt% of SLS improved total REE leaching efficiency by 10% while reducing aluminium (Al) leaching efficiency by 5%. Leaching kinetic tests conducted show that addition of 0.03 wt% SLS also reduced the required time to complete ion exchange leaching by 17.74%. Ion exchange leaching process improvement via addition of SLS was due to improvement of permeability coefficient of the ion adsorption clay sample which was proven via leaching hydrodynamics test. The results show that addition of 0.03 wt% SLS increased permeability coefficient of the ore feed.

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SERiES22-10

KEY CONSTRUCTION 4.0 TECHNOLOGIES FOR SUSTAINABLE AND RESILIENT ORGANIZATIONS

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The fourth Industrial Revolution (IR 4.0) has created a paradigm shift toward digital transformation in the construction industry through Construction 4.0. However, low digital adaption and resistance to change among construction professionals have negatively influenced the success of Construction 4.0. This is due to a lack of understanding and unclear direction among decision-makers in selecting the appropriate emerging technologies. As a result, construction organizations suffer from high waste, high environmental risk, high resource consumption, and exposure to disasters. Thus, this research aims to evaluate emerging technologies in the context of sustainability and resiliency for Construction 4.0. To achieve that, Analytic Hierarchy Process (AHP) survey is conducted amongst twenty (20) experts that hold a position as managers in the construction organizations from clients, consultants, and contractors. The expected output is informed and effective decision-making for selecting appropriate emerging technologies for enhancing organizational sustainability and resiliency. The findings assist in producing more competent decision-makers that can play a central role in realizing Construction 4.0 success. This study will contribute to Malaysia's pledge to the United Nation's Sustainable Development Goals on the ninth (9th) pillar- industry, innovation, and infrastructure for environmental sustainability.

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SERiES22-11

KEY INDICATORS FOR PUBLIC EVALUATION OF ENVIRONMENTAL MANAGEMENT PLAN PERFORMANCE IN ROAD CONSTRUCTION PROJECTS

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Monitoring road construction site is crucial as it involves open workspaces and exposure to environmental impact. The increasing public awareness of the environmental implications of road construction has created an urgency for everyone to collaborate in collectively analyzing this issue. Hence each construction party should have good coordination and teamwork in place to assure that the road construction regulates the Environmental Management Plan (EMP) appropriately. This study aims to explore the Performance Indicators (PI) for EMP of road construction projects. To achieve that aim, the study objectives are to compare the PI between Environment Auditors (EAs) and Environment Officers (EOs) and among the stakeholders, to develop groupings to categorize interrelated PI, and to evaluate the effectiveness of PI and interrelated construct. A questionnaire with 39 Performance Indicators (PI) identified from interviews and systematic literature reviews were sent to the 82 professionals with related experiences. The data were analyzed via mean score ranking, normalization, agreement analysis, factor analysis, and fuzzy synthetic evaluation. The expected research output of this study is to identify the potential PI which highlighted by the professionals in implementing EMP in road construction. The highlight of PI provides valuable references to help environmental professionals understand the primary obstacles in EMP implementation. Thus, it would also benefit the policymakers to formulate strategies and develop assessment tools for public evaluation of road construction projects.

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SERiES22-12

WELL Building: Alternative Concepts and Features for Office Buildings

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Employees spend an average of at least 8 hours a day in the office. The prolonged poor physical environment of the office building may deteriorate occupants' health, affect their well-being, and subsequently work performance. Therefore, this study aims to identify the significant features of WELL Building to support office building occupants' WELL concerning health, well-being, and productivity. To achieve this objective, a questionnaire survey with thirty-three features was developed from a systematic literature review, semi-structured interviews with office building occupants, and the current WELL Building Standard. Snowball sampling was employed to collect data from the office building occupants. 206 completed survey was analysed using the mean score ranking technique with normalisation method, agreement analysis, and exploratory factor analysis. This study identifies 22 significant features to support building occupants' WELL. New features like security system, safety at car parks, cleanliness, efficiency of building services, IT infrastructure, and design safety are the key features absent from the current WELL Standard. Each building has a distinct function and accommodates specific groups of occupants who may require a different level of attention and support. For instance, IT infrastructure is vital to pillar work performance in an office building. The new evidence provides governing authorities with a framework for developing a local WELL standard for office building assessments to support office building occupants' WELL in a Malaysian context. In addition, developers can refer to the standard for the brief requirements, and construction stakeholders can incorporate the WELL features of an office building into the design.

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SERiES22-13

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SERiES22-14

KEY COMPETENCIES FOR IDENTIFYING CONSTRUCTION ACTIVITIES THAT PRODUCE RECYCLABLE MATERIALS

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Construction activities (CA) continuously generate vast amounts of waste. Disposing of these wastes in landfills is the common approach. This option has high environmental impacts and hinders national development. Besides, not recycling construction waste is a lost opportunity. Meanwhile, CA can be harnessed to produce recyclable materials. However, the construction practitioners face a competence barrier. This study aims to assess the key competencies that can help in identifying CA that produce recyclable materials. For this aim, a systematic literature review identified a list of 20 competencies and categorized into three groups. These competencies and groups were used to conduct a questionnaire survey and distributed to novice experts in construction projects. A total of 101 responses were collected and analyzed using various statistical techniques, including mean ranking, normalization value, agreement analysis, confirmatory factor analysis, and fuzzy synthetic evaluation. The study will reveal in order the most important of KSA. Also, it will address the overall importance level of the KSA. The findings can guide practitioners on the importance of KSA to manage CA effectively, policymakers on creating new strict policies toward handling CA, and researchers on having a list of KSA to raise knowledge scope on CA.

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SERiES22-15

Evaluation of Image Analysis-based Size Distribution System in Compact Scale Aggregate Plant

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Compact scale quarries contribute more than 50% of market share and aggregate production in Thailand. This production rate has been continuously raised since the establishment of Thailand's 12th National Economic and Social Development Plan. In accordance with the development scheme, the expansion of infrastructure will be conducted, including the development of railway-networked and large-scale construction projects. Recently, the development of modeling of image analysis-based size distribution software has been assigned in many activities of quarries and aggregates production, especially quality control systems, thus there are some limitations and complexity in their application. In this study, the self-developed image analysis-based, named Automatic Aggregates Size Distribution Application (AASDA), was compared with other applications to determine its capability and efficiency in determining the size distribution of aggregates, produced from the plant. After the comparison, the AASDA was further examined and evaluated according to the significant parameters which can affect the efficiency of the system, including light intensity, color scale of the material, and opacity of the working area. The results determine that the AASDA application contains average efficiency and accuracy in conducting automatic-size distribution analysis, despite the extreme environment, at 89.91% and 87.73% respectively.

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SERiES22-16

THE COMPARISON BETWEEN SOIL SUCTION CONTOURS WITH ELECTRICAL RESISTIVITY MAPPING (E.R.M) AT PAHANG MATRICULATION COLLEGE, MALAYSIA

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This paper discusses the comparison of soil suction contour with subsurface imaging on tropical residual soil slope located at Pahang Matriculation College. This study aims to generate the soil suction contour together couple with the generation of electrical resistivity mapping (E.R.M.) contour. A field monitoring work consists of soil suction data and rainfall data collected for six months to study the suction pattern of a slope without and with the existence of single mature tree on top of it. A significant contribution of matric suction is high for slope with the existence of a single mature tree (*Alstonia Angustiloba*) compared to slope without tree (Ishak *et al*., 2021). However, the suction decreased after a prolonged intense rainfall (Ishak *et al*., 2021). The contours of matric suction profiles are presented to reveal moisture flow due to tree water uptake. E.R.M. surveys were done to obtain the subsurface image of the slope at the study area. The resistivity and chargeability values obtained from the E. R. M. confirmed the existence of clay in the study area which similar to the soil types obtained from the study area. Finally, comparisons of contour generated from the soil suction and subsurface imaging from the E.R.M. were made to study the similarities and differences between these two contours. In conclusion, soil suction contour shows the contribution of single mature tree on top of slope in term of tree water uptake increased the stability of soil slope. Meanwhile, the resistivity contour proved the early prediction of materials that existed in soil subsurface.

Keywords: residual soil, soil suction, electrical resistivity mapping (E.R.M), suction contour

The authors would like to express their gratitude to Universiti Malaysia Pahang for Grant (RDU1903144-Application of Digital Surface Model to Investigate the Potential Slope Hazard) that served as full financial support to conduct this research. Thank you to all BTC staffs (Faculty of Civil Engineering Technology, Universiti Malaysia Pahang) for their kindness and full support to conduct this research from the start until finished.

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SERiES22-17

TREE INDUCED SUCTION AND COMPARISON BETWEEN NUMERICAL MODEL AND FIELD MONITORING

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This study validates the explorations of transpiration on the unsaturated soil slope under the influences of tree (*Alstonia Angustiloba*) induced suction with the unsaturated flow equation of tree water uptake model. The numerical model simulation proposed by [1] was implemented to verify the soil moisture pattern with the actual suction data collected at study area located in Pahang Matriculation College. Daily soil matric and daily rainfall event were monitored by using field monitoring equipment (tensiometer, gypsum blocks and rain gauge). The data from field monitoring between 21st of May 2019 until 12th June 2019 were presented. The numerical simulation was performed to the model of the slope in relation to moisture migration patterns in the unsaturated zone within the vicinity of mature tree. The results of numerical simulation and field monitoring of suction are in acceptable condition. The final outcome of this comparison shows only less than 5 % differences between actual soil suction patterns with simulated patterns by numerical model [2]. It is important to note that, the differences of soil suction value between simulated numerical and field measurement are related to inconsistence effect of root density.

Keyword: numerical modelling, tree water uptake, field monitoring, unsaturated soil, matric suction

The authors would like to thank Universiti Malaysia Pahang and Yayasan Pahang for their support during this research study.

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SERiES22-18

SUSTAINABLE BIOETHANOL PRODUCTION BY SOLID STATE FERMENTATION: A SYSTEMATIC REVIEW

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Escalation in the global population had caused an accelerated demand for sustainable energy sources such as bioethanol. Traditionally, bioethanol was produced using fossil fuels, which is non-renewable, non-sustainable and not-eco-friendly. Thus, there is a need to discover new technologies and low-cost raw materials to make bioethanol economically comparable to traditional fossil fuels. Solid state fermentation (SSF) has been in the limelight within scientific community due to its efficient, cost-effective and promising technology to produce various products such as enzymes and bioethanol. SSF involves cultivation of microorganisms on solid substrate in the absence of free-flowing water, which in turn will eliminate the need for sugar extraction process and reduced wastewater production. This systematic review provides an overview of the applications of SSF for bioethanol production while presenting the recent studies and advancement on this technology for sustainable and cost-effective bioethanol production.

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SERiES22-19

Application of Artificial Neural Network in Predicting a Muck Pile Height of Blasted Limestone

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Beside the size distribution of blasted material that mainly indicates the blasting efficiency of each blast, the swelling and the geometry profile of the after-blasted muck pile also affect the productivity of the different types of loading equipment. For example, a muck pile that is too extended generates a low productivity zone for large loading equipment such as rope or hydraulic shovels. The geometry of a muck pile is governed many parameters, such as height of bench, burden, spacing, powder factor, initiation sequences, and delay timing. In this study, the high of muck pile after blasting was estimated by using Artificial Neural Network (ANN) technique and a conventional Multiple Linear Regression (MLR) technique. A data set from total of 112 blasts was recorded, of which 75% (84 blasts) was used for training and 25% (28 blasts) was used for testing the models. The input parameters were burden/spacing ratio, average drill hole depth, powder factor, and average charge weight per drill hole to estimate the output which is the height of muck pile. The root mean square error (RMSE) and Coefficient of Determination (R2) performance criteria were calculated to compare the performance of both techniques. The result indicated that the well-trained ANN model with 4-4-2-1 structure predicted the after-blasted muck pile height more precisely than the MLR technique given RMSE 2.16 and 4.46, and R2 0.95 and 0.147, respectively.

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SERiES22-20

BREVIBACILLUS PARABREVIS AND ITS CHARACTERISTICS AS A MESOPHILE PLA-DEGRADER

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Polylactic acid (PLA) has been advocated as a renewable polymer that can be used as a replacement for petroleum-based plastics. However, this bioplastic poses an environmental threat whereby it does not efficiently decompose in mesophilic temperature if it is discarded in the landfill [1,2]. This paper highlights the degradation problems at landfill site due to absence of external heat energy to optimize PLA-degradation [3]. Thus, proposing the study of bacterial isolation of potential mesophilic PLA-degrader from local landfill soil as a mean to combat this problem. In this study, isolation, characterization, and identification of PLA-degrading bacteria from landfill soil were carried out. Isolated bacteria were able to degrade PLA at 30°C and was identified via 16S rRNA gene sequencing as Brevibacillus parabrevis. The strain was characterized for (i) morphological studies; (ii) Gram staining (iii) protease presence and relative enzyme activity. The isolate B8A gave the highest relative enzyme activity at 1.33 and was further characterized for growth curve profiling, and enzyme assay testing (protease, amylase, lipase). The strain B8A was observed for biodegradation test and SEM analysis. Result shows that biodegradation test shows that sample B8A was able to degrade 37.8 % (w/w) of PLA film buried in soil inoculated with isolated media within the span of 8-week. Up to date, there is no report of Brevibacillus parabrevis species capable of degrading PLA, therefore proposing this strain to be further studied as a promising PLA-degrader in the future of bioplastic solid waste management.

This work was supported by UMP Postgraduate Research Grant Scheme (PGRS 210323) and internal grant RDU1803175.

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SERiES22-21

THE APPLICATION OF COCONUT WASTE AS GREEN ROOF MATERIALS FOR STORMWATER QUALITY IMPROVEMENT

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Urbanization had led to numerous problems related to stormwater issues such as flash flooding, Urban Heat Island (UHI), and degradation of water quality. A tremendous strategy and plan have been proposed to reduce the negative impact of development and urbanization. The green roof has become one of the solutions to improve the quality of stormwater runoff. However, there was still a lack of green roof practices in Malaysia's buildings, even though it has many benefits to offer. Hence, an attempt has been made to produce a low-cost green roof system using recycled waste materials. Three lab-scale roof models i.e., conventional (control), commercial and recycled waste green roofs were constructed to evaluate the performance of green roofs in improving stormwater quality. The green roof models consist of five layers i.e., vegetation, substrate, filter, drainage, and waterproofing layers. The focus is to utilize the use of recycled waste i.e., coconut shell and coconut fiber as drainage and filter layers respectively. The green roof systems manage to reduce the concentration of parameters COD, BOD, and DO with a percentage of reduction up to 51%. As the result, it was found that the recycled waste green roof is better in reducing the concentration of COD (51%) compared to the commercial green roof (48%). On the other hand, the recycled waste green roof shows a good performance in reducing the DO and BOD where the percentage of reduction is 28% and 45% respectively.

Keywords Green roof, Recycled waste material, Coconut waste, Stormwater, Water Quality

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SERiES22-22

SENSITIVITY ANALYSIS AND APPLICATION OF XBEACH AT CHEROK PALOH BEACH, PAHANG, MALAYSIA

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XBeach, a coastal response numerical model, developed to stimulate the nearshore and coastal processes (Roelvink *et al*., 2009). It is 2HD open-source process-based which includes short wave propagation, sediment transport, flow and bathymetry changes from difference wave spectral and flow boundary conditions. The mode is focus on horizontal circulations and effects of coastal evolution due to anthropogenic measures (Ab Razak *et al., 2013).* In this case, the application of XBeach was used at Cherok Paloh Beach located in Pahang, Malaysia. The model stimulated an extreme storm event during Typhoon Rai, 11 to 21 December 2021. The case of the event was tested using 1D beach erosion test during the storm conditions. The evaluation of the sensitivity analysis for the profile (morphological changes) was compared and determine using an error indicator (Brier Skill Score) proposed by van Rijn *et al*., (2003). The sensitivity was tested using different morphological influenced parameters (*facua*, *wetslp* and *dryslp*) and been compared with the final beach profile to calculate the BSS. Based on the BSS, the validated value obtained then replicated to other 1D profile around Cherok Paloh Beach. Based on stimulated the default parameters tested shows overestimated erosion volume. The result obtained from the BSS, it revealed that the best model was obtained by changing the calibration parameter *facua* and *wetslp*.

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SERiES22-23

TEMPERATURE ASSESSMENT OF PALM OIL CLINKER AS DRAINAGE LAYER IN EXTENSIVE GREEN ROOF SYSTEM UNDER TROPICAL CLIMATIC CONDITION

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In the last few decades, new urban areas and city development projects are being created throughout Southeast Asia to accommodate the rapidly urbanizing population [1]. As a result, urban heat flow, heat- absorbing construction materials, and reduced vegetation coverage have a significant impact on the microclimate of cities, building performance, and the quality of urban living [2]. Therefore, it is critical to consider and implement strategies to improve the thermal conditions in urban areas. This study investigates the potential of indoor and ambient temperature reduction in tropical climatic conditions under an extensive green roof system. The palm oil clinker was used as a drainage layer and the influence of different depths (60 mm, 70 mm, 80 mm) drainage layer on the temperature reduction was also investigated in a wooden cubicle. Creeping ox-eye and Ipomoea pes-caprae were used as a vegetative layer and the ambient temperature was measured in between those plants. The results showed that the indoor temperature of the green roof has a reduction of 1^{o}C to 2^{o}C as compared to the bare roof from 10.00 AM until 4.00 PM (Fig. 1(a)). Meanwhile, the ambient temperature of the green roof has an average reduction of 4^{o}C from 10.00 AM until 4.00 PM (Fig. 1 (b)). The reduction in the indoor temperature of the green roof could reflect the indoor heat gain and thus could reduce the energy consumption to cool the building. In addition, the extensive green roof has the potential to reduce the temperature due to the effect of urban heat island (UHI).

Acknowledgement

The authors would like to convey special thanks and acknowledgement to Universiti Malaysia Pahang for the fund provision for this study via Fundamental Research Grant (RDU200343)

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SERiES22-24

EFFECT OF NANO POFA AND NANO EGGSHELL POWDER ON THE CONCRETE DURABILITY

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In this investigation, the efficiency of eggshell powder (ESP) and palm oil fuel ash (POFA) was assessed as an alternative material to replace the ordinary Portland cement (OPC) in different replacement levels. Combining ESP and POFA in Nano particle size led to form high-pozzolanic reaction during the concrete production. The high-pozzolan materials were used with cement in different ratio to enhance the concrete durability. The resistance to sulfate attacks test of the pozzolanic concrete at early curing was examined. The results obtained illustrated that the use of 10% NPOFA and 0% NESP achieved the concrete with little weight loss compared to other ratios. In addition to that, the appearance of the surface of NPOFA concrete did not affect as compared with control cement concrete when immersed in sulfate solution. It is recommended that to use other waste pozzolan materials in improvement of concrete durability, such as fly ash and rise husk ash.

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SERiES22-25

THE FOAM STABILITY FOR ENHANCE OIL RECOVERY USING ZNO AND NIZNFEO NANOPARTICLES IN OIL/WATER INTERACTION CONTACT

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Nanoparticles, because of their nanoscale, may be employed as data mining in every aspect of petroleum progression. The nanoparticles can migrate to the intended region in the water zone if they have a hydrophilic state. The oil zone and the water zone will be distinguished by the hydrophilic state. The study's goal is to use the sand-pack displacement test to determine water saturation according to water zones. The hydrophilic nanoparticles were employed to collect data in an experiment that used the sand-pack approach. Zinc oxide (ZnO) and nickel-zinc ferrite oxide (NiZnFeO) were employed as nanoparticles. The results revealed that the water saturation was sustained at 100 percent for NiZnFeO at a 3-inch distance from the injection site, but only after 30 seconds for ZnO. The considerable decrease in resistivity percentage at a 3-inch distance demonstrates this. To summarize, the usage of both types of hydrophilic nanoparticles can result in considerable changes in resistivity at the well reservoir's front internal face with oil zone only. The water saturation in Zones 2 and 3 decreased, implying that sand pack fluid was swept from Zone 1 to Zones 2 and 3. It may be inferred that nanoparticles were present in Zone 1, and that sand pack fluid began to migrate to Zones 2 and 3. Zones 2 and 3 fluctuate and exhibit substantial values when NiZnFeO nanoparticles are used. The sweeping process caused by the nanofluid injection is responsible for this. As a result, it may be argued that nanoparticles only exist in Zone 1, whereas sand pack fluid accumulates in Zones 2 and 3.

The result obtains from the experiment will be analyzed and compared to obtain a better result of the experiment. Based on the experiments, the data show that the increasing water saturation showed that nanofluid has been injected into the sand-pack, and it has consequently swept the sand-pack fluids. Increasing water saturation occurred because nanofluid reached electrode 1 then continues to electrode 2, electrode 3, and electrode 4.

Water saturations shown in Fig 1 are the ZnO nanofluid injection in the sand pack displacement unit. Water saturation reached a stable stage, an indication that this is the maximum amount of nanofluid the sand pack can hold. In Zone 2, water saturation decreased significantly from 100% to 90% after 300 seconds. In Zone 3, water saturation increased from 88% to 94% at 60 seconds. Water saturation then decreased from 94% to 86% at 300 seconds. Water saturation in Zone 2 and 3 experienced a decrease, suggesting that the sand pack fluid was swept from Zone 1 to both Zones 2 and 3. It can be concluded that nanoparticles existed in Zone 1, sand pack fluid start to move to Zone 2 and Zone 3.

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SERiES22-26

SUCTION VARIATION OF A SINGLE MATURE TREE ON TOP OF TROPICAL RESIDUAL SOIL

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This paper discusses the investigation of active root tree zone which is located on top of a slope. This section of slope generated matric suction due to tree water uptake. A field monitoring program was carried out to collect matric suction data at slope with two conditions; in absent of a tree and with a tree located on top of tropical residual soil slope [1]. The variation in matric suction values and matric suction profiles response to the tree water uptake and rainfall are investigated. Matric suction significantly increased at vicinity of tree on top of slope compared to slope without tree. The variations of matric suction response due to climate change occur significantly at swallow of the slope and decrease gradually with depth. The decreases of matric suction occur after long duration of intense rainfall. This condition was function as an initial condition before the water uptake driven by active root tree generate to maximum matric suction (low moisture content). Analyses from matric suction profiles revealed that majority of matric suction changes were greater near tree trunk (< 4.4 m) and at shallow depth (0.25m) [2]. The contours of matric suction profiles are presented to reveal moisture flow due to tree water uptake. This investigation provides the viewed contribution of single mature tree significantly alter the matric suction or moisture variation distribution driven by transpiration in an unsaturated soil slope. It takes consideration by preserving mature tree can improved soil properties in modern slope designs.

Keywords: active root zone, tree water uptake, field monitoring

The authors would like to express their gratitude to Universiti Malaysia Pahang that served as full financial support to conduct this research. Thank you to all BTC staffs (Faculty of Civil Engineering Technology, Universiti Malaysia Pahang) for their kindness and full support to conduct this research from the start until finished.

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SERiES22-27

THE FUTURE OF SUSTAINABLE MINING IN INDONESIA: SUSTAINABLE MINING FUND CONCEPT

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Sustainable mining is a mining industry governance system that focuses on the development of economic, environmental, community development, socio-economic, efficiency, and safety aspects. The application of sustainable mining is inherently challenging, because mining is the act of removing and consuming limited natural resources. Reducing the environmental impact of mining is a focus common sustainable mining frameworks. Strategies for assessing the sustainability of mining operations include measuring, monitoring, and improving various environmental performance metrics. The main metrics for environmental sustainability in mining relate to efficiency in resource consumption, minimizing land disturbance, reducing pollution, and reclamation of exhausted mine land. Sustainable mining has one of the main functions, for helping the recovery of mining areas in improving the community's economy. In Indonesia, the Government formulates a policy on the use of non-tax state revenue (Penerimaan Negara Bukan Pajak, PNBP) with the sovereign wealth fund concept. The Sustainable Mining Fund policy is very important to be implemented because the amount of mineral and coal resources in Indonesia is limited and may not last long. This paper provides a review of the existing research literature and thoughts on mining sustainable funds, so it can be used as government considerations in implementation of PNBP to ensure the continuity of capital development in the future.

Keywords: limited natural resources, fund, sovereign wealth, sustaible mining.

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SERiES22-28

One-stop Integration System for Bioelectricity Generation, Wastewater Treatment, CO2 Sequestration and Biomass Production

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This topic is sparking strong research interests in determining the potential and efficiency in generating bioelectricity through microalgae biotechnology. The behavior of bioelectricity in literature has not enough yet been investigated. Far too little attention has been paid to the study of microalgae as source for bioelectricity generation. Microalgae have been long recognized as potentially as good sources for biodiesel, bioethanol methane or hydrogen production because of their high relatively oil content and rapid biomass production. However, the newest and recent research work on microalgae has identified new innovative biotechnology of bioelectricity production in addition of wastewater treatment and CO2 sequestration. The new application is to integrate microalgae with microbial fuel cell (M-MFC), whereas this leads to generating bioelectricity, remediating wastewater and producing biomass/biofuel simultaneously. The substantial biotechnology energy is produced by altering the chemical energy to electrical energy through the reaction of the microorganism. In M-MFC biotechnology system, microalgae are introduced as a substrate at anode, is oxidized, electrons are generated and whereas electrons are ferried through an external circuit for bioelectricity generation. While the cathode electrolyte chamber, is applied with photosynthetic microalgae in order to increase oxygen availability, secondarily treat anodic chamber effluent which is wastewater and produce lipids as biodiesel by-product. Considerably, the resulting M-MFC systems can generate bioelectricity using the electrons released to the anode during microalgae substrate degradation. However, this review is offered some important insights and presented an overview of new applications of microalgae for bioenergy production. It highlights novelty of using microalgae for electricity generation in microalgae-MFC, Wastewater treatment, CO2 sequestration and biomass production, their advantages, limitations and prospects.

Keywords: Microalgae-Microbial Fuel Cell (M-MFC) Biotechnology, Bioelectricity; Biomass; Lipid; biodiesel, Wastewater treatment, CO2 sequestration.

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SERiES22-30

One-stop Integration System for Bioelectricity Generation, Wastewater Treatment, CO_2 Sequestration and Biomass Production

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This topic is sparking strong research interests in determining the potential and efficiency in generating bioelectricity through microalgae biotechnology. The behavior of bioelectricity in literature has not enough yet been investigated. Far too little attention has been paid to the study of microalgae as source for bioelectricity generation. Microalgae have been long recognized as potentially as good sources for biodiesel, bioethanol methane or hydrogen production because of their high relatively oil content and rapid biomass production. However, the newest and recent research work on microalgae has identified new innovative biotechnology of bioelectricity production in addition of wastewater treatment and CO_2 sequestration. The new application is to integrate microalgae with microbial fuel cell (M-MFC), whereas this leads to generating bioelectricity, remediating wastewater and producing biomass/biofuel simultaneously. The substantial biotechnology energy is produced by altering the chemical energy to electrical energy through the reaction of the microorganism. In M-MFC biotechnology system, microalgae are introduced as a substrate at anode, is oxidized, electrons are generated and whereas electrons are ferried through an external circuit for bioelectricity generation. While the cathode electrolyte chamber, is applied with photosynthetic microalgae in order to increase oxygen availability, secondarily treat anodic chamber effluent which is wastewater and produce lipids as biodiesel by-product. Considerably, the resulting M-MFC systems can generate bioelectricity using the electrons released to the anode during microalgae substrate degradation. However, this review is offered some important insights and presented an overview of new applications of microalgae for bioenergy production. It highlights novelty of using microalgae for electricity generation in microalgae-MFC, Wastewater treatment, CO_2 sequestration and biomass production, their advantages, limitations and prospects.

Keywords: Microalgae-Microbial Fuel Cell (M-MFC) Biotechnology, Bioelectricity; Biomass; Lipid; biodiesel, Wastewater treatment, CO_2 sequestration.

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SERiES22-31

SAFETY CULTURE AND SAFETY EDUCATION IN MINING INDUSTRY: ISSUES AND CHALLENGES

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Nowadays, safety culture is emerging in order to avoid near-misses, injuries, accidents, and disasters. Malaysian mining industry is rich in minerals that may be discovered and exploited. However, a literature study on safety culture and safety education among Malaysian mine workers are lacking. The objective this research is to investigate the importance of safety culture and safety education among Malaysian mining industry by focusing on their issues and challenges. The research interviewed fifteen mining professionals or mining experts who were volunteered to involved in this research. By applying a thematic analysis, three main themes were created namely: (1) Internal issues (2) External issues and (3) Challenges, respectively, with six, four, and three sub-themes respectively. The finding showed it is quite challenging to inculcate safety culture due to negligence of mine operator to prioritize the culture of safety especially for small scale mining operation. In conclusion, this study may be beneficial to government agencies, mine operators, and local governments in emphasizing the need of a strong safety culture and safety education in the mining sector. In the near future, safety culture and safety education can help to develop responsible miners, establish a safe working environment, enhance worker productivity, and reduce the number of mining accidents in Malaysia.

Keyword: Malaysian mining industry, mining accidents, mining experts, responsible miners, safety culture, safety education

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SERiES22-32

DISPERSION OF POLLUTANTS IN STREET CANYON OF URBAN ENVIRONMENT

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The Operational Street Pollution Model (OSPM) was adopted to predict the pollutant concentration (NO_2, CO, ozone, benzene, PM2.5, PM10, and suspended particulate matter (SPM)) in the urban street canyon, Kyoto City, Japan. The OSPM simulation reveals all mean modelled pollutants concentration permitted to the environmental quality standard of Japan and World Health Organization. Road no. 9 under the category of highway administrated by the Ministry of Land, Infrastructure, and Transport (MLIT) can be classified as the most polluted road. The correlation analysis exhibits the pollutant concentrations are positively strong correlated to the traffic volume (r:0.302-0.834, p<0.01), wind speed (r:0.418-0.641, p<0.01), wind direction (r:0.449-0.623, p<0.01), and aspect ratio (height/width) (r:0.325-0.875, p<0.01) of the urban street canyon, and vice-versa on travel speed (r:-0.283-(-0.735), p<0.01). Overall, OSPM model suggests its practicality for estimating dispersion of pollutants in urban street canyon.

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SERiES22-33

Critical Analysis of Benefits and Difficulties of Construction Waste Management Implementation for Developers

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Construction wastes are negatively impacting the economy, environment, and public health globally. Policymakers in every country has come out with a lot of efforts to mandate sustainable practices in managing construction waste. However, construction waste management (CWM) is still poorly practiced in many countries. CWM is widely established in the literature but prior research work lack of targeted study towards individual stakeholder. The two main aims of this study are to explore the gap between the policy and practice and narrowing the research gap. To achieve the aims, this study target on only developer, which is the key project initiator. A total of 15 benefits and 17 difficulties obtained through systematic literature review of 214 prior works and phone interviews with 26 targeted developers. Statistical analysis is then performed to comprehend the significance of factors for both benefits and difficulties of CWM for developers. The findings provide a detailed practical developer's issues in CWM. This information is of important for the policymakers to develop targeted guidance and effective policies in promoting CWM.

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SERiES22-34

Effects of Time Taken for The Optimization of Prebiotic Syrup Production by Enzymatic Reaction

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Consumption of prebiotics and probiotics in order to enhance the human gastrointestinal health has been increasing for the past few years. This paper analyzes the effects of time taken to optimize the production of prebiotic syrup into the communities. Optimization aims to determine the minimum or maximum value of an objective function that is affected by an obstacle that represents the limits imposed by the user's preferences and the nature of the question at hand. For this particular paper, it focuses more on the production of Fructo-oligosaccharides, FOS by enzymatic reaction. The experiment basically uses yeast as an enzyme to stimulate the sucrose content in the fruit to be converted to prebiotic, in this case, FOS. The raw materials consist of a few mixtures of red fruits which are: watermelon, dragon fruit, grape and red date (jujube), mineral water, white sugar and yeast. The amount that was used in this research was 650g of white sugar, 250ml of watermelon, dragon fruit and grape juice respectively and 250g of red date. Lastly, the amount of enzyme used was around 5mL. All the mixture will be mixed until homogenous before inserted into a bioreactor for an enzymatic reaction to take place. For the amount of the raw materials needed, a ratio was made by using Design Expert by using Central-Composite Design or CCD method. This software will be used to optimize the ratio of raw materials needed for analysis. For the analysis, the glucose concentration can be determined by using the DNS method. This method requires a DNS reagent, the sample solution, and UV-VIS Spectrophotometer. The results of prebiotic content were obtained by subtracting the value of sucrose with the value of sucrose after reacting with hydrochloric acid (HCL). After that, the sample can be inserted into a rotary evaporator. The parameters given should at least be around 100°C for 3-5 hours. The results showed that the prebiotic content increases from 0.460 Nm on day 4 to 2.41 Nm on day 7. However, by applying the rules of diminishing returns, it shows that the most optimal day for the enzymatic reaction to take place is 6 days.

Keywords: Optimization, prebiotics, probiotics, FOS, enzyme, fruit mixture, design expert

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SERiES22-35

SAFETY CULTURE AND SAFETY EDUCATION IN MINING INDUSTRY: ISSUES AND CHALLENGES

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Nowadays, safety culture is emerging in order to avoid near-misses, injuries, accidents, and disasters. Malaysian mining industry is rich in minerals that may be discovered and exploited. However, a literature study on safety culture and safety education among Malaysian mining industries are lacking. Therefore, the objective this research is to investigate the importance of safety culture and safety education among Malaysian mining industry by focusing on their issues and challenges. The research interviewed fifteen mining professionals or mining experts who were volunteered to involved in this research. By applying a thematic analysis, three main themes were created namely: (1) Internal issues (2) External issues and (3) Challenges with six, four, and three sub-themes respectively. The finding showed it is quite challenging to inculcate safety culture due to negligence of mine operator to prioritize the culture of safety especially for small scale mining operation. In conclusion, this study may be beneficial to government agencies, mine operators, and local governments in emphasizing the need of a strong safety culture and safety education in the mining sector. In the near future, safety culture and safety education can help to develop responsible miners, establish a safe working environment, enhance worker productivity, and reduce the number of mining accidents in Malaysia.

Keyword: Malaysian mining industry, mining accidents, mining experts, responsible miners, safety culture, safety education

This work was supported by Majlis Ugama Islam Pahang (MUIP)-RDU220701

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SERiES22-36

STABILIZATION OF PROBLEMATIC SOIL BY UTILIZING SILICA FUME, EGGSHELL ASH AND LIME

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Presently, the stabilization of soft kaolin clay soils by utilizing agro-waste products continues to gain researchers' attention in the field of construction. Therefore, this study investigates the influence of silica fume and eggshell ash on the properties of soft kaolin clay. Silica fume of 2%, 4%, and 6% by dry weight of kaolin; the eggshell ash of 3%, 6%, and 9% by weight of the dry weight of kaolin and silica fume content, and lime of 3%, 6% and 9% by weight of the dry weight of kaolin, silica fume, and eggshell ash content was used and tested for basic engineering properties tests (particle size distribution (PSD), specific gravity, Atterberg limits, and compaction), undrained shear strength, XRF, XRD, and FESEM. There were changes in a basic engineering property (i.e. lower specific gravity, lower plasticity index value, reduction in maximum dry density, and an increment in optimum moisture content) and higher undrained shear strength of the sample. The optimum strength was recorded with the inclusion of 6% of silica fume, 6% of eggshell ash, and 9% of lime in the sample. The investigation concludes that silica fume, eggshell ash, and lime firmly influence the engineering properties of soft kaolin clay thus opening a route to the low-cost and eco-friendly materials in soft soil stabilization.

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SERiES22-37

GROUND IMPROVEMENT OF SOFT KAOLIN CLAY REINFORCED WITH ENCAPSULATED BOTTOM ASH COLUMNS

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The uncontrollable usage of bottom ash (waste material) can cause pollution to the environment. The aim of this research is to investigate the role of single and group encapsulated bottom ash columns in improving the shear strength of the soft reconstituted soft kaolin clay by using the laboratory scale model. The shear strength characteristic can be obtained by determining the effect of area replacement ratio, height penetration ratio, and volume replacement ratio on single and group of encapsulated bottom ash columns. The reinforced kaolin samples were tested under the Unconfined Compression Test (UCT) and Unconsolidated Undrained Triaxial Test (UU). The highest improvement of shear strength of the single encapsulated bottom ash column on area replacement ratio of 4.00% at 10 mm diameter columns is at 0.8 height penetration ratio with 77.00% while for area replacement ratio of 10.24% at 16 mm diameter columns are also at 0.8 height penetration ratio with 71.48%. Meanwhile, the highest improvement of shear strength of the group encapsulated bottom ash column on area replacement ratio of 12.00% at 10 mm diameter columns is at 0.8 height penetration ratio with 75.63% while for area replacement ratio of 30.72% at 16 mm diameter columns is also at 0.8 height penetration ratio with 56.41%. The maximum improvement of shear strength was at a 0.8 height penetrating ratio for both single and group encapsulated bottom ash columns. UU testing showed a significant improvement in cohesion which was recorded to be from 4.31% to 89.21%, and the improvement of friction angle, ϕ was from 4.17% to 27.92%. The improvement of deviator stress versus axial strain at failure of 70 kPa, 140 kPa, and 280 kPa for cell pressure was recorded to be between 12.55%–51.80%. In conclusion, the installation of single and group encapsulated bottom ash columns can improve the shear strength and the compressibility of the soft reconstituted kaolin clay.

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SERiES22-38

Multi Analysis of Water Quality Index and Pollution Load Capacity at Sutami Reservoir, East East Java Indonesia

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Sutami Reservoir is the largest reservoir in East Java as a flood controller, electricity generator, clean water supply and irrigation provider where the water flow comes from the Brantas river. The problem that occurs in the Brantas River is the decline in water quality due to agricultural, domestic and industrial waste. The purpose of this study is to determine the fluctuation of water quality with different approaches and to determine the capacity of the pollution loading capacity in the Sutami reservoir. The analytical method used is DOE-WQI, Pollution Index, Oregon-WQI, and Prati Index based on parameters BOD, COD, DO, NH3-N, TSS, pH, NO3, and PO4. The secondary data used is from 2016 – 2020. Water quality sample data is taken at 3 (three) collection points for upstream of the reservoir, in the middle of the reservoir, and downstream of the reservoir. The results showed that the Sutami Reservoir was still classified as lightly polluted and tended to be of moderate quality based on the Polynomial regression model approach. The carrying capacity of the flood load in the Sutami reservoir almost exceeds its capacity based on the status of class II water quality regulation.

Keywords: Multi analysis, water quality, pollutant load capacity and reservoir

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SERiES22-39

Flood Risk Simulation of Sponge City and LID Flood Disaster Reduction Benefit Assessment

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In this context of global climate and the influence of human activities, "sponge city" is put forward to realize the purification, collection and reuse of rainwater.The effective evaluation of LID facilities in sponge cities is of great guiding significance for the promotion and construction of sponge cities. Guyuan was selected as the research object.The characteristics of precipitation change in the past 60 years were analyzed to obtain the trend change.IFMS Urban calculation platform was selected to construct the rain and flood model. LID facility parameters were added to simulate the improvement of urban waterlogging after the construction of sponge city, and a reasonable disaster loss assessment method was selected to calculate the disaster reduction benefits brought by the construction of sponge city. Through the comparison of the inundation situation before and after LID facilities construction, it can be concluded that the reduction effect of LID facilities on the overall inundation area of the city decreases with the increase of rainfall recurrence period, with the maximum reduction rate reaching 13.63% in the 5-year recurrence period and the minimum reduction rate of 11.06% in the 50-year recurrence period. LID facilities have a better disaster reduction effect for rainfall events with a small recurrence period than for rainfall events with a large recurrence period.

Key words: sponge city, rain and flood simulation, low impact development, precipitation characteristics, disaster reduction benefit

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SERiES22-40

IDENTIFICATION OF RIVER CONTAMINANT SOURCES USING A CELLULAR AUTOMATA MODEL AND BAYESIAN MCMC METHOD

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Identification of contaminant sources in rivers is crucial to river protection and emergency response. A methodology combing Bayesian inference with the contaminant transport model based on Cellular Automata (CA) is proposed to identify unknown sources of river pollutions in this paper. The efficiency and accuracy of the forward transport model greatly affect the computational efficiency of the Bayesian inference. Therefore, a cellular automata-based contaminant transport model is developed to efficiently simulate the concentration change of pollutant rivers in a specific space-time. Markov Chain Monte Carlo (MCMC) method is applied to get the posterior probability distribution of the location, time release and magnitude of contaminant source. The Metropolis-Hasting (M-H) method is used to sample in order to form Markov chains. A real case study derived from the publicly documented Fen River is tested using the proposed methodology. The results indicated that the proposed methodology is an effective way and may be used to identify the locations and release histories of river contaminant sources.

Keywords: Contaminant source identification, Bayesian inference, MCMC, Cellular automata, River pollution

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SERiES22-41

STABILIZATION OF SLOPE VIA ALSTONIA ANGUSTILOBA TREE WITH THE INFLUENCE OF TREE WATER UPTAKE

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Cutting down of trees can vanish the reinforcement provided by the root of tree to the soil by means of weakening the soil shear strength due to the increasing value of pore water pressure and decreasing value of effective stress. Root of a tree plays an important part in preventing landslides event to occur either it is by modifying the soil moisture regime via evapotranspiration or providing root reinforcement within the soils. This study is conducted to explores the vegetation approach by using tropical mature tree (Alstonia Angustiloba) and monitors the activeness of the root zone of a tree that lies at the top of the slope by which the data of the matric suction generated within this section of the slope is recorded and applied to the slope stability problem to increase the value of factor of safety (FOS) which can represents the hydrological condition and hence can provide essential quantification information on the behaviour of matric suction (pore-water pressure) changes in relation to tree water uptake. Besides, to validate the soil suction, a contour was plotted and compared to the resistivity and chargeability contour which was conducted through ERI survey. Based on the research conducted, it is proven that by using tree water uptake method can increase the FOS of the slope up to 53% (from 2.17 to 4.57) and both matric suction contour and ERI survey contour can be used as a method of analysis to observe and investigate the tropical residual soil slope stability. In retrospect, the method used in preventing the landslides event to occur at the slope is economical and eco-friendly which can be implemented globally.

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SERiES22-42

EFFECT OF LARGE RANGE POROSITY TO SOIL CHARACTERIZATION OF LATERITIC BAUXITE SOIL IN KUANTAN

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In general, very small porosity are identified in tropical sandy soil with no gravel or stones, as in indicates to close packing of soil particles and in contrast, larger porosity is related to the presence of numerous macropores that results from both faunal activity and root development. However the condition at bauxite ex-mining sites in Kuantan is quite different. Prior understand the post mining lateritic bauxite soil behavior, study the soil porosity is the important main key. Dry sieving method is implemented to identify the soil particles distribution. The porosity value is evaluated based on the fine sand to coarse sand ratio, which is obtained from the Particle Size Distribution (PSD) analysis. Based on the PSD analysis, grading characteristics are identified. The ground is found to be well graded sand, which Grading Coefficient (C_g) is lower than 2. Meanwhile, the Uniformity Coefficient (C_u) is higher than 3, but with acceptable large range of porosity, 42%. It is identified that without proper soil rehabilitation during post bauxite mining activity, this inhibit the flora root development, hence exposed the soil surface mining areas to wetting and drying, eventually lead to the sudden changes to the lateritic bauxite soil characteristic. Hence, dealing with tropics sandy soil like lateritic bauxite soil becomes quite challenges as it has large range of porosity. Affected by the wetting and drying cycles, even small differences in composition leads to distinct physical properties of the soil. Therefore, sustainable bauxite mining is crucial, especially the soil surface rehabilitation, as to exhibit the redevelopment of the plant root, as to preserve the condition of the land form quality.

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SERiES22-43

TRACEABLE OF BMIM BF_4 ON WATER SPINACH GERMINATION AND GROWTH

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The 1-Butyl-3-methylimidazolium tetrafluoroborate ([Bmim] [BF4]) was successfully tested as draw solution for seawater desalination wherein the traceable amount of ILs was effectively regenerated using nanofiltration in previous study. The quality of produced water was tested to the aquatic plant reveal that exerted growth effect on terrestrial plant. Although many studies describe ionic liquids (ILs) as potentially greener solvents, few studies address their relationship with the environment. Recent research suggests that some ILs have toxicity. ([Bmim][BF4]) was reported to have the lowest toxicity among ILs. In this work, we studied the toxicity of this IL on water spinach germination and growth. The plant growth was observed starting form germination until 20 days. It was noticed that the root system was retarded with increasing ILs concentration. Similarly, the root and shoot length and weight of water spinach decreased with increasing concentrations of [Bmim][BF_4] from 0 to 500 ppm. Thus, [Bmim][BF_4] at the concentration of 500 ppm or more was toxic to water spinach seedlings. More research is needed on toxicity of ILs to estimate the safe concentrations amount of ILs towards humans and environment for wide range applications.

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SERiES22-44

Electrodialysis Membrane Desalination for Water and Wastewater Treatment: Diagonal Membrane Spacers with A 45° Spacer-Bulk Attack Angle

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The use of such a spacer allows for longer and more tortuous flow paths, as well as much higher hydraulic pressure drop and flow mixing qualities, which aids in obtaining turbulent flow at lower Reynolds numbers than an empty flow channel. Flow behavior within the passages of spacer-filled channel differs depending on spacer geometry, resulting in different mass transfer to energy losses rates. This highlights the importance of spacer geometry in determining flow dynamics and concentration profiles throughout the channel. The current study aims at systematically reviewing features of 45° attack angle for membrane spacers with its impact on polarization, fluid dynamics, dead zones, and encouraging turbulences and mixing along feed channel. Spacers with a flow attack angle of roughly 45° to the main flow direction, often known as diamond configuration [1]. Diamond configuration is a spacer often made of filaments that are inclined (or oriented diagonally) with respect to the channel axis against the main flow direction. A diamond mesh configuration of spacers is typically either a rhombus, parallelogram or square with a two-level structure, where the cross-filaments are welded on top of each other. Others described the 45° attack angle spacer as comprised of squares turned diagonally to flow direction [1]. The flow through the 45° nominal incident angle spacer is described as complex, exhibiting tortuous trajectories without calm regions. In addition, high rates of streamlines were identified near the diagonals, indicating high velocities there and encouraging low concentration gradients [2]. It can be hypothesized that the presence of 45° attack angle causes a low shadow effect on the solution compartment. However, this parameter shadow factor of 45° attack angle has not been studied sufficiently which caused a difference in calculated and empirical solution resistance. The 45° oriented strands were found able to disturb the solution sufficiently and causing significant changes to inlet flow direction [3]. They are therefore highly promising, where mixing is increased by complicated flow fields with considerable vertical and horizontal velocities, when dead areas are missing at 45° attack angle. The channeling by the hydrodynamic angle of 45° eventually causes a flux reduction of 16–25% and increases residence time.

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SERiES22-45

Electrodialysis Membrane Technology for Water and Wastewater Processing: Application of Ladder-Type (90°) Membrane Spacers to Impact Solution Concentration and Flow Dynamics

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Concentration polarization is a key issue in electrochemical reactors and electrodialysis-related processes that happens at the interface between a membrane and a solution, and eventually impacts stack power density [1,2]. Polarization then creates a flat diffusion boundary layer along the membranes. The current work in-depth reviews a ladder-type configuration composed of longitudinal and transverse filaments, and its effects on solution flow direction and hydrodynamics. The review discovered that a laddered spacer can provide mass transfer and mixing activity along the channel while maintaining comparable patterns of concentration boundary layer and solute distributions at the membrane surface, but at the expense of high-pressure losses. The use of ladder-type configuration spacers can considerably minimize concentration polarization while increasing turbulence and pressure drop rates. High turbulence rates can result in increased heat transfer rates as well as an increase in the ion transfer coefficient along membrane surfaces. The high-pressure drop, which is produced by the significant contribution of the spacer manifolds, can be employed to eliminate dead spots in the spacer configuration. The use of a ladder-type spacer therefore has a substantial impact on stack energy consumption and voltage drops across the membrane sheets at an operational current density. The Ladder-type geometry is made up of a layer of straight longitudinal filaments in the x-direction on top of a layer of straight latitudinal filaments in the y-direction. Transverse filaments dominate all fluid flow parameters, while longitudinal filaments have little effect on fluid dynamics and cause no changes in flow direction. The average mass transfer coefficient increases with increasing transverse filament thickness and decreasing the distance between the transverse filaments, both of which are associated with pressure drop increases. The inclusion of additional transverse spacer filaments and a reduction in parallel filament number with respect to the main flow direction improves solution flow disturbance and vortex rate while decreasing concentration polarization at lower flow rates. The use of a small number of extremely thin longitudinal filaments minimizes nodes and enhances voidage for solution disruption and channel flow dynamics, allowing for a higher mixing rate and lower pressure drop values. However, if the spacers leave relatively significant sections of the membranes unsupported, the membrane surfaces would be subject to a severe membrane deformation, decreasing their hydraulic pressure limit.

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SERiES22-46

Irregular Flow Attack Angles of Membrane Spacers Positioned in Electrodialysis Membrane Technology for Water and Wastewater Processing: A Systematic Review

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The present study aims at discussing irregular flow attack angles of membrane spacers in order to uncover unknown and non-discovered knowledge. As authors, spacer brought our attention when it was employed in a past study of ours. The spacer improved the electrodialysis desalination from a very unacceptable performance to a very good desalination rate and quality [1]. Fluid flow and heat transfer through irregular orientation angles (°) spacer-filled channel with regard to the main flow direction were simulated in past studies to describe the change in direction of the fluid as it flows in the channel [2]. Other studies modified the attack angle of regular spacers in order to investigate the impact of irregular spacer orientation [3]. For instance, Schwinge et al. [4] studied spacers placed at attack angles of 45° compared to 74° towards the main flow direction. Irregular attack angles provide different flow patterns due to the filaments of the spacer being more or less transverse with regard to flow direction, which may lead to significant changes to the overall flow dynamics (i.e., pressure drop, pumping power, mixing properties). Lowering the flow rate results in more uniform flow distributions; nevertheless, as the flow rate decreases, the addition of more transversally spacer filaments with respect to the main flow direction increases solution flow disturbance and vortex rate. If the flow attack angle is quite large (i.e., close to 0° attack angle), the fluid flow may line-up with the filaments. Yet, the few studies considering different attack angles, as well as physical intuition, suggest that orientations other than the basic ones mentioned above may offer advantages in terms of heat/mass transfer and frictional pressure drop, and thus are worth investigating. The shortage of research exploring spacers at varied flow attack angles is owing to the commercial unavailability of spacers and the uncertain reasons for their use.

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SERiES22-47

A Comparative Study on The Effect of Chemical Additives on Clinker Grinding

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Cement production consumes high energy and cost due to the requirement of high fineness grinding during the clinker production and clinker grinding [1]. Grinding additives are used to increase production and fineness or act as performance enhancers by reducing the particles' agglomeration and coating of balls and mill liners. Such additives help decrease cement production's enormous energy consumption [2]. This work compared a commercial grinding additive, Triethanolamine (TEA) and two industrial grinding additives (GAA079 and GAA088) obtained from a cement industry to the clinker grinding using a ball mill with the dosages of 0.05, 0.25, 0.50 and 1.00 wt.%, respectively. The industrial grinding additives were characterized using gas chromatography-mass spectrometry (GC-MS). Particle size analysis and morphological analysis by SEM image XRD test were done on the samples. It was found that the grinding additives produced elongated, cubic, angular, rhombus, needle-like, flaky, and irregular grains shape of cement powder that may affect the hydration rate and quality of the cement. The XRD shows no significant structural distortion with and without the grinding additives and it was also found that the grinding additives help to decrease the ball coating and mill lining during the grinding process. These comparative study id the grinding additives are advantageous as they can provide the optimum dosage and types used in the clinker grinding process.

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SERiES22-48

OLEOCHEMICAL WASTEWATER AS SYNBIOTIC PLANT NUTRIENT ENHANCER

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Oleochemical wastewater is one of the main sources of water pollution. The effluent discharge from the industry requires treatment which is costly and takes a lot of process. Several studies showed that oleochemical waste contains nutrients and probiotics which could be used as nutrient provider for the plants. Thus, instead of discharging the waste to the landfills, it is possible for the waste to be used for plant growth whereas the mixture of the oleochemical waste and prebiotic nutrients, produces synbiotic which are beneficial for plant health and growth. The aim of this study is to formulate plant nutrients mixed with oleochemical waste which provides synbiotic enhancement and validating its significance on three different types of plants, namely, Abelmoschus esculentus (Okra), Solanum Melongena (Brinjal), and Capsicum annuum (Chilli peppers). For clarification, synbiotic is a combination of both prebiotics and probiotics that benefits the host by stimulating the growth of a limited number of health-promoting bacteria. The formulation of the mixture of plant nutrient is as follows; the wastewater was filtered with cloth before adding the prebiotic solution. Solution A (filtered wastewater) was mixed with Solution B (prebiotics solution) with different percentages. First batch of mixtures are mix of Solution A and Solution B respectively; S1 (100%:0%), S2 (75%:25%), S3 (50%:50%), S4 (25%:75%), S5 (0%:100%) while the second the second batch is the mix of Solution C (unfiltered wastewater) to Solution B respectively; S6 (50%:50%). The validation was done by measuring the growth of the plants. The height of the plant and the number of leaves were measured weekly for four months duration. The results showed that S3 gave significant result for the okra plant, in which it is the highest among the other plants, and the heights are as follows; 43.96cm, 58.40, 83.73cm. Whereas S6, gave best outcome for brinjal and chilli plant in which the results were 20.59cm, 26.67cm, 37.32cm for chilli plant and 22.26cm, 33.02cm, 51.85cm for brinjal plant. It is shown that the addition of the wastewater and when it is used as synbiotic plant nutrient enhancer, the plant growth is better.

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SERiES22-49

BASELINE STUDY ON APPLICATION OF PRECIPITATED CALCIUM CARBONATE AS AN ALTERNATIVE IN WATER TREATMENT

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Calcium carbide sludge represents a by-product of acetylene gas production in which this waste material is converted to precipitated calcium carbonate (PCC) [1,2]. In this study, the PCC products were used for the treatment of acid mine drainage (AMD) which manifested a major concern to the groundwater pollution. Groundwater are contaminated due to its high acidity, concentration of dissolved heavy metal ions and anions [3]. Acid mine drainage (AMD) was collected from iron (Fe) tailing pond that is located at Bukit Besi, Terengganu. Jar test method was used to study the effectiveness of PCC in AMD treatment. There are six parameters of weights and twelve interval times used in the experiments. Throughout the experiment, the pH value was observed and recorded for every time interval. The water sample was tested using Inductively Coupled Plasma (ICP-OES) before and after the jar test to determine the content of heavy metal. From the result of jar test, it shows by using 2.0g of PCC the water sample was able to neutralize to 7.04 within 55 minutes. Results from ICP-OES also shows that heavy metals content such as Aluminium (Al), Copper (Cu) and Ferum (Fe) were able to be removed up to 96% leaving Manganese that was only able to be removed by 7.7%.

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SERiES22-50

SEPARATION OF LANTHANUM USING FLAT SHEET SUPPORTED LIQUID MEMBRANES FABRICATED AT DIFFERENT CONDITIONS

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Rare Earth Elements (REEs) have raising demand globally as REEs are widely use in production of gadget and high-technology product. It is reported that REEs are found all over Malaysia. Separation of REEs is a challenging process especially REEs with similar chemical and physical properties. The objective of this research is to determine the best formulation and condition for fabrication of Polyvinylidene Fluoride (PVDF) flat sheet supported liquid membrane (SLM) via Vapor Induced Phase Separation (VIPS) for separation Lanthanum (La). For the experimental work, flat sheet membrane was prepared by using VIPS with three different factors which are exposure time (10s – 70s), water coagulation bath temperature (30^{o}C – 60^{o}C) and membrane thickness (150µm – 400µm) which was controlled by gap size of semi-automatic casting machine. The membrane surface was characterized by using Fourier-transform infrared spectroscopy (FTIR) to determine the functional group of the membrane, Field Emission Scanning Electron Microscope (FESEM) for the morphology and contact angle measurement for the hydrophobicity of the membrane. The morphology of the membrane should be asymmetry with macrovoid and porous structure for the best performance. The average contact angle reading of the membranes were reported in the range 76-88° which is considered as hydrophilic characteristic. Figure 1 shows the highest La separation (56.32%) was achieved by membrane 1 fabricated using gap size of 100µm, 40s exposure time and 45^{o}C water bath temperature. The membrane with lowest La separation efficiency (9.47%) was observed for the membrane 6 which was fabricated at 40s exposure time, 30^{o}C coagulation bath temperature and 400µm gap size. From the result, it is proven that flat sheet supported liquid membrane is feasible to control the separation of La by manipulating membrane fabrication conditions. The separation process using SLM is environmental-friendly and cost-efficient. The future research should focus on other parameters such as membrane porosity, flow rate of feed and stripping solution, formulation of feed and stripping solution, type of liquid membrane and organic solvent.

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SERiES22-51

SELECTION OF EXPERIMENTAL DOMAIN USING TWO-LEVEL FACTORIAL DESIGN TO DETERMINE EXTRACT YIELD VIA MAE

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Archidendron Pauciflorum (*A.pauciflorum*) or Jering is well-known delicacies of Malaysia that is abundant and the fruit pod is considered food waste. It's easy to get the supply all over the year and non-seasonal. *A.pauciflorum* has many health benefits such as reducing hyper glucose for diabetics and high blood pressure patients regarding its chemicals and biological compounds. This research is focusing on the extraction of bioactive compounds from the empty pod as a waste of *A. Pauciflorum*. A two-level factorial design was used for initial screening of the following independent factors, namely solvent concentration (20-80 %), power (300-700 Watt), temperature (20-80 ^{o}C), and time (2-20 min) to determine the extract yield from using MAE. Among all the factors, only time is significant ($p<0.0133$) in obtaining higher extract yield, whereas the altering solvent concentration and temperature very close to significant. In conclusion, power was not a significant parameter to affect the yield of extraction because the contribution to the experiment only to heat the sample solely.

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EFFECT OF BIO-BASED NANOSILICA ON SINGLE EMPTY FRUIT BUNCH FIBRE

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This project highlights the utilization of bio-based nanosilica that was derived from rice husk to enhance the properties of waste empty fruit bunch (EFB) fibre. EFB fibre was one of the lignocellulose biomass wastes from palm oil industry, conventionally, it is used as energy sources in boiler. EFB fibres have the properties like light weight, nonabrasive and biodegradable which suitable to be used as reinforcing agent for plastic and composite application. However, hydrophilic native property of EFB fibre leads to weak interface due to poor interfacial adhesion between EFB surface and polymer matrix that can potentially giving bad impacts to its mechanical properties. To remedy this situation, the EFB fibre will be modified via enviromental friendly ultrasound assisted alkaline and acrylic acid treatment. The bio-based nanosilica will be introduced during the acrylic acid treatment, in which can further improve the thermo-mechanical properties and control the biodegradability of the composite. Scanning Electron Microscopy (SEM), Fourier-Transform Infrared Spectroscopy (FTIR) and tensile test were conducted to characterize the treated EFB fibre. Findings reveals that the impurities on the surface of EFB fibre were washed away after the treatment and impregnation of nanosilica on the surface of EFB fibre were visualised. FTIR results confirms the removal of hemicellulose ranging from 2900-1700 cm^{-1}. Tensile test demonstrates that small amount of bio-based nanosilica improves the mechanical properties compared to raw EFB fibre.

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SERiES22-53

THE ASSESSMENT OF WATER PURIFICATION QUALITY CHARACTERISTICS (WPQC), WATER QUALITY INDEX (WQI) AND THEIR MEASUREMENT TECHNIQUES

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Drinking water quality is extremely important for public health. With the aid of the water quality index, the current research investigation aimed to monitor the quality of drinking water and assess the action of water purification plants in the surrounding areas of PMAS Arid Agriculture University Rawalpindi (WQI). A total of 150 water samples were gathered from 20 water purification plants. The pH, EC, TDS, free chlorine turbidity, total hardness, cations (Na, K, Ca, and Mg), anions (Cl, HCO3, SO4, NO3, and F), manganese, iron, and total hardness of drinking water were all analyzed. In terms of the assessed physicochemical character, the results showed that purified water was of acceptable quality for consumption. The overall water purification efficacy for the reduction of total dissolved salts and related anion and cation was greater than 90%. TDS levels in groundwater, for example, averaged 1919806 mg/L, but were reduced to 11932.9 mg/L in purified water. According to the water quality index, all of the filtered water samples were determined to be of high drinking quality (class I). Meanwhile, due of the large amount of dissolved salts, 80.6 percent of the contaminated groundwater sample was determined to be of poor drinking quality (class III), and 10.9 percent was determined to be of extremely bad drinking quality (class IV). Groundwater filtration improved the water quality from extremely low to poor (classes III and IV) to good (class I).

Keywords: Water Quality, Purification, physicochemical Characteristics, Drinking water regulation, quality index

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Utilization of Rice Husk as a Material for Production of Activated Carbon for Environmental Treatment: A Review

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Successful utilization rice husk, which accounts for approximately 20% of weight of rice grain, carries strong implications in reducing agricultural waste and devising cost-effective materials for environmental applications [1]. This review focuses on summarizing approaches to afford activated carbon, an important adsorbent material used in wastewater treatment, from rice husk material [2–5]. The materials synthesis method was mainly studied by the physicochemical activation method. The most commonly used activators were KOH and NaOH. The properties and structure of the materials were also analyzed by means of XRD, FTIR, and BET. The characteristic functional groups of materials are included OH, C=C, C=O, CC, CO, CH. The crystal of the material was shown in the range 2θ = 22°-30° and 2θ = 44°. The material surface area was more 1000 $m^2.g^{-1}$ synthesized by the physicochemical method. The adsorption capacity of the material has also been specifically reported. Treatment efficiency reached 70% of pollutants such as dyes, heavy metals, phenols and other organic compounds. The kinetic and isothermal models were showing good agreement with the Langmuir, Freundlich and PSO.

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SERiES22-55

CHARACTERIZATION OF LOW-COST STONE BASE MATERIAL MADE USING NATURAL AGGREGATE AND CRUSHED STONE

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This paper provides the laboratory characterization of a low-cost stone base material for road construction made from locally available natural aggregate and crushed stone aggregate. To create the stone base material, crushed aggregates and natural aggregate were blended in a 1:1 ratio and then subjected to a series of laboratory tests in accordance with British standard procedure. Grain size analysis, specific gravity, moisture-density relationship, and California bearing ratio (CBR) tests were performed. The obtained results revealed that the formed stone base materials contain approximately 2% fine particles smaller than 75µm, and approximately 80% of the materials are between 50mm and 5mm. The stone base also has a maximum dry density (MDD) of 2085kg/m3, an optimum moisture content (OMC) of 6.2%, a specific gravity of 2.67, and an 82% CBR value. The material is recommended for use in the construction of road base courses based on the results of the characterization. Keywords: Stone base, base course; articles size distribution; moisture density relationship; specific gravity; California bearing

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Influence of Extractant Concentration in Aliquat 336-Polymer Inclusion Membranes (A336-PIMs) for Gold Extraction from Aurocyanide Solution

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Cyanide leaching is one of the gold production processes which commonly used nowadays in industries. This process involved the usage of cyanide to interact with the grinded gold resulted to the formation of aurocyanide $(AuCN)^-_2$ solution. The loaded gold aurocyanide solution was then being extracted via various kind of techniques such as carbon adsorption and solvent extraction technique. Unfortunately, carbon adsorption exhibited slow in adsorption of gold. Meanwhile, solvent extraction had led to the environmental health issue since it involved the usage of organic extractants which was highly volatile and flammable [1]. The introduction towards membrane technology specifically the polymer inclusion membranes (PIMs) integrating with a suitable extractant had been proposed to resolve some drawbacks of the conventional methods. Quaternary ammonium salt (A336) is an ecologically friendly extractant which acts as the carrier in the fabricated PIMs for selectivity of the membrane. PIMs were prepared by dissolved 50 wt% of poly(vinylidenefluoride-co-hexa-fluoropropylene) (PVDF-co-HFP) in THF solvent followed by the addition of A336 with different composition initiated with 10 wt% (M1), 20 wt% (M2), 30 wt% (M3), 40 wt% (M4) and 50 wt% (M5). The extraction experiment was being conducted for continuous 5 hours of diffusion using H-cell device containing synthetic $(AuCN)^-_2$ and thiourea solution in the feed and receiving phase respectively. The concentration of gold in $(AuCN)^-_2$ solution were being measured using ICP-OES instruments. ICP-OES results revealed the highest concentration of gold extracted had been contributed by the M5 with highest A336 composition (50 wt%) due to the enhancement in gold transportation facilitated by the presence of A336 in high concentration [2]. Hence, the percentage of extractant used in the membrane solution had affected towards the membrane effectiveness for gold extraction from $(AuCN)^-_2$ solution.

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SERiES22-57

Mimosa Pudica (Sensitive Plant): Chemical Component, Phenolic Content, Flavonoid Content, and Antioxidant Activity

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Due to its effectiveness and safety, natural product-based medicine continues to gain popularity [1]. *Mimosa pudica* has been used therapeutically for many generations, with good results in treating a variety of disorders [2]. This plant is widespread and useful locally as well as globally [3]. The phytochemical results of *Mimosa pudica* were the presence of various compounds such as alkaloids, coumarins, reducing sugars, flavonoids, saponins, tannins, and terpenoids. The ethanol extract had a high amount of both polyphenols and flavonoids contents, which were 154.23 ± 8.38 (mgGAE/g) and 38.58 ± 3.31 (mgGAE/g), respectively. The antioxidant capacity also showed similar results when the IC50 value of ethanol extract was statistically significantly lower than that of aqueous extract. According to the DPPH assay, the IC 50 values of *Mimosa pudica* extracted by water and alcohol were 182.55 ± 17.51 µg/mL and 54.21 ± 8.21 µg/mL, respecttively.

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SERiES22-58

PRELIMINARY STUDY ON THE EFFICIENCY OF BIOLEACHING PROCESS IN GOLD EXTRACTION

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Bioleaching refers to the solubilization of target metals by microorganisms from materials. In this study, *Shewanella oneidensis* and *Acidithiobacillus ferrooxidans* has been used as bioreduction and biooxidation agent, respectively. *Shewanella oneidensis* reduced Fe^{3+} to Fe^{2+} (Bennett, 2017) while *Acidithiobacillus ferrooxidans* metabolized iron and sulphur (Valdés et al., 2008). Normally, cyanidation is used extensively to extract gold, however it is not environmentally friendly. Therefore, bioleaching was proposed since it was economically extract gold while also being environmentally friendly. This study aimed to determine the efficiency of bioleaching process including biooxidation and bioreduction process in gold extraction by using *Shewanella oneidensis* and *Acidithiobacillus ferrooxidans,* respectively. The rock sample from Gua Musang were provided by Benua Sunda Cari Gali Sdn Bhd. The provided sample was sieved to 32um and its composition was determined using XRD analysis. Inoculum was added to the liquid media containing the samples, which was then cultured in an incubator shaker at 30°C for 20 days. The samples were then dried at 100°C before going through the Aqua regia process. Then, the gold yield concentrations were analyzed by ICP-OES. As a result, the bioxidation and bioreduction processes increased the gold concentrations from 19 ppb to 28.5 ppb with a 50% yield increase and from 320 ppb to 520 ppb with a 62.50% yield increase, respectively. In addition, hematite and magnetite in the samples was also reduced after bioleaching which might lead to the increasing amount of gold concentration. As a conclusion, it was determined that bioleaching method were successful in enhancing the gold extraction process

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SERiES22-59

THE EFFECT OF ANNEALING TEMPERATURE ON MECHANICAL PROPERTIES AND MICROSTRUCTURE OF STEEL GRADE SS 400

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Heat treatment is a method of altering the physical properties of a material for the greater way. A material is typically heated to a desired temperature during a heat treatment process, at which point its physical properties change. The temperature is then gradually lowered at controlled rate [1]. Carbon steel is the most often used metal and malleable iron-based metal with traces of silicon (Si), manganese (Mn), and phosphorus (P). Steel grade SS400 also known as a low carbon or mild carbon steel has good magnetic characteristics due to its high iron content. Along with its weldability and machinability, the steel is frequently utilized as structural steel [2].

Although the influence of annealing temperature on various steel grade has been well researched, there are limited study on full annealing on SS 400 steel grade [3]. The purpose of this study is to investigate the effect of annealing temperature on electrical resistivity, mechanical properties and microstructure of steel grade SS 400. Annealing process was performed at different temperatures of 900°C, 940°C, 980°C and 1020°C with 20 minutes soaking time followed by slow cooling in the furnace. Electrical resistivity analysis of the annealed samples was done by using four-point probe, mechanical properties were conducted based on ASTM D790 for flexural test, while microstructure composition was determined by using X-Ray Diffraction (XRD). From characterization analysis, the result of electrical resistivity showed increment at high annealing temperature from 2.58 μΩ.m to 4.00 μΩ.m due to annealed steel exhibit more resistance because it is more difficult for electrons to move from one atom to another in the material due to larger grain size. Flexural strength test result show that it will slightly decrease from 620.80 MPa to 375.77 MPa with increasing of annealing temperature. This shows that the greater a material's flexural modulus, the more difficult it is to bend. Furthermore, the phase composition from X-Ray Diffraction (XRD) analysis shows the growth of α-Fe grains of steel grade SS 400 after the annealing treatment of 1020°C.

As a conclusion, the study shows that the electrical resistivity increase and flexural strength decrease in varying degrees as the annealing temperature rises while the microstructure of steel grade SS 400 at higher annealing temperature differs from as-received sample.

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SERiES22-60

PETROGRAPHY & GEOCHEMISTRY OF METAPSAMMITE AND METAGRANITE ROCKS FROM LUK ULO COMPLEX, CENTRAL JAVA, INDONESIA

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The Tertiary various type of rock exposed unconformably in Luk Ulo Complex. This complex consists of various type high-pressure metamorphic rocks, sedimentary rocks, ophiolites and volcanic rocks. Field observation shows metapsammite and metagranite rocks were crop out as small boulders (±1 m) at the junction of Loning and Luk Ulo River. These metapsammite and metagranite rocks were analysed by petrography and geochemistry analyses.

Petrography analyses of 30 samples of metapsammite and metagranite rocks from Luk Ulo Complex give out the data that showing clear foliation of biotite and muscovite minerals, plagioclase and graphic texture which is intergrowth of quartz and alkali feldspar. Based on detailed observation of metapsammite and metagranite rocks from Luk Ulo Complex can be grouped into 2 groups based on texture and mineral compositions. The first group is hornblende bearing metapsammite and metagranite rocks which indicate from magmatic activity. The second group is garnet bearing metapsammite and metagranite rocks commonly having foliation which indicate from metamorphic origins.

The geochemical analyses were carried out know the characteristics of major, trace and rare earth elements by using XRF and LA-ICP-MS. The data categorized the protolith of hornblende bearing metapsammite and metagranite rocks as Cordilleran granitoids (I-type) that come from magmatic arc with basaltic differentiation while the protolith of garnet bearing metapsammite and metagranite rocks were categorized as Caledonian granitoids (S-type) that form resulted of post-collisional orogeny.

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SERiES22-62

SYNTHESIS OF COLORED SMOKE BOMB WITH POTASSIUM NITRATE (KNO_3) AS THE OXIDIZER

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Pyrotechnic smoke is very commonly used in the military as a weapon and in photography as a background effect. The smoke bomb can sabotage, deceive, and can paralyze the enemy forces as well as a signal beacon. Coloured smoke bomb mixture consists of oxidizer, fuel, coolant, and dye. Commonly, potassium chlorate is used as an oxidizer for the smoke bomb. However, the toxicity issue of the usage of potassium chlorate as an oxidizer rises. Thus, an alternative of oxidizer is needed to be studied to give options of oxidizer in smoke bomb mixture. In this study, potassium nitrate was used as an oxidizer, sugar as fuel, magnesium carbonate as a coolant, and dye for the colouring agent. The author conducted three trials which having the oxidizer, fuel, and coolant as the manipulated variable in each trial. The smoke output, ignition time, and burn time of the smoke bomb was observed to determine the best smoke bomb mixture ratio. The objective for this study is to design a smoke bomb mixture using potassium nitrate as the oxidizer and develop a component ratio between the oxidizer, fuel, and coolant. This study only covers the ratio of the smoke bomb composition which gives the best color output, best ignition time and the longest burn time. As conclusion, best-looking coloured smoke bomb with ratio of 50 wt% of KNO_3, 20 wt% $MgCO_3$ and 30 wt% sugar gives the best results with 5s ignition time and 120s burn time with consistent colour opacity and thickness of the smoke. The smoke bomb composition was successfully developed but needs more improvement in the future studies.

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RECENT METHODS OF LIGNIN DEMETHYLATION: A MINI REVIEW

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The methoxy group is the most abundant functional group of lignin and affects the properties, reactivity, and applications of lignin. Efficient demethylation is always of interest in the area of lignin chemistry and application. For the lignin structure, the unsubstituted carbon at the C3 or C5 position on the aromatic ring is reflex on its activity. For that reason, the lignin needs a higher temperature and longer pressing time to produce crosslinkers bonds such as phenolic resin, furfural, and ethylenimine to achieve the appropriate modification to enhance the reactivity of lignin. Several lignin modification methods, such as hydroxymethylation, oxidation, reduction, hydrolysis, phenolation, and amination, can be effective in increasing lignin reactivity; however, all these modifications have significant drawbacks. Demethylation is the most common modification for incorporating lignin into phenolic compounds. Demethylation under mild reaction conditions has become clear to be an effective and potential method. However, the degree of demethylation of lignin differs because the effectiveness of this process is affected by the lignin type and process due to the reactive sites available for different lignin types. Dimethyl formamide and iodocyclohexane, Na_2SO_3 and HI are greater effects nucleophilic demethylation reagents. Acidic concentrated lithium bromide (ACLB) had a higher selectivity of demethylation and fungi species such as Aspergillus sp. and Cylindrocladium sp. all these reagents were demethylated to varying degrees of effectiveness.

Keywords: methoxy group lignin structure, lignin modification, lignin demethylation development.

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SIMULATION OF BIO-LNG PRODUCTION USING ASPEN HYSYS

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Bio-LNG, also known as liquefied biomethane (LBM) is a highly sustainable version of LNG, with almost the exact same chemical compositions and inherits similar physical and chemical properties. Bio-LNG is increasingly recognized as a sustainable option that can be dropped and blended with LNG, with no changes required onboard the vessel, as fuel for the existing LNG bunkering infrastructure and can be re-gasified and injected in the natural gas pipeline In order to fulfill the demand of energy, biomethane gas need to be transported to the end users. However, transportation in gaseous state is seemed uneconomic especially involving long distance and trans ocean. Therefore, liquefaction of bio transportation an alternative way for the transportation instead of using existing pipeline. Although the processes are extremely energy demand, it is desirable to study the potential of energyefficiency in liquefaction processes. This paper aims to develop simulation models of bio-LNG production consisting three main cycles, and to evaluate and compare performances of those three cycles. The liquefaction cycles namely i) Double-mixed Refrigerant (DMR), ii) Propane Pre-cooled Mixed Refrigerant (C3MR) and iii) Cascade. A model of each cycle have been constructed by using ASPEN HYSYS simulator. A published parameters of treated biogas feed were introduced to each of the cycles. Then, validations against the published results were done and comparative evaluations for the performances focusing on energy consumption and economics using Aspen Economic Analyzer. For DMR, simulation results show that total energy consumption, total capital cost, operating cost and utilities cost are 968.111 MW, 73,139,000 USD, 19,801,300 USD/year, and 14,263,800 USD/year, respectively. C3MR cycle show 815.7392 MW, 12,908,000 USD, 50,547,500 USD/year and 45,788,500 USD/year, and for cascade cycle, 964.420 MW, 10,575,000, 7,617,130 USD/year, 6,038,230 USD/ year, in that order, value of bio-LNG flowrate for the three cycles at 6239m3 /hr, the product production cost for DMR, C3MR and Cascade cycle are 11.72 USD per m3, 2.17 USD per m3, and 1.78 USD per m3. This study demonstrates how energy-efficiency of each cycle influenced the total production cost. KEY WORDS: Bio-LNG; DMR; C3MR; Cascade; Liquefaction Cycle.

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Evaluation of Alternative Approach for Missing Rainfall Data Filling in Kuantan River Basin

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Researchers in hydrological studies frequently encounter missing data. Hydrological data, particularly rainfall data, is very sensitive to being overlooked for a variety of reasons, including equipment failure, inaccurate readings, and station relocation [1, 2]. These issues may compromise the quality of rainfall data, resulting in inaccuracy in analysis results. The objective of this study is to find the relationship between observed and TRMM rainfall data and to estimate the missing rainfall data in Kuantan River Basin using alternative approach. The rainfall data were collected from three different sources which are observed rainfall data from Department of Irrigation and Drainage (DID), meteorological rainfall data from Malaysia Meteorological Department (MMD) and TRMM rainfall data from NASA website. Based on the available rainfall data, XLSTATS Software was used to estimate the missing values. The methods that being used for imputation is Markov Chain Monte Carlo (MCMC), Replace by Mean, Nearest Neighbor, Value imputation, Non-linear Iteration Partial Least Square (NIPALS) and EM algorithm. In order to assess the method's performance, the results were compared to the conventional approach which is station average method. Eight rainfall stations in Kuantan River Basin were chosen to test the imputation methods. The outcomes for this study have proved that Replace by Mean, MCMC and Nearest Neighbor method are the best approach in order to estimate the missing rainfall data for all the station in Kuantan River Basin. This study's findings provide a full rainfall dataset that may be utilized to evaluate future hydrological studies.

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SERiES22-66

LAND USE AND LAND COVER (LULC) CLASSIFICATION IN KUANTAN RIVER WATERSHED USING VARIOUS SATELLITE IMAGERY

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Kuantan district has undergone rapid development and the land has been explored over the past few years, changing the land usage to various industries and purposes. The land use and land cover (LULC) changes has resulted a major threat to natural resources especially in water resources in term of its water quality and quantity [1]. It is also has affected local hydrology in river basins. In fact, identification of land cover type is vital to generate comprehensive hydrological modelling as a baseline data. In addition, use of remote sensed data from satellite imagery with the combination of Geological Information System (GIS) has become one of the effective tools to generate and monitor LULC map changes [2]. Therefore, we did an experiment in our study area, Kuantan, Malaysia and the outcomes were compared with qualitative and quantitative analysis to come up with best performance. In this study, the aim is to produce LULC classification map of Kuantan River watershed using unsupervised classification from Landsat-8/9 OLI, Terra-Moderate Resolution Imaging Spectroradiometer (MODIS) [3], and Sentinel-2 satellite image. Ancillary imageries from local authority agencies were used to enhance clustering. The map results from ISODATA (Iterative Self-Organizing Data Analysis Technique) unsupervised classification and supervised classification (maximum likelihood method) were compared with its correlation between normalized difference vegetation index (NDVI), standardized difference accumulation index (NDBI) and normalized difference water index (NDWI) in order to rectify the of the final classification. Post-classification was done using a confusion matrix for accuracy assessment. A total of 5 major classes with vegetation, building, concrete area, bare soil and water were produced. Result shows that the Sentinel-2 poses high accuracy of clustering followed by Landsat 8/9 OLI and MODIS respectively. In short, an acceptable result was achieved with all the data is in range of an acceptable significant interval of p-value which is less than 0.2 (20%).

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Effect of Different Concentration Polyethylene Glycol on Polysulfone Membrane in Filtration Process

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Currently, the used of PEG additives in membrane polymer has become major attraction for researchers due to its ability as hydrophilic properties, which can optimize membrane structural morphology surface and performance in filtration process. However, there is still lacking information on the effect of different concentration of PEG on membrane performance in filtration process. Therefore, this research has been carried out to identify the effect of PEG additives with different concentration (0.5,1.0,1.5,2.0 wt%) on Polysulfone polymer membranes. Flux analysis has been conducted to observe membrane performance in filtrate humid acid solution. In addition, phase inversion method has been carried out by preparing dope composition for membrane solution by mixing PEG in 16 wt% PSF and the rest was filled by dimethylacetamide (DMac) as solvent medium. As a result, the membrane physical properties of fabricated membrane such as contact angle, porosity, mean pore radius and SEM has been revealed.

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Ecological Connectivity Network for Malayan Tapirs (*Tapirus Indicus*) at Chini-Bera Forest Complex, Pahang, Peninsular Malaysia

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In peninsular Malaysia, land use and land cover (LULC) change significantly affects the composition and configuration of forest patches. Much of them reduced in size while others are fragmented or isolated which surrounded by human dominated landscapes. For wildlife conservation purposes the Master Plan of Ecological Linkages has proposed ecological corridors at Chini-Bera forest complex to connect the forest patches to form ecological network. Nevertheless, the analysis of patch size, patch distance and LULC that are reliable for potential ecological network are unexplored. Thus far, little evidence on their reliability for wildlife ecological network especially Malayan tapirs (*Tapirus indicus*). Therefore, this study aims to identify reliable patches for Malayan tapirs (*Tapirus indicus*) ecological network. This study mainly uses geographic information system and remote sensing techniques that involve the processing of satellite images to develop landscape data of the study area. The data used in network analysis which involve the application of landscape models, circuit-theory and linkage mapper to identify the reliable patches. The outcomes are useful to improve conservation planning of Malayan tapirs (*Tapirus indicus*) and for sustainable land use planning at the forest complex.

Keywords: Tapir, Bera-Chini forest complex, Circuit Models, Connectivity Analysis, Least Cost Path Model, Biodiversity Conservation

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SERiES22-69

CHEMICAL WEATHERING OF S-TYPE GRANITE AND MINERALOGY CHARACTERISTIC OF ION-ADSORPTION TYPE REE DEPOSIT IN NILAI-SEMENYIH SAPROLITE HORIZON

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Ion-adsorption type rare earth elements (REE) deposit are widely known formed by weathering process of igneous rocks (typically granites) that contain REE-bearing minerals. The bulk of REE in granites are hosted in accessory rather than rock-forming minerals. These accessory minerals can be subdivided into three groups: (1) strongly resistant to weathering - xenotime, apatite and zircon; (2) moderately resistant to weathering - monazite, allanite, and (3) weakly resistant to weathering - bastnaesite, parisite, cerianite, synchysite (REE-fluorocarbonates group). The occurrence of REE-fluorocarbonates in granites rock is important for the formation of ion adsorption deposits because they are more easily dissolved than silicates, oxides and phosphates in moderately low pH soil waters during chemical weathering process. A research study has been made in discovery the ion-adsorption type REE prospecting in Nilai-Semenyih saprolite horizon as the results from chemical weathering process of S-type granites. Formation of the thick saprolite profile is closely associated with some specific lithological factors of its parent granite. Contrastingly, it has coarse-grained with equigranular and porphyritic textures, wider microcracks, as well as higher biotite and plagioclase contents, which is expected to be more conductive to enhance water-rock interaction and drive deep weathering. The main REE-bearing minerals in the S-type granites are zircon, apatite, monazite and cerianite with total REE concentrations range from 329 to 420 ppm in the parent granite. The REE-bearing minerals (zircon, apatite, monazite and especially cerianite), are critical REE source mineral in supplying mobile REE to the saprolite, through which REE have access to be fixed by clay minerals (mainly kaolinite and illite) and then developed ion-exchangeable form enrichment in the saprolite. This evidence indicate that the granite lithology exerts a principal influence on the formation of thick and REE-rich saprolite through fundamental control of chemical weathering and REE mineralogy input. Moreover, this study finds that, the S-type granite particularly in Nilai-Semenyih province seems potential in generating ion-adsorption type REE deposit by weathering process.

Keywords: Rare earth elements, Ion-adsorption type, S-type granite, REE-bearing minerals

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SERiES22-70

BCR Leaching Procedure to Evaluate the Mobilization Behavior of Ion Adsorption Type REE Deposit in I-Type Granite Weathering Profiles

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Rare earth elements (REE) with specific application value have become the relatively important strategic resource for all countries. These so called 'technology minerals' are in increasing demand due to rapidly rising use in consumer technology, renewable energy generation systems, automotive industry, and other high technology sectors. In order to provide information on the chemical processes in mobilization behavior of ion-adsorption type REE, this study investigated the extraction of REE from ion-adsorption clay deposit samples from weathering I-type granite profiles (saprolite horizon) at Maran, Pahang and Mersing, Johor (Eastern Belt of Peninsular Malaysia). Using a 0.5 M ammonium sulfate solution (adjusted at pH = 4), samples were leached in 1 hour through a Bureau of Certified Reference (BCR) leaching using BCR-701 standard, chosen based on experimental evidence to optimize the leachable REE. The Al2O3 concentration (27-31 wt.%) in saprolite horizon indicates depleted (change <0%) in mobile major (alkali and alkaline earth) elements, most conspicuously in the upper parts of the weathering profiles. The total REE concentrations in saprolite samples is between 438 – 453 ppm and experimental results revealed 70% of ∑REE was leached as ion-adsorption fraction. Saprolite horizon is strongly depleted in Fe and Ti and this depletion in Fe and Ti suggests that REE-bearing minerals containing these elements were broken down and were mobilized in this horizon. Therefore, BCR leaching was proven to be the potential leaching process and could be useful to assess ion-adsorption type REE deposit with low-grade geological resources, especially granite weathering profiles with similar geological settings.

Keywords: BCR leaching, Ion-adsorption type, I-type granite, mobilization

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SERiES22-71

FEASIBILITY STUDY RECOVERY OF LANTHANUM, CERIUM, PRASEODYMIUM, NEODYMIUM, AND YTTRIUM FROM MALAYSIA SAPROLITE BY HDEHP-HCL CASCADE FRACTIONAL SOLVENT EXTRACTION

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Malaysia's rare earth elements from saprolite are highly potential to be recovered as an alternative resource to China's rare earth supply due to its high concentration of non-radioactive rare earth elements source. Separation of high purity lanthanum, cerium, praseodymium, neodymium, and yttrium obtained from Malaysian sources required multi-stages of solvent extraction and a multi-separation circuit. A massive number of multi-stage fractional solvent extraction is necessarily attributable to the similarity of physiochemical properties of an adjacent element. Process design, data analysis, and prediction of process behavior of rare earth element extraction are multifaceted tasks. Process simulation is an ideal candidate for this complex task. The application of Xu's cascade extraction principles for process simulation of separation of lanthanum, cerium, praseodymium, neodymium, and yttrium is discussed in this paper. An HDEHP-HCl cascade fractional solvent extraction simulation model has been used to simulate the elements' recovery from Malaysia saprolite. All the process properties, estimation of separation stages, purity, and recovery behavior are determined by Xu's cascade extraction principles. Process simulation results mapped out the space feasible cascade fractional solvent extraction circuits and identify the optimal design parameter required to achieve the targeted purity and recovery. Material distribution and balance tables are used to evaluate the separation of the elements in each stage from the initial stage to the final stage. The production output is measured by predicting the output of lanthanum, cerium, praseodymium, neodymium, and yttrium extraction. Even though it lacks an optimization attribute, it is crucial to get an insight into the recovery worthiness of the elements from a particular source. The process simulation predicts the separation stages (extraction and scrubbing stages), the recovery behavior of each circuit, and the production output of lanthanum, cerium, praseodymium, neodymium, and yttrium

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SERiES22-72

TECHNOSPHERIC MINING OF RARE EARTH FROM MALAYSIAN TIN TAILING

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Technospheric mining refers to the extraction of the valuable elements from technospheric stocks. One of the common, disregarded and valuable stocks available for rare earth is the tailing from the mining process. In this study, the tailing from the tin mining processes were evaluated for rare earth recovery. Three main processes were discussed; a) physical separation b) leaching c) solvent extraction. The targeted minerals in the physical separation process were xenotime, monazite and tourmaline. After the separation, the rare earth percentage from the minerals was increased from 5.22%to 63.91%. The leaching process continues with dissolution of the tailing into sulfuric medium at different concentration and duration. The best condition was at 2.5M sulfuric acid for 24 hours, with a leaching percentage of 89.73%. The leachate containing six rare earth elements were then separated into their respective group: a) light rare earth b) heavy rare earth and c) middle rare earth. The pH, acid to organic phase ratio and number of cycles were evaluated during the extraction process. It was found that the rare earth groups can be separated at different pH for each group. At the end of the process, the recovery and purity of each group reached at least 90%. The results proved that the valuable metals from the tin tailing can be recovered and the copious amount of tin tailing in Malaysia can be reduced to help save the environment and minimize the waste.

Keywords: rare earth; extraction; technospheric; physical separation; solvent extraction

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SERiES22-73

INTEGRATION OF USAGE COMMIPHORA GILEADENSIS AND VALUABLE BIOACTIVE COMPONENTS FOR VARIOUS MEDICINAL APPLICATION: A BIBLIOMETRIC ANALYSIS

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The usage of herbal remedy is growing vividly all around the world. Nowadays there is a need to find naturally occurring substances from plants with bioactive components as an alternative to available used antibiotics. Commiphora gileadensis is one of the significant medicinal plant that used traditional and futurity. Commiphora gileadensis is also known as balsam, was renowned for the expensive perfume that was produced from it, as well as for exceptional medicinal properties that were attributed to its sap, wood, bark, and seeds where this tree species is important economically and medicinally. The medicinal potential of C. gileadensis plant is because of the occurrence of secondary phytoconstituents which have numerous functions such as antioxidant, antimicrobial, cytotoxic, anticancer, and antiviral. Various studies have been undertaken on the integration of the ecological and biological properties of the C. gileadensis. However, ere has been no attempt of scientometric analysis to explore the holistic understanding of the above-mentioned plant. The purpose of this research is to carry out a bibliometric analysis of the available C. gileadensis plant literature nd to provide a picture of the research status from 2010 to September 2022. There were 31 documents extracted from the database of Scopus. VOSviewer tool was used to visualize the literature contained through countries, scientific journals, and keywords. The outcomes showed that “Antibacterial”, “Antioxidant”, “Anti-microbial”, “Anticancer” and “Sustainable Medicinal Plant” were lately risen to prominence as mainstream topics associated with this field and piqued the curiosity of academics, which may represent future research possibilities as well. Furthermore, based on the most keywords frequently utilized, seven important research domains linked with C. Gileadensis have been identified, including “Balm of Gilead”, “Balm of Judea”, “Apharsemon”, “Opobalsamum”, “Mecca Balsam”, “Besham (Becham)’’ and “Myrrha”. Accordingly, the explanations related to research outcomes, recommendations for future studies have been provided on the integration of the C. Gileadensis usage and its Valuable Bioactive Components for multi-Medicinal application.

Keywords: Balm of Gilead, Commiphora Gileadensis, Bioactive Components, VOSviewer

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SERiES22-74

DOWNREGULATION OF QUORUM SENSING IN BIOFILM PRODUCING WATER-BORNE PATHOGEN, *PSEUDOMONAS AERUGINOSA,* BY FATTY ACID METHYL ESTERS

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Pseudomonas aeruginosa is highly versatile in adapting to harsh environment of water purification system where an extensive treatment and disinfection processes occur rigorously. *P. aeruginosa* versatility is primarily contributed by its multifactorial, quorum sensing network. In this study, we isolated fatty acid methyl esters from *Piper betel* leaf and investigated its effect on the expression of the quorum sensing genes of *P. aeruginosa* from the *las* and *rhl* pathways. When grown with fatty acid methyl esters at 100 µg/L, all tested genes showed a significant reduction in their expression by almost half, as compared to the untreated sample. With a disturbed quorum sensing mechanism, the production of virulence factors; elastase, protease, and pyoverdine; in fatty acid methyl esters-treated *P. aeruginosa* were found to be decreased significantly. Formed biofilm by *P. aeruginosa* was notably distorted and reduced in the treated sample. The work presented suggests the ability of fatty acid methyl esters to act as natural disinfectant against *P. aeruginosa*, with an advantage of least possibility in inducing drug resistance in the water-borne pathogen.

Keywords: Fatty acid methyl esters, *Pseudomonas aeruginosa*, quorum sensing, biofilm, water-borne pathogen.

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SERiES22-75

LANDSLIDE SUSCEPTIBILITY MAPPING AND ASSESSMENT IN SABAH MALAYSIA: A COMPARATIVE TECHNIQUE OF GIS-BASED STATISTICAL MODELS AND HOLISTIC ENVIRONMENTAL FACTORS

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Landslides in Malaysia are mostly caused by heavy and sustained rains, which are often related to monsoon downpours. Sabah has been also experiencing a significant amount of rain and is prone to landslides due to heavy rainfalls and several environmental factors. This study created GIS-based landslide susceptibility maps (LSMs) and compared the prediction accuracy results in Kota Kinabalu, Penampang, and Tambunan. The dataset of rainfall, road network, Digital Elevation Model (DEM), land cover, geology, lithology, past landslide inventory, and Landsat 8 satellite images were utilised in the development of the LSMs. These dataset produced 15 causative factors of the landslide, including slope, aspect, terrain raggedness index (TRI), terrain wetness index (TWI), stream power index (SPI), sediment transport index (STI), distance from stream, rainfall distribution, lithology, geology, plan curvature, profile curvature, land cover, normalized difference vegetation index (NDVI), and distance to road. The susceptibility rates of the causative factors were computed for producing the LSMs using the model of frequency ratio (FR), Shannon's entropy (SE), and information value (IV). The validated LSMs were evaluated with a receiver Operating Characteristic (ROC) curve and the Relative Landslide Density Index (R-index). The key finding showed the most influential factor of the local triggering landslide was lithology, while the FR model had the highest accuracy, with a fitting ROC area of 0.890. It was found approximately 576.008 km² or 25.68% of the total area were categorised as a very high and a high landslide risk class (Figure 1). Previous seven over the nine landslide events occurred at the Western Penampang and Southern Kota Kinabalu and were also concentrated at the potential risk areas. The local agencies could use this comparative findings to enhance the better management of landslide mitigation risk system in the state.

This work was technically supported by Faculty of Architecture, Planning and Surveying, Universiti Teknologi MARA (UiTM), Selangor, Malaysia

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SERiES22-76

SPATIAL PATTERN OF AIR POLLUTANTS DURING THE COVID-19 MOVEMENT CONTROL ORDER IN KLANG VALLEY, MALAYSIA

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This study analysed the spatial pattern of air pollutants in Klang Valley during the COVID-19 Movement Control Order (MCO) from November 2019 to December 2020. The areas cover Batu Muda, Cheras, Klang, Petaling Jaya and Shah Alam. The first objective of this study was to analyse the spatial pattern of individual pollutant distribution in 2 months before and after the MCO, including Particulate Matter 10 (PM10), Particulate Matter 2.5 (PM2.5), Nitrogen Dioxide (NO2), Sulphur Dioxide (SO2) and Ozone (O3). The second objective was to examine the temporal pattern of the pollutants distribution during the MCO based on the weekly average readings from week 1 to week 8 of the MCO phases. The main dataset were collected from the Department of Environmental Malaysia, while Inverse distance weighted (IDW) of the spatial Interpolation method utilised to map and analyse the pollutant distribution. The first result showed there was a variation pattern for the pollutants. The status of air quality before to during the MCO indicated a better condition than from during to after the MCO except for O3 (Figure 1). The PM10 was identified as major contributor for the air pollution, especially in the highest air pollution areas; Klang, Shah Alam and Petaling Jaya. The second finding revealed that most of the pollutant concentrations were decreasing from week 1 to week 3 at every air quality monitoring stations. The concentration was then slightly increasing from week 3 to week 5 and towards an increasing pattern for week 6 to week 8. This finding was also consistent with the previous studies where the average of Air Pollutant Index (API) before the MCO, during the MCO I, MCO II, MCO III, Recovery MCO and Conditional MCO were much better from 1st phase to 4th phase of the MCO. MCO is not only able to curb the spread of COVID-19 disease, but also reducing air pollution effecting on environment-human health.

This work was technically supported by Faculty of Architecture, Planning and Surveying, Universiti Teknologi MARA (UiTM), Selangor, Malaysia

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SERiES22-77

CHARACTERIZATION OF MG-RICH GYPSUM WASTE AND PEAT SOIL

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The stabilization of problematic soils with chemical additives has increased in demand globally. Highly development of industrial plants made an urgent need to utilize all types of soils even the problematic soils such as organic, marine clay, lateritic or expansive clay. The use of industrial waste by-products namely Magnesium-rich gypsum for improving the weak characteristic of peat soil have not been investigated. This paper investigated the mechanism of gypsum that contributes to the compressibility of peat soil, a typical soil in Malaysia. The optimum combination of the additives into the soil was further examined by physicochemical properties by analytical techniques such as pH, scanning electron microscopy (SEM), X-ray fluorescence (XRF), and Fourier infrared spectroscopy (FTIR). This technical paper is more on comparison of theoretically analyzing the characteristics of peat and gypsum that have the potential to be strongly mixed and improve the characteristics of peat soil. The significance of this result shall contribute to the potential application of industrial waste by-products by recycling methods for soil improvement techniques.

Keywords: Chemical Soil Stabilization; Peat Soil; Mg-Rich Gypsum; Soil stabilization; Chemical Additives

This work was supported by the Universiti Malaysia Pahang for laboratory facilities as well as additional financial support under Internal Research grant RDU210342 and RDU223305.

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SERiES22-78

Application of Two-Level Factorial Design to Determine Yield Inulin Production Via Enzymatic Reaction Using Citrullus Lanatus as an Alternative Substrate

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Citrullus Lanatus (C.Lanatus) or watermelon is non-seasonal fruit which growth abundantly across Malaysia. Thus, handling fruit waste becoming an environmental issue as it requires a wise waste disposal method. *C.Lanatus* has many health interest and function such as hydrating with high water content while reduce digestive problem regarding its chemicals and biological compounds. This study focusing on the enzymatic reaction from *C.Lanatus* waste. A two-level factorial design was used for initial screening of the following independent factors, substrate concentration (10-45 %w/v), enzyme concentration (60-90%w/v) and temperature (35-60°C) to determine yield from enzymatic reaction. Among all the factors, they are all significant but substrate concentration is most significant ($p< 0.0003$) nearest to ideal p-value 0.0001 in obtaining higher yield, whereas enzyme concentration and temperature has bigger value than p-value. In conclusion, all the factor will be proceed to optimization process using Central Composite Design (CCD).

Keywords: Citrullus Lanatus, factorial fractional design (FFD), inulin, invertase

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SERiES22-79

Physical and Chemical Properties of Basalt in Pahang

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Basalt is an extrusive igneous rock derived from lava and spread over different localities in Pahang. Kuantan basalts represent one of the largest bodies of basic extrusive in Peninsular Malaysia. Many studies of basalt rock focused on geochemistry and petrology and lacked comprehensive engineering investigations on Pantai Batu Hitam basalt rock. Thus, this study has investigated basalt rock's physical and chemical properties in Pantai Batu Hitam, Kuantan. The specimens were collected from different sites and prepared according to the International Society for Rock Mechanics Standard. Results exhibited that the basalt rocks in the studied location are classified as crystalline texture with a range of density (2.52-2.65), specific gravity (2.38-2.56), absorption values (0.92% - 0.97%), and rebound number of Schmidt hammer hardness test is average 44. The chemical composition of basalt rock specimens consists of of SiO_2 (41.52% - 44.56%), Fe_2O_3 (12.36% - 16.54%), Al_2O_3 (12.30% - 13.10%), CaO (11.20% - 13.71%), MgO(4.14% - 6.54%) and K_2O (4.30% - 5.95%) respectively. It indicates that the engineering properties of basalt in Pantai Batu Hitam, Kuantan is comparable with European countries. Therefore, this study supports using basalt rock from Kuantan for industrial applications such as basalt fiber, cast, and ceramic

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SERiES22-80

An Evaluation of Natural Disinfectant for the Treatment of Fungal Contamination in Drinking Water Distribution System

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Water must be pure and free of any contaminants for human consumption. However, due to indiscriminate human activity, its quality has worsened, resulting in many illnesses that plague humanity, particularly in developing nations. Promising water treatment procedures are considerably more expensive, and many of the disinfectants now in use are toxic, making the hunt for safer organic alternatives even more difficult. *Moringa* seeds and *Neem* leaves have long been used to clean drinking water and minimize the health concerns associated with microorganisms in rural communities. Using central composite design (CCD) in response surface technique, the parameters identified as the essential components, dose, duration, and agitation, were chosen to assess their influence on eradicating the growth of fungal communities in the drinking water by response surface methodology (RSM). The CCD was done with two complete factorial combination components at five distinct levels. The typical two fungi widespread in the drinking water samples have selected *Aspergillus sp*. (73%) and *Rhodotorula mucilaginosa* (63%). Fungal mycelia growth gradually decreased with increased concentration of *Moringa oleifera* seeds and *Neem* leaves extract and chlorine on *Rhodotorula mucilaginosa* and *Aspergillus sp*. The modified determination coefficients (adj R^2) for the CFU of *Moringa* seeds were also 0.8122, 0.8405 and 0.8319, 0.8870 for *Neem* leaves. This study aims to highlight the performance activity of natural disinfectant while treating drinking water in distribution system instead of using rapid usage of chlorine in the traditional method. This study found that *Moringa oleifera* seeds and *Neem* leaves extract have antifungal action against contamination fungal at all concentrations similar to chlorine. Using *Moringa oleifera* seeds extract and *Neem* leaves as a disinfectant on *Rhodotorula mucilaginosa* and *Aspergillus spp*. in treating drinking water is a viable alternative. This method would significantly reduce the high costs and health concerns of current chemical water treatment methods. The method is traditional and simple to apply, making it suitable for rural regions. It also produces no non-treatable wastes because it is biological.

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SERiES22-81

METHODS OF TREATING OILY SLUDGE: A REVIEW ON CURRENT TRENDS

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Oily sludge is a highly stable water-in-oil (O/W) and oil-in-water (W/O) emulsions that are mainly generated during the refinery and production of petroleum industries. This hazardous scheduled waste contains crude oil, water, solid particles, heavy metals, and heteroatoms. The physicochemical properties of oily sludge differ from one source to another depending on the oilfield type, soil composition, and storage conditions. Treating this ecological threat has been of extreme importance and the focus of thousands of studies. Many technologies and treatment methods such as solvent extraction, ultrasonication, demulsification, microwave irradiation, centrifugation, and freezing/thawing have been introduced to treat oily sludge and retrieve valuable resources. Thus, this article reviewed previous studies on the treatment methods based on the level of oil recovery and economic feasibility. Having studied different published articles, effective combined treatments were established for future studies.

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SERiES22-82

THE IMPACT OF MOTIVATIONS BEHIND MALAYSIA'S ENERGY INITIATIVES

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This research examines Malaysia's involvement in activities which render energy as the subject and/or object of foreign policies, either via bilateral or multilateral engagements, from the perspective of Neoliberal Institutionalism. Malaysia's increased involvement in the global energy market necessitates this research which seeks to determine the significance of energy in Malaysia's economy and diplomacy, to understand Malaysia's motivation for its involvement in these co-operations. For this research, information is obtained through various official sources, interviews, published statistical data and past studies. The research shows that energy contributes significantly to Malaysia's economy. Malaysia's involvement in Lao PDR-Thailand-Malaysia-Singapore Power Integration Project (LTMS-PIP) initiative demonstrates the viability of multilateral electricity trade in the region. The Four-Fuel Diversification Policy 1981 (4FDP 1981) which increases natural gas utilization and the construction of the Peninsula Gas Utilisation (PGU) pipeline in Peninsular Malaysia are related to Malaysia's involvement in Malaysia-Thailand Joint Development Area (MT-JDA), whereas these initiatives contribute towards enhancing Malaysia's energy security, Malaysia can still play proactive roles in regional energy cooperation, as regional energy hub or transit state. Malaysia might also want to consider consolidating its energy administration for efficiency. Malaysia's experience in negotiating for JDA is also useful in addressing the current disputes in South China Sea.

Keywords: Energy diplomacy, Malaysia-Thailand Joint Development Area, Regional cooperation.

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SERiES22-83

Effect of Ground Cockle Shell Ash as Ash Partial Cement Replacement on Compressive Strength of Mortar

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Expanding population creates an increasing demand for more infrastructure to be constructed and a larger food supply that boosts the growth of the related industries. Rising limestone harvesting for cement production to cater to the need for widely used concrete in construction has a destructive impact on the green environment. Simultaneously, the cockle industry which supplies cockles for the food industry also generates cockle shells that are disposed of as waste and pollute the environment. The present research investigates the potential use of cockle shell ash as partial cement replacement in mortar. A total of 5 mortars were prepared by varying the percentage of cockle shell ash used ranging from 0, 10, 20, 30, 40, and 50%. All mortar cubes were subjected to water curing. Two types of testing were carried out namely the flowability test and compressive strength test. Findings show that the flowability of mortar increases as a larger quantity of cockle shell ash is used. Cockle shell cement-based mortar exhibits continue strength increment with curing age. A combination of 10% cockle shell ash contributes to the strength enhancement of mortar. Excessive use of cockle shell ash should be avoided as it results in significant strength declination. Conclusively, the approach of utilizing cockle shell waste for cement production contributes to a cleaner and green sustainable environment.

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SERiES22-84

PARAMETRIC STUDIES ON RADIATION GRAFTING OF TRIPROPYLENE GLYCOL DIACRYLATE ONTO WASTE TIRE DUST

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Waste tire dust (WTD) was activated and modified via an electron beam to graft with tripropylene glycol diacrylate (TPGDA) monomer. This process was investigated in conjunction with reaction parameters namely, monomer concentration, absorbed dose, grafting temperature and grafting time. The effect of grafting conditions on the grafting yield (GY) was investigated. It was found that GY increased with the increase of absorbed dose, TPGDA monomer concentration, and the grafting temperature. However, a further increase in the grafting reaction time would not affect the GY. The radiation-induced grafting technique used in this study was successful with the maximum GY of 930% at an optimum grafting parameter of; 5 w/v% TPGDA concentration, 60 kGy irradiation dose, 3 hours reaction time and 60ºC reaction temperature. Fourier Transform Infrared Spectroscopy (FTIR) and Scanning Electron Microscopy (SEM) were used to provide evidence for the formation of graft copolymers in the grafting systems. The results of the present study show that RIG techniques can be used to prepared grafted WTD successfully.

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SERiES22-86

A Comparative Study on Effect of Leaching Reagents for Aluminium and Rare Earth Extraction from Ion Adsorption Clay

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In this study, three different leaching reagents; aluminium sulfate, ammonium sulfate and magnesium sulfate were used to study the effect of aluminium (Al) and rare earth elements (REEs) extraction from ion absorption clay ore. The raw sample was subjected to chemical composition analysis, mineral phase identification, elemental trace analysis, and surface morphology study by XRF, XRD, ICP-MS, and SEM. The leaching residue was also subjected to zeta potential analysis to compare and assess the effect of leaching reagents on the repulsion force of the clay residues. The batch leaching experiments were conducted, and different concentrations of leaching reagents were used to compare the effect of leaching extraction on Al and REE. It was found that the recovery of the REE increased when the concentration of leaching reagents increased. The effect of leaching reagents on the recovery of total REE (TREE) appeared to be in descending order $Al^{3+} > NH^{4+} > Mg^{2+}$. For Al extraction, aluminium sulfate leached highest the concentration Al compared to magnesium sulfate and ammonium sulfate. At the same time, the zeta potential of clay particles is found to be around -1.14mV, which is near zero that indicates a relatively lower risk of landslide by using aluminium sulfate (0.01 M). However, the zeta potential of magnesium sulfate (0.2 M) and ammonium sulfate (0.2 M) is 28.7 mV and -15.9mV respectively, and far from the zero values. As a conclusion, the effect of leaching reagents on Al and TREE extraction was successfully evaluated and further work needs to be done to study the mechanisms and kinetics of the leaching process for ion adsorption clay ores.

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SERiES22-87

PARTICLE SIZE DISTRIBUTION ANALYSIS OF BLENDED SOILLESS SUBSTRATE FROM COCO PEAT AND BURN RICE HUSK FOR AGRICULTURE MEDIA

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Soilless media is commonly used for drip irrigation systems whereby fertilizer and water are supplied concurrently. When different soilless media are mixed at various compositions, their physical and hydrological properties have changed, affecting the yield and crop growth performance. Understanding the combination effect of coco peat (CP) and burn rice husk (BRH) concerning particle size distribution suitability for the potting medium is of great importance. Therefore, the present study used the mechanical sieve analysis method to analyze particle size distribution [1] of the blended soilless substrate from CP and BRH at different compositions (T1:100% CP, T2:100% BRH, T3: 50% CP & 50% BRH, T4: 30% CP & 70% BRH, and T5: 70% CP & 30% BRH). The percent finer was plotted against aperture size on the semi-logarithmic scale to obtain the respective particle size. The analysis of variance (ANOVA) test was deployed for assessing significant differences between particle size and mean comparison was carried out by Duncan Multiple Range Test at $p = 0.05$ if significant differences were detected from the ANOVA model. The combination of CP and RBH at different ratios has changed the coarse (> 2.3 mm), medium (2.3 to 0.6 mm) and fines (< 0.6 mm) particle size composition. The particle size distribution result (Fig.1) indicates that adding BRH increases the medium and fine particle size percentage where the combination ratio treatment curves have shifted between the CP and BRH curves. These results suggest that adding BRH could increase water holding capacity by increasing micropore space between soilless media particles [2]. This finding provides valuable information on physical changes due to the blend of CP and BRH for potting soilless media. Understanding soilless media characteristics would guide farmers to better manage drip irrigation practice towards precision irrigation through cloud base [3] for optimum agricultural production.

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SERiES22-88

Soil Water Characteristic Curve (SWCC) of Lime-Laterite Stabilised Soil as a Clay-Liner Design

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Leachate was produced from infiltration of rainwater through landfill that contaminate the groundwater with some dissolved suspended particles such as heavy metals and microplastic. Due to the fact that this issue will endanger human health and pollute the environment, a proper design of clay-liner needs to be considered. Thus, lime-laterite stabilized soil has been chosen to test its compatibility for it to be used as a lining system. Past Researchers has been stated that the addition of an effective lime percentage that produces a pH of 12 is one of the mechanisms that can significantly decrease the pathogen in the leachate and improve the absorption of heavy metal ions by the lime-laterite soil. Therefore, this paper studies the Soil Water Characteristic Curve (SWCC) of untreated and treated laterite soil using quick lime as the stabilizer to investigate the hydromechanical behavior of laterite soil under unsaturated conditions in order to be applied as clay-liner that act as a hydraulic barrier which prevents the permeation of leachate. The soil sample was tested in the geotechnical laboratory using pressure plate equipment. For this study, lime dosages of 3%, 5%, 7%, and 9% by weight with seven days of optimum curing are applied for soil stabilization. The obtained experimental data were then fitted using Fredlund and Xing (1994) and Van Genutchen (1980) models to achieve matric suction in a range of 0.1 kPa to 1,000,000 kPa. The experimental testing result showed that the saturated volumetric water content of the soil sample decreased while the air entry value increased with the increasing percentage of lime content. In conclusion, overall results show that the water holding capacity of untreated and treated laterite soil decreases with the increasing lime content. This initial finding shows insights into the possibility of treated soil to be used in the landfill, thus solving the leachate permeation problem.

Keywords: leachate, groundwater, SWCC, landfill

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SERiES22-89

Characterization and Selection of Testing Beam Material for Active Vibration Cancellation Studies

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Active Vibration Cancellation (AVC) is a technique for an isolation system that reacts to the incoming external vibration or noise with an active counter actuation. A series of testing and investigation on the system are required before the deployment to the targeted system to increase system efficacy. In this study, the dynamic properties of aluminium, stainless steel, and mild steel beam materials with similar dimension are studied using an Experimental Modal Analysis (EMA). The beam material with the least natural frequency within the frequency of interest from 0.5 Hz to 500 Hz is selected for the AVC studies. However, the implementation of piezoelectric patch actuator and testing rig will affect the mechanical properties of the AVC system. Thus, subsequent study is carried out on the effect of beam dynamic properties after the installation of piezoelectric patch and testing rig using the EMA. The results are discussed and proven that the inclusion of piezoelectric patch and testing rig has affected and changed the mechanical properties of the AVC system.

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SERiES22-90

EXTRACTION OF COFFEE OIL FROM SPENT COFFEE GROUND BY SOXHLET EXTRACTION

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Coffee beans are one of the most often used raw materials in the beverage industry, with 9 million tonnes produced each year. The great majority of coffee harvested, roasted, and sold for human consumption. Due to the presence of caffeine, polyphenols, and tannins, spent coffee grounds (SCGs), which are the solid residue left over after the brewing process, are disposed as garbage to landfill, causing environmental difficulties. When used coffee grounds are not disposed correctly, they emit greenhouse gases such as methane. Therefore, this study investigated the potential of spent coffee grounds (SCG) as a valuable source of oil for sustainable production of biodiesel. The moisture content and the functional group of the spent coffee ground was identified to observe the quality of the spent coffee ground and how the quality of the spent coffee ground effect the amount of oil yield. The oil from the spent coffee grounds was extracted using the Soxhlet extraction method and characterized using Fourier transform infrared (FTIR) and titration method. In order to produce high yield of coffee oil, three factors of extraction conditions were investigated: the influence of several types of extraction solvents, such as hexane, pentane, acetone, and isopropyl alcohol, the optimal ratio of spent coffee ground-to-solvent, and the effect of extraction time. Then, the coffee oil was studied and characterized by identifying the chemical properties and functional groups of the oil to evaluate the potential of oil as a value added product from spent coffee ground and for sustainable production of biodiesel. As a result, the chemical properties of oil produced from hexane have low free fatty acid fraction, lowest saponification value, and ester value, which clearly benefits to the efficiency of the oil transesterification process for the production of biodiesel. Moreover, with an extraction time of 60 minutes and a SCG to solvent ratio of (1:10), hexane is the best solvent to choose. As a conclusion, the findings from the study successfully solve the research objective since it was determined that spent coffee grounds had the ability to yield a high proportion of oil and the oil was found to be a high quality and cost-effective feedstock for biodiesel production

Keywords: Spent coffee ground; Coffee oil; Biodiesel; Soxhlet Extraction

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SERiES22-91

Investigation the Effect of Nano Carbon Tube Prepared from Tea Waste on Microstructure and Properties of Cement Mortar

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Environmental contamination and the massively higher cost of disposal of wastes have been a big concern for scholars throughout the globe, prompting them to seek a way to recycle waste materials in various implementations filed. The rising expenditure of disposal and the shortage of naturally big aggregate have increased interest in reusing recycle waste materials to manufacture concrete and mortar. The some of the country population annually consumes hundreds of tonnes of black tea, resulting in a considerable number of discarded teabags. These huge quantities are disposed of in landfills without being recycled or otherwise used. Moreover, landfills are considered one of the country's biggest global issues. Therefore, the aim of this experimental work to investigate influence of nano carbon tube produced from tea bag waste as cement replacement materials in mortar mixtures. Cement mortar mixes containing four replacement levels (1%, 2%, 3%, and 4%) of cement with nano carbon tube produced from tea bag waste. The compressive strength, ultrasonic pulse velocity, and water absorption were tested to demonstrate the effect of the nano carbon tube made from recycled tea bag waste on the mechanical properties of the mortar mix. The fresh properties such as flow rate was evaluated in accordance with the specific standards. Scanning electron microscopy (SEM) and energy dispersive spectroscopy (EDX) analyses were performed to demonstrate the microstructure of the mixtures. The results show that the fresh properties (flowability) of mortar containing nanocarbon tubes from tea bag waste were improved with the increase of the replacement ratio. In addition, the compressive strength was improved by substitution of up to 2%. For the other levels of substitution, it decreased with increasing proportion. In contrast, the density was increased with the increase the substitution level of tea bag waste. Based on the results of the experiments, it seems that the suggested bio-mixture could increase the compressive strength of the material by up to 2% of the replacement at 28 days of curing.

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WATER FOOTPRINT OF DAILY ACTIVITIES IN UNIVERSITI MALAYSIA PAHANG

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Human daily activities consume and pollute a lot of water. The method of WF is used to measure water consumption related to a different daily activity during the whole life cycle of a product and service. Minimum use of water daily by a consumer or sum of the water used for the population will be determined from the data collection at this area. Moreover, the population growth in the case study area caused the water demand to increase. The purpose of this study is to carry out the total water consumption of Universiti Malaysia Pahang community. Minimum use of water daily by a consumer or sum of the water used for the population will be determined from the data collection at this area. This study will be accounting daily WF of daily activities in order to determine the contribution factors that affect the water consumption trend in UMP. Based on the results obtained, the average amount of water consumption from the UMP community is lower compared to the average amount of WF which is good practice from the UMP community towards their water consumption in daily activities. In addition, there are various factors that can contribute to water consumption trends in UMP communities including the population, activities of community and social background.

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SERiES22-95

NANOHYBRID POLYMER ELECTROLYTES BASED ON SEAWEED KAPPA-CARRAGEENAN FOR POTENTIAL APPLICATION IN ENERGY STORAGE DEVICES

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Polymer electrolytes are widely used as electrolytes in electronic devices of conventional electrochemical machines and sophisticated energy storage materials. However, the available polymer electrolytes system had long suffered from structural instability and mechanistic incompatibility with electrode materials due to molecular leaching thus giving unstable ionic conductivity at room temperature with insufficient energy generation for practical application. To overcome these problems, nanohybrid polymer electrolytes system with promising ion transports are developed from synthetic polymers, that raised to environmental concern and high cost. Hence, a low-cost and biopolymer such as seaweed is a great alternative to replace the synthetic polymer for sustainable energy development. In this study, aluminum oxide (Al_2O_3) has been incorporated into the naturally abundant biopolymer of seaweed kappa-carrageenan along with N-N-Dimethyl-N-(methylsulfanylmethylene) ammonium iodide (DNH_4I) salt as mobile charge carriers to promote stable ion conducting properties. These electrolytes were prepared using solution casting technique and their properties were subjected to electrochemical impedance spectroscopy, transference number measurement and linear sweep voltammetry to investigate the electrochemical properties. The study showed that the presence of Al_2O_3 increases the conductivity of the seaweed kappa-carrageenan/DNH_4I salt. This indicated that the newly developed nanohybrid polymer electrolytes system of kappa-carrageenan seaweed/DNH_4I/Al_2O_3 showed sufficient ion conductivity for energy storages devices.

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SERiES22-96

EFFECT OF WETTING DRYING CONDITION IN SOIL WATER CHARACTERISTIC CURVE (SWCC) FOR LIME- TREATED LATERITE

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Natural soil typically experiences multiple drying and wetting cycles due to the variability of climatic condition that can affect hydro-mechanical properties of soil. The soil water characteristic curve (SWCC) of soil samples is significantly affected by wetting-drying cycles. The influence of multiple wetting drying cycles on the soil water characteristic curve (SWCC) of untreated laterite and lime treated laterite are further investigated using pressure plate test. Lime is applied to the soil at 3%, 5%, 7%, and 9% by weight, with seven (7) days of curing time for optimal results. In addition, all experimental SWCC results were fitted using Fredlund and Xing and van Genuchten models. Test results indicated that lime content had a significant effect on air entry value of SWCCs. The Air Entry Value (AEV) increased with the increasing lime content. Overall, the results revealed that the water holding capacity of laterite soil decrease with increasing lime content.

Keyword: SWCC, wetting-drying cycles, Air entry value (AEV), lime

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SERiES22-97

THE COMPRESSIBILITY CHARACTERISTICS OF CEMENT-TREATED LATERITE SOIL UNDER SATURATED AND UNSATURATED CONDITIONS

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Considering its history of being firm soil, laterite soil is commonly utilized as a workable subgrade material for pavement. However, Malaysia's road infrastructure is severely impacted by the dry and rainy seasons due to climate change, which weakens its natural bonds. Therefore, to build a pavement subgrade with long service life, it is crucial to comprehensively emphasise the soil's compressive strength and compressibility. Soil stabilisation is a technique for strengthening on-site materials to provide a stable and reliable subgrade. Therefore, the primary goal of this research is to examine cement's ability to act as a stabilising agent in soil stabilisation. Hence, this paper presents a laboratory study in evaluating the influence of cement stabiliser on the compressibility of laterite soils subjected to saturated and unsaturated conditions. According to the results of the unconfined compression test (UCT), an optimal blend of 6% cement-treated laterite soil could achieve the stabilised soil requirement strength (800 kPa) of the low-volume road by the Malaysia Public Work Department (MPWD) for 1.0 million ESAL after 7 days of curing (Equivalent Single Axle Load). Next, the compressibility test results discovered that the laterite soil had high compressibility under fully saturated conditions, but much lower compressibility under unsaturated conditions. The unsaturated oedometer test showed that soil compressibility was substantially reduced at higher level suction (drying condition) than at lower suction (wetting condition). In conclusion, this study result has contributed fundamental knowledge by proving the cement's potential to be used as a stabiliser for the subgrade material in Malaysia's design guidelines for road infrastructure.

Keywords
Compressibility, Cement, Laterite soil, Saturated and Unsaturated Conditions

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FACTORS AFFECTING COST OVERRUNS IN CONSTRUCTION PROJECTS FROM A STAKEHOLDER PERSPECTIVE

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The construction industry is one of the main sectors in every country that provides various services to individuals in addition to other sectors. Therefore, researchers focused on studying the challenges facing this sector in order to be able to find proposed Integrated and scalable solutions to improve its efficiency, which are reflected in the growth of the national economy. Simultaneously, this study focused on the major factors affecting cost overrun in construction projects from the perspectives of stakeholders. To achieve the aim of the study, the researcher adopted the quantitative study to collect and analyze data through the use of a structured questionnaire. The finding of the study revealed that the owners and contractors agreed to identify Fuel cost increase as the most important factor affecting cost overruns. Meanwhile, the results of PRAF revealed that the main factors affecting cost overrun are: Frequent design changes, Fuel cost increase, High transportation cost, Extra quantity during construction, Owner's financial difficulties. The results of this study can help the construction industry professionals to predict the main factors affecting cost overrun based on their assessment of the previously mentioned factors according to the state of their projects. Predicting these factors helps to develop necessary plans that reduce their impact on cost overruns in future projects.

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AC Conductivity by Quantum Mechanical Tunnelling and Dielectric Properties of Hexanoyl Chitosan/PVC-NaI-MPImI Electrolyte for Application in Dye Sensitized Solar Cells

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Polymer electrolyte composed of hexanoyl chitosan/PVC blend as the host polymer, sodium iodide (NaI) as the salt and 1-methyl-3 propyl imidazolium iodide (MPImI) as the ionic liquid were prepared by solution casting method. The highest room temperature ionic conductivity was exhibited by hexanoyl chitosan/PVC-NaI containing 8 wt.% MPImI which is one order of magnitude higher than ionic liquid free electrolyte system. The effect of MPImI concentration on the dielectric properties of hexanoyl chitosan/PVC (90:10)-NaI complexes were investigated in the temperature range of 303 to 343K. Dielectric properties of the samples were strongly dependent on frequency, conductivity of the sample as well as temperature. The frequency dependence of the conductivity was found to obey universal power law. The conduction mechanism of the electrolyte system was interpreted by the quantum mechanical tunnelling (QMT) model.

Keywords hexanoyl chitosan, PVC, Sodium iodide, MPImI, EIS

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RARE EARTH ELEMENTS GEOCHEMISTRY OF KELANTAN RIVER FLUVIAL SEDIMENTS

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The status of REE as the global strategic commodity has encouraged the identification of REE ore deposits. This research was carried out to identify the mining feasibility of fluvial sediment REE; and to understand the sediment physical and chemical characteristics effect on geochemical behavior of REE in Kelantan River sediments. Surface sediment samples were collected along Kelantan River (n=28) in 10 km distance interval. The sediment samples were analyzed using XRD and XRF to determine the major oxide and mineral content, respectively. Meanwhile, REE content in the sediment samples were extracted using Total Digestion method and analyzed using ICP-MS. The average values of ΣREE at surface sediments of Kelantan River is 49.00±33.40ppm with the highest ΣREE (327.35±34.17ppm). These values were too low to be economically mined. Kelantan River shows higher fractionation of light REE than heavy REE with negative europium anomalies, suggesting these sediments derived from felsic rocks. The sources of REE in Kelantan River surface sediments were predicted using the model from the average of REE in rock formations in Kelantan. The finding shows that REE in Kelantan River surface sediment were originated 50% from metasedimentary rocks (Taku-Schist) and another 50% from granite rocks which come from Pergau (20%), Dabong (15%), and Gua Musang (5%). As conclusion, the findings of this research are thus generally useful for further REE mineral exploration and fluvial sediment environmental monitoring, specifically for studies in Kelantan.

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SERiES22-103

INFLUENCE OF WASHING PRE-TREATMENT ON WHOLE EMPTY FRUIT BUNCHES

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This paper describes the influence of water washing pre-treatment on whole empty fruit bunches (EFB) of oil palm. Washing pre-treatment on EFB could improve the quality of biomass by decreasing the ash content. High-quality biomass will enhance better combustion efficiency and may reduce pollution emissions. The amount of ash in EFBs is found to be considerably high. The objective of this study is to find the relationship between the ash content and heating value of EFB and to find the correlation between leachate electrical conductivity with the different soaking times of the samples. The electrical conductivity of leachate is measured to determine the presence of ionic elements. In this study, whole EFBs were soaked in distilled water for a range of 10-50 minutes at ambient temperature. Ash content in treated samples was found to reduce up to 50% after undergoing washing pre-treatment while the heating value of the treated samples had increased to around 15-20 MJ/kg.

Keywords: Empty Fruit Bunches, Washing Pre-treatment, Leachate

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SERiES22-104

New Magnetic Schiff's Base-Chitosan-Glyoxal/Fly Ash/Fe_3O_4 Biocomposite for the Removal of Anionic Azo Dye: An Optimized Process

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In this study, a new magnetic Schiff's base-chitosan-glyoxal/fly ash/Fe_3O_4 biocomposite (Chi-Gly/FA/Fe_3O_4) was successfully synthesized by direct compositing of magnetic chitosan (Chi) with fly ash (FA) powder particles, and followed by Schiff's base formation *via* cross-linking reaction with glyoxal (Gly). Various techniques such as BET, XRD, FTIR, and SEM-EDX were utilized to characterize of Chi-Gly/FA/Fe_3O_4 biocomposite. The effectiveness of Chi-Gly/FA/Fe_3O_4 as an adsorbent was evaluated for the removal anionic azo dye such as reactive orange 16 (RO16) from aqueous environment. The effect of adsorption process parameters namely adsorbent dose (A: 0.02-0.1 g), pH (B: 4-10), temperature (C: 30-50 °C), and contact time (D: 5-20 min) were optimized *via* Box–Behnken design (BBD) in response surface methodology (RSM). The adsorption process followed the pseudo-second order (PSO) kinetic, and Freundlich isotherm models. The maximum adsorption capacity of Chi-Gly/FA/Fe_3O_4 biocomposite for RO16 dye was recorded to be 112.5 mg/g at 40 °C. The RO16 dye adsorption mechanism was attributed to various interactions such as electrostatic, n-π, H-bonding, and Yoshida H-bonding. Furthermore, the Chi-Gly/FA/Fe_3O_4 biocomposite exhibited a high ability to separate from the aqueous solution after adsorption process by external magnetic field.

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UTILIZATION OF PALM KERNEL SHELL AS CEMENT REPLACEMENT MATERIALS IN CONCRETE: A REVIEW

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Rapid growth and increasing demand for building materials have led to a shortage of key resources for conventional building materials. However, concrete is one of the most important and demanding building materials in the globally. As a result, the concrete industry consumes large amounts of essential raw materials and emits hazardous chemicals such as carbon dioxide (CO_2) into the environment. Consequently, the production of conventional building materials consumes a significant amount of electricity and conventional energy resources and contributes to CO_2 emissions. Accordingly, alternative, environmental sustainable materials should be utilized in the production of concrete to meet the demand for building materials from agricultural waste. Palm kernel shell is among the agricultural byproducts utilized widely in tropical nations. In order to obtain better sustainability in the concrete industry, research should concentrate on the use of substitute renewable resources such as recycled palm kernel shells. This study summarized previous research on the use of palm kernel shells as a building material. In this paper the physical properties and chemical compositions of palm kernel Shell are discussed. A review of previous studies on the incorporation of palm kernel shell wastes and their effects on the fresh and strength properties and durability of concrete are described. The prospects for further research on the use of palm kernel shell waste in concrete are determined on the basis of a thorough study. Numerous studies have shown that concrete containing palm kernel shell waste has superior strengths, and other properties compared to conventional concrete without palm kernel shells.

Keywords: Cement Replacement, Palm Kernel Shell, supplementary cementitious materials, Chemical and Physical Properties, Fresh and Mechanical Properti

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