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ICGERE 2023

Faculty of Mining and Petroleum Engineering

The 5th International Conference on Geoscience and Earth Resources Engineering

PROGRAM BOOK

"Geosciences and Earth Resources Engineering for Sustainable Future"

9 - 10 August

2023

Organized by:

Faculty of Mining and Petroleum Engineering

In Collaboration with:

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Foreword

Dear colleagues,

The International Conference on Geoscience and Earth Resources Engineering (ICGERE) is an annual conference organised by Faculty of Mining and Petroleum Engineering, Institut Teknologi Bandung (FTTM-ITB). It serves as a meeting point for collaboration, sharing and developing new ideas and technologies in the fields of geoscience and earth resources engineering. It will also create an opportunity for academics, professionals, and students to promote and discuss recent development in the fields. This year, the 5th conference is conducted with the theme of Geosciences and Earth Resources Engineering for Sustainable Future.

Geoscience, earth resources engineering, and sustainability are interconnected concepts that play a crucial role in understanding the earth's natural systems, managing its resources, and ensuring a sustainable future for all living organisms.
The geoscience is essential for understanding the formation, availability, distribution of earth resources. Geoscientists explore how these resources are created, where they are located, and how they can be extracted. This knowledge is crucial for making informed decisions about resource management and exploitation.

Sustainability is a critical framework that guides the responsible use of earth resources. By considering the principles of sustainability, societies can make choices about resource consumption to ensure a healthier planet for current and future generations. Sustainability in the context of earth resources requires a holistic understanding of geoscience.

In summary, geoscience, earth resources engineering, and sustainability are interconnected fields that together provide the knowledge and tools needed to manage earth resources in a way that supports both human well-being and the health of the planet. Balancing these aspects is essential for creating a sustainable and equitable future.

I believe all of us will engage in meaningful dialogues, share ground-breaking research, and cultivate collaborations that have the potential to strengthen our knowledge in geoscience, earth resources engineering, and sustainability. Let us embark on this conference with an open mind, a collaborative spirit, and an unwavering dedication to leaving a lasting, positive impact on our world.

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Prof. Ir. Ridho Kresna Wattimena, M.T., Ph.D.

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- Fasya Mediati Hapsari, ST. (Engineering)
- Dr. Tomy Alvin Rivai
- Ulvienin Harlianti, S.T., M.T.

ICGERE 2023 Highlights

Keynote Speakers

Day 1 - Wednesday, 9 August 2023

Prof. Ir. Tutuka Ariadji, M.Sc., Ph.D., IPU.
(Bandung Institute of Technology)

Oil and Gas Potential and Its Contribution to Indonesia's Transition Energy

Prof. Kun Sang Lee
(Hanyang University, South Korea)

Techno-Economic Analysis of Dimethyl Ether(DME)-enhanced CO2-Water-Alternating-Gas Process

Prof. Yiqiang Li
(China University of Petroleum-Beijing)

"Progress of Chemical Enhanced Oil Recovery technique in China and polymer flooding design in Daqing Oilfield"

Ignatius Sonny Winardhie, Ph.D.
(Bandung Institute of Technology)

Seismic-Based Petrophysical Property Estimation for Reservoir Characterization

Prof. Nicholas Rawlinson
(Cambridge University, United Kingdom)

Melt Migration Within the Icelandic Crust

Dr. Masoud Babaei
(University of Manchester, United Kingdom)

CO2 Plume geothermal (CPG): Importance of Considering Non-Oversimplified Geology

ICGERE 2023 Highlights

Keynote Speakers

Day 2 - Thursday, 10 August 2023

Dr. Ir. Edy Sanwani M.T.
(Bandung Institute of Technology)

"Development of Primary Tin Ore Processing for Tin Production Sustainability in Indonesia"

Ir. Nenny Miryani Saptadji, Ph.D.
(Bandung Institute of Technology)

"Geothermal Reservoir Management for Sustainable Future"

Dr. Eng. Iwan Setiawan, MT.
(Head of Research Center for Geological Resources of BRIN)

"Granite Petrology and Potential IAT REE deposits of Bangka-Belitung (tentative)"

Tegar Ksatria, S.T.
(Underground Mine Engineer, LKAB Sweden)

"Kiruna Mine Long-Term Planning Using Deswik Scheduler"

Schedule

Day 1 – Wednesday, 9 August 2023

TIME	Activities	
09:00 - 09:05	Opening by MC	
09:05 - 09:10	Welcome Addresses from the Head of the ICGERE 2023 Organizing Committee	
09:10 - 09:20	Welcome addresses from Dean of Faculty of Mining and Petroleum Engineering ITB and Opening Ceremony	
	Plenary Session	
09:20 - 09:50	Prof. Tutuka Ariadji	Moderator : Ivan Kurnia, Ph.D.
09:50 - 10:20	**Coffe break and poster session**	
	Parallel Session	
	Room A (Geophysical Engineering - TG)	**Room B (Petroleum Engineering - TM)**
	Moderator : Ulvienin Harlianti, S.T., M.T.	Moderator : Dr. Ing. Calvin Lumban Gaol S.T., M.Sc.
10:20 - 10:40	Speaker TG: Adi Patria (Fault segmentation, seismicity, and deformation rate of the Matano fault, Sulawesi, Indonesia)	Speaker TM: Tomi Erfando (Simulation study analysis of the normal five-spot model and inverted five-spot polymer injection on X field)
10:40 - 11:00	Speaker TG: Heri Syaeful (Liquefaction hazard assessment on the nuclear installation area of Puspiptek-Serpong)	Speaker TM: Indah Widyaningsih (Comparison of Rhamnolipid and Sophorolipid Application on Sandstone Reservoir for Enhanced Oil Recovery)
11:00 - 11:20	Speaker TG: Faridz Nizar (The Interpretation of Subsurface Structure Beneath Banda Api Volcano Inferred from Gravity Data)	Speaker TM: Zaid Alfageh (Applying The Technology to Increase Oil Production Review of Enhanced Oil Recovery Techniques)
11:20 - 11:40	Speaker TG: Imam Santosa (The summit situation mapping of rokatenda volcano, east nusa tenggara using a drone)	Speaker TM: Arik Daniati/Zuher Syihab (An Integrated Approach to Economic Analysis of EOR Projects: EOR Screening to Optimization of Field Development Scenario)
11:40 - 12:00	Speaker TG: Nia Kurnia Praja (Stress –strain distribution of volcanic earthquake: a case study of semeru-tengger 2010 seismic activities)	Speaker TM: Ardhiya (Estimation of Future Inflow Performance Relationship for Solution-Gas Drive Reservoirs by Considering Changes in Water Cut Using Production Data)
12:00 - 13:00	**Lunch Break**	

Schedule

Day 1 - Wednesday, 9 August 2023

	Plenary Session	
13:00 - 13:30	Prof. Kun Sang Lee	Moderator : Dr. Ing. Calvin Lumban Gaol S.T., M.Sc.
	Parallel Session	
	Room A (Geophysical Engineering - TG)	**Room B (Petroleum Engineering - TM)**
	Moderator : Madaniya Oktariena, S.T., M.T.	Moderator :Galang Merdeka S.T., M.Sc.
13:30- 13:50	Speaker TG: Sonny Winardhi (Direct Estimation of Petrophysical Properties from Elastic Parameter: A case Study on the Baturaja Formation)	Speaker TM: Vincentius Brilian (Numerical Modeling of a Convective Closed-Loop Geothermal Heat Extraction from an Idle Geothermal Well)
13:50 - 14:10	Speaker TG: Muhammad Ragil Setiawan (Elastic property analysis and characterization of rocks using digital rock image)	Speaker TM: Adam Muhammad (A Quick and Robust Screening Method Using Pareto and Four Quadrant Analysis for WO/WS Candidates Selection in a Mature Field to Unlock Production Gain Opportunities)
14:10 - 14.40	Coffee Break and Poster Session	
	Plenary Session	
14:40 - 15:10	Ignatious Sonny W., Ph.D.	Moderator : Dr. Shindy Rosalia
15:10 - 15:40	Prof. Nicholas Rawlinson	Moderator : Dr. Shindy Rosalia
15:40 - 16:10	Dr. Masoud Babaei	Moderator : Dimas Taha Maulana, MT.
	Parallel Session	
	Room A (Geophysical Engineering - TG)	**Room B (Petroleum Engineering - TM)**
	Moderator : Putu Billy Suryanata, S.T., M.T.	Moderator : Galang Merdeka S.T., M.Sc.
15:40 - 16:00	Speaker TG: Wahyu Dwi Nurcahyo (Correlation between N-SPT value and shear wave velocity for clayey soil)	Speaker TM: M. Khatami Rafsanjani (Advancing Relative Permeability Prediction in Water-Gas Reservoir Systems: A Comparative Study of Models Utilizing Porous Plate Capillary Pressure Measurements)
16:00 - 16:20	Speaker TG: Indra Gunawan (A High Resolution of Terrain Gravity of Bandung Area)	Speaker TM: M. Fakhri Athallah (The Effects of Permeability Anisotropy on Reservoir Rock Type Using Digital Rock Physics Method)
16:20 - 16:40	Speaker TG: Nugroho Prasetyo (The Early Study for Nature-Inspired Algorithms in Geophysical Modeling Based on Gravity Method: Prototype Bat Algorithm in 3D Gravity Inversion)	Speaker TM: Lutfi Abel Baskara (Flow Assurance Study for Pipeline CO2 Transport During Offshore Carbon Capture Storage (CCS))

Schedule

Day 2 - Thursday, 10 August 2023

TIME	Activities	
	Plenary Session	
08:00 - 08:30	Nenny Miryani Saptadji, Ph.D.	Moderator : Dr. Nurulhuda Halim
08:30 - 09:00	Edy Sanwani, Ph.D.	Moderator : Dr. Nurulhuda Halim
	Parallel Session	
	Room A (Mining Engineering - TA)	**Room B (Geothermal - PB)**
	Moderator : Dimas Agung Permadi, ST., MT	Moderator : Zela Tanlega Ph.D.
09:20 - 09:40	Speaker TA: Westia Alifah Surya Pratiwi (Elemental Mass Balance Calculation Using Easygresgrant of the Hydrothermal Alteration in Awak Mas Gold Deposit, Sulawesi Island, Indonesia)	Speaker MG: Subandrio (Bulk Flotation Optimization of Pb Levels for Suitable Smelter Feed)
09:40 - 10:00	Speaker TA: Resty Intan Putri (Hydrothermal Alteration and Vein Characteristics of Dayak Gold Mine Low Sulfidation Epithermal Deposit in the Baruh Area, Murung Raya Regency, Central Kalimantan Province)	Speaker MG: Nurulhuda Halim (Effects of Coal Pretreatment and Feeding Method on The Performance of Low-Rank Coal Gasification: Experimental Study and Its Analysis Using Aspen Plus)
	Coffee Break and Poster Session	
	Plenary Session	
10:00 - 10:30	Dr. Iwan Setiawan	Moderator : Periska Rasma, MT
	Parallel Session	
	Room A (Mining Engineering - TA)	**Room B (Geothermal - PB)**
	Moderator : Ignatius Klemens Dwika, ST., MT.	Moderator : Fauziah Maswah, MT. (Geoscience) & Fasya Mediati Hapsari, ST. (Engineering)
10:30 - 10:30	Speaker TA: Dwi Vidya Sari (Geochemical Characteristic of Whole-rock Weathering Profile at Nickel Laterite Deposit in Central Halmahera Island)	Speaker PB: Yunus Daud (Identification of Permeable Zone Using Gravity Data in DB Geothermal Field)
10:50 - 11:10	Speaker TA: James Andrew Eric Putra Gigy (Petrological Constraint On Pre-Cenozoic Chert Origins of Embaluh Group in Long Wehea, East Kalimantan, Indonesia)	Speaker PB: Sahrul (Integration of gaussian filter and Bidimensional Empirical Mode Decomposition methods in separating gravity anomalies: A case study of geothermal potential area in Central Sulawesi, Indonesia)

Schedule

Day 2 - Thursday, 10 August 2023

11:10 - 11:30	Speaker TA: Karl Karoluz Meak (Chemical Analysis to Determine Coal Rank in Ombrob Village Coal Deposits, Nimboran District, Jayapura Regency, Papua)	Speaker PB: Faiq (Change of Phase in Geothermal Fluids Impacting Power Plant Operation (A Case Study: Transfiguration System of Separated Steam Cycle to Direct Dry Steam Power Plant))
11:30 - 11:50	Speaker TA: Ahmad Ali Syafi'i (Remote Sensing Imagery Approach for Diamond Mining Monitoring, Operation, and Post-Mining, Study Case: Cempaka Diamond Mine)	Speaker PB: Herianto (Thermodynamic Analysis of Orhanic Rankine Cycle Systems Using Low Enthalpy Fluid for Small Sclae Electricity Generation with Aspen Hysys V8.8 Software Simulation)
11:50 - 13:00	**Lunch Break and Poster Session**	
	Parallel Session	
	Room A (Mining Engineering - TA)	**Room B (Mining Engineering - TA)**
	Moderator : Dr.Eng. Intan Nurul Rizki, S.Si, MT.	Moderator : Dimas Agung Permadi, ST., MT
13:00 - 13:20	Speaker TA: Danu Putra (The impact of underground support and mine opening profile on the economics of underground mining projects)	Speaker TA: Mohammad Army (Stope Dimension Optimization Based on Geomechanical Properties Using Brute Force Algorithm)
13:20 - 13:40	Speaker TA: M. Alibasya (Forecasting Commodity Prices with Mean Reversion of Vasicek Mode)	Speaker TA: Wahyu Dwi Nurcahyo (Determining Subsurface Characteristic Based on Geophysical Survey for Yogyakarta-Bawen Tunnel)
13:40 - 14:00	Speaker TA: Sepriyani Sitohang (Identifying Geochemical Anomalies of Au-Ag-Cu-Pb-Zn-Sb-As from Stream Sediment Samples in Pacitan-Ponorogo District, Java Island, Indonesia)	Speaker TA: Bagaraja Sirait (Geomechanical characteristics of surrounding rocks in underground coal gasification reactors)
14:00 - 14:20	Speaker TA: Angelina Randa (The Potential of Limestone as Raw Material for Cement in the Entrop area of Jayapura City, Papua Province)	Speaker TA: Sari Melati (Laboratory measurement to identify the mechanical behavior of competent rocks in deep underground mining: a preliminary study on Diorite and Skarn)
14:20 - 14:50	**Coffee Break and Poster Session**	
	Plenary Session	
14:50 - 15:20	Tegar Giri Ksatria, ST.	Moderator : Dr. Tomy Alvin Rivai
15:20 - 15:50	Prof. Yiqiang Li	Moderator : Galang Merdeka S.T., M.Sc.

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85	Bagaraja Sirait, Nuhindro P. Widodo, Simon H. Prassetyo, Ridho K. Wattimena	Geomechanical characteristics of surrounding rocks in underground coal gasification reactor under high temperatures	115
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Abstracts

A High Resolution of Terrain Gravity of Bandung Area

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Abstract. Bandung basin, which has about 30 km x 60 km, is surrounded by mountains. Therefore, the gravity due to terrain variations has significantly contributed to the area's Complete Bouguer Anomaly (CBA). In this study, we have applied a high resolution of terrain gravity (TG) using the block of rectangular prisms with 100 m x 100 m x 10 m dimensions. The investigation includes up to 70 km x 100 km terrain areas where the data was obtained from the shuttle radar topography mission digital elevation model (SRTM DEM). The results show that the southern region has about 20 mGal TG higher than the northern region due to more and higher mountain variation. Our investigation also found that the reasonable terrain areas included in the calculation must be at least 40 km wider from the outer gravity stations to get less than one mGal change in the 5 km terrain area width change. This result gives a good overview of the terrain effect on gravity calculation and interpretation, especially in the Bandung area.

Abstracts

INASTER (Indonesia Disaster Platform): Cloud Computing Based Geospatial Platform in Monitoring Indonesia Natural Disaster

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Abstract. Tsunami natural disasters are tidal wave disasters generated by tectonic earthquakes, volcanic eruptions in the ocean, or landslides that can cause damage, loss, and even death. One of the tsunami disasters occurred in Palu City and its surroundings due to landslides in deep sediments reaching 200-300 meters. Palu City is a city located in the valley plain and coastal areas of Palu Bay. The natural disaster activity produced tsunami waves in 2018 that damaged most coastal forest ecosystems and settlements around the coast. This requires a disaster impact monitoring system as a basis for disaster mitigation planning in affected areas. This research was conducted by creating a disaster impact monitoring platform, namely Indonesia Disaster Platform (INASTER) by using a cloud-based geospatial model. This geospatial model is created by three indices, Normalized Difference Vegetation Index (NDVI), Normalized Difference Built-up Index (NDBI) and Index-Based Built-up Index (IBI). These indices analysis involves Sentinel-2 MSI image data that is extracted via the cloud computing-based Google Earth Engine platform. This platform succeeded in producing the distribution of affected areas in the coastal area of Palu City. This platform has succeeded in producing a distribution of affected areas in the coastal areas of Palu City. Analysis showed that there was damage to several types of land use on the coast of Palu City. There fore, geospatial information through this platform can be a reference in regional rehabilitation and disaster mitigation efforts so as to control the impact of disasters. This research is expected to be a consideration for local governments in order to develop disaster-resilient areas.

Keywords: Tsunami, Geospatial, Palu, Index.

Abstracts

Integration of Gaussian Filter and Bidimensional Empirical Mode Decomposition in separating gravity anomalies in sythetic data.

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Abstract. The separation of regional and residual components in the analysis of geological features through gravity methods is a widely employed technique by geoscientists worldwide. Despite ongoing improvements in gravity anomaly separation methods, there is no single method that can be considered an absolute solution for obtaining the most accurate information about geological features. Hence, there is always room for further refinement and enhancement. The present study has assessed various gravity anomaly separation techniques, including the Gaussian filter, Bidimensional Empirical Mode Decomposition (BEMD), and a combined methods using both the Gaussian filter and BEMD. The study investigated different methods for separating gravity anomalies, such as Gaussian filters, Bidimensional Empirical Mode Decomposition (BEMD), and a combination of Gaussian and BEMD techniques. The findings indicate that the combined use of Gaussian and BEMD filters proves to be more efficient in characterizing near-surface gravity anomaly features in two synthetic gravity data models, both of which include noise. This conclusion is supported by the observed patterns and relatively lower Root Mean Square Error (RMSE) values of 0.0245 and 0.6172. As a result, this research offers enhanced opportunities for interpreting gravity anomalies more effectively. The procedure adopted in this study was developed utilizing the MATLAB programming language.

Abstracts

Estimation of Future Inflow Performance Relationship for Solution-Gas Drive Reservoirs by Considering Changes in Water Cut Using Production Data

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Abstract. Inflow Performance Relationship (IPR) represents a well's production behavior at a particular time. The curve is obtained by plotting flow rate versus flowing pressure. In two-phase reservoirs, as reservoir pressure depletes, reservoir deliverability drops due to reduction of relative permeability to oil and increased oil viscosity. Thus, it is unable to apply the IPR curved used the first time to evaluate the productivity of the current reservoir. Therefore, it is necessary to forecast or estimate the IPR curve in the future. Several methods have been developed to analyze future IPR for solution-gas drive reservoirs for both two and three phase reservoirs. However, all methods assumed that only suitable for future IPR in which the water production is not changed, in this case the water cut is the same throughout the production phase. As a result, if the well is producing water or there is an increase in the water cut during the production, the future IPR used at the beginning needs to be enhanced. In addition, due to limited core data availability from laboratory, relative permeability curve to analyze water cut is alternatively built using fractional flow from production data. Therefore, the main contribution of this paper is development of a correlation to estimate future IPR for solution-gas drive reservoirs by considering changes in water cut using production data in order to provide production performance with better accuracy. In this study, base case reservoir is developed using reservoir simulation CMG-IMEX and then validated using Vogel's dimensionless curve. Water cut analysis is evaluated during future IPR development. Further analysis is necessary to assess or develop future IPR correlations.

Keywords: solution-gas drive reservoirs, future inflow performance relationship, changes in water cut, production data, analytically future IPR correlation

Abstracts

Earthquake relocation and deformation analysis on the Mentawai segment of the Sumatra subduction zone

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Abstract. The Mentawai segment, which is located on the western coast of Sumatra, Indonesia, is characterized by the convergence of the Indo-Australian Plate and the Sunda Plate. The complex interactions between these two tectonic plates have given rise to numerous earthquakes and deformations. After the devastating earthquake (Mw 7.8) in 2010 followed by a tsunami, this segment remains locked and has the possibility to produce a great earthquake. This study aims to determine precise earthquake locations and analyze the pattern of seismic distribution along with the deformation analysis from continuous GPS observations to understand the plate dynamics. We use the earthquake catalog data from the Agency for Meteorology, Climatology and Geophysics (BMKG) of the Indonesian earthquake network during the time period April 2009 - December 2021.

To improve the accuracy of the hypocenter, we relocated 1,130 events consisting of 10,994 P- and 3,414 S-wave phases and update the minimum 1- D velocity model simultaneously using the Joint Hypocenter Determination Method. Our results show that the intense seismicity occurred at a depth of less than 50 km. At deeper depths, the earthquake is distributed along the subducting plate to a depth of ~200 km in north and ~250 km in the south. Our findings strongly support the inference that the plate interface lies at a depth of 20 km. This conclusion is substantiated by the sharp increase in seismic velocity at that particular depth, which is indicative of a significant boundary between distinct geological layers. Furthermore, our investigation has uncovered a prominent aseismic zone beneath the forearc basin, situated approximately 100 km away from the trench line. The plate velocity derived from continuous GPS observations confirmed the stable movement of subducting Indo-Australian place towards the Sunda plate along the Mentawai segment. Finally, the results of this study are addressed to conduct further three-dimensional velocity inversion studies.

Abstracts

Chemical Analysis to Determine Coal Rank in Ombrob Village Coal Deposits, Nimboran District, Jayapura Regency, Papua

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Abstract. This study aims to determine the chemical characteristics and rank of coal from coal deposits in Ombrob Village, Nimboran District, Jayapura Regency, Papua. Three samples were obtained from the results of field investigations namely OBB-1, OBB-2 and OBB-3 which were then analyzed at the Bandung Tekmira Lab using the proximate, ultimate and calorific value analysis methods. Based on the analysis results from the laboratory, the results of the analysis were for the OBB-1 sample: moisture content 25.98% (adb), ash 17.06% (adb), volatile matter 35.65% (adb), fixed carbon 21.31% (adb), carbon 38.26% (adb), hydrogen 5.72% (adb), nitrogen 0.76% (adb), total sulfur 4.36 (adb), oxygen 33.84% (adb) and calorific value 3616 cal/gr, (adb). OBB-2: moisture content 27% (adb), ash 16.24% (adb), volatile matter 37.45% (adb), fixed carbon 19.31% (adb), carbon 39.14% (adb), hydrogen 5.66% (adb), nitrogen 1.04% (adb), total sulfur 3.29% (adb), oxygen 34.63% (adb) and calorific value 3704 cal/gr, (adb). While the results for the third sample, OBB-3: moisture content 27.02% (adb), ash 17.82% (adb), volatile matter 34.44% (adb), fixed carbon 20.72% (adb), carbon 37.44% (adb), hydrogen 5.80 % (adb), nitrogen 0.99% (adb), total sulfur 3.39%, calorific value 3594 cal/cal (adb). Based on chemical analysis of coal, Kampung Ombrob's coal rank according to ASTM D388 is lignite-B.

Abstracts

The Potential of Limestone as Raw Material for Cement in the Entrop area of Jayapura City, Papua Province

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Abstract. Papua has very complex rock types due to tectonic activity, one of which is a sedimentary rock with a carbonate chemical composition which covers a wide area. Areas with quite a lot and wide carbonate rock content, namely in Jayapura City, especially in the Entrop area. In this area, cliffs are found which are large and wide limestone outcrops that add to the special features of the area. Limestone is one of the raw materials for cement production, in addition to claystone, gypsum and silica sand and iron sand as additives. In the current era of development, the need for cement is always increasing according to the pace of development throughout Indonesia (Sukandarrumidi, 1999). The purpose of this research is to research the potential of limestone in the Entrop area of Jayapura City which can be used as a source of cement raw materials, by taking several limestone samples.

The sample is then analyzed for the chemical composition of the limestone in the laboratory. The purpose of this special problem research is to find the percentage of CaO and MgO elements and to determine the feasibility of limestone as a raw material for cement. Based on the results of analysis using X-Ray Flourescene (XRF), the limestone in the study area has a CaO content ranging from 97.8% to 99.3% and an MgO content ranging from 0.254% to 0.4%, where the CaO content of the chemical composition is based on SNI 15 -2049-2009 Portland Cement Raw Material exceeds the maximum grade. The recommended CaO content is around 67%.

Abstracts

Preliminary result: Scanning electron microscopy of surface sediment in Lake Buyan and Lake Tamblingan, Bali

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Abstract. Lake sediment is one of natural documents that can record and provide information about the history of changes in lake environmental conditions. Each lake sediment layer can provide information about environmental conditions at the time of deposition. One of the studies regarding condition of the lake was carried out using Scanning Electron Microscopy (SEM). SEM analysis is used to identify the minerals present in the sample. This study of mineral characteristics and environmental conditions uses surface sediment samples from Lake Buyan and Lake Tamblingan, Bali. Lake Buyan and Tamblingan are located in a Bratan Caldera that has not shown activity for a long time, also surrounded by Mount Tapak and Mount Lesong. SEM analysis results show the presence of clay mineral morphology in the form of flakes and stacked plates. In addition, the samples also found centric diatoms and pennate diatoms. There are four genera of diatoms found, namely Encyonema, Denticula, Discostela, and Aulacoseira. The abundance of diatoms in both lakes is probably related to the eutrophication process.

Abstracts

Source Analysis of April 2, 2023, Magnitude 5.6 Flores Sea Earthquake North of Bima, Sumbawa, Indonesia

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Abstract. The seismotectonic setting and the potential of significant earthquakes from the Flores Sea region in eastern Indonesia are not well understood. On April 2, 2023, a magnitude 5.6 earthquake occurred north of Bima (Sumbawa), specifically under the Flores Sea. This area has a complex tectonic setting with a Flores back-arc thrust and some local active faults. Our study aims to analyze the source mechanism of this earthquake using moment tensor inversion and hypocentre relocation methods. We utilized five (5) three-component regional BMKG seismic stations for the moment tensor inversion and analyzed aftershocks within one month following the main event for hypocentre relocation purposes. Our findings indicate that the earthquake was generated by an unidentified fault segment with a strike-slip mechanism, either an N/NW-S/SE west-dipping fault segment or E-W north-dipping fault segment. Through hypocentre relocation, we found that aftershocks were oriented directly to the N/NW-S/SW north of the Flores Thrust fault zone. We interpreted that this earthquake was not directly associated with the activity of the Flores Thrust system. This study can be helpful in updating our understanding of the active fault system around the Flores Sea and as a constraint to support seismic hazard mitigation.

Abstracts

Magnetic Basement Modeling at Karimata Strait Using MagB_Inv

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Abstract. Indonesia is a country with abundant natural resources, such as tin, which is associated with granite rocks. Granite can be found under sedimentary rocks as basement rock. The depth of the magnetic basement will provide a value that indicates the location or presence of granite rock. This research is expected to be possible to identify the depth of the magnetic basement in the Karimata Strait area and obtain a relationship between the results of magnetic basement modeling using the MagB_Inv program and the regional geological structure in the Karimata Strait area. Based on magnetic anomaly data used, digitization was carried out to obtain contour maps using ArcMap and gridding using Oasis Montaj. Then do the calculation of the average depth estimate using the Radially Averaged Power Spectrum (RAPS) and magnetic basement modeling using MagB_Inv. Depth values that vary from 3.2 to 6.3 km, with average of 4.5 km, indicate significant undulation in the west-east direction. Meanwhile, in the north-south direction, the depth undulation tends to be less significant. According to geological modeling, there is an indication of a basin known as the Bangka Basin, and the magnetic basement in the study area is granite.

Abstracts

Determination of Rock Mass Deformation Modulus Based on Geotechnical and Geophysical Surveys: Samarinda Tunnel Case Study

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Abstract. Samarinda is one of the biggest cities in East Kalimantan province and a center of economy and government in Indonesia. High traffic mobility requires a plan to build a 400-meter tunnel to maintain the smooth flow of traffic in that area. The deformation modulus is one of the important parameters needed to create a numerical model for various rock engineering projects such as the construction of a tunnel. Laboratory tests are often inadequate to accurately determine the deformation modulus of the rock mass, so an empirical approach and in situ tests are used. Based on the geological survey, the research location was dominated by soil, high weather claystone, medium weather claystone and sandstone with dominant rock mass quality in RMR class II and class III.

Laboratory testing showed that the average modulus of elasticity was 240 MPa, 575 MPa, and 890 MPa for high weather claystone, medium weather claystone, and sandstone materials, respectively. The pressure meter test measurements showed the average value of the deformation modulus is 807 MPa. Meanwhile, seismic downhole deformation modulus was more than 10,000 MPa which is much larger than the pressure meter test, so these variables tend to have a weak relationship. The seismic downhole measurements have shear wave velocity values of more than 750 m/s, which means that the research location falls into the category of rock site according to SNI 1726: 2019. From deformation modulus surveys based on laboratory test, pressure meter test, and empirical approaches, a new deformation modulus equation is obtained that can be used for the Claystone MW and Sandstone properties at the boreholes along the tunnel. This equation can be used as a consideration in the Samarinda tunnel design.

Keywords: Pressure meter test, modulus deformation, seismic downhole, RMR.

Abstracts

Evaluation of Depth Dependent Seismic Anisotropy within Limited Offset on Vertical Transverse Isotropy Media: Deep Water Reservoir Case Study

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Abstract. Hydrocarbon bearing sediment in deep water reservoirs are uniquely characterized by the body of water being an additional weight on the top of vertical sedimentary layering. While large aerial extent of deep water reservoirs are known for their ability to contain substantial amount of reserves, they come with technical difficulties mainly in acquisition and imaging aspect. Deep water seismic imaging more often than not suffers from the hockey stick effect found in the long offset. At the same time, the presence of hockey stick in seismic long offset could be utilized as a tool to extract anisotropy information from seismic data. However, the deep target level requires a rather long offset in seismic data to be able in capturing a proper hockey stick condition. This research intends to evaluate seismic anisotropy behaviour in various depth level within a limited range of offset instead of the commonly used very long offset. Seismic related anisotropy (η) is extracted from travel time error as a delta to the isotropic travel time. The extracted anisotropy η is to be plotted against several known VTI travel time approximation in order to identified the equation that most fitted to the deep water real data condition. Several depth levels are to be analysed as an attempt to capture depth related variation in multi reservoir scenarios. At last, Fresnel Zone for each depth level would be calculated as a quantitative guide to determine resolvable sedimentary layers that still hold reservoir character as well as anisotropy information on the seismic data.

Abstracts

Observation is conducted on PMBG Seismic Gather around several well location as point of validation. The result shows indication of seismic anisotropy degree variation within progressed depth that could be concluded as depth dependant behaviour. The fact that the observed area has a typical character of weak anisotropy which only has a small impact on seismic data encourages a possibility to delineate anisotropy from seismic data with a certain treatment. Analysis on limited range offset seismic promotes the utilization of old vintage seismic data for seismic anisotropy extraction that contribute to the vision of using a new insight on the existing data as part of enhanced oil recovery strategies.

Keywords: seismic anisotropy, depth depnedant anisotropy, deep water, limited offset seismic, and vertical transverse isotropy

Abstracts

Magnetic Basement Relief Modelling Using the Magb_Inv Program in South of The Makassar Strait Area

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Abstract. Indonesia is located between three large plate confluences: Indo-Australian, Eurasian, and Pacific. The activity of the three plates will affect the orientation and distribution of geological structures such as formation of faults and basins, in this case, the research was conducted in the South Makassar Strait and includes two basins, namely the Makassar Basin and Spermonde Basin. Magnetic method used in research to provide magnetic modeling information in the region study. This method works based on the measurement of susceptibility variations on the earth's surface caused by differences in anomalies in the surrounding area. Data used in research, namely magnetic anomaly data obtained from the ESDM geoportal and bathymetry data research area.

In this research, magnetic basement relief modeling was carried out using MATLAB based MagB_Inv program. The initial parameters that affect the result of the study are inclination and declination, contrast magnetization, wavenumber range selection, and initial depth estimation. Depth estimation Initial results were obtained using the radial average power spectrum (RAPS) method. The results of this study in the form of basement depth in the range of 5.5 km to 8.9 km. According to geological conditions, there is a decrease in the basement to the southeast in 3D modeling caused by a fault Spermonde Basin Flat.

Abstracts

Low Sulfidation Epithermal Deposit Hydrothermal Alteration and Vein Characteristics of Dayak Gold Mine in the Baruh Area, Murung Raya Regency, Central Kalimantan Province, Indonesia

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Abstract. The research takes place at the Dayak Gold Mine in the Baruh area of Konut Village, Tanah Siang District, Murung Raya Regency, Central Kalimantan. The Dayak gold mine is one of the gold mines in Indonesia with an epithermal deposit type. In the process of forming this type of mineral deposit, it occurs due to side rock contact with hydrothermal solutions resulting from interactions between magmatic fluids and meteoric fluids in fractures formed due to tectonic activity. The fluid carries ore minerals which bind metal elements, one of which is gold metal. This study aims to determine the geological conditions of the research area including lithology, geological structure, distribution of alteration and mineralization, and also characteristics of the epithermal deposits of the study area. The methods used in this study were field mapping, analysis of petrography, XRD (X-Ray Diffraction) of altered rock, and AAS (Atomic Absorption Spectrophotometry) of the quartz vein. The research area consists of Breccia Pyroclastic unit and Tuff Ash unit. The geological structure that developed in the area has a shear fracture and dextral strike-slip relative to the NW-SE trend and then produces the dominant pattern directions NE-SW and N-S. The Geomorfology unit in the research is pyroclastic flow ridge. Rock units in the research area have silicified alteration and argillic (illite-smectite) alteration. The texture of the quartz veins that developed in the study area were comb, vuggy, drusy, lattice bladed, saccharoidal, colloform and crustiform. The mineralization of the research area is present in the elements Au, Ag, Cu, Pb and Zn, for the element Au has the highest content is 9.41 ppm, the highest level of Ag is 21.7 ppm, the highest level of Cu is 396.2 ppm, the highest level of Pb is 1133.5 ppm, the highest level of Zn is 117.8 ppm. Based on the characteristics of the epithermal deposits, the research area is a low-sulfidation type of epithermal deposit at the level between precious metal and base metal horizon.

Keywords: epithermal, low-sulfidation, alteration, mineralization, Baruh

Abstracts

Stability Analysis of Quartz Sand Tailing Mine Operation Using Particle Flow Code Method

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Abstract. Tailing is a residue that is not a target mineral and is considered less valuable. Tailing materials from the processing plant will be placed in an area called a tailings storage facility (TSF). Tailing may contain materials or minerals that are valuable. TSF mining can be done to exploit materials that have the potential for reuse. In the process of quartz tailing mine operation, slopes will form in the excavation boundary area. Slopes formed of loose material have a higher risk of instability. In this study, slope failure mechanism will be analyzed using (PFC2D) software. The input parameters of the software are in the form of grain size distribution and material microparameters obtained from calibration results between macro parameters obtained from laboratory test results with macro parameters that obtained from UCS simulation using (PFC2D). The simulation was carried out on a slope model obtained from the recommendation of the Hoek & Bray (1981) graph with a variable slope. The modeling results show that slope failure begins with deformation then forms a crack and ends with slope failure.

Abstracts

Elemental Mass Balance Calculation of the Hydrothermal Alteration in Awak Mas Gold Deposit, Sulawesi Island, Indonesia

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Abstract. Primary gold mineralization is associated with the hydrothermal processes. Interaction between the hydrothermal fluids and the wall rock resulting an alteration which characterized and indicated a mineralization proces. The understanding of the mechanisms of alteration requires quantification of elemental changes in proximal to distal alteration zones. This study was conducted on an orogenic gold deposit at Awak Mas determine the lithogeochemical in each alteration zone caused by the hydrothermal processes. A total of eight schist rock samples geochemical data were applied in this study representing the least altered, quartz-albite zone, and albite-ankrite-pyrite zones.

Major elements geochemical data was resulted by XRF analysis, and trace elements obtained by ICP-MS analytical method. The calculation method for mass balance during alteration is carried out using EASYGRESGRANT software which is an application from the Microsoft Excel spreadsheet program. The calculation results show that there are gains and losses of elements that cause changes in rock volume and mass due to the reaction of hydrothermal solutions with wallrocks. From the least altered schist to quartz-albite zone, the alteration process increases 19,9% SiO2, 4.5% Na2O, 3.4% Fe2O3 and decrease of some elements, while Al and Ti were relatively immobile. This alteration process causes a gain in total rock volume of 20.7%. Furthermore, the alteration from quartz-albite to albite-ankrite-pyrite showed the gains of 0.16% SiO2, 0.43% Na2O, 1.3% SO3, 1.55% CaO, this reaction resulted in an additional volume to 9.7%. These calculations indicate that the hydrothermal solution is dominated by silica and sodium elements which form the secondary minerals of quartz and albite in distal zone. In the proximal alteration zone, which carries gold mineralization besides silica and sodium there is also characterized by enrichment of calcium, iron and sulfur which results in the formation of ankrite and pyrite. Gold is associated with pyrite which are formed in the albite-ankrite-pyrite zone.

Abstracts

Identification of Permeable Zone Using Gravity Data in DB Geothermal Field

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Abstract. Permeability is one of the key factors in a geothermal system that accommodated the geothermal fluid to flow in the reservoir through faults. The DB geothermal field has a geothermal system, as evidenced by the appearance of manifestations such as fumaroles, steaming grounds, and hot springs. The appearance of manifestations is influenced by weak zone or permeable zones associated with the main structures as a fluid conduit in the study area. This study was conducted to identify permeable zones using gravity data in the DB geothermal field.

In detecting permeable zones associated with the presence of structures, advanced processing on gravity data can be used, namely from Complete Bouguer Anomaly (CBA), regional and residual anomalies, Horizontal Gradient Magnitude (HGM), Second Vertical Derivative (SVD) and Multi Scale-Second Vertical Derivative (MS-SVD) which is correlated with geological and geochemical data. The integrated analysis shows the contrast of gravity anomaly, the maximum value of HGM, and the zero value of SVD that forms alignment patterns in the NW-SE direction. The alignment pattern is associated with the geological structure developed in the study area, which is NW-SE oriented, and along the structure, there are manifestations of hot springs. Therefore, the results of this study can identify high permeability zones that can be used as drilling well targets and can develop the DB geothermal field in the future.

Keywords: geothermal, permeability, gravity, horizontal gradient magnitude, second vertical derivative

Abstracts

FEATURES OF REFLECTANCE SPECTROSCOPY AND GEOCHEMISTRY TOWARDS REE MINERALISATION IN CLAY MINERALS

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Abstract. As the global demand for rare earth elements (REE) has escalated, their recognition as critical raw minerals has prompted intensive exploration, particularly in Indonesia, a region with a significant potential for REE mineralization. REEs are often enriched in clay minerals weathered from granitic bedrock, positioning clay as a vital source of these sought-after elements. The chemical composition and structure of certain clay minerals facilitate the adsorption of REE3+ ions, making them repositories of these elements. This study introduces a systematic approach to rapidly identify the presence of REE in ion-adsorption deposits by employing reflectance spectroscopy as a primary investigative tool.

In a meticulously controlled environment, an analytical spectral device FieldSpec4 spectroradiometer (ASD FieldSpec4) was deployed to record the spectral reflectance of the clay samples, providing a comprehensive wavelength profile. The spectral data were compared with the results of Inductively Coupled Plasma Mass Spectrometry analyses. By correlating these datasets, we extrapolated the absorption depths and distinctive wavelengths indicative of REEs in the clay minerals. X-ray diffraction further clarified the clay mineral species in the samples. Such analysis facilitates the quick identification of REE in clay samples, leveraging the portability of ASD FieldSpec4, and offers a practical alternative to traditional, more resource-intensive detection methods. By employing this innovative approach, we demonstrated the potential of spectroscopy in geoscience, particularly for REE exploration. This study underscores the substantial benefits of reflectance spectroscopy, including cost-effectiveness, rapid data acquisition, and field adaptability, illuminating a new pathway for efficient REE exploration in Indonesia and beyond.

Keywords: rare earth elements (REE), clay minerals, spectroscopy, geochemistry, exploration.

Abstracts

The Interpretation of Subsurface Structure Beneath Banda Api Volcano Inferred from Gravity Data

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Abstract. Indonesia has 127 active volcanoes along subduction zone, one of them is Mount Banda Api. As active volcano which is surrounded by the sea, volcanic eruption may trigger destructive tsunami in the adjacent coastline. Several geological studies had been conducted to understand the history of volcanic eruption based on the surface mapping. However, in order to further interpretation regarding subsurface activity of the volcano geophysical data is needed. Therefore, the purpose of this study was to understand the subsurface structure of Mount Banda Api based on the interpretation of gravity data. The Complete Bouguer anomaly are acquired by PSDMBP in 2016. The complete Bouguer anomaly range is 130-200 mgal with low values located on the Banda Api volcano and high anomalies on Neira Island and Lonthoir Island. Then 2D spectral analysis is conducted to estimate the depth of regional dan residual anomaly and determine the optimal Moving Average (MA) windows to conduct regional-residual separation. Furthermore, the residual anomaly and background density of 2.63 g/cc was used to interpret the subsurface structure beneath the volcano by conducting forward modelling 2,5 D. The resulting model shows that the low anomaly in the study is estimated as a response to the presence of magma at the bottom of Mount Banda Api-Neira.

Keywords: Banda Api, volcano, Banda, volcano, gravity, interpretation

Abstracts

An Integrated Approach to Economic Analysis of EOR Projects: EOR Screening to Optimization of Field Development Scenario

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Abstract. Conducting a comprehensive evaluation for framing enhanced oil recovery (EOR) projects poses challenges during the initial stages. There is no evaluation that can provide a precise quick-look assessment that can be applied in a field. This study aims to implement an integrated EOR analysis workflow using the Pertamina's in-house PertaEOR-lite© software in the "ADP" field. A predictive model developed by the US DOE was used to perform reservoir performance prediction based on the most suitable EOR method. Economic evaluation was performed to determine the NPV, IRR, and POT values, while sensitivity analysis and risk assessment were conducted using the Monte Carlo simulation. The optimal scenario was determined using stochastic optimization methods on fields with different pattern areas and the number of infill wells. Based on the EOR screening, chemical injection of Miscellar Surfactant+Polymer was selected as the most suitable EOR method. The economic indicators determined through sensitivity analysis are primarily influenced by technical factors such Sor, and VDP. Additionally, economic variables such as oil prices, investment, and injection costs. The results showed that the best EOR development scenario was to be 8 patterns with an area of 28 acres each, no additional infill wells required, 8 injectors from converted producers. This scenario produces an NPV of K.USD 6,309, an IRR of 48.9%, and a POT of 2.8 years. The study's novelty is in its integrated approach. Further analysis is necessary to determine decision quality and obtain the best decision prior to field implementation project.

Keywords: Screening EOR, integrated approach, US DOE, Miscellar Polymer, Economic Analysis

Abstracts

Magnetic Basement and Curie Point Depth model of Bali Island: Implication for the thickness of the sediment layer in the island arc area

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Abstract. The island of Bali is an example of a volcanic arc with a recently active volcano at its center. Volcanoes on the island of Bali were active and had major eruptions in the past, as evidenced by the construction of calderas on the Buyan-Bratan and Batur volcanoes. Mount Agung is an active volcano at the moment. The results of the volcanic eruption on the island of Bali covered almost the entire island. There is a possibility that there is a continuous layer of carbonate under the island of Bali at the bottom of the island, causing the tectonic conditions under the island of Bali to be unique to study, especially regarding how the basement is under the island of Bali. To determine the basement of the island of Bali, the Magnetic Basement (MB) and Curie Point Depth (CPD) methods are used. The MB method is calculated using a 3D inversion system with the MagB_Inv application. While the CPD method uses calculations based on the centroid method, the spectral analysis is calculated using the Oasis Montaj application. The data used is magnetic ground data taken directly. From these two approaches, two different surfaces were obtained from the basement under the island of Bali. The magnetic basement has a depth of between 2 and 6 kilometers. The shallowest part is in the volcanic area, and the deepest is located in the lowlands in the south of the volcano area on the island of Bali. It is possible that the surface resulting from this magnetic basement is associated with a geological basement or a boundary between sedimentary rocks and rocks that have crystalline minerals (igneous or metamorphic rocks that are considered basement rocks). Meanwhile, the CPD method generally shows a shallower depth than the MB method.

Abstracts

It is not commonly found in other areas. The depth of the CPD surface is between 3 and 10 km, with a surface shape similar to that of the MB. The depth of the Curie Point is probably caused by the relatively narrow area of the study area, which causes shallower anomalies. The depth of the CPD is likely associated with the boundary between deposits from volcanic eruptions on the surface and the carbonate layers immediately below and below the top of the magma chamber. These results can confirm the existence of continuous carbonate layers and the overall thickness of sediment beneath Bali Island, and of course, this information can be used to generate new data for the purposes of mitigating volcanic and earthquake disasters.

Abstracts

Forward Modeling Study of Gravity Method with 2D and 2.5D Polygon Body Approach for Simple Application to Area in Kabupaten Luwu, South Sulawesi

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Abstract. This research focuses on the gravity method as a geophysical technique to investigate subsurface conditions and density distribution. The study employs forward modeling, which generates data based on an initial model, utilizing the polygon body approach. Two types of forward modeling approaches are utilized: the 2D polygon body approach, assuming an infinite strike length, and the 2.5D polygon body approach, assuming a finite strike length. The research aims to analyze the impact of geological structure strike on gravity anomalies. A forward modeling program is developed in MATLAB and validated against FastGrav and ModelVision software.

Testing is conducted on various geological scenarios, such as basin, intrusion, and fault. The results show that the 2D modeling program has a maximum difference of -0.029 μGal and an average difference of -0.057 μGal. For the 2.5D modeling program, the maximum difference is 0.25 μGal, and the average difference is 0.18 μGal. The program is also applied to model the subsurface of Kabupaten Luwu under two conditions, with variations in surface geological strike data, yielding a maximum difference of 272.3 μGal and an average difference of 81.7 μGal. Lastly, using synthetic uniform geological strike data with a length of 5 km, the 2D and 2.5D modeling programs show significantly different results, with a maximum difference of 1297.7 μGal and an average difference of 908.8 μGal, attributed to the assumption of infinite strike length in the 2D program.

Abstracts

The impact of underground support and mine opening profiles on the economics of underground mining projects

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Abstract. Mining dimensions and support in underground mines, especially in the cut and fill method, are important aspects that cannot be ignored. Determining the appropriate and efficient dimensions and mine support is crucial to ensure safe excavation holes. Increasing mining dimensions affect the amount and quality of mine support needed, but are proportional to the production capacity that can be achieved. Furthermore, using more support affects the total cost of mining , although it can ultimately lower mining costs, as the amount of material that can be moved increases. Optimization by implementing mining scenarios can be performed to assess the impact of support costs on the economy of a mining block. This study attempts to examine the feasibility of three mining scenarios with various excavation profiles. Excavation profiles of stope cut and fill with variations of 2mW x 2.5mH; 3mW x 3mH; 5mW x 5mH, further referred to as scenario 1, scenario 2, and scenario 3, respectively, are established as the base scenarios for optimization. The mine support requirements are then calculated based on the material load per square meters of tunnel progress and the available mine support specifications. Based on the mine support analysis, the required support is grouped into two categories, with scenario 1 and 2 grouped in one separate category from scenario 3. Scenario 3 requires stronger and more mine support than scenario 1 and 2, including the need for 18 pcs/m of dome plate type 47 (un-galvanized) and split set type 47 (un-galvanized), respectively, along with other primary support of 2 pcs H-beam per meters. The calculation of mine support costs is then performed and combined with other mining cost components to form the required cost parameter in the optimization process. The optimum stope shape is then created through the optimization process, commonly known as Stope Shape Optimization (SSO), by applying the mining profile in each scenario.

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The stope optimization results show the stope layout in the zone with high grade where the total estimated reserves for each scenario are 20,482 tonnes; 30,057 tonnes; and 43,508 tonnes, with an average gold grade of 2.74 g/t, 2.73 g/t, and 2.71 g/t, respectively. Economic value calculations have also been performed on the amount of mined reserves in the optimization process, with the highest mining cost shown in scenario 1 at $1.40 million, resulting in a mining cost per ton of 59.93 $/ton. The highest revenue is obtained in scenario 3 with an economic value of $112.58 million, which is consistent with the profit of $109.17 million, indicating that scenario 3 is economically feasible.

Abstracts

Identifying Geochemical Anomalies of Precious and Base Metals from Stream Sediment Samples in Pacitan-Ponorogo District, Java Island, Indonesia

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Abstract. Pacitan-Ponorogo is an prospect area of metalic mineralization. The prospect has been known for a long time. Pacitan-Ponorogo was located in the Southern part of East Java, Indonesia. The area is part of the Southern Mountains Range that resulted of Indo-Australian plate subduction on the Eurasian Plate. The product of volcanic activity in the Oligocene to Miocene was anomalous of precious metals such as Au, Ag and base metals such as Cu, Pb, Zn, and associated element of Sb and As in the several area. A number of 232 stream data were collected from the study area. Geochemical anomalies for mineralizing elements and element associations were identified using statistical analysis, including the mean ± 2 standard deviations (Mean + 2STD) and the median ± 2 median absolute deviations (Median + 2MAD) from 232 samples. Mean + 2STD is used to identification of the threshold values for normally distribution data, meanwhile Median + 2MAD is analysed of abnormally distribution data for example Au and Ag. The both of methods could identify geochemical anomalies related to metallic mineralization and their associations. Geochemical anomalies were recognized by the element content values that are greater than the threshold value. The statistical analysis identified anomalies values of Au, Cu, Pb, Ag, Sb and As are 9-58.47 ppb, 192-524 ppm, 316-660 ppm, 764-1818 ppm, 6-46 ppm, 175-400 ppm and 8-14 ppm, respectively. Deliniation of mineralization zone was conducted for some areas that have high anomaly, such us the Gempol, Kasihan, Tegalombo-Jompong and Tuking areas. The area has the potential to be further exploration, that found the economical metal deposits.

Keywords: exploration, geochemistry, statistical analysis, mineralization.

Abstracts

Analysis of Peak Ground Acceleration Values in Central Java Using Microtremor Data

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Abstract. The geology of Central Java is one of the most complex and active areas in Indonesia. The presence of active volcanoes and the Kendeng Basin, which is a continuation of the North Serayu Mountains in the eastern part of Java. The study of the geological conditions in Central Java is a challenging task. Therefore, a comprehensive understanding of the geological phenomena in Central Java is important to better reduce the risk of possible disasters caused by the geological dynamic in the area. A seismological study is needed to complete the understanding of subsurface structures. In this study, using the Horizontal to Vertical Spectral Ratio (HVSR) we can extract the dominant frequency values and amplification values from the MERAMEX network microtremor data. Shear wave velocity values are obtained using 1D inversion beneath the stations and we try to determine the peak ground acceleration (PGA) values at the surface. This surface PGA value is important for soil mechanics analysis in geotechnical engineering. The peak ground acceleration (PGA) value on the surface of central Java is 0.36 – 0.72 g and this value seems to strengthen from north to south.

Abstracts

Elastic property analysis and characterization of rocks using digital rock image

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Abstract. Rocks are composed of a variety of materials, making them complex. Their mechanical and elastic properties are affected by several factors. In this research, we drilled a diabase core and prepared it to be characterized and analyzed. This study aims to conduct rock's elastic properties using dynamic and static methods using ultrasonic measurements and digital rock physics, as the sample was characterized using mineralogical analysis using XRD and thin sections. Moreover, micro-CT scanning was used to investigate the presence of layering and fractures that may affect the anisotropy of acoustic wave propagation through digital images.

The results suggest that ultrasonic measurements and XRD analysis are useful in uncovering the properties of rocks. Additionally, multiphase digital rock physics simulation and numerical calculation may need to overcome the difference between dynamic and static methods.

Abstracts

Remote Sensing Imagery Approach for Diamond Mining Monitoring, Operation, and Post-Mining, Study Case: Cempaka Diamond Mine

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Abstract. Satellite technology is utilized throughout various stages of the diamond industry, including the exploration-exploitation monitoring process, production phase, and monitoring activities after closure. The appropriate method for exploration or monitoring in a Cempaka deposit classified as secondary (alluvial) depends on its type using an integrated set of multi-scale remote sensing data and methods across ten years. An integrated Geographic Information System (GIS) targeting database that typically incorporates data from sources such as Landsat, ASTER, and UAVs is essential for efficiently managing these deposits. In addition, digital elevation maps and mineralogical and geochemical sampling results would provide supplementary information. ASTER has gained significant attention as an exploration tool due to its ability to combine reflected and emitted long-wave infrared (LWIR) signals, which helps identify mantle minerals spectra. High-resolution digital elevation models (DEMs) are crucial in exploring alluvial deposits, as there is typically a correlation between the deposit's richness and its geomorphology. DEMs help differentiate between paleochannels, alluvial flats, and terraces. For constructing DEMs, monitoring surface changes, operational expansions, and calculating the volume of rock dumps and tailing storage facilities, high-resolution optical data like UAVs with a 0.5-5.0 m per pixel resolution is necessary. Additionally, detecting and plotting the size and distribution of artisanal workings can help determine the extent of an alluvial deposit. Satellite and UAV imagery was used to interpret mining activities for each year between 2013 and 2021.It is noticeable that although several diamond mining locations during the specified years are situated within the 'Mining/Bare' zone of the regional-scale dataset, numerous diamond pits exist outside of this area.

Abstracts

Forecasting Commodity Prices with Mean Reversion of Vasicek Model

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Abstract. A feature of commodity price is that they often exhibit mean reversion that tend toward the long-run equilibrium level (similarly to interest rates). Some of the models developed for interest rates can be adapted to apply to commodities, due to supply and demand phenomenon. This paper is investigating a model that is suitable to represent the dynamic of nickel price movement as the underlying. The equilibrium model of vasicek model is applied to forecast the expected nickel future prices and it's long-run level. The annual average price of LME is obtained from 2003 to 2022. The parameter of vasicek model is estimated by the ordinary least square method. The OLS classic assumption test is carried out to determine the unbiasness of the model. The result shows that the vasicek model significantly explain the dynamic of nickel price movement. The parameter values of vasicek model which is obtained by the OLS method are the convergence speed (a) of 0.39, the equilibrium level (b) of $18,061 and σ of 0.27. The expected future prices for 2024, 2025, 2026 and 2027 at the initial price of $22,459 (11 Mei 2023) are $20,921.32, $19,943.96, $19,310.58 and $18,894.73 respectively.

Keywords: forecasting, mean reversion, vasicek model, Ordinary Least Square (OLS), nickel price

Abstracts

Liquefaction hazard assessment on the nuclear installation area of Puspiptek-Serpong

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Abstract. Natural hazards and their resulting disaster have become a global issue after causing many disasters that impact the environment and human life. Geotechnical hazard is one natural hazard that directly affects the environment and causes ground movements. It includes earthquakes and their related hazards, such as soil liquefaction, lateral spreading, sinkhole, tsunami, and landslide or slope failure. This research will focus on hazard mitigation by analyzing and modeling the potential liquefaction in the research area. Sandy fluvial deposits of the Serpong Formation and marine claystone of the Bojongmanik Formation cover the surface of the research area in Puspiptek-Serpong. Puspiptek-Serpong is the area of several nuclear installations, including a research reactor, radioactive waste processing and storage, fuel element fabrication, radioisotope and radiopharmaceutical, and others. Several new nuclear installations also have been proposed in the area, including an experimental power reactor (EPR) and demonstration disposal facility. Recognizing the potential liquefaction hazard is essential in the mitigation analysis of proposed and installed nuclear installations. Methods applied in this research are assessment of grain size distribution curve for possible liquefiable soil, safety factor calculation, correlation, and 3D modeling. The safety factor is the cyclic resistance (CRR) ratio over the cyclic stress ratio (CSR). The drillhole analyzed for this research is 22 drillhole with a depth range between 25 to 100 m. In susceptibility assessment using grain-size distribution curves, none of the soil samples fall precisely within the boundaries for most liquefiable or boundaries for potentially liquefiable soil on Tsuchida's (1970) curve. Nevertheless, some fine-grain samples that fall outside the liquefiable boundaries are also calculated as SF<1. Liquefaction potential layers are identified in the fluvial deposit of the Serpong Formation. It occurs in the form of two separate layers.

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The liquefaction potential layer was primarily composed of coarse grain sediment from silty sand to gravely sand. Penetration test generally shows low to medium N-SPT or in the zone of loose to medium dense sand. Regarding the rock facies, liquefaction potential in the research area comprises point bar and crevasse splay deposits.

Keywords: hazard mitigation, geotechnical hazard, nuclear installations, liquefaction potential, safety factor

Abstracts

Interpretation of Tunnel Hazard Warning Levels Based on Laboratory Study Data on Indonesian Rock Types

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Abstract. A number of tunnel collapses occurred where the strain measured did not match the Hazard Warning Levels (HWL) graph. This is due to the absence of a comprehensive expansion of the database used in HWL. In this study, we will interpret HWL by analyzing the results on the Sakurai graph against the strain data from UCS tests of various rock types in Indonesia. After analyzing the 3 levels on the HWL graph, it is found that HWL I corresponds to the critical strain at 21%, HWL II corresponds to the critical strain at 41% UCS, and HWL III corresponds to the critical strain at 86% UCS. This result shows that the stress-strain curve in the uniaxial compressive strength test can be used to predict tunnel stability.

Keywords: hazard warning levels, critical strain, unconfined compressive strength, tunnel stability

Abstracts

The Effects of Permeability Anisotropy on Reservoir Rock Type Using Digital Rock Physics Method

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Abstract. Rock typing is an essential reservoir characterization and description process for many engineering applications. However, the presence of rock permeability anisotropy can complicate the process. Anisotropy in rock formations can be intrinsic or induced by deposition, diagenesis, and tectonic movements. Further investigation of the effect of anisotropy on reservoir rock type is critical because it controls lateral and horizontal fluid movements. The ratio of vertical to horizontal permeability has a significant effect on fluid flow and recovery factors in water drive reservoirs or EOR operations. Since the three-dimensional (3D) pore geometry structure of reservoir rocks can be captured and visualized, and it is capable of computing core sample parameters (such as porosity and absolute permeability), digital rock physics (DRP) has advanced at a rapid pace.

Core CT-Scan data from the Bentheimer Sandstone study was processed with the DRP software to obtain porosity and tensor (anisotropy) permeability values. The tensor permeability values were converted to anisotropy permeability using the equation derived from Liakopoulos' paper. Furthermore, Amaefule's HFU technique was used for rock typing. The RQI, Phi_z, and FZI values were calculated to classify the rock types. In addition, the consistency of rock types along the x, y, and z axes was evaluated.

Based on the research results, it was found that the anisotropic permeability values in each direction (x, y, and z) are directly proportional to the porosity values in each direction. In addition, rock typology can also be determined using the Reservoir Quality Index (RQI) values against Phi_z, which is built based on the Flow Zone Indicator (FZI) values. The results of the 25 values obtained show that the FZI values are in the same range and have a gradient of 1 because they come from one core sample of Bentheimer Sandstone rock. The DRP method is also considered more efficient in determining the porosity and permeability values of rocks quickly and efficiently compared to conventional research methods that require more time and cost. Therefore, it can be concluded that the DRP method has great potential in determining important parameters in reservoir characterization.

Abstracts

Petrological Constraint on Pre-Cenozioc Chert Origins of Embaluh Group in Long Wehea, East Kalimantan, Indonesia

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Abstract. . Chert is a kind of sedimentary rock that was deposited in a deep-sea environment around 3000m to 4000m below sea level. The presence of chert in the Long Wehea area is located in the Protection Forest area, Muara Wahau, East Kutai. Long Wehea is known as a narrow area that has complex geological features belonging to the Embaluh Group. No research was conducted to acknowledge the petrogenesis of the chert in Long Wehea however, the lateral accretion of the chert is quite wide. We use petrological and petrographical analysis to classify them into two categories: bedded chert and single-layered chert. Both of these are brownish red in color.The bedded chert is the most common type; it occurs 1 cm to 5 cm thick with conchoidal fragments and commonly exhibits carbonate veins. The thickness of the veins is up to 3mm. Petrographically, the bedded chert is composed of microquartz and megaquartz, and the matrix of these cherts is dominated by cryptocrystalline quartz. The single-layered chert is structureless and homogeneous, and no veins appear. Petrographically, the single-layered chert has a dominant quartz content in the form of microcrystalline quartz. These petrological and petrographical data provide compelling evidence that the chert at Long Wehea has been dominantly influenced by hydrothermal activity and is classified as a type II chert due to the absence of radiolarians or siliceous sponge spicules.

Keywords: Chert; Petrology; Petrography; Long Wehea; Embaluh Groups.

Abstracts

Lithofacies Analysis and Sedimentation Dynamics Modelling of Balikpapan and Pulau Balang Formation in Sungai Payang, Loa Kulu District, East Kalimantan Province, Indonesia

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Abstract. The Kutai Basin, which has various formations, is known to have economic potential due to the discovery of coal and oil-bearing formations at the research location, so it is important to accomplish geological mapping and analysis of sedimentation dynamics at the research location. Administratively, the research location is in the Sungai Payang area, Loa Kulu District, Kutai Kartanegara Regency, East Kalimantan Province. The area is in the Lower Kutai Basin which is in the Balikpapan Fm. and Pulau Balang Fm. The Kutai Basin was formed because of subsidence from the Early Oligocene to the Early Miocene. This study aims to identify lithofacies and model sedimentation dynamics using surface and subsurface data, which consists of the results of geological mapping and well logging data, then lithofacies analysis, electrofacies analysis, and sequence stratigraphy will be used in this analysis. Furthermore, a merger is carried out to integrate the results of surface and subsurface analysis. The result of analysis obtained 12 lithofacies associated with each other consisting of sandy micrite lithofacies, muddy micrite, sandy allochem limestone, micritic sandstone, micritic mudstone, fitted grainstone, lithic arenite, quartz arenite, quartz wacke, mudstone, coal, and shale, as well as 4 depositional facies consisting of distributary channels, tidal bars, mouth bars, floodplains, and after interpretation there are 4 sets of parasequences that are interconnected, which is a repetition of HST, LST, TST, and HST, and represent the coarsening upwards pattern.

Keywords: Modelling; Sungai Payang; Loa Kulu; Kutai Basin; Balikpapan Fm.

Abstracts

Identification screening and ranking framework of potential CO2 in saline aquifer storage: a case study in Longyearbyen

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Abstract. Greenhouse gases emissions are the main cause of climate change in the world with CO2 ranked as the largest number of major pollutants (82%). The UNIS CO2 Lab examines the state of CO2 emissions in Longyearbyen through carbon capture storage. This study focused on a well in the research area, namely Dh4 and also additional seismic data. This research data is for analyzing the pre-condition first with geological and geophysical values. SRF produces primary containment that describes the state of implementation of Rurikfjellet – De Geerdalen RSC before CO2 injection which is applied to support the health safety environment. The results of SRF show the average value of weighted assessment of attribute is 1.41 and the average value of containment is 1.9, which is good value because the magnitude of the total average shows a value of 3.918 which is close to perfect in terms of the risk produced will be small when store CO2 later. The state of the seal and thick reservoir makes CO2 planning more convincing and on the other hand there is only one RSCs because only one oil and gas system (reservoir-caprock) can be analyzed for SRF and is the only primary containment.

Abstracts

Determination of the significance of hydraulic fracturing success factors for shale reservoir

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Abstract. Shale gas is a shale rock that has low permeability. The right way to explore it is to do hydraulic fracturing to increase well productivity by injecting fluid into the fracture using high pressure. The statistical method used to establish a relationship between one independent variable X or more with a response variable Y uses linear regression analysis. The method used in this research is simulation research by using CMG GEM simulator for reservoir simulation modeling and running sensitivity analysis using CMOST as much as 80 data, then performing multiple linear regression analysis with SPSS (Statistical Product for Service Solutions). This study aims to determine the factor parameters significant to hydraulic fracturing success in shale gas. Parameters used for sensitivity analysis were significant factors for successful hydraulic fracturing: fracture half-length, matrix porosity, young elastic modulus, natural fracture porosity, Poisson ratio, and Langmuir pressure.

The results of the T-test, which were carried out partially sequentially, showed that the variable X1 (fracture half-length) effect with a significant value of 0.985 > 0.05, variable X3 (Young's modulus of elasticity) significant value of 0.734, variable X4 (natural fracture porosity), dan variable X6 (Langmuir pressure) significant value 0.088. In addition to the results of the F hypothesis, the calculated F value simultaneously (together) is 11.231. While the R-value Square (R2) of 0.480 if it is a percentage, the result is 48%. It can be concluded that the six independent variables affect the dependent variable by 48%. The remaining percentage of about 52% is influenced by other independent variables, which are not examined in this study.

Abstracts

Bulk Flotation Optimization of Pb Levels for Suitable Smelter Feed

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Abstract. Galena mineral as one of the important types of minerals producing Pb metal, also has interesting potential for mining because it is widely needed in the market, but in Indonesia it is found concentrated in various locations. Galena Mineral Ore comes from Sindanglaya Village,Sukatani District, Purwakarta Regency, West Java, with a content of Pb ~ 8.7% contained in galena ore. Processing to produce Pb metal (ingot) is carried out in a smelting furnace (Pyrometallurgical Process), the level of impurity material (SiO2) needs to be kept as low as possible so that heat energy is effectively used to smelt the ore, while it is necessary to increase the Pb content in the ore. To increase the Pb content in the ore, a concentration process was carried out using the flotation method, so it is expected that by optimizing the parameters of the flotation process, the Pb content can increase in the flotation product, namely concentrate. The results of the study showed that changes in reagent dosage greatly affected the concentration of concentrated Pb. The optimum value resulted from a ZnSO4 depressant dose of 300 grm/ton and a Na2SO3 depressant dose of 0.03 ~ 150 grm/ton with a Pb content of 40%. While the effect of % solid and pH on concentrated Pb levels, the highest value was achieved at pH 8.5 percent solid 20, but it needs to be considered that the % solid 25 shows a tendency to increase but data above pH 9.5 is not obtained because the difference is not too big around 3 % whereas the percentage of solids is greater so that the optimum values taken are pH 9.5 and percent solids.

Keywords: lead; galena, flotation, metallurgy, smelter

Abstracts

Comparison of Rhamnolipid and Sophorolipid Application on Sandstone Reservoir for Enhanced Oil Recovery

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Abstract. Currently, the development of Enhanced Oil Recovery (EOR) technology leads to biotechnology that is more environmentally friendly to avoid high toxicity, which can damage the environment. This study will review the injection of bioproducts, namely rhamnolipid and sophorolipid biosurfactants, because they can be degraded by nature, are non-toxic, environmentally friendly, and resistant to salinity and high temperatures. In addition, biosurfactants are able to bind to hydrocarbon molecules, reduce interfacial tension (IFT) between water and oil, alter the wettability, and form microemulsions. This review compares the biosurfactant mechanisms of fluid-to-fluid and fluid-to-rock interactions in increasing oil recovery. The mechanism of these two biosurfactants is based on reducing IFT between the fluids and wettability alteration. Based on a literature review the interfacial tension test of rhamnolipids were superior to sophorolipids in reducing IFT. This occurs because rhamnolipids have a lower critical micelle concentration compared to sophorolipids. Both biosurfactants change the wettability from weak water wet to strong water wet with contact angles less than 75o. Furthermore, in the core-flooding test, both sophorolipid and ramnolipid increased recovery by 30% and 10%, respectively. The aim of this study is to give a brief review of the application of sophorolipid and rhamnolipid on enhancement oil recovery. This review presents an investigation on the comparison of the effectiveness of sophorolipid and rhamnolipid bisourfactants in sandstone reservoir. The results of this review are expected to be able to greatly contribute to science and the petroleum industry, especially in EOR applications.

Keywords: biosurfactant, rhamnolipid, sophorolipid, fluid to fluid, fluid to rock.

Abstracts

Simulation study analysis of the normal five-spot model and inverted five-spot polymer injection on X field

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Abstract. Increasing oil production has become the main focus in the oil and gas industry, so various methods are needed to increase oil recovery after production has decreased, one of which is polymer injection. The X field is located in Indragiri Hulu Regency. It has passed the secondary recovery stage, with an estimated oil-in-place reserve of 328,542.4 MSTB, recoverable reserve of 170,426.5 MSTB, recovery factor of 51.9%, and cumulative oil production of 135,856.8 MSTB. One of the activities that need to be carried out in chemical injection is to choose the right and efficient production-injection well pattern to be applied in the field. Therefore, a reservoir simulation study compared the normal and inverted five-spot patterns using variations in polymer concentrations of 500ppm, 1000ppm and 1500ppm and injection rates of 4000bpd, 5000bpd and 6000bpd. This study aims to determine the best scenario based on the largest oil recovery factor that can be applied to the X Field by looking at the cumulative change in oil obtained and the water cut.

The simulation results show that the maximum cumulative oil value in the inverted five-spot model with a concentration of 1500 ppm and an injection rate of 6000 bpd is 69757.4 bbl, and the minimum water cut value in the inverted five-spot model with a concentration of 1500 ppm and an injection rate of 6000 bpd is 94.81 %. While the maximum value of cumulative oil in the normal five-spot model with a concentration of 1500 ppm and an injection rate of 6000 bpd is 310241bbl, and the minimum water cut value in the normal five-spot model with a concentration of 1500 ppm and an injection rate of 6000 bpd is 92.78%. This study shows that the higher the polymer concentration used, the higher the cumulative oil increase, followed by the higher water cut reduction, so the selection of the right polymer concentration is very important to increase oil recovery in the X field.

Keywords: Polymer Injection, CMG-STAR, Normal five spot, inverted five spot, polymer

Abstracts

Optimization of stopes through the evaluation of cavity monitoring system data at the Big Gossan Mine, PT Freeport Indonesia

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Abstract. The mining industry use the Mathews Stability Graph (MSG) method as an empirical design tool to assess stope stability at the design stages prior to mining. It determines the stability of stopes by rating the rock mass characteristics against the hydraulic radius of the host rock. The cavity monitoring system (CMS) is a method used to determine the actual stope profile after production stage have been completed. The result is used to determine the dilution and ore losses during the production stage by comparing the actual stope profile against the original designed stope profile. The difference between the designed and actual stope dimensions are presented as an overbreak or underbreak volume according to the measured profiles..

The results of this study indicated predominantly stable conditions, with no overbreak's, in more than 95% of all the surveyed stopes. Further evaluation of the surveyed data indicates that the measured overbreak's are mostly related to operational drill or blast factors and less related to geological rock quality factors. In conclusion, this study indicated that stope designs can be further optimized to improve production, minimize dilution, and efficient of mining sequences, whilst maintaining a stable and safe mining environment at the Big Gossan mine.

Abstracts

Stability analysis of open stope #20 in sill pillar #2840 based on mining frame 134 using numerical, empirical, and analytical approaches at the Big Gossan Mine, PT Freeport Indonesia

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Abstract. Sill pillar #2840 has been identified as an economical reserve and is therefore planned to be mined. Stope #20 is one of 69 stopes in the sill pillar that will be mined. The stope is about 540m from surface. Mining activities that are far from the surface will cause stress redistribution. A geotechnical analysis was required to observe the stability condition of the open stope. The stability can be calculated by considering the induced stress around the open stope.

The calculation of the Factor of Safety (FS) will be carried out using a numerical approach with Rocscience's RS2 software using the Generalized Hoek-Brown failure criterion for hard rock and the Mohr-Coulomb failure criterion for paste fill, an empirical approach using a Modified Stability Number (N') (Potvin, 1988) to calculate the stability of hard rock around the open stope, and an analytical approach using the Limit Equilibrium Equation (Mitchell, 1991) to calculate the stability of the paste fill around the open stope. The results of the approaches will be verified by the Sakurai chart. Based on the approaches, stope #20 in sill pillar #2840 is in stable condition to be mined.

Abstracts

Geochemical Characteristic of Whole-Rock Weathering Profile at Nickel Laterite Deposit in Central Halmahera Island

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Abstract. As one of the world's largest nickel (Ni) producers, Indonesia should become one of the centers determining the direction of global nickel policy and is expected to be an important source of Ni in the future. Ni laterite deposits are developed by chemical weathering processes of ultramafic rocks in tropical humid climates such as Indonesia. In general, Ni laterite deposits evolved with three layers from the bottommost bedrock, saprolite layers, and uppermost limonite layers, as a consequence of intense weathering processes. A common trend of Ni enrichments concentrated in the saprolite layers must be understandable for efficient exploration. This study is to investigate the geochemical characteristics of weathering profiles at Ni laterite deposits from Central Halmahera island which developed from specific bedrock, and to clarify the Ni enrichment processes by geochemical perspective through qualitative analyses. The complexity of Ni raw ores may be challenging for ore processing in the metallurgical processes, as the reason to identify comprehensive through the different series of analytical approaches methods. The bedrock type through mineralogical analyses by XRD 2Θ Cu-Kα is to determine the characterization of bedrock from a mineralogical point of view where the result revealed that the bedrock was composed of serpentine predominantly, followed by pyroxene, magnetite-chromite, and small numbers of hematite. The dominance presence of serpentine was notified with the sharp peaks (e.g., 7.4 Å) and high intensity may indicate that serpentine is the major mineral in the bedrock with high crystallinity. Furthermore, the presence of hematite may assume that bedrock already weathered in advance. Similarly, microscope observation portrayed that the bedrock predominantly evolved from serpentine, pyroxene, and magnetite, where pyroxene appeared as a single large crystal and magnetite identified with dark freckles and usually surrounding serpentine whole-rock geochemical characteristic through XRF is to analyze the major elements (e.g., SiO_2, MgO, Al_2O_3, Fe_2O_3, and NiO) and minor elements (TiO_2, MnO, CoO, and Cr_2O_3) in which examined from the bedrock, rocky saprolite, soft saprolite, transition, yellow limonite, and red limonite layers.

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The whole rock trends show that there are inverted trends where SiO2 and MgO typically show downward trends and depleted from the bedrock towards the red limonite layers, compared to Fe2O3 which is extremely enriched towards the top of profiles, while Al2O3 which less characterized since the bedrock but significantly increased in the transition and yellow limonite layers, though fell back less enriched at red limonite layer. NiO shows fluctuating trends throughout the whole profile where started less enriched in the bedrocks but dramatically enriched further up the rocky saprolite and soft saprolite layers with NiO 2.4 wt% and reach the peaks of Ni enrichment between soft saprolite and transition layers with NiO 3.1 wt%. Furthermore, while TiO2 is typically less enriched in the whole profile, CoO, MnO and Cr2O3 tend to significantly increase towards the top of profiles. Consistently, the gain and losses (τ value) from the bedrock to further up the limonite layers may indicate the Ni enrichment processes where Fe2O3 and NiO show the positive gain correlation with (τ = 0 - 9) and (τ = 0 - 11), respectively, which may indicate that Fe is the important factor of Ni mobilization and enrichment throughout the whole profiles, while SiO2 and MgO loss and depleted at the top of profiles.

The major elements from the XRF result, furthermore, be able to indicate the geochemical evolution through the degree of chemical weathering in which visualized by the molar ternary diagram Si-(Fe+Al)-Mg, from the equation of the ultramafic index alteration (UMIA). The trends of MgO and SiO2 depletion and Fe2O3 and Al2O3 enrichment from the bedrock toward the top of profiles, where the UMIA value of the bedrock was low (3,3) and extremely increased from the saprolite layers (7.0-18.5) to limonite layers (44.4 – 83.7), assumed that the highest degree of chemical weathering was located in the limonite layers and indicate strongly altered.

The geochemical trends and mineralogical analyses ultimately can provide the information of the center Ni enrichment processes and the highest degree of chemical weathering which is located in the saprolite layers and limonite layers, respectively, as a consequence of the mobilization major and minor elements.

Keywords: Nickel; geochemical; mining; earth resources; weathering

Abstracts

Lithium and rare-earth elements in kaolin: mineralogy and mass-balance constraints on major and trace elements during kaolinitization of granite in Belitung, Indonesia

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Abstract. Mineralogical and geochemical variations of kaolin as a product of the weathered Triassic and Jurassic granite from the Belitung Island provided an opportunity to examine the effects of the source area on compositions of deposits. This study deals with the trace and rare-earth elements in kaolinite deposit from Belitung regions. Field observations along with geochemical and mineralogical observations using electron microscope were summarized to document mineralogy and element mobilization during weathering and alteration. The weathering of the Middle Triassic of Tanjungpandan granite produces kaolinite, muscovite and illite, with minor abundances of quartz and muscovite. Lithium and rare-earth elements (REE) concentration of these kaolin deposits ranging from 5-40 µg/g Li and up to 980 µg/g REE. Kaolin deposits originates from the Jurassic granite yield lower lithium and REE contents. Spectroscopic study of kaolin samples indicates that strong absorption mostly occurs at wavelengths of 1413, 1914 and 2207 nm. We report mass balance profile and the geochemical affinities to better understand the behaviour of elements and genetic links between kaolinite, rare-earth elements and metal associations.

Abstracts

Utilizing the Gravity Method for Initial Estimation of CO2 Storage Capacity in Supat Field, South Sumatera

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Abstract. Carbon Capture and Storage (CCS) technology is one solution to global warming. CCS is a method that involves separating CO2 from industrial and energy sources, transferring it to storage, and isolating it from the atmosphere for long periods of time. The Supat Field, South Sumatra is one of the mature oil and gas fields that could be used for CO2 storage in Indonesia. The gravity method is used to determine how much volume of CO2 can be stored in the Talang Akar Formation, Supat Field. By utilizing residual anomaly data and the Occam and Singular Value Decomposition (SVD) inversion method, it is possible to model in three-dimensions and estimate the volume of CO2. The Talang Akar Formation is dominated by sandstone with interconnected porosity. The effective volume can then be calculated by multiplying the bulk volume by the range of sandstone porosity (15-30%). The Complete Bouguer Anomaly Map provides a range of Bouguer anomaly values between 42 mGal to 46 mGal. Based on the spectrum analysis graph, the anomaly depth limit is 2.0996 kilometers below the surface, while the residual anomaly depth limit is 0.9524 kilometers below the surface. The anomaly separation technique used is Polynomial Trend Surface Analysis with the order used is first order. The effective volume of CO2 that can be stored in the Supat Field ranges from 1.73 to 4.42 $km3$.

Abstracts

Flow Assurance Study for Pipeline CO2 Transport During Offshore Carbon Capture Storage (CCS)

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Abstract. Climate change has become a priority concern in many countries; the most common pollution is carbon dioxide (CO2). Total indirect greenhouse gas (GHG) emissions from oil and gas operations in 2020 are about 5,200 million tonnes (Mt) of carbon-dioxide equivalent (CO2- eq) or 15% of total GHG emissions from the energy sector and will continue to rise in the future. Therefore, carbon capture and storage (CCS) holds potential for reducing global emissions by reinjecting CO2 back to reservoirs and/or geological storage. This activity also supported by Ministry of Energy Policy to combat global climate change in order to fulfill the goals of the UNFCCC Paris Agreement. Offshore CCS operations will always provide the bigger challenge compare to onshore operations. Complete and thorough study of from GnG, surface facilities, and subsurface need to be conducted for the implementation. This paper discusses a case example of CCS implementation on offshore field and focusing on flow assurance for pipeline injection. A transient dynamic simulator to capture pressure and temperature changes over the time is used to model injection performance inside the pipe. The fluid is transported in the form of supercritical or liquid state as the requirement of CO2 transport to honor the volume and fluid properties. The analysis based on Pressure – Enthalpy (P – H) and/or Pressure – Temperature (P – T) and monitored per pipe section to assure the fluid properties is honored. Corrosion rate and erosional velocity are important parameters to be concerned during the fluid transport inside pipeline. Corrosion model used in this paper is de Waard (1995). Optimum diameter will be selected to guarantee the transportation as well as the capital cost to be meet with the fluid specification. The compressor outlet and injection point are connected by a 201.58 km long pipeline that was laid down on a seabed with maximum depth of -1,523 m (MSL). Based on P – H analysis with fluid properties where there are variations in impurities of 0% to 0.5%, still in the liquid phase region during CO2 transport operating conditions. The corrosion rate appears when the impurities value is close to 0.5% with the largest value is 15.34 mm/year at pipeline section 51.16 km and a depth of -1,516 m (MSL).

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The selected optimum pipeline diameter based on EVR and pressure difference along the pipe is 12” with an EVR value of 0.435 and a pressure difference of 47.03 Psia. The designed used in this paper provide safest operating condition to ensure single-phase CO2 in supercritical or liquid dense type condition during. transportation is by maintaining the pressure along the pipeline above critical point of CO2 phase envelope.

Keywords: Flow assurance; Carbon capture and storage; Pipelines; Corrosion.

Abstracts

Digging force analysis of loose material using laboratory-scale excavator

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Abstract. The forces during excavation may vary depending on the condition of the material, the digging position, and the diameter of the hydraulic cylinder. This research aims to study the required digging force to unload material by measuring hydraulic pump pressure on a laboratory-scale excavator (bucket volume ± 4 liters). The test was carried out on loose andesite materials from various attack angles (40˚, 50˚, 60˚, 70˚, and 80˚). Calibration with a load cell is required to link the pump pressure data to the digging force. Another approach is used to calculate the force (resistive force) during excavation with the Fundamental Earth-Moving Equation (McKeys, 1985).

The result shows that the digging force values for excavating material with various attack angles of 40˚, 50˚, 60˚, 70˚, and 80˚ are 5.79 kN, 16.08 kN, 4.82 kN, 10.77 kN, 13.49 kN, respectively, and the resistive force values are 6.42 kN, 12.66 kN, 6.12 kN, 8.20 kN, 12.36 kN, respectively. The specific energy of excavation is directly proportional to the digging force, the lowest specific energy is 0.15 MJ/m3 with an attack angle of 60˚, and the highest specific energy is 0.50 MJ/m3 with an attack angle of 50˚.

Abstracts

Advancing Relative Permeability Prediction in Water-Gas Reservoir Systems: A Comparative Study of Models Utilizing Porous Plate Capillary Pressure Measurements.

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Abstract. Accurate prediction of relative permeability is vital for effective reservoir management and hydrocarbon recovery in water-gas reservoirs. This paper presents a comparative study of models using capillary pressure characterization to advance relative permeability prediction, specifically focusing on complex multiphase flow in water-gas reservoirs. Traditional models like Purcell-Burdine, Corey, and Rose-Bruce are baseline models for relative permeability prediction using capillary pressure data. The study introduces modified Corey models developed for water-gas reservoirs. Experimental data validate the models, comparing them against baselines to assess accuracy and superiority in predicting relative permeability. Factors such as fluid properties, wettability, and capillary pressure significantly influence the predictions, providing insights into each model's strengths and limitations for water-gas reservoirs. Modified Corey models outperform baselines in accuracy and agreement with laboratory-measured relative permeability data, enhancing predictions in water-gas reservoirs. Utilizing capillary pressure characterization underscores its value in advancing relative permeability prediction. Incorporating modified Corey models enables accurate predictions, improving reservoir characterization and hydrocarbon recovery strategies. This work significantly advances relative permeability prediction in water-gas reservoirs through a comparative study. The validated superiority of modified Corey models opens the path to improving reservoir management and achieving more effective hydrocarbon recovery by predicting relative permeability accurately.

Keywords: Relative permeability prediction, Water-gas reservoir, Capillary pressure characterization, Modified Corey models, Hydrocarbon recovery.

Abstracts

Applying Decision Analysis for EOR Selection

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Abstract. The selection of a suitable Enhanced Oil Recovery (EOR) method is a significant challenge in the oil and gas industry. Traditional screening methods commonly consider technical parameters, and often overlook non-technical and facility readiness aspects, which leads to suboptimal decisions. This study proposes a robust workflow integrating subsurface and non-subsurface analyses for EOR selection. The new workflow includes EOR screening, predictive modeling, Monte Carlo simulation, optimization, economic modeling, and decision analysis. The workflow produces a reliable EOR alternative that can be efficiently implemented in the field and includes a value of information (VOI) analysis to determine the project cost worth acquiring new data to support decision-making.

The workflow was tested to evaluate the EOR project selection in the Alpha Field. The evaluation involved several optimization processes, and the decision tree analysis was performed using Monte Carlo simulation to account for the uncertainty of oil production and other parameters that presented in P10, P50, and P90. The results demonstrated the potential of EOR development in the Alpha Field based on the highest Expected Monetary Value (49 MMUSD) within the field's development period. This study's new integrated workflow for EOR selection is straightforward, yet robust in evaluating the potential EOR development projects in the early phase, providing broader options for the project development team. It only takes one until three months to conduct the evaluation. Furthermore, it provides a better understanding of the project's opportunities, risks, and data required during EOR development. The workflow's strength lies in its ability to produce a reliable EOR alternative that can be efficiently implemented in the field.

Abstracts

Correlation between N-SPT value and shear wave velocity for clayey soil

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Abstract. Shear wave velocity (Vs) is an important parameter for tunnel design to evaluate seismic site classification and earthquake hazard at a site. Unfortunately, determining in situ shear wave velocity for large areas is expensive and takes a long time. To overcome these problems, a correlation between the standard penetration test (N-SPT) and Vs is made in order to facilitate predicting Vs from the N-SPT value. N-SPT data were obtained from a total of 41 boreholes ranging from 40 to 85 m in depth. Shear wave velocity was obtained from seismic downhole tests and seismic refraction. The correlation between N-SPT and Vs in this study has a coefficient of regression value of 0.901. The correlation in this study is validated using normal consistency ratio, comparison between Vs predicted and Vs measured and a scaled error percent graph. The correlation in this study can be used as a predictor to estimate shear wave velocity for initial design before a survey is conducted.

Abstracts

The summit situation mapping of rokatenda volcano, East Nusa Tenggara using a drone

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Abstract. Rokatenda volcano, with an elevation of 875m, is a strato-shaped volcanic island with andesitic rock compositions. The volcano is located on Palue Island, Sikka Regency, East Nusa Tenggara. The eruptions of Rokatenda volcano occurred in 1928, 1972, 1973, 1985, 2012-2013. In developing mitigation strategies, the most recent eruption of Rokatenda volcano in 2012-2013 is used as a model. According to previous research, the stratigraphy of Rokatenda volcano is divided into four periods. One of the components needed to implement a mitigation strategy is the information about the crater's situation, which can be obtained by the situation mapping using a drone that has been conducted in 2019. The summit map shows that Rokatenda volcano has four craters. The first one in the southeast is the largest, the second one located in the northwest-north, the third one situated in the west, and finally the fourth crater (estimated) located in the west-northwest. This study helps us understand the summit's situation, its current development in comparison to previous conditions, potential impacts, and the implementation of endangered areas management at Rokatenda volcano. As a result, we will promptly follow up with these areas in the form of disaster management implementation at Rokatenda volcano.

Abstracts

Thermodynamic Analysis of Organic Rankine Cycle Systems for Small Scale Power Plants Using Low Enthalpy Fluids With Aspen Hysys V8.8 Simulation Software

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Abstract. Failed geothermal exploration wells can be used as mini power plants with a binary organic rankine cycle system. The FA-2 well was chosen as the research object because it has a temperature of 102 ˚C and a pressure of 8 bar which can use a low enthalpy turbine. The methodology of this paper includes several stages in utilizing unproductive exploration wells as small-scale power plants with organic rankine cycle systems, which include brine fluid analysis, selection of working fluids, simulation of thermodynamic processes with Hysys V8.8 software. The working fluid that has been heated in the heat exchanger moves to the turbine to generate electricity. For this case, propane was chosen because under the pressure conditions in the heat exchanger, propane can still pass its critical temperature until it becomes superheated. The thermodynamic cycle planning starts from the outlet of the feed pump and uses pressure and temperature assumptions to make it easier to understand. By using propane working fluid, it is hoped that the optimum output of electrical power will be obtained.

Keywords: exploration well, mini power plant, brine fluid, thermodynamic working fluid.

Abstracts

REVIEW PROGRESS STUDI MECHANISM AND INJECTION NANOSILICA FLUID IN CHEMICAL ENHANCED OIL RECOVERY

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Abstract. Nowadays, Nanotechnology has entered and contributed in many industries including Oil and Gas Industry, nanoparticles have become one of the alternative choices to be used as chemical research objects to increase oil recovery because of their unique properties. Some researchers see nanosilica as a superior material among the types of nanoparticles that have good potential that can be used in increasing oil recovery ,especially in chemical enhanced oil recovery. There are several mechanisms that are thought to be important variables in increasing oil recovery using nanosilica.

Nanosilica fluid which is nanosilica dissolved in solvent can be unlocking oil trapped in the reservoir rocks. Initial wettability of rocks, IFT ,and nanofluid flooding parameters are important in the mechanisms in nanosilica chemical oil recovery. In this paper, we will review the use of polysilicon nanoparticle or nano silica for enhanced oil recovery and progress of evaluation of recent studies of nanosilica enhanced oil recovery using nanosilica.The first section in your paper.

Abstracts

Analysis of Bathymetric Data Influence on Terrain Correction in Gravity Data Processing: Case Study in the Banda Neira and Kur Island Regions, Indonesia

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Abstract. Terrain correction is one of the crucial stages in gravity data processing. Previous research has shown that terrain correction using topographic data can result in a maximum correction of 14.74 mGal while incorporating bathymetric data can provide corrections up to 29.1 mGal. To accommodate terrain correction calculations in research areas in Indonesia, we utilized both the topographic data from DEMNAS and the bathymetric data from BATNAS. Gravity method researchers have widely used DEMNAS topographic data for land research areas in general. In contrast, the utilization of BATNAS bathymetric data is still limited, especially for land research areas adjacent to the sea. In this study, both datasets are employed in the computational terrain correction calculations, combining the sloped triangle, flat-topped square prism, and annular ring methods. The research is conducted in Banda Neira and Kur Island regions due to the presence of Weber Trench between the two areas, which is suitable for demonstrating the contribution of bathymetric data to the total terrain correction. The research results show that terrain correction calculations involving bathymetric data significantly contribute to terrain correction. The difference reaches approximately 81.3 mGal in the Banda Neira region and 69.8 mGal in the Kur Island region. Besides the substantial contribution of bathymetric data to the total terrain correction, the correction pattern also changes in certain cases. In areas far from deep-sea regions, such as Banda Neira, the contribution of bathymetric data exhibits a terrain correction pattern, like the terrain correction pattern resulting from the contribution of topographic data. However, in Kur Island region, the contribution of bathymetric data significantly impacts the change in terrain correction pattern. The correction pattern even managed to reverse the total terrain correction pattern obtained solely from topographic data. This indicates that bathymetric data is worth considering in gravity data processing, particularly in areas adjacent to extensive and deep trenches or seas.

Abstracts

Coal Mine Wastewater Treatment Management In Jetty of Kertapati, PT Bukit Asam Tbk, Palembang, South Sumatera

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Abstract. PT Bukit Asam Tbk Kertapati is a place for loading and unloading coal as well as a coal stockpile. Before the coal is loaded onto the barge or ship usually the coal will be in the stockpile. Stockpile conditions are in the open which is directly related to weather conditions, especially when it rains. Coal liquid waste is liquid waste generated from the mining industry, coal processing, and operational activities, as well as from rainwater runoff. The content of the coal liquid waste includes Total Suspended Solid (TSS), an increase in degree resulting in a decrease in the pH value of the water, and its content of metal (Fe) and manganese (Mn). Management of the coal waste that is formed must be carried out by providing a Sludge Settlement Pond (KPL) as well as providing adequate coal waste management facilities, in this case, drainage channels and coal waste treatment systems, to achieve efforts to protect the environment, as well as the final result of liquid waste disposal. is by the quality standards of liquid waste that have been set by the local government. The drainage channel owned by PTBA Kertapati is in the form of a trapezoid with different lengths and dimensions, with an area owned by PTBA Kertapati of 6.4 ha divided into three catchment areas of which catchment area one with an area of 2.9 ha will go to KPL A, with the channel length of the channel is divided into three sections as well as the maximum channel discharge of different. Furthermore, the catchment area with an area of 1.3 ha will go to KPL B with a channel length of 290 m, while for catchment area three with an area of 2.2 ha it will go to KPL C with a drainage channel length of 660 m with different maximum channel discharges. Mud Settlement Pond (KPL) is one of the supporting facilities for mining which has function as a place for storing and managing coal waste until the water meets quality standards before heading to the Musi River. Therefore, optimal handling is needed in the management of coal liquid waste to reduce the TSS value and normalize the pH in the settling pond by using alum and lime to meet the environmental quality standards of wastewater at PT Bukit Asam Tbk Dermaga Kertapati Palembang.

Abstracts

Stress–strain distribution of volcanic earthquake: a case study of semeru-tengger 2010 seismic activities

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Abstract. Semeru (3676 m asl) located in east Java is one of the most active volcanoes in Indonesia. Its eruptive activity has been recorded since 1818 and recent activity has been persistent since 1967. Since early February 2010, the number of Volcano-Tectonic (VT) events had increased, there were 873 explosion earthquakes registered with an average of 34 events per day, and pyroclastic flows have successively occurred from the end of February 2010. The focal zone vertically extends to about 8 km deep beneath the summit. The deep VT events are located at a depth of 2.21 – 8.70 km and the shallow ones are located at a depth shallower than 1.88 km. The focal mechanism of VT events was estimated by using both polarity and amplitude of P-wave first motions at 5 seismic stations, assuming a double couple mechanism and a homogenous medium. Determined focal mechanisms for either deep VT or shallow VT events are of normal-fault types. To test stress and strain distribution, we use two known fault systems acting in this area. From the strain horizontal component (SXX) analysis, the highest strain is distributed near the fault system, which denotes that the strain acting in this fault plane has a big value only for the surrounding fault plane area. While from the Coulomb stress change analysis, the highest value is distributed at the edge of the fault system. The horizontal displacement shows that volcano earthquake events, mainly occur at high-stress zone.

Keywords: seismicity; focal mechanism; fault system; stress transfer and strain

Abstracts

Fault Delineation On Seismic Post Stack 3D Data Using Artifical Intelligence

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Abstract. Fault delineation is a vital process for exploring stratigraphic structures and reservoir properties from seismic data and has an important role because faults usually provide information about the accumulation and migration paths of geological resources. Along with the increasing size of seismic data, fault picking work becomes a tiring activity and requires high accuracy from an interpreter. Automation is needed to speed up the process and reduce human subjectivity in picking the fault itself. To carry out this automation, we apply a deep learning algorithm, specifically a convolutional neural network (CNN). The architecture used in this study is the U-Net 3D architecture (FaultSeg3D) with the focal loss function as the loss function, which is then carried out separately by the training process. The dataset was prepared by utilizing 220 pairs of synthetic data consisting of 200 pairs of train/test data and 20 pairs of validation data. The results obtained in the training process show that the loss function curve has converged, namely 0.0154 for train and 0.0308 for test, where this convergence indicates the success of the training process. Quantitatively, the estimation of fault delineation using the CNN model shows a good value based on the performance metrics used, namely precision, recall, and f-1 score using validation data, which are around 0.7, 0.8, and 0.9, respectively. Qualitatively or visually the fault delineation estimation results on the validation data using the CNN model outperform the variance attribute, where the variance attribute resulting fault delineation estimation is not continuous and there are still many points that miss the estimate compared to the CNN model.

Keywords: fault delineation; geophyscis; seismic; deep learning; cnn

Abstracts

Applying The Technology to Increase Oil Production Review of Enhanced Oil Recovery Techniques

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Abstract. . The general production value per barrel per day from the North African country "Libya" is 1.2 million barrels per day (Mbpd). It is tend to be light, with specific gravity varying from 33°API to 39°API and sweet, with the sulfur content is below 0.25%. Decreasing production levels in maturing fields have revived interest in enhanced recovery techniques in many parts of the world. Improved technologies for understanding and accessing reservoirs have increased the possibilities for successful enhanced oil recovery (abbreviated EOR) implementation. All forms of EOR techniques with both fundamental principles and specialized application will be covered in this paper. Professional researches and Engineers in all areas of fluid flow in permeable media can benefit from the unified approach to enhanced oil recovery based on common first principles, conservation of mass, momentum and energy. Mathematical techniques based on phase behavior and the Method of Characteristics (MOC). Planning for EOR from the earliest stages of field development saves money, boosts ultimate recovery and ensures maximum return on investment.

Keyword: Libya, API, improved technologies, EOR, MOC.

Abstracts

Modeling the Effect of Chemical Structure in Surfactant as Interfacial Tension Reduction Agent for Chemical Enhanced Oil Recovery

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Abstract. Enhanced Oil Recovery (EOR) techniques play a significant role in maximizing oil production from reservoirs. However, selecting the most suitable surfactants for use in EOR can be a challenging and time-consuming task. With machine learning algorithms, it is now possible to carry out selective screening of various surfactants in a relatively short period. This research aims to develop a predictive model to map the surfactant performance for application in Indonesian Oil Fields, where the interfacial tension reduction represents the surfactant performance. Firstly, laboratory testing was carried out to create the model database. The data obtained in laboratory testing include EACN, salinity, oil solubilization ratio, concentration, temperature, and IFT. Furthermore, the chemical characteristics of the surfactants, such as their hydrophobic number and hydrophilic group, were collected. Next, machine learning algorithms were used to develop several predictive models with IFT set as the target output and the other parameters as inputs. Hyperparameter optimization was conducted in the modeling process to optimize the created model. The coefficient of determination (R2), real-predicted plot, and error metrics are used to evaluate the model performance. The best model was picked based on an acceptable deployment performance with sufficient R2 and low error values. The developed model is believed to be helpful for engineers to screen suitable surfactants for chemical EOR flooding.

Abstracts

Laboratory measurements for quantifying the effect of fracture frequency on ultrasonic velocity and mechanical properties of hard rocks mass

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Abstract. A method for interpretation of velocity variations become the rock mass quality is crucial due to micro seismic tomography has been implemented in most massive mining. So, geophysical data in form of velocity distribution should be optimized for geotechnical analysis and mining stability. Four sample of hard rock mass were drilled to obtain the core samples: Beser Andesite, Gunung Parang Gabro, Sentolo Limestone, and Wonosari Limestone. Artificial joints had been prepared using diamond rock cutter, produced the planar and parallel joints. The design of fracture frequency in this experiment varies from 0 to 20's joints/meter as representative of rock mass. The ultrasonic velocity apparatus, Oyo Sonic Viewer SX and Ultracon170 Concrete Tester were operated to measure the P-wave velocities from P-wave form. The laboratory measurement of ultrasonic velocity on intact and jointed rock sample was successfully conducted. The empirical equation between fracture frequency and ultrasonic velocity was proposed as Vpj/Vp0 = e-0,041FF. It will be useful for approach to determine the rock mass quality using velocity variation.

Abstracts

Effects of Feeding Method and Coal Pretreatment on The Gasification Performance of Indonesian Coal: Experimental Study and Its Analysis Using Aspen Plus

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Abstract. Although the contribution of renewable energy (RE) in Indonesia's energy mix continues to increase, the role of fossil fuels, particularly coal, as the main source of energy cannot be replaced soon. With existing technologies, the production cost of electricity from coal is still lower than that of RE. Unfortunately, the utilization of coal is dominated by direct combustion, which is less efficient and thus produces high CO2 emissions per unit of energy (i.e., kWh). Converting syngas, produce from coal gasification, into electricity, e.g., using a combination of integrated gasification combine cycle (IGCC) and mine-mouth coal-fired power plant, is a greener way to produce more environmentally friendly energy. The entrained-flow gasifier (EFG) is commonly used in IGCC because produces syngas with high thermal efficiency and low tar content. EFG has two optional feeding systems, namely a dry-feeding system, which has high thermal efficiency, and a slurry-feeding system, which does not need a drying system. To find out the gasification performance of Indonesia's LRC in both options, a series of experimental studies and process simulations using ASPEN was conducted to identify which feeding system that more suitable for Indonesia's low-rank coal (LRC). In the slurry-feed system, two treatments were adapted: coal-water slurry (CWS) and coal-water-alcohol slurry (CWAS) to improve slurry stability. Meanwhile, in the dry-feed system, coal drying (drying), which requires external heat, was conducted to increase cold gas efficiency (CGE). In addition, acid-washing (AW) pre-treatment was also carried out to determine the effect of alkali and alkaline earth metal (AAEM) content on the gasification rate. In this study, a series of characterization and gasification experiments were carried out on five samples of LRC, namely raw, drying, AW, CWS, and CWAS.

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Characterization of coal samples was conducted using Fourier-transform infrared spectroscopy (FTIR), thermogravimetric analysis (TGA), ultimate and proximate analysis, calorific value (CV), and analysis of ash content. The gasification experiments were also conducted at 900˚C to study the kinetics of coal gasification using a horizontal tube furnace with a flow of synthetic air (100 ml/minute, O2:N2 10:90 vol/vol). The results of characterization and gasification of coal were then used as input for Aspen Plus software to simulate the performance. The results showed that the addition of alcohol to the CWS increased CV from 6,291 to 6,358 kcal/kg (daf). Acid-washing treatment removed most of AAEM species, and thus decrease the gasification rate of the AW-coal sample drastically. The rate of coal gasification is found in order of drying>CWAS>CWS>raw>AW. Based on simulation using Aspen Plus, the electricity production from gasification of the dried coal sample shows the highest efficiency and thermal power production with 74.0% CGE and 0.71 MW per ton of coal.

Keywords: coal, gasification, IGCC, entrained-flow gasifier, Aspen.

Abstracts

Study of the Influence of Reduced to the Pole, Reduced to the Equator, and Hilbert Transformation on Geomagnetic Data Modelling

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Abstract. .Mining is one component of natural resources that is widely used in life. This is inversely proportional to the issue of diminishing supplies of mining commodities. The need for mining commodities needs to be met, given the many benefits in human life. Meeting the needs of mining commodities must be balanced with increased exploration and production activities. In order to increase exploration, it is necessary to use a method to realize exploration activities, one of which is the geomagnetic method as a regional exploration method. The geomagnetic anomaly is dipole in nature, so the interpretation of the body anomaly becomes more difficult. Therefore, a filter is needed to convert dipole geomagnetic data into monopole. In this study, filters are used in the form of reduced to the pole (RTP), reduced to the equator (RTE), and Hilbert transformation. Several synthetic models are used to study the effect of the filter in the body anomaly interpretation process. The synthetic data created is simple data and varies based on dimensions, location, depth, and inclination. The filtering results in this study were observed qualitatively and quantitatively. Qualitatively, body anomalies become more clearly visible when using this filter. Meanwhile, quantitatively, it can be observed from the variance value of the filtered results which tends to get smaller and the percentage of accuracy of the number of anomalous body indications to the actual number of anomalous bodies. In general, RTP is the best filter to apply in all variations of inclination, depth and dimensions, with an average variance value of 0.02397 and an average percentage accuracy of the number of anomalous bodies of 90%. RTE is good for the majority of variations in inclination and depth, but the dimensions are still imprecise. RTE has an average variance value of 0.04117 and an average percentage accuracy of the number of body anomalies of 80.416%. Meanwhile, the Hilbert transformation tends to be suitable for geomagnetic data that has a low inclination value (≤ 30o). The Hilbert transformation has an average variance value of 0.06221 and an average percentage accuracy of the number of body anomalies of 82.0825%.

Keywords: geomagnetic; reduced to the pole; reduced to the equator; hilbert transformation; variance

Abstracts

Study on the Significance of Reduction to the Equator (RTE), Reduction to the Pole (RTP), Hilbert Transform, and Pseudogravity in Magnetic Data Interpretation

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Abstract. .The geomagnetic method is widely employed in diverse disciplines, encompassing earthquake structural analysis, characterization of mineralized zones, and other relevant applications. However, the practical interpretation of geomagnetic anomaly data often poses considerable challenges, due to the dipole nature of the Earth's magnetic field, particularly in research areas characterized by low latitudes. This study aims to investigate the significance of methodologies that transform dipole anomalies into monopoles. The employed methodologies encompass the Reduce to Equator, Hilbert Transform, Pseudo-Gravity, and Reduce to Pole methods. The RTP method is implemented using general equations for RTP, Pseudo-Inclination (PI), and Nonlinear Thresholding (NTRTP). Furthermore, MATLAB programming language is utilized to develop programs for calculating RTP and RTE, and various synthetic models are constructed to examine the impact of inclination values, object dimensions, and positions on the resulting magnetic anomaly respons. The analysis of synthetic data characterized by low inclination (less than 50) reveals the superior performance of the NTRTP and pseudo-gravity methods, which exhibit impressive correlation coefficient values of 95% and 85%, respectively. Conversely, the general equation and pseudo-inclination methods yield significantly lower correlation coefficients of 30%. NTRTP and pseudogravity methods effectively pinpoint the location of anomalies and successfully eliminate the dipole effect. Although the Reduce to Equator method delivers satisfactory results with an 82% correlation coefficient, its ability to fully eradicate the dipole effect is qualitatively limited. Moreover, the developed methodologies are applied to field data in the vicinity of the Mount Pandan area. The calculation outcomes demonstrate the superior performance of the pseudo-gravity method. Nonetheless, further investigations are warranted to refine and enhance the comprehension and applicability of these methodologies.

Keywords: anomaly magnetic;reduce to pole;reduce to equator; NTRTP; pseudogravity.

Abstracts

Direct Estimation of Petrophysical Properties from Elastic Properties: A Case Study on The Kujung Carbonate Formation

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Abstract. .Rock physics analysis is a method to characterize the petrophysical properties of rocks based on their elastic behavior. However, this approach requires complete information on the mineral composition of the matrix, pore-filling fluids, and reservoir in-situ conditions. Recently, a new method was introduced to model the rock physics of clastic sediments using only acoustic impedance (AI) and the ratio between P- and S- wave velocity (Vp/Vs ratio) for predicting fluid saturation without the need for detailed Voigt-Reuss-Hill and/or Hashin-Shtrikman bounds and Gassmann fluid substitution. The above approach provides a way to estimate the petrophysical properties of rocks directly from their elastic properties.

In this study, we integrated the above method with our approach of combining AI and Vp/Vs ratio to form the pseudo elastic impedance attributes. The approach is applied to a different type of sedimentary rock, namely carbonate sediments in the Kujung formation. We used the pseudo elastic impedance approach which is based on an attribute rotation scheme due to its simplicity. First, we combined AI and Vp/Vs ratio to produce the S-CPEI (Simple Curved Pseudo Elastic Impedance) attribute that has the best correlation to water saturation. Then, we also looked for the best combination of AI and Vp/Vs ratio to get the S-PEIL (Simple Pseudo Elastic Impedance for Lithology) attribute that correlates well with porosity. Those two attributes were then used as guidance to obtain a better estimate of porosity and water saturation based on the new rock physics model described previously. Some promising results were demonstrated. The new approach presented in this study provides a way of estimating the two main petrophysical properties, namely porosity and water saturation, from elastic properties commonly derived from seismic inversion.

Keywords: Rock Physics Modeling; Curved Pseudo Elastic Impedance (CPEI), Pseudo Elastic Impedance for Lithology (PEIL), Petrophysical Properties, Carbonate Rocks.

Abstracts

Lithology of the Composition of the Beruang Kanan Area, Central Kalimantan

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Abstract. .Rock units in the study area are differentiated based on lithology type, rock uniformity, rock distribution and rock geometry contained in one area as well as the stratigraphic position of the units beneath it and above it. The rock units in the study area generally have undergone a strong alteration process as a whole so that the primary mineral composition of the rock has been replaced by secondary minerals (alteration minerals). Determination of rock sequences uses the law of cross cutting, using regional geological map sources and previous research data. In general, the stratigraphy of the study area is divided into 3 rock units which can be seen on the geological map, in order from old to young, namely Sandstone Unit, Dacitic Tuff Unit, Andesite Unit and Quartz Sand Deposition Unit.

Keywords : Rock, Sandstone, geological map

Abstracts

Slope Stability Analysis for Coal Mining Design Evaluation Using Limit Equilibrium and Finite Element Methods in South Pit, PT X, Merapi Barat District, Lahat Regency, South Sumatra

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Abstract. .PT X is one of the coal mining companies located in Tanjung Telang Village, Merapi Barat District, Lahat Regency, South Sumatra Province. The excavation and stockpiling process for coal mining will cause the slope equilibrium to be disturbed, so it is necessary to analyze the slope stability for mining design evaluation. Slope stability analysis was carried out in the South Pit area of PT X using limit equilibrium and finite element methods.

This research began with a literature study followed by field investigations and laboratory testing. Based on the test results, the parameters used include: weight, cohesion, inner shear angle, and UCS.

The parameter values went through the process of statistical analysis, then the standard deviation and Coefficient of Variation (CoV) values were calculated. Then, data processing was carried out using two methods. The limit equilibrium method to generate Factor of Safety (FS) values with SLIDE V.6.0 software, and finite element method to generate Shear Reduction Factor (SRF) values with Phase2 software.

Data processing with the limit equilibrium method resulted in a Factor of Safety (FS) value at Pit-1 of 1.539, Pit-2 of 1.536, Pit-3 of 1.68, Pit-4 of 1.502, and Pit-5 of 1.493. Meanwhile, data processing with the finite element method produces a Shear Reduction Factor (SRF) value at Pit-1 of 1.14, Pit-2 of 1.45, Pit-3 of 1.55, Pit-4 of 1.22, and Pit-5 of 1.26. Based on the FS and SRF results, the authors recommend evaluating the mining design to increase the safety factor value based on the limit equilibrium method and the finite element method by changing the slope geometry.

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The results of the evaluation resulted in an FS value at Pit-1 of 1.698, Pit-2 of 1.603, Pit-4 of 1.648, and Pit-5 of 1.935. Meanwhile, the SRF value at Pit-1 is 1.58, Pit-2 is 1.42, Pit-4 is 1.44, and Pit-5 is 1.72. The evaluation results of these design changes can increase the percentage increase in the Safety Factor in Pit-1 by 10.33%, Pit-2 by 4.36%, Pit-4 by 8.86%, and Pit-5 by 29.6%. Furthermore, this paper also showed the comparison between limit equilibrium methods and finite element method in the case of this study. Safety factor results from the limit equilibrium and finite element methods used show that the factor of safety values and collapse pattern predictions from these two methods have the similiar results.

Keywords: mining; slope stability; limit equilibrium method; finite element method; factor of safety.

Abstracts

Java Island Ambient Noise Tomography: A Preliminary Result

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Abstract. .The complex geological structure of Java Island holds plentiful information for a natural resource for seismic hazard study. This condition makes Java Island substantially need more exploration from a different point of view. In this study, we present the preliminary result of tomography from the ambient noise cross-correlation technique, utilizing vertical component data of the Indonesia Tsunami Early Warning System (InaTWES) network from the Meteorology, Climatology, and Geophysics National Agency (BMKG) deployed in 2022 across Lampung, Java, Madura, and Bali. This research is a collaboration program between the Bandung Institute of Technology (ITB) and BMKG. The network consists of a permanent seismograph of 87 stations around the study area. From this, stations can generate 3741 cross-correlation pairs each day. As the first of the data processing, we will focus on conducting single data preparation and cross-correlation to retrieve an estimate of green's function between station pairs. Further on, the processing continued to frequency-time analysis technique to obtain dispersion curves to measure the interstation group velocity. This group velocity of different periods is used as tomography inversion data input. Our preliminary is dispersion curves result from cross-correlation.

Keywords: Java; tomography; ambient noise; green's function; group velocity.

Abstracts

Quantitative Identification of Log Shape Patterns and Bed Boundaries to Assist Electrofacies and Permeability Prediction Using Volatility Attributes and Unsupervised Learning Methods

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Abstract. .In reservoir characterization, facies distribution and its relationship to depositional environment is one of the main focus in permeability modeling. One methodology is to characterize electrofacies types from wireline log data which will then be analysed and interpreted further to facies types and its depositional environment. The current methodology inherent uncertainty in the bed boundaries detection and irregular curve shape.

Conventionally, all wireline log data are analysed and classified to distinct electrofacies types based on its unique log responses that are charaterized by different log curve baselines, trends, shapes, abrupt breaks, and anomalies. This analysis is often time consuming and subjective, depending on the log analyst itself. Some patterns may also not be fully identified by the log analyst due to the complexity of multiple log curve patterns and geometry.Thus, the objective of this study is to quantify and automate the conventional methodology, and to enable comprehensive pattern recognition that may not be identified fully by manual and conventional methodology. This will reduce the bias in previous methods.

To answer this problem, we propose a novel methodology based on quantification of log responses and its change by assigning volatility attributes to log data. Each pattern will have its own unique and distinct volatility attributes characteristic and response, enabling identification of log curves' characteristics. These properties will then be used to identify different electrofacies types using a non-parametric unsupervised learning method. This is done by eliminating the bias from pre-determined parameters if parametric unsupervised learning methods are being used instead.

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The results are then validated by comparing the permeability predictions of each electrofacies types to conventional permeability prediction methods. A k-fold cross-validation of the permeability prediction for comparison is also done to ensure robustness of the results. The significance of this study is to provide a workflow of quantitative electrofacies identification without introducing bias and subjectivity in the process.

Keywords: electrofacies; log data; feature augmentation; volatility attributes; machine learning; reservoir characterization;

Abstracts

Preventing Machine Learning Trap in Petrophysical Parameters Prediction: A Case Study on X Field

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Abstract. . Reservoir characterization is an important aspect in petroleum industry, especially in the estimation of reservoir parameter, such as porosity and water saturation. Those parameters are obtained from interpretation of petrophysical logs or core analyses. As an alternative, Machine Learning (ML) can be used as an inexpensive and efficient approach for the estimation. However, the invisible trap of ML complicates the development of prediction models. These traps are related either to the algorithms or data.

Algorithms-related traps are usually either overfitting or underfitting. Meanwhile, the identified data-related traps are feature selection and importance. In theory, the prediction of porosity using log data relies mainly on bulk density, neutron porosity, and sonic log. However, inadequate data preparation may lead feature selection to specify irrelevant well logs. Moreover, the regression model may rank less significant feature, e.g., coordinate higher than the porosity log. The objective of this paper is to address this problem and achieve a synergy between ML and petropyhsical theory by designing a proper workflow.

The method in this study includes several steps. The model was developed based on data from several wells in X field, where the data are randomized and split into test and train data. Before train-test split, a well-log normalization was performed. Next, the input features were normalized followed by outliers removal. Then, a feature selection function was used to select a predetermined amount of log data to be used. This function uses the Root Mean Square Error (RMSE) metrics and Kolmogorov-Smirnov test for normality as its metrics. Then, a model evaluation function was used to select the highest scoring model. In this case, the function gives random forest as the best model. However, it does not select the relevant log data that is in line with petrophysical theory. Furthermore, random forest is prone to overfitting, especially on small datasets. By iterating between different models, it was found that Support Vector Regression (SVR) gives the appropiate log data.

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The model was able to predict porosity and water saturation accurately with RMSE of 0.07 and 0.1 respectively. Moreover, with small dataset, the model does not overfit and have a normal distribution. It was found that an additional categorical input could improve the model performance, in this case the formation. One alternative is by conducting clustering before regression to create several groups that may be used as a categorical input in the regression model. This can help the model to better analyse the relation between each features. An increase in dataset is greatly recommended to further improve the model performance.

The significance of this study is to provide a structured workflow to assist in building a predictive model without worrying about ML trap.

Keywords: porosity; water saturation; machine learning; reservoir characterization; feature selection.

Abstracts

SPREADSHEETS FOR GEOTHERMAL RESOURCE CLASSIFICATION BASED ON UNITED NATION FRAMEWORK CLASSIFICATION (UNFC) AND INDONESIAN GEOTHERMAL FIELD CASE STUD

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Abstract. United Nations Framework Classification (UNFC) is a resource classification method created by United Nation Economic Commission for Europe (UNECE) collaboration with International Geothermal Association (IGA). UNFC assesses and classified the geothermal resources of the field from three aspects (i.e., socio-economic, project feasibility, and geological knowledge).The uniformity in resource classification, assessment and comparison for geothermal resources could be significant in global communication related to geothermal resources. Implementation of UNFC in Indonesia will impact the development and financing this renewable energy. This paper shows the development of Microsoft Excel spreadsheet for characterizing geothermal field in Indonesia using UNFC classification standard and applied it to one of geothermal field in Indonesia. The spreadsheet will divide socio-economic into axis-E, project feasibility into axis-F, and geological knowledge and resource into axis-G. The case studies were conducted in Jailolo Geothermal Field, located at Halmahera Regency, North-Maluku Province. The field is at an early stage of development and included on government drilling programs agenda. On the other hand, the feasibility of extraction by a defined development project cannot be evaluated due to limited technical data, although site-specific geological studies and exploration activities have identified the potential for an individual deposit with sufficient confidence to warrant drilling or testing. Based on geological studies, there are estimated quantities associated with a potential deposit, which is a low confidence estimate as 75 MW. The Field is categorized as E3.2 for social and economic aspects, F3.1 for the feasibility of extraction based on maturity studies, and G4 for geological studies

Keywords: geothermal, resource classification, UNFC, Jailolo.

Abstracts

Study of the Thermal Condition of the Tunnel in the Process of Loading-Hauling Materials with Load Haul Dump Diesel at Ramp Down

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Abstract. . All activities in underground mining, one of which is loading and transporting materials on-ramp down, cannot be carried out 100% effectively because there are internal factors (tools and workers) and external factors (work environment) that affect changes in velocity and temperature-humidity values which are the components forming the effective temperature of the thermal conditions of a worksite. Therefore, a good ventilation system is needed to achieve an effective temperature.

This research uses computational numerical method simulation based on fluid dynamics called Computational Fluid Dynamics (CFD) using Ansys software. The numerical model of the auxiliary ventilation system was validated based on Gani's (2017) research data. Then, changes in conditions due to heat sources are brought closer to Yulianti's (2020) research data. The model made is Model 1 for initial validation with criteria for air velocity 19.05 m/s (with a cross-sectional diameter of 0,9 m air duct), relative humidity inlet 79.1% and intake air temperature 30.5 ˚C, Model 2 with a heat source from a 102 kW LHD engine and operator, two 37 kW exhaust fans, and a foreman, then the Model 3 differs from the Model 2 in the intake air temperature by a value of 20 ˚C and as a recommended model. Based on the modeling results, the research has an error rate based on Model 1 against the actual conditions in the range of values of 0.01%-2.38%. Then, the change in temperature due to the presence of a working heat source in Model 2 and Model 3 relative have similar value. Model 2 has a Gradient 1 of 1.26 ˚C/hour, a Gradient 2 of 0.70 ˚C/hour, and a Gradient of 3 -0.05 ˚C/hour while Model 3 has a Gradient 1 1.29 ˚C/hour, Gradient 2 0.71 ˚C/hour, and Gradient 3 -0.05 ˚C/hour.

The model that complies with the feasibility standard based on ventilation systems regulation in Indonesia is Model 3 which produces an effective temperature at a normal temperature of 25.1 ˚C, a peak temperature of 25.9 ˚C, and a residual temperature of 25.7 ˚C.

Keywords: mining, ventilation, temperature; heat; CFD.

Abstracts

INTERACTION OF CAVITIES AND PILLAR IN UNDERGROUND COAL GASIFICATION REACTORS

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Abstract. . Underground coal gasification activities are often analogous to the longwall method in underground coal mining. Designing of chain pillar on the longwall method becomes an important issue in designing of protection pillar on coal gasification. The temperatures generated from coal combustion in the panel gasification are usually in the range of 700˚ – 900˚ C but could reach up to 1200˚ C. Such a high temperature will cause thermal stress and could decrease the pillar strength. Research on the interaction of the protection pillar and cavities nearby is required to maintain the stability of gasification panels and also to predict subsidence potential on the surface.

In this article, information related to research on the interaction of pillars and cavities in gasification panels is given. A numerical approach is utilized to explain this interaction. The effect of high temperatures on the gasification reactor will be examined to discover the stress-displacement and also the potency of subsidence that occurs in the surrounding rocks.

Keywords: high temperatures, cavities-pillar, numerical, stress-displacement.

Abstracts

ASSESSMENT OF LIQUEFACTION SUSCEPBILITY IN LOLU VILLAGE, CENTRAL SULAWESI, USING GRAVITY METHOD

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Abstract. . A seismic event of magnitude 7.5 struck the Palu region in Central Sulawesi on September 28, 2018, precipitating a subsequent calamity in the form of a tsunami measuring 4-7 meters in height. This catastrophe was further compounded by the occurrence of liquefaction, leading to extensive devastation and a significant loss of life. In order to identify areas susceptible to liquefaction, it is anticipated that the employment of the gravity method, renowned for its capacity to discern density fluctuations associated with the mass of voluminous materials over a considerable detection range, will prove instrumental. The investigation of parameters and the characterization of liquefaction phenomena in regions previously afflicted by liquefaction disasters can be instrumental in devising strategies for mapping zones that are predisposed to such occurrences. The present study seeks to employ geophysical methods, specifically the gravity method, to delineate zones with the potential for liquefaction within the Lolu Village at Palu City, Central Sulawesi. Through the application of techniques designed to isolate regional and residual anomalies, it is envisaged that a clearer understanding of anomalies situated in shallower regions can be attained, with a specific focus on residential areas. Notably, due to liquefaction, approximately half of the residential areas have shifted a considerable distance of around 132 meters from their original positions.

Abstracts

To facilitate the interpretation of subsurface layers, two-dimensional cross-sections are modeled to intersect the displaced and stationary areas. The residual map reveals discernible variations in anomaly values, with lower values observed in the areas that experienced liquefaction-induced movement. Subsurface modeling further demonstrates the presence of three distinct rock layers, namely a sandy layer, a gravel layer, and a rock layer. Additionally, the modeling depicts the formation of canals composed of hard rock, exhibiting varying thicknesses within the surface layer as a consequence of the liquefaction event in 2018. The existence of these canals serves as an indicator that when the sandy layer becomes saturated with water, it will flow along the topographical gradient, following the path of the subterranean canals that have formed.

Abstracts

STRUCTURE IDENTIFICATION OF KEPAHIANG BENGKULU GEOTHERMAL FIELD USING THE MAGNETOTELLURIC METHOD

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Abstract. . The Kepahiang geothermal area is tectonically located in a magma arc located west of Sumatra island. Geothermal manifestations in the Kepahiang area include vents, hot springs, weathered rocks, and solfataras. Geothermal activity, its occurrence is associated with the types of fault structures, especially those with northeast-southwest trends and the main active fault zones of the Sumatra fault system tending to the west. south-southeast. The Kepahiang geothermal system belongs to the volcanic geothermal system and is associated with the volcanic activity of Mount Kaba. This study aimed to identify the subsurface structure of the Kepahiang Bengkulu geothermal field in Indonesia using the magnetotelluric (MT) method. MT data were collected at 15 stations along two profiles, and the data were processed using 2D inversion techniques to produce resistivity models of the subsurface. The results of the MT inversion indicated the presence of a low-resistivity zone beneath the surface, which is interpreted as the geothermal reservoir. The study also identified a low-resistivity zone in the upper part of the subsurface, which is interpreted as a caprock. Furthermore, the resistivity structure of the Kepahiang Bengkulu geothermal field is characterized by there are some faults, suggesting a complex geological setting. The findings of this study provide important insights into the subsurface structure of the Kepahiang Bengkulu geothermal field and can be useful for future exploration and development of the geothermal resource.

Keywords : Caprock, Geothermal, Kepahiang, Magnetotelluric, Reservoir

Abstracts

NUMERICAL SIMULATION OF CONVECTIVE CLOSED-LOOP GEOTHERMAL HEAT EXTRACTION FROM AN IDLE GEOTHERMAL WELL IN EASTERN INDONESIA

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Abstract. . A geothermal resource typically experiences a production decline caused by exploitation activities. Once the power generation from the resource reaches its subeconomic threshold, the production activities might be abandoned, and the production wells are converted into idle wells. However, idle geothermal wells still have thermal energy from the geofluid inside the wellbore that could be extracted to extend the economic lifetime of the well. In this study, a convective closed-loop geothermal (CLG) heat extraction system from an idle geothermal well is developed. It is performed through numerical simulation using COMSOL to calculate and optimize the rate of heat extraction. Convective CLG systems offer the advantage of having higher heat transfer rates than conductive CLG systems in hot dry rocks. In the numerical model, a hypothetical idle geothermal well is created based on the typical conditions of geothermal fields in eastern Indonesia with a depth of 500 m and a bottom hole temperature of 190oC. A closed-loop coaxial borehole heat exchanger (BHE) is inserted into the wellbore to extract the the geofluid's heat by injecting water as the working fluid into the BHE's annulus. The numerical model results suggest that the optimized BHE could extract up to 185.48 kW of thermal energy.

Abstracts

STOPE DIMENSION OPTIMIZATION BASED ON GEOMECHANICAL PROPERTIES USING BRUTE FORCE ALGORITHM

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Abstract. . Mining operations play a crucial role in meeting global resource demands, emphasizing the importance of determining optimal stope dimensions for safe and efficient ore extraction. However, the complexity arising from multiple geomechanical factors affecting stope stability poses challenges in identifying ideal dimensions. Traditionally, engineers use an iterative process for stability analysis, but its limited scope and time-consuming nature call for more efficient algorithms. In this research, we propose a series of algorithms based on the brute force method, using Potvin's empirical stability criterion. The algorithm efficiently generates and evaluates stope dimension scenarios, enabling comprehensive stability analysis. Testing on case studies demonstrates its remarkable speed and effectiveness, making it a valuable tool for mine planning and optimization.

Abstracts

A QUICK AND ROBUST SCREENING METHOD USING PARETO AND FOUR QUADRANT ANALYSIS FOR WO/WS CANDIDATES SELECTION IN A MATURE FIELD TO UNLOCK PRODUCTION GAIN OPPORTUNITIES

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Abstract. One crucial milestone in mature field development is the well screening for work-over/well-service (WO/WS) candidate selection. The first step of the screening process is reveal to any potency from idle and low-performance wells. The day-day operations in an old field requires a quick and robust methods to reveal the potency. The work is focus on the development of screening methods to maximize the economic value from a brownfield. A four-quadrant analysis is a mapping techniques based on heterogeneity index concept. The heterogeneity index is a variable that described the individual performance compare to overall achievement. The index shows the distance can be used to measure the position of deviation of one well from the average performance. The analysis of the heterogeneity index data to generate a map that can described the position from all wells. By integrating the index, the potency of all wells can be identified. Therefore the results from this analysis can be used for selecting WO/WS candidates. After having a WO/WS candidates, the Pareto Principle can be used to rank the overall feasibility parameter value. This principle selects the top 20% of potential that can generate the 80% of proceeds. The feasibility parameter values described areas that have the potential to be developed based on the reservoir rock, fluid, and pressure aspects. The work generated pareto implemented in a computer program. Finally, the authors strongly recommended its implementation for WO/WS candidate selection in a mature fields.

Keywords: Mature Field, Pareto Analysis, Four Qudrant, Heterogeneity Index, Work-Over/Well-Service Candidate Selection

Abstracts

FAULT SEGMENTATION, SEISMICITY, AND DEFORMATION RATE OF THE MATANO FAULT, SULAWESI, INDONESIA

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Abstract. The Matano fault is one of the fast-slipping faults in Indonesia with a slip rate of ~20 mm/yr, accommodating the motion between the Pacific and Australian plates. The fault has remained unruptured at least for the past two centuries. Recent paleoseismological study suggested that the Matano fault has accumulated enough slip for the next surface-rupturing earthquakes. However, studies on the structures, seismicity, and deformation rate of the Matano fault are very scarce. This study characterizes the fault segmentation, evaluates the modern seismicity, and calculates the deformation rate of the Matano fault.

The segmentation model of the Matano fault comprises eight major geometric segments, separated by structural discontinuities. Analysis of modern seismicity shows the high a- and b-value on the Matano fault, suggesting the high tectonic activity. Result of InSAR modeling also shows the rapid deformation on the Matano fault. Integrating our results suggest that the Matano fault can be divided into two major portions, separated by Lake Matano, that could rupture independently and produce Mw ≥7 earthquakes, possibly similar to the 2018 Mw 7.5 Palu earthquake. This study highlights the importance of comprehensive approaches for better understanding the active fault behaviors.

Abstracts

THE EFFECT OF INDONESIAN COAL CHARACTERISTICS ON THE PYROLYSIS ACTIVATION ENERGY

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Abstract. Coal is one of the primary energy sources in Indonesia. As the demand for thermal coal has increased, global environmental concern has also raised. Implementation of clean coal technology such as gasification is therefore a challenge and opportunity for future coal beneficiation. Pyrolysis is an early stage of gasification process which in this study would be investigated. Samples of three coals were taken from different coal basins to evaluate their characteristics. Sample B1, B2 and B3 are from Meulaboh, Kutai and South Sumatra Basins, respectively. The characterization included proximate, ultimate, calorific value and thermogravimetric analyses. Thermogravimetric analysis (TGA) supports the understanding coal thermal behavior, specifically on the pyrolysis stage. The data can also be used for activation energy (Ea) determination. The results of this study show that sample B1 is classified as sub-bituminous C with an Ea value of 64.27 kJ/mol, sample B2 is categorized as sub-bituminous A with an Ea value of 79.41 kJ/mol, and sample B3 is ranked higher, classified as high volatile C bituminous, with an Ea value of 96.24 kJ/mol. The higher coal rank, the higher Ea is needed for pyrolysis decomposition.

Keywords: coal characteristics, thermogravimetric analysis, reaction kinetics, activation energy.

Abstracts

REMOTE SENSING OF GAS CHARACTERISTICS IN 2018 GAMALAMA ERUPTION

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Abstract. The area of Mount Gamalama is located near from densely populated settlements and vital objects such as airports and ports. The eruption of Mount Gamalama in 2018 had a significant impact on aviation activities and social activities of the surrounding communities in the eruption area. The eruption caused airport closures and flight cancellations which impacted population mobility and the local economy. In addition, the eruption also caused losses in the agricultural and tourism sectors. Social impacts were also felt, where communities around the eruption area had to evacuate and face discomfort due to volcanic ash spreading in the surrounding environment. The increase in SO2 gas concentration can indicate the presence of magma activity rising to the surface and can be an early indicator for early eruption detection. Additionally, the measurement of gas characteristics can also provide information on gas flow patterns and volcanic ash cloud movement in the atmosphere that can impact human health and safety as well as air transportation. Therefore, measuring gas characteristics using remote sensing technology is important to improve our understanding of volcano behavior and strengthen early warning systems to reduce disaster risks. This study utilized the GEE (Google Earth Engine) platform with Sentinel-5P satellite data to determine SO2 gas characteristics before and after the eruption.

Keywords: remote sensing; gamalama; SO2; sentinel; gee

Abstracts

THERMODYNAMICS ANALYSIS OF A NOVEL TRANSFIGURATION SYSTEM THE SEPARATED STEAM CYCLE TO DIRECT DRY STEAM POWER PLANT AND STEAM-FIELD PATUHA GEOTHERMAL

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Abstract. Dalam upaya pemenuhan kebutuhan energi di Indonesia, sebuah Geothermal Power Plant Company di Jawa Barat berupaya memperbaiki kualitas produksi dari pembangkitnya. Pembangkit tersebut telah beroperasi sejauh 10 tahun dengan 10 sumur geothermal produksi dan 2 sumur injeksi. Pembangkit tersebut mempunyai anomali pada salah satu sumurnya yakni well-pad PTX2. Sumur itu mempunyai karakteristik basah, sehingga memerlukan peralatan separator untuk memisahkan uap. Hasil penelitian terdahulu mengemukakan bahwa penyebab uap basah dari sumur PTX2 adalah adanya water sub surface yang masuk kedalam pipa reservoir. Pada tahun 2020 perusahaan itu melakukan perbaikan kebocoran di pipa reservoir PTX2. Impactnya adalah tidak diperlukannya separator sebagai alat pemisah steam, kondisi ini disebut transfigurasi dari separated steam cycle ke direct dry steam. Penelitian ini difokuskan untuk membandingkan nilai efisiensi termal dan eksergi pembangkit. Perhitungan dilakukan mulai dari sisi steam-field hingga turbin. Berdasarkan hasil perhitungan efisiensi energi sebelum dilakukan perubahan terjadi kenaikan fraksi.

Abstracts

THE IMPORTANCE OF REDUCE TO POLE, REDUCE TO EQUATOR, HILBERT TRANSFORM, AND PSEUDOGRAVITY METHODS IN MAGNETIC DATA INTERPRETATION

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Abstract. Interpretation of geomagnetic anomaly data is challenging, due to the influence of the Earth's dipole magnetic field. In this study, we investigate the importance of employing methods to transform dipole anomalies into monopoles, aiming to enhance the interpretability of the data. Four methods were examined: Reduce to Pole (RTP), Reduce to Equator (RTE), Hilbert Transform and Pseudo-Gravity. The RTP method was implemented using general equations for RTP, Pseudo-inclination (PI), and Nonlinear thresholding (NTRTP). The computation programs for RTP and RTE were developed using the Matlab programming language. Synthetic models were constructed to investigate the effects of inclination values, object dimensions, and positions on the resulting magnetic anomaly response. The result shows that NTRTP methods give the best result, it can be used in every condition (low or high inclination). Quantitative analysis was performed by calculating the correlation coefficients between synthetic data at a 900 inclination (pole) with the computed results of each method. The NTRTP method produced excellent results when tested against synthetic data with low inclinations (less than 50), with correlation coefficient values ranging from 0.78 to 0.95. On the other hand, the correlation coefficient values obtained using the general equation method and pseudo-inclination method were 0.4101 at an inclination of 50 and 0.9933 at an inclination of 300. With a correlation coefficient of 0.80, the Reduce to Equator method also produced promising results. Qualitatively, the pseudogravity method successfully eliminated the influence of the dipole and pinpointed the locations of anomalies, and Hilbert Transform successfully eliminated the dipole's effect at inclinations of 300-450.

Abstracts

INTEGRATION OF GRAVITY AND GEOSPATIAL DATA TO DETERMINE GEOLOGICAL HAZARD PROSPECT ZONES USING GIS WEIGHTED OVERLAY INDEX (WOI) METHOD

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Abstract. Halmahera Island is one of Indonesian Archipelago that formed from the interaction among three major plates, Indo-Australian, Eurasia, and Pacific. This convergence causes Halmahera Island presumably to be a geological hazard susceptibility area. This study used a gravity data to delineate subsurface structure based on Euler Deconvolution technique and further combined with various geospatial data comprises of lineament density that extracted from Sentinel-1A imagery, rainfall rate, PGA, and vegetation index (NDVI) derived from optical imagery processing to generate geological hazard potential zone map based on the Geographic Information System (GIS) implementation. Each thematic map is weighted using Analytical Hierarchy Process (AHP) approach, normalized by Weighted Overlay Index (WOI) technique, and summed up to calculate Hazard Potential Index (HPI). The calculated map is ranked and reclassified as the most and the least dangerous zone of geological hazard vulnerability. HPI shows the most dangerous area located in the several places, including the north and south arm of Halmahera with the index of 0.63 and 0.51, respectively, while the lowest potential zone is in the southeast arm (0.15). The outcome of this mapping presumably to be used as hazard mitigation reference henceforward.

Abstracts

THE EARLY STUDY FOR NATURE-INSPIRED ALGORITHMS IN GEOPHYSICAL MODELING BASED ON GRAVITY METHOD: PROTOTYPE BAT ALGORITHM IN 3D GRAVITY INVERSION

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Abstract. The physical properties of the subsurface are a crucial consideration in various geoscientific analyses. Geophysical methods offer insights into the distribution of subsurface physical properties, with varying approximations based on these properties. One approach to developing a subsurface model is inverse modeling, a technique that converts data into models. However, new approaches are needed for gravity inversion methods to obtain models with reduced ambiguity. Stochastic inversion techniques are commonly used to avoid local optima that can occur in gravity data modeling due to the underdetermined nature of the model parameters. Nonetheless, a key constraint of this approach is selecting a range of model parameters that accurately represent the geological conditions. To address this issue, the Bat Algorithm is applied as a meta-heuristic method to stochastic inversion techniques. This method emulates the behavior of microbats in randomly searching for prey in the model space. Through simultaneous communication, all microbats aim to locate the best solution within a global search topology, thereby avoiding the entrapment of local optima. This study aims to develop a novel approach to 3D modeling of gravity data through inversion methods. A 3D grid of stacked rectangular prisms serves as the density model, with perturbation achieved through manipulation of the 3D array index as a density grid. Synthetic testing demonstrates a success rate of over 85% for single and multi-layer array models with a density body in the center of the mesh grid. The random distribution of density originates from the bat's propagation of the Bat Algorithm in finding the best model. The suggested technique displays potential for expansion towards the modeling of gravity data with greater complexity, including its practical application in field data analyses.

Abstracts

APPLICATION OF SOURCE INDEPENDENT FULL WAVEFORM INVERSION TO LAND SEISMIC DATA: A CASE STUDY OF DONGGI FIELD, INDONESIA

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Abstract. Full-waveform inversion (FWI) is a data-fitting process based on seismic full-wavefield modeling that provides high-resolution images of subsurface geological structures from observed field data. However, its applicability to real-world scenarios, particularly in land data, is limited due to several factors. These factors include the lack of modeling of strong surface waves, converted waves, phase dispersion, near-surface weathering layer distortion, and wave phenomena such as attenuation energy and distortion because of complex geology. Additionally, the source wavelet information is often missing for land surveys, and recorded waveforms can vary significantly due to spatially variant shot characteristics such as source charge size, shot depth, and hole-pattern, as well as the distortion caused by the near-surface weathering layer. In this study, we address the main challenges of seismic data with low signal-to-noise ratio and an unknown correct source wavelet. To solve for the unknown source wavelet, we use a source independent objective function and perform several preprocessing techniques on the seismic input to improve the signal-to-noise ratio without significantly changing the amplitude. We use velocity analysis data as a prior model to reduce the non-linear problem. We demonstrate the effectiveness of our technique by applying it to land seismic data from the Donggi Basin in Indonesia, and our results show that the velocity model improves and has a better correlation with well log data.

Keywords: Full Waveform Inversion (FWI), Source Independent FWI, Seismic Inversion.

Abstracts

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Abstract. Identifying and characterizing subsurface underground pipelines are routine tasks conducted by geophysicists using geophysical methods such as ground-penetrating radar (GPR) and electrical resistivity tomography (ERT) techniques. This work sometimes experiences difficulty due to the type of pipe material and the weak contrast in electromagnetic properties between pipes, their fluid content, and their host. To observe the detectability of such objects using the geophysical method, we built a test field with buried PVC pipes with different diameters and fluid contents, all parallel to each other. We measured time-domain-induced polarization (IP) on the test field for the first attempt. We deployed a 4-light HP 10w TDIP device manufactured by Lippmann

We applied two electrode configurations, i.e., dipole-dipole and Wenner-Schlumberger, with 1.5 m electrode spacing. Research results showed that the existence of all pipes is recognized in the resistivity section using a dipole-dipole electrode configuration, and pipes filled with water are more recognized than those filled with air. This preliminary result led to the future deployment of the GPR technique for result comparison because pipe diameters are solvable using GPR

Keywords: geophysical techniques; time-domain IP; electrical resistivity tomography; pipe diameter.

Abstracts

Geomechanical characteristics of surrounding rocks in underground coal gasification reactor under high temperatures

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Abstract. Combustion of coal in underground coal gasification activities could achieve temperatures up to 1200° C. The temperatures affect the coal seam and it's surrounding rocks that the physical and mechanical properties of these rocks will be altered. Research on the effect of high temperatures generated from coal combustion is necessary to discover if the elevated temperatures could result in an increase or decrease in the strength of surrounding rocks. This article is based on the research results in the laboratory due to the influence of high temperature given to surrounding rock nearby coal seam. Elevating the temperatures usually done by gradually increasing the temperature on the rocks heated with the furnace. Then, rock mechanics testing is conducted. The characteristic shape of the stress-strain curve that describes the process of the failure of the rock sample under the influence of uniaxial compressive stress was also discussed.

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