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## Abstract Index

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**Risk Assessment of Open Pit Slope Design at PT Adaro Indonesia**

*Penilaian Risiko Kestabilan Lereng Tunggal Tambang Terbuka di PT Adaro Indonesia*

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P. 113 - 121**

Risk assessment of open pit slope stability is an important aspect to be considered in a decision making of slope design. The risk of slope failure that occurred on the slopes of the mine affect two factors namely the failure probability (FP), and consequences (C) of slope failure. FP is obtained from the collection of the value of Safety Factor (SF)  $\leq 1$  compared to the total value of SF, while the consequences is estimated from the sectional area multiplied by the width of slope failure. Physical and mechanical properties of sandstone was collected from PT Adaro Indonesia, and tested by "Kolmogorov-Smirnov (K-S)" fitting method to obtain an assumed theoretical distribution that be sued with the character of the original distribution data. "Monte Carlo (MC)" and "Latin Hypercube (LH)" sampling method is used as a tool to generate sample data, and both methods were compared. Finally Validation is conducted in order to propose an acceptable criteria of FP for single slope of sandstone.

**Keywords:** risk, open pit, failure probability, slope stability

**Abidin, Hamdan Z. and Utoyo, Harry (Geology Survey Centre)**

**Mineralization of the Selected Base Metal Desposits in the Barisan Range, Sumatera, Indonesia (Case Study at Lokop, Dairi, Latong, Tanjung Balit and Tuboh**  
*Mineralisasi Cebakan Logam Dasar Terpilih di Bukit Barisan, Sumatera - Indonesia (Studi Kasus di Lokop, Dairi, Latong, Tanjung Balit dan Tuboh)*

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P. 122 - 133**

Three types of base metal occurrences discovered along the Barisan Range, Sumatera are skarn, sedex and hydrothermal styles. The skarn styles include Lokop, Latong and Tuboh, while Dairi and Tanjung Balit belong to sedex and hydrothermal deposits, respectively. The Lokop deposit is dominated by galena with minor pyrite and is hosted within interbedded meta-sandstone, slate, phyllite, hornfels and quartzite of the Kluet Formation.

The Skarn Latong deposit consists of galena with minor sphalerite and chalcopryrite with skarn minerals of magnetite, garnet and calcite. It is hosted within the meta-limestone of the Kuantan Formation. The Skarn Tuboh deposit is dominated by sphalerite with minor galena, pyrite, manganese, hematite and magnetite. It is hosted within interbedded meta-sandstone and meta-limestone of the Rawas Formation. The Dairi deposit belongs to the sedimentary exhalative (sedex) type. It is hosted within the sedimentary sequence of the Kluet Formation. Two ore types known are Julu and Jehe mineralization. The Julu mineralization referring to as sediment exhalative (sedex), was formed syngenetically with carbonaceous shale. Ore mineralogies consist of galena, sphalerite and pyrite. The deposit was formed within the temperature range of 236-375°C with salinity ranges from 9,3-23% wt.NaCl. The Jehe mineralization which belongs to the Mississippi Valley-Type, is hosted within dolostone of the Jehe Member. Ores comprise galena, sphalerite, pyrite, chalcopryrite, tetrahedrite and tenantite. The deposit was formed at temperature range from 193-400°C with salinity up to 38.2% wt.NaCl. The Tanjung Balit deposit belongs to the hydrothermal mineralization. The deposit is hosted within the sedimentary sequence of the Silungkang Formation. Ores consist of chalcopryrite, galena and sphalerite with minor gold and silver. Hydrothermal minerals such as silica, illite, montmorillonite, pyropilite, muskovite, siderite, diaspor, dickite, magnesite, chlorite, carbonate, rhodochrosite, analcime, alunite, smectite, ankrite, calcite, dolomite, sericite and zeolite are common found. The Tanjung Balit mineralization is formed at the temperature range from 185-350°C and belongs to meso-epithermal type.

**Keywords:** kluet, sedex, skarn, base metals

**Suratman and Handayani, Sri (R&D Centre for Mineral and Coal Technology)**

**Beneficiation of Sambiroto Silica Sand by Chemical and Biological Leachings**

*Benefisiensi Pasir Silika Sambiroto dengan Pelindian Secara Kimia dan Biologi*

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P. 134 - 143**

The commercial value of silica sand significantly affected by the presence and content of iron, aluminium and other metal impurities that can have detrimental effects on the manufactured product. A leaching technology on Sambiroto silica sand had been studied using chemical (HCl and H<sub>2</sub>SO<sub>4</sub>) and biological (*Aspergillus niger*'s metabolite) methods to remove undesired metal impurities and obtain a high purity silica. The rates and

extent of chemical leaching and bioleaching were different depending on the leaching agents used and their concentrations. The results showed that the laboratory experiments improved the silica sand sample to a high grade purity. The major and minor impurities of Fe, Al, Ca, Cr, Ti, Zr and Cu were reduced significantly by acid leaching with HCl and H<sub>2</sub>SO<sub>4</sub> 4M at 90°C, 30% pulp density for 4-hours process. The chemical composition of the silica sand improved with the SiO<sub>2</sub> content increased from 97.24 to 98.77%, on the other hand, the sum of impurities decreased from 1.148 to 0.237 %. These changes bring the beneficiated product very close to a feedstock of metallurgical grade silicon for advanced materials. Among the tested methods, chemical leaching is the most efficient in terms of both increasing percentage of SiO<sub>2</sub> and metal impurities removal compared to biological leaching. Nevertheless, bioleaching process is sufficient to produce silica sand with a desired minimum value of Fe and Al contents for high quality glass industries. Both process characteristics could facilitate their industrial applications.

Keywords: beneficiation, silica sand, chemical leaching, bioleaching, metallurgical grade silicon

**Wahyudi, Tatang (R&D Centre for Mineral and Coal Technology)**  
**Process Mineralogy for Evaluating Mineralogy, Physical and Chemical Characters of the Tailing Comes from Gold Processing**  
*Mineralogi Proses untuk Mengevaluasi Karakter Mineralogi, Fisika dan Kimia Limbah Pengolahan Emas*  
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Based on mineralogy, physical and chemical analyses, character of gold-processing tailings from Pongkor showed relatively complex condition. Gold particles were normally included by either sulfide (pyrite, chalcopyrite, galena, arsenopyrite, sphalerite etc.) or silicate minerals (mainly quartz). The inclusion structure performed single, double or multiple forms. Single inclusion meant that gold particle(s) was encased by one mineral phase while double and multi inclusions im-

plied that the gold was sheathed by two or more phases. Gold was distributed along the micro-cracks of either similar or different phase. Chemical analyses showed that Pongkor tailings were characterized by several elements that might be ineffective for gold leaching by cyanide. Preg-robbing solution might be occurred.

Keywords: mineralogy, physical and chemical analyses; tailings characters; Pongkor; inclusions

**Mursito, Anggoro T.; Saepuloh, Atet and Dida, Eki N. (Research Centre for Geotechnology - Indonesian Institute of Sciences)**  
**Carbonization of Banten Coal by Adding Water Steam; Changes on Carbon Functional Groups and Pore Characteristics**  
*Karbonisasi Batubara Banten dengan Penambahan Uap Air; Perubahan Gugus Fungsi Karbon dan Karakteristik Pori*  
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Experimental research and a fundamental study of carbonization of coal have been done by adding steam. The coal sample used in this study was obtained from Bayah, Banten, where the coal was mined by a small-scale underground mining. The study was carried out on a laboratory-scale of adjustable tube furnace reactor. The processes could give carbonized coal with a high calorific value (about 7,600 kcal/kg) and a high fixed carbon content (about 87 wt%). Specific surface area of carbonized products was also interesting as having for 160.5 m<sup>2</sup>/g. Specific surface area and pore distribution determined by BET techniques and also scanning electron microscope analyses were used to test for the pore and physical properties in the coal. In addition, changes in carbon functional groups and their properties were determined by Fourier Transform Infrared Spectroscopy and Raman Spectroscopy analysis of the products, upgrading process and maturation analyses.

Keywords: carbonization, upgrading process and maturation analyses