



p-ISSN 0854-1418

e-ISSN 2503-426X

Accreditation by the Directorate General of Higher Education,
Research and Technology No. 158/E/KPT/2021

EKSPLORIUM

Buletin Pusat Pengembangan Bahan Galian Nuklir

Bulletin of the Center for Nuclear Minerals Development

Volume 44 No. 2, November 2023



**DIRECTORATE OF REPOSITORIES, MULTIMEDIA, AND SCIENTIFIC PUBLICATION
NATIONAL RESEARCH AND INNOVATION AGENCY**

EKSPLORIUM	Volume 44	No. 2	Pages 49 - 92	Jakarta Nov 2023	p-ISSN 0854- 1418 e-ISSN 2503-426X	Accreditation No. 158/E/KPT/2021
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p-ISSN 0854-1418

e-ISSN 2503-426X

Accreditation by the Directorate General of Higher Education,
Research and Technology No. 158/E/KPT/2021

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Eksplorium, the Bulletin of the Center for Nuclear Minerals Development, is a scientific journal which contains the results of studies, research, and development of nuclear geology with the scope of geology, exploration, mining, processing of nuclear minerals, and environmental safety as well as the development of nuclear technology for people's welfare. **Eksplorium** published 2 (two) times a year, in May and November.

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(Contributor: I Gde Sukadana)

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DIRECTORATE OF REPOSITORIES, MULTIMEDIA, AND SCIENTIFIC PUBLICATION
NATIONAL RESEARCH AND INNOVATION AGENCY

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Buletin Pusat Pengembangan Bahan Galian Nuklir
Bulletin of the Center for Nuclear Minerals Development
Volume 44, No. 2, November 2023

FOREWORD

Dear Readers,

This edition of **Eksplorium** contains five (5) research articles from various fields. The first paper describes uranium and thorium distribution in tin belt granite with titled “Radioactive Mineral Distribution on Tin Placer Deposits of Southeast Asia Tin Belt Granite in Bangka Island.” The second paper is about empirical equation to calculate the sediment thickness with titled “Empirical Equation between Predominant Frequency and Sediment Thickness in Plampang, West Nusa Tenggara”. The third paper discusses thorium separation from monazite, titled “Separation of Thorium (Th) from Monazite Sand of Bangka Island using Primene JMT Solvent Extraction Method”. The fourth paper is about the method validation for thorium ore analysis with titled “Analytical Method Validation of Thorium in Ore Sample Using Uv-Vis Spectrophotometer.” The last paper is a review paper about phytoremediation for nickel mine waste, with titled “Phytoremediation of Hexavalent Chromium Using Aquatic Plants in Nickel Mine Waste.”

We believe that **Eksplorium** can benefit readers, especially in developing insights into nuclear minerals technology, including geology, mining, processing, and the environment.

Editor in Chief

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Radioactive Mineral Distribution on Tin Placer Deposits of Southeast Asia Tin Belt Granite in Bangka Island

Ngadenin^{*}, I Gde Sukadana, Heri Syaeful, Adi Gunawan Muhammad, Frederikus Dian Indrastomo, Ilsa Rosianna, Roni Cahya Ciputra, Tyto Baskara Adimedha, Fadiyah Pratiwi, Yoshi Rachael
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Article received: 15 October 2023, revised: 20 November 2023, accepted: 30 November 2023

DOI: [10.55981/eksplorium.2023.6969](https://doi.org/10.55981/eksplorium.2023.6969)

ABSTRACT

Bangka Island is an area rich in primary and secondary tin deposits. Tin deposits are formed around the contact between granite and older rocks, while secondary tin deposits are formed in the modern channels and paleochannels. Many previous researchers have researched radioactive minerals in primary tin deposits and modern channel deposits, but research on radioactive minerals in paleo channel deposits has never been carried out. The characterization of radioactive minerals in paleo channel deposits was done in this study to determine the potency of radioactive minerals in secondary tin deposits by comparing the content of radioactive minerals in paleochannels with modern channels and tin mine tailing deposits. The data used were mineralogical data and radioactivity data, along with the uranium and thorium content of the rocks from several previous studies. Data showed significant mineral content differences in paleo channel, modern channel, and tin mine tailings deposits. Mineral (monazite and zircon) content in tin mine tailing deposits was the highest. Source rocks for the radioactive minerals monazite and zircon are predicted to be the granitic rocks or tourmaline quartz veins of primary tin deposits. The radioactivity value of rocks in the paleo channel is relatively the same as the modern channel, ranging from 20 to 150 c/s. Uranium content in paleo channel is the same as modern channel deposits, ranging from 10 to 15 ppm eU. The thorium content of the rocks in the paleo channel ranges from 1 to 60 ppm eTh, while in the modern channel, it ranges from 1 to 45 ppm eTh. The radioactivity value and uranium content of the rocks are less effective for determining potential areas of radioactive minerals in placer tin deposits. In contrast, data on thorium content are quite effective for determining potential areas of radioactive minerals in placer tin deposits.

Keywords: Bangka Island, paleo channel, monazite, zircon, alluvium.

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Buletin Pusat Pengembangan Bahan Galian Nuklir
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Empirical Equation between Predominant Frequency and Sediment Thickness in Plampang, West Nusa Tenggara

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Article received: 24 August 2022, revised: 16 October 2023, accepted: 30 November 2023

DOI: [10.55981/eksplorium.2023.6918](https://doi.org/10.55981/eksplorium.2023.6918)

ABSTRACT

Soil characteristics mapping is one of the essential aspects in the development of a region. Soil characteristics such as the predominant frequency and thickness of the sediment layer are needed to ensure the capacity of soil against the load of an infrastructure construction. The existence of tectonic activity causes West Nusa Tenggara Province to be an area with high seismic activity. Along with the plan to accelerate the development of the Samota Area, seismic studies are one of the aspects that determine project feasibility. The predominant frequency value from the results of microtremor measurements is used in the development of an empirical formula to predict soil thickness in the Plampang area. The empirical formula from previous research is used as a conformity test of the empirical formula obtained. Empirical equations are then used to map variations in sediment thickness in the Plampang area, which are justified based on geological data. The results of the sediment thickness map based on the empirical formula for the Plampang area showed a good correlation with the predominant frequency and also showed a good correlation with the results of the formula that has been carried out by previous studies.

Keywords: sediment thickness, empirical formula, microtremor

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Buletin Pusat Pengembangan Bahan Galian Nuklir
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Separation of Thorium (Th) from Monazite Sand of Bangka Island using Primene JMT Solvent Extraction Method

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Article received: 19 May 2022, revised: 19 May 2022, accepted: 30 November 2023

DOI: [10.55981/eksplorium.2023.6480](https://doi.org/10.55981/eksplorium.2023.6480)

ABSTRACT

Thorium is an essential element as an alternative nuclear fuel to replace uranium. Thorium is found in the mineral monazite, which is a by-product of the alluvial tin mining process. Many methods have been used to extract and separate thorium from uranium and REEs from monazite, one of which is the organic solvent extraction method. In this research, the primene JMT, which is an extractant of primary amine compounds, was used in the method. The studied parameters are feed pH, JMT primene concentration, and stirring speed. The results show that the optimum conditions for Th extraction in monazite using solvent extraction method primene JMT were obtained at pH 0.5, extractant concentration of 2%, and stirring speed of 300 rpm with Th recovery of 94.05% while U and REE were not extracted.

Keywords: solvent extraction, thorium, monazite, primene JMT, primary amine

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Volume 44, No. 2, November 2023

Analytical Method Validation of Thorium in Ore Sample Using Uv-Vis Spectrophotometer

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Article received: 3 October 2023, revised: 12 November 2023, accepted: 30 November 2023

DOI: [10.55981/eksplorium.2023.6965](https://doi.org/10.55981/eksplorium.2023.6965)

ABSTRACT

Monazite contains several rare earth elements (REE) along with radioactive elements, i.e., thorium (Th) and uranium (U). Thorium content in monazite is several times higher than uranium. Monazite contains around 12% thorium oxide, but the thorium content in this mineral varies depending on location. To determine the thorium content in monazite, an appropriate and validated analytical method is needed so that the reliability of the test results can be trusted. Apart from that, method validation is one of the clauses in SNI ISO/IEC 17025:2017 that must be fulfilled by the laboratory to be certified and produce reliable data. This research aims to validate analytical methods for non-standard and modified methods that are likely to be used outside the scope. In this research, the method used to digest and analyze thorium in mineral samples refers to the ASTM E2941-14 method with several modifications. Therefore, the analysis method needs to be validated. Validation of the analytical method is carried out by testing several parameters such as linearity and working range tests, accuracy, precision (repeatability), Limit of Detection (LOD), and Limit of Quantitation (LOQ). The results of linearity, accuracy, and repeatability tests that meet the acceptance requirements can be used as a method of validation evaluation. The results of the method validation parameter test met the acceptance requirements, with the linearity test showing a coefficient of determination (R^2) of 0.997, the accuracy test showing % a recovery value of 106.22%, and the precision (repeatability) test showing %RSD of 3.76% with LOD value is 0.650 mg/L, and LOQ is 0.724 mg/L. Based on the results of these parameter tests, the method for analyzing thorium in mineral samples was validated.

Keywords: monazite, minerals, thorium, validation method

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Phytoremediation of Hexavalent Chromium Using Aquatic Plants in Nickel Mine Waste

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Article received: 19 May 2022, revised: 19 May 2022, accepted: 30 November 2023

DOI: [10.55981/eksplorium.2023.6927](https://doi.org/10.55981/eksplorium.2023.6927)

ABSTRACT

The abundant wealth that Indonesia has is very profitable. Wealth is not only from natural resources, but wealth or biodiversity is also able to make Indonesia an independent country in managing its environment. One of the varieties that can be utilized is the existence of aquatic plants that can be used in the restoration of polluted environments. The ability of plants to recover from pollutants is called phytoremediation. Hexavalent chromium/Cr(IV) is a hazardous waste originating from the washing of ore/open pit waste from rainwater washing. The quality standard allowed for Cr (IV), according to the Minister of Environment Regulation No. 9 of 2006, concerning the Quality Standard of Wastewater for Nickel Ore Mining Businesses and/or Activities is 0.1 mg/L. Besides being used to reduce pollutant loads, this aquatic plant can also provide aesthetic value because it has a very beautiful shape, type, color, and flowers. The purpose of this research is to find out which plants can be used to reduce hexavalent chromium levels. Variations of aquatic plants that can reduce levels of hexavalent chromium which are harmful to living things include water *hyacinth/Eichornia crassipes*; *water hyacinth*; *Kayambang/Salvinia Cucullata*; *Kiambang/ Apu Wood/ Pistia Stratiotes*; *Hydrilla verticillata*; *Water Bamboo/Equisetum hyemale*; *Water spinach / Ipomoea Aquatica*; and *Sagittaria lancifolia*. This aquatic plant can reduce Cr (IV) up to 99.5%. The ability of these aquatic plants not only to reduce Cr (IV) but also to reduce TSS, BOD, and COD and to neutralize pH. The combination of several aquatic plants also provides a high effectiveness value.

Keywords: phytoremediation; hexavalent chromium; water mine waste; aquatic plants.
