



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 45 No. 1, May 2024



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

| | | | | | | |
|------------|--------------|----------|---------------|---------------------|---------------------------------------|-------------------------------------|
| EKSPLORIUM | Volume 45 | No. 1 | Pages 1-56 | Jakarta May 2024 | p-ISSN 0854- 1418 e-ISSN 2503-426X | Accreditation No. 158/E/KPT/2021 |
|------------|--------------|----------|---------------|---------------------|---------------------------------------|-------------------------------------|



9 772503 426021



9 770854 141426

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 45 No. 1, May 2024

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.

Chief Editor

Dr. Ir. I Gde Sukadana, M.Eng., IPM, BRIN, Indonesia

Associate Editors

Frederikus Dian Indrastomo, M.T., BRIN, Indonesia

Heri Syaeful, M.T., BRIN, Indonesia

Kurnia Setiawan Widana, M.T., BRIN, Indonesia

Roni Cahya Ciputra, M.T., BRIN, Indonesia

Editorial Board

Prof. Dr. Muhayatun Santoso, M.T., BRIN, Indonesia

Prof. Dr. Ir. Ildrem Syafri, DEA., Padjajaran University, Indonesia

Prof. Dr. Eng. Sidik Permana, M.Eng., Institut Teknologi Bandung, Indonesia

Prof. Himawan Bayumurti Petrus, M.E., D.Eng., Universitas Gadjah Mada, Indonesia

Dr.rer.nat. Ir. I Wayan Warmada, IPM, Universitas Gadjah Mada, Indonesia

Dr. Sri Mulyaningsih, Institut Sains dan Teknologi "AKPRIND" Yogyakarta, Indonesia

Dr. Hill Gendoet Hartono, Institut Teknologi Nasional Yogyakarta, Indonesia

Dr. Sulaksana Permana, M.T., Gunadarma University, Indonesia

Iwan Susanto, Ph.D., Politeknik Negeri Jakarta, Indonesia

Rahman Yaccub, M.Sc. Ph.D., Malaysia Nuclear Agency, Malaysia

Pipat Laowattanabandit, M.Sc., Ph.D., Chulalongkorn University, Thailand

Abduelhamed Mohamed Salem Ethman, M.Sc., Libyan Atomic Energy Establishment, Libya

Ir. Yarianto Sugeng Budi Susilo, M.Si., BRIN, Indonesia

Yuniarti Ulfa, M.Sc., Politeknik Geologi dan Pertambangan "AGP", Indonesia

Copy Editor

Windi Anarta Draniswari, M.T., BRIN, Indonesia

Ersina Rakhma, M.T., BRIN, Indonesia

Tyto Baskara Adimedha, M.Eng., BRIN, Indonesia

Apriwi Zulfitri, M.Sc., BRIN, Indonesia

Layout Editor

M. Ilham Bayquni, M.T., BRIN, Indonesia

Mirna Berliana Garwan, S.T., BRIN, Indonesia

Managing Editor

Dra. Noeraida, BRIN, Indonesia

Andri Agus Rahman, A.Md., BRIN, Indonesia

Photo caption: The fault-controlled Handeuleum Hotspring of Mount Endut Geothermal Area,
West Java (Contributor: Mochamad Ikral Pamungkas)

Publisher:

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

Editorial Address:

Building 720, B.J. Habibie Science and Technology Area, South Tangerang, Banten 15314

Telp. 081 110 646 830, E-mail: eksplorium@brin.go.id

Website: <http://jurnal.batan.go.id/index.php/eksplorium>

EKSPLORIUM

Buletin Pusat Pengembangan Bahan Galian Nuklir
Bulletin of the Center for Nuclear Minerals Development
Volume 45, No. 1, May 2024

FOREWORD

Dear Readers,

This edition of **Eksplorium** contains five (5) research articles from various fields. The first paper describes uranium and Rare Earth Element (REE) characterization from Rirang uranium Deposits with titled “Distribution and Characteristics of Rare Earth Elements in Uranium-Ore Deposits from Rirang Area, West Kalimantan Province, Indonesia” The second paper is about identification of radioactive and REE in placer deposits with titled “Characterization of Radioactive and Rare Earth Elements in Heavy Minerals from River Sediments in Marau Region, Ketapang, West Kalimantan”. The third paper discusses about development method for geological structure identification titled “Geological Structure Identification Using GGMplus Satellite Gravity Data in The Area Surrounding Mount Tampomas”. The fourth paper is a study for land suitability analysis, with titled “Geology and Land Suitability Analysis for Final Processing Waste Site in Ambon Island”. The last paper is about the method validation for the determination of REE oxide with titled “Validation of The Gravimetry Method for Determining Rare Earth Elements Oxides”

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

EKSPLORIUM

Buletin Pusat Pengembangan Bahan Galian Nuklir
Bulletin of the Center for Nuclear Minerals Development
 Volume 45, No. 1, May 2024

Table of Contents

| | |
|---|-------|
| Foreword | i |
| Table of Content..... | ii |
| Current Content..... | iii |
| | |
| Distribution and Characteristics of Rare Earth Elements in Uranium-Ore Deposits from Rirang Area, West Kalimantan Province, Indonesia. <i>Tyto Baskara Adimedha, Rayhan Aldizan Farrenzo, I Gde Sukadana, Rosmalia Dita Nugraheni, Fadiyah Pratiwi, Roni Cahya Ciputra, Frederikus Dian Indrastomo, Heri Syaeful, Yoshi Rachae</i> | 1–16 |
| | |
| Characterization of Radioactive and Rare Earth Elements in Heavy Minerals from River Sediments in Marau Region, Ketapang, West Kalimantan. <i>Fadiyah Pratiwi, Yoshi Rachael, Widodo, Rachman Fauzi, Nunik Madyaningarum, Tyto Baskara Adimedha, Frederikus Dian Indrastomo, I Gde Sukadana</i> | 17–26 |
| | |
| Geological Structure Identification Using GGMplus Satellite Gravity Data in The Area Surrounding Mount Tampomas. <i>Haidar Prida Mazzaluna, Rustadi, Rahmat Catur Wibowo</i> | 27–38 |
| | |
| Geology and Land Suitability Analysis for Final Processing Waste Site in Ambon Island. <i>Winardcova Vania Cerwyn Mailoa, Micky Kololu, Yuniarti Ulfa, Deni Juanda Puradimadja</i> | 39–48 |
| | |
| Validation of The Gravimetry Method for Determining Rare Earth Elements Oxides. <i>Afiq Azfar Pratama, Amalia Ekaputri Hidayat, Rommy, Suci Indryati, Roza Indra Laksmana, Kurnia Trinopiawan, Tri Purwanti, Kurnia Setiawan Widana, Aditya Widian Putra, Mutia Anggraini, Dzaki Hasan Nasrullah</i> | 49–56 |

EKSPLORIUM

Buletin Pusat Pengembangan Bahan Galian Nuklir
Bulletin of the Center for Nuclear Minerals Development
Volume 45, No. 1, May 2024

Distribution and Characteristics of Rare Earth Elements in Uranium-Ore Deposits from Rirang Area, West Kalimantan Province, Indonesia

Tyto Baskara Adimedha^{1*}, Rayhan Aldizan Farrenzo², I Gde Sukadana¹, Rosmalia Dita Nugraheni², Fadiah Pratiwi¹, Roni Cahya Ciputra¹, Frederikus Dian Indrastomo¹, Heri Syaeful¹, Yoshi Rachael¹

¹Research Center for Nuclear Material and Radioactive Waste Technology, ORTN-BRIN
KST B. J. Habibie, South Tangerang, Banten, 15314, Indonesia

²Department of Geological Engineering, Faculty of Earth Technology and Energy, Universitas Trisakti
Letjen S. Parman St., No.1, Campus A, West Jakarta, DKI Jakarta, 11440, Indonesia

*E-mail: tyto001@brin.go.id

Article received: 15 May 2024, revised: 30 May 2024, accepted: 31 May 2024

DOI: [10.55981/eksplorium.2024.7058](https://doi.org/10.55981/eksplorium.2024.7058)

ABSTRACT

Uranium and rare earth elements (REE) are essential elements for the development of green environmentally friendly, and sustainable energy. To meet the increasing demand for these raw materials, Indonesia has taken steps to explore and map potential deposits, including the Rirang Sector in Melawi Regency, West Kalimantan. However, the available information on the mineralization of these elements in the area is limited. Therefore, this study aimed to provide a detailed characterization on the petrology and geochemical characteristics of uranium ore and to synthesize the mineral genesis of uranium and REE-bearing ore in the Rirang Sector. The analytical methods used included petrography, micro-XRF, and geochemical analysis. The results showed that uranium mineralization was present in brannerites, uranophane, and swamboite associated with tourmaline and monazite ore. Similarly, REE concentrations were hosted by REE-bearing minerals, such as monazite, xenotime, and loparite. Geochemically, the uranium concentration in the monazite ore ranged from 1,110–28,440 ppm, while the total REE (TREE) concentration varied between 85,320 to 138,488 ppm. The formation of uranium and REE mineralization were due to the metasomatism process and its association with the Na-rich fluid of felsic intrusion. Notably, the weathering process did not enrich uranium and REE content in the soil but rather decreased it due to the leaching process and the absence of clay minerals capable of absorbing the REE cations on the surface of clay crystal structures.

Keywords: West Kalimantan, monazite, rare earth elements, tourmaline, uranium

EKSPLORIUM

Buletin Pusat Pengembangan Bahan Galian Nuklir
Bulletin of the Center for Nuclear Minerals Development
Volume 45, No. 1, May 2024

Characterization of Radioactive and Rare Earth Elements in Heavy Minerals from River Sediments in Marau Region, Ketapang, West Kalimantan

Fadiyah Pratiwi^{1*}, Yoshi Rachael¹, Widodo², Rachman Fauzi³, Nunik Madyaningarum⁴, Tyto Baskara Adimedha¹, Frederikus Dian Indrastomo¹, I Gde Sukadana¹

¹Research Center for Nuclear Material and Radioactive Waste Technology, ORTN-BRIN
KST B. J. Habibie, South Tangerang, Banten, 15314, Indonesia

²Polytechnic Institutes of Nuclear Technology
Babarsari St., PO BOX 6101/YKKB, Sleman, D. I. Yogyakarta, 55281, Indonesia

³Research Center for Geological Resources, ORKM-BRIN
KST Samaun Samadikun, Bandung, 40135, Indonesia

⁴Research Center for Safety, Metrology, and Nuclear Quality Technology, ORTN-BRIN
KST B. J. Habibie, South Tangerang, Banten, 15314, Indonesia

*E-mail: fadi005@brin.go.id

Article received: 7 December 2023, revised: 29 May 2024, accepted: 31 May 2024

DOI: [10.55981/eksplorium.2024.6971](https://doi.org/10.55981/eksplorium.2024.6971)

ABSTRACT

Alluvium deposits from the Kendawangan River located in Marau, Ketapang, West Kalimantan have been known for their radioactive and rare earth mineral potential. In this paper, heavy minerals taken from alluvium deposits will be characterized to determine the elemental distribution of uranium, thorium, and rare earth elements in each mineral and their mineralogical composition. The samples are taken by panning and prepared using the flotation method to obtain heavy mineral concentrates. Geochemical analysis was carried out using a Bruker M4 Tornado plus Micro-XRF and continued with mineralogical analysis using AMICS (Advanced Mineral Identification and Characterization System) software. It was found that the distribution of heavy minerals from the sand samples was dominated by manganian ilmenite, ilmenite, rutile, zircon, magnetite, and monazite, as well as thorite, cassiterite, xenotime, allanite, and other minerals in small quantities. Uranium, thorium, and rare earth elements are found in monazite, thorite, xenotime, zircon, and allanite.

Keywords: heavy minerals, Micro-XRF, radioactive minerals, rare earth element

EKSPLORIUM

Buletin Pusat Pengembangan Bahan Galian Nuklir
Bulletin of the Center for Nuclear Minerals Development
Volume 45, No. 1, May 2024

Geological Structure Identification Using GGMplus Satellite Gravity Data in The Area Surrounding Mount Tampomas

Haidar Prida Mazzaluna¹, Rustadi¹, Rahmat Catur Wibowo^{1*}

¹Department of Geophysical Engineering, Faculty of Engineering, Lampung University,
Sumantri Brojonegoro St. No.1, Bandar Lampung, Lampung, 35145, Indonesia

*E-mail: rahmat.caturwibowo@eng.unila.ac.id

Article received: 2 October 2023, revised: 2 April 2024, accepted: 22 April 2024

DOI: [10.55981/eksplorium.2024.6924](https://doi.org/10.55981/eksplorium.2024.6924)

ABSTRACT

Satellite gravity provides a new alternative in geological exploration with several advantages, such as low operational cost and large covering area. GGMplus satellite gravity data provide better accuracy for several applications such as lithology or fault identification. Satellite gravity provides a new alternative in geological exploration with several advantages, such as lower costs, broader area coverage, and easily accessible data. Mount Tampomas is one of the areas that has geothermal prospects and a mountain area that has many types of rock formations and faults. This research has been conducted using GGMplus satellite gravity data in the Mount Tampomas area to obtain the second vertical derivative (SVD) and identify the fault distribution in the area. The GGMplus Gravity Acceleration data was corrected and filtered to obtain SVD structures in the area. The structure in this area is dominantly trending northwest-southeast and west-east. The area around Mount Tampomas forms a structure in the form of a caldera. In addition, there are also structures trending north-south at coordinates 81500-82000 E. Some of these structures were overlaid with a geological map to see the suitability of the processed data with the geological conditions that have been studied. The comparison is done by overlaying the structure of the interpretation results and the contour of the value 0 from the Second Vertical Derivative (SVD) data so that we get four fault structures that correlate with the geological map, three calderas, and one lineament that correlates with the lineament map.

Keywords: Mount Tampomas, GGMplus, gravity method, geological structure.

EKSPLORIUM

Buletin Pusat Pengembangan Bahan Galian Nuklir
Bulletin of the Center for Nuclear Minerals Development
Volume 45, No. 1, May 2024

Geology and Land Suitability Analysis for Final Processing Waste Site in Ambon Island

Winardcova Vania Cerwyn Mailoa^{1*}, Micky Kololu¹, Yuniarti Ulfa², Deni Juanda Puradimadja³

¹Program Study of Geological Engineering, Faculty of Engineering, Pattimura University,
Ir. M. Putuhena St., Kampus Poka, Kota Ambon, Maluku, 97223, Indonesia

²Program Study of Geological Engineering, Polytechnic of Geology and Mining "AGP"
Lodaya St., No. 38, Bandung, 40264, Indonesia

³Program Study of Geological Engineering, Faculty of Earth Science and Technology,
Institut Teknologi Bandung, Ganesha St., No.10, Bandung, West Java, 40132, Indonesia

*E-mail: mailovania@gmail.com

Article received: 18 March 2024, revised: 22 April 2024, accepted: 29 May 2024

DOI: [10.55981/eksplorium.2024.7042](https://doi.org/10.55981/eksplorium.2024.7042)

ABSTRACT

The production of waste in Ambon City increased from 200 tons per day to 297 tons per day between 2017 and 2021, yet the state of the Toisapu landfill in Ambon did not keep up with this growth. The Toisapu landfill has been in operation since 2007, however, due to its proximity to residential areas and slope of more than 20 percent, it is currently in an overload state and requires a re-evaluation. The goal of this study is to identify a different landfill to replace the Toisapu landfill that fulfills the Indonesian National Standards and functions as a Waste Processing and Final Processing Site (TPPAS). This study combines an evaluation of the geological and non-geological parameters using an environmental geological technique called Spatial Multi-Criteria Evaluation (SMCE). In order to determine the most possible land, the study findings for each parameter are superimposed, assigned a value, and then added together. According to the research's findings, Wakal, which has 126,668 hectares of land is the best option. Since the groundwater in this area is quite deep (>80 meters) and has low permeability, there is minimal possibility of leachate seepage contaminating the groundwater. Wakal, unlike the Toisapu landfill, is located far from inhabited areas and protected forests, with a slope of less than 20%.

Keywords: Ambon Island, waste, environmental geology, SMCE, waste processing, final processing.

EKSPLORIUM

Buletin Pusat Pengembangan Bahan Galian Nuklir
Bulletin of the Center for Nuclear Minerals Development
Volume 45, No. 1, May 2024

Validation of The Gravimetry Method for Determining Rare Earth Elements Oxides

Afiq Azfar Pratama^{1*}, Amalia Ekaputri Hidayat¹, Rommy¹, Suci Indryati¹, Roza Indra Laksana¹, Kurnia Trinopiawan¹, Tri Purwanti¹, Kurnia Setiawan Widana¹, Aditya Widian Putra¹, Mutia Anggraini², Dzaki Hasan Nasrullah³

¹Research Center for Nuclear Material and Radioactive Waste Technology, ORTN-BRIN
KST B. J. Habibie, South Tangerang, Banten, 15314, Indonesia

²Directorate of Laboratory Management Research Facilities and Science and Technology Park, DIRI-BRIN
KST B. J. Habibie, Serpong, South Tangerang, Banten 15314, Indonesia

³SMK-SMAK Bogor, Binamarga 1 St., Bogor, West Java, 16143, Indonesia

*E-mail: afiq001@gmail.com

Article received: 22 March 2024, revised: 2 May 2024, accepted: 29 May 2024

DOI: [10.55981/eksplorium.2024.6972](https://doi.org/10.55981/eksplorium.2024.6972)

ABSTRACT

The demand for minerals to meet technological developments is increasing, including minerals that contain rare earth elements (REE). The levels of REE in solids can be determined using conventional analysis methods (gravimetry) and instruments. Even though the instrument method provides more accurate results with a small amount of analyte, the cost is higher compared to the gravimetric method, which requires more analyte and provides good results. Therefore, the gravimetric method is a solution for areas with limited instruments and budgets. The study aims to validate the gravimetric method for determining REE oxides levels, evaluate its precision and accuracy, and assess its feasibility of use. In this study, two methods were used for REE analysis: the ASTM E2941-14 method with sample weight modification and the addition of acid to increase REE oxides recovery and a precipitation method using oxalic acid. The validation stages include sample dissolution, precipitation, filtration, and ash-making. The research results show that the RSD value is 0.3154, which is smaller than 2/3 of Horwitz's CV, namely 4.1727, which means it meets the precision acceptance requirements of ISO/IEC 17025:2017. The REE oxides recovery value, which indicates accuracy, also increased to 97.74%. Therefore, the gravimetric method can be used as an alternative for determining REE oxides levels.

Keywords: gravimetric methods, method validation, oxalic acid, REE oxides
