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Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

DAFTAR PUSTAKA

Amijaya, H., dan Littke, R., 2006, Properties of thermally metamorphosed coal from Tanjung Enim Area, South Sumatra Basin, Indonesia with special reference to the coalification path of macerals: International Journal of Coal Geology, v. 66, p. 271–295, doi:10.1016/j.coal.2005.07.008.

Amijaya, H., Wiranata, B., dan Anggara, F., 2020, Occurrence of rare earth element and yttrium (REY) in Tanjung formation coking coal from Sekako area, Central Kalimantan: E3S Web of Conferences, v. 200, p. 4–7, doi:10.1051/e3sconf/202020006008.

Anggara, F., Amijaya, D.H., Harijoko, A., Tambaria, T.N., Sahri, A.A., dan Asa, Z.A.N., 2018, Rare earth element and yttrium content of coal in the Banko coalfield, South Sumatra Basin, Indonesia: Contributions from tonstein layers: International Journal of Coal Geology, v. 196, p. 159–172, doi:10.1016/j.coal.2018.07.006.

Anggara, F., Amijaya, D.H., Moore, T.A., Fadhillah, A.N., dan Patria, A.A., 2025, Petrological, mineralogical, and geochemical compositions of the Eocene coals from Senakin Peninsula, South Kalimantan, Indonesia: International Journal of Coal Geology, v. 301, p. 104722, doi:10.1016/j.coal.2025.104722.

Anggara, F., Fadhillah, A.N., Patria, A.A., Amijaya, D.H., dan Petrus, H.T.B.M., 2023, Microfacies and Depositional Environment of Senakin Coal, Tanjung Formation, South Borneo, Indonesia: Advances in Science, Technology and Innovation, p. 163–166, doi:10.1007/978-3-031-43744-1_33.

Anggara, F., Patria, A.A., Rahmat, B., Wibisono, H., Putera, M.Z.J., Petrus, H.T.B.M., Erviana, F., Handini, E., dan Amijaya, D.H., 2024, Signature characteristics of coal geochemistry from the Eocene Tanjung Formation and the Miocene Warukin Formation, Barito Basin: Insights into geological control on coal deposition and future critical element prospection: International Journal of Coal Geology, v. 282, p. 104423, doi:10.1016/j.coal.2023.104423.

Anggara, F., dan Petrus, H.T.B.M., 2015, Potential Source of Rare Earth Elements (Ree) From Sangatta Coal, Kutai Basin, Indonesia: Abstracts of 32nd Annual Meeting of The Society for Organic Petrology, v. 32, p. 17, doi:10.1016/0166.

UNIVERSITAS
GADJAH MADA
**Pengayaan dan Moda Keterdapatan Rare Earth Elements and Yttrium (REY) pada Batubara Formasi Tanjung
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Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

Anggara, F., Petrus, H.T.B.M., Patria, A.A., dan Bangun, A.S. V., 2020, Preliminary Study of Rare Earth Element and Yttrium (REY) Content of Coal In Sangatta Coalfield, East Kalimantan, Indonesia: Indonesian Journal on Geoscience, v. 7, p. 305–314, doi:10.17014/ijog.7.3.305-314.

Arbuzov, S.I., Mezhibor, A.M., Spears, D.A., Ilenok, S.S., Shaldybin, M. V., dan Belaya, E. V., 2016, Nature of tonsteins in the Azeisk deposit of the Irkutsk Coal Basin (Siberia, Russia): International Journal of Coal Geology, v. 153, p. 99–111, doi:10.1016/j.coal.2015.12.001.

ASTM D2798-20, 2020, Standard Test Method for Microscopical Determination of the Vitrinite Reflectance of Coal: ASTM International, v. D2798–20, p. 1–6, doi:10.1520/D2798-21.position.

Balaram, V., 2020, Current and emerging analytical techniques for geochemical and geochronological studies: Geological Journal, v. 56, p. 2300–2359, doi:10.1002/gj.4005.

Balaram, V., 2019, Rare earth elements: A review of applications, occurrence, exploration, analysis, recycling, and environmental impact: Geoscience Frontiers, v. 10, p. 1285–1303, doi:10.1016/J.GSF.2018.12.005.

Bau, M., 1996, Controls on the fractionation of isovalent trace elements in magmatic and aqueous systems: Evidence from Y/Ho, Zr/Hf, and lanthanide tetrad effect: Contributions to Mineralogy and Petrology, v. 123, p. 323–333, doi:10.1007/s004100050159.

Bau, M., 1991, Rare-earth element mobility during hydrothermal and metamorphic fluid-rock interaction and the significance of the oxidation state of europium: Chemical Geology, v. 93, p. 219–230, doi:10.1016/0009-2541(91)90115-8.

Bau, M., Dulski, P., dan Moller, P., 1995, Yttrium and holmium in South Pacific seawater: vertical distribution and possible fractionation mechanisms: Chemie der Erde - Geochemistry, v. 55, p. 1–15.

Van Bemmelen, R.W., 1949, The Geology of Indonesia-Volume I A: The Hague, U.S. Government Printing Office, 732 p.

Bergman, S.C., 1987, Lamproites and other potassium-rich igneous rocks: A review of

UNIVERSITAS
GADJAH MADA
**Pengayaan dan Moda Keterdapatan Rare Earth Elements and Yttrium (REY) pada Batubara Formasi Tanjung
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Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

their occurrence, mineralogy and geochemistry: Geological Society Special Publication, v. 30, p. 103–190, doi:10.1144/GSL.SP.1987.030.01.08.

BHP, 2001, Description of Business and Financial Statements.:

Chou, C.L., 1997, Abundances of sulfur, chlorine, and trace elements in Illinois Basin coals, USA:

Chou, C.L., 2012, Sulfur in coals: A review of geochemistry and origins: International Journal of Coal Geology, v. 100, p. 1–13, doi:10.1016/J.COAL.2012.05.009.

Climate Transparency, 2022, Climate Transparency Report: Comparing G20 Climate Action: , p. 1–20, https://iesr.or.id/en/pustaka/climate-transparency-report-2022.

Cobb, J.C., 1981, Geology and Geochemistry of Sphalerite in Coal:

Dai, S. et al., 2013a, Factors controlling geochemical and mineralogical compositions of coals preserved within marine carbonate successions: A case study from the Heshan Coalfield, southern China: International Journal of Coal Geology, v. 109–110, p. 77–100, doi:10.1016/j.coal.2013.02.003.

Dai, S. et al., 2013b, Mineralogical and geochemical anomalies of late Permian coals from the Fusui Coalfield, Guangxi Province, southern China: Influences of terrigenous materials and hydrothermal fluids: International Journal of Coal Geology, v. 105, p. 60–84, doi:10.1016/j.coal.2012.12.003.

Dai, S., dan Chou, C.L., 2007, Occurrence and origin of minerals in a chamosite-bearing coal of Late Permian age, Zhaotong, Yunnan, China: American Mineralogist, v. 92, p. 1253–1261, doi:10.2138/am.2007.2496.

Dai, S., dan Finkelman, R.B., 2018, Coal as a promising source of critical elements: Progress and future prospects: International Journal of Coal Geology, v. 186, p. 155–164, doi:10.1016/j.coal.2017.06.005.

Dai, S., Finkelman, R.B., French, D., Hower, J.C., Graham, I.T., dan Zhao, F., 2021, Modes of occurrence of elements in coal: A critical evaluation: Earth-Science Reviews, v. 222, p. 103815, doi:10.1016/j.earscirev.2021.103815.

Dai, S., Graham, I.T., dan Ward, C.R., 2016a, A review of anomalous rare earth elements and yttrium in coal: International Journal of Coal Geology, v. 159, p. 82–95,

UNIVERSITAS
GADJAH MADA
Pengayaan dan Moda Keterdapatan Rare Earth Elements and Yttrium (REY) pada Batubara Formasi Tanjung
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Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

doi:10.1016/j.coal.2016.04.005.

Dai, S., Hower, J.C., Finkelman, R.B., Graham, I.T., French, D., Ward, C.R., Eskenazy, G., Wei, Q., dan Zhao, L., 2020, Organic associations of non-mineral elements in coal: A review: International Journal of Coal Geology, v. 218, p. 103347, doi:10.1016/j.coal.2019.103347.

Dai, S., Li, T., Seredin, V. V., Ward, C.R., Hower, J.C., Zhou, Y., Zhang, M., Song, X., Song, W., dan Zhao, C., 2014a, Origin of minerals and elements in the Late Permian coals, tonsteins, and host rocks of the Xinde Mine, Xuanwei, eastern Yunnan, China: International Journal of Coal Geology, v. 121, p. 53–78, doi:10.1016/j.coal.2013.11.001.

Dai, S., Liu, J., Ward, C.R., Hower, J.C., French, D., Jia, S., Hood, M.M., dan Garrison, T.M., 2016b, Mineralogical and geochemical compositions of Late Permian coals and host rocks from the Guxu Coalfield, Sichuan Province, China, with emphasis on enrichment of rare metals: International Journal of Coal Geology, v. 166, p. 71–95, doi:10.1016/j.coal.2015.12.004.

Dai, S., Liu, J., Ward, C.R., Hower, J.C., Xie, P., Jiang, Y., Hood, M.M., O'Keefe, J.M.K., dan Song, H., 2015a, Petrological, geochemical, and mineralogical compositions of the low-Ge coals from the Shengli Coalfield, China: A comparative study with Ge-rich coals and a formation model for coal-hosted Ge ore deposit: Ore Geology Reviews, v. 71, p. 318–349, doi:10.1016/j.oregeorev.2015.06.013.

Dai, S., Luo, Y., Seredin, V. V., Ward, C.R., Hower, J.C., Zhao, L., Liu, S., Zhao, C., Tian, H., dan Zou, J., 2014b, Revisiting the late Permian coal from the Huayingshan, Sichuan, southwestern China: Enrichment and occurrence modes of minerals and trace elements: International Journal of Coal Geology, v. 122, p. 110–128, doi:10.1016/j.coal.2013.12.016.

Dai, S., Ren, D., Chou, C.L., Finkelman, R.B., Seredin, V. V., dan Zhou, Y., 2012, Geochemistry of trace elements in Chinese coals: A review of abundances, genetic types, impacts on human health, and industrial utilization: International Journal of Coal Geology, v. 94, p. 3–21, doi:10.1016/j.coal.2011.02.003.

Dai, S., Tian, L., Chou, C.L., Zhou, Y., Zhang, M., Zhao, L., Wang, J., Yang, Z., Cao, H., dan Ren, D., 2008, Mineralogical and compositional characteristics of Late

UNIVERSITAS
GADJAH MADA
**Pengayaan dan Moda Keterdapatan Rare Earth Elements and Yttrium (REY) pada Batubara Formasi Tanjung
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Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

Permian coals from an area of high lung cancer rate in Xuan Wei, Yunnan, China: Occurrence and origin of quartz and chamosite: International Journal of Coal Geology, v. 76, p. 318–327, doi:10.1016/j.coal.2008.09.001.

Dai, S., Wang, X., Zhou, Y., Hower, J.C., Li, D., Chen, W., Zhu, X., dan Zou, J., 2011, Chemical and mineralogical compositions of silicic, mafic, and alkali tonsteins in the late Permian coals from the Songzao Coalfield, Chongqing, Southwest China: Chemical Geology, v. 282, p. 29–44, doi:10.1016/J.CHEMGEO.2011.01.006.

Dai, S., Ward, C.R., Graham, I.T., French, D., Hower, J.C., Zhao, L., dan Wang, X., 2017, Altered volcanic ashes in coal and coal-bearing sequences: A review of their nature and significance: Earth-Science Reviews, v. 175, p. 44–74, doi:10.1016/j.earscirev.2017.10.005.

Dai, S., Yang, J., Ward, C.R., Hower, J.C., Liu, H., Garrison, T.M., French, D., dan O'Keefe, J.M.K., 2015b, Geochemical and mineralogical evidence for a coal-hosted uranium deposit in the Yili Basin, Xinjiang, northwestern China: Ore Geology Reviews, v. 70, p. 1–30, doi:10.1016/j.oregeorev.2015.03.010.

Deer, W.A., Howie, R.A., dan Zussman, J., 1992, An introduction to the rock-forming minerals. Second edition: Longman, Harlow/Wiley, New York.

Diessel, C.F.K., 1992a, Coal-Bearing Depositional Systems: Coal-Bearing Depositional Systems, p. 714, doi:10.1007/978-3-642-75668-9.

Diessel, C.F.K., 1992b, Coal-Bearing Depositional Systems: Berlin, Springer-Verlag, 1–23 p., doi:10.1007/978-3-642-75668-9.

Elderfield, H., dan Greaves, M.J., 1982, The rare earth elements in seawater: Nature, v. 296, p. 214–219, doi:10.1038/296214A0;KWRD=SCIENCE.

Endang, S., Bambang, P., dan Teuku, I., 2010, Potensi Logam Tanah Jarang di Indonesia: Buletin Sumber Daya Geologi, v. 5, p. 131–140.

ESDM, 2021, Road Map Pengembangan dan Pemanfaatan Batubara: Direktorat Jenderal Mineral dan Batubara.

Eskenazy, G.M., 1987a, Rare earth elements and yttrium in lithotypes of Bulgarian coals: Organic Geochemistry, v. 11, p. 83–89, doi:10.1016/0146-6380(87)90030-1.

UNIVERSITAS
GADJAH MADA
**Pengayaan dan Moda Keterdapatan Rare Earth Elements and Yttrium (REY) pada Batubara Formasi Tanjung
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Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

Eskenazy, G.M., 1987b, Rare earth elements in a sampled coal from the Pirin deposit, Bulgaria: International Journal of Coal Geology, v. 7, p. 301–314, doi:10.1016/0166-5162(87)90041-3.

Eskenazy, G.M., 1987c, Zirconium and hafnium in Bulgarian coals: Fuel, v. 66, p. 1652–1657, doi:10.1016/0016-2361(87)90357-7.

Febriadi, E., 2010, PT Arutmin Indonesia: Discovery of South Kalimantan Coal: Proceeding, MGEI – IAGI, p. 27–48.

Finkelman, R.B., 1995, Modes of Occurrence of Environmentally-Sensitive Trace Elements in Coal: , p. 24–50, doi:10.1007/978-94-015-8496-8_3.

Finkelman, R.B., 1993, Trace and Minor Elements in Coal, *in* Springer, Boston, MA, p. 593–607, doi:10.1007/978-1-4615-2890-6_28.

Finkelman, R.B., Dai, S., dan French, D., 2019, The importance of minerals in coal as the hosts of chemical elements: A review: International Journal of Coal Geology, v. 212, p. 103251, doi:10.1016/j.coal.2019.103251.

Flores, R.M., 2014, Coal and coalbed gas : fueling the future: Elsevier, 249–269 p.

Friederich, M.C., Langford, R.., dan Moore, T.., 1999, The Geological Setting of Indonesian Coal Deposits: The AusIMM Proceedings, v. 304, p. 23–29, http://dx.doi.org/10.1016/j.coal.2017.04.007.

Fu, B., Hower, J.C., Zhang, W., Luo, G., Hu, H., dan Yao, H., 2022, A review of rare earth elements and yttrium in coal ash: content, modes of occurrences, combustion behavior, and extraction methods: Progress in Energy and Combustion Science, v. 88, p. 100954, doi:10.1016/j.pecs.2021.100954.

Gluskoter, H.J., 1967, Clay minerals in Illinois coals: Journal of Sedimentary Research, v. 37, p. 205–214, doi:10.1306/74D7168B-2B21-11D7-8648000102C1865D.

Hall, R., van Hattum, M.W.A., dan Spakman, W., 2008, Impact of India-Asia collision on SE Asia: The record in Borneo: Tectonophysics, v. 451, p. 366–389, doi:10.1016/j.tecto.2007.11.058.

Hamdani, A.H., 2015, The Liburdinding Miocene Pamaluan coal mine, Pasir-Sub Basin, East Kalimantan: origin and paleoenvironmental implications from biomarker

UNIVERSITAS
GADJAH MADA
**Pengayaan dan Moda Keterdapatan Rare Earth Elements and Yttrium (REY) pada Batubara Formasi Tanjung
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Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

studies, *in* The 2nd International Conference and The 1st Joint Conference IGC 2015, Faculty of Geology Universitas Padjajaran dan Faculty of Science and Naturan Resources University Malaysia Sabah, p. 213–217.

Hamilton, W., 1973, Tectonics of the Indonesian Region: Bulletin of the Geological Society of Malaysia, v. 6, p. 3–10, doi:10.7186/bgsm06197301.

Hatch, J.R., Gluskoter, H.J., dan Lindahl, P.C., 1976, Sphalerite in coals from the Illinois Basin: Economic Geology, v. 71, p. 613–624, doi:10.2113/gsecongeo.71.3.613.

Henderson, P., 1984, Rare earth element geochemistry, Developments in geochemistry: v. 2, 510 p., http://ezproxy.lib.utexas.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=geh&AN=1984-023694&site=ehost-live.

Heryanto, R., Supriatna, S., Rustandi, E., dan Baharuddin, 2007, Peta Geologi Lembar Amuntai, Kalimantan skala 1:250.000,.:

Hower, J.C., Ruppert, L.F., dan Eble, C.F., 1999, Lanthanide, yttrium, and zirconium anomalies in the Fire Clay coal bed, Eastern Kentucky: International Journal of Coal Geology, v. 39, p. 141–153, doi:10.1016/S0166-5162(98)00043-3.

Huggins, F.E., Huffman, G.P., Kosmack, D.A., dan Lowenhaupt, D.E., 1980, Mossbauer detection of goethite (α-FeOOH) in coal and its potential as an indicator of coal oxidation: International Journal of Coal Geology, v. 1, p. 75–81, doi:10.1016/0166-5162(80)90007-5.

Humphries, M., 2013, Rare earth elements: The global supply chain: Rare Earth Minerals: Policies and Issues, p. 1–20.

ICCP, 2001, New inertinite classification (ICCP System 1994): Fuel, v. 80, p. 459–471, doi:10.1016/S0016-2361(00)00102-2.

ICCP, 1994, The new vitrinite classification (ICCP System 1994) International Committee for Coal and Organic Petrology (ICCP): Fuel, v. 77, p. 349–358.

International Energy Agency (IEA), 2022, An Energy Sector Roadmap to Net Zero Emissions in Indonesia. International Energy Agency Special Report: , p. 1–232, www.iea.org/t&c/.

UNIVERSITAS
GADJAH MADA
**Pengayaan dan Moda Keterdapatan Rare Earth Elements and Yttrium (REY) pada Batubara Formasi Tanjung
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Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

IUPAC, 2005, Nomenclature of Inorganic Chemistry: RSC Publishing.

Jarvis, I., dan Jarvis, K.E., 1992, Inductively coupled plasma-atomic emission spectrometry in exploration geochemistry: Journal of Geochemical Exploration, v. 44, p. 139–200, doi:10.1016/0375-6742(92)90050-I.

Jiu, B., Jin, Z., Wang, Z., Liu, R., dan Hu, Q., 2024, International Journal of Coal Geology Modes of occurrence of gallium in Al-Ga-rich coals in the Jungar Coalfield , Ordos Basin , China : Insights from LA-ICP-MS data: International Journal of Coal Geology, v. 282, p. 104436, doi:10.1016/j.coal.2023.104436.

Johannesson, K.H., dan Zhou, X., 1997, Geochemistry of the rare earth elements in natural terrestrial waters: A review of what is currently known: Chinese Journal of Geochemistry, v. 16, p. 20–42, doi:10.1007/BF02843369/METRICS.

Kearns, S., dan Wade, J., 2020, Electron Probe Microanalysis in Mineralogy: Elsevier Inc., v. 1, 532–545 p., doi:10.1016/B978-0-12-409548-9.12073-1.

Ketris, M.P., dan Yudovich, Y.E., 2009, Estimations of Clarkes for Carbonaceous biolithes: World averages for trace element contents in black shales and coals: International Journal of Coal Geology, v. 78, p. 135–148, doi:10.1016/j.coal.2009.01.002.

Kisch, H.J., dan Taylor, G.H., 1966, Metamorphism and alteration near an intrusive-coal contact: Economic Geology, v. 61, p. 343–361, doi:10.2113/gsecongeo.61.2.343.

Krmíček, L., dan Chalapathi Rao, N. V., 2022, Lamprophyres, lamproites and related rocks as tracers to supercontinent cycles and metallogenesis: Geological Society Special Publication, v. 513, p. 1–16, doi:10.1144/SP513-2021-159.

Lefebvre, N., Kopylova, M., dan Kivi, K., 2005, Archean calc-alkaline lamprophyres of Wawa, Ontario, Canada: Unconventional diamondiferous volcaniclastic rocks: Precambrian Research, v. 138, p. 57–87, doi:10.1016/j.precamres.2005.04.005.

Liu, Y., Liu, G., Qu, Q., Qi, C., Sun, R., dan Liu, H., 2017, Geochemistry of vanadium (V) in Chinese coals: Environmental Geochemistry and Health, v. 39, p. 967–986, doi:10.1007/s10653-016-9877-2.

Long, K.R., Gosen, B.S. Van, Foley, N.K., dan Daniel, C., 2010, Non-renewable resource issues: Geoscientific and societal challenges: Springer Science Business Media B.V,

UNIVERSITAS
GADJAH MADA
**Pengayaan dan Moda Keterdapatan Rare Earth Elements and Yttrium (REY) pada Batubara Formasi Tanjung
di Daerah Petangis, Cekungan Pasir, Kalimantan Timur**
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Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

131–155 p., doi:10.1007/978-90-481-8679-2.

López-Días, V., Urbańczyk, J., Blanco, C.G., dan Borrego, G., 2016, Maceral composition and molecular markers of two condensed Middle Holocene peat profiles in N Spain: International Journal of Coal Geology, v. 168, p. 55–70, doi:10.1016/J.COAL.2016.09.009.

Luther, G.W., dan Rickard, D.T., 2005, Metal sulfide cluster complexes and their biogeochemical importance in the environment: Journal of Nanoparticle Research, v. 7, p. 389–407, doi:10.1007/S11051-005-4272-4/METRICS.

Mahesh, S., Murthy, S., Singh, V.P., dan Roy, J.S., 2015, Thermally altered coals from bore core EBM-1, East Bokaro coal field, Damodar Valley, India: A petrographic inference: Journal of the Geological Society of India, v. 86, p. 535–546, doi:10.1007/s12594-015-0344-y.

Marheni, L., Aditiyo, R., Putra, A.E., dan Anggraeni, E., 2009, Tertiary tectonic of Barito Basin, South East Kalimantan, and implication for petroleum system., *in* Proceedings, PIT IAGI, 38th Annual Convention and Exhibition., p. 12, doi:www.researchgate.net/publication/273424151.

Milligan, E.N., Friederich, M.C., dan Wu Lim, M.S., 2009, Coal exploration and development in southeastern Kalimantan, Indonesia, *in* Proceedings, Circum-Pacific Energy and Mineral Resources Conference Transaction 2009s:, Circum-Pacific Council for Energy and Mineral Resources, p. 221–230.

Moore, T.A., 1990, An Alternative Method for Sampling and Petrographically Characterizing an Eocene Coal Bed, South East Kalimantan, Indonesia: University of Kentucky, https://is.muni.cz/th/i4vu4/Dissertation.Mlcochova.pdf.

Moore, T.A., 1987, Hardgrove grindability of the Senakin coal bed, southeast Kalimantan, Indonesia.:

Moore, T.A., dan Ferm, J.C., 1992, Composition and grain size of an eocene coal bed in southeastern Kalimantan, Indonesia: International Journal of Coal Geology, v. 21, p. 1–30, doi:10.1016/0166-5162(92)90033-S.

Moore, T.A., Friederich, M.C., Trofimovs, J., Anggara, F., dan Amijaya, D.H., 2020, Syn-sedimentary mafic volcanics in the eocene coal-bearing tanjung formation,

UNIVERSITAS
GADJAH MADA
**Pengayaan dan Moda Keterdapatan Rare Earth Elements and Yttrium (REY) pada Batubara Formasi Tanjung
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Senakin Peninsula, South Kalimantan (Borneo), Indonesia: Indonesian Journal on Geoscience, v. 7, p. 65–85, doi:10.17014/IJOG.7.1.65-85.

Moore, D.., dan Reynold, R.., 1997, X-Ray Diffraction and the Identification and Analysis of Clay Minerals, 2nd ed: New York, Oxford University Press.

Murphy, D., Moore, T.A., Amijaya, D.H., Anggara, F., Friederich, M., Gaina, C., Trofimovs, J., Dalton, H., dan Ominigbo, E., 2024, Constraints from lamprophyre petrogenesis on the timing of Eocene lithospheric thinning and associated rifting of Borneo and Sulawesi: Journal of Asian Earth Sciences, v. 260, p. 105952, doi:10.1016/j.jseaes.2023.105952.

Patria, A.A., dan Anggara, F., 2022, Petrological, mineralogical, and geochemical compositions of coal in the Ombilin Basin, West Sumatra, Indonesia: International Journal of Coal Geology, v. 262, p. 104099, doi:10.1016/j.coal.2022.104099.

Patria, A.A., Suhendra, R., Anggara, F., Agangi, A., Obrochta, S.P., dan Setiawan, I., 2024a, Association and textural-compositional evolution of pyrite-organic matter in coals of the Tarakan, Barito, and Pasir Basins, Kalimantan, Indonesia: International Journal of Coal Geology, v. 282, p. 104442, doi:10.1016/j.coal.2023.104442.

Patria, A.A., Suhendra, R., Anggara, F., Agangi, A., Obrochta, S.P., dan Setiawan, I., 2024b, Association and textural-compositional evolution of pyrite-organic matter in coals of the Tarakan, Barito, and Pasir Basins, Kalimantan, Indonesia: International Journal of Coal Geology, v. 282, p. 104442, doi:10.1016/j.coal.2023.104442.

Pickel, W. et al., 2017, Classification of liptinite – ICCP System 1994: International Journal of Coal Geology, v. 169, p. 40–61, doi:10.1016/j.coal.2016.11.004.

Ruppert, L.F., dan Moore, T.A., 1993, Differentiation of volcanic ash-fall and water-borne detrital layers in the Eocene Senakin coal bed, Tanjung Formation, Indonesia: Organic Geochemistry, v. 20, p. 233–247, doi:10.1016/0146-6380(93)90041-9.

Satyana, A.H., Nugroho, D., dan Surantoko, I., 1999, Tectonic controls on the hydrocarbon habitats of the Barito, Kutei, and Tarakan Basins, Eastern Kalimantan, Indonesia: Major dissimilarities in adjoining basins: Journal of Asian Earth Sciences, v. 17, p. 99–122, doi:10.1016/S0743-9547(98)00059-2.

Satyana, A.H., dan Silitonga, P.D., 1994, Tectonic reversal in East Barito basin, South

UNIVERSITAS
GADJAH MADA
**Pengayaan dan Moda Keterdapatan Rare Earth Elements and Yttrium (REY) pada Batubara Formasi Tanjung
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Kalimantan : consideration of the types of inversion structures and petroleum system significance, in, *in* Proceedings Indonesian Petroleum Association, p. 58–74, doi:doi:10.29118/ipa.623.57.74.

Seredin, V. V., 1996, Rare earth element-bearing coals from the Russian Far East deposits: International Journal of Coal Geology, v. 30, p. 101–129, doi:10.1016/0166-5162(95)00039-9.

Seredin, V. V., dan Dai, S., 2012, Coal deposits as potential alternative sources for lanthanides and yttrium: International Journal of Coal Geology, v. 94, p. 67–93, doi:10.1016/j.coal.2011.11.001.

Seredin, V. V., dan Finkelman, R.B., 2008, Metalliferous coals: A review of the main genetic and geochemical types: International Journal of Coal Geology, v. 76, p. 253–289, doi:10.1016/j.coal.2008.07.016.

Shao, L., Jones, T., Gayer, R., Dai, S., Li, S., Jiang, Y., dan Zhang, P., 2003, Petrology and geochemistry of the high-sulphur coals from the Upper Permian carbonate coal measures in the Heshan Coalfield, southern China: International Journal of Coal Geology, v. 55, p. 1–26, doi:10.1016/S0166-5162(03)00031-4.

Spiro, B.F., Liu, J., Dai, S., Zeng, R., Large, D., dan French, D., 2019, Marine derived 87Sr/86Sr in coal, a new key to geochronology and palaeoenvironment: Elucidation of the India-Eurasia and China-Indochina collisions in Yunnan, China: International Journal of Coal Geology, v. 215, p. 103304, doi:10.1016/j.coal.2019.103304.

Stach, E., 1982, Stach's Textbook of Coal Petrology (3rd ed): Schweizerbart Science Publishers, 38–47 p.

Stopes, M.C., 1919, On the four visible ingredients in banded bituminous coal: Proc. R. Soc., Ser. B, v. 90, p. 87–470.

Stopes, M.C., 1935, On the petrology of banded bituminous coals: Fuel, v. 14, p. 4–13.

Sun, S.S., dan McDonough, W.F., 1989, Chemical and isotopic systematics of oceanic basalts: Implications for mantle composition and processes: Geological Society Special Publication, v. 42, p. 313–345, doi:10.1144/GSL.SP.1989.042.01.19.

Swaine, D.J., 1994, Galena and Sphalerite Associated with Coal Seams: Sediment-Hosted Zn-Pb Ores, p. 59–73, doi:10.1007/978-3-662-03054-7_5.

UNIVERSITAS
GADJAH MADA
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Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

Taylor, S.R., dan Mclennan, S.M., 1981, The Composition and Evolution of the Continental Crust: Rare Earth Element Evidence from Sedimentary Rocks: Philosophical Transactions of the Royal Society of London, v. 301, p. 381–390.

Taylor, G.H., Teichmüller, M., Davis, A., Diessel, C.F.K., Littke, R., dan Robert, P., 1998, Organic Petrology: Berlin, Gebruder Borntraeger, 704 p.

Thomas, L., 2013, Coal Geology: Second Edition: A John Wiley & Sons, Ltd, v. 50, 1–444 p., doi:10.5860/choice.50-6779.

Vassilev, S. V., dan Vassileva, C.G., 1996, Occurrence, abundance and origin of minerals in coals and coal ashes: Fuel Processing Technology, v. 48, p. 85–106, doi:10.1016/S0378-3820(96)01021-1.

Wang, W., Qin, Y., Sang, S., Zhu, Y., Wang, C., dan Weiss, D.J., 2008, Geochemistry of rare earth elements in a marine influenced coal and its organic solvent extracts from the Antaibao mining district, Shanxi, China: International Journal of Coal Geology, v. 76, p. 309–317, doi:10.1016/J.COAL.2008.08.012.

Ward, C.R., 2016, Analysis, origin and significance of mineral matter in coal: An updated review: International Journal of Coal Geology, v. 165, p. 1–27, doi:10.1016/J.COAL.2016.07.014.

Ward, C.R., 2002, Analysis and significance of mineral matter in coal seams: International Journal of Coal Geology, v. 50, p. 135–168, doi:10.1016/S0166-5162(02)00117-9.

Ward, C.R., 1984, Coal geology and coal technology: Blackwell Scientific Publications, Inc.,Palo Alto, CA.

Ward, C.R., Warbrooke, P.R., dan Ivor Roberts, F., 1989, Geochemical and mineralogical changes in a coal seam due to contact metamorphism, Sydney Basin, New South Wales, Australia: International Journal of Coal Geology, v. 11, p. 105–125, doi:10.1016/0166-5162(89)90001-3.

Van De Weerd, A.A., dan Armin, R.A., 1992, Origin and evolution of the Tertiary hydrocarbon-bearing basins in Kalimantan (Borneo), Indonesia: American Association of Petroleum Geologists Bulletin, v. 76, p. 1778–1803, doi:10.1306/bdff8ace-1718-11d7-8645000102c1865d.

UNIVERSITAS
GADJAH MADA
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Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

Weng, Z., Jowitt, S.M., Mudd, G.M., dan Haque, N., 2015, A detailed assessment of global rare earth element resources: Opportunities and challenges: Economic Geology, v. 110, p. 1925–1952, doi:10.2113/econgeo.110.8.1925.

Wicaksono, D.D., Setiawan, N.I., Wilopo, W., dan Harijoko, A., 2017, Teknik Preparasi Sampel Dalam Analisis Mineralogi Dengan XRD Di Departemen Teknik Geologi, Fakultas Teknik, Universitas Gadjah Mada: Proceeding Seminar Nasional Kebumian ke-10, p. 1864–1880, http://journal.unnes.ac.id/sju/index.php/ijcs%0AOptimalisasi.

Winchester, J.A., dan Floyd, P.A., 1977, Geochemical discrimination of different magma series and their differentiation products using immobile elements: Chemical Geology, v. 20, p. 325–343, doi:10.1016/0009-2541(77)90057-2.

Witts, D., Davies, L., dan Morley, R., 2014, Uplift of the Meratus Complex Sedimentology, Biostratigraphy, Provenance, and Structure: Proceeding Indonesian Petroleum Association,.

Witts, D., Hall, R., Nichols, G., dan Morley, R., 2012a, A new depositional and provenance model for the Tanjung Formation, Barito Basin, SE Kalimantan, Indonesia: Journal of Asian Earth Sciences, v. 56, p. 77–104, doi:10.1016/j.jseaes.2012.04.022.

Witts, D., Hall, R., Nichols, G., dan Morley, R., 2012b, A new depositional and provenance model for the Tanjung Formation, Barito Basin, SE Kalimantan, Indonesia: Journal of Asian Earth Sciences, v. 56, p. 77–104, doi:10.1016/j.jseaes.2012.04.022.

Won, S., Shinn, Y.J., Setiawan, H.L., Hadimuljono, J.S., dan Son, M., 2018, A study on petroleum exploration potential of Barito Basin in southeastern Kalimantan, Indonesia: comparison of petroleum system with adjacent Kutai Basin: Journal of Petroleum and Sedimentary Geology, v. 1, p. 1–15, doi:10.31697/jpsg.2018.1.1.1.

Yuan, Y., Tang, S., Zhang, S., dan Yang, N., 2018, Mineralogical and geochemical characteristics of trace elements in the Yongdingzhuang Mine, Datong Coalfield, Shanxi province, China: Minerals, v. 8, doi:10.3390/min8070297.

Zhang, J., Amakawa, H., dan Nozaki, Y., 1994, The comparative behaviors of yttrium and lanthanides in the seawater of the North Pacific: Geophysical Research Letters,

UNIVERSITAS
GADJAH MADA
**Pengayaan dan Moda Keterdapatan Rare Earth Elements and Yttrium (REY) pada Batubara Formasi Tanjung
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Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

v. 21, p. 2677–2680, doi:10.1029/94GL02404.

Zhao, L., Dai, S., Nechaev, V.P., Nechaeva, E. V., Graham, I.T., French, D., dan Sun, J., 2019, Enrichment of critical elements (Nb-Ta-Zr-Hf-REE) within coal and host rocks from the Datanhao mine, Daqingshan Coalfield, northern China: Ore Geology Reviews, v. 111, p. 102951, doi:10.1016/j.oregeorev.2019.102951.

Zheng, X., Dai, S., Nechaev, V., dan Sun, R., 2020, Environmental perturbations during the latest Permian: Evidence from organic carbon and mercury isotopes of a coal-bearing section in Yunnan Province, southwestern China: Chemical Geology, v. 549, p. 119680, doi:10.1016/j.chemgeo.2020.119680.

Zhou, B., Li, Z., dan Chen, C., 2017, Global potential of rare earth resources and rare earth demand from clean technologies: Minerals, v. 7, doi:10.3390/min7110203.