Oral presentation | T1: Comprehensive understanding of the crustal evolution and resource exploration in Asia (Symposium)

Fri. Sep 13, 2024 9:00 AM - 12:00 PM JST | Fri. Sep 13, 2024 12:00 AM - 3:00 AM UTC | ES Hall Higashiyama Campus

T1: Comprehensive understanding of the crustal evolution and resource exploration in Asia (Symposium)

Chairperson:Yasuhito Osanai, Masaaki Owada

9:00 AM - 9:25 AM JST | 12:00 AM - 12:25 AM UTC

[T1-01] Decarbonized Society and Essential Metal Resources

「招待講演」

*YOSHITAKA HOSOI[1] (1. JICA)

9:25 AM - 9:50 AM JST | 12:25 AM - 12:50 AM UTC

[T1-02] Japan's current approach to securing mineral resources

「招待講演」

*Kazuhiro YONEMURA[1] (1. JOGMEC)

9:50 AM - 10:15 AM JST | 12:50 AM - 1:15 AM UTC

[T1-03] Critical metal potentiality of Mongolia

「招待講演」

*Sereenen Jargalan[1], M. Arvinzun[2] (1. Mongolian University of Science and Technology, 2. Mongolian Society of Economic Geologists)

10:15 AM - 10:30 AM JST | 1:15 AM - 1:30 AM UTC

[2Lecture-101-06-4add] 休憩

10:30 AM - 10:55 AM JST | 1:30 AM - 1:55 AM UTC

[T1-04] Geology, sedimentation environment of the
Ovoot khural coal bearing depression, in South Mongolia

「招待講演」

*Magsarjav Ochirbat[2], Sereenen Jargalan[1] (1. Mongolian University of Science and Technology, 2. Mongolian Society of Economic Geologists)

10:55 AM - 11:20 AM JST | 1:55 AM - 2:20 AM UTC

[T1-05] Insights into the mineralogical characteristics of Li-enriched metasomatic albitite from the Iwagi islet, SW Japan

「招待講演」

*Mariko NAGASHIMA[1], Teruyoshi IMAOKA[1] (1. Yamaguchi Univ. Sci.)

11:20 AM - 11:45 AM JST | 2:20 AM - 2:45 AM UTC

[T1-06] Ion adsorption-type REE deposits: the source of HREE

「招待講演」

*Yasushi Watanabe[1] (1. Akita Univ. Int. Res. Sci.)

11:45 AM - 12:00 PM JST | 2:45 AM - 3:00 AM UTC

[2Lecture-101-06-8add] 休憩

Decarbonized Society and Essential Metal Resources

*YOSHITAKA HOSOI[1]

1. JICA

Measures to curb the rise in global temperature include energy conservation, low-carbon energy (promotion of the use of wind power, solar power generation, geothermal power generation, etc.), and conversion of energy use (electrification, use of hydrogen, etc.).Here, when trying to reduce the carbon value of energy, it became clear that special metals were needed in unusually large quantities. For example, solar power generation requires gallium and cadmium as solar cells, in addition to copper and aluminum. Wind turbines use generators that use permanent magnets composed of rare earth minerals such as neodymium and dysprosium. Geothermal power generation requires titanium for heat-resistant wells, and chromium is also needed for other technologies. Storage batteries are also needed for electric vehicles and wind power generation, but they also require lithium and vanadium. The demand for electric vehicles is expanding rapidly in various countries, and the demand for storage batteries will expand proportionally.According to the World Bank's 2020 report, if we forecast the amount of production required for 2050 compared to the production volume in FY2018, the amount of graphite 494%, lithium 488%, cobalt 460%, indium 231%, vanadium 189%, etc. It has become necessary. This is not the only metal needed. The World Bank lists 17 mineral types. As for the reserves, production, and consumption of these metals, the author considered the priority countries. Many of these resources are found in developing countries.Here, we consider the challenges of securing critical mineral resources.In addition, there are concerns that many of these limited producer countries are politically unstable, environmental pollution associated with mine development is a problem, and social turmoil occurs frequently.JICA is committed to solving the problems of resource-rich developing countries.

Keywords: Decarbonization, Essential metals, Mining challenges

Japan's current approach to securing mineral resources

*Kazuhiro YONEMURA[1]

1. JOGMEC

The global green transformation (GX) is intensifying competition to secure Critical Minerals for batteries, semiconductors, and other applications. In particular, not only existing resource companies but also automakers and battery manufacturers around the world are accelerating their efforts to secure those material source to lithium, nickel, and graphite, which are used in electric vehicles. In some cases, there are concerns about economic security risks due to the ubiquity of supply source and midstream processes for these mineral resources.

Under these circumstances, efforts to diversify supply sources and midstream processes are being promoted worldwide, including financial support from governments and institutional design. There is also a growing movement to promote sustainable resource development by high level ESG standards.

In Japan, based on the "Storage Battery Industrial Strategy" and the "Policy for Initiatives to Ensure Stable Supplies of Critical Minerals" based on the Economic Security Promotion Act, Japanese government supports Japanese companies investment for mine development, technology development and smelting-processing, specifically, increasing the ratio of financial support and providing subsidies for development and other activities through JOGMEC. In addition to these measurement, it is also actively conducting resource diplomacy with resource-rich countries and responding to multiple-frameworks.

As for diversification of supply sources, while existing resources are being depleted, investment is concentrated on promising projects. As one solution, JOGEMC is focusing on ore minerals that have not been considered as resources (e.g., Awaruite) and areas where exploration has not progressed. Asia, which contains complex tectonics settings and remains un-exploration areas, has great potential of critical minerals.

Keywords: Critical Minerals, Securing Mineral Resources

Critical metal potentiality of Mongolia

*Sereenen Jargalan[1], M. Arvinzun[2]

1. Mongolian University of Science and Technology, 2. Mongolian Society of Economic Geologists

Critical metals such as copper, lithium, nickel, cobalt and rare earth elements are essential components in many of today’s rapidly growing clean energy technologies –from wind turbines and electricity networks to electric vehicles. Lithium, nickel, cobalt, manganese and graphite are crucial to battery performance. rare earth elements are essential for permanent magnets used in wind turbines and EV motors.
Mongolia has wide potential on mineral resources in variety of types.
Regarding to critical metal tendency, there is no clear classification in Mongolia, partly identify as high technology minerals and some government official documents use as important minerals. Even though some small projects are carried out to identify how potential is critical metals including REE, Li, Ni, Co as well as graphite in recent years.
Therefore, we carried out geological reconnaissance study to make clear genetic type, regional distribution characteristics and ore mineral identification. As result we have quite good potentiality on REE mineralization, including carbonatite and alkaline metasomatite types. Lithium is not so studied in Mongolia, but recently, we have several discoveries of Li bearing pegmatites in the central-eastern part. Nickel and cobalt are almost not studied instead of small occurrences found during geological mapping at scale 1:200000 and 1:50000, so no clear potentiality is recognized. There are several deposits and occurrence in Mongolia which are closely relate with marbles metamorphic rocks and has possible potentiality. Copper is the most potential resource making in all, almost 1 billion tons of reserves and resources. Annual production is expected to more than double from 300,000 tons of copper concentrate per year to over 600,000 tons per year from 2028 to 2036 once the Oyu Tolgoi mine is fully operational in 2023.
This time we would like to make general introduction of how potential is in critical metal tendency in Mongolia.

Keywords: Metal potentiality, Mongolia

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[2Lecture-101-06-4add]休憩

Geology, sedimentation environment of the Ovoot khural coal bearing depression, in South Mongolia

*Magsarjav Ochirbat[2], Sereenen Jargalan[1]

1. Mongolian University of Science and Technology, 2. Mongolian Society of Economic Geologists

Mongolia has abundant resources of coal, which are distributed mainly in the south and southeastern part, including some deposits in the north and west part of the country. In recent years, the exploration of coal deposits has been intensively carried out, but not much effort has been made to determine the origin, regional regularity of coal distribution as well as relationship between geological condition and coal quality.
The purpose of this study is to clarify geology and sedimentation environment of the Ovoot khural coal bearing depression in order to contribute to the reconstruction of the Mesozoic geologic and geodynamic setting of the Mongolia.
The study area is located at the 1000 km southwest of Ulaanbaatar and 50 km north of the Mongolia-China border, forming latitudinal trending depression which is 40 to 60 km in width and continues more than 200 km. There are five independent coal bearing parts with 16 coal deposits, which are: Bayantes part, contains Elstei, Khurshuut, Khuvd, Gashuu Tolgoi and Khuren tasv deposits; Ovoot Tolgoi part, contains Sunset and Sunrise deposits; Nariin sukhait part contains West Nariin sukhait, Central Nariin sukhait, East Nariin sukhait and Khuren shand deposits; Sumber part contains Central Sumber, Sumber and Biluut deposits and Jargalant part contains Jargalant and South Biluut deposits.
Result of geochemical study indicates that sediments deposited in the Ovoot khural depression is sourced by the weathering and transporting of intermediate and felsic composition magmatic rocks, mainly from dacite, andesite including minor amount of metamorphic, sedimentary and intrusive rocks.
Spider diagrams of trace element composition of sedimentary rocks of the Orgilokhbulag formation, show Nb-depletion and Pb, Mo enrichment, indicating possible origin of magmatic rocks formed under subduction environment and they are intermediate to felsic in composition. The major trace and rare earth element composition of the Orgilokh bulag formation sedimentary rocks, indicate that the source rocks of sediments might have been formed in the active continental margin tectonic setting.
According to provenance model, coal deposition is undertaking with good tissue preservation, in an alternating environment of oxygenic and deoxygenated swamps.
Based on the metamorphic degree, the temperature of peat compression, the amount of volatile, and the depth gradient of temperature, peat was buried and deposited at a depth of 3500-7000 meters. Low sulfur content, low ash content and low volatile content of coal at the various parts of the depression indicates thet the peat deposition is occurred under two stages.

Keywords: Ovoot khural coal, Mongolia

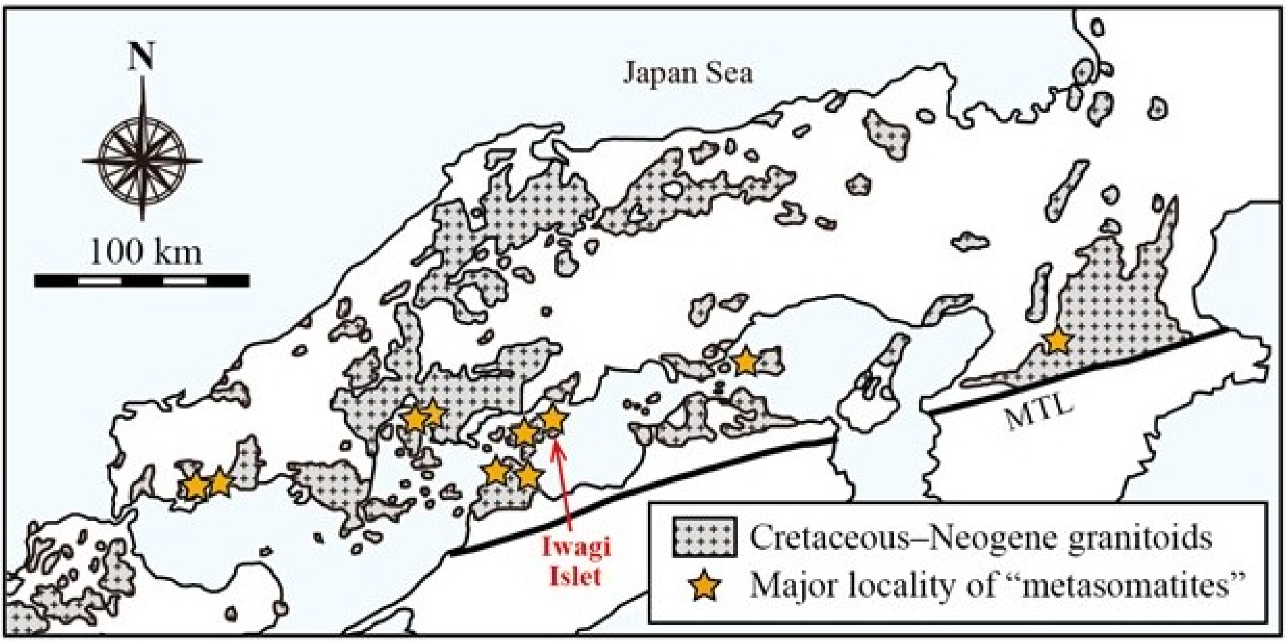
Insights into the mineralogical characteristics of Li-enriched metasomatic albitite from the Iwagi islet, SW Japan

*Mariko NAGASHIMA[1], Teruyoshi IMAOKA[1]

1. Yamaguchi Univ. Sci.

The study of metasomatic rocks is essential for comprehending the nature and origin of metasomatic agents. It might provide a clue for fluid circulation within the crust. In the Setouchi Province, metasomatic rocks are distributed along an approximately E–W trend, and these rocks are associated with Late Cretaceous granites. The Iwagi albitite is one such metasomatic rock. However, unlike other metasomatites in the area, its high lithium content (500 ppm) is unique. Detailed investigations of the mineralogical characteristics of Li-minerals have been conducted to better understand the formation and evolution of Iwagi albitites. The albitites exist as small masses, and the textures of the weakly metasomatized ones resemble those of the host adjacent granite. The transition from granite to albitite occurs gradually and can be understood through the mineral assemblages. The Iwagi albitite is known as the type locality of four Li-analog minerals: sugilite $KNa_2(Fe^{3+}, Mn^{3+}, Al)_2Li_3Si_{12}O_{30}$, katayamalite $KLi_3Ca_7Ti_2(SiO_3)_{12}(OH)_2$, murakamiite $LiCa_2Si_3O_8(OH)$, and ferro-ferri-holmquistite $Li_2(Fe^{2+}{}_3Fe^{3+}{}_2)Si_8O_{22}(OH)_2$. The former three minerals were found in the fully albitized rock, while the latter was found in the weakly albitized granite. The albitites display a variety of replacement textures due to Na–Li metasomatism, and they also exhibit noticeable strain-induced textures.
The δ^7Li values of murakamiite and Li-rich pectolite show a wide range from -9.1 to +0.4‰ (ave. -2.9‰) and should have resulted from hydrothermal fluid-rock interactions at 300–600 °C. The very low δ7Li values may have originated from intra-crystalline Li isotope diffusion or involvement of deep-seated, Li–Na-enriched subduction-zone fluids with low δ7Li values. This finding highlights the significance of fluid-rock interactions in the formation of metasomatic rocks. Deformation-induced fracturing of the rock may have enhanced fluid circulation, leading to the formation of the metasomatic rocks along the E–W trending lineament.

Keywords: Lithium, albitite, metasomatism



Distribution of metasomatites in Setouchi Province, SW Japan.
(after Murakami 1976)

Ion adsorption-type REE deposits: the source of HREE

*Yasushi Watanabe[1]

1. Akita Univ. Int. Res. Sci.

Ion adsorption rare earth deposits were confirmed in southern China including Jiangxi province in late 1970's. This unique deposit type forms by adsorption of rare earth ions on clay minerals represented by kaolinite and halloysite due to weathering of granitic rocks. Although the ore grades of this deposit type is extremely lower (<0.2 wt%) than the other rare earth deposits such as carbonatite, extraction of rare earths from the clay ores is easy and inexpensive. The development of this deposit type has been accelerating since 2000 as the source of heavy rare earths. This is due to the invention of neodymium magnet in 1983, followed by commercialization in 1985, and production of hybrid vehicle (Prius) in 1997. Because major rare earth deposits such as carbonatite and placer deposits are enriched in LREE but poor in HREE, the ion adsorption type deposits became the important HREE supply source. Although exploration of HREE prospects has been conducted worldwide and a few HREE enriched alkaline-rock related deposits were discovered, no deposit is better than the ion adsorption deposits in terms of production cost and easiness in processing. The ion adsorption type deposits are distributed not only in southern China but also in southeast Asia. This type of deposits also present in suthern Africa including Malawi and Madagascar and South America such as Brazil and Chile. Presently Myanmar has become the major country that produces ionic ores. For the formation of ion adsorption HREE deposits needs the following three conditions; 1) presence of HREE enriched host rocks, 2) formation of thick (>10 m) weathering crust, and 3) presence of REE minerals in the host rocks that easily dissolve during weathering.

Keywords: ion adsorption-type deposit, heavy rare earth elements, weathering, magnet

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