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Exploration of dysprosium: the most critical element for Japan

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Dysprosium (Dy), one of the heavy rare earth elements, is used mainly as an additive for NdFeB permanent magnets which are installed in various modern industrial products such as voice coil motors in computers, factory automation machinery, hybrid and electric vehicles, home electronics, and wind turbine, to improve heat resistance of the magnets. Dy has been produced about 2,000t per year from the ores from ion adsorption type deposits in southern China. However, the produced amount of Dy was significantly reduced in 2011 in China due to reservation of heavy rare earth resources and protection of natural environment, resulting in soaring of Dy price in the world. In order to respond the increasing demand of Dy, unconventional supply sources are inevitably developed, in addition to heavy rare earth enriched ion adsorption type deposits outside China.
Heavy rare earth elements including Dy are dominantly hosted in xenotime, fergusonite, zircon, eudialyte, keiviite, kainosite, iimoriite, etc. Concentration of xenotime is found in placer deposits in Malaysia and India, hydrothermal deposits associated with unconformity-type uranium mineralization (Athabasca basin in Canada, Western Australia), iron-oxide fluorite mineralization (South Africa) and Sn-bearing alkaline granite (Brazil). Zircon and fergusontie concentration is found as igneous and hydrothermal products in peralkaline syenite, alkaline granite and pegmatite (e.g., Nechalacho in Canada). Eudialyte concentration is found in some peralkaline syenite bodies in Greenland, Canada, Sweden and Russia.
Among these sources, large Dy resources are estimated in the deposits hosted in peralkaline rocks (Nechalacho: 79,000t, Kvanefjeld: 49,000t, Norra Karr: 15,700t, etc.) compared to the present demand of Dy. Thus, Dy will be supplied from the deposits associated with peralkaline and alkaline deposits in future instead of ion adsorption type deposits in southern China.