In situ Nd isotope measurement of bastnaesite *via* LA-MC-ICP-MS

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Some research workers had done pioneering work of *in situ* Nd isotope analysis by laser ablation multiple-collector inductively coupled mass specrometry (LA-MC-ICP-MS) [1-2] and reliable $^{143}Nd/^{144}Nd$ data can be obtained for light-rare-earth elements (LREEs) enriched common accessory minerals such as apatite, titanite, monazite, allanite and perovskite, indicating potential geological application. In this paper, we developed this technique on a Neptune MC-ICP-MS coupled with a 193 nm ArF excimer laser ablation system and sucessfully measured Nd isotope data of bastnaestie and briefly described several geological application of this new method.

In situ $^{143}Nd/^{144}Nd$ and $^{147}Sm/^{144}Nd$ ratio were measured for bastnaestie from the Bayan Obo giant REE-Nb-Fe deposit. Owing to its high Nd concentrations (upward of 10 wt%), precision of less than 20 ppm can be obtained for laser spot size of 10 μm. 25 analyses of bastnaestie indicate that there is significant variation in the $^{147}Sm/^{144}Nd$ and $^{143}Nd/^{144}Nd$ ratios and yield an isochron age of 0.80 ± 0.13Ga. the corresponding initial $^{143}Nd/^{144}Nd$ ratio is 0.511150 ± 45. Additionaly, 38 analyses of monazite (BY49) from a dolomite, the host rock of the REE mineralization, at the 1474 m level in the eastern orebody of the Bayan Obo deposit yield an isochron of 0.86 ± 0.10 Ga, the corresponding initial $^{143}Nd/^{144}Nd$ ratio is 0.511136 ± 38. However, 31 analyses of another monazite from a carbonatitic dyke intruded into the quartz conglomerate of Meso-Proterozoic Bayan Obo Group yield an isochron age of 1.32 ± 0.21 Ga, same as the zircon U-Pb age (1.4 Ga), within errors. The initial $^{143}Nd/^{144}Nd$ ratio is 0.510885 ± 58, with $\varepsilon Nd(t)$ of 0.67 ± 0.94 (2SD), indicating its derivation from primitive mantle.

These analyses indicate that the Bayan Obo deposit is heterogeneous in terms of Nd isotopes and the monazite from the dolomite might have undergone late stage alteration.

[1] Foster & Vance (2006) *JAAS*. **21**, 288–296. [2] McFarlane & McCulloch (2007) *Chem. Geol.* **245**, 45–60.

Rare earth element geochemistry of black shales in Middle Miocene Hırka formation (Ankara, Turkey)

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Hırka Formation black shales (~100 km NE of Ankara, Turkiye) occured in Middle Miocene. Hırka Formation become volcano-sedimentary stack that is generally formed from claystone, black shale, trona, mudstone, intra-formation pebblestone, siltstone and pyroclastic rocks. All this lithofacies developed to change environment condition from consistently lake to playa lake. Black shale samples are collected off surface (37 number), drill (49 number) and gallery (22 number) that REE contents are determined with ICP-MS technique at ACME laboratory (Canada). Rare earth elements (REEs) have been used as tracers to identify sources and epigenetic modification of organic matter [1]. Upper crust, Average Shale, PAAS and NASC was used for the normalization. NASC and Average shale normalized samples pattern shows a flat Ce anomaly, a positive Eu anomaly, and an enrichment of LREEs. However PAAS and Upper Crust normalized samples pattern shows a negative Ce anomaly, a positive Eu anomaly and an enrichment of MREEs. REE partition coefficients are entirely flat and no positive Ce anomaly or lanthanide tetrad effect is detected. The lack of any positive Ce anomaly or MREE enrichment to lanthanide tetrad effect in the organic samples is likely to be due to an anionic adsorption of the REE-organic complex. The negative Ce anomaly is an indicator of the marine depositional environments [2] but redox changes from anoxic groundwater to the O_2 enriched lake water do not influence Ce concentrations. In contrast to those commonly could observe in anoxic, neutral and alkaline waters. Positive Eu anomaly in the sediments shows that either high CO_2 content (samples average CO2 ~%12) or it is generally not affected by diagenesis, strongly reducing condition at low temperature can lead to REE mobility during organic matter formation [3-5]. The humic substance in sample also ought to main reason to enrichment of MREEs [6]

[1] Schatzel, S.J. Stewart, B.W. (2003) *Int. J. Coal Geol*. **54**, 223–251. [2] Murray, R.W. Buchholtz, T. Brink, M.R. Jones, D.L. Gerlach, D.C**.** Russ, G.P. (1990) *Geology* **18**, 268–272. [3] Eskenazy, G.M. (1987) *Bulgaria. Int. J. Coal Geol.* **7**, 301–314. [4] Eskenazy, G.M. (1999)**.**. *Int. J. Coal. Geol.* **38,** 285–295. [5] Ismael, I.S. (2002) *Chin. J. Geochem*. **21** (1) 19–28. [6] Seredin, V.V. Shpirt, M.Ya. (1999)**.**. *Lithol. Miner. Res*. **34** (3) 244–248.