Sm-Nd System in Divnoe Meteorite. O. Bogdanovski and E. Jagoutz, Max-Planck-Institut für Chemie, Abteilung Kosmochemie, Postfach 3060, 55020 Mainz, Germany.

Abstract. The Sm-Nd system for the Divnoe meteorite was investigated. For a whole rock fragment we measured a value of $\varepsilon_{\text{Nd}}=192.1 \pm 0.5$. The calculated "model age" relative to CHUR is $4.62 \pm 0.07$ Ga. An excess of $^{143}\text{Nd}$ ($\varepsilon_{\text{Nd}}=+6.7 \pm 0.9$) indicates the presence of live $^{146}\text{Sm}$ at the time of meteorite formation. The calculated initial ratio $^{146}\text{Sm}/^{144}\text{Nd}$ is $0.0116 \pm 0.0016$.

Divnoe meteorite, an olivine-rich primitive achondrite, was found in 1981 in Russia. Divnoe meteorite consist of a granoblastic, coarse-grained, olivine groundmass with relatively large pyroxene-plagioclase poikilitic patches and small fine-grained domains of an opaque-rich lithology [1]. Both the poikilitic patches and the opaque-rich lithology are inhomogeneously distributed within the groundmass. The bulk chemical composition of Divnoe meteorite is similar to olivine-rich primitive achondites, but it is depleted in incompatible elements. The rare earth element concentrations in Divnoe meteorite are very low and it is strongly depleted in LREE. The REE patterns is quite different from those of branchinites, the group of meteorites with oxygen isotopic composition close to that of Divnoe. The REE patterns of Divnoe also are distinct from those of acapulcoites/lodranites, another meteorite group similar to Divnoe, in composition.

Extremely low REE concentrations creates great difficulties in Sm-Nd isotopic determinations. To obtain measurable amounts of Nd for isotopic analysis we have to use large sample weights which brings additionally complications in the chemical extraction of Nd and Sm as well as in blank estimation. Because of low Nd concentrations in Divnoe meteorite we corrected our results for blanks in a similar way as is commonly used for the lead isotopes. To make this correction we measured Nd isotopic composition in the acids used for chemical preparation of the samples, assuming that this is the main source of Nd and Sm in the total lab blank. To measure very low quantities of Nd we improved our measuring technique, by changing our vacuum system and introducing pure oxygen into the ion source of the mass-spectrometer. We used a quadrupole gas mass-spectrometer to monitor residual gas composition in the ion source and have found optimum conditions for isotopic analysis of neodymium as an NdO$^-$ ions. All these changes allow us to confidently measure isotopic composition from less than one ng of Nd.

Results of our Sm-Nd measurements for Divnoe meteorite are presented in Fig. 1, along with a 4.55 Ga reference isochron. Measured values are shown as squares, and blank corrected values as circles. The amount of Nd extracted for analyses is also displayed on this plot. We have measured the acid-leached magnetic fraction (ML); the leachate (L) and the residue (R) of the whole rock sample; clinopyroxene (Cpx) and an unleached whole rock (WR) fragment. All measured samples have very radiogenic Nd isotopic composition and high Sm/Nd ratios. Because of the significant blank contribution to the low Nd samples, and the relatively high error in measurement of Nd isotopic composition for them, we will use only the whole rock unleached sample (WR) for further discussion.

The Nd concentration in Divnoe WR is 3.7 ppb, and the $^{147}\text{Sm}/^{144}\text{Nd}$ ratio is 0.5174. We have measured for the WR $^{143}\text{Nd}/^{144}\text{Nd} = 0.522486 \pm 0.000026$ (equal to $\varepsilon_{\text{Nd}}=192.1 \pm 0.5$). Using these data and CHUR values we calculate the "model age" of this meteorite as $4.62 \pm 0.07$ Ga and initial $^{143}\text{Nd}/^{144}\text{Nd} = 0.50660 \pm 0.00009$. This ancient age of Divnoe agrees with a
Sm-Nd System in Divnoe Meteorite. O. Bogdanovski and E. Jagoutz

K-Ar age (4.67 ± 0.20 Ga), obtained by Yu. Shukolyukov et al. [2]. We also found an excess of \(^{142}\)Nd - a daughter product of short-lived \(^{146}\)Sm. Measured \(\epsilon_{142} = +6.7 \pm 0.9\) indicates the presence of live \(^{146}\)Sm at the time of meteorite formation. Following reasoning similar to that above, we calculate initial \(^{142}\)Nd/\(^{144}\)Nd = 1.14136 ± 0.000065 (equal to initial \(\epsilon_{142} = -4.2 \pm 0.6\) and \(^{146}\)Sm/\(^{144}\)Sm = 0.0116 ± 0.0016. In Fig. 2 data points for different meteorites are plotted as \(^{147}\)Sm-\(^{143}\)Nd ages versus initial \(^{146}\)Sm/\(^{144}\)Sm ratios [3]. The \(^{146}\)Sm evolution curve for an initial \(^{146}\)Sm/\(^{144}\)Sm = 0.008 at 4.56 Ga. is also shown on this plot. The data point obtained for Divnoe meteorite falls on this curve and thus shows no disturbance of the long-lived and short-lived Sm-Nd isotopic systems.

We thank Meteorite Committee of Russian Academy of Sciences for supplying the Divnoe sample. We also thank Dr. M. Petaev for helpful comments.