Preliminary TIMS results on the Neodymium isotope composition of the JNdi-1 oxide standard at the LAGIR - Geochronology Laboratory of the Rio de Janeiro State University, Brazil

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ABSTRACT

Preliminary analyses of the isotope composition of Nd in the JNdi-1 standard are reported here from the recently built Laboratory of Geochronology and Radiogenic Isotopes - LAGIR, from the Rio de Janeiro State University. The averages of the obtained Neodymium isotope ratios are: $^{142}Nd/^{144}Nd = 1.141821 \pm 8$, $^{143}Nd/^{144}Nd = 0.512099 \pm 2$, $^{145}Nd/^{144}Nd = 0.348407 \pm 1$, $^{148}Nd/^{144}Nd = 0.241588 \pm 1$, $^{150}Nd/^{144}Nd = 0.236454 \pm 3$, $^{146}Nd/^{144}Nd = 0.722523 \pm 281$. The average of the $^{143}Nd/^{144}Nd$ ratio = 0.512099 ± 2 shows a ratio of 1.000031 with respect to the $^{143}Nd/^{144}Nd$ ratio (0.512115 ± 7) calculated by Tanaka et al. (2000) as the average of published results from several laboratories.

Key words: Reference material, REE, mass spectrometry.

INTRODUCTION

Preliminary analyses of the isotope composition of Nd in the JNdi-1 standard are reported here from the recently built Laboratory of Geochronology and Radiogenic Isotopes - LAGIR, from the Rio de Janeiro State University.

The LAGIR represents the fifth TIMS (Thermal Ionization Mass Spectrometry) laboratory built in Brazil. The chemical procedures are performed in clean rooms under positive air pressure and the isotope ratio measurements are done with a Finnigan-TRITON multi-collector mass spectrometer.

The JNdi-1 is a Neodymium oxide reference material prepared by the Geological Survey of Japan, reported by Tanaka et al. (2000) to have a relative $^{143}Nd/^{144}Nd$ ratio of 1.000503± 1 (1σ) with respect to the LaJolla standard (Lugmair & Carlson, 1978).

As the exhaustion of the widely used LaJolla standard is expected soon, an increasing number published reports of the JNdi-1 standard is observed in the literature (see the GeoReM database), allowing continued interlaboratory calibration.

PROCEDURES

High purity water and acids and only teflon™ containers were used. Water is previously filtered and de-ionised for the Milli-Q™ unit, then distilled in a Savillex™ 90° teflon bottle sub-boiling device. Hydrochloric acid from Merck™ is sub-boiling distilled twice: first in a quartz distillator then with a Savillex™ 90° bottle device.

A quantity of 100 mg of powder from batch 89 (split 1) of JNdi-1 Nd was dissolved into a HNO_3 5% stock solution with a gravimetric Nd concentration of 861 ppm. A diluted batch solution of 150 ppm concentration was then separated for the analyses.

Each analysis represents between 30 ng and 120 ng of Nd directly loaded on a previously degassed Rhenium filament using HCl as the ionization activator.

The isotope ratio measurements were performed between Sept 2005 and Dec 2006 in multi-collector static mode using an array of 8 Faraday cups according to Table 1.

Table 1: Cup configuration for the measurement of Nd isotope compositions.

Cup	**L4**	**L3**	**L2**	**L1**	**Central**	**H1**	**H2**	**H3**
Mass	^{142}Nd	^{143}Nd	^{144}Nd	^{145}Nd	^{146}Nd	^{147}Sm	^{148}Nd	^{150}Nd

RESULTS

The measured Nd isotope ratios shown in Table 2 are (power law) normalized to the La Jolla $^{146}Nd/^{144}Nd$ ratio of 0.7219, except for the $^{146}Nd/^{144}Nd$ ratio itself. All errors are stated within 2SE.

The obtained averages of the Neodymium isotope ratios are (Table 1): $^{142}Nd/^{144}Nd = 1.141821 \pm 8$, $^{143}Nd/^{144}Nd = 0.512099 \pm 2$, $^{145}Nd/^{144}Nd = 0.348407 \pm 1$, $^{148}Nd/^{144}Nd = 0.241588 \pm 1$, $^{150}Nd/^{144}Nd = 0.236454 \pm 3$, $^{146}Nd/^{144}Nd = 0.722523 \pm 281$.

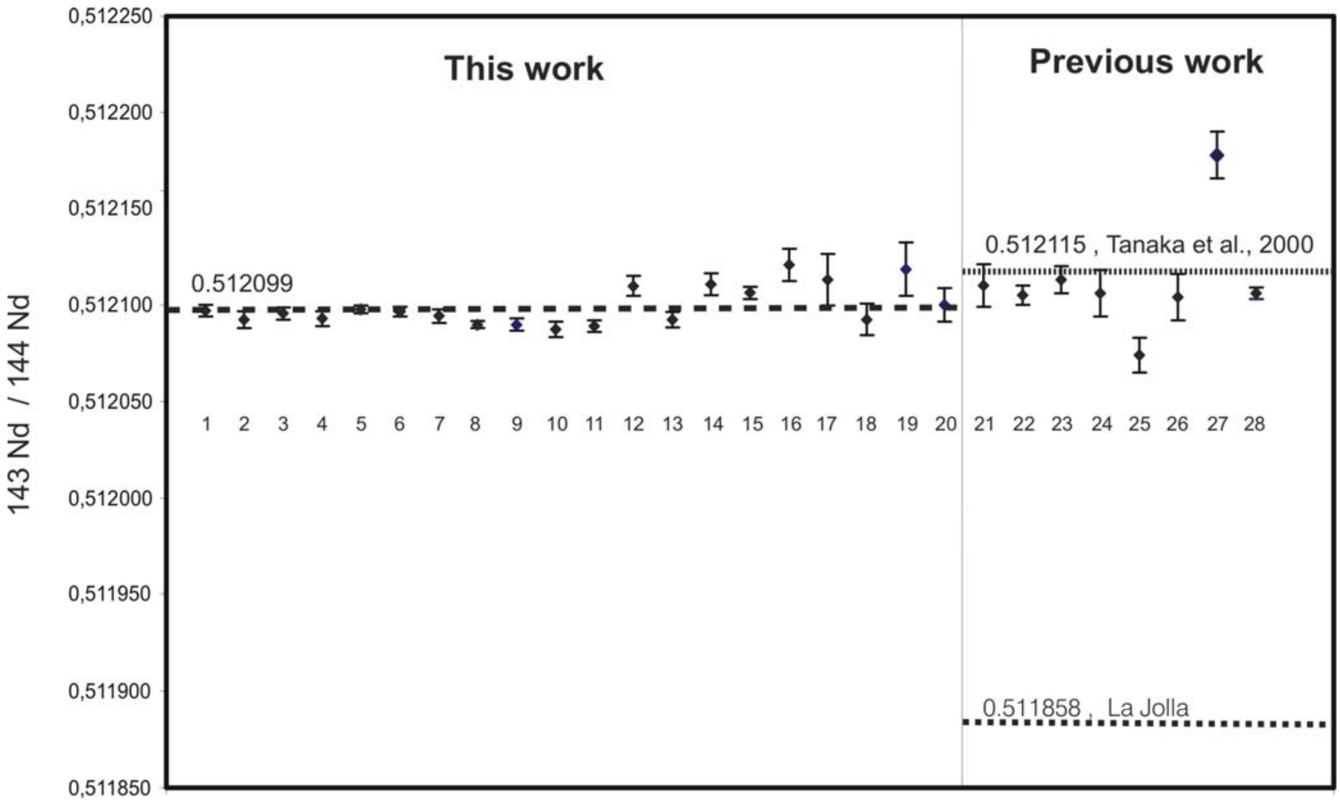

Figure 1- $^{143}Nd/^{144}Nd$ values of Jndi-1, as measured at LAGIR (1 to 20), compared to results from the literature: 21- Ohara et al. (2002); 22-Hoang & Uto (2003); 23- Amakawa et al. (2004); 24 – Piercey et al., (2003); 25- Skuf & Theart (2005); 26- Tamura et al., (2005); 27- Kawabata & Shuto Kenji (2005); 28- Shuto Kenji et al. (2005). Averages are represented by dashed lines. The $^{143}Nd/^{144}Nd$ ratio of 0.511858 for the LaJolla standard is also shown for reference.

The obtained average of the $^{143}Nd/^{144}Nd$ ratio = 0.512099 ± 2 agrees well and shows a ratio of 1.000031 with respect to the $^{143}Nd/^{144}Nd$ ratio (0.512115 ± 7) calculated by Tanaka et al. (2000) as an interlaboratory average (Fig 1).

ACKNOWLEDGEMENTS

The authors acknowledge the effort of the Universidade do Rio de Janeiro – UERJ – in the construction of LAGIR, and the financial support of FINEP (CT-MINERAL 3648/05) and CNPq (471200/2003-4 and 502006/2005-6) Brazilian funding agencies. W. R. Van Schmus (University of Kansas) assisted us with setting up procedures.

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Table 2- Nd isotopic compositions of the Jndi-1 standard.

Date	run#	Filament current [mA]	146Nd intens (V)	142Nd/ 144Nd	2σ St Error (abs)	143Nd / 144Nd	2σ St Error (abs))	145Nd / 144Nd	2σ St Error (abs))	148Nd / 144Nd	2σ St Error (abs))	150Nd / 144Nd	2σ St Error (abs))	146Nd / 144Nd	2σ St Error (abs))	Nd loaded (ng)	# cycles
13-Sep-05	36	2200	1,927	1,141803	6	0,512097	3	0,348412	2	0,241592	3	0,236456	3	0,722983	7	90	100
13-Sep-05	38	2213	2,205	1,141819	6	0,512093	4	0,348405	2	0,241590	2	0,236457	3	0,722655	1	90	100
13-Sep-05	40	2300	3,715	1,141821	6	0,512096	3	0,348404	1	0,241594	2	0,236462	2	0,722679	2	90	100
13-Sep-05	41	2133	1,054	1,141815	6	0,512093	4	0,348408	3	0,241590	3	0,236452	6	0,722732	3	90	100
13-Sep-05	42	2210	2,089	1,141828	8	0,512098	2	0,348408	2	0,241597	2	0,236457	5	0,722334	1	90	100
13-Sep-05	43	2210	1,866	1,141834	7	0,512097	3	0,348403	2	0,241592	3	0,236455	3	0,722429	1	90	100
13-Sep-05	44	2220	1,847	1,141829	12	0,512094	3	0,348405	2	0,241586	3	0,236449	4	0,722514	1	90	100
10-Oct-05	64	2120	1,719	1,141840	8	0,512090	2	0,348410	2	0,241589	2	0,236466	4	0,723979	2	90	100
10-Oct-05	65	2310	0,780	1,141756	14	0,512090	3	0,348406	4	0,241597	4	0,236438	5	0,724016	4	90	100
28-Nov-05	69	4500	1,075	1,141730	21	0,512087	4	0,348411	2	0,241580	3	0,236477	5	0,724441	17	90	100
5-Dec-06	355	2200	6,149	1,141788	7	0,512089	3	0,348411	1	0,241590	2	0,236445	2	0,723682	2	30	100
5-Dec-06	356	2000	1,921	1,141874	22	0,512110	5	0,348406	3	0,241584	4	0,236463	4	0,720952	13	30	50
5-Dec-06	356b	2000	2,695	1,141802	7	0,512092	4	0,348406	2	0,241592	4	0,236458	5	0,722514	9	30	50
5-Dec-06	357	2100	0,939	1,141835	18	0,512111	6	0,348407	7	0,241593	7	0,236448	12	0,721269	10	30	50
5-Dec-06	357b	2100	0,955	1,141833	14	0,512106	3	0,348410	7	0,241575	5	0,236444	4	0,722050	8	30	50
5-Dec-06	358	2000	1,022	1,141888	22	0,512121	8	0,348408	5	0,241592	5	0,236487	8	0,719713	3	30	50
5-Dec-06	358b	2000	0,904	1,141880	22	0,512113	14	0,348407	6	0,241579	10	0,236469	13	0,720118	2	30	50
5-Dec-06	359	2100	1,795	1,141801	11	0,512093	8	0,348402	7	0,241587	2	0,236451	4	0,722253	11	30	50
12-Dec-06	360	2250	6,345	1,141811	27	0,512119	14	0,348410	9	0,241576	4	0,236424	10	0,723696	1	120	40
12-Dec-06	360b	2500	1,324	1,141828	19	0,512100	9	0,348408	6	0,241581	5	0,236431	8	0,723440	2	120	40
Average				1,141821		0,512099		0,348407		0,241588		0,236454		0,722523			
2σ Std Dev (abs)				0,000037		0,000010		0,000003		0,000007		0,000015		0,001255			
2σ Std Err (abs)				0,000008		0,000002		0,000001		0,000001		0,000003		0,000281			