Electronic Supplementary information (ESI)

Figures

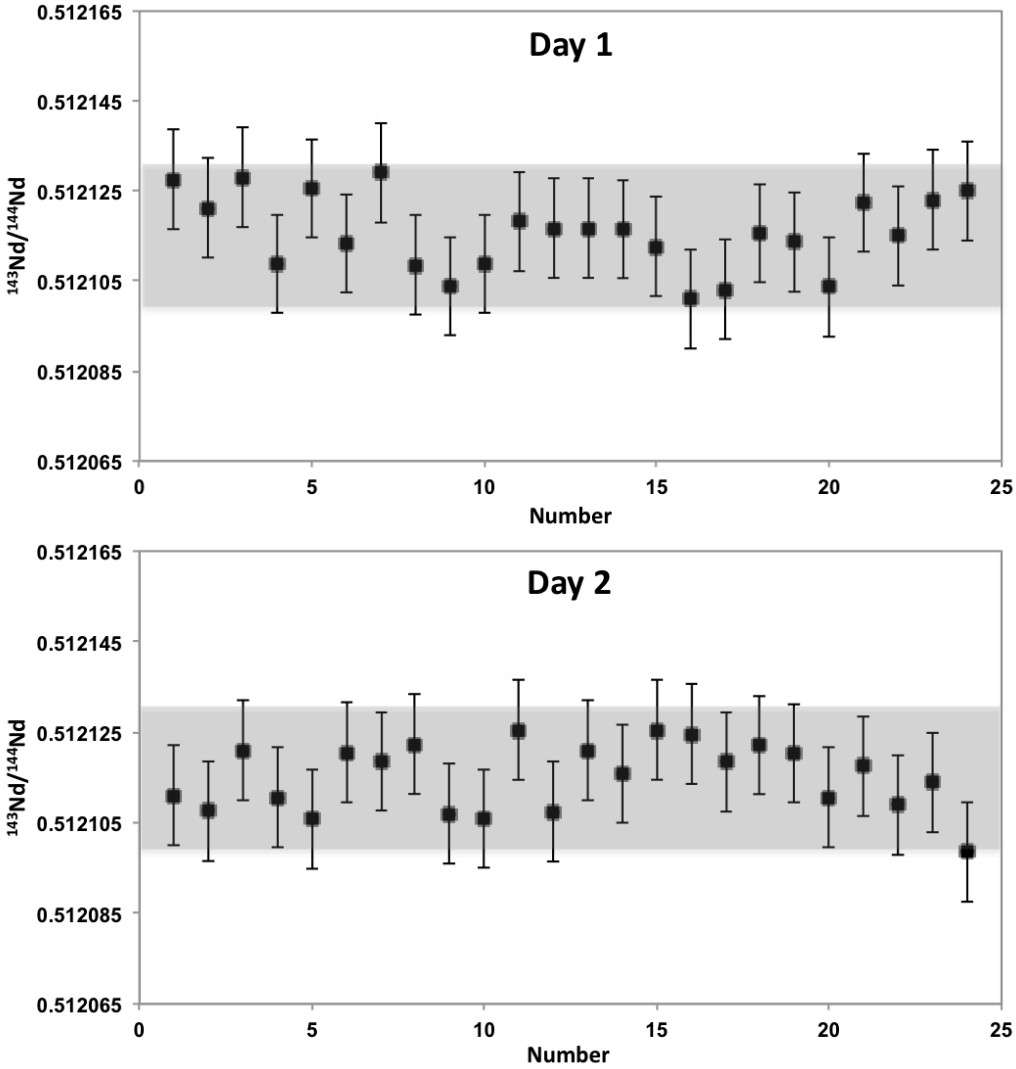

Fig. S1. Measured $^{143}Nd/^{144}Nd$ ratios of the bracketing JNdi-1 between the samples during two analytical sessions. All the data were normalized to $^{146}Nd/^{144}Nd$ for mass bias using exponential law and corrected for daily drift based on the daily mean of the La Jolla. The error bars (± 0.000016, 2SD) on the absolute Nd isotope ratios are depicted as the gray field for comparison.

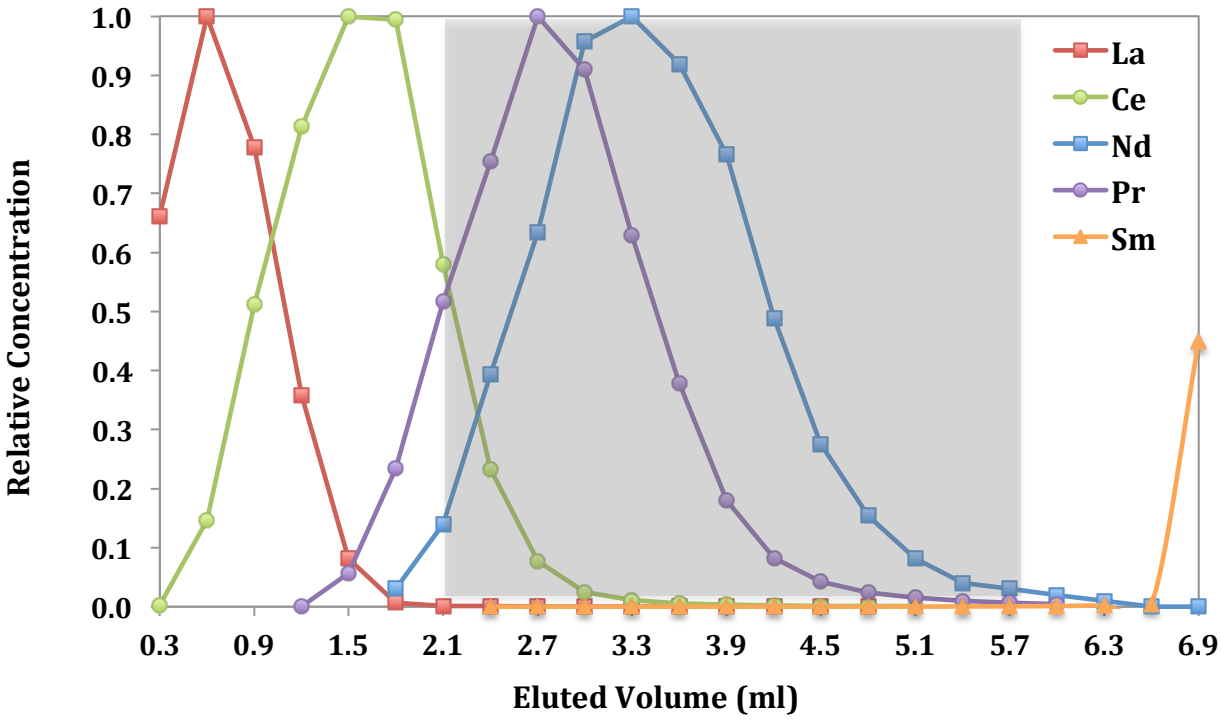

Fig. S2. Elution curve (relative concentration vs. volume) for the separation of REE using the LN resin in this study. The figure only shows the elution curve after sample loading (0.5 ml of 0.25 N HCl) and 0.6 ml of 0.25 N HCl for removals of the remaining major elements. Relative concentration was normalized to peak concentration. Collection of Nd is in gray. There is no significant shift of the elution curve for different sample matrices, and Sm is completely separated from Nd using our column chemistry.

Tables

Table S1. Analytical results of all international RMs measured in this study

Sample	Sample ID	Chemistry		$^{143}Nd/^{144}Nd$	$2\sigma_{mean}$	ε_{Nd} [a]	2σ [b]	$\Delta\varepsilon_{Nd}$ [c]	Yield (%)
AGV-1	AGV-1_1	LN only		0.512790	± 0.000009	2.97	± 0.3	-0.20	94
	AGV-1_1 (rerun)[d]	LN only		0.512792	± 0.000009	3.00	± 0.3	-0.16	-
	AGV-1_2	LN only		0.512801	± 0.000011	3.18	± 0.3	0.02	93
	AGV-1_3	LN only		0.512795	± 0.000012	3.06	± 0.3	-0.10	92
	AGV-1_4	LN only		0.512785	± 0.000013	2.87	± 0.3	-0.29	95
	AGV-1_5	LN only		0.512802	± 0.000013	3.20	± 0.3	0.04	98
			Mean	**0.512794**		**3.05**			
			2SD	**0.000013**		**0.23**			
BHVO-1	BHVO-1_1	LN only		0.512990	± 0.000012	6.87	± 0.3	0.04	95
	BHVO-1_1 (rerun)[d]	LN only		0.512985	± 0.000013	6.77	± 0.3	-0.06	-
	BHVO-1_2	LN only		0.513001	± 0.000010	7.08	± 0.3	0.25	96
	BHVO-1_3	LN only		0.513002	± 0.000009	7.10	± 0.3	0.27	93
	BHVO-1_4	LN only		0.512987	± 0.000009	6.81	± 0.3	-0.02	99
	BHVO-1_5	LN only		0.512986	± 0.000013	6.79	± 0.3	-0.04	94
			Mean	**0.512992**		**6.90**			
			2SD	**0.000015**		**0.30**			
Nod-P-1	Nod-P-1_1	LN only		0.512430	± 0.000012	-4.06	± 0.3	-0.04	96
	Nod-P-1_1 (rerun)[d]	LN only		0.512425	± 0.000010	-4.15	± 0.3	-0.14	-
	Nod-P-1_2	LN only		0.512421	± 0.000009	-4.23	± 0.3	-0.21	97
	Nod-P-1_3	LN only		0.512427	± 0.000009	-4.12	± 0.3	-0.10	92
	Nod-P-1_4[e]	LN only		0.512440	± 0.000011	-3.86	± 0.3	0.16	92
	Nod-P-1_5[e]	LN only		0.512438	± 0.000014	-3.90	± 0.3	0.12	93
			Mean	**0.512430**		**-4.05**			
			2SD	**0.000015**		**0.29**			
JCp-1 (Nd-doped)	JCp-1_1	TRU + LN		0.512122	± 0.000015	-10.07	± 0.3	0.14	94
	JCp-1_2	TRU + LN		0.512105	± 0.000013	-10.40	± 0.3	-0.20	95
	JCp-1_3	TRU + LN		0.512117	± 0.000011	-10.16	± 0.3	0.04	96
	JCp-1_4	TRU + LN		0.512116	± 0.000010	-10.18	± 0.3	0.02	93
	JCp-1_5	TRU + LN		0.512108	± 0.000008	-10.34	± 0.3	-0.14	95
			Mean	**0.512114**		**-10.23**			
			2SD	**0.000014**		**0.27**			
Column JNdi-1 (Sm-doped)	JNdi-1_1	LN only		0.512110	± 0.000010	-10.30	± 0.3	-0.10	-
	JNdi-1_2	LN only		0.512110	± 0.000009	-10.30	± 0.3	-0.10	-
	JNdi-1_3	LN only		0.512115	± 0.000012	-10.20	± 0.3	0.00	-
	JNdi-1_4	LN only		0.512105	± 0.000011	-10.40	± 0.3	-0.20	-
	JNdi-1_5	TRU + LN		0.512125	± 0.000011	-10.01	± 0.3	0.20	-
	JNdi-1_6	TRU + LN		0.512120	± 0.000014	-10.10	± 0.3	0.10	-
	JNdi-1_7	TRU + LN		0.512109	± 0.000009	-10.32	± 0.3	-0.12	-
	JNdi-1_8	TRU + LN		0.512120	± 0.000013	-10.10	± 0.3	0.10	-
			Mean	**0.512114**		**-10.19**			
			2SD	**0.000014**		**0.33**			
BATS Seawater (Nd-doped)	BATS Seawater-1	Fe(OH)3+TRU+LN		0.512113	± 0.000014	-10.24	± 0.3	-0.04	94
	BATS Seawater-2	Fe(OH)3+TRU+LN		0.512110	± 0.000008	-10.30	± 0.3	-0.10	94
	BATS Seawater-3	Fe(OH)3+TRU+LN		0.512112	± 0.000012	-10.26	± 0.3	-0.06	97
	BATS Seawater-4	Fe(OH)3+TRU+LN		0.512102	± 0.000011	-10.46	± 0.3	-0.25	98
	BATS Seawater-5	Fe(OH)3+TRU+LN		0.512120	± 0.000015	-10.10	± 0.3	0.10	95
			Mean	**0.512111**		**-10.27**			
			2SD	**0.000013**		**0.25**			

[a] Measured ratios are normalized to the CHUR value of 0.512638.[28]
[b] Including external precision.
[c] $\Delta\varepsilon_{Nd}$ values are the deviation from the published value.
[d] Rerun: ran back-to-back with the first analysis.
[e] Nod-P-1 samples were prepared by HH-leaching method.

Table S2. Comparison of measured $^{143}Nd/^{144}Nd$ ratios and the published techniques

Standard	Reference	Analytical method	Cone Type	Nd amount used	$^{143}Nd/^{144}Nd$	2SD	N
La Jolla	*Amelin* (2004)	TIMS / NdO^+	-	0.3 ng	0.511874	0.000023	6
	Weis et al. (2006)	TIMS / Nd^+	-	100-150 ng	0.511853	0.000012	118
		MC-ICP-MS / Nu Plasma / Wet plasma	Standard cones	> 200 ng	0.511856	0.000015	59
	Yang et al. (2011)	MC-ICP-MS / Neptune / Wet plasma	Standard cones	> 200 ng	0.511849	0.000014	68
	Vance and Thrilwall (2002)	MC-ICP-MS / IsoProbe / Dry plasma	Standard cones	30-50 ng	0.511856	0.000013	11
				4 ng	0.511857	0.000020	7
	Scher and Delaney (2010)	MC-ICP-MS / Neptune / Dry plasma	X-cone	10 ng	0.511840	0.000015	13
	This study	**MC-ICP-MS / Neptune / Dry plasma**	**Jet-cone / X-cone**	**1.25 ng**	**0.511852**	**0.000015**	**15**
JNdi-1	*Li et al.* (2007)	TIMS / NdO^+	-	1.0 ng	0.512123	0.000014	5
	Chu et al. (2009)	TIMS / NdO^+	-	2.0 ng	0.512113	0.000025	6
		TIMS / NdO^+	-	0.5-1.0 ng	0.512112	0.000028	13
		TIMS / Nd^+	-	20-100 ng	0.512120	0.000014	8
	Yang et al. (2011)	MC-ICP-MS / Neptune / Wet plasma	Standard cones	> 200 ng	0.512110	0.000010	54
	This study	**MC-ICP-MS / Neptune / Dry plasma**	**Jet-cone / X-cone**	**5.0 ng**	**0.512124**	**0.000010**	**6**
				2.5 ng	**0.512119**	**0.000013**	**6**
				1.25 ng	**0.512113**	**0.000015**	**6**
				1.0 ng	**0.512108**	**0.000020**	**6**
				0.5 ng	**0.512101**	**0.000029**	**6**
AGV-1	*Weis et al.* (2006)	TIMS / Nd^+	-	100-150 ng	0.512791	0.000013	10
	Weis et al. (2006)	MC-ICP-MS / Nu Plasma / Wet plasma	Standard cones	> 200 ng	0.512800	0.000023	6
	This study	**MC-ICP-MS / Neptune / Dry plasma**	**Jet-cone / X-cone**	**1.25 ng**	**0.512794**	**0.000013**	**6**
BHVO-1	*Weis et al.* (2006)	TIMS / Nd^+	-	100-150 ng	0.512986	0.000009	19
	Weis et al. (2006)	MC-ICP-MS / Nu Plasma / Wet plasma	Standard cones	> 200 ng	0.512988	0.000010	6
	This study	**MC-ICP-MS / Neptune / Dry plasma**	**Jet-cone / X-cone**	**1.25 ng**	**0.512992**	**0.000015**	**6**
Nod-P-1	*Foster and Vance* (2006)	LA-MC-ICP- / Neptune	X-cone	-	0.512420	0.000011	5
	Foster and Vance (2006)	MC-ICP-MS / Neptune / Dry plasma	X-cone	-	0.512436	0.000008	3
	This study	**MC-ICP-MS / Neptune / Dry plasma**	**Jet-cone / X-cone**	**1.25 ng**	**0.512431**	**0.000015**	**6**

Table S3. Seawater Nd isotopic data for the study site near the BATS station.

Sample ID	Depth (m)	εNd					Mean	2SD	2SE
		Run-1	Run-2	Run-3	Run-4	Run-5			
A0908-1	300	-10.4	-10.7	-10.2	-10.4		-10.4	0.4	0.2
A0908-2	800	-11.0	-11.2	-10.8	-11.0		-11.0	0.3	0.2
A0908-3	1000	-13.2	-13.0	-13.0	-12.8	-12.9	-13.0	0.3	0.1
A0908-4	2000	-13.2	-13.4	-13.6	-13.4	-13.5	-13.4	0.3	0.1
A0908-5	3000	-13.5	-13.2	-13.3	-13.2		-13.3	0.3	0.1