Methods

REE contents in biogenic apatite were obtained by instrumental neutron activation analysis (INAA) in the Institute of Precambrian Geology and Geochronology, St. Petersburg. Handpicked and carefully purified air-dried samples of 0.3–15 mg were placed in pure quartz vials and irradiated for 100 hr with epithermal neutrons at the Institute of Nuclear Physics, St. Petersburg (Reactor VVR-1). The density of neutron flux is 5×10^{13} neutrons/cm^2s^{-1}. The measurment procedure was described by Felitsyn et al. (1990), mean relative errors are less than 3% for Sm, Nd, and Tb, less than 5% for La, Ce, Ho, and less than 10% for Nd and Tb.

For Sm-Nd determination crushed samples were spiked by ^{146}Nd – ^{149}Sm and decomposed during 2-5 days in an oven at 120 °C. Sm and Nd separation was carried out according to standard methods of two-stage ion-exchange and extraction chromatography. The measurements were performed on a Finnegan MAT-261 mass spectrometer equipped with eight collectors under static mode at the Institute of Precambrian Geology and Geochronology, St. Petersburg.

The $^{143}Nd/^{144}Nd$ ratio was normalized withinrun to $^{148}Nd/^{144}Nd$ = 0.241570 and then adjusted to a $^{143}Nd/^{144}Nd$ value of 0.511860 (La Jolla.standard). Assigned errors (2σ) for $^{147}Sm/^{144}Nd$ and $^{143}Nd/^{144}Nd$ were ±0.3% and ±0.000015 of standard (external reproducibility). The 2σ errors cited in table for $^{143}Nd/^{144}Nd$ reflect in-run precision and demonstrate only the quality of these analyses. The blank level for Sm was 0.01 ng and was for Nd 0.05 ng. The data obtained for BCR-1 during thecourse of this analytical work are: Sm = 6.487 ppm, Nd = 28.45 ppm, $^{143}Nd/^{144}Nd$ = 0.512663 ±0.000009, $^{147}Sm/^{144}Nd$ = 0.13829 (for details, see Ovchinnikova et al. 1995).

Nd isotopic analyses are reported in the standard epsilon notation where $\varepsilon_{Nd}(T) = [(^{143}Nd/^{144}Nd)_{sample}(t)/(^{143}Nd/^{144}Nd)_{CHUR}(t)-1]10^4$, where CHUR is

the chondritic uniform reservoir with a present-day $^{143}Nd/^{144}Nd$ = 0.512638 and $^{147}Sm/^{144}Nd$ = 0.1967.

REFERENCES CITED

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Ovchinnikova, G. V., Belyatsky, B. V., Vasilieva, I. M., and Levsky, L. K., 1995, Sr-Nd Pb isotope characteristics of the mantle sources of basalts from the Canary Islands: Petrology, v. 3(2), p. 172-182.

TABLE A

Sample	Material	Age Biozones	Sm ppm	Nd ppm	147Sm/144nd	143Nd/144Nd +/-2s measured.'	Host rock type
Ma-U1	brachipod	*A. Pisiformis/Homagnostus*	27.39	126.4	0.13149	0.52116+/-13	sandstone
M-77/9	brachiopod	*Peltura*	71.84	290.2	0.15013	0.512062+/-9	sandstone
T-3/28	brachiopod	*Cordylodus proavus* (redepos.)	59.88	275.6	0.13178	0.512051+/-7	sandstone
Syas-1	brachiopod	*Cordylodus proavus*	68.51	297.9	0.13947	0.512124+/-9	sandstone
Lava 1	brachiopod	*Cordylodus proavus*	54.96	239.1	0.13937	0.512112+/-27	sandstone
U83-8/9	brachiopod	*Cordylodus lindstromi*	48.92	223.96	0.13246	0.512036+/-6	sandstone
U-83-6	brachiopod	*Cordylodus proavus*	34.55	155.3	0.13494	0.512033+/-46	sandstone
MB I beta	conodont	*Prioniodus elegans*	97.78	425.6	0.13933	0.512149+/-13	limestone
MB IIab	conodont	*Oepikodus evae*	149.9	661.1	0.13668	0.512122+/-16	limestone
Tonu-5	brachiopod	*Baltoniodus navis/B. triangularis*	250	1079	0.14045	0.512165+/-8	limestone
Tonu-24	brachiopod	*Paroistodus originalis*	189.7	957.2	0.1342	0.512129+/-12	limestone
Tonu-30	brachiopod	*Microzarkodina flabellum parva*	207.9	899.1	0.14024	0.512219+/-6	limestone
KJ B I beta	brachiopod	*Prioniodus elegans*	199.3	881	0.13718	0.512036+/-7	limestone
6817-8C	brachiopod	*Oepikodus evae*	355.1	1375	0.15665	0.512295+/-5	limestone
EO-2	biogen. apatite unidentfied	*Eoplacognathus variabilis*	107.6	461	0.14155	0.512225+/-5	limestone
E22-2	biogen. apatite unidentfied	*Eoplacognahtus variabilis*	218.1	842.1	15703	0.512281+/-11	limestone
E11-5	biogen. apatite unidentfied	*Eoplacognathus variabilis*	394.8	1475	0.1623	0.512106+/-5	limestone
R11-5	biogen. apatite unidentfied	*Eoplacognathus variabilis*	363.9	1415	0.15592	0.512214+/-5	limestone
E21-4	biogen. apatite unidentfied	*Eoplacognathus variabilis*	118.3	470.3	0.15269	0.512109+/-11	limestone
Hallek	biogen. apatite unidentfied	*Eoplacognathus variabilis*	92.05	399	0.13993	0.512199+/-8	limestone
SV-1	volcanic ash, residue	*Eoplacognathus suecicus*	7.78	39.16	0.12046	0.512244+/-6	limestone
225555	phosphorite, Greenland	Middle Cambrian, Greenland	18.5	90.1	0.1245	0.511990+/-7	
225556	phosphorite, Greenland	Middle Cambrian, Greenland	15.46	76.17	0.12306	0.512006+/-8	
225569	phosphorite, Greenland	Middle Cambrian, Greenland	20.76	100.2	0.1257	0.511995+/-6	
VF5-Ph	phosphorite, Moscow syneclise	Early Cambrian Rovno	95.4	542	0.12308	0.511915+/-9	
VTyR	phosphorite, Moscow syneclise	Early Cambrian, Rovno	108.4	606	0.13377	0.511985+/.4	
2 BS	Shale, Moscow syneclise	Vendian Redkino	6.3	36.1	0.10562	0.51105+/-13	
8 BS	Shale, Moscow syneclise	Vendian Kotlin	6.84	39.11	0.10612	0.511836+/-13	
37 BS	Shale, Moscow syneclise	Cambrian Rovno	4.23	21.77	0.11786	0.511890+/-8	

TABLE B

La	116	172	160	210	241	158	165	367	701	586	519	681	393
Ce	270	577	414	660	760	397	456	1298	1722	1425	1559	1671	842
Pr													
Nd	140	401	260	351	330	238	260	795	1368	1089	864	1225	664
Sm	30	73	47	63	76	43	48	148	264	198	195	256	128
Eu	7.9	14.6	10.3	16.7	19.7	10.8	13.2	30.8	54.2	40.7	44	58	28
Gd											198	258	126
Tb	6.5	11.9	9	11	13	9.2	9.9	21	36	27	31	38.6	26.6
Dy													
Ho	8	10.5	10	12	17	11	12.2	18.8	35.1	29.5			
Er													
Tm													
Yb	10.4	14	13.6	17.6	23.6	14.2	15.4	25.4	46.1	43.6	31	34.4	27.1
Lu											3	3.4	3.2
Sample nr.:	**Ma-U1**	**T-3/28**	**E-10/2**	**Syas-1**	**Lava-1**	**U-83-6**	**U-83-8/9**	**MBIbeta**	**Tonu-5**	**Tonu-24**	**EST-1**	**EST-2**	**EST-3**
Age	U. Camb.	U. Camb.	U. Camb.	U. Camb.	U. Camb.	U. Camb.	L. Ordov.	L. Ordov.	L. Ordov.	L. Ordov.	L. Ordov.	L. Ordov.	L. Ordov.
Conodont zones	*A. pisiformis Homagnost.*	*Redepo. in Cordyolodus proavus*	*C. andresi*	*C. proavus*	*C. proavus*	*C. proavus*	*Cordylodus lindstromi*	*Prioniodus elegans*	*Baltoniodus navis/trian.*	*Paroistodus originalis*	*E. variabilis*	*E. variabilis*	*E. variabilis*