Spinel lherzolite and garnet lherzolitic xenoliths from the Vitim volcanic field, Baikal region, Siberia; subchondritic Os/Ir ratios

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The Sayan-Baikal fold belt originated in the Early Paleozoic from closure of the paleo-Asian ocean and collision of several Precambrian micro-continents with the Siberian craton to the north. It experienced repeated orogenic and intracontinental magmatic episodes; the last of them producing the Cenozoic Vitim volcanic field, in which Miocene and younger alkali basalts and tuffs contain xenoliths of spinel- and garnet-bearing peridotites that provide a valuable insight of the lithospheric mantle.

We have analysed a suite of xenoliths from these region for HSE. The eleven samples analysed include three spinel lherzolites and eight garnet lherzolites (Table 1). The garnet xenoliths range from 2.72 to 3.46% CaO and from 38.08 to 41.54% MgO; the spinel xenoliths range from 0.50 to 2.48% CaO and from 38.51 to 43.70% MgO. The peridotite suite is characterised by very low S contents. Os abundances of the garnet lherzolites appear anomalously low (0.74±0.15 ng/g Os) in comparison to the three spinel lherzolites (2.29±1.42 ng/g Os). These low Os abundances have been recently confirmed on some samples by N-TIMS (Pearson et al. 1997). All samples show fractionated PGE ratios (e.g. gt-lherzolites; Os/Ir=0.41±0.12; Os/Ir_{CI}=1.06; Rh/Ir=0.53±0.19; Rh/Ir_{CI}=0.31; Ru/Ir=2.10± 0.60; Ru/Ir_{CI}=1.56). The general observation that these garnet xenoliths contain very low Os and have low S is evidence for Os mobility under certain conditions. This has important implications for interpreting Os isotopic data. Osmium control by sulfides is confirmed by several authors (e.g., Burton et al. 1998). The fractionated Os/Ir ratios in these rocks show that Os can be lost from mantle xenoliths by mobilisation of sulfides (magmatic fluids). Subchondritic Os/Ir ratios from Mongolian samples (Schmidt et al. 1996) and other localities (Handler et al. 1999) show that geological processes in the continental lithosphere may alter the primary HSE mantle signatures. The very low Re contents suggests a behavior of Re similar to Os and S in these rocks.

Table 1. HSE contents of garnet (313) and spinel (314) lherzolites from the Vitim volcanic field, Baikal region

Sample	Os ng/g	Re pg/g	Ir ng/g	Ru ng/g	Pt ng/g	Rh ng/g	Pd ng/g	Au ng/g	Os/Ir	Ru/Ir	Pt/Ir	Rh/Ir	Pd/Ir	Au/Ir
313-102	0,73	<19	1,76	4,86	<7	1,10	<0,5	<0,22	0,42	2,8	<4,0	0,63	<0,3	<0,1
313-104	0,62	<7	1,41	4,06	5,58	<0,14	<0,4	0,20	0,44	2,9	3,96	<0,1	<0,3	0,1
313-112	0,63	<5	3,49	3,21	6,29	0,71	1,96	1,29	0,18	0,9	1,8	0,20	0,56	0,4
313-110	0,84	<7	2,50	5,18	<7	0,80	<0,2	0,60	0,33	2,1	<2,8	0,32	<0,1	0,2
313-6	0,55	<9	1,21	2,26	<7	0,79	<0,2	n.d.	0,46	1,9	<5,8	0,65	<0,2	
313-241	0,73	<8	1,84	3,98	<7	1,18	<0,2	n.d.	0,40	2,2	<3,8	0,64	<0,1	
313-106	0,99	<13	2,02	4,20	<7	1,11	<0,3	<0,15	0,49	2,1	<3,5	0,55	<0,2	<0,1
313-240	0,87	<9	1,47	3,06	<7	1,01	<0,2	n.d.	0,59	2,1	<4,8	0,69	<0,2	
Average	0,74	<10	1,96	3,85	5,94	0,96	<0,4	0,70	0,41	2,10	2,88	0,53	<0,3	0,25
S.D.	0,15		0,74	0,97	0,50	0,19		0,55	0,12	0,60	1,52	0,19		0,11
314-72	1,05	<7	2,29	4,32	7,53	0,66	<0,2	n.d.	0,46	1,9	3,29	0,29	<0,2	
314-71	3,84	<14	2,59	5,16	<7	<0,3	<0,4	n.d.	1,48	2	<2,7	<0,2	<0,2	
314-5	2,00	<9	3,13	6,68	6,84	1,25	<0,2	0,82	0,64	2,1	2,19	0,4	<0,2	0,3
Average	2,29	<10	2,67	5,39	7,19	0,96	<0,3	0,82	0,86	2,00	2,74	0,34	<0,2	0,3
S.D.	1,42		0,43	1,20	0,49	0,42			0,55	0,12	0,78	0,08		