SUPPLEMENTARY MATERIALS

The Ruthenium Isotopic Composition of the Oceanic Mantle

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The Ru concentration, mass digested, and $\mu^{x}Ru$ values for chromitites, Os-Ir-Ru alloys, and iron meteorites studied are presented in SM1. The $\mu^{189}Os$ and cosmic ray exposure uncorrected $\mu^{x}Ru$ for IAB iron meteorites are presented in SM2.

SM1. The Ru concentration, mass digested, and μ^{x}Ru values for chromitites, Os-Ir-Ru alloys, and iron meteorites studied here. Data are corrected using the Nier reduction method unless otherwise specified. The uncertainties associated with individual analyses are the internal error (2SE) associated with the measurement, unless there is only one analysis for the sample in which case the uncertainties are the 2SD of the standards measured during the relevant campaign. The uncertainties for sample means, where n <3, are reported as the 2SD of the *Alfa Asear* standard, or the sample, whichever was greater. The uncertainties for sample means, where n ≥3, are the 2SE associated with the multiple measurements of the sample. The uncertainties associated with the IAB iron meteorite group are defined by the extent of the error envelop at μ^{189}Os = 0 for the trend μ^{189}Os *vs.* μ^{x}Ru, obtained using the ISOPLOT program (Ludwig, 2003). The uncertainties associated with the oceanic mantle are an average of the 2SD of repeated analysis of the *Alfa Asear* standard from each measurement campaign.

Location/Sample	Ru[†]	Mass (g)	μ^{96}Ru	±	μ^{98}Ru	±	μ^{100}Ru	±	μ^{102}Ru	±	μ^{104}Ru	±
SOC(UK)												
C1	17 ppm	0.5	-39.9	55.4	-143.6	149.8	4.0	9.0	30.0	34.6	11.9	29.2
C2	7 ppm	1	21.0	55.4	39.3	149.8	4.0	9.0	10.4	34.6	-3.7	29.2
C3_a	20 ppm	0.5	30.3	15.5	-4.3	18.4	-1.4	5.4	0.1	5.9	-9.2	10.9
C3_b			8.5	18.6	87.5	27.5	-0.1	6.8	3.8	8.1	11.8	12.8
C3_c			17.8	9.3	4.9	9.2	-1.4	2.7	3.8	3.8	16.3	6.4
C3_d			42.7	15.5	41.6	27.5	1.3	5.4	8.7	5.4	34.6	11.8
C3 $_{mean}$			24.8	14.9	32.4	41.7	-0.4	1.3	4.1	3.5	13.4	18.0
JOC (US)												
M3_6	≤14 wt.%	<0.05	36.4	72.8	-24.0	133.1	7.4	6.8	10.3	22.2	53.3	55.7
M8_02	≤15 wt.%	<0.05	60.4	72.8	-32.1	133.1	-4.5	6.8	4.0	22.2	12.2	55.7
L5_3_a	≤6 wt.%	<0.05	66.3	16.0	27.3	26.0	2.6	5.8	-19.9	6.5	-12.1	11.8
L5_3_b			15.6	15.4	-141.3	24.2	-3.7	5.4	30.0	6.4	43.8	12.0
L5_3_c			15.7	20.1	7.0	33.5	-5.4	6.7	-0.5	7.9	22.4	14.6
L5_3_d			12.6	10.8	-3.0	16.3	1.5	3.9	-18.9	4.7	-31.9	8.4
L5_3_e			36.6	23.1	29.0	36.8	2.6	8.1	26.0	9.3	40.2	17.5
L5_3 $_{mean}$			29.4	20.4	-16.2	63.7	-0.5	3.4	3.3	21.3	12.5	29.7
Witswatersand (SA)												
B-1_a	5-55 wt.%	<0.05	8.3	8.1	-10.2	10.5	0.3*	2.5*	2.6	3.5	4.3	6.0
B-1_b			40.3	10.4	55.8	14.6	0.4*	3.7*	5.5	4.5	29.7	7.6
B-1_c			31.2	9.3	-40.1	12.6	4.1*	3.3*	14.5	4.1	27.4	6.9
B-1_d			34.2	10.3	-12.8	14.4	1.5*	3.3*	11.0	4.3	26.2	7.8
B-1_e			25.0	8.4	6.0	12.1	-1.1*	3.0*	-5.1	3.8	-1.9	6.6
B-1_f			53.9	9.1	99.9	12.3	-4.4*	3.2*	-19.1	3.9	3.7	6.9
B-1_g			26.3	9.3	6.7	13.2	1.8*	3.4*	0.2	4.0	18.8	7.2
B-1 $_{mean}$			31.3	10.7	15.0	35.8	0.4*	2.0*	1.4	8.4	15.4	9.9
Urals (RU)		<0.05										
Kushva_a			106.3	15.8	299.7	12.6	-4.4	5.1	-54.2	6.6	14.1	12.0
Kushva_b			52.4	9.0	63.0	8.2	2.4	3.1	-13.0	3.9	3.5	7.3
Kushva_c			-5.8	9.6	-139.1	9.1	10.0	3.4	42.3	4.1	61.2	7.0
Kushva mean			51.0	98.7	74.5	327.7	2.7	10.9	-8.3	71.6	26.3	37.0

Location/Sample	Ru†	Mass (g)	$^{96}Ru/^{101}Ru$	±	$^{98}Ru/^{101}Ru$	±	$^{100}Ru/^{101}Ru$	±	$^{102}Ru/^{101}Ru$	±	$^{104}Ru/^{101}Ru$	±
Nizhny Tagil_a		<0.05	-40.7	19.6	-82.8	17.3	14.9	6.3	39.8	7.8	57.8	15.7
Nizhny Tagil_b			83.5	14.8	89.0	13.1	3.2	5.0	-5.8	6.2	46.0	12.1
Nizhny Tagil $_{mean}$			21.4	125.0	3.1	247.2	9.1	7.5	17.0	71.9	51.9	13.9
Guli_a	65-98 wt%	<0.05	92.3	20.6	212.5	15.9	4.3*	6.5*	-35.5	8.3	14.0	15.1
Guli_b			113.9	13.5	248.4	10.5	-4.8*	4.7*	-35.4	6.1	20.4	12.2
Guli_c			57.6	10.9	117.8	9.0	3.9*	3.5*	-9.9	4.6	27.0	8.0
Guli_d			79.1	11.2	79.6	10.9	2.8*	4.0*	-10.7	4.5	15.3	7.9
Guli $_{mean}$			85.7	39.9	164.6	117.6	1.6*	3.9*	-22.9	25.1	19.2	8.1
Tasmania (AU)												
Bald Hills			85.6	11.2	192.7	104.1	-7.8	8.6	32.7	5.3	-19.2	37.9
Savage River			34.1	7.4	-13.4	104.1	-6.8	8.6	3.1	3.2	15.6	37.9
Papua New Guinea												
Yodda_a		<0.05	41.5	9.4	71.6	9.7	1.5	3.3	-10.1	4.4	4.8	7.7
Yodda_b			16.6	10.5	73.3	10.1	6.5	3.3	-5.5	4.5	-3.7	8.1
Yodda_c			68.1	12.8	93.4	11.2	4.1	4.7	-13.9	5.7	30.1	9.9
Yodda $_{mean}$			42.0	29.7	79.5	14.0	4.1	2.9	-9.8	4.8	10.4	20.3
IAB (MG,sLL)	3.5-9.6 ppm	0.5 - 1	36.0	67.0	74.0	70.0	0.9	3.0	-0.7	14.0	16.8	15.0
Oceanic mantle			39.0	77.5	38.2	175.4	1.2	7.2	0.6	41.5	17.2	48.0

†Ruthenium concentration.

*Data obtained using the measured oxygen reduction scheme.

SM2. μ^{189}Os and cosmic ray exposure uncorrected μ^{x}Ru for IAB iron meteorites. The uncertainties for multiple analyses of individual samples, where n <3, are reported as the 2SD of the standard, or the sample, whichever was greater. The uncertainties for individual samples, where n ≥3, are the 2SE associated with the multiple measurements of the sample. Where n is the number of analyses of a single sample solution for (a) Ru and (b) Os.

Sample	n[a]	μ^{96}Ru	±	μ^{98}Ru	±	μ^{100}Ru	±	μ^{102}Ru	±	μ^{104}Ru	±	n[b]	μ^{189}Os	±
IAB Main Group														
Campo del Cielo $_{mean}$	1	115.5	61.4	190.1	144.0	2.1	5.6	-26.6	29.2	17.6	30.3	2	4.0	5.0
Morasko $_{mean}$	3	-3.2	47.7	-5.3	155.0	8.5	4.9	16.2	50.8	8.4	32.8	1	-12.0	4.0
Hope	1	0.4	61.4	-80.9	144.0	-2.1	5.6	28.7	29.2	41.5	30.3	3	-3.5	5.9
IAB sLL														
Bischtube	1	17.4	82.5	65.3	142.1	15.9	9.2	13.9	21.9	2.1	30.8	3	-28.0	5.0
Deport $_{mean}$	2	34.4	20.0	28.7	121.3	41.7	13.5	33.6	27.6	16.9	31.5	3	-107.0	3.0
Toluca $_{mean}$	1	55.0	61.4	156.4	144.0	-0.2	5.6	-11.1	29.2	7.1	30.3	4	-5.0	6.0

References

1. Ludwig K. R. (2003) User's Manual for Isoplot 3.00. Berkeley Geochronology Center Special Publication No. 4, Berkeley, CA, 70pp.