DOI 10.5012/bkcs.2011.32.6.

Supplementary Material

Quantification of Ultra-Trace Levels of Pt, Ir and Rh in Polar Snow and Ice Using ICP-SFMS Coupled with a Pre-Concentration and Desolvation Nebulization System

Tseren-Ochir Soyol-Erdene,[†,#] Youngsook Huh,[†,‡] Sungmin Hong,[§] Hee Jin Hwang,[#] and Soon Do Hur[#,*]

[†]*School of Earth and Environmental Sciences, Seoul National University, Seoul 151-747, Korea*
[‡]*Research Institute of Oceanography, Seoul National University, Seoul 151-747, Korea*
[§]*Department of Oceanography, Inha University, 253 Yonghyun-dong, Nam-gu, Incheon 402-751, Korea*
[#]*Korea Polar Research Institute, Songdo Techno Park, 7-50, Songdo-dong, Yeonsu-gu, Incheon 406-840, Korea*
[*]*E-mail: sdhur@kopri.re.kr (Soon Do Hur)*
Received December 22, 2010, Accepted April 26, 2011

Key Words : Platinum group elements, Antarctic snow, Ice core

Cleaning Procedures

The cleaning procedures for the experimental tools, including low- and high-density polyethylene bottles (LDPE and HDPE), Teflon beakers and stainless steel tools used for mechanical chiseling during the decontamination procedure of the ice core sample, were performed in the class-10 clean booth according to the previously established cleaning protocol.[1] Grease and other production materials on the bottles are first removed with chloroform, and the bottles are then rinsed well with Millipore RO water. The bottles are then immersed for a week in each of a series of three, covered acid cleaning baths, which include one 20 L carboy (Nalgene) filled with 25% Merck "Suprapur" HNO_3 and two 20 L carboys filled with 0.1% (v/v) Merck "Optima" grade HNO_3, before a final rinse with Milli-Q water. The bottles are then filled with 0.1% "Optima" grade HNO_3 in Milli-Q water, capped and packed in acid-washed polyethylene bags before use. Acid-cleaned polypropylene (PP) tongs were used to rinse and transfer all of the items immersed in the successive acid baths.[1] Further improvement in the described cleaning procedures of the protocol[1] was made by an additional step that involved soaking all labware in an initial acid bath filled with ~25% of guaranteed reagent (GR) grade HNO_3 before cleaning the items in the successive acid baths. The cleaning procedure for the PFA Teflon beakers and other small items is similar to that for the bottles except that they are immersed in concentrated Merck "Suprapur" HNO_3 at room temperature for at least a week before immersion in the second bath. PFA beakers used for the non-boiling pre-concentration of the samples are left immersed in the last acid bath until use. Polypropylene (PP) pipette tips are cleaned by immersion inside a 1000 mL PFA jar containing concentrated Merck "Suprapur" HNO_3 for a week. PP tips are cleaned by pipetting concentrated "Optima" grade HNO_3 into the tip, ejecting the acid and then washing with Milli-Q water many times just before use.

Table S1. Instrumental conditions and measurement parameters for the ICP-SFMS and the desolvation system

Parameters	Values
Gas flow rates	
Cool (L min^{-1})	16.00
Auxiliary (L min^{-1})	0.40-0.90*
Sample (L min^{-1})	0.85-1.00*
Nitrogen flow rate (mL min^{-1})	~8*
Spray chamber (°C)	100
Chiller temperature (°C)	2
Washing time (min)	1 (by 5% HNO_3) 1 (by 1% HNO_3)
Take up time (s)	50
Resolution	Low ($m \cdot \Delta m^{-1}$) = 300
Selected isotopes	^{179}Hf, ^{193}Ir, ^{195}Pt, ^{103}Rh
Dwell time per acquisition points (ms)	10
Sample per peak	200
Total acquisition time (per mass segment, s)	0.2
Acquisition window (%)	10
Search window (%)	0
Integration window (%)	10
Run number	9
Pass number	20

*Optimized daily to obtain maximal intensity.

Table S2. Potential interferences that could affect the determination of ultra trace levels of Pt, Ir and Rh in polar snow and ice samples

Analyte		Potential interference	
Isotope	Abundance (%)	Species	Abundance* (%)
^{103}Rh	100	$^{63}Cu^{40}Ar$	68.89
		$^{87}Sr^{16}O$	6.98
		$^{87}Rb^{16}O$	71.99
^{193}Ir	62.7	$^{177}Hf^{16}O$	18.56
^{195}Pt	33.8	$^{179}Hf^{16}O$	13.60

*Calculated by multiplying the natural abundances of each isotope and dividing by 100.

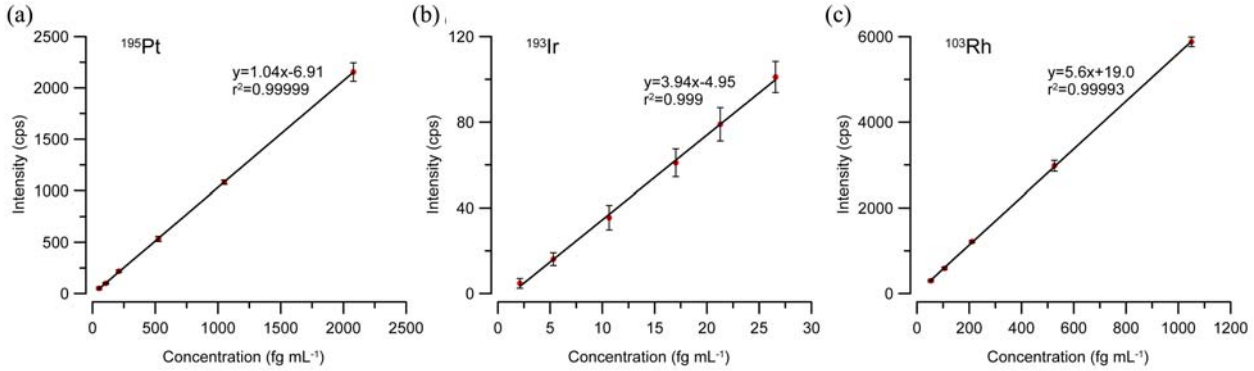

Figure S1. External calibration curves for (a) ^{195}Pt, (b) ^{193}Ir and (c) ^{103}Rh.

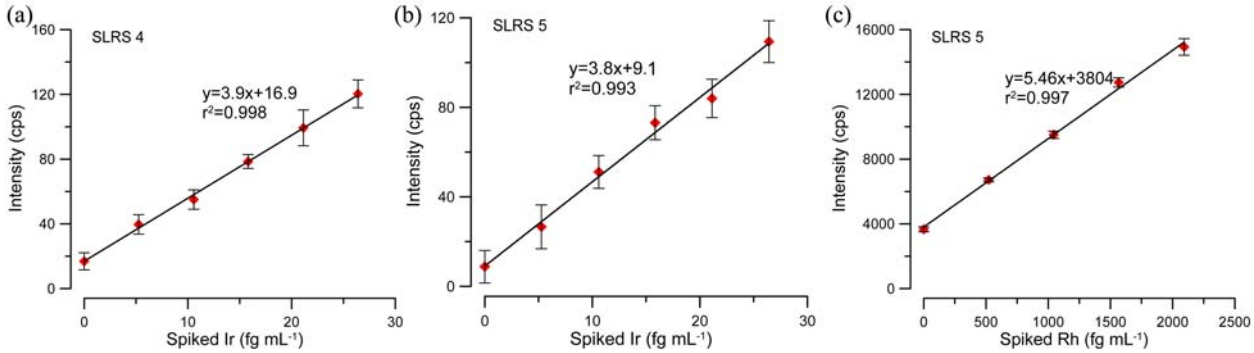

Figure S2. Calibration of the standard addition experiment using PGE standard solutions with a river water matrix. The concentrations of Ir and Rh in river water reference materials were calculated by $C = 2 \times (y/a)$, where C is the concentration, 2 is the correction (dilution) coefficient, y is the intercept and a is the slope.