# Ultra-sensitive determination of femtogram quantities of osmium isotopes in Greenland snow samples

DAECHOL SHIN[1,2], CHANGHEE HAN[2]

JI-HYE SEO[3], MUKUL SHARMA[3]

SOON DO HUR[2], SUNGMIN HONG[1]*

[1]Department of Ocean Sciences, Inha University, 100 Inha-ro, Michuhol-gu, Incheon 22212, Republic of Korea (*smhong@inha.ac.kr)

[2]Korea Polar Research Institute, 26 Songdomirae-ro, Yeonsu-gu, Incheon 21990, Republic of Korea

[3]Department of Earth Sciences, Dartmouth College, Hanover, New Hampshire 03755, United States

Recently, platinum group elements (PGEs: Os, Ir, Pt, Pd, Ru, and Rh) in polar snow and ice cores are of a growing concern (Gabrielli et al., 2004), because the records of changing occurrence of PGEs in the past atmosphere provide clues to unravel natural and human impacts on climate and environment. However, despite that limited data of PGEs in polar snow and ice are available, the determination of Os isotopic ratios in polar archives still remains an analytical challenge, because of extremely low concentrations of Os at a sub-femtogram per gram level.

In this study, we present highly sensitive and ultra-clean analytical procedures to achieve reliable determination of extremely low Os concentrations (~$10^{-15}$ g $g^{-1}$) and its isotopic composition in polar snow and ice. Approximately 50 g of meltwater with $^{190}$Os tracer soluition was heated to 300°C at 100 bar in quartz-glass reaction vessel with a Jones reagent ($Cr^{VI}O_3$). This allows all species of Os to be comletely oxidized to volatile $OsO_4$ via sample-tracer equilibration. The bulk of resulting $OsO_4$ in aqueous solution was then separated and purified using glass distillation apparatus (Chen and Sharma, 2009). All samples were measured using negative thermal ionization mass spectrometry (N-TIMS). Detailed and reliable blank determinations for the successive steps of analytical procedures were carefully evaluated. Using our ultra-senstive and ultra-clean methods, Os concentrations and isotopic composition were determined in central Greenland snow layers. These data are the first comprehensive and reliable data obtained in recent Greenland snow, which show prominent seasonal variations in concentrations and isotopic ratios of Os. The $^{187}$Os/$^{188}$Os ratios in the samples reflect recent inputs of anthropogenic Os to central Greenland snow, particularly originating from automobile exhaust catalysts.