Melting History of Northern Mariana Residual Trench Peridotite: A Re-Os-PGE Study

T.GHOSH[1*], J.E.SNOW[1], A.D.BRANDON[1]

[1]Earth and Atmospheric Sciences, University of Houston, TX, USA. (*correspondence: tghosh2@uh.edu)

To track early melt extraction and re-fertilization events experienced by forearc peridotites collected from the inner trench wall of Northern Mariana, Re-Os isotopes and platinum group element (PGE) concentrations were obtained on bulk samples that spanned a range in Cr# from 0.35 to 0.8. These trench peridotites from Northern Mariana provide an excellent window to examine the extent of mantle wedge melting as a consequence of subduction initiation of the Pacific plate below the West Philippine plate around 52 Ma. The peridotites (harzburgite and dunite), being extremely residual in nature, mainly have preserved spinel along with olivine, enstatite and occasionally interstitial diopside within a serpentine matrix.

Os abundances vary from 1–12 ppb except for three samples where the bulk Os content is ~100 ppt. Bulk rock $^{187}Os/^{188}Os$ ratios range from 0.1133 to 0.1281 making them mostly sub-chondritic but compared to abyssal peridotites, some of the samples are more radiogenic. Irrespective of the lithology, most of the samples are enriched in Ru compared to other PGE. Predominantly, the rocks display PGE patterns reflective of partial melting, where Pt, Pd, and Re go into the produced melt - typical of abyssal peridotites. However, the majority of the dunites show evidence of Re addition to the system without any increase in Pt and Pd. This might signify sea-water interaction and weathering, and accumulation of Re in the peridotites. Conversely, one dunite sample displays clear indication of late-stage melt-rock interaction and enrichment in Pt, Pd, and Re.

Sub-chondritic $^{187}Os/^{188}Os$ values can be attributed to the samples having evolved from a Re-depleted mantle source indicating a previous melt-extraction event. The Re-depletion model ages of 300 Ma to 2 Ga indicate that the early melting events long predate the inception of subduction of the Pacific plate. The late re-fertilization event might be a result of the subduction initiation and subsequent migration of melts in the mantle wedge.