Possible high-PGE-Au silicate melt/aqueous fluid in mantle wedge: Inferred from Ni metasomatism in Avacha peridotite xenolith

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Platinum-group elements (PGE) and gold (Au) have highly siderophile features and favor to be partitioned into metals and sulfides (such as the Earth's core). Among them, IPGE (Os, Ir and Ru) are well partitioned into residues relative to PPGE (Rh, Pt and Pd) and Au during partial melting of mantle peridotite, although PGE are not mobile during low-temperature alteration processes. We found Ni-rich domains in a highly metasomatized mantle peridotite xenolith (#159) from Avacha volcano, the Kamchatka arc, composed of ordinary mantle minerals (olivine, orthopyroxene, clinopyroxene, chromian spinel, and monosulfide solid solutions; MSS) with high-Ni contents, around aggregates of clays rich in Fe, Ni and S [1]. The high-Ni, -Fe, -S clays at the center of the Ni-rich domain show varied colors under the microscope, from yellowish to brownish. Most of them fill interstitices or cracks, but some are observed as globluer inclusions in olivine (Fo$_{93}$). The MSS in this sample #159 rarely have quite thin hydroxide alteration rims. The Ni/(Fe + Fe) atomic ratio of the clays are varied (0-0.7) and show a good correlation with their color; when the Ni/(Fe + Ni) is low, the color of the clay is pale and yellowish. The S content of the clays also varies from below the detection to 66,000 ppm but does not show any correlation with the Ni/(Fe + Ni) ratio. Some clays have an extremely PGE- and Au-enriched feature, and the IPGE concentration is 100 times higher than the chondrite values. The presence of high-Ni halo and chemical zoning of NiO content of olivine from the center (5.3 wt%) to the outward (0.4 wt%) in the Ni-rich domain, the high-Fe, -Ni, -S clays are an alteration product of the metasomatic agent that drastically enhanced the Ni content of the surrounding minerals. We propose these clays were new type of S-rich silicate melt or silicate-bearing aqueous fluid to concentrate PGE and Au in addition to Ni and Fe within the mantle wedge.

[1] Ishimaru & Arai (2008) *CMP* **156**, 119-131.

Processes and timescale of subduction initiation and subsequent evolution of oceanic island arc

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The Izu-Bonin-Mariana (IBM) forearc is thought to be an excellent location for investigating the record of subduction initiation and subsequent arc evolution [1] because of the exposure of early-arc lavas on the forearc islands. Recent dredging and diving in the IBM forearc [2, 3] have revealed a bottom to top stratigraphy of: 1) mantle peridotite, 2) gabbroic rocks, 3) a sheeted dyke complex, 4) basaltic pillow lavas (forearc basalts: FAB), 5) boninites and magnesian andesites, 6) tholeiites and calcalkaline arc lavas. This forearc stratigraphy is remarkably similar to that found in many ophiolites.

The FAB and associated diabase overlying gabbros can be regarded as a first magmatic product produced by decompression melting associated with subduction initiation. ^{40}Ar/^{39}Ar ages of 48-52 Ma for these basalts as well as 51.6-51.7 Ma zircon U-Pb ages for the gabbros strongly imply that subduction initiation took place at 51-52 Ma. The change to flux melting and boninitic volcanism took 2-4 m.y., and the change to flux melting in counterflowing mantle and "Normal" arc magmatism took 7-8 m.y. This evolution from subduction initiation to arc normalcy occurred nearly simultaneously along the entire length of the IBM subduction system. The contemporaneousness of IBM forearc magmatism with the major change in plate motion in Western Pacific at ca. 50 Ma suggests that the two events are intimately linked. Mesozoic rocks found in the deep Bonin forearc suggest that the overriding plate at subduction initiation consisted of Mesozoic terranes.

The similarity between the IBM forearc stratigraphy and many ophiolites supports the hypothesis that the forearc crust section that is produced at subduction initiation and is preserved in the IBM system represents an in-situ section of supra-subduction zone ophiolite.

[1] Stern & Bloomer (1992) *Geol. Soc. Am. Bull.* **104**, 1621-36. [2] Reagan *et al.* (2010) G^3, doi:10.1029/2009GC002871. [3] Ishizuka *et al.* (2011) *Earth Planet. Sci. Lett.* **306,** 229-240