

Highly siderophile element and Re-Os isotope constraints for the origin of ultra-refractory peridotites in the Kamuikotan belt, Hokkaido, Japan

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Studies of peridotite xenoliths from kimberlites have shown that the cratonic lithosphere underlying the Archean crust is particularly depleted in melt components. Ultra-refractory peridotites with supra-subduction zone affinities have been reported in circum-Pacific regions, and may serve as an analogue material for elucidating the geodynamic setting for the formation of the Archean craton. The Kamuikotan belt in Hokkaido is known to host ultramafic bodies originated from highly depleted harzburgites and dunites that occur sporadically along the north-south trending belt [e.g. 1]. Since the entire region is extensively serpentinized, a comprehensive study of the whole-rock chemistry has not yet been undertaken. In this work, we have carried out whole-rock analyses including major, trace, highly siderophile (HSE) and chalcophile element concentrations and Re-Os isotopes, of ultramafic rocks in an area spanning 300 km from north to south in Pinneshiri, Horokanai, Takadomari, and Iwanai-dake.

Despite varying degrees of serpentinization, little effect on immobile trace elements, HSEs, or Os isotope ratios, is inferred from the lack of correlations with loss on ignition (LOI) values. The most striking feature of their whole-rock abundance variations is that highly depleted harzburgites and dunites tend to show greater variations in Os and Ir (Os = 0.001-24 ng/g; Ir = 0.004-17 ng/g). Since strongly fractionated Os, Ir, and Pt patterns are commonly observed in highly refractory residues from circum-Pacific regions such as Papua New Guinea and New Caledonia [2-3], we consider that the generation of a boninitic melt in supra-subduction zone settings is related to the Os-Ir alloy dissolution. In contrast, their ¹⁸⁷Os/¹⁸⁸Os ratios are relatively homogeneous with a peak value of ~0.121, and show no correlation with Os abundances. From these observations, we propose that the Kamuikotan ultramafic rocks are derived from a mantle domain that underwent partial melting at ~1.0 Ga and subsequently acquired highly refractory compositions with unique HSE patterns via recent subduction processes.

[1] Nishio et al. (2023) *JGR*, 128, e2022JB025066. [2] Barrett et al. (2022) *JPET*, 63, 1-30. [3] Secciarri et al. (2020) *Lithos*, 354-355, 105338.