Experimental and geochemical constraints on origin of corundum-bearing aluminous mafic rocks from the Horoman, Japan

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We examined origin of corundum-bearing aluminous mafic rocks from the Horoman complex by means of both experimental and geochemical methods. We concluded that the rocks are possible remnants of subducted lithosphere still retain their original compositions without major chemical modifications during subduction, reheating and exhumation.

High-pressure experiments have been carried out at 1-4.5 GPa, 1100-1400 C, on an aluminous mafic composition, which is the same in major element composition as corundum-bearing mafic rocks in the Horoman Peridotite Complex, Japan. Corundum has been observed both in supersolidus and subsolidus conditions at pressure between 2 to 3 GPa. Kyanite has been observed at > 2.4 GPa. Two possibilities can be considered for genesis of corundum in aluminous mafic protolith. Experimental results suggest that corundum-bearing mafic rocks in the Horoman complex were derived from > 2 GPa , e.g. upper mantle conditions, along with the surrounding peridotite.

Whole-rock trace element compositions of a corundum-bearing mafic rock and related rocks in the Horoman complex were determined by laser-ablation ICP-MS. Variations of trace element compositions among these rocks can be explained by modal variations of plagioclase, clinopyroxene and olivine, indicating that they formed as gabbroic to peridotitic rocks at low-pressure conditions, and the corundum-bearing rock was derived from plagioclase-rich variety of them. These rock show no evidence for partial melting after they formed as low-pressure cumulates. Coronitic texture around corundum shows that corundum was not stable during the later P-T conditions recorded in the Horoman peridotite, which are those of high temperature diapirism. The geochemical evidence for low pressure protoliths combined with the petrological evidence for high pressure metamorphism at > 2 GPa, but without partial melting, define the early history of the Horoman complex. The Horoman complex is an example of a large peridotite body containing possible remnants of subducted lithosphere still retain their original compositions without major chemical modifications during subduction, reheating and exhumation.