Magmatic and hydrothermal platinum group mineralization of the Boula-Nuasahi Area, Odisha, India

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Ultramafic intrusions and chromitite bodies are widely recognized as potential hosts of platinum-group minerals (PGM) [1, 2]. However, not all ultramafic intrusions globally are enriched in PGMs. The Mesoarchean Boula-Nuasahi ultramafic complex (India) hosts PGMs that has considerable economic potential. This PG mineralization is interpreted to have formed by both magmatic and hydrothermal processes and is related to interaction of evolved boninitic magmas with earlier formed cumulates [3, 4]. While PGMs included within unaltered pyroxene and plagioclase in a gabbroic unit are orthomagmatic, the PGMs associated with the altered matrix of a breccia zone are of hydrothermal origin. The former type is insignificant compared to the hydrothermal type which is often associated with base-metal sulfides. PGMs can form before, during and probably after primary chromite precipitation. Earlier investigations and our recent studies demonstrate that the hydrothermal event and the main PGE mineralization formed later than the primary chromite of the chromitite bodies. However, it is not yet resolved whether hydrothermal PGMs have initially crystalized at depth and were hydrothermally transported to the brecciated zone or whether they have directly precipitated from PGE-rich fluids during the brecciation event. Texturally, the PGMs show highly variable grain size (few microns to > 20 μm) and grain shapes ranging from highly irregular grains to large euhedral crystals. The PGM mineralization does also include large zoned laurite grains with Os-rich rims (15 wt.% Os), which is generally interpreted as product of liquidus crystallization at high T and low f_{S2}. The mineralogical and textural variability of the PGMs could therefore reflect superposition of different igneous and hydrothermal processes.

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