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Maggie Hays Ni Deposit: Part 1. Stratigraphic Controls on the Style of Komatiite Emplacement in the 2.9 Ga Lake Johnston Greenstone Belt, Yilgarn Craton, Western Australia

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Abstract
Komatiites occur in many Archean greenstone belts and host significant Ni sulfide ore deposits. Establishing the stratigraphy and the control that stratigraphy has on the emplacement and morphology of ultramafic magmatism is crucial in understanding Archean geodynamic environments and in targeting for Ni sulfide mineralization within these environments.

The ~2.9 Ga Lake Johnston greenstone belt, in the southern portion of the Youanmi Terrane of Western Australia, contains komatiite flows and related subvolcanic intrusions, mafic volcanic rocks, felsic volcanic rocks, banded iron formation, and sedimentary rocks. The stratigraphic sequence is intact, preserving original sedimentary and igneous textures and contact relationships, despite being overturned and variably deformed. This study proposes that the lithostratigraphic succession and ultramafic intrusions identified within the Lake Johnston greenstone belt record a transition from arc- to plume-dominated magmatism, accompanied by the establishment of a banded iron formation-dominated sedimentary basin.

It is proposed that the rheological contrast between the felsic volcanic unit and overlying banded iron formation acted as a stratigraphic barrier, trapping ascending ultramafic magmas. The stratigraphic barrier inhibited the upward ascent of ultramafic magma causing the development of a subvolcanic magma chamber. Magma trapped beneath the banded iron formation progressively inflated and spread out along the contact, until overpressuring breached the banded iron formation and magma escaped, forming the overlying extrusive komatiites. Both the geodynamic and lithologic transitions gave rise to favorable substrate rock units and an ideal tectonic setting for formation of komatiite-hosted Ni sulfide ores.