Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.19010

U-Pb dating and trace element analysis of zircon and apatite in chromitite: constraints on the forearc evolution of the New Caledonia Ophiolite

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Ophiolitic ultramafic rocks are essential for understanding subduction zones and dynamics of mantle-wedge systems. However, they often lack robust geochronological data, limiting understanding of the timescale of processes associated with these systems. Zircon and apatite from a chromitite (a sample of 20 kilos) from Massif du Sud of New Caledonia were investigated and their relationships with associated intrusions from the Peridotite Nappe were examined. U-Pb dating and trace element analysis of zircon and apatite, as well as U-Pb dating and Hf isotopic analysis of zircon from adakitoid intrusions, provide new insights into magmatic processes involved in the crystallization of these minerals and the evolution and thermal history of the Peridotite Nappe.

U-Pb dating of zircon and apatite from the chromitite yields Early Eocene ages. Both minerals exhibit geochemical characteristics similar to those observed from intermediate to felsic slab melts (adakitoids). Zircon U-Pb ages and Hf isotopes from the adakitoid intrusions reveal similar ages to those minerals dated in the chromitite and exhibit a narrow range of juvenile εHf(t) values. These findings suggest that zircon and apatite in chromitite might have formed through the percolation of adakitoid-like melts originating from the intrusions.

Additionally, the overlap between zircon and apatite ages, both of which have different U-Pb system closure temperatures, indicates that concordant chromitites at the south of the Peridotite Nappe were at low temperatures (< 600 ^{o}C) during the adakitoid melt percolation. These results, together with available geochronological data, indicate that ultramafic rocks from the Massif du Sud were formed and cooled in a short period of time and constrain a dynamic nature for the evolution of this ophiolite mantle-wedge system.