Carbonation and silicification of the New Caledonia peridotite Nappe: a stable isotope survey

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The ophiolite of New Caledonia (Southwest Pacific), known as the Peridotite Nappe, has been subject to tropical weathering since its emersion during the Oligocene. Silica veins at the base of the weathering profile and magnesite veins along the serpentine sole structurally ≈ 400 – 800 m beneath the laterites are attributed to downward infiltration of meteoric waters enriched in dissolved atmospheric CO_2, carrying Mg and Si released by lateritization of the peridotite. The oxygen isotope composition of magnesite and silica veins confirms this model. However, temperatures of quartz formation are higher than expected for a lateritization process. Heat released by exothermic serpentinization and/or ascent of fluids from the serpentine sole are required to explain this difference.

Locally, listvenites of the serpentinite sole contain a variety of silica phases associated with magnesite. These rocks have low $\delta^{18}O_{Mgs}$ values (19.5 to 22‰) compared to meteoric-derived magnesite veins (27.5 to 30‰), a feature that suggests the involvement of deep-seated fluids. The $\delta^{18}O$ values of quartz span a large range of values, some of which are lower than those of quartz from the weathering profile. The homogenization temperatures of fluid inclusions within a hydrothermal quartz vein have a consistent range from 145 to 225°C. Listvenites are thus likely related to the upward circulation of deep-seated fluids perhaps during the nappe emplacement (late Eocene – early Oligocene) or in association with granitic magmatism (Oligocene). The oxygen isotope compositions of magnesite and quartz thus record a variety of conditions, which relate to the evolution of Peridotite Nappe, including obduction, magmatism and lateritization.

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