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Structural control on supergene nickel deposits explored by heliborne electromagnetic surveys in New Caledonia

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Obduction of mantle peridotites occurred in New Caledonia in latest Eocene time. The ultramafic allochthon referred to as Peridotite Nappe covers the southeastern third of the island (Massif du Sud) and crops out in a series of klippen aligned NW-SE along the west coast. Since its emersion in Oligocene time, the Peridotite Nappe has experienced tropical weathering and thick Ni-bearing laterite development. During this period, the fracture system (pre-obduction dikes, serpentinitised, and un-serpentinitised faults and joints) played a prominent role on water circulation in these otherwise impermeable rocks and hence tightly controlled nickel mobility.

The prominently variable regolith thickness and irregular topography of the bedrock need a very dense and expensive drilling program to be set up for nickel mining exploration. Therefore, the search for more effective methods to be tested in this geological context has become a major challenge. With this in mind, a heliborne magnetic and electromagnetic survey was flown, with SkyTEM304 system, on three sites representative of the variability of nickel deposits in New Caledonia: Port Boisé-Goro to the south, Boulinda and Koniambo massifs to the north. Electromagnetic results provide a 3D view of rocks conductivities up to 300 m allowing imaging the regolith thickness. In addition, interpreted specific magnetic and electromagnetic signatures of serpentine and dikes allow exploring the structures of the underlying protolith. These electromagnetic data cross-interpreted with previous structural studies and fracture analysis in already mined nickel deposits is expected to improve the geological knowledge of the ophiolite in order to build new predictive models for supergene nickel ore deposits.

