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# Structure of weathered and fractured peridotites of New Caledonia: from field data to simplified modelling

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The Peridotite Nappe obducted on New Caledonia in Late Eocene [1]. Since its emersion in Oligocene, a deep weathering profile developed and now covers the fractured and serpentinized peridotites. From a structural point of view, fracturing and related serpentinisation of the Peridotite Nappe span over a long period (ca. 100 Ma) and correspond to a general low temperature hydration and cooling of the mantle protolith. Thus, the ultramafic rocks outcrop over more than one third of New Caledonia and the associate regolith leads to Nickel ore deposits mined on scattered massifs all over the island. The weathering profile consists in, from top to bottom, one hard layer of ferricrete, a semi-impervious layer of laterites (also termed 'red laterites') and saprolites ('yellow saprolites' or 'fine saprolites'), and a saprock that consists of coarse saprolites and a fissured zone within slightly weathered peridotites. Considering fracturation of peridotites and the fractured layer as a constitutive part of the aquifer is a new way of building the aquifer model as till now substratum of the aquifer was considered a few meters deeper than the bottom of the saprock layer [2], or at least the bottom of the nickel ore deposits layer. Measurements and characterization of distribution of fractures along depth rely on borehole observations of four 200 m deep boreholes. Highly fractured and weathered zones have been isolated and the fracture frequency and equivalent hydraulic conductivity are extracted from field test results.

We document the location of the upper and lower limits of the main aquifer system which appears to be closely dependent from the weathering processes [3]. We suggest that this saprock aquifer refers to the transition zone between saprolites and fresh bedrock and corresponds to an incremental evolution of the hydraulic conductivity that increases from the saprolites to the fissured bedrock and decreases until the aquitard fresh bedrock. As a consequence, the thickness and hydraulic parameters of the saprock remains one of the key issues for water resources management using groundwater modelling. Depending of the definition of the saprock aquifer, various hypotheses could lead to erroneous results used for numerical modelling for water resources assessment undertaken by mining companies. Based on a general conceptual model describing the multi-layered aquifer patterns, we use a 2D finite elements model in order to produce tests of sensibility and robustness, varying of saprock geometry. The simulations results are assessed according to hydrodynamic data observed in boreholes.

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