MRS and electrical prospection in the context of weathered peridotite rocks in the South of New Caledonia.

Jean-François Girard, Jean-Michel Baltassat, Pierre Maurizot, A. Legchenko, Benjamin François

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Girard[1*] J-F., J-M. Baltassat[1], A. Legchenko[2*] A., S. Morlighem[3], I. Domergue- Schmidt[3], P. Maurizot[4], J-L. Folio[3] and B. François[1]

[1]BRGM, Orléans, France; [2]IRD / LTHE, Grenoble, France; [3]VALE, New Calédonia. [4]BRGM, Nouméa, New Caledonia;
jf.girard@brgm.fr

In November 2011 and July 2012 were conducted geophysical prospections in the southern part of New Caledonia. Both electrical tomography (ERT) and Magnetic Resonance Sounding (MRS) were performed to obtain a better understanding of the water storage and circulation. The geological context is the weathering profile of peridotite rock (Maurizot and Vendé-Leclerc, 2009).

In such environment, the general distribution of geology is (from surface to depth), the iron cap, laterite (red and yellow), saprolite, fractured and then fresh bedrock. The lateritic profile is developed over a thickness ranging from 20m to 60 m.

Electrical imagery is a well-established method to detect variations in depth and laterally in this geological context (Robineau et al., 2007) and is routinely used in mining exploration and exploitation to estimate the thickness of laterite.

Hydrogeology in this environment is complex because water flows in heterogeneous media: infiltration trough the iron cap, unsaturated zone, fractured bedrock. As a consequence, various regimes of hydrological responses are observed, from low permeability (laterite) to high permeable zones (fractured zone and locally "pseudo-karst" behavior).

MRS as a tool to detect directly water and provide insight of higher permeable zone sounds attractive in such a context. The sites studied are well documented thanks to pre-existing boreholes logs and hydrogeological studies.

Difficulty to perform MRS there is link to two major reasons. First, the rocks present non-negligible magnetic susceptibility. Despite surface measurement of the geomagnetic field revealed to be relatively homogeneous at the loop scale (< 100 nT variation), standard Free Induction Decay (FID) MRS measurement appeared to be un-practicable (like observed by Roy et al., 2008). The average magnetic susceptibility is 5 10^{-4} SI and it proved to be suitable to perform MRS measurement in Spin Echo (SE) mode (Roy et al, 2009, Legchenko et al., 2010, Vouillamoz et al., 2011).

The second difficulty is link with the very fine structure of laterite, where a large part of water is not detectable by MRS like bound water in clay. But the high yield zones revealed to produce a clear MRS signal in SE mode.

We present a review of the various ERT and MRS responses observed in this context.

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