Paleomagnetic dating of ferricretes in New Caledonia: constraints on the morphogenesis of the Grande Terre

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Although the description of the emplacement and the weathering of the New Caledonia peridotites are well documented in the literature, the knowledge and the age of the planation surfaces formed upon the ultrabasic massifs are poorly documented. Despite the important volume of recent studies on the weathering profiles development, ambiguities remain on the timing and modality of weathering and formation of supergene nickel ore and also on the role of the parameters controlling its evolution:

- geometry of the ophiolitic nappes and possible inherited structures from the obduction history,
- petrology of the ultrabasites (proportions of dunite, harzburgite, gabbro, more or less serpentinized...),
- geomorphological evolution related to recent tectonics,
- paleogeographic and paleoclimatic evolution of the New Caledonia after the end of the obduction and after the intrusion of the last granitic plutons, ie in the Pacific realm and during the last 35 to 25 Ma.

Several planation surfaces have been recognised along the island since the beginning of the twentieth century and their correlation in the southern part of the Grande Terre has been done (Chardon and Chevillote, 2006), but no reliable ages could be attributed. Authors demonstrate implications concerning recent movements. Furthermore several questions remain unresolved.

- Are all planation surfaces of the same age? Are they deformed on a regional scale?
- Or are there stepped planation surfaces of different ages? Are differences in elevation linked to variations in uplift rate?
- Are there 1, 2 or more generations of weathering profiles associated to the planation surfaces identified? Are they different in petrography, mineralogy and geochemical nature, and possibly related to different ages and thus different paleoclimatic and/or geodynamic evolutions?
The weathering being still active on the peridotites in the current differentiated landscape and in the current tropical climate, the beginning of the ferruginisation is not well constrained and estimated to have occurred between 34 Ma (end of the obduction) or 25 Ma (last granitic intrusions) and Actual.

The processes of absolute dating are not relevant to lateritic weathering profiles of New Caledonia (K-Mn oxides are poorly concentrated). Nevertheless ferricretes and various ferruginous materials are largely present in the weathering profiles and in the fluvio-lacustrine sediments as well. They have the potential to record the ancient geomagnetic field providing means of age determination. In tropical soils, most of the primary remanence carrying minerals are dissolved during weathering and secondary magnetic minerals, such as goethite and haematite, are formed in situ acquiring a crystallisation (or chemical) remanent magnetization (CRM). The paleomagnetic pole recovered by demagnetizing the CRMs are plotted on the local apparent polar wandering (APWP) reference curve, providing an age for the different parts of the paleoweathering profiles.

The data and interpretations we present here are based on paleomagnetic analysis of ferricretes capping the weathering profiles along the Grande-Terre. Well constrained ages have been obtained for the first time ever: 0-5 Ma to 25 Ma in Goro in the South highlighting possible stepped paleosurfaces; 25 Ma in 4 subsites along a section crossing the Tiebaghi plateau in the North-West. These paleomagnetic data give the first dating results which help to constrain the morphogenesis of the Grande Terre paleolandscaes. They enable reliable correlation of the planation surfaces.

These datings and the future ones to obtain from the ferricrete from other weathering profiles and from ferruginous materials studied in the fluvio-lacustrine sediments are of primary importance to discriminate the different paleosurfaces, to refine the deepening steps of weathering and therefore to constrain the timing of lateritization processes.

A comparison with isotopic curves and paleoclimatic evolutions at a global and a regional scale in the Pacific during the Neogene, additional isotopic data on Fe oxides from the same ferricretes and from kaolinites sampled in weathering profiles developed above other rocks upon similar planation surfaces, additional thermochronological data, and petrographic studies of the weathering profiles from the ferricrete until the non weathered bedrock should help to decipher the relative roles of climate, tectonics and nature of the parent rocks.