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Fossil Fluvio-Lacustrine System of the Southern Grande Terre of New Caledonia : Paleo-environmental Archives and Dynamics of Trace METALlic Elements (TME)

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Located in the south-west Pacific, New Caledonia is an archipelago with a complex geodynamic history. Grande Terre, the main island, is covered by more than 25% of regolith developed on ultramafic rocks. These peridotites, naturally enriched in metallic elements (Fe, Al, Ni, Co, Cr), constitute most of the southern part of New Caledonia. Since approximately 27 Ma, these rocks have undergone weathering (under a humid tropical climate) and erosion. This combination has led to the formation of the fluvio-lacustrine system, by accumulation of sediments eroded from local summits in depressions and valleys.

The distribution of the fossil fluvio-lacustrine system in New Caledonia has been mapped by Folcher N. (2016). The sedimentary filling of this system is essentially of fluvial origin, with rare lacustrine occurrences. Its structure is complex and some sedimentary levels show abnormally high accumulations of Trace Metallic Elements (Ni, Co, Cr). Thus, the METAL FLAP thesis project aims to understand how the geodynamic history, paleoenvironmental evolution, and diagenetic processes within the fluvio lacustrine formation influence the dynamics of metallic elements and their potential transfer to the modern fluvial system?

In one of the sub-basins of the system (the basin of the pirogue river), the relationships between geochemistry and structures have been studied at the edges of two types of objects: horizontal indurated beds and vertical ferruginous partitions. The first results suggest that these two types of structures, which have different formation origins, strongly impact the distribution of elements in sediments (enrichment in Cr, depletion in Fe, etc.). The vertical partitions are thought to be related to fluid circulation in basin fractures, while the formation of horizontal indurated layers is believed to originate from fluctuations in groundwater levels. The quantification of the contribution of each phenomenon to the dynamics of elements is still poorly defined but constitutes one of the major focuses of this study.

Furthermore, a detailed analysis of the system's architecture and a thorough sediment characterization, coupled with the study of the few fossils present in the formation, shed light on the paleoenvironmental history of the region during deposition. This also provides assistance in understanding the geological processes affecting the formation of the fluvio-lacustrine system, as well as the dynamics of metallic elements in the land-sea continuum. This fossiliferous continental system in the southern region is one of the least studied formations in the area, despite the wealth of information it holds about the geodynamic history of New Caledonia during the last post-obduction cycle.