



Geology and geochemical evolution of the ophiolitic belts in Guatemala. A field guide to nickel-bearing laterites

R.A. Valls Alvarez

Nichromet Extraction Inc., Toronto, Canada (vallsvg@aol.com)

The Caribbean Plate is the result of the Mesozoic-Present interaction of the Nazca, Cocos, North, and South American plates. The margins of these plates are large deformed belts resulting from several compression episodes that started in the Cretaceous and had been followed by tensional and strike-slip tectonics.

The present day north-western margin of the Caribbean Plate crops out in Guatemala along the Motagua Suture Zone (MSZ). The MSZ represents a sinistral shear-zone between the Maya Continental Block to the north and the Chortis Continental Block to the south. The MSZ includes the fault systems of Polochic, Motagua, Cabañas, Río Negro and Jocotán. All these are E-W and ENE-WSW strike-slip faults. Some of them are still seismically active. The MSZ also includes E-W uplift structures (Sierra de Chuacús, Sierra de Las Minas, and Montañas del Mico), and pull-apart basins like the one responsible for the formation of the Lake Izabal, and N-S oriented grabens (Chiquimula, Guatemala, etc.).

In Guatemala, only the rocks from the South and North Motagua ophiolitic complexes are classified as harzburgites (trench wall), while the rest are a mix of dunite, olivine-rich lherzolites; normal lherzolites and olivine websterites more typical of an Island Arc environment. The absence of plagioclase is also common among these rocks. Existing data indicate that these rocks underwent fractional crystallization and probably some degree of magma mixing and contamination prior to their main tectonic event.

Most of the rocks from the Sierra de Santa Cruz (SSC), the Juan de Paz-Los Mariscos (JPZ), and the Baja Verapaz (BVP) complexes contain Ni-bearing minerals in the form of Ni-Fe alloys (Awarite), sulfides (pentlandite, millerite), silicates (serpentine) and

oxides (goethite). All the known lateritic deposits are constrained to these complexes.

The Geosol Izabal is a new stratigraphic unit defined by the author within the SSC ophiolitic complex. The Geosol Izabal is composed of the following five pedosols:

- a. Gossan or Iron-Silica Cap (a.k.a. Ferricrete)
- b. Limonitic Horizon
- c. Stoneline Horizon
- d. Mottled Zone Horizon (a.k.a. Transition Zone)
- e. Saprolitic Horizon

The Saprolitic Horizon lies over a Saprock Horizon, which lies directly over a less weathered bedrock of the SSC ophiolitic complex. The most complete profiles are usually presented over weathered olivine-rich rocks, while on top of the less altered pyroxenites there usually forms only a limonitic horizon. This Geosol is common for all the ophiolitic complexes in Guatemala

The Geosol Izabal represents an immature wet lateritic profile, which develops mainly as large pockets controlled by tectonics and the presence of olivine-rich rocks. The most striking difference from other wet laterites is the presence of up to 30% magnetite (which carries nickel grades of 1.5 to 2% associated to nickel sulphides) within the Saprolitic Horizon, which is another indication of the relatively young age of these laterites. The presence of these large amounts of magnetite also allows the use of aeromagnetic surveys for the identification of these targets.

This publication is the result of over three years of field exploration and it represents the most current knowledge about the regional geology, petrology, and geochemistry of the ophiolitic belts in Guatemala which are located within the Motagua Suture Zone in Central Guatemala.

This last edition includes a more complete stratigraphic section and updated geological information. All field names of the units have been changed to proper petrographically-identified terminology, and I also included new description points for the field guide.

As always, I would like to acknowledge the influence that this publication had from the 2002 field trip guidebook prepared by G. Giunta et al., as well as from the 1985 Preliminary Stratigraphic Lexicon for North and Central Guatemala compiled by S. A. Millan. I combined information from these milestone works with my personal experiences in the mapping of the area and that of Oscar Pinzón, Julio Roberto Pérez, and other geologists from the Guatemalan Ministry of Energy and Mines. This publication has also benefit from discussions with several geologists and consultants that have vis-

ited the area over the last three years, like Velasquez Spring, Gordon Glenn, Michael Hitch, Jim Steel, Rob Callander, John Redstone, Lineu Saboia, Petronila Ronze, Cesar Ferreiro, and Carlos Rodriguez just to mention a few.