©2004 by Economic Geology
Vol. 99, pp. 1197–1213

The Mineralogy and Geochemistry of the Cerro Matoso S.A. Ni Laterite Deposit, Montelíbano, Colombia

S. A. Gleeson,†,* R. J. Herrington,

Department of Mineralogy, Natural History Museum, London SW7 2BP, United Kingdom

J. Durango, C. A. Velásquez,

Cerro Matoso S.A.,Calle 114 no.9-01 Torre A Piso 5, Ofc. 509, A.A. 110027, Bogotá, Colombia

and G. Koll

GK Consulting, 170 Nigel Road, Springs 1559, South Africa

Abstract

The Cerro Matoso S.A. Ni laterite deposit in northwest Colombia is an important producer of ferronickel; expanded production of ferronickel is planned to be 55,000 Mt by mid-2004. The deposit is developed over a peridotitic protolith that is exposed in the form of an elongated hill. The deposit's weathering profile is variable both vertically and laterally, and 10 distinct lithostratigraphic units have been characterized.

Two typical sections through the weathering profile were sampled from an area of the mine with high (pit 1) and lower (pit 2) Ni grades. Bench mapping has shown that pits 1 and 2 have distinctly different weathering profiles. From bottom to top, the profile in pit 1 is weakly serpentinized peridotitic protolith → saprolitized peridotite → green saprolite (main ore horizon) → "tachylite" (used by mine geologists to describe an enigmatic Fe oxide horizon) → black saprolite → yellow laterite → red laterite. The sequence is then capped by a magnetic to nonmagnetic ferricrete known locally as "canga." The succession in pit 2 is from serpentinized peridotite → saprolitized peridotite → brown saprolite → yellow laterite → red laterite and lacks the green saprolite ore horizon. All the units in pit 2 have currently uneconomic Ni grades. The thickness of the units is highly variable, but most of the major horizons have maximum thicknesses of the order of tens of meters. Both pits contain abundant fault- and joint-related silicate veins, sometimes in stockworks, in the lower part of the sequence. These veins contain the distinctive green mineral known as "garnierite" (actually pimelite, a form of nickeliferous talc) as well as quartz and chalcedony, and they can have a Ni content of up to 30 to 40 wt percent.

The bulk geochemistry in most units of both profiles shows a fairly typical Ni laterite pattern, in which MgO and SiO_2 are depleted toward the top of the sequence whereas FeO increases. Mineralogic studies confirm that the protolith in both pits is a partly (up to 50%) serpentinized harzburgite and that, in pit 1, the main Ni-bearing phases in the weathering profile are Ni sepiolite, Ni serpentines, and other hydrous silicates. The garnierites in Cerro Matoso have been identified as pimelite in which various amounts of Ni have substituted for Mg. The upper part of the sequence is dominated by amorphous and crystalline Fe oxide phases. The magnetic canga is composed mainly of maghemite that may have been produced by oxidation of magnetite-rich units. The mineral content of pit 2 is dominated by poorly structured Fe oxides or goethite and by subordinate clay minerals and quartz.

The geochemistry and mineral content of the deposit suggest that, as in many other Ni laterite deposits, ore genesis is strongly controlled by local climate, topography, and drainage. Mass balance calculations indicate that the profiles in pits 1 and 2 had different weathering histories, because the degree of profile collapse and residual enrichment in pit 1 is far more extreme than that in pit 2. This difference may be the result of different degrees of serpentinization of the protolith in the two pits and potential dilution of the ore in pit 2 by input from an exotic unit. Ni in the deposit has also undergone supergene enrichment resulting from the leaching of Ni from the upper part of the lateritic profile and its transport to the green saprolite unit, where the Ni was fixed in silicate minerals.

† Corresponding author: e-mail, sgleeson@ualberta.ca
* Present address: Department of Earth and Atmospheric Sciences, University of Alberta, Edmonton, Alberta, Canada T6G 2E3.

0361-0128/01/3453/1197-17 $6.00