Portable XRF for Nickel Laterite Exploration, Grade Control, and Processing

Olympus portable X-ray fluorescence (pXRF) instruments, including the Vanta™ XRF analyzer, provide high-performance, real-time geochemical data for rapid multielement characterization of soils, rocks, and ores. Recent, major advances in pXRF technology have improved the limits of detection and the number of elements measured, while significantly reducing analysis test times. pXRF is now used as an effective tool for determining nickel content and estimating ore value as well as maintaining a constant ore feed into the extraction process.

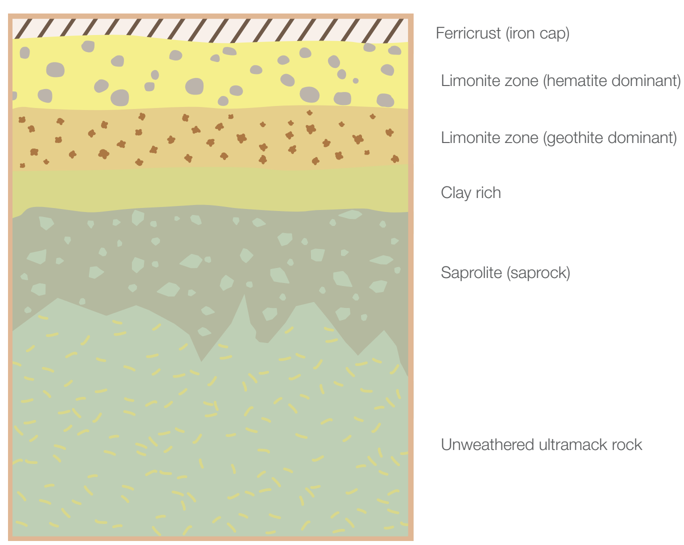
Nickel Laterite Geology

Nickel is found in two key types of deposits; nickel laterites and magmatic (volcanic) sulfide deposits. Although nickel laterites contain around 70% of nickel reserves, most historical nickel production has come from nickel sulfides. This tendency is changing as nickel sulfide reserves deplete and the world's consumption of nickel grows steadily each year. Another favorable by-product of mining nickel laterites is their concentration of cobalt, which is specifically valuable due to the rise of battery metals.

Nickel laterites are the result of the intense weathering of nickel-bearing ultramafic bedrock that formed through prolonged chemical and mechanical weathering in wet, warm tropical environments. Nickel laterites have long tabular bodies that spread over several hundred meters, but are only tens of meters deep. These deposits consist of a predictable weathering profile that includes five zones (below): unweathered ultramafic bedrock, weathered bedrock or saprolite, a clay-rich layer, a limonite zone, and a ferricrust or iron cap.

A Vanta pXRF analyzer being used to sample stockpiles

Active open cut mine faces in New Caledonia



A generalized cross section of nickel laterite deposits.
Source: www.geologyforinvestors.com/nickel-laterites/

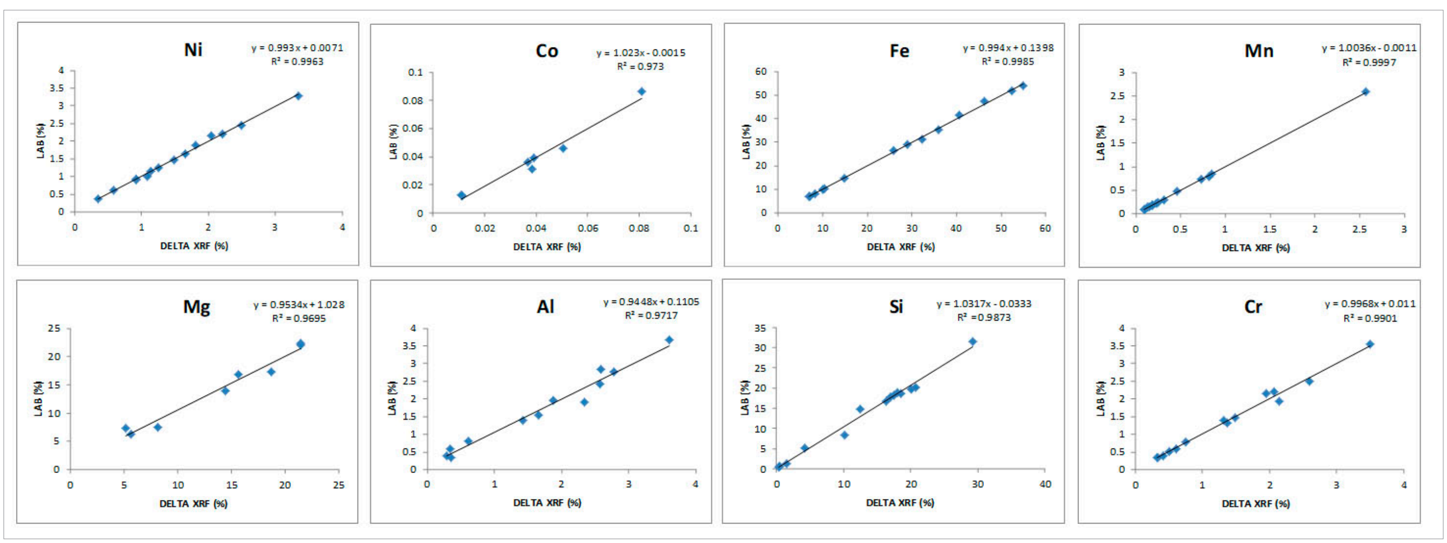
The Use Case for pXRF

Because of the shallow, tabular ore body geometry of nickel laterites and the open cut mining methods employed to extract the nickel, pXRF can be effectively used across the whole mining value chain for most of the key element suite (Ni, Co, Fe, Mn, Mg, Al, Si, and Cr). Blending a constant ore feed is critical to optimizing Ni and Co recovery because processing and extraction of nickel laterites often require very large-scale acid leaching or roasting in rotating kilns or autoclaves. Consequently, pXRF is often employed from the exploration phase (diamond and percussion drilling), to grade contro during mining (trenching and face sampling), run-of-mine (stockpile management and blending), as well as for analyzing final concentrate grades prior to shipping out to a smelter.

Dealing with Moisture Content

One of the challenges of using pXRF on laterite deposits is dealing with the inherent variability in moisture content when sampling in situ. Moisture creates variation in the pXRF results as it interacts with the X-rays, attenuating the signal received back to the detector. This often results in an underestimation or low-bias in the reported results. This bias can be corrected by generating moisture-specific calibration methods or by various drying techniques. This can be as simple as sun-drying the samples in plastic or aluminium containers or using portable drying equipment, such as a propane torch or small, field-portable ovens.

Field photos showing the various use cases for pXRF on a nickel laterite project:
On diamond drill core, face sampling, stockpile sampling and concentrates in the laboratory



Project-specific pXRF calibration data for nickel laterite (saprolite) deposit in New Caledonia.

www.olympus-ims.com

OLYMPUS

OLYMPUS CORPORATION OF THE AMERICAS
48 Woerd Avenue, Waltham, MA 02453, USA, Tel.: (1) 781-419-3900
110 Magellan Circle, Webster, TX 77598, USA, Tel.: (1) 281-922-9300

For inquiries - contact
www.olympus-ims.com/contact-us

Nickel_in_Laterites_AppNote_201804 • Printed in the USA • P/N 920-556-EN Rev. A