HIGH RESOLUTION ELEMENTAL, MINERAL AND ISOTOPIC ASSESSMENT OF CYCLES OF THE VACA MUERTA FORMATION, ARGENTINA

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PROJECT OBJECTIVES

- Conduct an elemental, mineralogical, and isotopic calibration of the depositional cycles of the Vaca Muerta Formation.
- Correlate elemental logs from short cores using X-ray Fluorescence (XRF) to the mineralogy retrieved from X-ray Diffraction (XRD), Near-Infrared Spectroscopy (NIR), and Hyperspectral Core Imaging (HCI).
- Compare the mineralogy in outcrops from XRD, thin sections, NIR and HCI measurements.

PROJECT RATIONALE

The early Tithonian-Valanginian Vaca Muerta Formation contains cycles of fine-grained calcareous and siliciclastic sediments (Fig. 1), the total organic carbon (TOC) varies through different stratigraphic levels and basinwide. Short-cores (~1m in length) drilled in different stratigraphic levels and different positions of the basin preserve in great detail sedimentary structures and also facilitate the study of the continuous (vertical) lithologi-cal and geochemical variations. Elements and minerals retrieved from short cores and/or outcrops using XRF, XRD, NIR and HCI technologies will provide for the first time a very detailed and continuous mineral calibration of the studied sections in the VM fm.

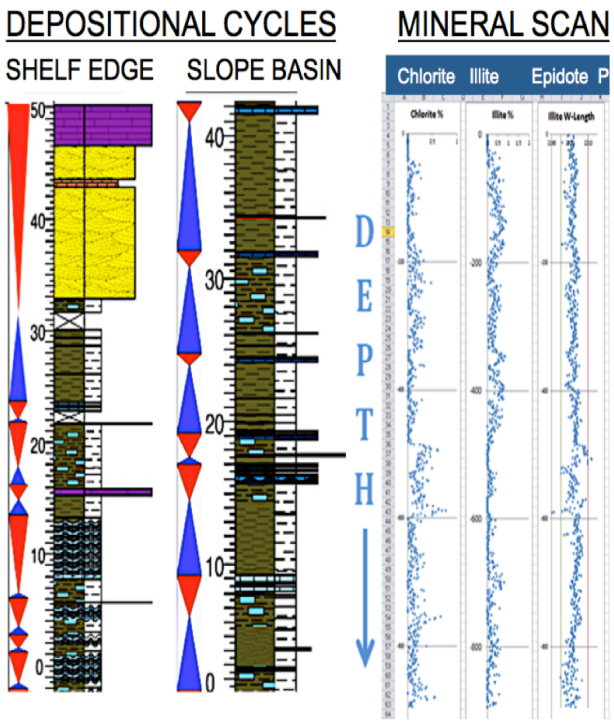

Figure 1. Left: Cycle-sets of the Vaca Muerta Formation in different positions of the basin. Right: Example of minerals calculated in a core using HCI system (image modified from www.corescan.com.au.)

SCOPE OF WORK

Measure minerals every 1m using the TerraSpec Halo mineral identifier (NIR system) in different measured sections in the Sierra

de la Vaca Muerta (proximal) and Puerta Curaco (distal). Calculate minerals, mineral alterations and changes in mineral crystallinity, as well as changes related to geochemical conditions in 80 short cores from outcrop using HCI and NIR systems (Fig. 2). Compare the lithological and the geochemical (NIR, HIC, XRD, XRF, TOC, $\%CaCO_3$, and $\delta^{13}C$ and $\delta^{15}N$ values) results to find associations and variations for a calibration of the logs and cycles. Outcrop analogs and cores from outcrop can aid in understanding the cyclicity and facies distribution and variability in a basin.

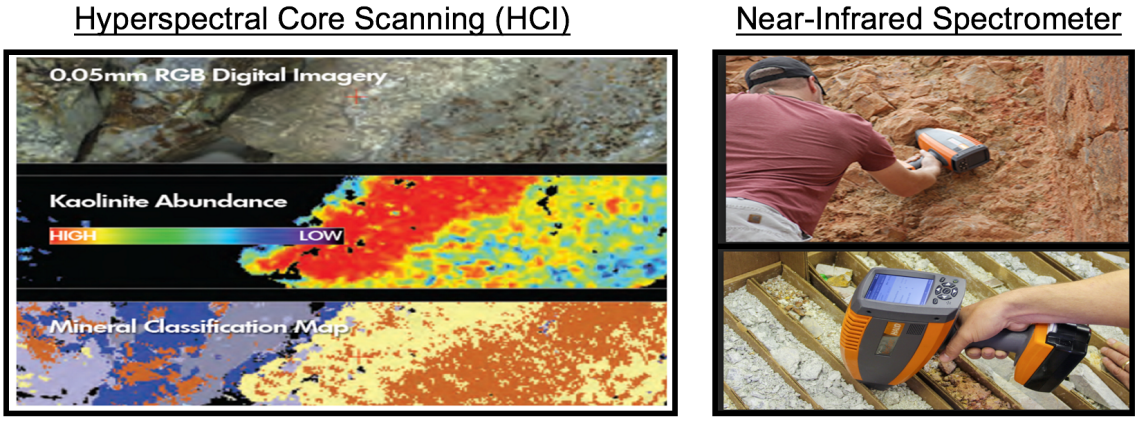

Figure 2. Left: Example of a core scanned for mineral identification using HCI system (image modified from www.corescan.com.au). Right: TerraSpec Halo mineral identifier handheld device being used in the field and in the lab (image modified from www.panalytical.com).

EXPECTED RESULTS AND SIGNIFICANCE

The high-resolution characterization of cores and outcrop from different stratigraphic levels and positions within the Neuquén Basin will be completed using geochemical approaches that include mineral identification using NIR, and hyperspectral core scanning techniques. Additionally, a correlation among minerals, elements (XRF), carbonate content, isotopes and lithofacies will aid in understanding the processes forming and/or disturbing the cycles within the stratigraphic sequences and also will give information about provenance and diagenesis of sediments.

A high-resolution geochemical and lithological study of the cycles in outcrops and cores from proximal and distal positions within the basin is required in order to quantify basinwide variations and to correlate them to log data. The lithological and geochemical signals placed into the already established stratigraphic framework will provide the basis to predict cycles in sectors of the basin with wells but without sediment cores.