LITHOLOGIC AND GEOCHEMICAL CALIBRATION OF THE BASAL CLINOFORMS IN THE SIERRA DE LA VACA MUERTA, NEUQUÉN BASIN, ARGENTINA (YEAR 2)

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PROJECT OBJECTIVE

- Reconstruct in detail the geometry of the early to late Tithonian clinoforms in the southern, proximal portion of the basin in the Sierra de la Vaca Muerta that contain the first high TOC interval in the Neuquén Basin.
- Place the mixed carbonate-siliciclastic facies into the shelf-margin clinoforms and produce a detailed model of the depositional processes.
- Correlate high-resolution geochemical logs with lithological logs in the different depositional sub-environments to produce a geochemical calibration of the various facies.

PROJECT RATIONALE

The dynamics of sedimentation in muddy mixed carbonate-siliciclastic systems, especially those that form unconventional reservoirs, is still in an exploratory phase. The Vaca Muerta (VM) Formation in the Neuquén Basin is one of these systems. In this mixed carbonate-siliciclastic prograding system the carbonate content, the total organic carbon, and the motif of the depositional cycles vary throughout the basin in a systematic manner (Leanza et al., 2011; Zeller et al., 2015). Outcrops in the Sierra de la Vaca Muerta (SdlVM) expose the early to late Tithonian clinoforms that fill the basin in a southeast to northwest direction (Fig. 1). A 3D terrain model using high-resolution, digital elevated satellite imagery allows the calculation of vertical

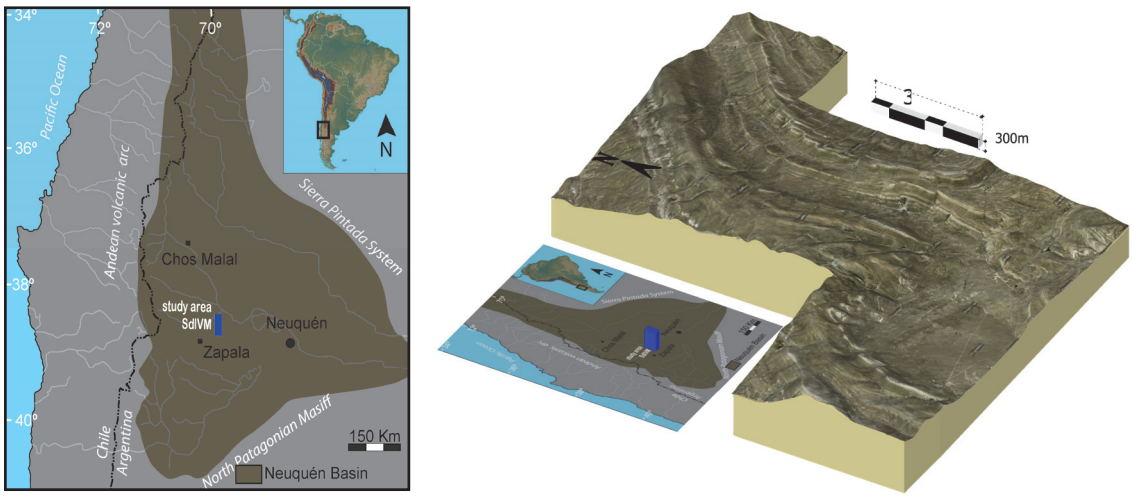

Figure 1: Left: Location map of the study area in the Sierra de la Vaca Muerta (Blue box). Right: 3D terrain model of the outcrop area in which clinoform geometry, and their lithologic and geochemical content, will be studied.

and lateral distances, improving the assessment of lateral and vertical variations of bed thicknesses and depositional geometries within these clinoforms. Previous sedimentologic studies of outcrop and subsurface data produced various depositional models, in which the interpretation of the depositional environment and the mode of sediment transport of the Vaca Muerta- Picun Léufu-Quintuco system varies widely. In this study of the lithological and geochemical variations in clinoforms exposed in the SdlVM we expect insights into other controls beyond the sea-level fluctuations that generated this mixed-system of prograding clinoforms.

PROJECT DESCRIPTION

In this study, the lithological and geochemical characteristics of the shelf margin clinoforms are analyzed within a detailed geometrical framework derived from a 3D terrain model (Fig. 1). The digital terrain model is constructed from high-resolution satellite imagery collected by DigitalGlobe satellites and stitched using the *Sketchup* software.

Nine sections within the terrain model serve as the calibration for a transect that covers ~25 km and a vertical succession of 716 m in a downdip direction of the oldest clinoforms. For the chemical calibration, 733 samples were analyzed for carbonate (%$CaCO_3$), total organic carbon (%wt TOC) content, and for organic $\delta^{13}C$ and $\delta^{15}N$ isotopes. A total of 985 samples (including duplicates) were studied for mineral composition using the ASD TerraSpec Halo mineral identifier, a near-infrared portable spectroscope. Correlations between the detailed logs and core descriptions, and the geochemical findings, will aid in the definition and interpretation of facies and cycles.

PRELIMINARY FINDINGS

The prograding shelf-margin clinoforms in the Sierra de la Vaca Muerta exhibit a sigmoidal geometry that, together with their low angles, controls the sediment partitioning into and across the basin. Clinoforms that exhibit relatively steep shelf edges are capped with carbonate-rich beds and are associated with large mass-transport complexes. In contrast, clinoforms with low angles that are made of calcareous-mudstones and sandstones contain small slumps. The clinoforms are fronted by mud-dominated bottomsets. Sedimentary structures and lateral thickness variation of the bottomset indicate bottom currents. Siliciclastic and carbonate mineral assemblages display a cyclicity that reflects sequence stratigraphic divisions.

REFERENCES

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