High-resolution Chemostratigraphy and Sequence Stratigraphic Correlation of the Vaca Muerta Formation, Neuquén Basin

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ABSTRACT

Recent technological advances have turned the Vaca Muerta Formation, the most prolific source rock in the Neuquén basin of Argentina, into a productive unconventional play. Multi-disciplinary analysis is key to characterizing the most optimum reservoir intervals.

The Vaca Muerta Formation is mainly composed of alternating black shales and marls. Because of the fine-grained nature of this formation, analyses such as elemental and stable carbon isotope chemostratigraphy aid in understanding these lithologies and stratal relationships.

The applicability of hand-held energy dispersive x-ray fluorescence spectrometer (ED-XRF) devices has recently become widely recognized for mudrock geochemistry. In addition, chronostratigraphic information from carbon stable isotope data can be used as a correlation tool.

This study characterizes the most complete suite of elements necessary to characterize chemostratigraphic subdivisions in the Vaca Muerta Formation. This is conducted through factor analysis and stratigraphic profiles of individual elemental concentrations, as well as profiles of important elemental ratios.

The present study examines the elemental and isotopic analysis of core and well cuttings from the Vaca Muerta Formation within the Neuquén embayment area. Data based on a three-meter sampling interval from the cuttings within the Vaca Muerta Formation are calibrated to a high-resolution chemostratigraphic subdivision from core from the lowermost part of the formation. Petrographic analysis is used to support the geochemical signatures of the described chemostratigraphic intervals and interval boundaries. TOC correlations highlight the richest units within the interval of interest. The time-transgressive nature of the Vaca Muerta Formation can be correlated by using a sequence stratigraphic approach, where older units to the east prograde into younger strata to the west.