

THE CARBON ISOTOPIC COMPOSITION OF PROXIMAL AND DISTAL SEDIMENTS IN THE VACA MUERTA FORMATION, NEUQUÉN BASIN ARGENTINA

Juliette Brophy, Ralf J. Weger, Gregor P. Eberli, and Peter K. Swart

PROJECT OBJECTIVES

- Evaluate the ability to use $\delta^{13}\text{C}$ values from organic material to correlate between different sections within the basin, sections kilometers apart, in both proximal and distal positions.
- Re-validate that the $\delta^{13}\text{C}$ values of organic material ($\delta^{13}\text{C}_{\text{org}}$) are unrelated to changes in the total organic content.
- Confirm that $\delta^{13}\text{C}$ values of organic material can be used to correlate coeval sections within a basin more accurately than the $\delta^{13}\text{C}$ values of carbonate.

PROJECT RATIONALE

The $\delta^{13}\text{C}$ values of carbonate and organic material within sedimentary deposits have been studied extensively and variations have been interpreted principally as changes in the rates of organic carbon production relative to burial and preservation (Hayes et al., 1999). Previously we studied the $\delta^{13}\text{C}$ values of organics and carbonates from 800 m of continuous, Late Jurassic to Early Cretaceous strata (~ 15 Myrs) exposed in the Neuquén Basin, Argentina (Rodríguez Blanco et al., 2019; Rodríguez Blanco et al., 2020; Tenaglia et al., 2020). The data provided a unique opportunity to compare this high-resolution $\delta^{13}\text{C}_{\text{org}}$ record to other published organic carbon isotope records from the same time period sourced in Atlantic, Arctic, and Tethyan sections. The data from the Vaca Muerta showed correlation to several globally distributed locations that show a large negative isotopic excursion of organic carbon ($\delta^{13}\text{C}_{\text{org}}$) of over 4‰ (V-PDB) and to a minimum of -30.3 ‰; an anomaly that has been named the 'Volgian Isotopic Carbon Excursion' (VOICE).

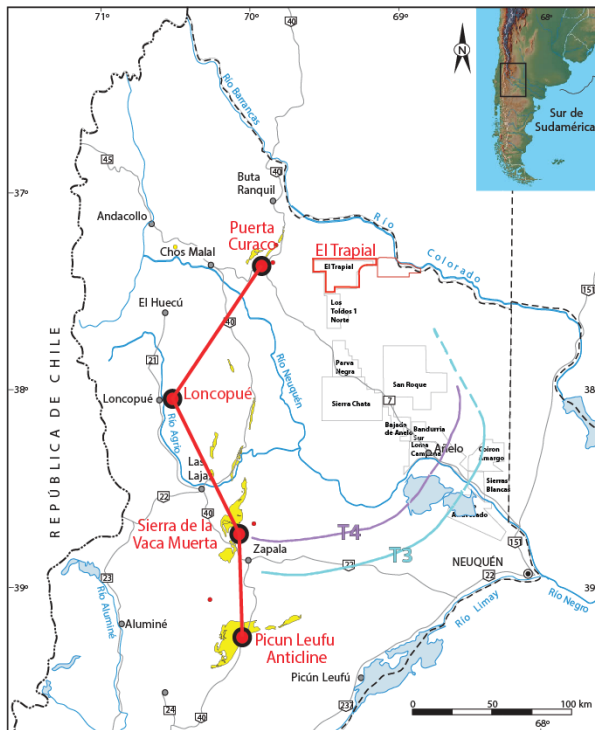


Figure 1: Location of outcrops in the Neuquén Basin. Box around Chos Malal Curaco indicates location of outcrop location. Stars indicate locations of published data used in this study for comparison.

WORK PROPOSED

We have obtained samples from approx. 350m of measured section of outcrops at the Picun Léufú anticline, the Tithonian portion of the Vaca Muerta Formation in a proximal setting. We have already carried out several studies of the variation of $\delta^{13}\text{C}$ and $\delta^{13}\text{C}_{\text{org}}$ values on the cores and measured sections in the basinal portions of the Vaca Muerta Formation (Rodriguez Blanco et al., 2022; Weger et al., 2023) and plan to perform the same analysis on these newly obtained proximal, time correlative samples.

SIGNIFICANCE

This study represents a combined study of the $\delta^{13}\text{C}$ values of organic and inorganic material found within the Neuquén Basin in Argentina. The $\delta^{13}\text{C}_{\text{org}}$ values appear to be unrelated to the global patterns in $\delta^{13}\text{C}_{\text{carb}}$ values, but they show similarity to patterns seen in $\delta^{13}\text{C}_{\text{org}}$ values at several boreal localities. This study will provide a detailed comparison of $\delta^{13}\text{C}$ values of carbonate and organic carbon and their variations between coeval distal and proximal locations. Key questions to be answered is if changes in $\delta^{13}\text{C}$ values proximal and/or distal behave correlative within the Neuquén Basin.

REFERENCES

- Hayes, J. M., Strauss, H., and Kaufman, A. J., 1999, The abundance of ^{13}C in marine organic matter and isotopic fractionation in the global biogeochemical cycle of carbon during the past 800 Ma: *Chemical Geology*, v. 161, no. 1-3, p. 103-125.
- Rodriguez Blanco, L., Eberli, G., Swart, P., Weger, R., and Tenaglia, M., $\delta^{13}\text{C}$ as a Proxy of Paleoenvironmental Water Conditions During Deposition of the Vaca Muerta Formation (Tithonian-Early Valanginian)—Neuquén Basin, *in* Proceedings 2019 AAPG Annual Convention and Exhibition:2019.
- Rodriguez Blanco, L., Eberli, G. P., Weger, R. J., Swart, P. K., Tenaglia, M., Sanchez, L. E. R., and McNeill, D. F., 2020, Periplatform ooze in a mixed siliciclastic-carbonate system-Vaca Muerta Formation, Argentina: *Sedimentary Geology*, v. 396, p. 105521.
- Rodriguez Blanco, L., Swart, P. K., Eberli, G. P., and Weger, R. J., 2022, Negative $\delta^{13}\text{C}_{\text{carb}}$ values at the Jurassic-Cretaceous boundary—Vaca Muerta Formation, Neuquén Basin, Argentina: *Palaeogeography, Palaeoclimatology, Palaeoecology*, v. 603, p. 111208.
- Tenaglia, M., Eberli, G. P., Weger, R. J., Blanco, L. R., Sánchez, L. E. R., and Swart, P. K., 2020, Total organic carbon quantification from wireline logging techniques: A case study in the Vaca Muerta Formation, Argentina: *Journal of Petroleum Science and Engineering*, v. 194, p. 107489.
- Weger, R. J., Eberli, G. P., Rodriguez Blanco, L., Tenaglia, M., and Swart, P. K., 2023, Finding a VOICE in the Southern Hemisphere: A New Record of global organic carbon? : *GSA Bulletin*.