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Organic and Inorganic Geochemistry of Early and Late Cretaceous Black Shales from Western Venezuela: Implications for the Paleoceanographic Evolution of Northern South America

Integrated organic and inorganic geochemical data for four black shale units deposited on the Cretaceous passive margin of northern South America suggest pronounced differences in organic matter composition and trace metal input. Organic-rich shales and marls from the Aptian Tibú Member and Aptian-Albian Machiques Member of the Apon Formation, Albian Lisure Formation, and Cenomanian-Santonian La Luna Formation were examined petrographically and geochemically. Although these shale units are stratigraphically separated from one another in the core by up to 400 meters, differences in biological marker distributions cannot be explained by thermal maturity alone. Solvent-extractable organic matter in Tibú and Machiques is rich in tricyclic terpanes and steranes and is inferred to represent marine algal detritus deposited in a restricted, possibly brackish water environment. Lisure organic matter is dominated by high-molecular-weight *n*-alkanes indicative of terrestrial higher plant input. Biomarker signatures in La Luna suggest a substantial input of bacterial detritus in addition to marine algal material.

Although both La Luna and Machiques represent stratigraphically condensed marine shales rich in organic matter and pelagic carbonate, trace metal abundances are very different. Paleoceanographic conditions during La Luna deposition responsible for this difference may include: a) enhanced availability of dissolved trace metals associated with widespread oxygen depletion; b) rapid transport of labile organic matter as a result of episodic upwelling; and c) high concentrations of dissolved sulfide in bottom waters due to vigorous sulfate reduction.