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¿What if? An alternate explanation of groundwater dynamics for the Llanos Orientales Basin, Colombia: The case of the Eocene-Miocene succession

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Resumen

PALABRAS CLAVE

Sub-hydrostatic pressure, seals, compaction modeling, pressure gradient, basin analysis.

CONTENIDO DEL RESUMEN

Sedimentary basins show dynamic interactions between rock formations, pore fluids, and tectonic processes, leading to continuous changes in fluid flow. The Llanos Orientales Basin in Colombia offers a unique opportunity to examine these processes and their influence on groundwater dynamics. This study compiles and analyzes a regional dataset, including seismic data, hydraulic head estimates, formation pressure data, and one-dimensional compaction models, to gain insights into fluid dynamics. The results show the combined role of pressure gradients, compaction histories, and basin geometry in driving the regional groundwater flows.

Pressure data reveals sub-hydrostatic to hydrostatic trends without overpressure development, showing the absence of effective regional seals restricting vertical and lateral connectivity of water reservoirs in the basin. Temperature variations over time indicate that some stratigraphic intervals in the western sector of the basin experienced temperatures exceeding 90°C from the Oligocene to the Miocene. This increase is likely associated with sedimentary overburden, leading to a shift from mechanical to chemical compaction in certain units, particularly within the Une, Gachetá, Guadalupe, Barco and Mirador formations. While the impact of these thermal and compactional changes on past groundwater flow remains uncertain, current flow dynamics are being evaluated to explore the possibility of margin-to-center flow patterns, as opposed to the bottom-to-margin flows suggested by previous studies. The findings from this study will enhance our understanding on the drivers of groundwater flow and their potential impacts on hydrocarbons and other resources.