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3D geochemical characterization of organic-rich shales of the Irati Formation, Paraná Sedimentary Basin: New perspective for CO_2 geological storage in southeastern Brazil

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ABSTRACT

To mitigate the worst impacts of global warming, the IPCC (Intergovernmental Panel on Climate Change) indicates the CO_2 geological storage as one of the most feasible technologies to be deployed in the next years to reduce greenhouse gas emissions (GGE) by injecting significant amounts of CO_2 into adequate geological formations. This work assessed southeastern Brazil where the largest concentration of stationary sources emitting CO_2 is located. The objective of the study was to evaluate the shale layers of the Irati Formation, Paraná Sedimentary Basin, in terms of organic geochemical parameters and 3D spatial extension, for characterizing potential CO_2 geological storage sites in unconventional reservoirs. Two layers of organic-rich shales, identified as Units E and H, were spatially delimited as potential shale gas reservoirs, based on organic geochemistry and petrography (0.46–0.55%Ro; 0.56–7.36% TOC, and 0.80%Ro; 8.45–9.62% TOC, respectively) and their feasibility as reservoirs to CO_2 geological storage. In terms of thermal maturity, alterations in Rock-Eval pyrolysis data in proximity of intrusions (relative decrease in S_1, S_2, and HI values) and vitrinite reflectance indicate two sites (wells 2-AA-1-SP and 2-TB-1-SP) more suitable to CO_2 storage as the high TOC values and elevated thermal maturity are indirect indicators of a higher potential sorption capacity. Thus, the organic chemistry parameters should be used together with the spatial analysis of 3D geological modeling as a guide to define intrusions of the Serra Geral Formation, and then to delimit reservoirs for CO_2 storage in shales rich in organic matter within the Irati Formation.