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Petrophysical Characterization of a CO_2 storage reservoir using well logs

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Developing a reservoir model for carbon dioxide storage requires a detailed petrophysical characterization of the subsurface rocks. Deep understanding of the lithologies and mineralogy present at depth in a potential storage formation is crucial to provide a good base to develop a reliable reservoir model and also of potential reactions of the CO_2 and the carbonate rock minerals.

The main objective of our research is the characterization of reservoir rocks at a pilot CO_2 geological storage site, in the frame of a project of the "Fundación Ciudad de la Energía" (CIUDEN), on behalf of the Spanish Government. The pilot-scale CO_2 injection project in the vicinity of Hontomin, (Burgos, Spain) has the objective of injection of a maximum of 100.000 tons of CO_2 at about 1500 meters deep. Using the available well logs and well information available from the Hontomin field, a detailed petrophysical and mineralogical interpretation of dolomitized limestones, dolomites and evaporites of Jurassic age was undertaken.

The area selected for the injection is a dome-shaped structure (approximate 3 x 4 kilometers) that was explored in the past for oil and gas, and later abandoned with oil shows. This site was selected because of its relative low structural complexity, and because of the availability of exploration and drilling data on which our study is based.

Besides the mineralogical inversion performed our results on porosity and permeability calculations constrain the storage capacity of the reservoirs and the petrophysical properties of seals. The petrophysical properties estimated with old well logs and well data allowed us to characterize reservoir interval of adequate porosity and permeability and the presence and features of potential seals.

The log-based interpretation of lithological logs was the first step for the study, followed by the estimation of petrophysical properties in zones of interest for CO_2 storage and finally the correlation of the different wells in the study area. This detailed petrophysical model will allow a better understanding of the reservoir and a more exact estimation of its properties and provide a good base for the drilling of injection and monitoring wells. Potential seal formations are also characterized by means of geophysical log interpretation.