

## **Proximal Volcaniclastic Reservoir in an Incipient Syn-Rift Basin: Geometry, Sedimentary Architecture and Petrography**

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### **ABSTRACT**

Proximal volcanic settings are characterized by unconformities and rapid spatial facies changes. Unconformities are due to erosion in a high-relief landscape associated to volcanoes. Spatial facies changes result from high-volume, topographically-controlled and areally-restricted instantaneous sedimentation close to the volcanoes. Together, they control the geometry and sedimentary architecture of the volcaniclastic reservoirs. In the Lower Jurassic of the Cañadón Asfalto Basin (Patagonia – Argentina), fluvio-lacustrine deposits of the Las Leoneras Fm. are overwhelmed by volcaniclastic deposits of the Lonco Trapial Fm., discharged in the proximities of growing volcanoes during incipient rift stages of the basin. This work describes their sedimentology and petrography, as achieved by a combination of fieldwork and petrographic analyses. Three groups of lithofacies have been defined, on the base of the temporal relationship between volcanic events and their depositions: non-, syn- and post-volcanic facies. Non-volcanic facies are all the deposits settled during volcanic inactivity. Their shapes are function of the sedimentary conditions of the environment (e.g., climate, sediment supply). They are good reservoir rocks, if detritus is well sorted, and medium- to coarse-grained. The syn-volcanic facies are subaerial and subaqueous pyroclastic flow, ash fall and lahar deposits. Shapes are topographically- and environmentally-controlled. They do not constitute good reservoir rocks, unless mineralogical changes due to their post-depositional history. The post-volcanic facies are all the deposits that mark the re-approach of the sedimentary system to pre-eruptive conditions. Their shapes and petrophysical characteristics are alike to those of the non-volcanic facies group. The result is a 4D reconstruction of the sedimentary basin that focuses on geometries and lithologies generated by the rapid sedimentation during volcanic events and quiescence stages, and their suitable features as reservoir rocks. The best reservoirs are few km wide and tens to hundreds m deep, post-volcanic sedimentary bodies filling paleovalleys. Black shales formed in lakes are usually the source rock in the oil systems. This reconstruction also shows that the Lower Jurassic of the Cañadón Asfalto basin represents a good analogue for the Jurassic and Neocomian in the subsurface of the Golfo San Jorge basin, the main oil-bearing basin of Argentina, and syn-rift basins in general.