

## **Burial History Modeling and Reservoir Quality in Exhumed Basins: Insights From the Illizi Basin, Algeria**

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### **ABSTRACT**

This study presents an integrated evaluation of the burial and thermal history of an exhumed (uplifted and eroded) basin, and investigates the implications for the evolution of reservoir quality of the Ordovician sandstone in the Illizi Basin, Algeria. Complementary techniques including sonic compaction analysis, apatite fission track analysis, thermal maturity analysis, fluid inclusion microthermometry, and sandstone petrography are integrated to provide calibration for burial and thermal history models and diagenetic forward modelling, in order to predict variations in sandstone reservoir quality across the study area. The Illizi Basin has been structurally modified due to multiple exhumation events, including the uplift of the Hoggar Massif. This study incorporates new apatite fission track data and analyses that constrain the onset of major exhumation in the Illizi Basin to the Eocene with exhumation magnitudes estimated to be 1-1.4 km in the study area. The study area contains a multi trillion cubic foot gas-condensate accumulation within a large four way dip closure and the hydrocarbon generation occurred during two main phases in the Carboniferous and the Mesozoic, but ceased during Cenozoic exhumation. A major implication of this work is the trap formed after the main generative phases, and alternative hydrocarbon charge mechanisms are proposed. A major pre-drill risk in many North African Paleozoic plays relates to sandstone reservoir quality, largely due to extensive quartz diagenesis. Furthermore, reservoir quality can be difficult to predict in exhumed reservoirs due to deeper burial in the past. The Ordovician reservoir in the study area is characterised through petrography and core analysis, and the impact of burial and thermal history on the reservoir quality is investigated through diagenetic forward modelling with Touchstone™. Results indicate that facies and subtle variations in thermal history are a major control in preserving reservoir quality and a work flow is presented to quantify and predict reservoir quality in other basins. References: English, K.L., et al. (2016), Constraining burial history and petroleum charge in exhumed basins: new insights from the Illizi Basin, Algeria. AAPG Bulletin, v. 100, pp. 623–655. English, K.L., et al. (2017), Controls on reservoir quality in exhumed basins - an example from the Ordovician sandstones, Illizi basin, Algeria. Marine and Petroleum Geology, v. 80, pp. 203-227.