Integrated Study of Late Palaeozoic to Mesozoic Stratigraphy, Tunisia

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Abstract

The Chotts Basin runs east-west across Central Tunisia and is a complex Late Palaeozoic to Mesozoic graben system with a sediment thickness reaching over 5km thick (Johns & Chine, 1995). The Chotts Basin is an oil and gas hydrocarbon province where two major petroleum plays linked to the Silurian source rock are identified: the Ordovician Hamra, Jeffara and El Atchane Formations and the Triassic TAG-I Formation. Due to the presence of thick Triassic and Liassic evaporites, seismic imaging of the Palaeozoic stratigraphy in the basin is challenging and the stratigraphy is barren of fossils in both the evaporitic and mature sandstone intervals. Erosion associated with the Hercynian and Hirnantian glacial events and the complex nature of the Triassic channelised fluvial deposits have had a profound impact on the ability to interpret sedimentary rocks in the Chotts Basin and have made inter-well correlations at a basinal scale challenging. In the study presented here, chemostratigraphy, biostratigraphy, isotope and provenance analysis have been employed in order to geochemically characterise and accurately age key lithostratigraphic formations of the Chotts Basin including those associated with hydrocarbon production.

A sedimentary composite has been produced using data and understanding obtained from the multidisciplinary examination of 14 wells across the Chotts Basin. The interval of study spans from the Cambrian to the Cretaceous and includes a wide range of both clastic and carbonate lithologies which are defined geochemically using the Si/Al ratio as well as $CaCO_3$, Mg, S and Mo abundance. Mineralogical techniques such as XRD and FTIR are employed to support interpretation of element-mineral affinities. The Triassic and Silurian age stratigraphy has also been compared to sections of equivalent age in the Ghadames Basin, south of a tectonic high known as the Telemzane Arch (Bouazizi, et al., 2014).

A regional geochemical marker has been identified not just in the Chotts Basin, but across much of North Africa. This marker is diachronous and in Tunisia, lies at the Palaeozoic/Mesozoic boundary. It is used to differentiate two chemostratigraphic megasequences assigned to the study interval (Megasequence 1 and Megasequence 2) and is thought to either indicate a climatic shift to warmer wetter conditions or a change in source terrain to one which has many stable Ti-oxide heavy minerals. The stratigraphy within Megasequences 1 and 2 is divided into eight chemostratigraphic sequences, which are tied to the established Tunisian lithostratigraphy and bound chronostratigraphically using both biostratigraphic and carbon isotope techniques. These chemostratigraphic sequences are differentiated based upon changes in elements that are interpreted to be controlled by sediment provenance, depositional environment and climate.