

Application of Chemostratigraphy to the Silurian-Devonian Tawil Formation in Central Saudi Arabia

Mohamed Soua¹

¹ETSD/GLTSD, Saudi Aramco, Dhahran, Eastern, Saudi Arabia.

ABSTRACT

The Silurian-Devonian Tawil Formation is mostly characterized by clastic-dominated depositional environment, which varies from fluvial to marginal marine. A Chemostratigraphic analysis and interpretation of ca. 700 core and cuttings samples have been applied on six wells, which are located in central eastern Saudi Arabia. This study aimed to produce a correlation workflow through the Silurian-Devonian Tawil Formation and define the lower Qalibah/Tawil and upper Tawil/Jauf boundaries. The study was based on Inductively Coupled Plasma - Optical Emission Spectrometry (ICP-OES) and Inductively Coupled Plasma - Mass Emission Spectrometry (ICP-MS) techniques, which were used to acquire data for ca. 50 elements, including major, trace, and rare earth elements. The scheme is based on specific changes in Zr/Nb, Nb/U, (Rb+Cs)/La, Al/(Ca+Mg+K+Na), (Zr*Hf)/(Nb*Ta), (Zr*Hf)/Nb, and Zr/(Nb*Ta). The generated scheme comprises a hierarchical order of four zones (C1 to C4) and five subzones (C2-1 to C2-3 and C3-1-C3-2). Zones C1 and C3 are characterized by the lowest values of Zr/Nb and (Zr*Hf)/(Nb*Ta) compared to the intervening zones C2 and C4. Of the three zone C2 subzones, C2-2 has lower values of Zr/(Nb*Ta) ratio than the underlying C2-1 and overlying C2-3 subzones. Two subzones are associated with the zone C3 (C3-1 and C3-2), their differentiation being based on variation in the (Zr*Hf)/Nb ratio. In general, there is a close match between the recognized chemozones and lithostratigraphic and biostratigraphic schemes. Zone C1 is generally associated with the Sharawra Formation, Zones C2 and C3 with the Tawil Formation, and Zone C4 broadly defines the lower part of Jauf Formation. However, chemostratigraphic zonal boundaries do not precisely correspond to biostratigraphical and formational boundaries, indicating that the C1-C2 and C3-C4 boundaries are time-transgressive. This suggests that the aforementioned lithostratigraphic units were probably deposited in multiple fluvio-deltaic systems, fed by sediments from the same clastic sources, active at different times.