

## **Integration of Chemostratigraphy and Sedimentology to the Correlation of the Permo-Carboniferous Unayzah Group, Central Saudi Arabia**

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### **ABSTRACT**

Integration of Chemostratigraphy and Sedimentology to the Correlation of the Permo-Carboniferous Unayzah Group, Central Saudi Arabia  
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ABSTRACT The following study integrates chemostratigraphy and sedimentology in a laterally heterogeneous reservoir where the assessment of its temporal and spatial relationships has proven very challenging using sedimentology and chemostratigraphy in isolation. The study focuses on the Permo-Carboniferous Unayzah Group encountered in six wells in central Saudi Arabia, with the primary aim of using a fully integrated chemostratigraphic and sedimentological approach to defining formations and members of this stratigraphic interval in each well. A secondary objective was to utilize chemostratigraphy to identify correlative chemozones within each formation/member useful in areas of low core samples coverage and/or frontier areas. The sedimentology study was completed on a limited number of cores, but revealed glaciogenic sediments in the lowermost part of the Unayzah Group of some wells, represented by the Juwayl Formation (Ghazal and Jawb members). The overlying Wudayhi Member of the Nuayyim Formation consists of quartzose sandstones and mudrocks that were deposited in marginal-marine and shallow-marine, tidally influenced settings. This is succeeded by the Tinat Member of the same formation, dominated by quartzose sandstone and siltstones, mainly of continental origin. A total of 1049 samples were analyzed by ICP-OES (Inductively Coupled Plasma-Optical Emission Spectrometry) and ICP-MS (Inductively Coupled Plasma-Mass Spectrometry) to produce data for 50 elements in the range Na-U in the periodic table. The chemostratigraphic interpretations were based on variations in Nb/U, Zr/Nb, Zr/Ti, Zr/Th, Ta/U and Zr/Ta, linked to changes in source/provenance. A scheme comprises a hierarchical order of three zones, five subzones and nine divisions. Integration involved relating specific chemozones to Unayzah formations and members in cored sections (based on sedimentological data), and then recognising the same intervals in uncored sections (where sedimentological data are absent) using chemostratigraphic data derived from cuttings. In addition to employing chemostratigraphy to identify the tops of formations and members, the technique also provided a much higher level of stratigraphic 'breakdown'. For example, a threefold subdivision is now identified in the Ghazal Member.