



The Relationship between Litho-Sequential Stratigraphy, Chemostratigraphy of Khuff Carbonates: Implication for Facies and Paleoenvironmental Recognition and Correlation, Central Saudi Arabia

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The Permian-Triassic Khuff Formation carbonate reservoirs (and equivalents) in the Middle East are estimated to contain about 15-20 % of the world's gas reserves. Excellently exposed outcropping Khuff strata in central Saudi Arabia provide good outcrop equivalents to the Khuff Formation in the subsurface. The Khuff Formation is composed of five members and from bottom to top are Ash Shiqqah, Huqayl, Dhahyan, Midnab and Khartam members. The Carbonates lithofacies dominate with minor terrestrial clastics, and the paleoenvironments vary from terrestrial, sabkha, tidal-intertidal and open marine environments. This study investigates the relationship between lithostratigraphy, sequence stratigraphy and chemostratigraphy by integration of both field and laboratory sedimentological and chemical elements data. The vertical chemical elements profiles along the Khuff members show variations in their chemical elements content with the variation in lithofacies types, stacking pattern, depositional and stratigraphic pattern. The chemostratigraphic distribution of the chemical elements also showed variation within and between the Khuff members. There is a general agreement between chemostratigraphic analyses based on vertical profiles and binary cross plots. The Khuff members and their stratigraphic boundaries can be differentiated based on their chemostratigraphic signatures. Moreover, the lithofacies and depositional paleoenvironmental of different Khuff members can be identified based on their chemical element contents. Chemostratigraphic zones or clusters are markedly established indicating different lithofacies and depositional paleoenvironments. Terrestrial, channel, lacustrine, shoreline to open marine carbonate lithofacies, as building blocks of sequence stratigraphy, all may be distinguished based on their chemical signatures. These outcrop analog results might be of significance to lithofacies, paleoenvironmental, stratigraphic identification, classification and correlation of Khuff Formation in the subsurface. The results might also provide guides and application to reservoir Khuff Formation identification, layering and zonation in the subsurface.