From Elemental XRF Analysis, SEM to Chemical Stratigraphy and Reservoir of Mixed Sedimentary Rocks: The Middle Permian of Jimsar Depression, Junggar Basin, China

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ABSTRACT

The middle Permian Lucaogou formation (P2l) of Jimsar Depression with 1200km2 square and average 300m thick is an important tight oil production and plays a significant role in the Junggar Basin tight oil exploration. Analysis of more than 500 meters core from 15 wells shows that the sedimentary rock of P2l is heterogeneous in composition. So the nature of these complicated rocks makes it difficult to recognize the compositional changes through conventional techniques. The portable XRF (x-ray fluorescence) combining SEM (scanning electron microscope), XRD (x-ray diffraction) and microscope analysis of cores are applied to accurately and quickly determine the mineralogical and geochemical compositions related to fabrics and rock properties. The results show that the rock of P2l are composed of three sources materials, including volcaniclastic materials, terrigenous clastics and intrabasinal carbonate precipitation. The mixed rocks are divided into four facies according to three-end-member classification method: 1- terrigenous clastics rocks, 2- volcaniclastic rocks, 3- carbonate rocks, and 4- mixed rocks. Facies are interbedded on scales ranging from millimeters to meters. Elements reflect the rocks composition, sources and sedimentary environment, especially the trace elements. The measured elements are R clustering analyzed using SPSS software to recognize the origin of components. For example, Th, Cu, Ni, Mo and Cr, Ti, Zr represent exogenous origin, while Ba, Mn and Sr represent intrabasinal chemical precipitation. Several elements are picked out to marker the paleosalinity, paleoclimate, redox conditions and clastics and volcanic inputs. The trace data set of Mo, V, U, Mn concentration trends are used to locate organic rich intervals and redox conditions. Elevated level of Mo, V and U with decreased Mn indicates a significant organic accumulation under anoxic conditions. Increasing Rb/Sr means relatively humid climate, and higher Sr/Ba reflects relatively high paleosalinity. Comprehensively using chemical stratigraphy, SEM and microscopy analysis, we summarize the lithofacies development pattern in vertical, and then establish 16 lithofacies combination types. And the most attractive targets are the lithofacies with volcaniclastics within the interval.