Lithofacies characteristics and diagenetic alteration in Permain Lucaogou Formation, Jimusar Sag, Junggar Basin

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Shale oil, as a typical unconventional resource, is of general concern to petroleum geologists. The Permian Lucaogou formation is the key horizon of shale oil exploration in Jimusar Sag, Junggar Basin. However, the complicated lithofacies and diagenesis hinder the further exploration of shale oil. Combining with the detail analysis of inorganic and organic geochemistry, the main lithofacies characteristics and diagenetic alteration were investigated. Lithifacies of laminated and massive structure were identified. For laminated lithifacies, four types of laminae, including pyroclastic and terrigenous clastic and carbonate and organic matter laminae, and 7 types of laminar assemblages were identified. 3 types of shales with binary laminar assemblages formed by pyroclastic and terrigenous clastic laminae, terrigenous clastic and carbonate laminae, pyroclastic and carbonate laminae were mainly developed. For massive lithifacies, dolomicrite, dolomitic tuff, silt dolostone, dolomitic siltstone and tufaceous siltstone were mainly developed. Significant differences of diagenesis were presented in different major lithofacies. In laminated lithofacies, obvious dissolution was occurred in terrigenous clastic laminae which was alternated with pyroclastic laminae without many carbonate minerals. However, no obvious dissolution but intense carbonate cementation were occurred in terrigenous clastic laminae which was alternated with pyroclastic laminae with relatively high content of carbonate minerals. Carbonate cementation was generally occurred in terrigenous clastic laminae which was alternated with carbonate laminae, but obvious dissolution was also occurred in some terrigenous clastic laminae. ‘Red shift’ was identified in fluorescence spectra of organic matters in carbonate or pyroclastic laminae which were alternated with terrigenous clastic laminae with obvious dissolution. In laminated and massive lithofacies formed by pyroclastic and carbonate minerals, carbonate recrystallization were mainly occurred near organic matters. In massive lithofacies, intense carbonate cementation was occurred in silt dolostone. In contrast, relatively obvious dissolution was occurred in dolomitic siltstone and tufaceous siltstone if they were closed to the lithofacies containing tuff components. The research results have certain guiding significance for further exploration and development of shale oil in Permian Lucaogou Formation.