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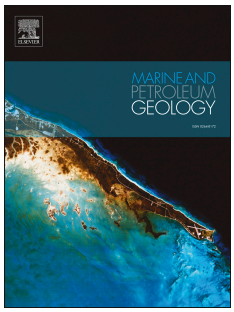

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Characteristics and origin of the major authigenic minerals and their impacts on reservoir quality in the Permian Wutonggou Formation of Fukang Sag, Junggar Basin, Western China

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Abstract: This research is focused on the characteristics and origin of major authigenic minerals and the influences on the reservoir quality of the Permian Wutonggou Formation sandstones in the eastern slope of Fukang Sag, Junggar Basin, Western China. Authigenic cements were observed and described from thin sections, scanning electron microscopy, fluorescence, and cathodoluminescence. The elemental concentrations of the authigenic minerals were measured by electron probe microanalysis. Additional characterizations were obtained from O and C stable isotope ratios and from the homogenization temperature of aqueous fluid inclusions. The results show that the sandstones in the Wutonggou Formation are dominated by volcanic lithic fragments. Carbonates and laumontites are the major authigenic minerals in the study area. Authigenic quartz and kaolinite can also be observed. Two types of carbonate cements are identified. The first type is calcite with yellow fluorescent hydrocarbon inclusions. The carbon and oxygen isotopes in the calcites are highly C-depleted and O-depleted. The homogenization temperatures of the aqueous fluid inclusions in the calcite cements are higher than the highest paleogeotemperatures during the burial history. Combined with the presence of authigenic fibrous illites and the illitization of kaolinites, it is determined that the precipitation of the calcites is related to the upwelling of deep fluids and was impacted by the CO_2 from the thermal decarboxylation of organic matters during the middle-late Jurassic. The second type is ferroan calcite with blue fluorescent hydrocarbon inclusions and higher contents of Fe, Mn, Cr, and Mg than in the calcites. The ferroan calcites in the Beisantai uplift are rich in ^{13}C ($\delta^{13}C_{(V\text{-}PDB)}$ values are +22.10‰ and +22.16‰). The precipitation of these ferroan calcites was impacted by the CO_2 from crude oil biodegradation after the late Jurassic. Two types of laumontites are identified. The first type is partially dissolved and is characterized by