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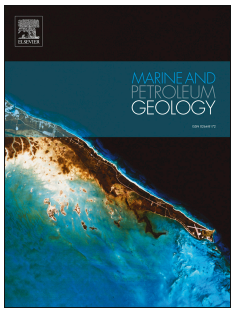

Genetic types of carbonate shoal reservoirs in the Middle Triassic of the Sichuan Basin (SW China)

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Abstract: Carbonate shoal reservoirs of the Middle Triassic Leikoupo Formation in the Sichuan Basin were investigated for potential gas resources. The carbonate shoal reservoirs can be divided on the basis of their formation mechanism into residual intergranular pore, karst (further divided into syndepositional-, burial-, and epigenetic-karstification types), dolomitized, and composite reservoirs. Residual intergranular pores and dissolved pores are the main reservoir spaces in the residual intergranular pore reservoirs. Isolated intragranular corroded pores and moldic pores are the main reservoir spaces in syndepositional-karstification reservoirs, the main spaces in burial-karstification reservoirs are dissolved pores and holes, and pores and caves on various scales are the main reservoir spaces of epigenetic-karstification reservoirs. Intercrystal pores and intercrystal solution pores are the main reservoir spaces of dolomitized reservoirs. Composite reservoirs are characterized by a variety of reservoir spaces with pores, holes, and fissures. High-quality shoal reservoirs were formed by superposition of carbonate shoals and constructive diagenetic modification. Preservation of residual intergranular pores was crucial for development of residual intergranular pore reservoirs. Platform-interior micro-highlands, relative declines in sea level, and rainfall controlled the development of syndepositional-karstification reservoirs. Dissolution by unsaturated acidic fluids, pre-existing pores and pore throats, and the direction of corrosive fluid flow were important for burial-karstification reservoirs. Epigenetic-karstification reservoirs formed as a result of significant sea-level drops or tectonic movement. Dolomitized reservoirs formed in shoals affected by dolomitization caused by evaporation of seawater or that occurred during burial. Composite shoal reservoirs were formed by two or more processes.

Keywords: genetic types; reservoir; carbonate shoal; Leikoupo Formation; Sichuan Basin

1. Introduction

Identification and production of oil or gas reserves from carbonate shoal reservoirs have attracted research interest because of the increasing global demand for oil and gas (Armitage et al., 2010; Liu et al., 2017). Porous shoal grainstones constitute very good reservoirs (Behrooz and Hossain 2014; Eugene 2014; Chen et al., 2017); thus, the stratigraphy, characteristics, and major controlling factors of carbonate shoal reservoirs have been extensively investigated (Zou and Tao 2007; Zhu et al., 2015). To date, many oil or gas fields with carbonate shoal reservoirs have been found in China, including the Tarim basin (Ordovician) (Liu et al., 2012; Gao and Fan 2015; Jin et al., 2017; Du et al., 2018; Jiang et al., 2018a), the Erdos basin (Ordovician) (Bai et al., 2016), and the Sichuan basin (Permian and Triassic) (Ran et al., 2006; Jiang et al., 2014; Qiao et al., 2016; Jiang et al., 2018b).

The Middle Triassic Leikoupo Formation in the Sichuan Basin is an important target sequence for natural gas exploration (proven gas reserves greater than 100×10^8 m^3) (Ma et al., 2008; Liu et al., 2018). Some previous studies have focused on the sedimentary features and concluded that the Sichuan Basin was primarily a carbonate-platform setting during deposition of the Leikoupo Formation (Ding et al., 2012; Li et al., 2011; Ding et

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