Vol. 91 Supp. 1 ACTA GEOLOGICA SINICA (English Edition) Apr. 2017
http://www.geojournals.cn/dzxben/ch/index.aspx http://mc.manuscriptcentral.com/ags

YANG Kang, ZHOU Xue, LI Hong, XIE Wei, DONG Yangkun, LIU Yongjie, SONG Shijun and ZHAO Leizhao, 2017. Diageneses and their Influences on Reservoir Properties of Chang 2 Oil Member in Renshan region, Zhidan Oilfield, Ordos Basin. Acta Geologica Sinica (English Edition), 91(supp. 1): 142-143.

Diageneses and Their Influences on Reservoir Properties of Chang 2 Oil Member in Renshan Region, Zhidan Oilfield, Ordos Basin

YANG Kang[1,*], ZHOU Xue[2], LI Hong[1,*] , XIE Wei[2], DONG Yangkun[1], LIU Yongjie[1], SONG Shijun[1] and ZHAO Leizhao[1]

1 *Department of Geology, Northwest University, Xi'an, Shaanxi 710059*
2 *Yongning Oil Production Plant, Yanchang Oilfield Co. Ltd, Yanan, Shaanxi 717500*

1 Introduction

Yanchang Formation in Upper Triassic, Ordos basin contains the most abundant hydrocarbon resources in North China (Wang *et al*., 2014). The sandstones are the most important oil-bearing reservoirs in Yanchang Formation, and their reservoir properties are usually controlled by initial sedimentary compositions and subsequent diagenetic modifications (Mansurbeg *et al*., 2008; Ozkan *et al*., 2011; Jin *et al*., 2016). Chang 2 oil member, the upper part of Yanchang Formation, characterized as layers of fluvial sandstones, siltstones, and mudstones, is one of the major productive reservoirs in Zhidan Oilfield. However, the exploitation facts show that Chang 2 reservoirs are highly heterogenetic and that seriously constrains the productive efficiency.

Here, based on cores and thin-section observations, granularity analysis, scanning electron microscope (SEM), electron microprobe analyses (EMPA), X-ray diffraction, nuclear magnetic resonance (NMR) experiments, and fluid inclusions analysis, petrological features, diageneses and diagenetic stages of Chang 2 sandstones are investigated aiming to discuss the diagenetic influences on reservoir properties in Renshan region, Zhidan Oilfield.

2 Diageneses and their influences on Chang 2 reservoir properties

2.1 Diagenetic influences on Chang2 sandstones

Renshan region lies in western part of Zhidan County, Ordos Basin, North China. Core and thin-section observations indicate that Chang 2 sandstones are mainly grey, light grey, fine grained arcose and lithic-arcose sandstones with 23% -56.5% alkali feldspars and plagioclases, 45% -61.5% quartz, and 5% -12% detritus. The grain sizes vary from 0.125mm to 0.25 mm with medium sorting and subangular roundness. The effective pores of sandstones are composed of residual primary pores and secondary dissolution pores under microscopic and SEM analysis. The sandstones have endured diverse diageneses since burial, including mechanic compaction among clastic grains, pressure solution of quartz, clay minerals and carbonate cementation, dissolution and replacement of feldspars and detritus, and so on. The compaction and pressolution are the main reasons for decrease of original porosity and permeability. The intergranular cementation of authigenic kaolinite and calcite reduced part of intergranular pores, but the authigenic chlorite, coating on pore walls protected part of primary pores successfully to resist mechanic compactions from upper load during burial. Moreover, dissolutions of feldspars and some lithic clasts produced substantial secondary pores which improved about 3% to 8% of total effective porosity in the reservoir sandstones. The porosity of Chang2 reservoir varies from 8.0% to 30.3%, average of 16.45%; while the permeability changes from several to thousands of millidarcies possibly because of tectonic fractures. The nuclear magnetic resonance (NMR) data shows faint bimodal pattern, the main peak locating in the right side of T_2 cutoff time, another peak in the left side, which indicate relative large pores and good connectivity of pore throats in sandstone reservoirs (Fig. 1).

* Corresponding author. E-mail: lihong2008@nwu.edu.cn; 1021618898@qq.com

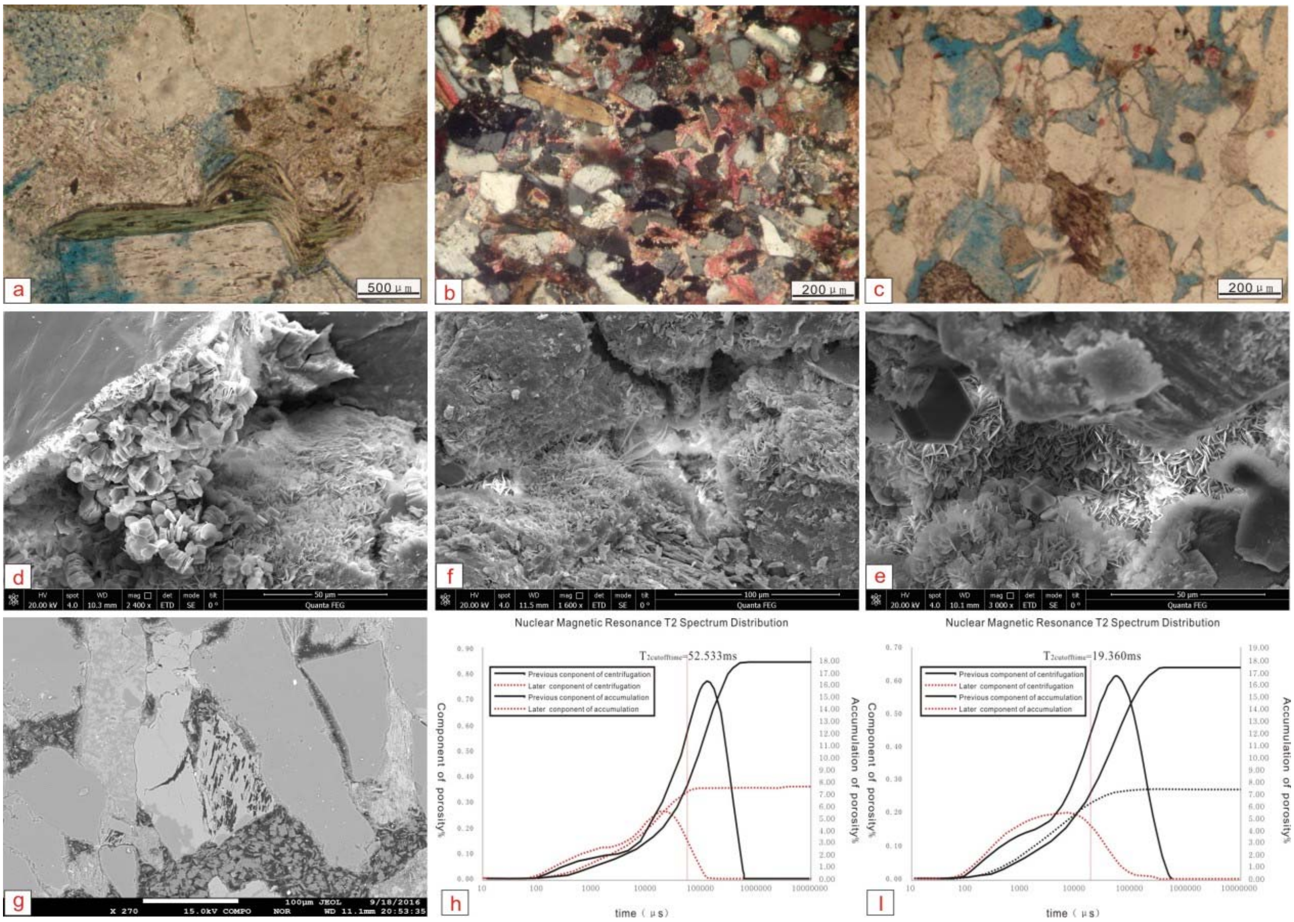

Fig. 1. Microphotographs of Chang 2 sandstone reservoirs in Renshan region, Zhidan Oilfield.
(a), Deformation of biotite, ×40, plane-polarized light; (b), Cementation of calcite, ×10, cross-polarized light; (c), Dissolution of feldspars, ×10, plane-polarized light; (d), Aggregations of authigenic kaolinite, ×2400, SEM; (e), Authigenic quartz and chlorite in the residual pores, ×1600, SEM; (f), Authigenic chlorite and illite, ×1600, SEM; (g), Dissolution of feldspar and authigenic kaolinite, ×270, EPMA; (h), Nuclear magnetic resonance(NMR) patterns of Chang 2 sandstone reservoirs; (h), Nuclear magnetic resonance(NMR) patterns of Chang 2 sandstone reservoirs.

2.2 Diagenetic stage

The homogenization temperatures of fluid inclusions on quartz surface range from 84℃ to 198℃, mostly in the zone of 110℃ to 160℃. There is obvious overgrowth along detrital quartz edges according to microscopic and EMPA analysis. X-ray diffractions shows main clay minerals of authigenic kaolinite (18%～58%), chlorite(29% 98%), illite(1% 10%) and illite/smectite mixed-layers (5% 11%). Authigenic illite crystallinity ranges from 0.56 to 0.74. Such quantitative and semi-quantitative date indicate that Chang 2 oil sandstones have been in early time of middle diagenetic stage.

Acknowledgements

This project is financially supported by the National Natural Science Foundation of China (grant No. 41272115).

References

Jin Lai, Wang Guiwen, Ran Ye, Zhou Zhenglong, and Cui Yufeng, 2016. Impact of diagnosis on reservoir quality of tight oil sandstones: The case of Upper Triassic Yanchang Formation Chang 7 oil layers in Ordos Basin, China. *J Petrol Sci Eng*, 145: 54-65.

Mansurbeg, H., Morad, S., Salem, A., Marfil, R., El-ghali, M.A.K., Nystuen, J.P., Caja, M.A., Amorosi, A., Garcia, G., Iglesia, A.L., 2008. Diagenesis and reservoir quality evolution of palaeocene deep-water, marines and stones, the Shetland-Faroes Basin, British continental shelf. *Mar. Pet. Geol*. 25: 514–54.

Ozkan, A., Cumella, S.P., Milliken, K.L., Laubach, S.E., 2011. Prediction of lithofacies and reservoir quality using welllogs, Late Cretaceous Williams Fork Formation, Mamm Creek field, Piceance Basin, Colorado. *AAPG Bull*. 95(10),1699–1723.

Wang,H.,Liao,X.,Lu,N.,Cai,Z.,Liao,C.,Dou,X.,2014.A study on development effect of horizontal well with SRV in unconventional tight oil reservoir. J. Energy Inst.87, 114–120.