
Influence of Sedimentation on Diagenesis—Taking the West Sag of Liaohe Depression as An Example

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Abstract

In order to predict high quality reservoir distribution more accurately, as an example, Shahejie reservoir in the southern West sag of the Liaohe depression was studied by using the data of measured porosity, whole-rock XRD, microscopic identification results of the wells in the study area. The influence(strength and way) of sedimentation on diagenesis of reservoir rocks was studied. The study founded that strength of diagenesis in the later stage of reservoir was influenced by sedimentation with controlling the sediment of the reservoir in the horizontal direction.

Keywords

Sedimentation, diagenesis, West sag of the Liaohe depression, horizontal direction.

1. Introduction

Liaohe depression is a secondary tectonic unit of the Bohaiwan basin, located in the central and southern part of Liaoning Province, north, East, and West is surrounded by mountains on three sides, South and extends into the waters of Liaodong Bay, the Qianshan Mountains and the Yiwulv Mountain distribution in the East and west sides of the basin, the north are Kangping and Faku hilly areas. Internal downwarp is low-lying, elevation in 20m below, is famous in the Liaohe River Delta regional distribution, and the Liaohe River and its tributaries, Raoyang River flows through the sag into the Liaodong Bay. The scope of this study for West sag of Liaohe depression in the South (Fig.1), east from Taian-Dawa fault, West to the concave slope transition zone Du 144 - Qi 65 - Jin 98 well line, arrived in North Xinglongtai majuanzi structural Xing Xi 1 well - Xing Dong 2 well line, South to the beach sea and land transition zone, with a total area of about 700km².

2. Effect of sedimentation on diagenesis of reservoir

The deposition mainly control the sediment composition, sedimentary structure, location to determine the reservoir physical property and the influence of diagenesis on reservoir properties.

2.1 Effect of sedimentation on mechanical compaction

Effect of mechanical compaction by southern West sag is obviously controlled by the impurity content. The higher the impurity content, the weaker the anti compaction ability of the reservoir, the more shallow the depth of the line contact between the clastic particles. The impurity content of Huanshu slope belt, Shuangtaizi tectonic belt, Xiaowa-Yuehai tectonic belt and Bijialing tectonic belt were 6.82%

and 3.65%, 6.00%, 4.72%, the depth of point-line contact respectively were 2646m, 2980m, 2650m, 2845m.

The mechanical compaction characteristics of different sedimentary microfacies were different. The result of statistic shows that the compaction is the main cause resulting in the disappearance of primary porosity, and the next one is cementation(Fig.2).

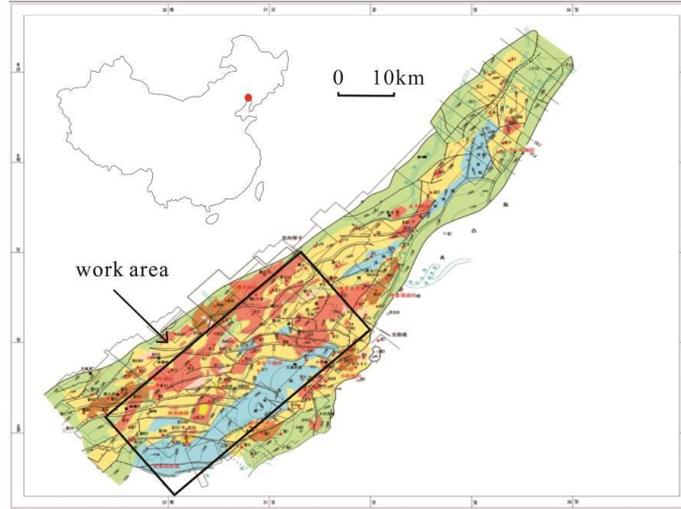


Fig.1. Work area location map

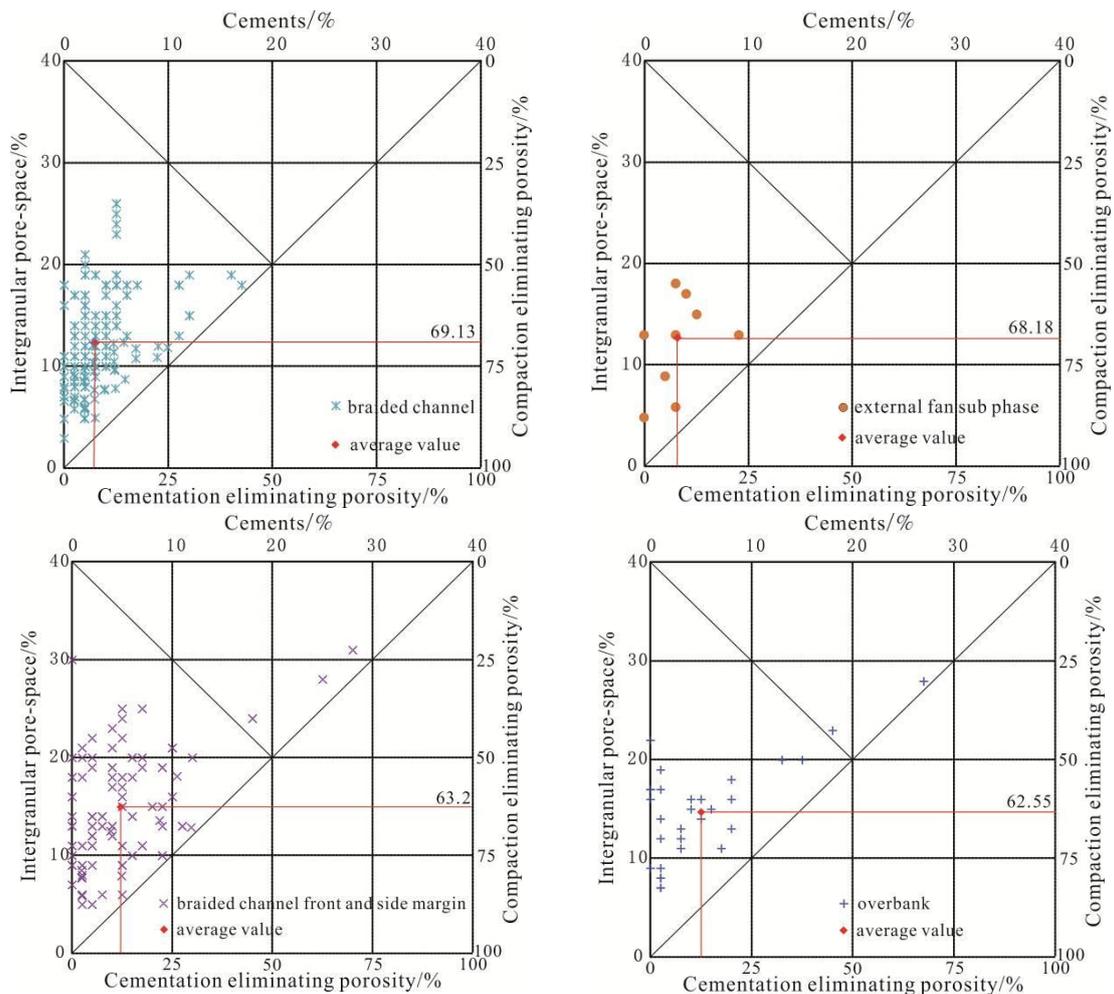


Fig.2. The relative importance of different sedimentary facies mechanical compaction and cementation of sedimentary system

Compaction is much stronger than the rest of the Bohaiwan Basin, vast majority fall in mechanical compaction area. The reason is that the tight sandstone is abnormally low pressure, and the sandstone of abnormally low pressure is often over compacted. The relative proportion of the porosity loss vary by compaction and cementation of microfacies mechanical was different (Fig.2), and in the sublacustrine fan system, The order of the relative size of the proportion of mechanical compaction is middle fan braided channel micro facies, external fan sub phase, braided channel front and side margin, overbank. The proportion of compaction were 69.13%, 68.18%, 63.2% and 62.55%. This is due to the strong water power in the sedimentary environment of the braided channel, the particle size of clastic particles is coarse, and the impurity content is small, so the mechanical compaction is the result. Therefore, the proportion of mechanical compaction is higher.

2.2 Effect of sedimentation on cementation

The result of statistic shows that clastic rock reservoir of southern West sag was mainly filled by carbonate and argillaceous, the two kinds of cements content in different sedimentary system was different. The main carbonate in the sandstone was mainly derived from the adjacent mudstone. Overbank, braided shaped channel side edge and edge were adjacent to the mudstone, the carbonate in mudstone are more likely to enter the neighbouring sandstone.

In the thin section observation, it was often found that the finer the grain size of sandstone was, the more development the quartz overgrowth was (Fig.3). The reason is that the specific surface of fine sandstone is larger than that of coarse sandstone, which is conducive to the formation of quartz overgrowth.

Research shows that the clay membrane on the surface of silica particles will hinder quartz overgrowth increase [1-3] (Fig.4). large amounts of intact clay membranes were not found in southern West sag, therefore quartz overgrowth inhibition by clay package shell in this basin is not obvious. However, in southern West sag, authigenic quartz content and clay content was negatively correlated (Fig.5). On the one hand, it shows that high mud content decreases the quartz overgrowth of space, on the other hand, it shows that Clay minerals have a certain inhibitory effect on quartz quartz overgrowth.

2.3 Effect of sedimentation on dissolution

Sedimentary facies and diagenesis influence the development of dissolution, the main geological factors that influence and control development of clastic rock dissolution were: (1) the content of feldspar and carbonate cements; (2) the concentration of organic acids; (3) migration of the dissolved substances. The content of feldspar and carbonate cements and the migration of dissolved substances were mainly controlled by sedimentary microfacies. The higher the mineral compositional maturity and structure maturity of the reservoir is, the higher the content of feldspar is, the more conducive to the dissolution of the reservoir. The sand and conglomerate with high structural maturity have good permeability, which is good for the migration of dissolved substances. In southern west sag, the braided channel microfacies and braided channel side edge and the leading edge micro phase is rich in soluble feldspar. The reservoir was in the early diagenetic stage B - the middle diagenetic stage A, the content of organic acid was high, the mineral compositional maturity was higher, the property of reservoir was better, it was conducive to the migration of organic acid and dissolved substances, its secondary face rate was 4.03% and 3.77%; dissolution of overbank is a bit poor, secondary face rate was 3.33% (Fig. 6).



Fig.3. Particles with chlorite film, $\times 100$, Huanshu slope belt, H11, 2490.3m, Es4

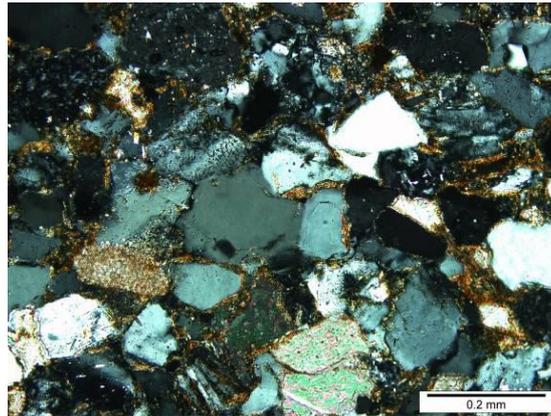


Fig.4. Quartz overgrowth, fine sandstone, $\times 200$, Bijialing tectonic belt, J101, 3535-3537.84m, Es2

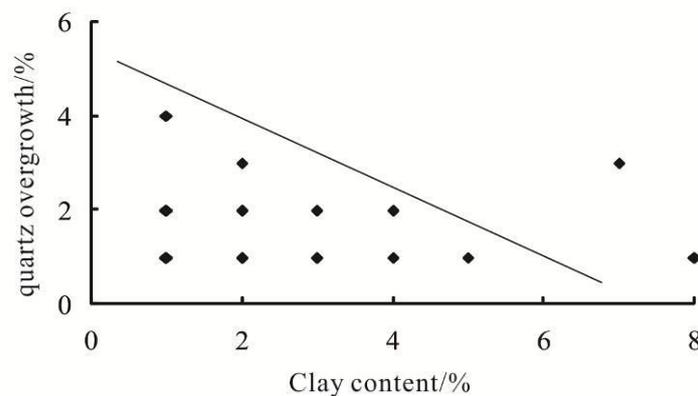


Fig.5. Relationship between SiO₂ content and shale content in the southern West sag

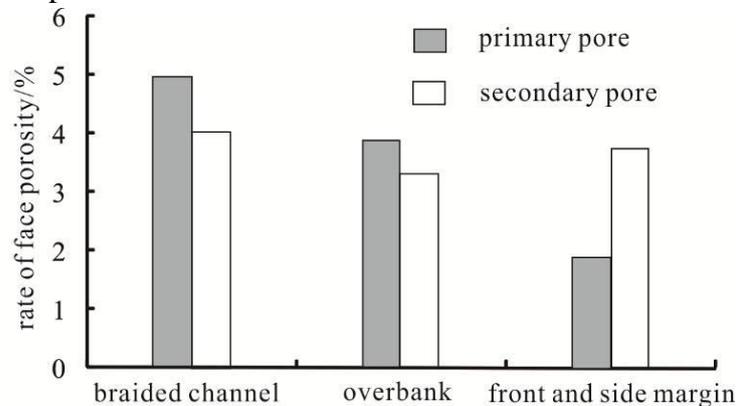


Fig.6. Proportion of primary and secondary pores in different sedimentary facies

3. Conclusion

The strength of diagenesis in the later stage of reservoir was influenced by sedimentation with controlling the sediment of the reservoir in the horizontal direction. And the diagenesis of the reservoir was affected by the diagenesis of mudstone in adjacent areas, the strength of the impact depends on the property of the reservoir and the distance between reservoir sedimentary area and mudstone sedimentary area.

Acknowledgements

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