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The Research Progress on the Occurrence Mechanism of Detained Hydrocarbon

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Unconventional oil and gas resources are closely to the retaining ability of hydrocarbon of source rock. The detained hydrocarbon can be divided to two parties: organic retaining ability including the swelling and adsorption function of kerogen and retaining ability of organic pore, and inorganic retaining ability including adsorption of detrital minerals and retaining ability of inorganic pore.

1 The Swelling Action of Kerogen

Swelling is a concept in polymer physics, which describes the phenomenon that cross-linked polymer don't dissolve but swell in the solvent.

In recent years, the initial migration/ expulsion of hydrocarbon based on the theory of polymer dissolution (solution theory polymer) and swelling method. The method was firstly introduced by Ritter. Ertas gave a swelling test technique for determining the retaining ability of kerogen. The existing data show that the degree of kerogen swelling capability decreases with the increase of burial depth and maturity, and has a close relationship with the attention of micro pores. Cai (2007) and Zhang (2008) used Ritter swelling technology prediction of hydrocarbon in the kerogen in hydrocarbon retention amount. The results show that Ritter, who seems too high an estimate of each component in the kerogen in hydrocarbon retention amount.

According to Kelemen, at different temperatures, the swelling ratio of 30-150°C was slightly different. This temperature covered the geological conditions, and the vast bulk of hydrocarbon generation temperature range, which means 30°C under the measured swelling ratio (hydrocarbon retention capacity) can represent geological conditions of organic matter hydrocarbon generation of the vast most of the temperature range under different sets of points of kerogen and the swelling hydrocarbon retention

characteristics. But it is still in the initial stage, is not perfect, the previous research methods cannot carry out the research of material differentiation.

2 Organic Material Adsorption

Polanyi (1914) carried out the adsorption theory, which shows that the adsorbent surface has a gravity for the surrounding adsorbed molecules, and the adsorbed molecules is adsorbed to the surface of the adsorbent and form a multi molecule layer adsorption. Previous studies indicated that organic matter abundance, type and maturity, pore structure and mineral composition had a great influence on methane adsorption. The methane adsorption in the shale was positively correlated with the total TOC. In mature shale methane adsorption capacity varies with the TOC and micropore volume increases linearly, and the organic components of the micro pore are main control factors of methane adsorption. Existing research shows that the chemical structure of organic matter in rocks rich organic matter to methane adsorption plays an important role, from I type to III kerogen, aromatic hydrocarbon content is gradually increasing, rich in aromatic kerogen has stronger affinity for methane, the methane adsorption capacity increased gradually. Zhang (2013), such as through under the condition of low maturity of organic matter type of gas adsorption characteristics experiments show that the influence of organic matter have very different types of gas adsorption characteristics, the influence of performance is: the typical three kinds of organic matter type corresponding to three different thermodynamic equation.

From hot gas adsorption dynamics perspective, organic and inorganic part of hydrocarbon source rocks, adsorption heat is generally bigger, and stronger affinity of methane molecules, contribution to the adsorbed gas in shale might be more big. Zhang (2012) was studied by isothermal high

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methane adsorption experiments in the shale kerogen types and thermal evolution degree of the influence of gas adsorption, has obtained the certain quantitative indicators, but there are many unsolved problems.

3 Kerogen Holding Function

The organic pore is the pore of the inside of the kerogen by the hydrocarbon generation, expulsion and so on. According to Jarvie et al, in the shale with the organic matter content of 7%, during the evolution of hydrocarbon generation, 35% of organic carbon can increase the porosity of the shale by 4.9%. Some researchers studies mud shale reservoir characteristic, types and forming conditions, put forward the shale gas reservoir evaluation parameters. In the Huang Renchun's studies of Jiao Shibai Longmaxi formation shale reservoir, in addition to the conventional reservoir pore types, particulate organic matter within the pore development degree is very high, organic pore is shale in dominant pore types, development degree is heterogeneity, morphological diversity, organic matter tiny pores, rough surface characteristics, methane adsorption provides specific surface area, the characteristics of oil (gas) make it a priority to adsorption and storage of natural gas, shale gas enrichment of the important role.

4 Inorganic Pore Adsorption and Retention

In the process of diagenesis, the transformation of clay minerals can result in the change of the related pore structure, and then the effect of the inorganic adsorption of shale gas. In theory, the interior of the clay minerals illite and montmorillonite can be developed with large pore whose diameter is 1-2 nm and for several tens of nanometers in hole, so as to constitute a considerable micropore volume and specific surface area, so it has a

strong adsorption capacity of methane. Therefore, adsorption properties of clay minerals in shale also has a important effect, especially in the shale of lower TOC, illite clay minerals are microporous structure, also is capable of adsorbing gas. The research shows that, the shale porosity can be increase with Si/Al value reduction. In 1990, Schettler and Parmoly in the Appalachian basin also pointed out that the basin shale adsorbed gas is mainly concerned with illite, and the adsorption effect of kerogen is secondary. However, the hydrophilicity of clay minerals makes the water molecules more easily occupy its adsorption sites, reduce the gas adsorption of microporous space, and reduce the capacity of clay mineral adsorbed gas. Ordos Basin is low mature degree of Lake Faces type I and rich machine Shale pore evolution and residual hydrocarbon content in the research: residual hydrocarbon content depends mainly on the total pore volume. However, there is no complete technical means and method in the quantitative aspects of hydrocarbon retention.

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