

Large-scale accumulation and distribution of medium-low abundance hydrocarbon resources in China

ZHAO Wenzhi^{1,*}, HU Suyun², WANG Hongjun², BIAN Congsheng², WANG Zecheng², WANG Zhaoyun²

1. PetroChina Exploration & Production Company, Beijing 100007, China;

2. PetroChina Research Institute of Petroleum Exploration & Development, Beijing 100083, China

Abstract: This paper analyzes the large-scale accumulation conditions and distribution characteristics of medium-low abundance hydrocarbon resources in China. Large-scale development of accumulation elements and their change in scale are the material basis of large scale oil and gas accumulation, determining the regional nature of oil and gas distribution. Liquid hydrocarbon dispersed in marine source rocks being cracked to form a large volume of gas and coal measure source rocks expelling gas during uplift are two important factors for the formation of large-scale hydrocarbon accumulation, which control the scale of source rocks that enter the main gas-generating stage. Volume flow and diffusive flow are the main migration-accumulation mechanism for the large-scale hydrocarbon accumulation, which ensures the sufficiency of hydrocarbon supply. Pancake, layer-like, and cluster are three main accumulation forms of large-scale hydrocarbon accumulation, which ensure the scale of hydrocarbon accumulation. Middle to low abundance hydrocarbon resources are characterized by near-source distribution, main-body play, late accumulation stage and single accumulation type. The pericline area of palaeo-highs in marine craton basins, the lower slopes and sags in an intra-continental depression basin, and the gentle slopes of foreland basins are the most likely areas for the development of large-scale hydrocarbon accumulation, and they have two types of accumulation, large area and large scope. The proposal of the large-scale accumulation of middle to low abundance hydrocarbon resources in China improves the hydrocarbon discovering potential in middle to deep layers of superimposed basins and in the lower slopes and sags in depression basins, enlarges the exploration scale, and extends the hydrocarbon exploration from local second-order structure zones to the whole basin with the main source rock as the center, and from middle layers to deep, even super-deep, layers.

Key words: middle-low abundance hydrocarbon resources; large-scale hydrocarbon accumulation; condition; distribution characteristics; exploration field; superimposed basin; depressed basin; onshore China

1 Overview of hydrocarbon resources in onshore superimposed basins in China

The mainland continent of China was formed as a result of the collision, accretion and merge of a number of small ancient plates (e.g. North China Plate, Tarim Plate, Yangtze Plate) of different scales^[1–2]. It has generally experience a long period of complicated evolution and multiple periods of geodynamic system superposition and reconstruction. The sedimentary basins in China received Early Paleozoic marine, Late Paleozoic marine to transitional and Mesozoic and Cenozoic continental depositional architectures from the bottom up^[3], forming a couple of large-scale superimposed basins with multi-cycles^[4–6], e.g. the Ordos Basin, the Sichuan Basin, the Tarim Basin, the Songliao Basin, and the Bohai Bay Basin.

Provided with abundant hydrocarbon resources, petroliferous basins with superimposed sedimentation are the current focus of hydrocarbon exploration and reserves increase in

China. Through the exploration over the last half a century, a number of large and medium sized oil and gas fields, e.g. Daqing, Shengli, north Dagang, Damintun have been discovered in Mesozoic and Cenozoic terrestrial formations, which symbolize the first milestone in the founding of China's petroleum industry^[7–8]. Since the late 1980s, more efforts have been put into hydrocarbon exploration targeting Paleozoic marine and transitional formations. Consequently, some large and medium oil and gas fields have been discovered in succession, e.g. Jingbian Gas Field in middle Ordos Basin and Sulige Gas Field in north Ordos Basin^[9], Kela2, Di'na and Dabei Gas Field in Kuche foreland province in the Tarim Basin, Lunnan, Tahe and Tazhong oil and gas fields in deep marine craton carbonate measures, Puguang and Longgang gas field in Permian and Triassic System in the Sichuan Basin^[10–13]. The exploration practices verify the existence of large oil and gas fields both in shallow to middle Mesozoic

Received date: 09 Aug. 2012; **Revised date:** 10 Nov. 2012.

* **Corresponding author.** E-mail: zwz@petrochina.com.cn

Foundation item: Supported by the National 973 Program (2007CB209500) and the National Carbonate Rock Major Project (2008ZX05004).

Copyright © 2013, Research Institute of Petroleum Exploration and Development, PetroChina. Published by Elsevier BV. All rights reserved.

and Cenozoic terrestrial formations and in middle to deep Paleozoic marine to transitional formations in superimposed petroliferous basins^[14–16]. According to petroleum exploration in recent years^[17–24], there are some trends in superimposed petroliferous basin exploration: (1) effective exploration depth has increased continuously. The exploration has deepened by 1 500–2 000 m compared with previous activities. In eastern China, continental clastic rock exploration has gone beyond 3 500 m depth, and discovered meaningful oil and gas in formations deeper than 4 000 m. In western China, exploration has been pushed down to over 5 000 m depth, and made breakthroughs in formations deeper than 6 000 m; the deepest exploration depth is close to 8 000 m; (2) exploration has expanded constantly from previous second-order structure zones to structural lows and depressions in spacious slope areas. Large scale hydrocarbon reserves discovered to date have made slope areas an important focus in onshore petroleum reserves and resulted in production increases in China; (3) fundamental changes in prospecting targets from previous structural reservoirs to composite stratigraphic, lithologic and structural-lithologic reservoirs have taken place. The latter has become a principal part in petroleum reserves increases; (4) reservoir types have diversified greatly from mainly clastic reservoir rocks in the past to an assemblage of clastic rocks, carbonate rocks, volcanic rocks and metamorphic rocks. Special reservoir types have gained an increasingly prominent position in reserves increases; (5) most large oil and gas fields discovered recently have medium to low abundance of hydrocarbons, indicating the deterioration of resource quality; but their large reserves scale indicates large-scale hydrocarbon accumulation in the past; (6) engineering technology plays a

crucial role in not only lowering exploration cost but also enhancing the economic value of resources.

Onshore hydrocarbon resources of medium to low abundance are spread extensively across China (Figure 1). Aiming at hydrocarbon resources with medium to low abundance in onshore superimposed petroliferous basins, this paper probes the geologic settings of these large-scale accumulations and their distribution in the hope of shedding a little light on hydrocarbon geologic theory and to push ahead exploration and reserves increases in the province.

2 Geologic settings for large-scale accumulation of medium-low abundance hydrocarbon

We have observed a special kind of hydrocarbon accumulation which is low in abundance^[25], extensive in distribution and large in potential reserve; widely spread over large onshore petroliferous basins in China; we refer to them as medium-low abundance hydrocarbon resources. In general this kind of resource differs significantly from medium-high abundance resources in terms of reservoir geometry, source-reservoir-seal assemblage, mechanisms of hydrocarbon generation, expulsion, migration and accumulation, preservation conditions, etc. Here we use the concept of “medium-low abundance resources in large-scale hydrocarbon accumulation” to indicate its accumulation and distribution features.

2.1 Concept and connotations of large-scale accumulation of medium-low abundance resources

2.1.1 Definition of medium-low abundance hydrocarbon resources

In accordance with their quality and economic value, hy-

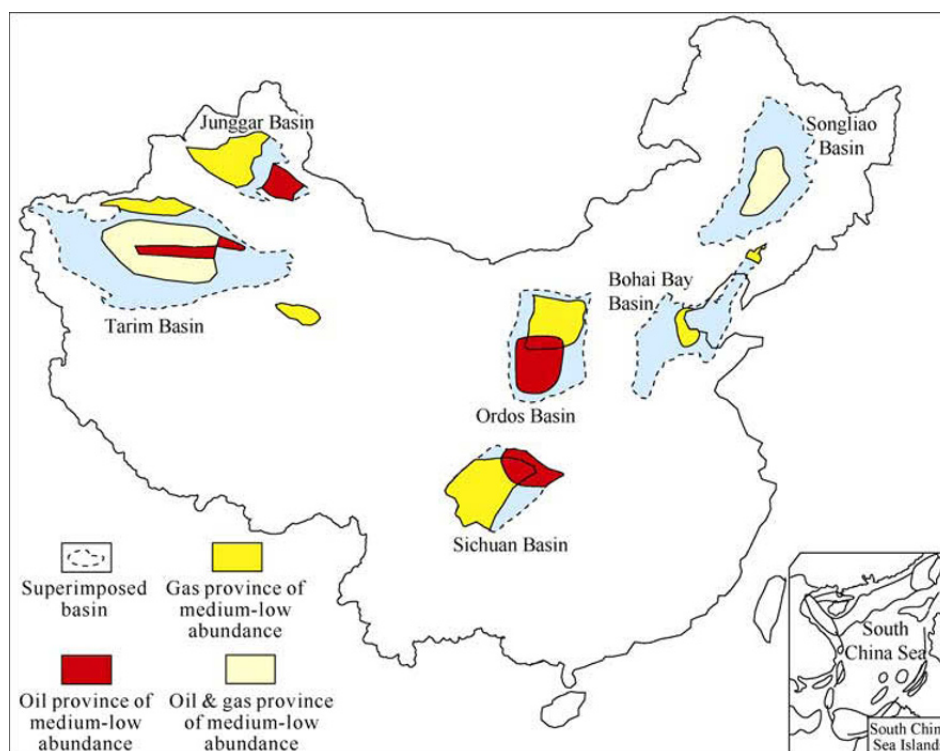


Fig. 1 Distribution of hydrocarbon resources of medium to low abundance in China

Download English Version:

<https://daneshyari.com/en/article/4720447>

Download Persian Version:

<https://daneshyari.com/article/4720447>

[Daneshyari.com](https://daneshyari.com)