

Research article

Exploration and development of large gas fields in China since 2000

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Abstract

Fifty-one large gas fields had been proved in China until 2013. Specifically, exploration characteristics of those discovered since 2000 are as follows: (1) Large gas fields are only found in basins with sedimentary area larger than $10 \times 10^4 \text{ km}^2$; (2) Large gas fields have been proved in 9 basins, with total proved reserves of $27085.88 \times 10^8 \text{ m}^3$ before 2005, much less than that after 2005, which reached $81683.77 \times 10^8 \text{ m}^3$ by the end of 2013; (3) The reserve abundance of large gas fields varies a lot. The Kela2 gas field has the largest reserve abundance of $59.05 \times 10^8 \text{ m}^3/\text{km}^2$, which is 86 times that of the smallest reserve abundance, i.e. $0.684 \times 10^8 \text{ m}^3/\text{km}^2$ of the Jingbian gas field; and (4) The reservoirs of large gas fields between 3000 m and 4500 m share a large proportion of proved reserves, accounting for 46.11% of the total. Development characteristics of the large gas fields in China are as follows: (1) The yield of large gas fields is essential to the natural gas industry of China. In 2013, the total yield was $922.72 \times 10^8 \text{ m}^3$, accounting for 76.3% of the nation's total natural gas yield; (2) The yield is dominated by coal-derived gas, which reached $710.13 \times 10^8 \text{ m}^3$ in 2013, accounting for 77.0% of the total yield of large gas fields in China; and (3) The yield of key large gas fields (Sulige, Jingbian, Daniudi, Puguang, and Kela2) is fundamental in making China a major gas producer.

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Keywords: China; Large gas field; Coal-derived gas; Exploration; Development; Reserves; Yield

In China, a large gas field refers to one with proved gas in place (GIP) equal to or more than $300 \times 10^8 \text{ m}^3$. The current number of proved large gas fields is different from that mentioned in previous literatures [1,2], because some large gas fields approaching this threshold (e.g. Qianmiqiao, Mahe and Panyu 30-1) have been removed from the list after their GIPs were graded down in reserves estimation. Figs. 1 and 2 show the geographic location and discovery year of 51 proved large gas fields in China by the end of 2013.

1. Exploration (geologic) features

The geologic features of large gas fields in China, including forming conditions, distribution regularity, main controlling factors, reservoir lithology and geologic ages, gas geneses and sources, traps and gas accumulation stages, have been widely

discussed by the previous researchers [3–8], which will not be described in this paper. This paper only deals with the features rarely studied.

1.1. Large gas fields are discovered in the basins with an area of more than $10 \times 10^4 \text{ km}^2$

There are 417 sedimentary basins in China, including 18 basins with an area larger than $10 \times 10^4 \text{ km}^2$, 67 basins with an area ranging in $(1-10) \times 10^4 \text{ km}^2$, and 332 basins with an area smaller than 10000 km^2 [9]. As is shown in Fig. 1, large gas fields have been discovered in 9 basins like Sichuan, Ordos, Tarim, Qaidam, Junggar, Songliao, Yingqiong, East China Sea and Pearl River Mouth of China (although Tiezhen-shan Gas Field has been discovered in Taiwan Basin, it is not included in them due to its undefined reserves, the same below). Specifically, the Tarim Basin has the largest area (about $56 \times 10^4 \text{ km}^2$) and the Qaidam Basin has the smallest area (about $10.4 \times 10^4 \text{ km}^2$). No large gas field has been

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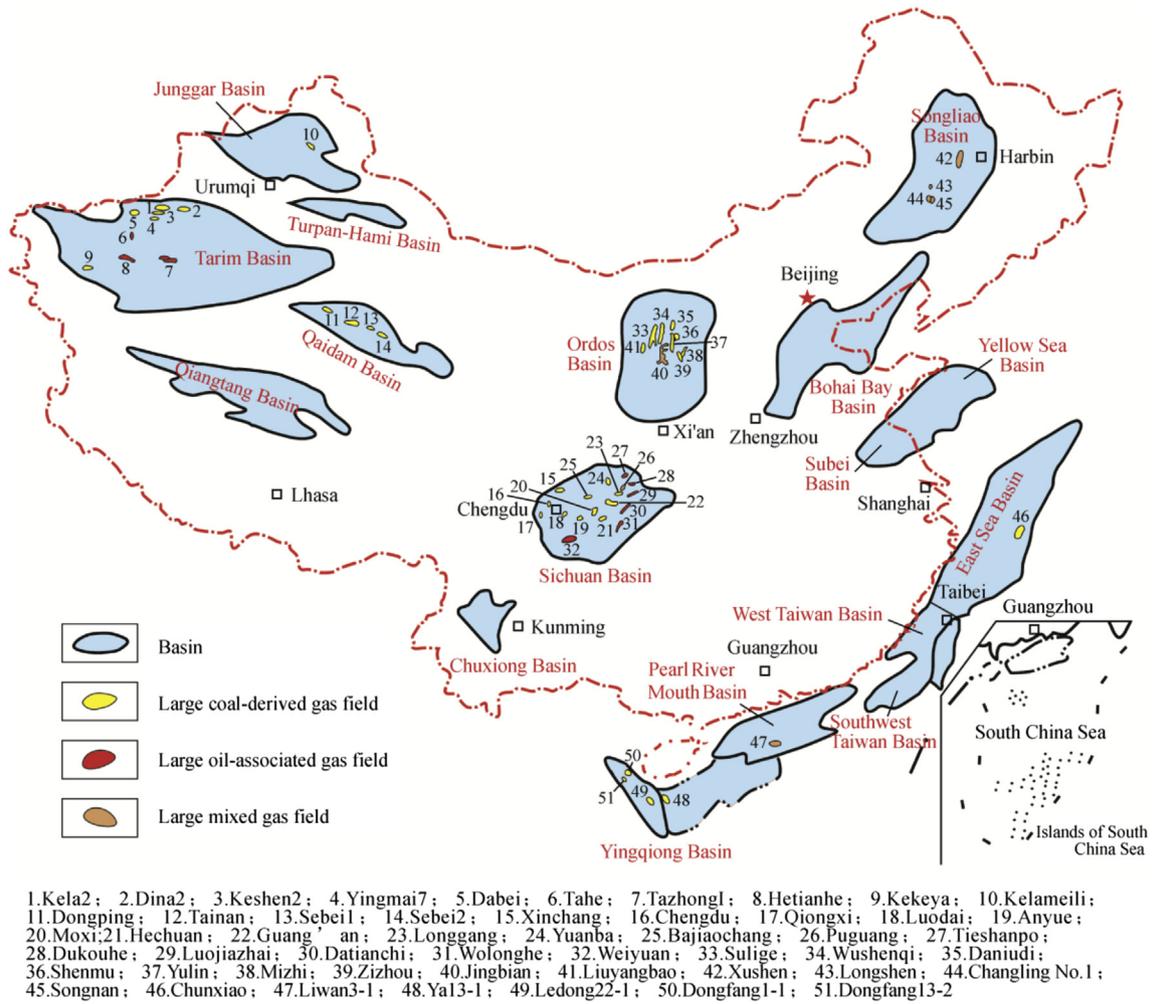


Fig. 1. Distribution of major sedimentary basins and large gas fields in China (by the end of 2013).

discovered in the basins with an area smaller than $10 \times 10^4 \text{ km}^2$ up to now.

In the 18 basins with an area larger than $10 \times 10^4 \text{ km}^2$ in China, only 9 basins have been found with large gas fields, while the remaining 9 basins are prospective for discovering large gas fields. Apart from further operations in the former 9

basins, attention will be paid to the remaining 9 basins where the potential is also large. Therefore, more large gas fields can be proved one after another in the future in China.

A larger sedimentary basin often corresponds to a larger area of source rocks, more horizons and stable structures, which provide the formation of a large gas field with two

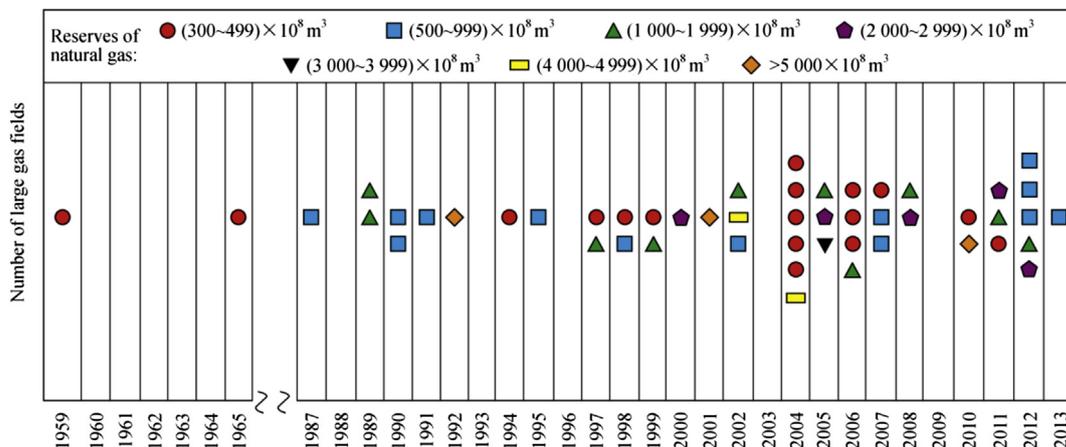


Fig. 2. Large gas fields proved in different years in China.

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