

Major Breakthroughs in Geological Theory, Key Techniques and Exploration of Tight Oil in China

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In recent years, U.S. tight oil exploration and development have achieved significant progress, with rapidly increasing production, which has significantly changed the U.S.A. energy supply pattern (Fig. 1).

Compared with the North American marine to marginal marine-continental transitional facies, China's tight oil (Fig. 1) is characterized by: (1) source rocks with middle to high organic carbon content and a great thickness but covering a small area; (2) reservoir rocks of various types, with poor physical properties and strong heterogeneity; (3) tight oil with a small area, great accumulated thickness and strong enrichment; (4) crude oil with greatly variable features and high oil saturation; (5) unobvious reservoir pressure anomalies; and (6) high production in the initial single-well reconstruction stage, but with a relatively quick decline. Factors controlling the formation and distribution of China's continental tight oil include: (1) stable and gentle depression-slope areas in continental lacustrine basins acting as favorable areas; (2) high-quality source rocks in continental depression-trough areas as a basis of large-scale tight oil formation and control of its distribution; (3) a large area of various continental tight reservoirs, locally forming accumulation areas; and (4) source

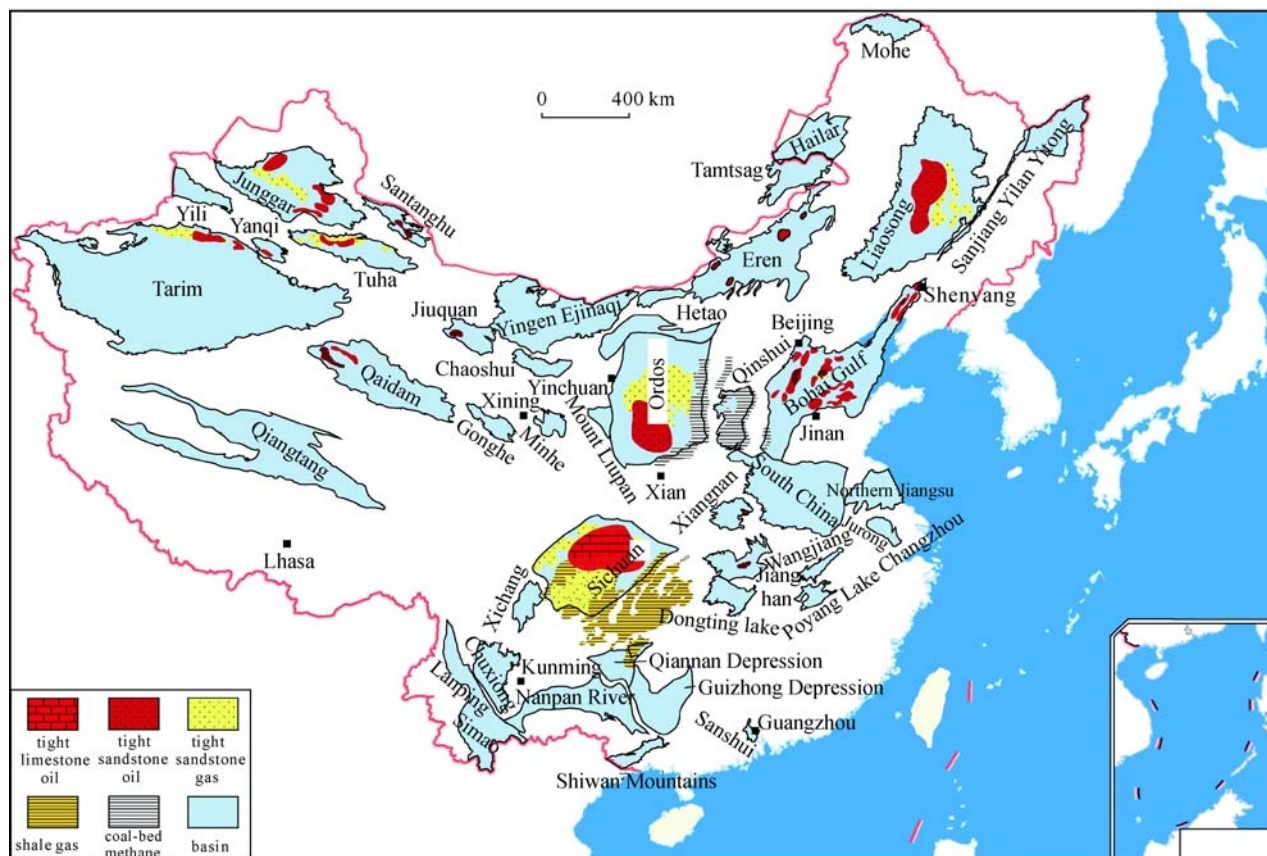


Fig. 1. Map showing main continental unconventional gas areas in China.

rocks in close contact with reservoirs, and near-source migration and accumulation in depression-slope areas forming many types of tight oil (Fig. 2).

An integrated utilization of four key techniques, i.e., seismic prediction, logging evaluation, horizontal well drilling, and volume fracturing, resulted in nearly 800 million tons of new controlled and predicted oil reserves in 2013, and led to three 50 to 100 million-ton-magnitude reserve areas—Chang 7 in Ordos, the Lucaogou Formation in the Jimusaer depression of Jungar, and the Fuyu oil layer in Songliao basin—and a number of 100-million-ton magnitude reserves areas, such as Zhahaquan in Qaidam and Leijia in the Bohai Bay basin. Till now, 1.5 billion ton reserves have been suggested in the significant tight-oil zones of the Fuyang oil layer in the Songliao basin, the Yanchang Formation in the Ordos basin and the Lucaogou Formation in the Jungar basin, making tight oil China's most realistic succeeding future energy source. This result has been ranked as the year's top ten prospecting achievements in 2013 by the Geological Society of China.

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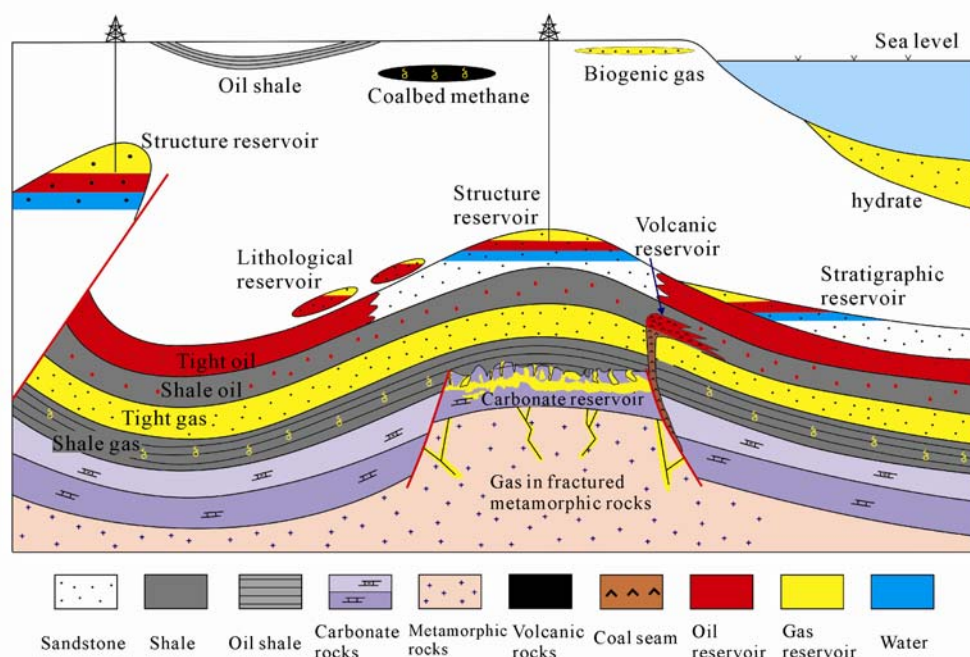


Fig. 2. Model showing distribution of tight oil.