

### 3 Discovery of a Giant Conglomerate Oilfield in the Mahu Sag

Since 2005, CNPC has been conducting research and studies to challenge the traditional understanding that no large-scale coarse sediment leads to few oil and gas reservoirs with scale benefits in sags. With the Mahu Sag in the Junggar Basin in Xinjiang as a pilot site, the company has been exploring a brand new exploration target — conglomerates in sags. Consistent efforts over the past decade have helped us develop a theoretical and technological framework for the exploration of conglomerate reservoirs in sags, resulting in the discovery of a giant conglomerate oilfield in Mahu with reserves of about 1 billion tons. In 2018, this significant discovery was awarded the first prize of the State Science and Technology Progress Award.

#### Project Background

The northwestern margin of the Junggar Basin in Xinjiang is one of China's major oil-producing areas featuring conglomerate reservoirs. The Karamay Oilfield, one of China's most important petroleum production bases, was discovered in this region. However, after half-century-long ongoing exploration, the region now lacks newly added reserves and needs to seek for new pay zones. And the discovery of this giant oilfield in the Mahu Sag has come just in time.

#### Theoretical and Technological Innovations

- **Oil bearing:** Break through the conventional view of sedimentology that conglomerates are distributed along the basin margin. The sag-wide conglomerate deposit model is introduced as a new theory for continental deposit
- **Oil generation:** Break through Tissot's single-peak oil generation model and establish the dual-peak oil generation model for hydrocarbon source rocks in alkaline lakes, developing the existing continental petroleum formation theories
- **Oil accumulation:** Break through the existing view that large-scale deposits result from source-reservoir assemblage and build the source-conglomerate accumulation model, developing the lithological reservoir theory
- **Oil extraction:** The bottlenecks in conglomerate reservoir evaluation, desert forecast and economic producibility are overcome to enable effective exploration and efficient production

#### Project Significance

The giant oilfield in the Mahu Sag witnessed the, probably, oldest alkaline lacustrine deposits in the world for the first time and managed to reconstruct the thermal evolution and hydrocarbon-generating process. As the greatest exploration achievement of China over the past decade, Mahu is the world's largest-ever monoblock conglomerate-type oilfield, and one of the most important sources of crude production ramp-up in China, with its production capacity expected to exceed 10 million tons by the end of the 13th Five-Year Plan period.

In particular, crude in Mahu Oilfield contains the naphthenic base component, a rare raw material essential for the production of high-end petrochemicals such as high-power aviation fuels and ultra-low temperature lubricants, etc.

For CNPC, the discovery in Mahu represents a successful move into a new sphere of hydrocarbon exploration and provides replicable theories and technologies for global peers, making it possible for the conglomerate reservoirs in sags, which is of vast potential, to serve as an important alternative of hydrocarbon exploration in the 21st century.

