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## **First-Ever Vessel-Based Large-Scale Propped Fracturing Treatment in a Tight, Deep, Hot Formation in Bohai Bay Yields Multiple Fold Oil Production Increase**

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### **Abstract**

Bohai Oilfield, CNOOC's offshore oilfield in northern China's Bohai Sea, is China's third largest oilfield in terms of oil & gas production. Most of the offshore shallow, high permeability reservoirs have been developed since early eighties. Recently, attention has been shifted to the deep, and low permeability reservoirs in the offshore Bohai Bay area.

The BoZhong (BZ) field, an important petroleum district in the Bozhong Depression, has a complex history of structural and depositional evolution. The Shahejie (SHJ) reservoir shows general characteristics of deep (~13,000ft), low to medium permeability; light crude; high temperatures; and overly pressured. The natural flow capacity of the formation without stimulation is around 60–190 BOPD, at a high drawdown pressure of 1,500 psi.

In 1992, propped hydraulic fractures had been attempted, but the jobs failed due to lack of horsepower by placing limited amount of frac equipment on the small platform. Between September 2006 and February 2007, hydraulic propped fracturing treatments on 5 wells have been successfully carried out, targeting the Shahejie section-II (SHJ-2) and section-III (SHJ-3) formations.

A fracture determination service was performed prior to the main frac treatment for all the wells in order to have a better understanding of the rock and fluid properties prior to pumping of the main hydraulic fracturing treatment. More than 600,000 lbm of 20/40 intermediate strength proppant were successfully placed into the formation, using a total of 9,120 barrels of high-temperature delayed borate crosslinked fracturing fluid.

Initial post-job oil production rate was encouraging, up to 2800 BOPD of post-frac oil production in a single well, which was a more than 10-fold production increase as compared to the wells that were not fracture stimulated. The post-frac productivity index increased by a factor of between 2 and 7.

The success of this project is considered to be a major breakthrough in Bohai Bay history:

- This is the first-ever large-scale, highest horsepower fracturing operation ever deployed to pump a frac job from a frac vessel in offshore China.
- The post-frac production rate proved that the Shahejie formation can be produced economically. CNOOC was able to recognize 180–450 million barrels of crude reserve in BZ field.