

## Characteristics of Lowstand Fans and Their Reservoir Quality since Middle Miocene in the Yinggehai and Qiongdongnan basins

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In the recent years, with the discovers of big oil or gas fields in the deepwater lowstand fans, such as America, Norway, Brazil, it has become a leading edge and hotspot field. The Yinggehai and Qiongdongnan basins, as Cenozoic sedimentary basins in the northwest margin of South China Sea, have the similar tectonic background and the prospect of hydrocarbon exploration in the two basins has been proved by several decades' exploration.

On the basis of analysis from the drillings, seismic profiles, logs and cores, firstly, as the background of lowstand fans formed, the sequence stratigraphy framework has been set up and the models of shelf-slope systems evolution have been proposed. Our results reveal that the stratigraphic patterns of the Yinggehai continental margin are mainly characterized by progradational slope prisms, which result in a rapid shift of shelf edges seaward and southwestward due to a high rate of sediment supply. In contrast, in the Qiongdongnan area, the slope margins show a vertical stacking pattern or a slight shift seaward, characterized by dense gravitational faults, roll over structures, and slump deposits.

Secondly, the characteristics and distributions of lowstand fans including lowstand wedge, lowstand delta, slope fan, basin floor fan and incised valley fill have been summarized. Their formation, scales and sedimentary composition are affected by the follow factors, such as sea level change, tectonic activity, sediments supply and palaeogeomorphology. In the view of sedimentary dynamics, there are mainly composed of gravity current deposits, such as fine grained turbidites, debris and slumps. And the factors include initial flow characteristics (i.e. scale and density) of the gravity current and the relief (i.e. length and obliquity) of the basin floor.

Thirdly, due to the sparse wells in these basins, it is very difficult to predict the reservoir features by the interpretation from logging. In order to estimate if they are made of sandstones or shale, hydrodynamics modeling has been done by FLUENT software. By tracing the depositional processes of the lowstand fans and their characteristics, including lowstand wedge, slope fan and basin floor fan, we can observe and change the characteristics of reservoirs by adjusting the granularity until the geometry is similar as that from the interpretation of seismic reflections. At that time, we think it is the grains building up the lowstand showed in the seismic profiles. The results verified by some drillings can be used to predict reservoir quality.

Furthermore, the effects of the high geothermal and overpressure on the evolution of porosity are very important for reservoir quality. Due to the unique temperature-pressure characteristics in the two basins, their reservoirs diagenesis has larruping processes and traits. With comparing two types of overpressure systems (self-source type and conduction type) that have been confirmed by cores and logs, the results show: 1)high geothermal gradient make some minerals tend to be dissolved easily, which firstly results in the prompt decreases of sandstone porosity, and then creating secondary porosity; 2)self-source overpressure can prevent parts of original porosity from compaction, which causes sometimes high porosity in deep reservoir; 3)fluids expulsion causes lots of cracks which effectively increase reservoir permeability, and hot fluid from deep can accelerate the process of diagenesis in overlying sections.

Finally, compared with the international cases in deepwater lowstand fans and combined with the evolution of diapirs, sedimentary characteristics of reservoirs, existing hydrocarbons structures and fields in the two basins, three models of hydrocarbon accumulation in lowstand fans of the Yinggehai and Qiongdongnan basins have been concluded: piercement diapir model and blind piercement diapir model in the Yinggehai basin, and incised valley erosion model in the Qiongdongnan basin.