# Evolution of Abnormal Pressure in Paleogene Es3 formation of the Huimin Depression, Bohai Bay Basin, China

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## Abstract

The evolution of abnormal pressure is crucial for hydrocarbon migrating processes. While paleo-pressure reconstruction is still a challenge at present. In this study, the PVT simulation method and homogenization temperature-salinity method based on fluid inclusion messages were used for abnormal pressure evolution analysis in the Huimin Depression, which is characterized by a complex distribution of abnormal pressure, including overpressure, normal pressure and underpressure. The origins of abnormal pressure were also analyzed in terms of quantity to examine the rationality and reliability of the paleo-pressure reconstruction. The results revealed different evolution processes of paleo-pressure in the Central Deep-Sag Zone (CDSZ) and the Northern Tectonic Uplift Belt (NTUB). In the CDSZ, the abnormal paleo-pressure experienced a rising stage from 30 to 24 Ma, with the pressure coefficient (Pcoe) rising to 1.2. From 24 to 15 Ma, the Pcoe fell to 1.0, followed by a second rising stage from 15 to 5 Ma with the Pcoe rising from 1.2 to 1.5. From 5 Ma to the present, the Pcoe fell again from 0.9 to 1.3. In the NTUB, the Pcoe fell from 1.0 to approximately 0.7 from 30 to 14 Ma and then rose again to approximately 1.0 from 14 to 6 Ma. From 6 Ma to the present, Pcoe fell from 0.6 to 0.8. The origin analysis of abnormal pressure showed the effect of disequilibrium compaction and hydrocarbon generation resulting in overpressure of 9.1 MPa and 6.39 MPa in the CDSZ, respectively. Rock dilatancy and the aquathermal effect caused a decrease in pressure of 1.71 MPa and 4.01 MPa. In the NTUB, only 2.85 MPa overpressure was provided by hydrocarbon accumulation. However, rock dilatancy and the aquathermal effect caused a decrease in pressure

of 6.46 MPa and 2.68 MPa, respectively. The results of paleo-pressure reconstruction and quantitative origin analysis of abnormal pressure showed well match, which indicates the reconstructing result is reliable. This analytical approach for paleo-pressure evolution could be helpful for improving the accuracy and reliability of the paleo-pressure reconstruction work.