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Quantitative Analysis on the Origin of Overpressure in the Qikou Sag of the Bohai Bay Basin, China

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The Cenozoic sediments in the Qikou Sag of the Bohai Bay Basin, China, are rapidly buried, and the overpressure commonly existed in the Paleogene Shahejie Formation. The overpressure always has a close relationship with the generation and distribution of hydrocarbons, which reduces the quantitative analysis of the origin of overpressure becomes important for the evaluation of the reservoirs. In our present work, three methods are used for analyzing the origin of overpressure, including the logging curve analysis method, the Bowers method, and the velocity-density cross-plotting method. Under the influence of under-compaction, the well-log responses in the formations are characterized by high porosity, high acoustic time difference, and low electrical resistivity. Under the influence of the hydrocarbon generation pressurization, the porosity and density are basically constant, while the acoustic time difference increases and the resistivity decreases with the depth. With both considerations of these two features, we established an evaluation model for the origin of overpressure, which can be used for quantitatively calculating the contribution rate of the under-compaction and hydrocarbon generation pressurization. By using the established model, the origin of overpressure in the Sha-2 and Sha-3 members of Shahejie Formation is quantitatively evaluated. The results show that the origin of the overpressure of in the Sha-2 and Sha-3 members is mainly caused by the under-compaction. However, the hydrocarbon generation pressurization also shows important influences on the origin of overpressure. The mean contribution rate of the under-compaction on the origin of overpressure in the Sha-2 member is 78 %. And the mean contribution rate of the under-compaction in the Sha-3 member is 63 %. The results and evaluation method in this study provide valuable insights for understanding the overpressure effect in Qikou Sag.