Causation of Carbonate Cements in Sandstones Near the Overpressured Top Seal in Niuzhuang Sag of Bohai Bay Basin, China

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ABSTRACT

The well-developed carbonate cementation in sandstones near the overpressured top seal (present-day depth: 2400~2900m) in Niuzhuang Sag are closely related to the overpressured fluid activities, commonly with carbonate content between 12%~32.5%. Through the data analysis of 90 carbonate cements samples selected from sandstones near the overpressured top seal by electron-microprobe showed that carbonate cements could be mainly divided into three kinds, including calcite, ferrocalcite and ankerite. Their diagenetic sequence can be determined as calcite→ferrocalcite→ankerite combined with X-ray diffraction and cathodoluminescence data. According to the observed results of the carbonate fluid inclusions, the depositing temperature of the calcite, ferrocalcite and ankerite cements in sandstones near the overpressured top seal are significantly much higher than the original formation temperature that indicated an obvious effect by overpressured thermal fluid invasion. Furthermore, the above researches were tested by using oxygen isotope geological thermometer and the results were consistent with the actual observation values that the precipitation temperature of calcite, ferrocalcite and ankerite cements range respectively from 85 to 105℃、110 to 130℃ and 125 to 140℃, for the homochromous overpressure fluid of δ^{18}OOSM is respectively around 0.00‰、0.20‰ and 0.25‰; the δ^{18}OPDB values fluctuate from -15.2‰ to -14.2‰ for calcite 、-14.2‰ to -10.3‰ for ferrocalcite and -13.2‰ to -10.6‰ for ankerite; However, the δ^{13}CPDB values of carbonate cement formed in the late diagenetic stage have an obvious positive drift, ranging from -1.6‰ to 3.4‰, which proves that the dissolution-reprecipitation process of Es4 lacustrine carbonate seems to play an important role in the source of δ^{13}CPDB. The carbon isotopic fractional distillation within carboxylic acid molecules also has some influence.