Investigating the Thermal Evolution of Organic Matter in Salt Lakes under the Influence of Different Ions

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Salt lakes can be divided into carbonate lake (CO_3^{2-}: rich, Ca^{2+}:depleted) and sulfate lake (Ca^{2+},SO_4^{2-}:rich, CO_3^{2-} :depleted) according to the relative content of 8 ions in the brine. The ionic composition of the two kinds of salt lake not only determine the mineral deposits and the transformation of clay minerals, but also affect the evolution of sedimentary organic matter in lake combined with salt and clay minerals.

The modern sediments from the two typical salt lakes are subjected to thermal simulation experiment in gold tubes of the anhydrous system. Through the analysis of the yield, the two types of salt lakes have distinct characteristics of organic matter evolution.

1. In the experimental temperature range of 300~540 °C, the gaseous hydrocarbon yields of the two are always rising, and the gaseous yield of the organic matter of the sulfate-type is always higher than that of the carbonate-type.

2.The sulfate lake sediment has a high liquid hydrocarbon yield at the beginning of the heating reaction (300°C), indicating that the initial soluble organic matter in the sulfate lake is higher.

3. At 360 °C, the carbonate-type organic matter reached the first oil-producing peak, earlier than the sulfate-type (420 °C), but the latter reached the peak of gas. It indicates that the carbonate-type organic matter enters the thermal evolution for oil generation earlier than the sulfate type.

The analysis of clay minerals from the two types of salt lakes shows that the carbonate-type deposits contain smectite, and the content of I/S mixed layer is higher than that of sulfate-type. The smectite and I/S mixed layer forms the organic-clay composite with organic matter. Compared with the combination of covalent bonds and organic matter in kerogen, the non-covalent bond energy of organic matter and clay is small, and it is easy to break when heated,and then releases the organic hydrocarbon.That is the reason that the organic matter of the carbonate type reaches the peak of thermal evolution for oil generation earlier.