

## **Calculation of biogenic elements proportion and their distribution characteristics in shales of the Shahejie Formation in the Dongying Depression**

ZENG XIANG<sup>1</sup> CAI JINGONG<sup>1\*</sup> XIE AOBO<sup>1</sup> LI YUANFENG<sup>1</sup>

<sup>1</sup> State Key Laboratory of Marine Geology, Tongji University, Shanghai 200092, China

Most elements in shales have a mixed origin, that is, authigenic and detrital. The authigenic fraction controlling biological processes can be referred as biogenic elements. Therefore, accurate calculation of biogenic elements composition and their distribution characteristics is a prerequisite for paleoproductivity analysis. Samples collected from the Shahejie Formation (the middle Es3, the lower Es3 and the upper Es4 submember) in the Dongying Depression are selected for X-ray diffraction analysis, pyrolysis analysis and elemental geochemical analysis. Results show that Al was positively related to clay and detrital minerals, and trace elements (TEs) also exhibited well positive correlations with Al in the middle Es3 submember, while the TEs with high discretization showed weaker correlation with Al in the other two submembers. This indicates that the TEs of the middle Es3 were mainly terrigenous input and could represent the detrital provenance of the ancient lake. Accordingly, in this study the authigenic fraction was estimated as the part in excess of the middle Es3 elements abundance. Research found that elements (P, K, Mn, Cu, Zn, Ni, Co, Cr, U, V) of the upper Es4 showed significantly higher concentrations than that of the lower Es3. Biogenic elements such as P, K, Mn, Cu, Ni covaried with TOC in shales, which, however, was not the case for environment sensitive elements (Zn, V, U, Co, Cr). This indicates that the authigenic elements normalized to the middle Es3 could accurately reflect the geochemical characteristics of the lake during sedimentation. Organic matters were mainly originated from autochthonous deposition of autotrophs in both of the lower Es3 and the upper Es4 submembers. The lower biogenic elements concentration led to lower paleoproductivity during sedimentation of lower Es3, while higher biogenic elements concentration had provided favorable nutritions for algal blooms during the upper Es4 sedimentary period. It also can be inferred that total content of original organic matter increased with increasing biogenic elements abundance in study area. In summary, layers with high biogenic elemental concentrations are beneficial to biological growth and trend to have better hydrocarbon potential.