

#### 11.4 Effect on Oil Shale Mineralization of Gravity Flows

Rong Liu, Zhaojun Liu, Qingtao Meng

*Jilin University, Changchun, China*

The Dalianhe oil shale mine, a famous coal-oil shale open pit mine, lies in the Yilan basin, a small fault basin in Heilongjiang province of China. In Yilan basin, two suites of Eocene oil shale developed. The top suite is a coal-bearing member that shows great thickness but low oil yield, whereas the lower suite is an oil shale member that developed with coal and has high oil yield. Utilizing outcrop, mineral features of rocks, organic petrology and analysis of geochemical characteristics, it has been determined that oil shale of the coal-bearing member was deposited in a lacustrine bog environment, whereas oil shale of the oil shale member was deposited in a semi-deep to deep lake environment. Studies show that though oil shale of the two members developed in different environments, they both consist of mixed type II<sub>1</sub>-II<sub>2</sub> kerogen and reflect weakly oxidizing-reducing conditions. Those characteristics are common for the lacustrine bog environment, but not for the semi-deep to deep lake environment. Usually oil shale in semi-deep to deep lake environment has type I-I<sub>1</sub> kerogen and reflects reducing conditions. Further studies shows that deposition in gravity flows cause the above characteristics in semi-deep to deep lake sediments.

Gravity flows developed in the oil shale member and display features of turbid flow. Turbid flows show many Bouma cycle patterns, such as ABCDE member, ACD member, CD member, CDE member. ABCDE member, ACD member and CD member developed in the bottom of the oil shale member. CD member and CDE member developed in the bottom of the oil shale member. Bouma cycle pattern deposition is not well developed in the middle part. Horizontal bedding developed well in oil shale layer. Rippled bedding, graded bedding, small festoon cross-bedding and deformation bedding developed in resedimented rock. Also there are local burrow structures in resedimented rock. In the field, resedimented rock flasers with 2 meter diameter can be found in thick oil shale layers. Frequent gravity flows which deliver inorganic material into semi-deep to deep lake with oxygen are unfavorable to organic preservation. As a result, the oil shale of both members are mixed type II<sub>1</sub>-II<sub>2</sub> kerogen, and reflect weak oxidizing-reducing conditions.