Oil-source correlation in the slope of the Qikou Depression with discriminant function analysis

L. ZHANG[1]*, G. BAI[2], X. ZHAO[3], L. ZHOU[3], S. ZHOU[1], W. JIANG[3], Z. WANG[1]

[1]Key Laboratory of Petroleum Resource, Institute of Geology and Geophysics, CAS, Beijing 100029, China (*correspondence: lpzhang@mail.iggcas.ac.cn)

[2]State Key Laboratory of Petroleum Resources and Prospecting, China University of Petroleum, Beijing 102249, China

[3]Dagang Oilfield Company of PetroChina, Tianjin 300280, China

Commonly-used tools for oil-source correlation, such as mass chromatograms and cross-plots of geochemical parameters, cannot process multiple geochemical variables and plenty of samples simultaneously, leading to uncertainties of source recognition and even failures. To solve this problem, discriminant function analysis (DFA) is selected from multivariate statistical methods based on theoretical analysis, and applied in the slope of the Qikou Depression. The main source rocks in the Sha-3 and Sha-1 Members of the Paleogene Shahejie Formation cannot be distinguished with commonly-used tools. Using DFA and 23 parameters, we developed the discriminant model for oil-source correlation. High correct rates of leave-one-out cross-validation (89.4%) were achieved, indicating a sufficient discriminatory power. The oil-source correlation results are consistent with geological conditions and illustrate that there is still a significant exploration potential in the Sha-3 petroleum system. The case study further demonstrates that DFA is a very powerful tool for oil-source correlation.