Geochemical Characterization of the Lower Pennsylvanian Morrow Formation in the Anadarko Basin of Oklahoma

Yagmur Sumer Gorenekli[1]

[1]University of Oklahoma

ABSTRACT

The Morrow Formation is one of the most widespread unit of Early Pennsylvanian period, found in Oklahoma, Anadarko Basin. This formation is part of a stacked oil and gas play in the South Central Oklahoma Oil Province (SCOOP) and it has been one of the most productive oil and gas reservoir since 1950s. However, publicly available geochemical information about this formation is very limited. In this study, geochemical trends of Morrow Shale in western Oklahoma will be characterized. Depositional environment, maturity and lithologic characteristics of the formation will be interpreted by use of bulk geochemical and biomarker analysis. In addition, unusual abundance of some of the biomarkers in Morrow Shales will be discussed.

In this study, 15 source rock samples from the Morrow Formation in the Anadarko Basin were evaluated. Additional source rock samples within the same study area will be also provided from Oklahoma Petroleum Information Center. Bulk-geochemical data of the formation will be produced by Rock-Eval pyrolysis. Extracted and fractionated source rock samples will be analyzed by using gas chromatography (GC), gas chromatography-mass spectrometry (GCMS) and gas chromatography-mass spectrometry-mass spectrometry (GC/MSMS) instruments.

Biomarker analysis indicated that the Morrow Formation was deposited in a suboxic environment with terrestrial higher plant input. Water salinity during formation of Morrow was normal to slightly elevated. M/z 191 chromatogram generally showed relatively higher abundance of pentacyclic terpanes compared to tricyclic terpanes. Exceptional higher tricyclic terpanes may be related to thermal maturity or changes in depositional environmental conditions. One of the characteristic feature of the M/z 191 chromatogram of the Morrow Formation is high concentrations of 18α(H) Norneohopane and 17α(H) Diahopanes. Moreover, significant amount of demethyalted hopanes such as 25-Norhopane, 28,30-Bisnorhopane, 25,30- Bisnorhopane, and 25,28,30-Trisnorhopane are present in the Morrow Source Rocks. These biomarkers are biodegradation products and their occurrence in source rock is unexpected. Oleanane is a pentacyclic terpane, which is produced by angiosperms of land plants. The age of oleanane bearing bitumens have been associated with Early Cretaceous or younger for a long time. However, most of the Morrow Source Rock samples, which were deposited during Early Pennsylvanian, have considerable amount of oleanane. In this study, potential source of the oleanane and demethyalted hopanes will be discussed. Moreover, detailed biomarker analysis of the Morrow Source Rock will be conducted and interpreted.