GeoConvention
Calgary • Canada • March 7-11 2016
OPTIMIZING RESOURCES

Organic/inorganic Geochemistry, Petrology and Palynology of the Turonian-Cenomanian Second White Specks Formation, SK and MB, Canada, Application for Paleo-condition Reconstruction

Somayeh Hosseininejad [1], Per K., Pedersen [1], Ronald J., Spencer [1], Hamed Sanei [1, 2]

[1]Department of Geoscience, University of Calgary

[2]Geological Survey of Canada

Abstract

Organic geochemistry and petrography data were collected for the Upper Cretaceous Second White Specks Formation (2WS) and the overlying and underling units in two areas along the eastern margin of the Western Interior Seaway (WIS). In addition to Rock-Eval pyrolysis, optical maceral petrography was performed on organic matter (OM) to determine the organic matter composition, depositional paleoenvironment, oceanographic conditions, and hydrocarbon potential of the studied units. Two sets of samples were obtained (total of 80 and 21 for Rock-Eval and Palynology, respectively) from cores located in Waskada Field (WF) in southwestern Manitoba and Pasquia Hills area (PH) in east-central Saskatchewan.

Mean vitrinite reflectance (VRo) of 0.54% and mean T_{max} values of 408°C show that 2WS sediments are thermally immature with respect to thermogenic hydrocarbon generation. High total organic carbon (TOC average=7%) and dominance of marine (type II) kerogen suggest excellent petroleum source rock potential. Maceral analyses showed that the kerogen is dominated by marine liptinite with subordinate amount of vitrinite and inertinite components. Palynology studies revealed different assemblages of organic matter including polymorphs, phytoclasts and amorphous organic matter (AOM), from which AOM is the most dominant constitute. AOM is mainly marine; with primary (algal) and secondary (bacterial) sources. This represents a period of phytoplanktonic bloom, associated with dysoxic/anoxic bottom-water conditions, during the Upper Cretaceous maximum sea-level highstand, corresponding with the 2WS deposition. Palynofacies studies also revealed the occurrence of *Dinogymnium sp*., found within the upper 2WS, as an important component of the Upper Cretaceous dinoflagellate cyst assemblages in worldwide marine paleoenvironments.

Autochthonous pyrite abundance was investigated as one of the dominant components within 2WS. TOC-S-Fe relationship was used to infer the ancient redox states; high TOC associated with high S contents suggested dominant anoxic/euxinic character of the sediment-water interface at the time of deposition in both WF and PH areas. Similarly, pyritic iron (Fe_{pyrite}) versus total iron (Fe_{total}) and total organic carbon (TOC) versus total sulfur content (TSC) crossplots were used to deduce the prevailing oxidation states at the time of deposition. Result supports periodic anoxia during deposition of these units. Also, upper and lower 2WS exhibit different ratios of Fe_{pyrite}/Fe_{total} with the upper unit exhibiting a less oxygenated character compared to the lower unit.

Result will provide useful insights into the basin history and depositional environments of the studied successions within the Cretaceous epicontinental Seaway and its potential from oil and gas exploration perspectives. On a broader level, the results will be applicable to analogous mudrocks and their interpretation of the depositional history.