geoconvention
Calgary • Canada • May 7-11 2018

White light reflectance spectrometry: a new old technique in chacterizing organic matter and hydrocarbon potential in petroleum source rocks

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White Light Reflectance Spectrometry (WLRS) allows the wavelength dispersion of reflectance (Ro) values to be measured and recorded. Previous studies have extensively evaluated the wavelength dispersion of macerals in various coal ranks and types. This study examines the wavelength dispersion of reworked vitrinite and inertinite macerals as well as bituminite macerals in an immature, organic rich, oil shale with the objective of studying the variation in wavelength dispersion associated with changes in Ro due to bacterial degradation of bituminite macerals and recycling of vitrinite macerals.

Four samples were analyzed from the thermally immature zone of the Upper Cretaceous Second White Specks Formation in Central Alberta. These samples were analyzed geochemically (using Rock-Eval) and petrographically for reflectance and using WLRS. Red/green quotients in bituminite macerals demonstrate a drop off in variation due to bacterial degradation at Ro of approximately 0.55%, which is close to the onset of the oil window. This dropoff suggests that the transformation of the organic matter (OM) leading to the liberation of hydrogen and oxygen rich molecules not only increases Ro but also results in a shift in the R/G ratio of the measured maceral. Wavelength dispersion trends in recycled vitrinite/inertinite macerals follows similar trends to those observed previously in coals, with a gradual decrease in reflectance toward lower wavelengths.

Results indicate that the wavelength dispersion trends of recycled vitrinite/inertinite macerals in an organic rich mud rock closely follow the trends previously observed in coals. Determination of unaltered macerals is a difficult task, but is an important step in characterizing the OM of the oil shale and in estimating its source rock potential. This study demonstrates that the WLRS method can be used in conjunction with Ro measurement by observing the R/G variability dropoff in order to distinguish the best preserved primary OM population from OM that has been bacterially or thermally degraded or altered.