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Organic matter facies of the thermally immature Upper Cretaceous Second White Specks and Belle Fourche formations, Alberta, Canada.

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Abstract

The Second White Specks and upper part of the Belle Fourche formations are being increasingly evaluated as source rocks and unconventional resource plays. Better understanding of the organic matter (OM) facies and their relationship to depositional environments is important for understanding the impact of OM compositional changes on the source rock properties of the formations.

In this study, samples from a core in the immature zone are analyzed using optical organic petrology, backscattered scanning electron microscopy (SEM), and Rock-Eval pyrolysis. Random reflectance (Ro) and relative abundance of three maceral groups (bituminite and alginate (both liptinite group macerals), and type III macerals) were measured. It was determined that there are significant OM compositional differences between micro-facies in the Second White Specks Formation. A shift is also observed in OM composition from the upper part of the Belle Fourche Formation to the Second White Specks Formation. These compositional changes represent shifts in sediment source, water depth, and depositional energy levels. These changes can be episodic, as observed between micro-facies, or large scale trends, as observed between the studied formations.

Dilution of total organic carbon (TOC) by largely inert recycled organic matter can have a significant impact on the petroleum potential of labile OM. In this study, a correction of TOC, based on petrographic observations, is proposed to give a better indication of hydrocarbon potential. A comparison of this correction with previous methodologies shows that it better accounts for small scale variation observed petro-graphically. This correction shows that standard cycle Rock-Eval over-estimates TOC and as a consequence, under-estimates hydrogen index (HI) within the studied formations, potentially impacting petroleum potential estimations and reserve estimations.