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## **Use of Compound Specific Hydrogen Isotopes Characterizing Crude Oils from the Canadian Williston Basin, SE Saskatchewan**

Hydrogen isotopic compositions of individual alkanes were measured in representative samples of major genetic oil families from the Canadian Williston Basin, SE Saskatchewan. The isotopic data, together with chemical compositions and geological information, were used to study the possible controls on the hydrogen isotopic values of alkanes in oils, including source, depositional environment, thermal maturation, mixing and the distance of secondary oil migration. The inherited difference in the lipid biosynthetic origins and /or pathways is reflected by a small hydrogen isotopic variability within n-alkanes, but much larger differences in the hydrogen isotopic values between n-alkanes and pristane/phytane. The lighter hydrogen isotopic compositions of oils produced from the Middle Cambrian Deadwood sandstones in the Newporte field compared to oils in other families in this basin reflect a currently unrecognized, possibly Cambrian, lacustrine source rocks. The strong influence of source water hydrogen isotopic values is demonstrated also by the high values for oils with source rocks deposited in more evaporative environments. Thermal maturation may alter the hydrogen isotopic values of the alkanes in the oil to some extent, but secondary oil migration does not appear to have had any significant impact. The fact that oils derived from source rocks that could be of Cambrian age and still retain a strong signature of the hydrogen isotopic compositions of source organic matter, and source water, indicates that hydrogen isotopic values are very useful for oil source correlation, paleoenvironmental reconstructions and petroleum fluid mixing estimates.