



## **Isotopic fingerprinting of hydrocarbon gases from Cretaceous coalbeds and shallow aquifers of central Alberta, Canada**

**B. Mayer, P. Klassen, K. Cheung and S. W. Taylor**

Department of Geology & Geophysics, University of Calgary, Calgary, Alberta, Canada T2N 1N4 (bmayer@ucalgary.ca / Phone: 001-403-2205389)

Production of coalbed methane (CBM) or natural gas from coal (NGC) from shallow coals is a relatively new industry in Alberta (Canada) and constitutes a vital new source of natural gas supply in Western Canada. There are, however, significant environmental concerns, some of them related to potential negative impacts on shallow groundwater resources. In order to test whether carbon isotope ratios can be used to fingerprint hydrocarbon gases from different sources, we analyzed the chemical and isotopic compositions of dissolved gases from fluids obtained from 73 wells completed in the coals of the Upper Cretaceous Horseshoe Canyon Formation and the Lower Cretaceous Mannville Formation of central Alberta, Canada. Simultaneously, we are in the process of establishing a database containing chemical and isotopic parameters for shallow groundwater and its free and dissolved gases in the vicinity of coalbed methane operations in central Alberta, Canada.

Dissolved hydrocarbon gases in produced fluids from the Mannville Group had the highest average carbon isotope values with  $-49.4 \pm 3.6\%$ , for methane (n=24),  $-28.8 \pm 2.1\%$ , for ethane (n=24),  $-26.9 \pm 1.1\%$ , for propane (n=23), and  $-25.0\%$ , (n = 4) for butane, indicating a significant thermogenic gas component. Dissolved hydrocarbon gases from the Horseshoe Canyon Formation fluids had more negative carbon isotope ratios with average  $\delta^{13}\text{C}$  values of  $-54.0 \pm 4.1\%$ , (n=45),  $-36.5 \pm 2.4\%$ , (n=42), and  $-29.4 \pm 1.0\%$ , (n=38) for methane, ethane, and propane respectively, indicating a higher proportion of biogenic gas. Free gas contained in shallow groundwater had a mean  $\delta^{13}\text{C}$  value of methane of  $-69.9 \pm 6.5\%$ , (n=51) and a mean  $\delta^{13}\text{C}$  value of ethane of  $-47.0 \pm 3.0\%$ , (n=31), indicating that these gases in groundwater are predominantly

of biogenic origin. These data suggest that coalbed-derived methane and ethane are often isotopically distinct from methane and ethane in shallow groundwater. Therefore, carbon isotope measurements on dissolved or free methane and ethane in shallow aquifers may serve as a suitable tool for monitoring potential contamination of shallow groundwater resources with produced gases in Alberta, Canada.