

# Sources, Trapping and Mixing Mechanisms of Commercial, Natural Gas Along the Sukunka-Bullmoose Structural Trend, Cordilleran Fold and Thrust Belt, NE British Columbia

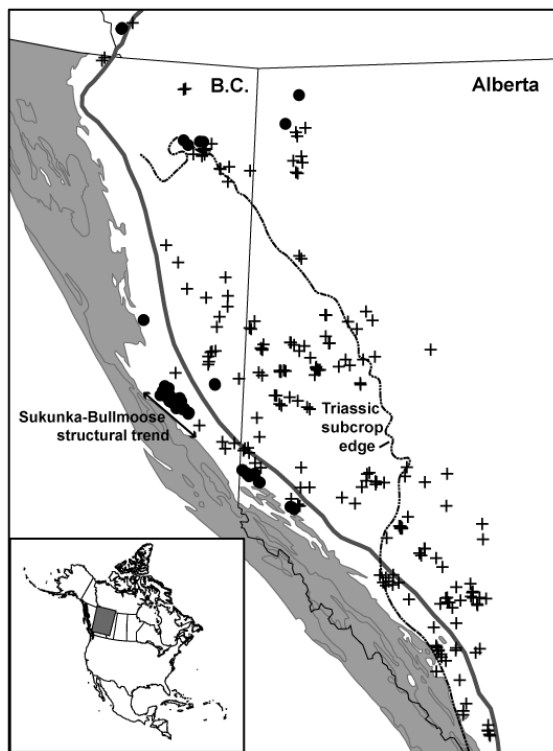
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Extremely unusual carbon isotope compositions are found in gases from some of western Canada's most prolific gas fields, located at the very western edge of the Western Canada Sedimentary Basin (Figure 1). Along the Sukunka-Bullmoose structural trend in the foothills of northeast British Columbia, the best Permian and Triassic gas producing wells are in fault-propagation folds, and the gas is characterized by isotope reversals where  $\delta^{13}\text{C}$  methane is more negative than  $\delta^{13}\text{C}$  ethane (Permian:  $\delta^{13}\text{C}$  methane -27 to -24 per mil,  $\delta^{13}\text{C}$  ethane -36 to -26 per mil; Triassic:  $\delta^{13}\text{C}$  methane -33 to -30 per mil,  $\delta^{13}\text{C}$  ethane -43 to -31 per mil). These isotope reversals are likely the result of mixing (1) conventional, over-mature, dry gas that was

expelled from shale during late stages of burial with (2) another gas that has anomalously low  $\delta^{13}\text{C}$  ethane. The origin of this low  $\delta^{13}\text{C}$  ethane gas may be cracking of residual petroleum in deep shale source rocks. Intense folding and faulting during orogenesis may have liberated this secondary cracked gas from the shale and allowed migration and mixing in the structural trap. The folding and faulting at the edge of the foreland basin provided pathways and traps for commercial accumulations of the deep gas. The low  $\delta^{13}\text{C}$  ethane gas may be analogous to deep unconventional shale gas that usually remains trapped in the shale, but in this case, tectonic activity has created a mechanism for squeezing the *in situ* oil-cracked gas out of the shale into naturally fractured reservoirs.



**Figure 1. Location of isotopically reversed gases (black circles) in Mississippian to Triassic reservoir rocks at the very western edge of the Western Canada Sedimentary Basin. Crosses indicate locations of isotopically normal pre-Cretaceous gases. The shaded area represents Proterozoic and Paleozoic outcrop.**