

Natural Gases in the Peace River Arch Belloy Field and the Alberta Deep Basin Kakwa Field: Isotope Depth Profiles

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Isotope depth profiles of gases from a well in the Peace River Arch Belloy Field and from a well in the Alberta Deep Basin Kakwa Field provide information about the origin, maturity and compartmentalization of gas from the entire stratigraphic section from the Mississippian Debolt Formation up to the near surface. Comparisons of the isotopic ratios and their trends with depth show that the history of the gases in the two areas is quite different.

Gases in the Deep Basin Kakwa well have uniformly heavy isotopic ratios (mature gas) throughout the Spirit River Group and down through the Fernie Group. Above the Spirit River Group there is a sharp break towards significantly lower isotopic ratios (less mature gas). These data are compatible with gas having migrated laterally within the Spirit River/Fernie section from the deeper, more mature stratigraphic equivalents further westward in the Deep Basin. The uniformity of the isotope ratios indicates that significant mixing of the gas occurred during or after migration and that regional shales such as the Wilrich and the Fernie did not act as effective barriers in this area. Gas in the Cardium in this well also has heavier, more mature isotopic ratios than gas from its overlying and underlying strata, suggesting that it also migrated laterally from westward deeper stratigraphic equivalents. In contrast, isotope ratios in the Spirit River Group of the Belloy well indicate several distinct gas compartments and complex gas origins.