Definition of Fractured Carbonate Reservoir Compartments with Gas Isotopes: JM-Brown Bassett Field, West Texas

Martin Schoell*, Chevron and Research Technology Co., San Ramon, CA,
MRTN@chevron.com
Bruce Cain, Altura Energy LTD, Houston

and

Dennis Coleman, ISOTECH Laboratories Inc., Champaign, Illinois

ABSTRACT

The JM-Brown Bassett Field in West Texas is located in the Val Verde Basin and produces lean, post-mature and CO2-rich gases. Ellenburger reservoir compartments are fractured karsts that formed in individual structural thrust blocks. Production and pressure decline, detailed structural mapping, and paleostructural interpretation define reservoir compartments. High-productivity compartments exhibit paleostructural growth defined by thinning or erosion of Devonian and Pennsylvanian formations.

We differentiate from production data 8 compartments A to H from NW to SE. The CO2 content decreases from SW to NE of the field from 57 to 20%, however, all other hydrocarbon gas properties vary very little. Using precision isotope analyses (reproducibility of ± 0.03‰ for C1 to C3 carbon isotopes) and cluster analysis, gas isotope and compositional data define all compartments independent of production information. In this field, gas composition and isotope data are a useful tool for reservoir management. For example, pressure data in some wells are not available and assignment of compartments is difficult based on production data, yet the gas data allow the assignment of wells to specific compartments.

Many other examples from gas fields around the world demonstrate that this is not a unique case history but pervasively observed in almost all gas and oil fields. Applied prior to production, gas isotope signatures could help predict compartments which, at the beginning of production, cannot be identified from pressure data. Definition of compartments prior to production could have significant economic impact as it could help in the design of better exploitation strategies. Another application of the technique is in the area of field unitization: Gas isotope fingerprints can help identify communicating compartments where pressure and other data are ambiguous.