

AAPG HEDBERG CONFERENCE
“NATURAL GAS GEOCHEMISTRY: RECENT DEVELOPMENT, APPLICATIONS AND
TECHNOLOGIES”
MAY 9-12-BEIJING, CHINA

**Timing of Biogenic Gas Formation and Accumulation Inferred from the Geochemistry of
Co-produced Formation Waters in the Eastern Qaidam Basin, China**

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Biogenic gas is a prolific natural resource formed by geomicrobial metabolism. It is important to study how and when biogenic gas form, which could not only help us to master the accumulation of this natural gas resource, but also to understand the action and distribution of the geomicrobial under the subsurface. Qaidam Basin, a prolific area for 320 billion cubic meters of biogenic gas resource in the Quaternary, provides an opportunity to probe such questions. To retrace the gas generation and filling history, a study has been undertaken to examine the systematic changes in the chemical composition and isotopes and of natural gases and co-produced waters in Quaternary strata. The gases as appear to be biogenic in origin, derived from CO₂ reduction, with over 99% methane, -65 to -68 ‰ in $\delta^{13}\text{C}_1$ and -223.1 to -232.9 ‰ in δD_1 values. In combination with the isotope ratios of the coexisting water and carbon dioxide, the water and biogenic methane is in the state of equilibrium. With the exception of one sampling site, ³⁶Cl/Cl ratios of the co-produced waters range from 10-51.7 × 10⁻¹⁵, corresponding to a geological age in the range of 0.36-1.34 Ma. As these ages are considerably younger than those of the host sediments, chlorine (and, by association, co-produced water) must have been derived from more recent meteoric water charge. The results provide convincing evidence for the late generation of biogenic gases in eastern Qaidam Basin when meteoric water intrusion occurred in sediments with a burial depth of 300-1200 m.