

What Else Can We Produce from this Gas Well?

Ronald Broadhead

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Abstract

Helium (He) is a ubiquitous component of almost all natural gases but is rare in concentrations $>1\%$. Other gases that constitute the dominant components of helium-bearing natural gases are hydrocarbons (HC's), carbon dioxide (CO₂), and nitrogen (N₂). The highest He concentrations occur where the dominant gas is N₂ but most He has been produced where the dominant gases are HC's. He occurs as two stable isotopes, ³He and ⁴He. ³He is dominantly primordial and originates from the earth's mantle while ⁴He is a radiogenic decay product of uranium and thorium mainly in granitic basement rocks. ⁴He is the dominant isotope in crustal gases. HC's are generated from petroleum source rocks. Their presence in a reservoir is dependent upon the presence of a mature source rock and a migration path between the source rock and the reservoir. Large accumulations of CO₂ in the southwestern U.S. resulted from the degassing of rising Tertiary magmas and subsequent migration into reservoirs. N₂ appears to originate mostly from degassing of the mantle but is also formed by the thermal maturation of coals and from the degradation of ammonia in pore waters. N₂ may also be trapped atmospheric gas. The presence of economic concentrations of He in reservoir gases is dependent not only on an adequate source of ⁴He generated from granitic basement rocks but also on accommodating flux rates of HC's, CO₂ and N₂. All of these gases differ in their origins, places of generation and rates of generation.