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The Challenges in Defining Natural Gas Petroleum Systems

Natural gas is produced from siliciclastic and carbonate reservoirs in conventional structural and stratigraphic traps, and from low-porosity and low-permeability tight sandstones, shales, and coal bed reservoirs in unconventional accumulations. Defining natural gas petroleum systems is a challenge, due primarily to the difficulty in correlating gas accumulations with the source rock or the cracked oil accumulation that sourced the gas. Natural gas originates from thermogenic and biogenic processes, which are relatively easy to recognize and interpret based on gas molecular and isotopic compositions. However, deriving an interpretation of the source that generated a thermogenic gas on the basis of it's geochemical signature is not straightforward, but is essential for defining gas petroleum systems.

The difficulty in of correlating thermogenic gases with a source results from the complexity of processes that influence gas occurrence. Generation, expulsion, migration, mixing, and secondary alteration all conspire to complicate gas-source correlations. Establishing criteria and procedures for gas-source correlation will enhance an understanding of basinal distribution of gas and the gas potential of sedimentary basins. Integrated geologic and geochemical approaches are required to address the problem, such as the joining of gas molecular and isotopic kinetic models with basin modeling applications.