

Genetic Origins of Naturally Occurring Carbon Dioxide in the Rocky Mountain Region, USA

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While enormous amounts of federal funds have been directed toward sequestration of CO₂, very little knowledge exists for the natural distribution of this inorganic gas dilutant. The purpose of this paper is to review the genetic origins of CO₂, and examine the regional distribution trends. The primary sources for CO₂ include volcanic processes, deep sedimentary processes, organic matter alteration, and biogenic processes. The volcanic processes can include outgassing as well as thermal destruction of carbonate rock in contact with magma. Deep sedimentary processes include the reaction of clays and carbonate chlorite to produce CO₂, as well as a by-product from thermochemical sulfate reduction. Organic sources are mainly associated with thermal degradation, especially humic types. Biogenic processes include the by-product of alteration such as the oxidation of methane to CO₂. By volume, the most important sources of CO₂ are attributed to deep sedimentary processes, followed by volcanic processes, whereas organic matter alteration and biogenic processes are relatively minor in comparison.

Isotopic analysis provides the essential tool for differentiating the various genetic sources, and in certain cases, the associated gases are analyzed (e.g., Nobel gases) to differentiate the genetic sources. Geologic observations are always important to incorporate and care must be directed to avoid potential interpretation pitfalls. An example of the latter is that CO₂ desorbed from a coal may intuitively be interpreted as being from an organic source, but it can actually be proven to originate from alternate sources, as coal acts as a geologic sponge for inorganic dilutants. Geographic and stratigraphic trends are identified to reduce risk in development of both conventional and unconventional resources.