

Origin of Helium and CO₂ Gas from Natural Carbonated Waters in the North-Eastern Area of South Korea.

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Many carbonated springs are found in Mesozoic granitoids and surrounding rocks in South Korea. Their presence is mainly restricted to the Kangwon and Kyungpook provinces. Discharge of many carbonated waters is mainly related to the geologic structures, i.e., the geologic boundaries, fault and dykes that could be a pathway for the rising of deep-seated CO₂ gas.

The composition of carbonated waters can be classified into three chemical types; Ca-HCO₃ water, Ca(Na)-HCO₃ water, and Na-HCO₃ water. Most of the carbonated waters are characterized a high CO₂ concentration (P_{CO2} 0.12 atm to 5.21 atm), a slightly acid pH (5.19 to 6.47), and high ion concentration.

Oxygen and hydrogen isotope data indicates that the carbonated waters are of meteoric origin. $\delta^{13}\text{C}$ data of -6.6 to -0.3‰ suggest that the CO₂ gas in carbonated waters is mainly derived from a deep-seated source, but is partly mixed with CO₂ derived from carbonate rocks. The ³He/⁴He ratios of carbonated waters range from 1.51x10⁻⁶ to 8.38x10⁻⁶. The data are mainly plotted along the air-mantle mixing line on the ³He/⁴He versus ⁴He/²⁰Ne diagram. These data strongly supported the deep-seated origin of CO₂ gas by $\delta^{13}\text{C}$ data.

Keywords: carbonated waters, CO₂ gas, $\delta^{13}\text{C}$, ³He/⁴He ratio