

# **The potential of helium in shale gas and coalbed methane (CBM): A possible new field for helium exploration**

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Helium is an scarce natural resource used in advanced technologies and the main commercial helium was separated from helium-rich natural gas. Our recent research analyzed 450 helium-bearing natural gas samples around the world to investigate the distribution and potential of helium in shale gas and CBM. The results show that helium abundance ranging from  $2 \times 10^{-8}$  to 1.14% (average 0.057%) in shale gas, and  $5 \times 10^{-7}$  to 2.28% (average 0.115%) in CBM. Overall, above twenty percent of the total gas samples exhibit helium concentrations higher than 500 ppm. All gas samples show remarkably low  $^3\text{He}/^4\text{He}$  ratios with ranging from 0.002 to 0.93 Ra (average 0.071Ra), indicating that the helium in unconventional gas is mainly crustal source, and only a few shale gas samples have obvious mantle helium mixing. Using the age and U and Th concentration of the shales, the calculated concentration of helium generated from shales are close to the present measured helium concentration, which suggests that the majority of the helium in the shale gas originates from the local shales. The helium concentration in CBM originates from the local coals are usually lower than 120ppm, the helium-rich CBM need external helium supply from the local crust or mantle-derived helium. The ancient shales rich in U and Th and the CBM located on ancient granite basement with stable tectonic conditions are favorable targets for helium-rich shale gas and CBM exploration.