

Distribution characteristics and controlling factors of helium-rich gas reservoirs

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With the increasing demand for helium and the gradual shortage of proven helium resources, discussing the distribution characteristics and controlling factors of helium-rich reservoirs discovered around the world can not only help us deeply understand the accumulation process of helium in the crust, but also provide guidance for finding helium resources. Based on the compilation of gas chemical composition, stable isotope and noble gas isotope data of helium-rich gas reservoirs found in the world, this paper discusses the distribution characteristics and key controlling factors in combination with geological data. According to the chemical composition, helium-rich gas reservoirs can be divided into three types: helium-rich CH₄, helium-rich CO₂ and helium-rich N₂. Among them, helium-rich CH₄ reservoirs are mainly distributed in cratons, while helium-rich CO₂ and helium-rich N₂ reservoirs are distributed in orogen and fault zones. The gas-producing layers of different types of helium-rich gas reservoirs almost show the characteristics of ancient age and shallow burial. The helium reserves of helium-rich CH₄ and helium-rich CO₂ reservoirs are similar and significantly larger than those of helium-rich N₂ reservoirs, but the helium content shows the opposite characteristics. Helium source, supplying intensity of associated gas, helium accumulation

mode, and tectonic-magmatic activity may be the key factors controlling the distribution of helium-rich gas reservoirs in the crust. As far as helium exploration is concerned, the Proterozoic and Paleozoic traps located in uplift structure which has developed Precambrian granite basement, moderate distance from the gas supply center, high geothermal gradient and developed faults are the most effective exploration target. At the same time, the Mesozoic traps connecting with the Precambrian granite basement through unconformity or deep-seated faults can also be used as potential exploration targets for helium resources.