New High-Grade Helium Discoveries in Tanzania

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Gas seeps containing up to 10.6% helium have been discovered in Tanzania. Since 1903, economic-grade helium has been discovered in 12 countries, raising the world's helium reserves to 35.2 billion m^3 in 2015 [1]. Despite this, discoveries of economic helium (0.3% ≤) are still only serendipitously found while searching for petroleum.

Radiogenically produced ^{4}He accumulates in ancient crust during quiescent periods and is subsequently released during periods of active tectonism [2]. Studies in North America have also shown a clear link between radiogenic ^{4}He released during orogenic events and ASW-derived ^{20}Ne indicating an important role for groundwater in helium transport into pre-existing gas traps [3, 4].

Here we present new data from 5 helium-rich gas seeps in Tanzania. Helium concentrations vary between 0.027 cm^3STP (2.7%) and 0.106 cm^3STP (10.6%). The ^{3}He/^{4}He ratio ranges from 0.039 R_A to 0.053 R_A (1 R_A = ^{3}He/^{4}He_{air}) showing a dominant crustal signature. ^{40}Ar/^{36}Ar ratios range from 409.9-548.7 and are distinct from air (^{40}Ar/^{36}Ar_{air} = 295.5). ^{4}He/^{20}Ne values across the seeps vary from 2.4×10^3 to 8.9×10^3, showing up to two orders of magnitude greater water involvement than North American wells which may indicate the importance of local hydrothermal systems to volatile transport in the region.

The high concentrations of helium in the region are likely related to the heating and fracturing of the Archean Tanzanian Craton and Proterozoic Mozambique Belt by the younger arms of the East African Rift System (< 5 Ma). The distribution of high helium seeps along active faults shows increased communication between the shallow and deep crust. This combined with the presence of gas traps in the area suggests that there may be a significant helium resource.

[1] Hamak (2016), USGS Mineral Commodities, Helium

[2] Ballentine and Burnard (2002), *RiMG,* **47(1)**, 481-538

[3] Ballentine and Sherwood-Lollar (2002), *GCA*, **66(14)**, 2483-2497

[4] Danabalan et al. (2015), *Goldschmidt Abstract*, **2015** 653