The unbearable lightness of helium may not be such a problem after all

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Image of a helium filled discharge tube shaped like the element's atomic symbol. Image: Pslawinski/ Wikipedia.

Helium gas - essential for MRI scanners, semiconductor manufacture (and according to some, party balloons) - may not be on the verge of running out after all. Previous studies had raised concerns that we were getting close to a world shortage of helium, but a new study shows that in many areas of North America, there is the potential for undiscovered quantities of helium to be associated with natural gas fields. This work is being presented in an award-winning poster at the Goldschmidt conference in Prague.

A group of researchers from Durham and Oxford Universities, led by Diveena Danabalan, analysed natural gas samples from 22 wells in the USA and Canada. Using mass spectroscopy, they measured the full suite of noble gases, with an emphasis on helium, neon and argon.

Diveena Danabalan said:"We identified neon isotope tracers which show a strong association between helium and groundwater. This means that in certain geological regions, groundwater transports large volumes of helium into natural gas fields, where trapping potential is greatest. This suggests that we have probably underestimated the volumes of helium which are actually available to explore".

"On a continental scale, and we are talking about a line running right down the Rocky Mountains, we are seeing processes which are releasing the existing helium which has been built up deep underground over hundreds of millions of years. In some places, like in Yellowstone Park in Wyoming, the deep helium is released directly into the atmosphere. In others, we are seeing that the deep helium which was released when the Rocky Mountains formed has percolated via the groundwater into the same underground reservoirs where we find natural gas. This means that there are almost certainly reservoirs of helium which we had not anticipated. More importantly, understanding how and why helium arrives in these reservoirs means that we now know where to look for new helium resources"

She continued:"Helium is the second lightest element in nature, it is so light that it leaks away into space. This is why it is ultimately a non-renewable, finite resource".

Helium is the essential for use in the MRI body scanners and superconductor production. It is also used in super-hi-tech installations such as the Large Hadron Collider at CERN, which address questions on the origins of the universe

Commenting for the Goldschmidt conference, Professor Barbara Sherwood Lollar, (University of Toronto) President of the Geochemical Society said:

"This work shows that the amount of helium which is available is greater than we had thought. Helium is essential for many things, with the most important use being in body scanners and in microchip manufacture. So in many ways it is essential for modern medicine, and perhaps even for modern life.

The lightness of helium means that it can escape off into space, to be lost forever, so a steady supply is needed. This work shows that it is trapped in natural processes, so the lightness of helium may not be as unbearable as we had thought".

More information: Noble gas evidence for the mechanisms creating commercial helium reservoirs, poster at the Goldschmidt conference 2015.

ABSTRACT
Since its first economic discovery in Kansas in 1903, helium has become an integral resource for today's society. With known reserves declining, discoveries of helium are still only serendipitously found with some petroleum discoveries; there are no viable exploration strategies in place for helium. Radiogenic 4He accumulates in the crust during quiescent periods and is subsequently released during periods of active tectonism [1]. In the Hugoton-Panhandle He-rich gas field (Texas/Oklahoma/Kansas), 4He correlates with water-derived 20Ne. This relationship is used to suggest that helium released from basement rock is dissolved in overlying groundwater and then quantitatively degassed following migration and contact with a pre-existing hydrocarbon gas phase [2]. To test whether this mechanism is common to other helium-rich natural gas fields, we have collected 22 natural gas samples to analyse for noble gas abundance and isotope determination. Preliminary data from the Kansas Basin, Central Kansas Uplift, the Harley Dome field in Utah, and two exploration wells in Montana and Saskatchewan, Canada, have helium contents that vary between 0.009 cc

STP and 0.080 cc STP. The helium isotope ratio, 3He/4He, ranges from 0.08 RA to 0.66 RA (RA = 3He/4Heair) showing a predominantly crustal He source with a small mantle input for most samples. Argon isotope (40Ar/36Ar) ratios range from 589-1435 in the Kansas samples and from 4586-8963 in the Harley Dome, Montana and Saskatchewan samples. 4He/20Ne in the Hugoton- Panhandle averages 3.4 × 104 [2]. Kansas samples range from 4He/20Ne = 3.5-7.8 × 104, showing the same degree of water involvement as the Hugoton-Panhandle for the lowest values. Harley Dome, Montana and Saskatchewan samples have 4He/20Ne = 1.0-2.3 × 105 showing a 3-7 times lower involvement of the groundwater system, consistent with the elevated 40Ar/36Ar ratios.

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