Scientists reveal the mystery about the origin of gold

November 22 2017

Peridotite from the deep mantle (green) enclosed in lava (black) from a Patagonian volcano, which was found by the researchers. Credit: UGR

An international group of scientists, with the participation of the University of Granada (UGR), has shed new light on the origin of gold, one of the most intriguing mysteries for the scientific community.

Their work, which has been recently published in *Nature*

Communications, has established that gold came to the Earth's surface from the deepest regions of the planet. Thus, the Earth's set of internal movements would have favored the ascent and concentration of gold.

The researchers have found evidence of this process in the Argentinean Patagonia, which also represents the first finding of gold beneath the South American continent at a depth of 70 kilometers.

UGR researcher José María González says that the interior of the Earth is divided into three layers—crust, mantle and core. "The minerals we extract and which support our economy are located in the crust. And although we are experts in taking advantage of them, we still know very little about their true origin. The search for gold has motivated migrations, expeditions and even wars, but its origin is is an open question."

The mantle is the layer separating the nucleus from the crust, and its upper limit is located at about 17 kilometers under the oceans and 70 kilometers under the continents. "This distance is unreachable for mankind, since we don't possess the means for reaching the mantle and thus knowing more about it in a direct way yet," González says.

Nevertheless, the mantle can reach the crust, thanks to volcanic eruptions, which carry small fragments, or "xenoliths," from the mantle under the continents to the surface. This research concerns rare xenoliths, inside which the researchers have found tiny native gold particles with the thickness of a human hair, and which originate in the deep mantle.

The researchers studied the region of the Deseado Massif at the Argentinean Patagonia, one of the largest auriferous provinces in the world, and whose gold mines are still being exploited. Since the concentration of gold is very high there, the researchers have been able

to figure out why mineral deposits are limited to some specific regions of the planet. Their hypothesis is that the mantle under that region has a unique tendency to generate gold deposits on the surface due to its history.

"Its history dates back 200 million years, when Africa and South America were part of the same continent," González Jiménez says. "Their separation was caused by the ascent of a 'mantle plume' from the deep mantle, which broke the much thinner and more fragile crust and caused the separation of the two continents. The ascent of the deep mantle plume generated a true chemical factory that enriched the mantle with metals, which would later generate the conditions for the creation of gold deposits. This time, the process was caused by the movement of one tectonic plate under another, allowing the circulation of metal-rich fluids through the cracks, which precipitated the metals and concentrated them near the surface."

The findings of the research team shed new light on the formation of mineral deposits, which are generally attributed to an origin in the crust itself, without taking into account the role of a deeper root from the mantle. This new scientific evidence could contribute to a more advanced exploration of deposits that takes into account not only surface images or 'radiographies' of the crust, but also studies the depths of the mantle, a region where the origin of gold could be traced.

More information: Santiago Tassara et al, Plume-subduction interaction forms large auriferous provinces, *Nature Communications* (2017). DOI: 10.1038/s41467-017-00821-z

Provided by University of Granada