

29/2017

The formation of gold deposits in South Africa German-Canadian research team discovers new ore-forming process in ancient marine sedimentary basin

20 April 2017/Kiel. The Witwatersrand basin in South Africa hosts the largest known gold repository on Earth – but how was it formed? Scientists of the GEOMAR Helmholtz Centre of Ocean Research Kiel and Canadian research institutes were able to figure out how parts of the Earth's largest gold deposits formed about three billion years ago. Crude oil and hot hydrothermal fluids played a major role. This study has been currently published in the journal "Precambrian Research"

At a first glance, the Witwatersrand basin, the largest known gold resource on our planet, is not automatically related to ocean research. However, in its 3 billion years old geological history, the Witwatersrand basin in South Africa has been covered by seawater, but experienced also episodes of drying out, flooding and erosion by rivers and the repeated coverage by seawater. In 1852, the English prospector J.H. Davis discovered the first gold in the Witwatersrand, leading to the South African gold rush and the discovery of much more gold deposits within the basin. Although the Witwatersrand has been subject for decades of research, the genesis of gold and uranium ore is still unclear.

A group of scientists from Canada and the GEOMAR Helmholtz Centre of Ocean Research Kiel, successfully unravelled some mechanisms of the ore-forming process using complex analytical techniques. The results were recently published in the scientific journal "Precambrian Research".

In this study, the scientists analysed samples from the Witwatersrand ore deposits with high-resolution scanning- and transmission-electron microscopes, and the processed their data using novel 2D and 3D software. "We were able to find out that fossil oil, that has been formed by organic matter derived from the first living organisms on Earth, mobilized uranium in the basin. Uraninite nanoparticles flocculated in the oil and formed uranium ore", explains Dr. Sebastian Fuchs from the GEOMAR, the first author of the study. "Hot hydrothermal fluids, similar to those fluids that we find today in modern seafloor Black Smoker systems, transported dissolved gold and formed oil-in-water emulsions at the site of the deposits. The oil droplets in the hydrothermal fluids initiated the efficient chemical precipitation of native gold and the formation of very complex-structured gold and uranium ore."

Using high-resolution imaging techniques, the researchers were able to visualize a to date unknown ore-forming process, in which migrating oil plays the dominant role in the distribution and concentration of metals. "With our method we have been able to show remnants of fossil oil entrapped in gold for the very first time" says Dr. Sebastian Fuchs.

"We are surprised to see such an intimate spatial relationship between the oil products and the metals", reports Dr. Fuchs. "We hope that our study gives new impulses to industry and science to explore new mineral deposits. Perhaps it is possible at some day to extract gold and other metals from mined crude oil".

With the methods used, it is now possible to study not only ore particles on the ocean floor in the range of millimetre to nanometre, but also the smallest fossils and living organisms, such as micro-organisms. “We are curious about what else we might discover on the ocean floor in the future”, Fuchs concludes.

Note:

This study was supported by a Canadian NSERC Discovery Grant.

Original work:

Fuchs, S.H.J., D. Schumann, A.E. Williams-Jones, A.J. Murray, M. Couillard, K. Lagarec, M.W. Phaneuf, H. Vali, 2017: Gold and uranium concentration by interaction of immiscible fluids (hydrothermal and hydrocarbon) in the Carbon Leader Reef, Witwatersrand Supergroup, South Africa. *Precambrian Research*, **293**, 39–55, <http://dx.doi.org/10.1016/j.precamres.2017.03.007>

Links:

www.geomar.de GEOMAR Helmholtz Centre for Ocean Research Kiel

Images:

Images are available for download at www.geomar.de/n5141

Contact:

Dr. Andreas Villwock (GEOMAR, Communication & Media), Phone: +49-431 600-2802, presse@geomar.de