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Geochemical model on uranium mineralizations in the rhyolite-granite complex in the Jabal Eghei area, Libya

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The history of geological investigations of the Tibesti Massif and its surroundings is dating from the mid-1860s. After almost half a century of inactivity, the first sketches and rough topographic maps of Tibesti were done in the early 1900s. Significant changes in the approach to geological investigations began when the Industrial Research Center of Libya, founded in 1970, commissioned the production of detailed geologic maps and geological investigations of rhyolite-granitoide rocks in the Jabal Eghei area in order to investigate the mining potential of this region.

The radiological survey of the terrain, followed by laboratory analysis of geological samples by gamma-spectrometry and ICP-MS techniques, resulted with discovery of two significant uranium mineralizations in rhyolite-granite rocks located in the central part of the investigated region, covering an area of about 60 square kilometres. The concentrations of uranium in these mineralizations were found to range from approx. 50 mg kg-1 to more than 600 mg kg-1, the latter being about 240 times above the Earth's average. Additional geochemical analysis had shown that these mineralizations are accompanied by increased contents of silver (up to 17 times), arsenic (up to 8 times), molybdenum (up to 50 times), mercury (up to 9 times), and lead (up to 14 times), with regards to the Clark values.

A simple generic model for uranium mineralization in the Jabal Eghei region is proposed. The main primary sources of uranium mineralization are granitoides and uranium was mobilized from them mostly through cold solutions and deposited in contact zones with rhyolites, fault structures filled with clay, ferrous oxides etc. Uranium mineralization is spatially and genetically related to the volcanic complexes (rhyolites) and the spatial position of the postorogen magmatism, which is the lithologic control factor of the mineralization position. The forms of the ore bodies depend on the structural and lithologic control factor and are probably in the form of a pillar (column). The main ore material was pitchblende, although the presence of uranitite, coffinite and uranium titanite could not be excluded. A full explanation of the genesis of these uranium mineralizations could be obtained from detailed geological investigations.

Regarding the genesis of the ore deposits and the possibilities of the formation of economically interesting uranium concentrations, which are spatially and genetically related to acidic and intermediate magmatic complexes, the leaching of uranium is of particular interest.

These results warrant a continued investigation of this region because of potential interest in the discovery of nuclear mineral raw materials.

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