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Geochemical studies of metasomatized rocks associated with uranium mineralization in the Jahaz deposit, North Delhi Fold Belt, North-Western India

PRIYANKA MISHRA[1] AND RAJAGOPAL KRISHNAMURTHI[2]

[1]Indian Institute of Technology Roorkee India
[2]Indian Institute of Technology Roorkee, India
Presenting Author: pmishra@es.iitr.ac.in

Geochemical studies of metasomatized rocks associated with uranium mineralization in the Jahaz deposit, North Delhi Fold Belt, North-Western India

Priyanka Mishra* and Rajagopal Krishnamurthi

**Department of Earth Sciences, Indian Institute of Technology Roorkee, Uttarakhand-247667, India*

**Email*-pmishra@es.iitr.ac.in

Jahaz is one of the promising U-deposits along the "albitite line" in the North Delhi Fold Belt, India, and is hosted within the Meso-Proterozoic metamorphic rocks of the Delhi Supergroup. U-mineralization is low-grade, medium-tonnage, metasomatic type, and structurally controlled. Quartzite, quartz biotite schist, and amphibolite are the rocks found to be deformed and altered. Petrography and geochemistry have been used to classify the altered rocks into two groups: *(i)* less to moderately altered (LTMA) and *(ii)* intensely altered (albitized). The aim of this study is to identify hydrothermal alteration types and correlate U-mineralized zones for nuclear energy exploration, using geochemical analysis. Lithogeochemical (General Element Ratio), alteration index, and isocon analyses are used to quantify the metasomatic alteration of rocks and the extent of material transfer during fluid-rock interaction. GER and alteration index plots show that albitization, chloritization, and calcitization are the dominant alterations found in the albitized rocks, whereas sericitization and biotitization are predominantly found in the LTMA rocks. These alterations are accompanied by the enrichment of major oxides i.e. Na_2O (10.3 wt%), MgO (12.95 wt%), and Fe_2O_3 (17 wt%) in the albitized samples as compared to LTMA rocks. The high U concentration (up to 690 ppm) was found in the albitized rocks as compared to LTMA rocks (4 ppm). Furthermore, the albitized rocks are enriched in Mo (740 ppm), Cu (916 ppm), and Sr (15600 ppm), while showing depletion in Ba, Pb, and Sn. Isocon analyses reveal that Nb, Zr, Ti, and Hf remained immobile throughout the alteration and mineralization processes. The ∑LREE/∑HREE ratios vary from 2 to 30 ppm and 1.5 to 3.5 ppm in the albitized rocks and LTMA, respectively. The enriched zones of uranium have high concentration of Na, Mg, Fe, Cu, Mo, and LREEs. The close association of uraninite, sulfides (pyrite, pyrrhotite, chalcopyrite), and molybdenite within albitized zones can be used as effective exploration guide in similar geological setting.