

An overview of uranium, rare metal and REE mineralisation in the crystallines of Sonbhadra district, Uttar Pradesh, India

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Uranium and REE mineralisation hosted by the Proterozoic migmatites and younger intrusives is identified over 350 sq km in Son Valley area, Sonbhadra district, Uttar Pradesh, which forms the northwestern extension of Chotanagpur Granite Gneiss Complex (CGGC). The rocks exposed include banded gneisses and metasedimentary enclaves, overlain by the Mahakoshal supracrustals and sediments of the Vindhyan Supergroup in the north and Gondwana Supergroup in the south. The craton had undergone repeated rifting, giving rise to intracratonic rift basins for the development of cover rock sequences of arkosic to psammo-pelitic metasediments, which now occur as migmatites comprising pegmatoid leucosomes and biotite melanosomes and associated mesosomes. These intracratonic zones are parallel to the Lower Proterozoic Mahakoshal supracrustals. Anorogenic, rift related plutons of alkali granite of middle Proterozoic age are seen emplaced within Mahakoshal supracrustals, which at places like Kundabhati and Sonwani are episyenitised.

Extensive exploration carried out by AMD has established a potential province in the terrain for U, Nb-Ta and REE mineralisation with complex metallogeny associated with the evolution of migmatites. Consistent uranium mineralisation has been established at Naktu, Kudar, Lakhar, Sirsoti, Nawatola, Dhanbhadua, Kudri and Anjangira, where the host rock is essentially albite-rich pegmatoid leucosome mobilizate (PLM) and to a lesser extent, biotite melanosome/melanosome mobilizate (MM). The lensoidal mineralisation is disposed in an en-echelon manner with variable dimensions along the strike and dip, and varying grades from 0.010-1.00%eU3O8. Development of thick PLM is observed in Naktu-Kudar tract, whereas the migmatites at Kirwil-Kudri-Anjangira tract occur as thin veneer over basement and contain thin PLM bands. The anorogenic alkali feldspar granites within Mahakoshal supracrustals at Kundabhati, Sonwani and Chitwar also host uranium mineralisation.

Three major types of uranium mineralisation are identified based on the host-rock characteristics, viz. (a) Pegmatoid Leucosome Mobilizate (PLM) and Biotite Melanosome (BMM) hosted mineralization, (b) Potassic granite/episyenite hosted mineralisation and (c) Magmatic Pegmatite hosted mineralisation. Uraninite, samarskite, fergusonite and xenotime are identified in the PLM and BMM hosted mineralisation at Naktu, Kudar, Kudri, where soda metasomatism in the form of albite replacing the alkali feldspars is ubiquitously seen. The mineralisation at Kundabhati, Sonwani and Chitwar are hosted by potassic granites and episyenites, which are characterized by K-metasomatism, desilicification and concomitant release of iron, rendering a deep red colouration to the mineralized rock. Magmatic pegmatite hosted mineralisation is at Jaurahi, where columbite, samarskite, aescheynite, thorite, xenotime, fluorite, fluorapatite and zircon occur as segregations in the pegmatites.

The present geological milieu in the Son Valley area has the imprints of repeated thermal, tectonic and metamorphic reactivation. The profuse occurrence of migmatites is the resultant product of ultra-metamorphism of arkosic to psammopelitic sequence deposited in ensialic extensional basins. Thermal regime in the course of ultra-metamorphism leading to anatexis had led to the remobilization of intrinsic uranium in sediments and subsequent concentration within the albite rich pegmatoid leucosome and biotite rich melanosome... for the rest see attachment

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