# Alteration of Uraninite and its implications to Chemical Dating: An example from Northwestern India

MANOJ KUMAR OZHA[1*], DIPAK CHANDRA PAL[2] AND BISWAJIT MISHRA[1]

[1]Indian Institute of Technology, Kharagpur-721302, India (*correspondence: mkozha@gg.iitkgp.ernet.in)

[2]Jadavpur University, Kolkata-700032, India (dcpal@geology.jdvu.ac.in)

Uraninite, with a general formula of ($U^{4+}O_2$) hosts the highest amount of U into its structure. Due to auto oxidation, the mineral structure is commonly defective and nonstoichiometric, thereby favors cationic substitution, which can lead to exchange of elements during subsequent fluid-assisted alterations [1] [2]. The substitution of elements into the mineral is a function of the physico-chemical conditions and consequently can act as a geochemical proxy pertinent to geochemical ambience of formation of the mineral [2] [3]. Additionally, the timing of mineralization and subsequent hydrothermal alteration can be constrained from uraninite dating. The Aravalli-Delhi Fold Belt in the central part comprises the linear metasedimentary Pur-Banera belt, which hosts significant U-anomalies within quartzite in the Samarkiya area, wherein uraninite is the ubiquitous U-bearing mineral [4]. Thus, the present study aims to appraise the geochemical and temporal evolution of uranium mineralization in the area.

Chemical compositions of uraninite along with X-ray elemental maps indicate substantial modification of the mineral. The pristine grains are characterized by insignificant concentration of Si+Ca (≤1 oxide wt. %). In contrast, low oxide total (min. 91.40 %) and enrichment of Si+Ca (max. ~20 oxide wt. %) for the modified grains, in conjunction with substitution of radiogenic Pb by Σ(Si+Ca) provide testimony for influx of low-T oxidized fluid related to coffinitization. Chemical dating of pristine uraninites reveal U-mineralization at ~1.30 and ~1.00 Ga, while modified grains yielded an intermediate age at ~1.20 Ga. The oldest age (~1.30 Ga) represents the first stage of mineralization in the quartzite followed by coffinitization of these grains at ~1.20 Ga, subsequently superimposed by recrystallization of uraninite at ~1.00 Ga.

[1] Janeczek & Ewing (1995), *Geochim. Cosmochim. Acta* **59**, 1917–1931. [2] Alexandre & Kyser (2005), *Can. Min.* **43**, 1005–1017. [3] Pal & Rhede (2013), *Econ. Geol.* **108**, 1499–1515. [4] Shaji *et al.* (2006), *Curr. Sci.* **92,** 592–594.