Sodic metasomatism and U - Zr mineralization: A model based on the Kurupung batholith (Guyana)

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Sodic metasomatism is a process observed in many sedimentary, metamorphic or plutonic geological environments. The Kurupung batholith (NW Guyana) displays a unique association of hydrothermal uranium and zirconium mineralizations. The Kurupung batholith consists mainly of monzogabbros, monzonites and monzogranites belonging to a high-K calcalkaline magmatic association, and by minor occurrences of peraluminous leucogranites probably of different origin. The mineralized zones are associated to "episyenites". When compared to the composition of granitoïds of the Kurupung batholith, these rocks attest for a K-feldspar albitization followed by quartz dissolution. The vugs resulting from the removal of quartz are firstly filled by albite, then by carbonates and chlorite and finally, by fine grained silica. The zirconium mineralization corresponds to hydrothermal zircon deposited together with newly formed albite in the vugs and as veins up to 1 cm wide. Uranium occurs as substitution in the hydrothermal zircons crystal lattice, as uraninite veins in zircon microcracks, as Ti-U oxides, and as pitchblende veinlets.

The new formation of albite and carbonates implies neutral to alkaline pH values. Fluid inclusion studies indicate low saline fluids and temperatures of 250 to 350° C for the development of this alteration, whereas temperature of 210° to 280° C are given by the chlorite geothermometer. The lack of evidence of highly corrosive fluids suggests that the simultaneous mobility of Zr and U result from leaching of an easily soluble U and Zr source. Acidic volcanic glasses, common above high-K calcalkaline granitoïdic complexes, could represent such a source.