

## **Discovery of uraniferous calcretes in Tharparkar, Pakistan**

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Detailed geological work revealed that the calcretes in the Tharparkar desert have been formed in a variety of settings, including the piedmonts, sheetwash aggraded plains, regolith, playa plains and interdunal plains, while sand dunes and sandy plains have weaker development of calcretes. The better developed calcrete horizons occur in piedmonts and interdunes or in areas that have sufficient groundwater at depths of 80 to 120 meters. In some areas, uraniferous calcretes have been discovered. Sections in the region show phases of pedogenic calcrete development in aeolian sand. The extensive sheetwash plains have mature calcretes. These calcretes can be correlated with the Indian side of Thar which has calcretes of similar characteristics and date to mid-Pleistocene. The calcretes of northern, central and north-eastern part of Tharparkar were surveyed and sampled. Radiometric checking in different areas alongwith geological mapping has been undertaken. More than 300 calcrete and kaolinite samples were analysed for uranium. These calcretes are classified Pedogenic, non-pedogenic valley calcretes, soft calcrete, hard calcrete, nodular calcrete, honey comb calcrete, sandy mix calcrete, kankar, caliche, gypcrettes, halcrettes, silcrettes and ferrocrettes. Some 46 calcrete bodies have been discovered and sampled in different parts of the desert for the first time. At some places uranium content is more than 40 ppm with a maximum value of 159 ppm at Khagia near Chachro. The surface/near surface gradients originating from the northeast and east towards west and south also support the possible transport of U, V, and K through shallow ground waters to the distal parts of the Thar desert and the potential non-pedogenic calcretes in the desert may host uranium mineralization. Preliminary studies show that a number of calcretes contain anomalous U content, i.e., >50 ppm. Our studies indicate that these calcretes represent a hybrid process, where carbonate enrichment of the originally calcareous host occurred due to periodically raised groundwater, and its differentiation into nodules occurred under subaerial environment, i.e., after recession of groundwater. Nodules display a multiplicity of carbonate precipitation events and internal reorganization of calcitic groundmass. The important source was probably provided by the pre-existing calcretes in the sheetwash aggraded plains and detrital carbonate in the aeolian sediments. The original source of carbonate in the region, however, remains unresolved and will need further investigations.