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Remote estimation of thermal and dielectric properties of palaeochannel-fill sediments in Yeelirrie area, Western Australia: implications for surficial uranium exploration

Alok Porwal (1), Avik Bhattacharya (1), Rahul Deb Das (2,1), and Sudarshanan Raghvan (1)

(1) Indian Institute of Technology Bombay, Mumbai, Australia (aporwal@iitb.ac.in), (2) Spatial Cognitive Engineering Lab, Department of Infrastructure Engineering, University of Melbourne, Parkville, VIC 3010, Australia

Night time thermal infrared and microwave data were used to characterize the thermal and dielectric properties of the Yeelirrie palaeochannel, Yilgarn Craton, Western Australia, which hosts the largest surficial uranium deposit of the world at Yeelirrie. The results showed that palaeochannels are characterized by steep dips in kinetic temperature and equally steep rise in dielectric permittivity, which does not correlate with the present topography. A series of profiles across the channel indicate that the dip in temperatures and the rise in dielectric permittivity, which are bulk properties, may be related to the thickness of palaeochannel fill sediments. Therefore, the temperature and dielectric profiles can be potentially used for estimating the topographic gradient of the floor of palaeochannels. Since the precipitation of surficial uranium in form of carnotite from dissolved uranium in the ground waters requires pooling of ground water in areas of low hydraulic gradient, remotely estimated dielectric and temperature profiles can be used to identify potential locations for surficial uranium mineralization in palaeochannels.