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Soil and Groundwater Radon variations in different geological formations of Bhilagana valley, Garhwal Himalaya, India

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Crustal discontinuities, such as fractures and faults of various dimensions facilitate emission of gases and aerosols from earth to hydrosphere and atmosphere. Radon being an inert gas has been used to understand various processes in geology, hydrogeology and geophysical studies. The present paper discuss the results of radon measurements made in soil and groundwater (springs and hand pumps) present in various lithological units and across major thrusts present between Ghansali and Ghuttu area in Bhilangana valley of the Garhwal Himalaya, India. Two major litho-tectonic units exposed in the Bhilangna Valley of Garhwal Himalaya are; lesser Himalaya and the higher Himalaya. Regional scale thrust planes further subdivided these units into litho-tectonic units of smaller extent. The higher Himalaya representing the central crystalline zone thrust over the lesser Himalayan sedimentary sequence along Main Central Thrust (MCT).

The rocks of Lesser Himalaya are predominantly quartzite and metabasic with intercalation of phyllite and chlorite schist. Several radon measurements in both soil (8.7 to 32.3 kBq/m3) and water (5.1 to 6.9 Bq/l) were made in this formation. Higher radon concentration recorded from this locality in both soil (59.3 kBq/m3) and water (168.2 Bq/l) is possibly related with subsurface radioactive mineralization, which would facilitate enhanced radon production. The occurrence of Uranium has been reported from these rocks and is associated with sheared biotite gneisses close to the Bhatwari - Ramgarh Thrust. The various fractures associated with thrust plane have provided the easy pathways for escape of gases from the deeper sources.

The Central Crystalline Group consists of sheared granitic gneisses, porphyritic gneiss, talc schist, mica schist, mylonites and quartzo-feldspathic schist. Overall, high concentration of radon i.e. 3.6 to 84.2 kBq/m3 in soil and 34.8 to 168.2 Bq/l in groundwater have been recorded from these crystalline rocks. Observations of low radon
concentration in colluvial springs suggest high porosity leading to natural de-emanation and relatively high values in fracture-joint and fault related springs and hand pumps is possibly due to increased ratio of rock surface area to water volume and presence of uranium mineralization.