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Geological appraisal of radioactive mineral occurrence at Ahl in Mansehra granite, North West Pakistan

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ABSRATCT: *An extensive radiometric survey in Mansehra Granitic Complex resulted in the discovery of secondary uranium mineralization in an over thrusted crushed part of Mansehra granite at Ahl. The crushed part indicates a roughly NS trending fault zone along the contact with Tanawal (Tanol) formation. Uranium mineralization consists of andersonite and uranophane. It reappears on the surface of granite after scratching within few days, as a result of precipitation from ground water. This prospect was investigated by shallow drilling of 18 holes totaling 1560 meters depth. 45 anomalous zones were encountered in drill holes ranging from 39-1100 ppm U_3O_8.*

Exploration data revealed thick sedimentary pile consisting of alternating sandstone and clay below crushed part of granite pointing to an intramountain basin. It is concluded from the data collected so far that an intermountain basin with torrential stream deposit near Ahl has trapped the labile uranium leached from crushed granite by ground water. Such an intramountain basin has yielded deposit at the contact of basement and overlying sediments. It is likely that this basin may have a comparable potential.

INTRODUCTION

Ahl radioactive zone occurs in a crushed part of Mansehra granitic complex. It is located 45 km from Mansehra on KKH road, district Mansehra This radioactive anomaly contains secondary uranium mineralization in the form of uranophane and andersonite. This prospect was subjected to detailed surface and subsurface exploration to asses its potential for a viable uranium deposit.

GEOLOGY OF THE AREA

Mansehra Granitic Complex covers an area of about 150 km^2. The apparent shape of the complex is sheet like in geometry. According to the classification of Sharma (1983) Mansehra Complex falls in the category of lesser himalayan granitoids. The complex can be divided into the following major groups of rocks.

i. Older gneisses and granite comprised of deformed biotite rich granite gneisses of possible Precambrian age such as Susalgali gneiss, Mansehra granite, Andalusite and associated minor bodies.
ii. Younger tourmaline granite bearing of Cambrian age such as Hakla granite, Sukal granite and associated acid minor bodies (pegmatites, aplites, albitites).
iii. The metamorphic rocks form a continuous outer belt to the granitic complex and alternate with granitic sheet in the interior of the area. The major lithology comprises of Tanol formation that also borders the immediate margins of the complex. For instance, in the SE,

SW and West, the Tanol formation is in tectonic contact with Salkhala metasediments of Precambrian age (Wadia, 1930) consisting of phyllites, marble and quartz feldspathetic units.

RESULTS AND DISCUSSION

Detail investigations consisting of mapping, radiometric survey, hydro-geochemical survey, trenching and drilling were undertaken in difference phases from 1982 to 1986. A geological map of Ahl prospect was prepared on 1:10,000 scales. Quaternary to recent deposits at the contact of the crushed granite were also mapped (Fig. 1). The anomalous zone extends for about 5.2 km with maximum width of 625 m. Hydro-geochemical survey and soil radon survey were carried out in the area in and around the crushed granite.

The anomalous zone was also subjected to subsurface exploration through drilling and a total of 18 numbers of holes were drilled totaling to 1560 meters depth. The maximum depth was 92 meter.

The drilling data revealed a large basin of deposition consisting of coarsed sandstone with boulders and pebbles, siltstone and minor clays below the crushed granite. The data also revealed that flat lying undisturbed Pleistocene fluviatile sediments have been overthrusted by Cambrian granite gneiss. A total of 45 moderately anomalous zones with small thickness were encountered at different level in the drill holes at the contact of sand and clay beds. The uranium content of these anomalous zones varies from 8 ppm to 180 ppm. Clays being non-porous and impermeable checked the path of down pouring uranium-bearing water and consequently uranium was deposited at the contact of clay layers and sandstone.

The 10 sq.km white looking material at Ahl previously regarded as kaolinite is actually a crushed part of Maneshra granite, which represents the post magmatic hydrothermal alteration of granite gneiss in to friable white feldspare rich mass consisting of albitites, aplites and pegmatites. This zone has undergone Na and K metasomatism, which might have prepared ground for late uranium bearing solution to concentrate at the contact of the basement and overlying sediments.

The drilling data suggest thrusting of granite over the basin of deposition. The idea of thrusting is based on certain field observation as well as by the regular pattern of appearance of sandstone below crushed granite in drilling. It also indicates that sediments of the basin rest mostly on granite rocks with the exception of only a small part laying on metasediments (Fig. 2).

The data revealed a huge basin of deposition, only a small part of which is exposed in deep cutting nalas and on road side. The basin consists of coarse sandstone, with boulders and pebbles, siltstone and minor clay. The highest radiometric and chemical uranium was fund within clays.

Uranium is either being dissolved in percolating groundwater from the altered granite and redeposit on the surface of altered granite clays below the granite or there is a uranium-enriched zone at depth, from which uranium is released in circulating groundwater, which carries it to the surface of crushed granite or deposits it in the clays bed.

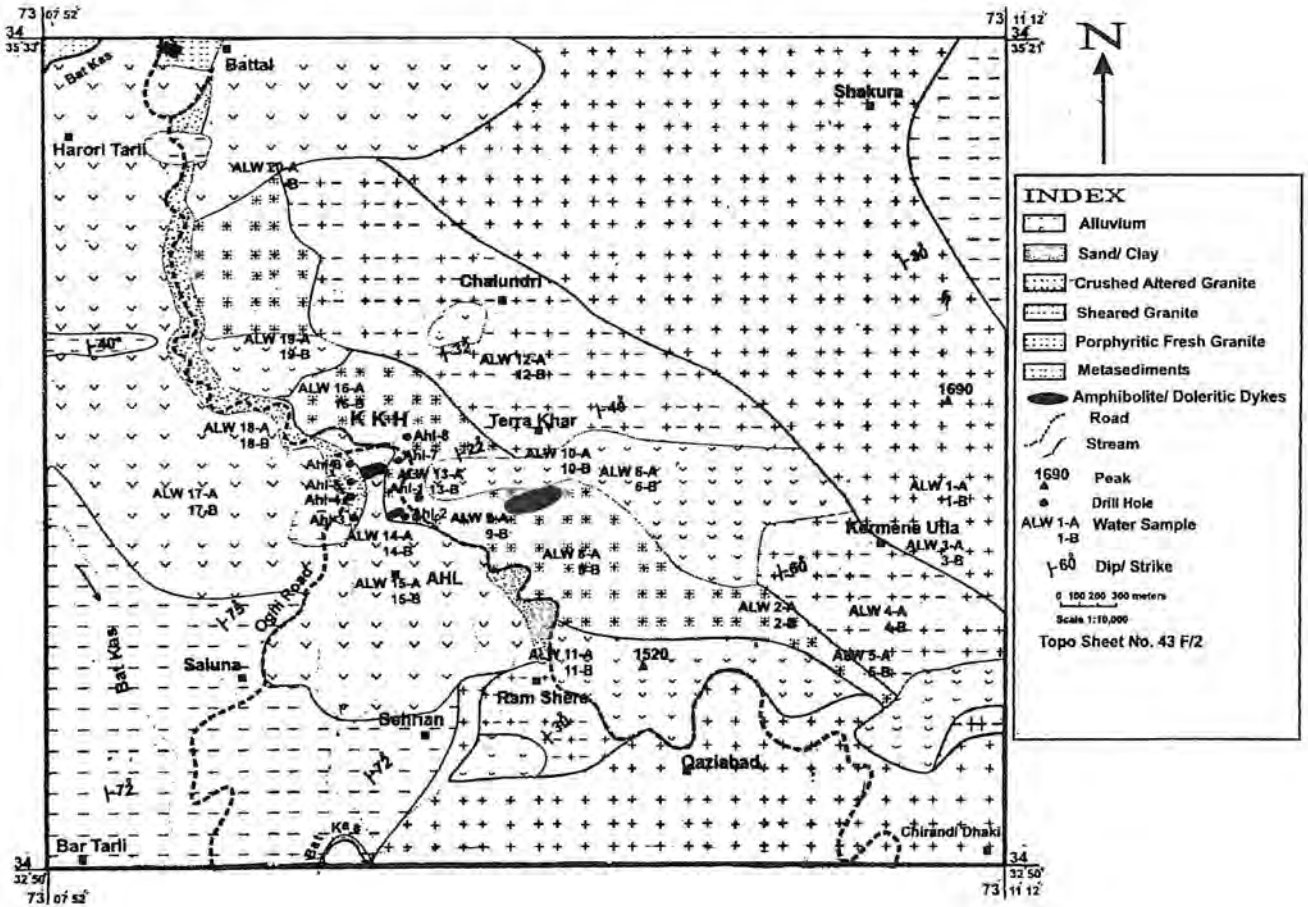

Fig. 1. Geological map of Ahl area. District Mansehra.

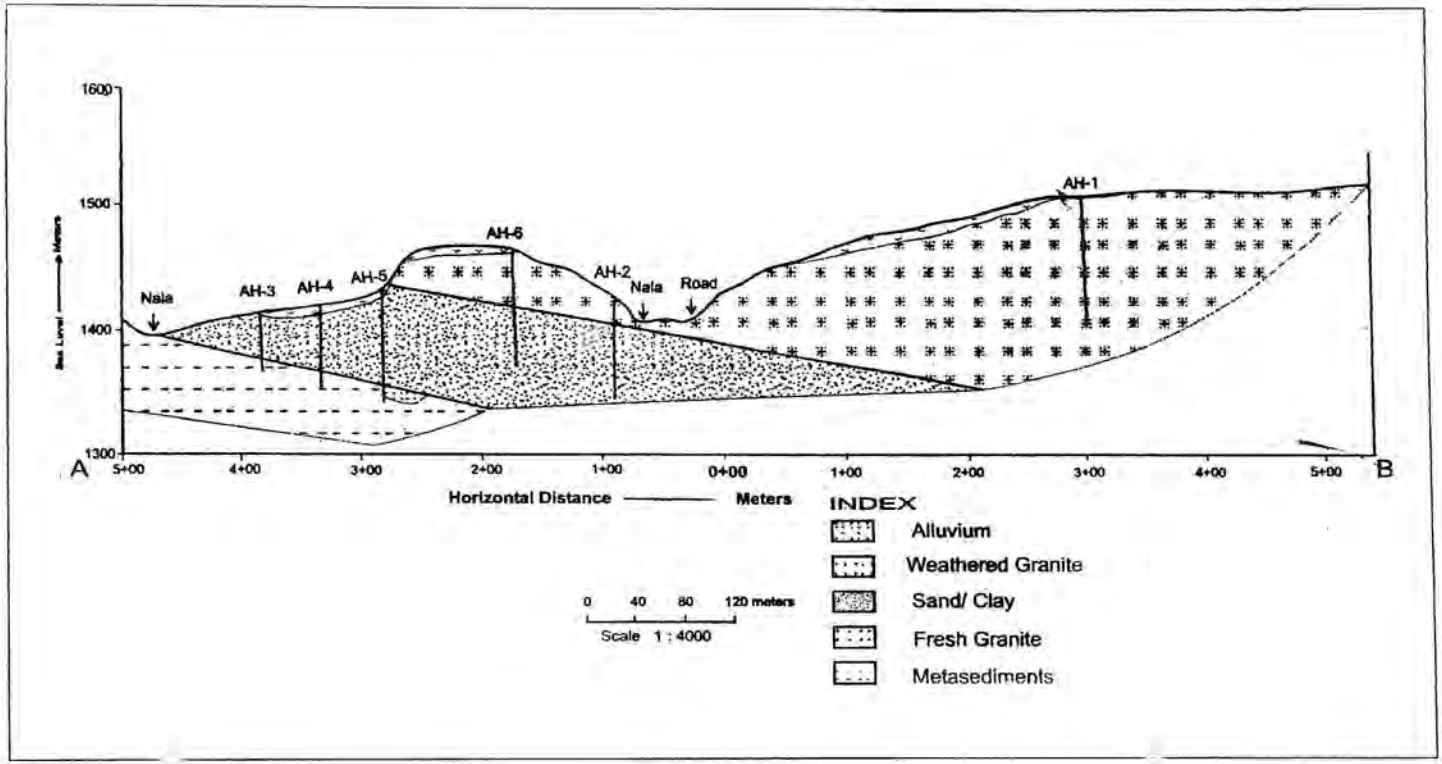

Fig. 2. Geological cross section along 3+00 line at Ahl area.

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