SANDSTONE-TYPE URANIUM MINERALISATION IN THE EARLY TERTIARY SEDIMENTARY SEQUENCE IN TAROL-MALTU AREA, SOLAN DISTRICT, HIMACHAL PRADESH

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Abstract: Ground radiometric survey carried out in the early Tertiary Dagshai-Kasauli Formations in the northwestern foothill Himalaya has led to the discovery of uranium mineralised sandstone bands extending for about (a) 500 m, with 5-10 m width, at Tarol, 8 km southwest of Solan and (b) 250 m, with 4-7 m width, at Maltu, 6.5 km southwest of Solan, in the Solan district of Himachal Pradesh. Grab samples from (a) Tarol assayed up to 1.41% eU_3O_8, 1.65% U_3O_8 (β/γ) and <0.005% ThO_2 and (b) Maltu assayed up to 0.24% eU_3O_8, 0.28% U_3O_8 (β/γ) and <0.005% ThO_2. In both the localities, majority of the samples show disequilibrium in favour of parent (uranium). Uraninite and uranophane are the main uranium minerals, which occur in close association with disseminated pellets of organic matter.

Keywords: Economic geology, U-mineralisation,Sandstone type, Tertiary, Dharamsala, Solan, Himachal Pradesh.

INTRODUCTION

Upper Eocene-Lower Miocene Dharamsala Group in the northwestern foothills of Himalaya gain importance for U-exploration in view of the discovery of significant radioactive zones at Tileli, Chah ka Dora, Garlwar, Rohin Khad etc. (Fig.1a), near the contact between the lower and upper formations of Dharamsala Group in parts of the Mandi and Bilaspur Districts, Himachal Pradesh (Sharma et al. 2000). The southeastern extensions and equivalents of Dharamsala Group in the Solan area are known as Dagshai and Kasauli Formations (Karunakaran and Rao,1979). Radiometric survey carried out in these formations revealed significant uranium-mineralised sandstone bodies. In the present note, we report the discovery of sandstone-type uranium mineralisation at Tarol (lat. 30°51'30"N; long. 77°02'40"E; Survey of India Toposheet no. 53F/1) and at Maltu (lat. 30°52'55"N; long. 77°02'45"E; Toposheet no. 53F/1), Solan district, Himachal Pradesh (Fig.1a and 1b).

GEOLOGICAL SETTING

The early Tertiary sedimentary sequence of rocks in the study area is bounded in the northeast, by Krol Thrust (KT) that separates the pre-Tertiary and Tertiary Formations, and in the southwest by Bilaspur Thrust (BT) that separates Siwalik from pre-Siwalik Tertiary rocks. Other prominent thrusts present in the area are: Surajpur Thrust (ST), Ranon Thrust (RT) etc. (Fig.1b). The ST divides the study area into two sectors of contrasting lithological association: in the western sector, lithological units occur as laterally persistent formations and maintain the normal order of superposition, whereas in the eastern sector, similar lithologic units occur as intertonguing facies due to repeated marine transgressions and regressions (Raiverman and Raman,1971). Also, there are several major anticlinal and synclinal folds to the east of ST, viz; Garkhal syncline, Sanawar anticline, Anji syncline and Kuthar anticline (Raiverman,1979). Pre-Siwalik Tertiary sequence is well developed in the Solan area and is subdivided into three units - Subathu, Dagshai and Kasauli. These units range in age from Eocene to Miocene (Medlicott,1864; Pilgrim and West, 1928). The lower unit of this sequence, viz. the Subathu Formation, consists predominantly of green shales, grey marls, limestones and occasional white sandstones. The middle unit, Dagshai Formation is predominantly represented by red shales with calcareous concretions and siltstones with subordinate amounts of grey and brown sandstones of coastal transitional environment, whereas the upper unit, Kasauli Formation, consists of alternations of thick greenish grey micaceous sandstones and greenish grey and red shales. The associated minor amount of splintery red shale *ipso facto* forms the lower part of Kasauli Formation. The sandstones of Kasauli

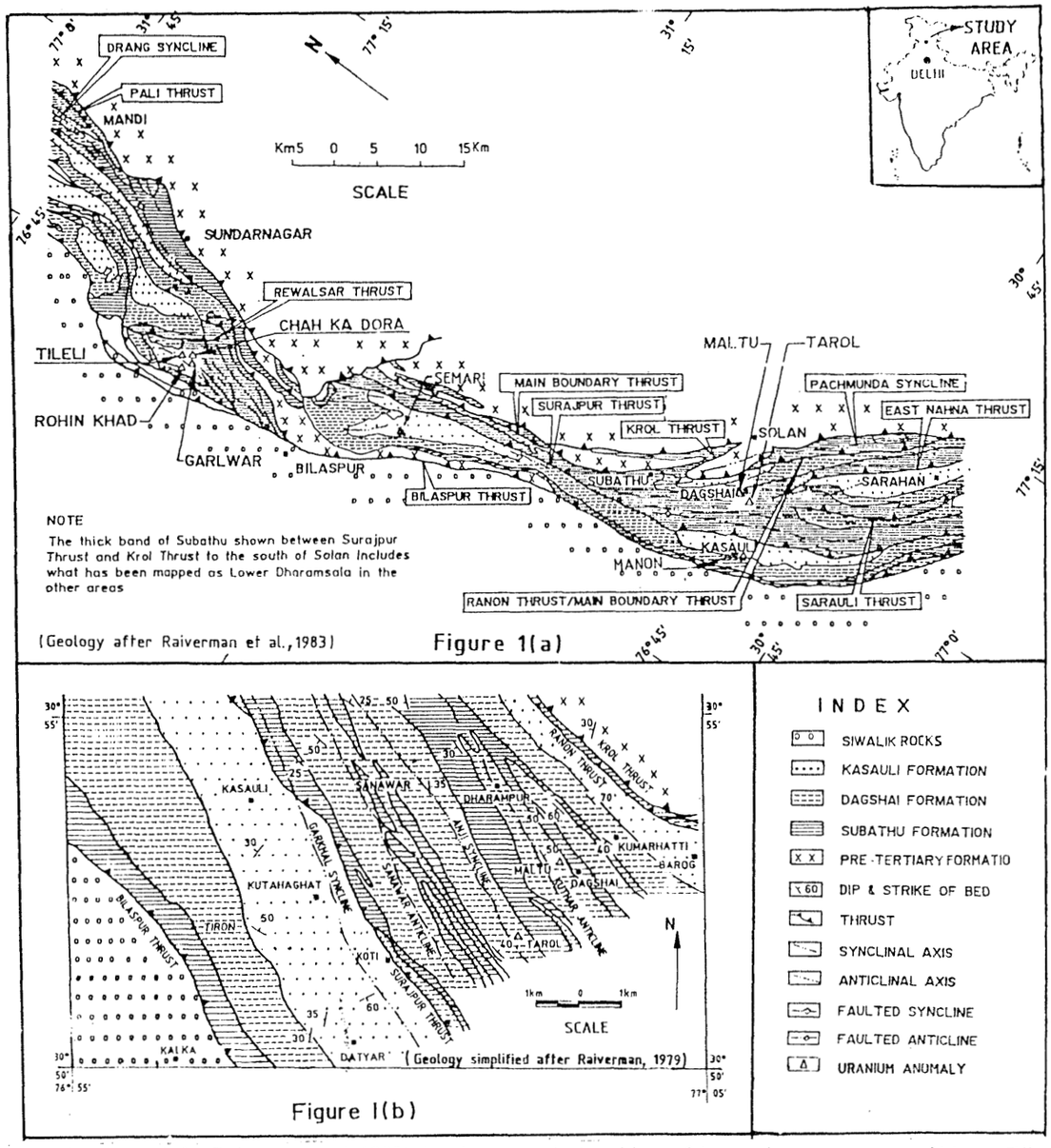

Fig.1. (**a**) Regional map (*after* Raiverman et al. 1983) showing geological positions of the uranium occurrences of Mandi, Bilaspur and Solan Districts, Himachal Pradesh. (**b**) Geological map of the Tarol-Maltu area, Solan District, Himachal Pradesh (*after* Raiverman, 1979).

consist of numerous plant impressions indicating a fluvio-deltaic environment. The estimated exposed thickness of early Tertiary sediments at Tarol is around 500 m and at Maltu is about 655 m. The Dagshai and Kasauli beds, in general, have dips of 40° to 70° towards northeast.

EXPLORATION FOR URANIUM

Systematic exploration for uranium in the early Tertiary sedimentary sequence in the Solan area, commenced during 1994-95 and resulted in locating uranium anomalies around Manon (lat. 30°53'10"N; long. 76°57'30"E) where carbonaceous fossil wood analysed 0.053% eU_3O_8 and 0.11% U_3O_8 (β/γ), with negligible amount of ThO_2. and Semari (lat. 31°14'30"N; long. 76°50'30"E) where ferruginous sandstone containing disseminated carbonaceous matter analysed 0.032% eU_3O_8, 0.02% U_3O_8 (β/γ) and negligible amount of ThO_2 (Fig.1a). Besides,

low order radioactivity was also located at Jharar nala and near Lohara village. The above uranium anomalies are confined to the Kasauli Formation (Basu, 1995).

Reconnaissance radiometric survey around Tarol and Maltu during 1998-99 led to the discovery of radioactive zones, about 1.75 km northwest of Tarol village and about 1 km east-north-east of Maltu (Fig.1b). At Tarol, a radioactive zone of 500 m was traced with width varying from 5 to 10 m in the sandstones of upper part of Dagshai Formation (Fig.1b). This radioactive zone recorded radioactivity of 0.03 mR/h to 0.1 mR/h, with several patches showing higher orders of radioactivity upto 1.0 mR/h. Grab samples from Tarol (n=15) radiometrically assayed 0.019 to 1.41% eU_3O_8 ($\bar{x}$ = 0.2149), 0.014 to 1.65% U_3O_8 (β/γ) ($\bar{x}$ = 0.2293) and < 0.005% ThO_2. Another significant radioactive zone was also picked up at Maltu extending for about 250 m with 4-7 m width in the sandstones of upper part of Dagshai Formation, above which Kasauli is not exposed. The radioactive zone recorded radioactivity of 0.03 mR/h to 0.1 mR/h with some of the patches showing higher order of radioactivity up to 0.8 mR/h. Grab samples from Maltu (n=11) radiometrically assayed 0.017 to 0.24% eU_3O_8 ($\bar{x}$ = 0.0702), 0.017 to 0.28% U_3O_8 (β/γ) ($\bar{x}$ = 0.0655) and <0.005% ThO_2. Uranium mineralisation in both the localities occur in the following forms: (i) secondary uranyl minerals (uranophane) occur along the weak planes, intergranular spaces, intragranular fractures and as coatings over micaceous minerals. (ii) fine aggregate of uraninite along intergranular spaces, intimately associated with pyrite. (iii) uranium along the intergranular spaces with no discernible uranium phase indicating labile uranium. (iv) uraninite and secondary uranyl mineral associated with framboidal pyrite suggesting biogenic origin. (v) uranium associated with carbonaceous matter in the form of urano-organic complex. The textural relationship of the uranium phases suggest its late diagenetic emplacement of U. Megascopically, the host rock of uranium mineralisation is fine to medium grained, thickly bedded, jointed, moderately hard and compact greenish grey sandstone containing impressions of plant remains, clay material, hydrated iron oxides as yellow and brown stains and flakes of white mica along the joint planes. At places, the host sandstone contains pockets of clay chip conglomerate.

CONCLUSION

In the light of the earlier reported uranium mineralisation at Tileli, Chah- Ka- Dora, Garlwar, Rohin Khad etc. in the Mandi and Bilaspur Districts and the present discovery of sandstone-type uranium mineralisation at Tarol and Maltu in Solan District, Himachal Pradesh, the early Tertiary sedimentary sequence, especially at the contact of Dagshai and Kasauli Formations, warrant a detailed radiometric survey.

Acknowledgements: The authors are highly grateful to Shri D.C. Banerjee, Director, Atomic Minerals Directorate for Exploration and Research for his constant encouragement. Thanks are also due to Shri R.K. Gupta, Additional Director (Operations-I) for his critical discussions and suggestions to bring this paper. Officers of the XRD and Petrology Laboratories, AMD, Hyderabad and Physics Laboratory, AMD, Northern Region, New Delhi are duly acknowledged for quick analytical support.

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