SHORT COMMUNICATIONS

DISCOVERY OF THE URANIFEROUS POLYMETALLIC VEINS IN THE GNEISSES OF CHHOTA-UDAIPUR, AJMER DISTRICT, RAJASTHAN

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Uraniferous polymetallic veins are found in the Gyangarh Asind acidic igneous suite and Sandmata Complex near Chhota-Udaipur in Rajasthan. These veins occur in continuation of the well-known U-Co-Mo mineralised albitite zone in Rajasthan and represent a potential target.

Introduction

Uraniferous polymetallic veins in the gneisses of Sandmata Complex intruded by Gyangarh Asind acidic igneous suite, are observed in dug well dumps near Chhota Udaipur (23°29'24": 74°51'36"). Chhota Udaipur is situated at 8.5 km S10°E of Kishangarh Railway Station on the Jaipur-Ahmedabad broad gauge line. Kishangarh is located on NH-8, which connects Jaipur and Ajmer towns of Rajasthan (Inset in Fig.1).

Geology and Mineralisation

Geologically, the area is a part of Sandmata Complex intruded by Gyangarh Asind acidic igneous rocks (Fig.1). Sandmata Complex is represented by biotite schist, gneisses and older mafic enclaves comprising pyroxenite, amphibolite, hornblende schist, chlorite schist and epidiorite of Badnor Formation and migmatites and gneisses of Shambugarh Formation. The Gyangarh Asind acidic rocks are mainly granitic and granodioritic in composition and represent syn- to late-orogenic intrusive bodies partly associated with migmatisation related to Bhilwara deformation (BD-2) and partly coeval with the Berach Granite (Prasad et al. 1997). These rocks are possibly related to albitite bodies which were reported by Ray and Ghosh (1989), Singh et al. (1998) and Sinha et al. (2000) in the areas southwest of Sambhar lake. The albitite bodies of northeastern Rajasthan have association of ore minerals in Khetri copper belt (Ray, 1987) and continues southwestward to Kishangarh area via Ladera (Ray and Ghosh, 1989 and Sinha et al. 2000). Further southwestern continuation of albitite is traced southwest of Kishangarh through the Gyangarh Asind acidic suite of rocks upto Tal in Rajsamand District via Nasirabad in Ajmer District of Rajasthan by Singh et al. (1998) and Sinha et al. (2000). The spatial association of the albitite bodies with Gyangarh Asind acidic igneous suite of rocks may have genetic implications. The albitite type uranium mineralisation is associated with old shields within reactivated zones (e.g., 1700 Ma in Ukrainian and Canadian shields). The ore zones represent steeply dipping metasomatic columns of small bodies measuring 10 m wide and a few 10 m long (Barthel, 1987). In India such type of association is reported from Khandela area where uraniferous polymetallic mineralisation including uraninite, molybdenite, pyrrhotite, chalcopyrite and pyrite in the Ajabgarh Group of Delhi Supergroup (Narayan Das et al. 1980; Yadav et al. 2000). The polymetallic association with albitite without uranium is well known from Ladera-Sakhun (Kothiyal and Kumar, 1990) and Kachhariya (GSI, 1976). In these occurrences, thorium and REE dominate (Sinha et al. 2000). The absence of uranium in these localiites is attributed to the precursor rock types, namely from Badnor Formation, and also due to metasomatising hydrothermal fluids that were poor in uranium and moderate in copper. Ladera-Shakun and Kachhariya are known for feeble copper occurrences.

The present work has brought to light the U-Mo-Cu occurrence near Chhota-Udaipur, and a few more copper occurrences in the southwestern continuity of the known locations. The new occurrences are located in the well dumps near Godiyana, Tikawara, Banewari, Srinagar, Kanakheri, Bhawanikhera and Banewara over an area of 40 km^2 (Fig.1). The Chhota-Udaipur occurrences at 1.2 km east of the village is significant among all new locations, as it has polymetallic character and found in two adjoining dug wells indicating a possible subsurface strike continuity. These two dug wells are separated by 210 m distance in NE-SW direction, which is the general trend of foliation

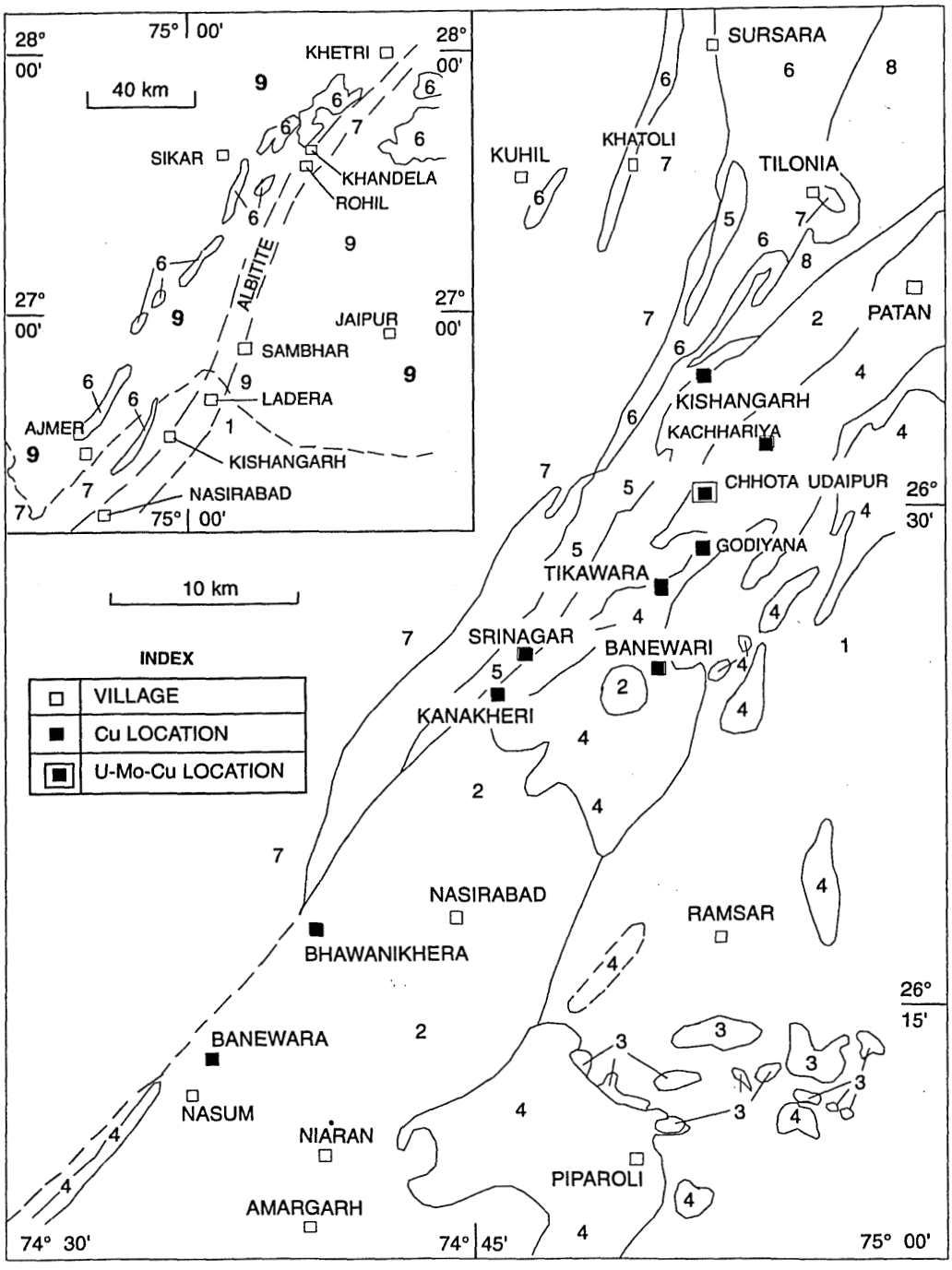

Fig.1. Geological map of Tilonia-Nasirabad area, district Ajmer, Rajasthan, showing mineral occurrences in well dumps (modified after Prasad et al. 1997). *Inset:* Albitite zone extending from Khetri to Tal after Sinha et al. (2000). *Common index:* **1** - Shambugarh Formation of Sandmata Complex, **2** - Badnor Formation of Sandmata Complex, **3** - Rajpur Jalayan mafic rocks, **4** - Gyangarh Asind acidic rocks, **5** - Srinagar Formation of Alwar Group, **6** - Naulakha Formation of Alwar Group, **7** - Ajmer Formation of Ajabgarh Group, **8** - Nepheline and soda syenite, **9** - Soil/alluvium.

and albitised bodies in the schistose and gneissose country. The assay values of the samples from these two dug wells are given in Table 1. The first three samples are from one dug well dump, while the other four samples belong to second well dump. Samples are analysed by gamma-ray spectrometry and by fused pellet fluorimetry for uranium to check the accuracy of values from physical and chemical methods. Thorium is obtained from gamma-ray spectrometry. Approximately 10% ThO_2 is present in all the samples, which is attributed to uraninite. Cu, Mo, and Pb vary from

Table 1. Assay results of polymetallic veins in the well dumps near Chhota Udaipur, Rajasthan

Sl No.	Location	Sample No.	Coordinates	$\%U_3O_8$*	$\%U_3O_8$**	% ThO_2*	% Cu**	%Mo***	% Pb***	Mineralogy ****
1	1.2 km E of Chhota Udaipur	DKS/16A	26°30'35" 74°52'20"	1.620	1.620	0.160	5.38	0.2573	0.1196	U, I, C, P, M, F, Mgt.
2	1.2 km E of Chhota Udaipur	DKS/16B	26°30'35" 74°52'20"	1.520	1.500	0.150	10.64	0.2037	0.1072	U, I, C, P, M, F, Mgt.
3	1.2 Km E of Chhota Udaipur	DKS/16C	26°30'35" 74°52'20"	1.010	1.000	0.090	1.37	0.3671	0.0712	U, X, I, C, P, M, F, Mgt.
4	210 m NE of a point at 1.2 km E of Chhota Udaipur	CHUPR/01	26°30'45" 74°52'30"	0.110	0.106	0.089	0.79	0.21	<0.020	U, X, I, C, P, M, Mgt.
5	210 m NE of a point at 1.2 km E of Chhota Udaipur	CHUPR/02	26°30'45" 74°52'30"	0.344	0.341	0.030	0.41	0.03	0.0328	U, X, F, M, P., Mgt.
6	210 m NE of a point at 1.2 km E of Chhota Udaipur	CHUPR/03	26°30'45" 74°52'30"	0.155	0155	0.013	0.61	0.39	<0.02	U, C, P, M., F, Mgt.
7	210 m NE of a point at 1.2 km E of Chhota Udaipur	CHUPR/04	26°30'45" 74°52'30"	0.757	0.748	0.0623	1.18	0.46	0.057	U, C, P, M, Mgt.

*Gamma-ray spectrometry; ** Fused pellet fluorimetry; *** Flame AAS, ****XRD; U = Uraninite; I = Ilmenite; C = Chalcopyrite; P = Pyrite; M = Molybdenite; X = Xenotime; F= Fluorite; Mgt. = Magnetite

0.41 to 10.64%, 0.03 to 0.46% and <0.02 to 0.11% respectively. The Cu and Mo are contained in chalcopyrite and molybdenite, while Pb is radiogenic and shows positive correlation with uranium. Xenotime, ilmenite and magnetite are related to Gyangarh Asind acidic igneous suite, while others are associated with late to post Gyangarh Asind acidic igneous suite. Fluorite mineralisation is related to hydrothermal activity.

Petrographically, the country rock is biotite gneiss made up of alternating bands of quartzofeldspathic minerals and biotite. Chloritised and bleached biotite bands swerve around the porphyroblasts of feldspars and quartz. Sericitisation is a common feature. The gneissose rocks were intruded by granites. The essential minerals in these granites are microcline, plagioclase, and quartz with minor chlorite. Granites were albitised, wherein the invading soda-rich hydrothermal solution replaced the existing feldspars to albite. Relicts of microcline in the newly formed albite indicates metasomatic replacement. Hydrous iron-oxide dusting on feldspars and granular aggregates of haematite along grain boundaries and fractures are associated with albitisation observed in granite. The invading solution has resulted in stockworks of quartz-chlorite and sulphide-oxide composite veins. Chlorites are altered product of pyroxenes (enstatite-hypersthene) from the mafic bands/enclaves of Badnor Formation of Sandmata Complex, probably due to subsequent hydrothermal activity related to intrusion of Gyangarh Asind acidic igneous rocks and albitisation of the pre-existing rocks. Ore microscopic and XRD studies have confirmed the presence of uraninite, molybdenite, chalcopyrite, pyrite, magnetite, ilmenite, xenotime and fluorite (Table 1). Ore microscopic studies have also shown the presence of minor galena, arsenopyrite, bornite and covellite. Uraninite is medium sized, subhedral to anhedral, records high density of alpha tracks on CN film (72 hours exposure), and is associated with sulphides. The paragenetic sequence of minerals is given in Table 2. Magnetite, ilmenite and xenotime are related to syngenetic mineralisation of Gyangarh Asind acidic igneous suite, while the sulphides

Table 2. Paragenetic sequence of ore minerals in the Chhota Udaipur dug wells

Minerals	Syngenetic	Epigenetic	Late Epigenetic Altered/Radiogenic
Magnetite	--------	--------	
Xenotime	--------		
Chalcopyrite	--------	--------	
Pyrite	--------	--------	--------
Ilmenite	--------	--------	--------
Molybdenite		--------	
Uraninite		--------	
Galena			--------
Bornite		--------	
Arsenopyrite		--------	

and uraninite are associated with subsequent albitite-related hydrothermal phenomenon.

Conclusions

The presence of such uraniferous polymetallic sulphide-oxide veins associated with Gyangarh Asind acidic igneous suite intruding the Archaean assemblage has enhanced the importance of this geological set up. The Archaean rocks, i.e. the Badnor Formation containing pyroxenite/amphibolite layers in them, have provided chlorite-rich zones for the precipitation of uranium. Such an association is also characteristic of Rohil-Ghateshwar-Khandela-Diara area, where albitites have played major role in U-Cu-Mo mineralisation, particularly in the chlorite schists and carbonaceous phyllites of Ajabgarh Group (Singh et al. 1998). In the light of these evidences the discovery near Chhota Udaipur has enhanced the potential of Gyangarh Asind acidic igneous suite and Badnor Formation for substantial U-Co-Mo mineralisation, especially along the SW continuity of albitite line (zone), where a number of Cu occurrences are well established. This area is under the active exploration programme of Atomic Minerals Directorate for Exploration and Research.

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