A PRELIMINARY APPRAISAL OF BAITADI PHOSPHORITE, FAR WESTERN NEPAL

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सारांश

सुदुरपश्चिम नेपालको मध्य पहाडी प्रदेशमा फोस्फोराइट अन्य बैतडीका कार्बोनेट संरचनाको यसको अध्ययन गरिएको छ। यो संरचनालाई सातवटा विविन्न प्रस्तरीय इकाईहरूमा विभाजन गर्न सकिन्छ। फोस्फोराइट जन्य तह चार्हि ती सातवटा इकाई मध्ये वृहत चर्ट डोलोमाइटको ईकाई भित्र मात्र अवस्थित छ। यस लेखमा प्रारंभिक अन्वेषण कार्यहरूको नतिजा प्रस्तुत गरिएको छ।

ABSTRACT

The phosphorite-bearing Baitadi Carbonate Formation is investigated in the Lesser Himalaya of Far Western Nepal. The formation is divisible into seven different lithological members and the phosphorite horizon is confined in the Massive Cherty Dolomite Member. The results of preliminary prospecti works are presented.

INTRODUCTION

The preliminary prospecting work was carried out for the stromatolitic phosphorites in the Lesser Himalaya of Baitadi district of Far Western Nepal. The phosphorite horizon was traced continuously and the phosphate content was evaluated by regular channel sampling.

About 150 sq. miles of purchuni-Sorar area of the district were investigated in detail. The area lies two days walking distance from Dandeldhura. The phosphorite horizon will be nearly at 6 to 8 miles aerial distance from the Baitadi - Dandeldhura Road(under construction).The phosphorite horizon is located on the east-west ridge in the middle part of the area, at an altitude of about 6000 ft. Many north-south running streams originate from this ridge.

Baitadi district was covered by a few regional geological traverses and the occurrences of the stromatolitic phosphorites were reported from Dhik Gad and Junkuna (Bashyal, 1982) as well as from Bajahang district (Bashyal, 1981). The P_2O_5 content was found to be 10-15% average in grap samples.

GENERAL GEOLOGY OF THE AREA

The area is composed of mainly two lithotectonic units: Baitadi Carbonate Complex in the south thrust over by the

Parchuni Crystallines of the north. The crystalline complex is represented by Banku Quartzite Formation and Parchuni Schists (Bashyal, 1981). The Chamlia Thrust, traceable continuously in the area, seperates the autochthonous metasedimentary Baitadi Complex from the allochthonous metasedimentary Baitadi Complex from the allochthonous crystalline complex.

Patan Slate Formation of the metasedimentary complex, exposed in the extreme south-western corner of the area, comprises of varicoloured slate, sandstone and quartzite. Probably the coloured slate, sandstone and thin-bed of dolomite exposed to the south of Chamlia Thrust, represent this formation occuring in an overturned flank.

BAITADI CARBONATE FORMATION

Baitadi Carbonate Formation occupies the major part of the present area and can be divided into the following main lithological members (from bottom to top):

i) Limestone Member
ii) Massive Cherty Dolomite Member (with phosphorite horizon).
iii) Calcareous Slate Member
iv) Dolomite & Quartzite Member
v) Black Slate Member
vi) Coloured Dolomite Member
vii) White Quartzite Member

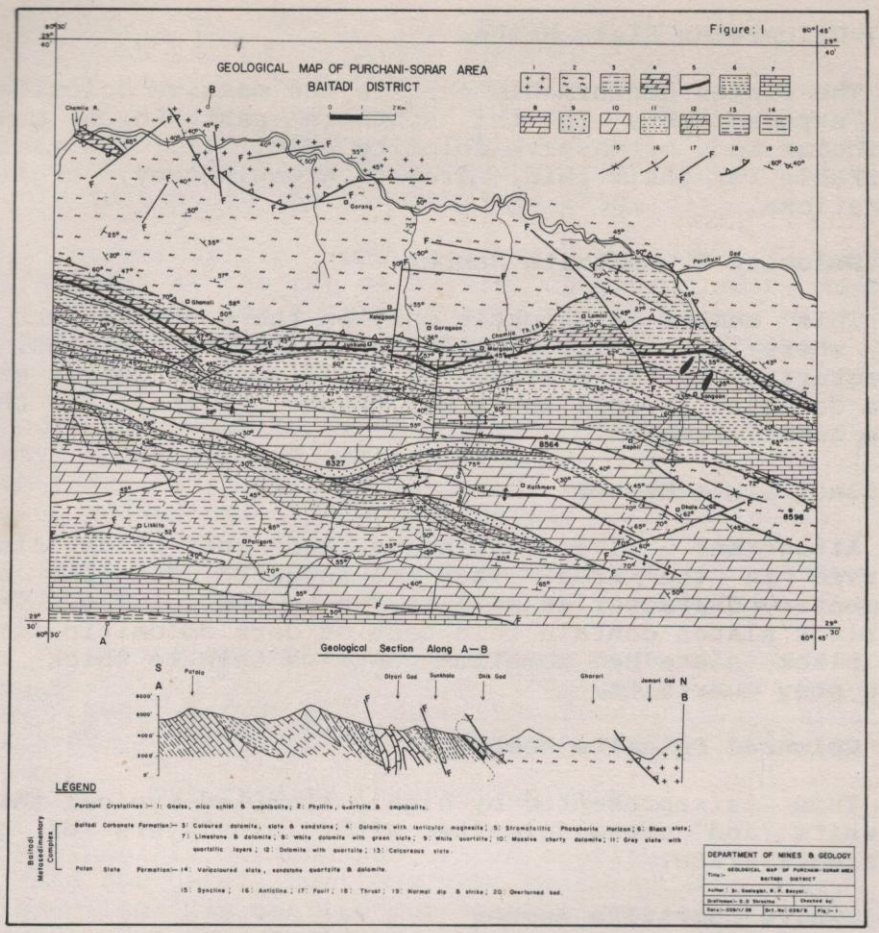
(i) Limestone Member

A major limestone bed, 1250m thick, overlies the Patan Slate Formation (Fig.1) with a gradational contact and due to folding in the middle part of the area. The limestones are gradually replaced by dolomitic limestone and then by dolomites from west to east. The limestone of the area are white-grey to dark and fine to cryptocrystalline. Thin greyish argillaceous laminations are common. The stratiferra stromatoitic structures occur near the contact with overlying Massive Cherty Dolomite Member as observed in Surnaya Gad.

(ii) Massive Cherty Dolomite Member

The major part of the area is covered by the massive dolomites which are characterised by the presece of black to white-grey cherty lainations and lenses. Dolomites are of white, grey and dark colour. Black slates occur as lenticular bodies in those dolomites (Fig. 1). The stromatolitic phosphorite horizon is confined within such massive cherty dolomites exposed in the northern part of the area. The sedimentary structures in the dolomites points to the shallower facies in the north.

Figure : I



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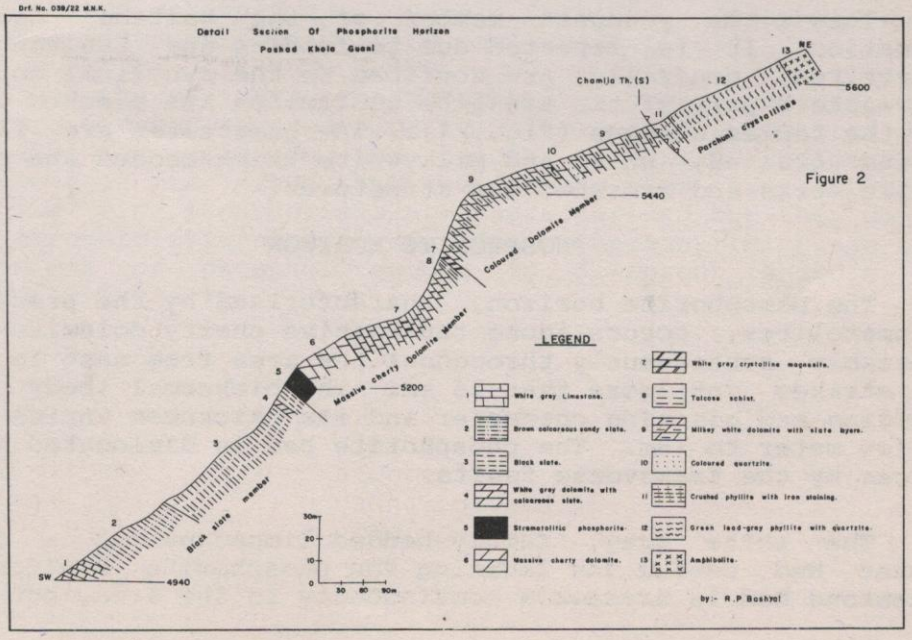

Figure 2

(iii) Calcareous Slate Member

The slates conformably overlie the massive dolomite. They are exposed only in the southern part which contain a lenticular body of massive dolomite (Fig. 1). The slates are remarkable for their thin, grey to greenishgrey, argillaceous laminations.

(iv) Dolomite & Quartzite Member

This member is mappable only in the southern part of the area where it is overlying the calcareous slates. It is characterised by the presence of small rounded quartz grains in white dolomite as well as it may change vertically to the thin white quartzite beds.

(v) Black Slate Member

Altogether five continuous beds of black slate are observed in the area. They are repeated due the original sedimentary character as well as due to the folding. The dark to black slates contain thin beds of dark dolomitic limestone. The black slate bed sometime contains thin to thick beds of white grey quartzite.

(vi) Coloured Dolomite Member

This is represented by highly crumpled typical thin beds of white and cream dolomite with interlayers of greenish calcareous slate.

(vii) White Quartzite Member

Thisis the youngest member of the Baitadi Carbonate Formation. It is repeated due to folding and faulting. The quartzites, generally, are confined to the synclinal cores. In the eastern part of the area,the quartzites are pinched out due to the facies changes (Fig. 1). The quartzites are fine to medium grained, white and milkywhite thick-bedded and contain ripple marks and crossbedding structures.

PHOSPHORITE HORIZON

The phosphorite horizon, characterised by the presence of stromatolites, occurs among the massive cherty dolomite and is traceable continuously throughout the area from east to west. It strikes for more than 25 km. The biohermal body is of swelling and pinching character and its thickness varies from a few meter to 18m. The phosphorite bed is dislocated at many places by the transverse faults.

The white grey, thinly-bedded limestone is a typical marker bed useful for locating the phosphorite horizon. The limestone bed is traceable continuously in the area, but to the

east of Bagichaur and Morgaon its thickness increases due to the latteral change into dolomitic limestone and dolomite. The limestone is overlain by brown to grey, phyllitic lead-grey slate with sandy layers and the black slate. The platly white-grey dolomite with laminations of calcareous slate is noted in the upper part of the Black Slate Member. A thin bed of black slate occurs just below the phosphorites (Fig. 2).

The stromatolitic phosohorite horizon, occuring stratigraphically at the top of Massive Cherty Dolomite Member, is very distinct in the outcrop due to the presence of black phosphotised stromatolites in association with white and grey dolomites.

The coloured Dolomite Member, stratigraphically underlying the cherty dolomite and occurring on the top in the field succession (Fig. 2), is represented by the purple, white and pink, thin bedded dolomite and sandstone with lamination and layers of varicoloured slate. The cross-laminations noted in sandstone also support the inversion of field succession as indicated by the stromatolites of the cherty dolomite.

The stromatolites found in the study area is represented by Collenia columnaris, Collenia kussiensis and Baicalia baicalica. Such forms are reported from Kumaun Himalaya (Valdiya, 1969, 1972) and Udaipur (Chauhan, 1973) in India.

PRELIMINARY PROSPECTING WORK

The phosphorite horizon was traced continuously form west to east and the detail sections were measured at places. The channel sampling was carried out generally at a distance of 500m to 1000m. The phosphorite horizon can be divided into four sectors, based on the P_2O_5%, namely Dhik Gad, Junkuna, Dhau Bisauni and Sanogaon from west to east respectively.

In all the sectors, the phosphorites occur between the black slate and the cherty dolomite. The beds are repeated due to folding as well as due to the original sedimentary characters. It is noted that the phosphorites are enriched updip. The rich phosphorites are characterised by the dense massive stromatolitic structures. The extension, thickness and P_2O_5% content of phosphorite bed in different sectors is presented in Table 1.

Table 1: Results of Prospecting Works

Sector		Thickness, m	Extension km.
Dhik Gad	More than 10	20.50-2.70	More than o.2
	17-18	0.70-1.80	-
Junkuna	10-12	1.00-4.70	1.0
	16-18	2.20	-
DhauBisauni	More than 10	2.30-4.70	8.0
	11-22	1.60-4.70	-
Sanogaon	More than 10	3.0	6.0
	19-26	0.40-0..90	-
	32	0.60	-

* Analyses conducted at DMG (Analyst, Mr. K.S. Kasaju).

PETROGRAPHY OF PHOSPHORITES

The microscopic study of the phosphorites reveals that the phosphate material "Collophane" is of yellowish brown colour and isotropic, which occurs in massive, laminated and pelletal forms. The massive and laminated forms are found in the stromatolitic phosphorites. The massive type is of irregular shape sometime interfingering with the fine to medium grained dolomite. The algal structure is represented by the alternating laminations of collophane and fine dolomite. The intercolumnar space of the stromatolites are filled by the pelletal phosphate, which are of rounded, elliptical and elongated froms and are in average 0.18mm wide and 0.36 to 0.50 mm long. The pellets are embedded in a sparry dolomitic mass. The phosphorites are of dark coloured due to the presence of abundant organic matter. The late diagenetic calcite veins cross-cut the phosphate mass.

The Chemical and X-ray analysis of one stromatolitic sample (Bashyal et al., 1981) reveal 22.88% P_2O_5, 30.63% Cao and 17.61% MgO, and other elements are in the range of 2-3%. A considerable amount of Cu, Mn, Cd, and Ni as trace elements is notable. The X-ray diffraction analysis indicates that the phosphate mineral is represented by carbonate fluorapatite. The bulk analysis however shows dolomite, calcite and quartz as gangue constituents.

CONCLUSION

Baitadi Carbonate Formation of Far Western Lesser Himalaya of Nepal is represented by seven lithological members (Fig. 1). Massive Cherty Dolomite Member contains the phosphorite horizon. The phosphorites are charactrised by the wide development of the stromatolites of Precambrian age.

The coloured dolomite, sandstone and slate underlying the phosphorite horizon (Fig. 2) were deposited in a shallow to near continental regime. The shallowness of the warm sea with deposition in a littoral zone was still prevailing during the proliferic development of algal bioherm and phosphatization. The deposition of overlying black slate and limestone represents the transgressive nature of sea.

The preliminary prospecting work carried out reveal the presence of phosphorite beds, 1m to 5m thick, containing 10 to 32% P_2O_5 and extending up to 8km in different sectors.

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