

Potential Dolomite Horizons and Sulphide Mineralisation Zones in Buxa and Gorubathan Formations of Sikkim and West Bengal

INTRODUCTION: Study of the Buxa and Gorubathan Formations of Daling Group of Precambrian age of Lesser Himalayan Belt have been carried out to delineate the potential dolomite horizons and the potential zones of sulphide mineralisation respectively in West & South districts, Sikkim and Darjeeling district of West Bengal. An area of about 168 km² has been covered by geological thematic mapping on 1:25000 scale. Besides mapping, a total of 86 nos. of bedrock geochemical samples from the potential zones of sulphide mineralisation in Gorubathan Formation and 20 nos. of samples from limestone and dolomite of Buxa Formation were collected and analysed.

GEOLOGY: The different lithounits exposed in the area can be grouped into Darjeeling Group of rocks, Lingtse granite gneiss, Daling Group of rocks and Gondwanas. The Darjeeling Group of rocks comprises a sequence of orthoquartzite, garnetiferous mica schist, calc silicate rocks and thin bands of gneisses supposedly equivalent to the Chungthang Formation and a thick pile of biotite gneisses (Darjeeling gneisses). The Daling Group of rocks comprises quartz-chlorite-sericite phyllite, muscovite-biotite phyllite, slates, quartzose phyllite and quartzites of Gorubathan Formation and dolomite, limestone and variegated phyllite of Buxa Formation. At the contact of the rocks of Gorubathan Formation and Chungthang Formation, a thick horizon of streaky biotite granite gneiss is observed, which is described as Lingtse granite gneiss. Gondwana Group of rocks are represented by a basal pebble slate (Ranjit Pebble Bed) followed by coal bearing sandstone-shale horizons with occasional plant fossils equivalent to the Damuda Group of rocks of the Indian Peninsular shield.

Systematic mapping reveals that most of the area is covered by the Daling Group of rocks and particularly by the rocks of Gorubathan Formation. The rocks of Buxa Formation occur as thrust wedges along the thrust contact of the rocks of Gorubathan Formation and Gondwanas, which form a tectonic contact with the overthrust metamorphites of the Dalings. The contact between Gorubathan Formation and Lingtse granite gneiss is gradational whereas, the contact between Lingtse granite gneiss and Chungthang Formation is tectonised one, represented by intense shearing and mylonitisation of both Formations. The boundary between different rock units of the Dalings have been observed to be gradational except for some localized displacement

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and truncations whereas, the boundary between Gondwanas and Dalings and between Dalings and Darjeeling group of rocks is tectonised and thrust.

STRUCTURE: The rocks of this area were subjected to more than one phase of deformational episodes. Overprinting of structures of three phases is clearly noticed. A pervasive and penetrative schistosity (S1) represents the earliest phase of deformation (AF1). It is axial plane to the F1 folds. The F2 folds are produced during second phase of deformation (AF2). These folds are most abundant fold structure in the area characterized by its wide variation in scale, magnitude and style. The regional schistosity (S2) is the resultant of these F2 folds and developed as crenulation cleavage, parallel to the axial-plane of F2 folds. The folds developed during third phase of deformation (AF3) produce broad open F3 warps on regional scale. Asymmetric kink and chevron folds are also common. A discrete and pervasive foliation plane S3, developed as axial plane foliation of F3 folds. The superimposition of F3 folds on F2 folds have resulted in the culmination and depressions and thereby forming dome and basin structures, which after erosion, develop tectonic window zones e.g. Ranjit tectonic window and Kitam window. Faults and minor slips are common phenomenon in this area. Thrusts in the area have been postulated on the basis of stratigraphic discontinuity, sudden change in the nature of metamorphism, cataclasis and mylonite zones. Along these thrusts, the older Daling Group of rocks has moved over the younger Gondwanas. Imbricated slices of Buxa dolomite and limestone and the Ranjit pebble bed has been noticed along these thrust contacts.

MINERALISATION: Evidences of sulphide mineralisation are found in some quartz veins in the phyllites, slates and quartzites of the Gorubathan Formation. It is in the form of malachite staining and disseminations, thin stringers, small pods and nests of pyrite, pyrrhotite and chalcopyrite in the quartz veins and rarely in the country rock occurring in the vicinity of the mineralized quartz veins. The mineralised quartz veins occur parallel to the dominant schistosity / foliation planes in an echelon pattern and shows pinch and swell structures. These mineralised quartz veins are thin, small and lensoidal in nature and their lateral extension could not be traced for a long distance. Several localities around Chakung village show outcrops of such mineralised quartz veins. These are Jugdum, Sisni, Keorani, Rathok Khani, Shribong and Chongbong. Beside these localities, sulphide mineralisation is also noticed in Sumbuk area near Rong. Evidences of old

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workings are also present at these localities in the form of adits, drifts and rat hole type openings along the mineralised quartz veins.

HIGHLIGHTS:

- The present investigation indicated anomalous copper content along with anomalous gold content in the samples from the Jugdum area, Shribong area, Rathok Khani area and Rong area. The analytical result reveals that in Jugdum area, the copper content varies from 400ppm to 7.99%. One sample, which was collected from a fallen boulder in a nala section near Jugdum occurrence, indicated 7.99% copper content and 9ppm Ag content. All other samples, which were collected from the mineralised quartz veins in old adits and drifts, the copper content varies from 584ppm to 1.11%. The gold values vary from <25 to 820ppb. In Shribong area, the copper content varies from 124ppm to 1.46%. The five samples shows gold values vary from 39 to 540ppb. In Rathok Khani area, the copper content varies from 62ppm to 3.36%. All samples collected from the mineralised quartz veins show encouraging values of the copper content. The five samples show gold values vary from 41ppb to >1ppm. Two samples show 3ppm Ag content also. In Rong area, the copper content varies from 0.11% to 0.97. The gold values in 3 samples vary from 26 to 31ppb. In Chongbong area, the copper content varies from 40ppm to 0.51%. The gold values vary from <25 to 59ppb.
- All other elements i.e. Pb, Zn, Ni, Co and Ag are in traces in all samples.
- The occurrences of dolomite and limestone of Buxa Formation are located in Nayabazar, Mangalbare and Maniram areas in the study area, In Nayabazar area, the samples collected from Jorethang-Namchi road section indicated CaO varies from 37.85 to 43.52%, MgO 0.48 to 0.75%, insolubles 15.52 to 27.66% and R2O3 3.93 to 8.03%. The samples from Jorethang-Legship road section contains CaO varies from 32.8 to 35.86%, MgO 0.73 to 1.27%, insolubles 30.1 to 40.49% and R2O3 5.75 to 7.42%. From chemical analysis it is evident that in Nayabazar area, the samples collected from Jorethang-Namchi and Jorethang-Legship road sections possess minimum qualitative requirement for cement manufacture. In Mangalbare area, Cao varies from 38.91 to 44.32%, MgO 0.64 to 1.07%, insolubles 17.84 to 26.91 % and R2O3 2.75 to 3.73%. The chemical analysis indicates that limestone bands possess minimum qualitative requirement for cement manufacture. However, in Maniram area, dolomite/limestone is of poor quality.

Old working pits in an oxidized zone with mineralized quartz vein showing limonite and malachite stains.
Location- Sirbong.



Old working pits in an oxidized zone with mineralized quartz vein showing limonite and malachite stains.
Location- Sirbong.



Excavation pits in a limonitised and ferruginised gray phyllites with thin mineralized quartz veins.
Location- Rathok Khani



Malachite stains on a mineralized quartz vein occurs in a limonitic zone within phyllites. Location-Rathok Khani



The old adit mouths on an escarpment face.
Location- Jugdum



A close view of an old adit mouth face.
Location- Jugdum





The steep escarpment face, where the evidences of basemetal mineralisation were located.

Location- Chongbong

An old adit mouth face in quartzite.

Location- Chongbong





An old adit mouth face in quartzite
Location- Chongbong

The inside view of an old
adit in quartzite.
Location- Chongbong

