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Research Paper

Genesis and Economic Potentialities of Talc Mineralization of Chandaak, District Pithoragarh, Uttarakhand

Geology

KEYWORDS : Talc, Magnesite, Diagenetic

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ABSTRACT

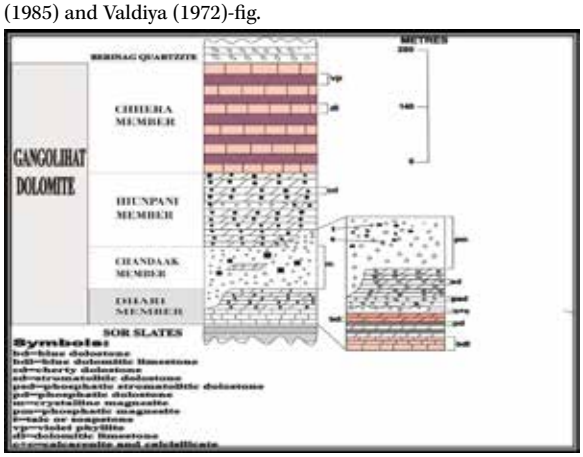
Chandaak Member of the Gangolihat Dolomite Formation is having talc mineralization as pockets and patches within crystalline magnesite deposit. Other minerals present with talc mineralization are very little amount of silica and phosphatic material. It is very interesting to note that talc and quartz shows antipathic relationship. Relicts of quartz are rarely seen in the talc. Megascopically colour of talc varies from white to dark grey depending upon the content of impurities and is extremely fine grained, compact, showing pearly/greasy lustre and having soapy feel on touch. Petrographic studies reveal the presence of magnesite, very little amount of quartz and dahlite but no relicts of dolomite and it corrodes the magnesite crystals very heavily which is lying mainly in contact zone indicating a very much later origin. The antipathic relationship between talc and silica indicates talc is formed by reaction of magnesite and silica. On the basis of above studies it is concluded that the Chandaak talc mineralization represents a product of reaction between magnesite and silica during high temperature diagenetic environment below 300˚C.

INTRODUCTION

Gangolihat Dolomite Formation (GDF) of Calc Zone of Pithoragarh has been divided into four Members

Chhera Member
Hiunpani Member
Chandaak Member
Dhari Member

It is shown by lithostratigraphic map below that is given by Sengupta et. al. (2015) slightly modified after Bhattacharya et. al. (1985) and Valdiya (1972)-fig.



1.

The talc is mainly found to associate with Chandaak Member. The appropriate thickness of the Chandaak Member is about 100m. The rock mainly consists of magnesite, dolostone, stromatolitic phosphorite, chert etc. In the bedded magnesite deposit talc mainly occurs as pockets and patches of various dimensions and has colour range from semi-transparent white to pinkish white to grayish black. At places it is foliated producing a phyllitic rock appearance.

FIELD STUDY

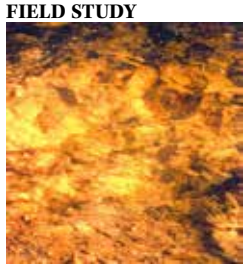


Figure No. 2: Field photograph showing contact between dolostone and magnesite, thick beds of magnesite having dark pockets of talcose rock.

PETROGRAPHY

Under petrography both megascopic and microscopic characters have been studied.

Megascopic characters: Talc/soapstone is intimately associated with magnesite host rock with a bewildering variety of occurrence, colour and form. It shows varieties of colour depending on the impurities present in it. It shows a typical greasy luster with soapy feel on touch and sometimes showing development of perfect basal cleavage. It occurs both as massive bodies and as in form of foliated soapstone rock with the development of minute puckerings. Rarely at places very small amount of quartz as relict may be seen that could easily be distinguished by its hardness.

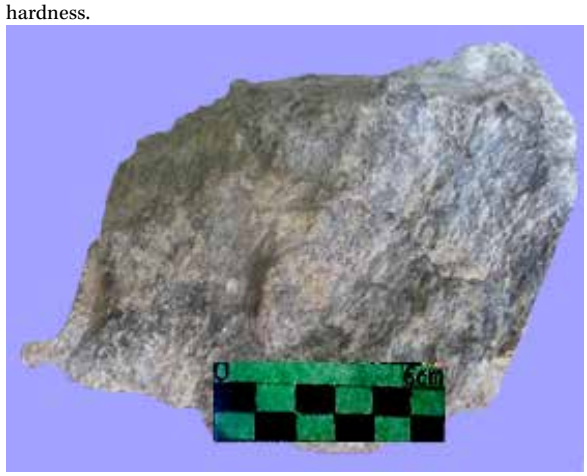


Figure No. 3: Hand specimen showing magnesite having thin film of dark grey colour talc on its surface.

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Microscopic characters: A very interesting relationship between talc and magnesite, talc-dolostone association, talc-dolostone-chert contact and contact of phosphorite and dolostone could be seen under microscope. Sporadic development of talc is also seen as criss-cross vein in the magnesite, dolsparite and phosphorite groundmass. In all these cases it shows a fibrous habit, the fibres being interleaved with chalcedony fibres both of which show mostly length slow character. The orientation of the talc fibres are generally at right angles to the vein wall but rarely it is parallel to it. In many cases talc particularly in magnesite body shows granular appearance consisting of an aggregate of extremely minute grains of micritic size with a high birefringence. Very interesting point to note that abundant relicts of magnesite crystals having all usual optical characters are very well seen in the talc groundmass showing all stages of corrosion and replacement. Presence of scattered grains of dahlite is well observed in the talc but relicts of quartz are occasionally seen in the talc. Another interesting feature to note that presence of somewhat elongated quartz grains in the coarse corroded magnesite spars with the intervening space being filled with fibrous talc. In some cases subhedral to euhedral minute opaque pyrite grains are found to occur in talc but they are generally limonitized. A very significant point to note that talc corrodes and replaces all other minerals like magnesite, dolsparite-dolspar, chert, chalcedony, etc. but it has been never been corroded by any constituent present testifying clearly to its later origin.



Figure No. 4: Contact of two magnesite grains having development of small talcose material (multicoloured) and relicts of silica (black-white). Talc and silica shows antipathic relationship. Talc forms as a result of reaction between magnesite and silica (C.N.).



Figure No. 5: The photomicrograph showing rhomb of magnesite corroded and surrounded by talc which makes it a relict and indicates apparently diagenetic replacement of magnesite by fine-grained talc (C.N.).

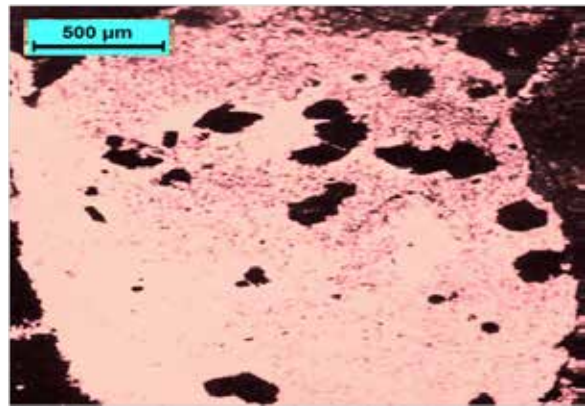


Figure No. 6: A big nodule of finely crystalline talc apparently of later origin and containing corroded relicts of magnesite and dahlite (C.N.).



Figure No. 7: Faint development of chert laminae in the talcose groundmass which are interpreted as relicts showing chert as precursor of talc (C.N.).

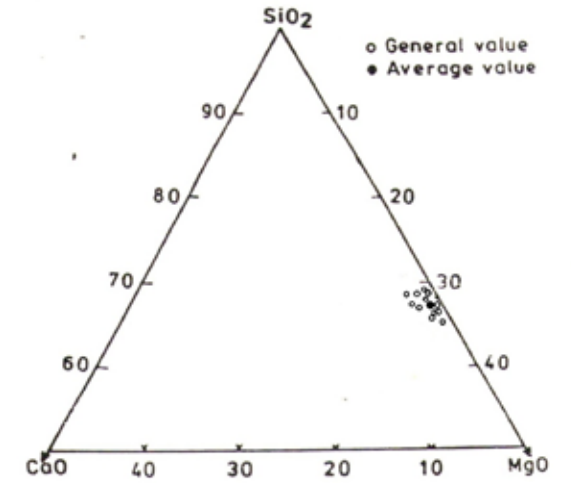
GEOCHEMICAL ANALYSIS

In the investigated area major oxide analysis of 15 samples were done of which ranges are given below, Table No. 1:

S. No.	Major oxides	Wt(%)
1	SiO_2	37.9-60.03
2	TiO_2	0.08-0.13
3	Al_2O_3	1.11-7.76
4	Fe_2O_3	0.15-0.18
5	FeO	1.19-1.73
6	MnO	0.05-0.65
7	CaO	1.61-2.41
8	MgO	28.2-36.1
9	Na_2O	0.01-0.13
10	K_2O	0.01-0.06
11	P_2O_5	0.01-0.29
12	Loss on ignition	4.5-14.1

The above table shows that SiO_2 and MgO are the major constituents. Little amount of alumina and iron oxides are mainly due to presence of minor amount of chlorite and pyrite etc. The above table shows the talc of the investigated area is non-ferrous magnesian variety which is corroborated by petrographic studies.

Figure No. 8: Triangular plot of SiO_2, CaO and MgO (wt%) for



Chandaak talc.

The triangular plot of SiO_2, CaO and MgO (wt%) for Chandaak talc shows that high contents of SiO_2, MgO and relatively very low percentage of CaO indicate more or less absence of calcite in this talc deposit.

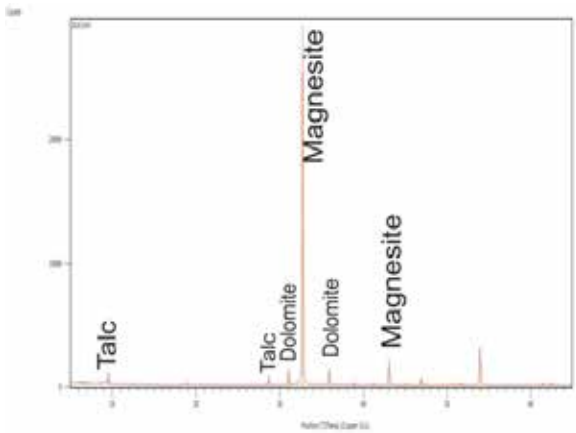


Figure No. 9: XRD analysis of talc bearing carbonate rock.

The XRD also confirms the presence of mainly magnesite, talc, quartz and dolomite.

SUMMARY AND CONCLUSION

The talc of the investigated area is intimately associated mainly with magnesite and also to some extent with dolomite, phosphorite, chert etc. Further talc in the investigated area occurs in the interstitial spaces of crystalline magnesite also as pockets and patches corroding the magnesite lying in contact. Calcite, chlorite, tremolite etc. are rarely present but chalcedony, dahlite and very little pyrite are sometimes present in intimate association with talc. Owing to the above observation it can be concluded that the talc is neither hydrothermal in origin nor produced by stress acting on the carbonate rocks. Finally it can be inferred that the talc of the present area is of two generations. In first generation it is formed in the intergranular margins of magnesite, developed contemporaneously with magnesite and in the second generation it occurs in form of veins and cleavage filling in the magnesite but all are formed in the diagenetic stage. On the basis of all observations- field study, megascopic and microscopic studies, XRD, geochemical analysis(major oxides) and also the observation of antipathic relation between silica and talc it is evident that talc is a product of diagenetic sedimentary environment formed at a temperature less than 300°C.

ECONOMIC POTENTIALITIES

In the present investigated area talc is generally found to occur as small pockets and patches in the magnesite body but it is not enough deposit for commercial exploitation. It is also containing good amount of impurities which hampers its uses in industrial scale because the quality and quantity both are very much essential for industrial uses.

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