CHAPTER VII

S T R A T I G R A P H Y

GENERAL

The present study has enabled the author to put forth a revised stratigraphy of the area. Based on a re-interpretation of the structure, he has been able to postulate some new concepts which are at a considerable variance with the existing ideas about the Chaukhutia region in particular and about the stratigraphic positions of the various members of the whole argillo-calcareous belt extending along the northern limit of the Almora Crystalline Thrust sheet in general.

As the author has already made out, the so called North Almora Thrust of the various previous workers, does not mark the tectonic boundary between the Krol Nappe metasedimentaries and the Almora Nappe. It is evident that the dislocation (Khastari Fault) though quite prominent and of regional extension, is not the south dipping flank of the Almora Thrust. All evidences point to the fact that the actual south-west dipping Almora Thrust (real North Almora Thrust) is pushed below the slates and quartzites of the Chaukhutia-Manwa Devi Group. The throw has been so considerable that the gneisses are seen in direct contact with the Krol Nappe rocks along the reverse fault. These gneisses show shearing due to the Almora thrust, in their present state are such that they have been wrongly designated as 'porphyries' by Heim and Gansser (1939). The author has worked out the following succession of the rocks that lie to the north-east of the Khastari Fault:

Quartzites with subgraywackes

Chlorite schist (Spilites etc.)

----------Unconformity----------

Dolomitic limestones

Slates and quartzites

STRATIGRAPHY OF THE CHAUKHUTIA-MANWA DEVI GROUP

The stratigraphy of the whole calc-zone to which the rocks of the Chaukhutia area belong, is rather uncertain and intriguing. Previous workers who have investigated this calc-zone to the NW and SE of Chaukhutia have put forth conflicting views regarding the succession and age of these rocks. Valdiya (1962) who investigated the Calc-Zone of Pithoragarh to the SE postulated that the entire sedimentary zone is inverted. According to him, the thick zone or sequence of quartzite (Berinag quartzites) that comes over the dolomitic limestone is older while the slate-quartzite formation below the calcareous and magnesitic horizon is younger. He suggested this inversion mainly on the basis of the attitude of stromatolites found in calc zone, and on cross beddings and ripple marks of the Berinag quartzites. Gansser (1964, p. 95) has however doubted this fact, and has written that "while some sections are undoubtly inverted I would not follow Valdiya in applying this concept to the whole sedimentary sections in the inner zone in the lower Kumaon Himalaya".

Mehdi *et al*. (1972) have also doubted the postulated inversion, and they have considered the

sequence to be normal and uninverted, such that the arenaceous horizon above the dolomitic limestones (Berinag quartzites of Valdiya, 1962; Khaira quartzites of West, 1939 and Gamri quartzites of Auden, 1934) is younger in age.

The present author too tends to agree with the opinion that the sequence is uninverted. He has critically studied the attitudes of the stromatolites and current bedding wherever possible, and has observed that there is no large scale inversion. If at all at some places the stromatolites are seen upside down, this is due to local overturned folds only. In the neighbouring areas of Dwarahat and Someshwar, Misra (1971) and Munshi (1971) have also arrived at similar conclusions.

An important fact observed by the present author is the unconformity along the contact of the limestones and the overlying chlorite schist. As will be seen from the map, the chloritic horizon is lensoid and pinches out in the northwest, while it increases in thickness to the SE. Further towards Dwarahat and Someshwar, a horizon of slates and quartzites is seen intervening between the limestone and the chlorite

schist. These chloritic rocks have been found to be cleaved spilitic lava flows and tuffs, and typically represent the geosynclinal volcanism preceding the deposition of the overlying sedimentary sequence. Similar contacts elsewhere have been taken by a few workers (Valdiya, 1973 and Fuchs, 1967) to be a thrust, but the author so far as his study area is concerned is not inclined to take this as a thrust contact.

According to the author, the Chaukhutia-Manwa Devi Group, comprises two depositional sequences - the lower one consisting of slates-quartzites and dolomites overlain unconformably by chlorite schists and quartzites including subgraywackes.

AGE AND CORRELATION

The metasedimentary sequence to the east and north of the North Almora Thrust, has been assigned varying stratigraphic ages in the past. Earlier workers have put forward different views regarding the age and stratigraphic positions of these Krol Nappe rocks. Auden (1937), considered the limestone of Dwarahat area (southern extension of the dolomitic limestone of the study area)

to be equivalent to the Deoban limestone of Chakrata. The Deobans have been found to be 'Pre-Blaini' and perhaps a part of the Jaunsar Series (Late Precambrian to Early Palaeozoic) by Pilgrim and West (1928). Heim and Gansser (1939, p.220) though not sure regarding the stratigraphic position of these rocks assigned with some uncertainty a much younger age to the calc-zone, being probably equivalent to the Krol Series. According to them "if it (the limestone series) is Krol, the large overlying quartzites must be Tal".

Gansser (1964, p.94) however has correlated these calcareous rocks of Kumaon with Kakarhati limestone (Auden, 1937) of the Simla Slates and with the Shali Limestone (West, 1939) of the Shali Window.

Das (1966), following Heim and Gansser, has considered the limestone of Chaukhutia-Dwarahat to be Krol rocks of Permocarboniferous age, but according to Misra and Valdiya (1961, p.86) "the limestone-slates series of Pithoragarh does not resemble and cannot be correlated with the Krol Series. The lithology and sequence of rocks are at considerable variance with those of the type area of Krols. The lithology of

the Pithoragarh calcareous zone has many things in common with that of the Deoban limestone of the Chakrata area. This formation is regarded as equivalent to the Kakar/hatti and Naldera limestone of the Simla Slates". The two authors found that this similarity was not only in regard to the lithology, but also in respect of the presence of stromatolites, which were referred to by Pilgrim and West (1928) as pseudo-organic structures. Misra and Valdiya (op. cit.) have compared the Berinag quartzite of Pithoragarh with the Jaunsar (Nagthat) Series. According to Pilgrim and West (1928, p. 44), "The Deoban limestone is intermediate in age between the Blaini and Jaunsars".

The stratigraphic position of the Deoban limestone is rather uncertain. They are certainly Pre-Blaini, but whether the Nagthat quartzites are older or younger to Deoban limestones is not very clear. Valdiya (1962) has put his Berinag quartzites of Kumaon equivalent to Nagthat and older than the Deobans. Pilgrim and West (1928, p.44) have found Deoban overlying a series of quartzites which cannot be anything but Jaunsars. However, on a perusal of the stratigraphic section of Simla-Krol belt prepared by Gansser (1964, p.86) on the basis of

Auden (1934) and West (1939), it is seen that the Deoban has been included within the Jaunsars, above Chandpur and below Nagthat.

So far as the stratigraphic age of the Deoban is concerned, it has been generally taken to be of Precambrian to Ordovician age by most workers (Auden, 1934, Gansser,1964, Misra and Valdiya, 1961, Mehdi et al., 1972). The dolomitic limestones with associated slates of the study area, could be considered as broadly equivalent to the Deoban and together with the underlying slates and quartzites, might comprise a part of the Jaunsar. The rocks above the unconformity viz spilite-quartzite association, could then be considered equivalent to Nagthat. In fact all previous workers have taken them to be so.

Accordingly, the entire sequence of the study area, east of the Khastari Fault, and comprising the eastern limb of the main anticlinal structure, could be assigned a Precambrian to Ordovician age.

In this connection, the author would like to make a special mention of the fact, that so far as the rocks above the unconformity, are concerned, there is a strong possibility of their being of a much younger age.

Recently O.K. Shah (1974) and C.P. Shah (1973), who have worked in the Bhowali-Bhimtal and Garampani area of Nainital district, have reported that

(i) The trappean rocks of Bhimtal comprise an assemblage of diabase, basalts, tuffs and tuffites - all of spilitic affinity.

(ii) The quartzites that overlie the spilitic trap, contain numerous slaty tuffaceous layers and also a few spilitic lava flow. Also the overlying Infra Krol slates are tuffaceous.

(iii) There is no unconformity between the Infra Krols and the 'so called' Nagthat quartzites.

(iv) The quartzites that overlie the trap are not Nagthat but are of Blaini age, and the entire sequence from spilite upward upto Krol limestones comprises an unbroken depositional sequence.

The author has strong reasons to correlate the spilites of Chaukhutia area with those of Bhowali-Bhimtal-Ramgarh. If this correlation is valid then, the chlorite schists (spilites) assume a much younger age. They could be Infra Blaini alright, but the overlying quartzites and

subgraywackes will have to be taken as equivalent to Blaini. The whole sequence starting with spilites (chlorite schists) thus could be assigned a Lower Carboniferous to Permocarboniferous age, comprising lower part of Krol Group (Bhattacharya and Niyogi, 1971).

The author has therefore to suggest following alternative stratigraphic ages for the rocks of the study area.

Karchuli Group	Schists, sheared gneisses and quartzites	Precambrian
----------Almora Thrust----------		(concealed)
Chaukhutia-Manwa Devi Group	Quartzites Chlorite schists (spilites etc.)	? Lower part of Krol Group (Lower Carboniferous-Permocarboniferous
	----Unconformity----	
	Dolomitic limestone Slates and quartzites	Deoban