CHAPTER VIII

SUMMARY AND CONCLUSIONS

OUTLINE OF THE GEOLOGICAL HISTORY:

In the preceding chapters, the author has given a detailed account of the stratigraphy, metamorphism and structure of the Majkhali area, and has established a sequence of metamorphic and structural events. The study ideally reveals that the area though limited in extent, has preserved in its rocks, a faithful record of almost all the important orogenic events that affected this part of the Himalayan Geosyncline. It is further seen that a close relationship existed between the

various structural and metamorphic episodes that affected the area. Before concluding, the author wishes to bring out therefore, the salient points of the geological history of the area, as brought out by the present study.

The rocks of the area are found to have undergone changes during a number of metamorphic episodes. After the deposition - sandstone-shale sequences, these underwent some load metamorphism on account of the weight of the overlying sediments in a sinking geosynclinal basin. The only evidence of this early metamorphism is at present seen in the form of ill preserved bedding schistosity (S). Perhaps during this stage, the metamorphosed sediments that sank deeper got granitised also.

With the first main orogenic upheaval, the metasediments were subjected to severe deformational stresses resulting into a series of recumbent isoclinal folds. During this episode, the existing metamorphic characters for the most part were impressed on the rocks (and the mineral assemblages characteristic of pelites,

semipelites, psammites belonging to "almandine" zone of Barrow came into existence). The principal foliation - the main schistosity, was the result of this progressive regional metamorphism that accompanied the isoclinal folding and marked the axial plane direction of the folds. The folding seems to have continued for a considerable time and synchronised with the main period of migmatisation. Transformation of schists into gneissic rocks, proceeded mostly along the axial plane schistosity.

The continued activity of the deformational stresses, ultimately culminated into the Almora Thrust. In the Majkhali area, a number of shear planes,parallel to the main dislocation developed during this thrusting, and along narrow zones of slipping, phyllonitic rocks with retrograde mineral assemblages are seen to have formed. This phase of retrogressive metamorphism which immediately followed the 'progressive' phase obviously crushed and granulated the rocks, and brought down the metamorphic grade of the rocks, along these planes of shearing.

During the next upheaval, the area was affected by another folding during which the Almora Nappe was

synformally folded (F_2). In the Majkhali area, during this deformation, the main axial plane schistosity (S_1) was crinkled and microfolded, giving rise to a strain-slip cleavage (S_2) at many places. The effects of this folding are very well preserved in the central portion of the area. Metamorphic changes that accompanied this folding consist of

(i) bending and breaking up of earlier mica flakes and their subsequent recrystallisation

(ii) granulation of quartz grains and their recrystallisation

(iii) formation of a new (static) garnet and

(iv) the development of biotite porphyroblasts almost parallel to the axial plane of the microfolds and crinkles.

The next conspicuous event is characterised by a N-S folding (F_3) giving rise to open flexures on various scales. This folding is responsible for the swing of the foliation of the rocks from WNW-ESE in the western part to EW and NE-SW in the eastern extremity of the area, giving rise to a late open synformal

structure. It is this folding that has caused the variation in amount and direction of the lineations L_1 and L_2.

The last deformational event is that of a large scale faulting, and which in the Majkhali area, is represented by a number of N-S faults.

MIGMATISATION:

The gneissic rocks in the area have been recognised as migmatised derivatives of pelitic and semipelitic schists. The various evidences point out that the migmatisation preceded, synchronised with, and outlasted the main deformational events (F_1 and F_2). The earliest phase of migmatisation was initiated before the early folding set in, and was confined to the deeper parts of the geosynclinal basin. This migmatisation broadly coincided with the load metamorphism of the geosynclinal sediments. The bulk of synkinematic migmatisation synchronised with the main orogenic upheaval (F_1 and F_2). it is seen that the dominant emanations were soda rich. During the late kinematic phase, potash appears to have dominated over the soda, and large scale replacement of

plagioclase by microcline is recorded.

CONCLUDING REMARKS:

The present study forms more or less a continuation of the work done by Vashi (1966) in the neighbouring area of Ranikhet-Pilkholi, to the SW.

Though the results of the author's investigations, in a broad way, agree with the findings of Vashi (1966), in some respects, the present study has revealed a number of facts which the rocks of the Ranikhet area do not furnish. The rocks of the Ranikhet area point out to the possibility that the main schistosity (S_1) developed directly by the deformation and metamorphism of the geosynclinal sediments (? unmetamorphosed) during the isoclinal folding (F_1). But the author has found that prior to the development of this axial plane schistosity (S_1), the rocks were already having an early bedding schistosity (S), perhaps due to the load. The S_1 did not develop directly, but is seen to be due to tight folding of a pre-existing metamorphic foliation (S).

In Ranikhet area, various criteria point to the fact that, the migmatisation started during the first (isoclinal) folding F_1, but the author has evidences to suggest that some migmatisation had already taken place before the folding (F_1) set in.

It could however, be concluded that the investigations in the Majkhali area, when considered along with those of Vashi in the Ranikhet, furnish valuable details about the structural and metamorphic evolution of this part of Kumaon.

The present study clearly shows that a close relationship existed between the deformation, regional metamorphism and migmatisation and the three formed an inter-related sequence of the orogenic events, associated ultimately with the obscure processes operating at geosynclinal depths.
