

GEOLOGY OF THE DANIYA AREA, DISTRICT ALMORA, U.P.

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The 'Crystalline Zone of Almora' in the Daniya area, district Almora, U.P., is lithostratigraphically subdivided into two formations; from older to younger they are—Sarju Formation and Duram Formation. The Sarju Formation is further subdivided into three lithostratigraphic members in the ascending order, viz., Naichun Porphyry Member, Naini Gneiss Member, and Daniya Schist Member. The Naichun Porphyry Member is represented by felspar porphyries and schists, Naini Gneiss Member by migmatites and biotite schists, etc., and Daniya Schist Member by garnetiferous biotite schists, quartzites and graphitoid schists. The Duram Formation is composed of quartzites.

The North Almora Thrust separates the Crystalline Zone of Almora from the sedimentaries of the Zone of Badoliser. The entire Crystalline Zone is in the form of a huge syncline with an axial trace running ESE-WNW. The presence of Duram quartzites in the southern limb of the syncline below the Daniya Schists is due to a reverse fault. The area is marked by a number of folds and faults.

INTRODUCTION

The Daniya area lies about 40 km ENE of Almora, U.P., and is bounded by long. $80^{\circ}0'-79^{\circ}45'$ and lat. $29^{\circ}45'-29^{\circ}30'$. It falls in the central sector of Lesser Himalaya and forms eastern part of the Almora District. Mapping was done by traversing with the help of a brunton compass during 1965–1967. In all about 250 sq. km. of the area has been mapped. It is covered by the Survey of India top-sheet 53 0/14.

Heim and Gansser (1939) were the first to give an outline of the structure of the area. Misra and Kumar (1965) established the lithostratigraphy of the area.

GEOLOGY

The rocks of the Daniya area (Fig. 1) belong to the Crystalline Zone of Almora of Heim and Gansser (1939). The name Crystalline Zone of Almora was proposed by them to include a great thickness of metamorphic and associated intrusives in the Almora region to the west of the area under consideration. In the present area, the Crystalline Zone of Almora is divisible into two distinct lithologic units: (i) Sarju Formation of Valdiya (1963) of Lohaghat area (Table II). represented by the porphyries, migmatites, schists and micaceous quartzites, (ii) Duram Formation represented by quartzites (Table I).

The progressive metamorphism in the area increases upwards i.e., at the base of the crystallines the chlorite schists are exposed and garnetiferous biotite schists are exposed in the core of the Daniya syncline.

Sarju Formation

The Sarju Formation has been subdivided into three members. All the members show gradational contacts. From oldest to youngest they are as follows :

Naichun Porphyry Member : This member represented by felspar porphyries, chlorite schists and migmatites has been named after the village Naichun, situated

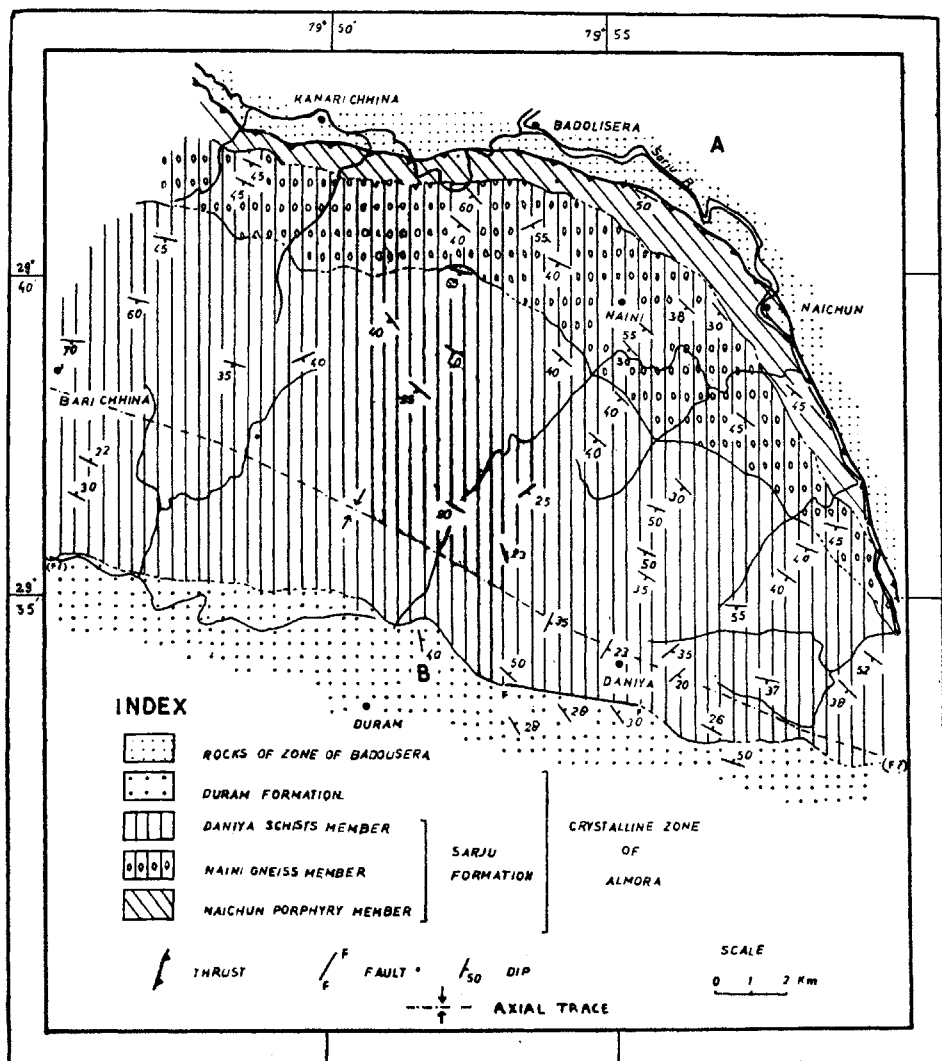


FIG. 1. Geological map of Daniya area, District Almora, U.P.
(After R. C. Misra and S. Kumar)

on these rocks. The felspar porphyry is dark greenish black in colour and shows specks of feldspars and quartz. The chlorite schists grade into the porphyries.

TABLE I

Crystalline Zone of Almora	Duram Formation	Duram Quartzites
	Sarju Formation	{ Daniya Schist Member { Naini Gneiss Member { Naichun Porphyry Member
.....North Almora Thrust.....		
Sedimentary Rocks of the Zone of Badolisera.		

The porphyries generally follow the thrust plane and they have nowhere intruded the rocks of the Zone of Badolisera suggesting that the intrusion of these rocks is either penecontemporaneous with the thrusting or older than the thrusting. The member runs parallel to the Sarju river from Bhainsia-Chhana in the north to Chimkholi in the south. It is well exposed in the valley of Jaingun river.

Naini Gneiss Member : Named after the village Naini on the Jageshwar-Gangolihat bridle path, this member is represented by gneisses and migmatites interbedded with chlorite schists and muscovite schists. The rocks running east-west

TABLE II

Present area	Lohaghat area (Valdiya 1963)	
Long. 79°-45' to 80°0'	Long. 80°0' to 80°20'	Lat. 29°15' to 29°32'
Lat. 29°-45' to 29°30'		
Sarju Formation	Sarju Formation	Gorakhnath Formation
	Porphyroblastic augen-gneisses	Augen gneisses with micaceous quartzites laminae
<i>Daniya Schist Member</i> Garnetiferous micaschist and micaceous quartzites	Garnetiferous mica schist and subordinate micaceous quartzite	Garnetiferous mica schist and micaceous quartzite
<i>Naini Gneiss Member</i> Migmatites, biotite schist and chlorite schist	Biotite, chlorite, sericite schist and phyllites	Porphyry rocks of Goraphor interbedded with paragneisses
<i>Naichun Porphyry Member</i> Felspar porphyry with chlorite schist and subordinate paragneisses	Felspar porphyry and paragneisses of Sarju Valley	Biotite chlorite sericite schist
.....N. Almora Th.....	Sarju Th.....	Ladhiya Th.....
Rocks of Zone of Badolisera	Protoquartzites and slates of Calc Zone of Pithoragarh	Ladhiya Formation

overlie the Naichun porphyries. Between Bunga in the west and Naini in the east, they occupy a 1.5 to 2.8 km wide belt. At Naini the outcrop takes a turn and runs SSE-NNW upto Askona village, on the slopes of the Sarju valley.

The gneisses are marked by prominent development of lathshaped porphyroblasts of feldspars. The porphyroblasts are generally aligned in one direction. The gneisses show gradational contacts with the schists.

The upper part of this member is marked by basic intrusives in the form of hornblende schists. However, large masses of amphibolite are exposed on the eastern slopes of the Sarju river, in the east and west of Harara on the Naini-Gangolihat mule path. In between the two amphibolite bands there is a thick band of muscovite quartzite. South of Pabhya Chalk overlooking the Jaingun river in the north a thick horizon of quartzites is seen. It continues upto Naini and Harara. In the same continuation the exposures can again be seen on the forest bridle path one km NE of Pania, south of the Alaknanda river. The chlorite schists and migmatites grade upwards into muscovite and biotite schists.

Daniya Schist Member : This member has been named after the important bus station of Daniya on the Almora-Pithoragarh motor road on both sides of which the rocks of this member are well exposed. Muscovite and biotite schists are occasionally garnetiferous. White to dark grey, fine to medium grained quartzites, graphitoid schists and gneisses constitute the important rock types. At a few places the garnetiferous biotite schists show the presence of quartz veins containing tourmaline crystals in great abundance.

The quartzites are massive and show pronounced jointing. The other important rock, the graphitoid schist, is friable and soft. Heim and Gansser (1939) have observed that the carbonaceous beds within the extensive series of mica schists seem to be useful as a mapping horizon. But the carbonaceous beds are apparently lenticular and cannot be traced laterally for long distances. Commonly the beds are sheared to confused masses. Excellent outcrops of the rocks can be seen about one km towards Dhiary from Daniya on the Almora-Pithoragarh road, 3/4 km from Bari-Chhina on the mule path towards Dhaul Chhina and at south of Gunial. At Gunial the rocks become arenaceous. Sulphur encrustations are commonly seen in the rocks.

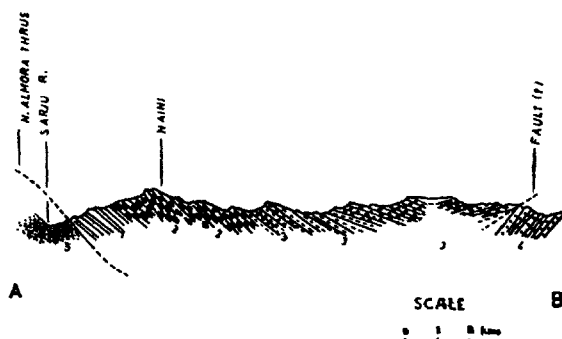


FIG. 2. Geological section along A-B : 1, Naichun Porphyry Member; 2, Naini Gneiss Member; 3, Daniya Schist Member; 4, Duram Quartzites; 5. Rocks of the Zone of Badolisera

The rocks of this member occupy the largest area under study and their outcrops strike EW from Bari-Chhina to Daniya and after this changing to ESE-WNW trend towards the eastern extremity of the area. They occupy a five to six km wide belt. The exposures of this member are seen on the Almora-Pithoragarh motor road for a distance of about 40 km from Bari-Chhina upto Dhaul-Kachna.

Duram Formation

This formation constitutes the younger formation of the Crystalline Zone. Named after the village Duram around which this formation is well exposed, it is represented exclusively by micaceous quartzites. The northern limit of the formation is marked by a low angle thrust fault which has brought these quartzites below the Daniya schists. The rocks form a belt passing through the villages of Duram, Kanda, Dhiari and extend eastward.

Medium to fine grained, grey to light greenish grey quartzites occur interbedded with subordinate pink bands. They are thickly bedded as well as thinly laminated. Fine grained white quartzites are commonly interbedded with medium grained light brown quartzites. At a few places, the bands are made up of stretched lenses and pods. Thick veins of crystalline calcite show pigmatic type of folding. There is pronounced development of current bedding but ripple marks are very rare. South of Kujeli, however, there is a good development of asymmetrical ripple marks with ripple index at 3.6 suggesting shallow water conditions of deposition.

STRUCTURE

The Crystalline Zone of Almora is separated from the meta-sedimentaries of the Zone of Badolisera by the North Almora Thrust. The Crystalline Zone is the prolongation of the Garhwal Nappe and the sedimentaries of the Krol Nappe.

An asymmetrical syncline at Bari Chhina described by Heim and Gansser (1939), is marked by high dips in the northern limb ranging in amount from 45° to 60° and in the southern limb from 20° to 30° . It extends further eastward upto the eastern extremity of the area (Fig 1). This syncline which is about 24 km long has been named Daniya syncline (Misra and Kumar 1965) after the village Daniya. The syncline plunges eastward and the hinge is marked by the prominent ridge extending from Gurara Banjh to Ati. Between these two villages, the Almora-Pithoragarh motor road follows this hinge. Along the hinge the dips are generally low ranging from 10° to 20° towards east. At Daniya, the asymmetrical nature of this fold is less marked. The dip in the northern limb ranges from 35° to 45° and in the southern limb from 25° to 35° .

The schistosity is parallel to the bedding plane over most of the area occupied by the crystalline but transects the bedding in the axial trace of the syncline.

The entire sequence of the Naichun porphyries and Naini gneisses form the northern limb, while the rocks of the Daniya schists are present in the central part of the syncline.

In the southeast at Lohaghat, Validya (1963) has named a big syncline as Lohaghat Syncline. It is apparent that the entire crystalline zone of Almora from

Almora to Lohaghat is in the form of a one big gigantic syncline with an axial trace running ESE-WNW.

The most puzzling problem regarding the Daniya Syncline is that in the southern limb, a new formation consisting of purely arenaceous, fine grained massive quartzites (Duram Formation) is exposed in place of Naini gneisses. The Duram Formation's position below the Daniya schists may be due to a reverse fault. Following are the additional points regarding the presumption of the reverse fault : The contact of quartzites with the biotite schists is always abrupt. The schists dip approximately NE 25° and the dip of quartzites is NE 48° . The hill face is always weak and marked by fallen material and both schist and quartzite show flexure folding with more or less the same fold axes.

Another fault of about 3.5 km extension is seen south of Daniya between Duram Formation and Daniya schists. It runs S 80° E – N 80° W (Fig. 1) and passes through Daheli and Naini villages. The fault plane is vertical. Minor fold and faults are also present in the area.

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