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STRATIFICATION AND CROSS-STRATIFICATION IN THE LAYERED ANORTHOSITE OF CHIMALPAHAD, KHAMMAM DISTRICT, ANDHRA PRADESH, INDIA

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Abstract

The Chimalpahad layered anorthosite at the border zone of Archaean supracrustal rocks of Khammam and Eastern Ghats shows normal stratification predominantly in the form of rhythmic layering and sometimes in the form of zebra layering. Cross-stratification showing clear truncation by the top normal stratification from the layered anorthosite of Chimalpahad is one of the very few such occurrences reported from layered rocks of the world. The cross-stratification could have originated due to flow of magma current and fluctuation in its velocity across the floor of the magma chamber. The structure is useful as a way-up criterion.

Geological setting

The Chimalpahad anorthosite body in Khammam District occupies an area of 200 km^2 at the border zone of Archaean supracrustal belt of Khammam and the Eastern Ghat belt (Appavadhanulu *et al* 1976). The anorthosite body is surrounded by hornblende gneisses, pelitic schists and granite gneisses which are part of the supracrustal belt of Khammam. Minor outcrops of charnockite of Eastern Ghat affinity occur at the southeastern end of the anorthosite body around Himamnagar. The Chimalpahad anorthosite body has been described as a part of the Khammam supracrustal belt rather than as a part of the Eastern Ghat (Subba Raju, 1975; Ramamohana Rao and Shah, 1981), although a contrary view is currently prevalent. The macrostructure of the anorthosite body is inferred to be a plunging synform which is cross-folded on NW-SE axis (Bose *et al* 1984). Preliminary results of mapping in the area indicate that the northwestern limb of the synform is probably normal and that the southeastern limb is overturned.

Stratification and cross-stratification in anorthosite

The Chimalpahad anorthosite is a layered rock, the individual layers ranging in thickness from a fraction of centimetre to a fraction of a metre. The layering is primary magmatic and is represented by alternation of felsic with less felsic layers. The felsic layer is made up invariably of 95% plagioclase, the rest being mafic mineral, mostly hornblende.

During the course of mapping of the Chimalpahad anorthosite complex, an interesting structure was noticed in the anorthosite outcrop on the western flank of the hill located one km east-southeast of Chimalpahad village. The layered anorthosite shows cross-stratification (Fig. 1). There is no doubt about this cross-stratification being a primary feature as this does not resemble any type of deformed structure. The thickness of the individual cross-stratified layers is 2 cm which is the same as that of the normal stratification layers occurring above and below the cross-stratification. In the vertical face of the outcrop, cross-stratification has been truncated by normal stratification layers towards the top. If this igneous cross-stratification has the same significance as sedimentary cross-bedding, then the

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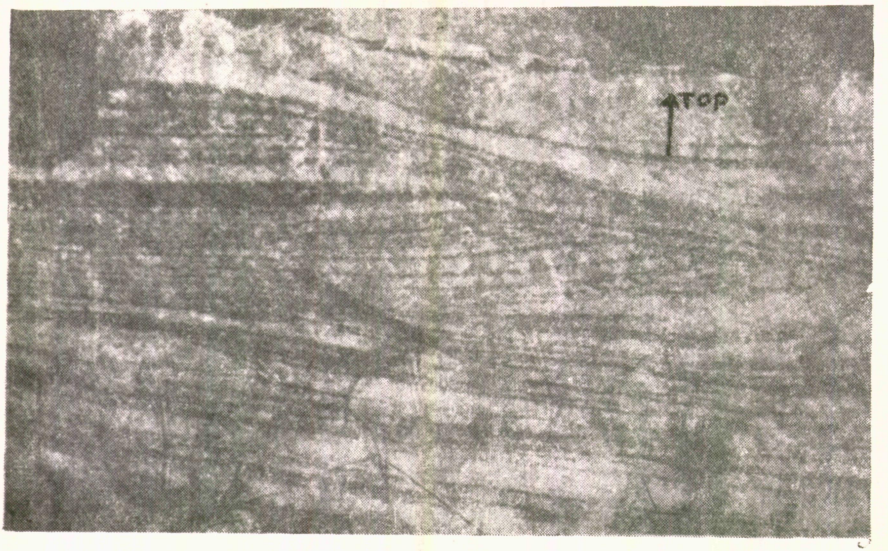

Figure 1. Layered anorthosite showing cross stratification 1 km east-southeast of Chimalpahad. The cross-stratification are truncated by the normal stratification on the top side of the layered anorthosite. The length of the pencil is 10 cm.

anorthosite body exposed on hill .492 metres is 'facing' up in the direction of 'younging'. It may be mentioned, that the above anorthosite outcrop is located on the northwestern limb of the major synformal structure and the preliminary field data indicate that this limb is normal and not overturned. The cross-stratification data corroborate the above inference. It appears, therefore, that the primary cross-stratification in the layered anorthosite has the same use as the graded (grain size variation) layering noticed in some layered rocks (Barton *et al* 1979) to infer the direction of 'younging'.

Discussion

Layered anorthosites are known from Archaean terranes but there are very few reports of the occurrence of cross-stratification in layered rocks. Apart from this occurrence at Chimalpahad anorthosite the two other examples of cross-stratification known are, one in the western part of Skaergaard layered intrusion (Wager, 1968) and the other in the southeastern part of Messina layered intrusion of Limpopo belt Barton, Jr. *et al* 1979). Both these are in ultramafic/mafic layered rocks.

In Skaergaard and Limpopo, cross-stratification and graded layering (grain size) also occur amidst normal stratification. Wager (1968) considered that convection current with or without other mechanism had operated in the Skaergaard layered rocks as evident from trough banding. Irvine (1980) has discussed the merits of magmatic density currents in explaining the cumulus process in layered rocks. The present authors are inclined to conclude that the cross-stratification in the Chimalpahad layered anorthosite had originated due to flow of magma current and fluctuation in its velocity across the floor of the chamber and the structure is useful as a 'way-up' criterion.

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