

COMMENT

Metamorphism of the Dalma mafic rocks

(A comment on the paper by D. S. Bhattacharyya and D. Dasgupta, published in the Journal of the Geological Society of India, Vol. 23, No. 2, pp. 90-98)

Bhattacharyya and Dasgupta's paper on the 'Metamorphism of the Dalma mafic rocks' has undoubtedly added much to our knowledge of the characteristics of this unique Proterozoic mafic-ultramafic band in eastern India. The authors have concluded from the distribution of mineralogical assemblages that the grade of metamorphism of this band increases from east to west, though in overlapping and overstepping stretches, from low greenschist to high amphibolite facies. It is intended in this communication to throw some light on the possible factor causing this regional variation from the study of metamorphism of the associated pelitic rocks, because, as suggested by structural and petrologic studies, the Dalma band was emplaced prior to any major structural deformation and metamorphism of the pelitic rocks.

Detailed textural and microstructural study of the pelitic rocks with respect to the deformation phases reveals three cycles of metamorphism, viz., M_1 , M_2 and M_3 , syn- to post-kinematic with reference to the F_1 , F_2 and F_3 deformations respectively. Of these, M_2 is not regionally developed, being reported only from the Sonapet valley. A compiled metamorphic map of the Singbhum orogenic belt shows that the M_1 isograds are disposed subparallel to the Dalma band and do not transgress it anywhere and that the Dalma band occurs within the lowest grade (greenschist facies) of this metamorphism everywhere. The M_3 isograds are superposed discordantly on the M_1 isograds and transgress the Dalma band in western Singbhum. Fig. 1 also shows that the highest grade of M_3 , viz., amphibolite-high amphibolite facies, occupies the central part of western Singbhum (Hesadi sector) with rocks of decreasing grades on either side. This fully agrees with the observation of Bhattacharyya and Dasgupta in the Dalma which shows the highest grade assemblages (viz., 10 and 11) in the central part of the Western and Hesadi sectors and assemblages of decreasing metamorphic grades both to the north and south. In eastern Singbhum, however, M_3 has not affected the Dalma and is developed far to the south. It is thus, seen that the spatial variation of metamorphism in the Dalma band is caused by the superposition of the M_3 metamorphism on the earlier M_1 metamorphism which is uniformly of low grade in the Dalma country.

In the Dalma metabasites, mesoscopic and microscopic diastrophic structures are much less developed than in the pelitic rocks. Neither do they show any porphyroblasts with good *si* fabrics. Hence, the observed assemblages can seldom be referred to the different deformation phases in the rocks, as is possible in pelitic rocks. Nevertheless, there are textural criteria which suggest polyphase characters of the metamorphism in western Singbhum. For example, in the schistose variety of the Dalma showing micropuckers, the neocrystallised hornblende often cross-cuts the schistosity (S_2), defined by actinolite, plagioclase, epidote and quartz. Obviously, this hornblende must be of later generation (i.e., M_3).

It is finally emphasised that the polyphase aspect of the metamorphism should not be overlooked while carrying out any metamorphic study of this band. Though Bhattacharyya and Dasgupta have stated that any single continuous cycle cannot explain the observed variation patterns, they have not elaborated this point; in

Table III and Fig. 5 of their paper, the mineral assemblages and P-T fields of M_1 and M_3 are not differentiated. There is, thus, a possibility of forming a wrong impression that the same metamorphism shows increasing grades from east to west.

Geol. Surv. India, Calcutta

A. N. SARKAR

AUTHORS' REPLY

1. It is agreed that a close comparison between the mineralogical assemblages in the metabasic rocks and those in the associated metapelitic rocks will be interesting and fruitful. This is beyond the scope of the paper. However, this does not disqualify us from drawing conclusions based on the mineral assemblages in the metabasic rocks.

2. The attempt by Sarkar to compare the status of metamorphism of the Dalma mafic rocks with those of the mica-schists and phyllites in the surrounding (not in the immediate vicinity) country rocks is a bit hazardous because the tectonic significance of the contact of the Dalma mafic rocks with the surrounding pelitic rocks may be quite complex, for example, if the contact be a shear zone involving substantial displacement and also if shearing is syn- or post-metamorphism, a straightforward correlation has to be avoided. In fact, this seems to be the case around Chandil, Sonapet Valley and many other spots. Besides we do not agree with Sarkar's comment 'the Dalma band occurs within the lowest grade (greenschist facies) of this metamorphism everywhere'.

3. We agree with Sarkar's contention that metapelites show polyphase character of metamorphism. In fact one of the authors (DSB) worked in detail on this aspect. Yet, the polyphase nature of metamorphism is not really well documented in the metamorphosed Dalma mafic rocks. The reason is not obvious and deserves further investigation. 'Neocrystallised hornblende often cross-cuts the schistosity' - has been cited by Sarkar as argument in favour of polyphase metamorphism. This is a very weak and inadequate feature for the purpose. It may be germane to point out that hornblende and actinolite may coexist in stable assemblages without implying superposed metamorphic phases.

*Indian Institute of Technology,
Kharagpur*

D. S. BHATTACHARYYA,
D. DASGUPTA