ABSTRACT

The Precambrian metamorphites occurring around Botlaguduru, Kanigiri taluk, Prakasan district, Andhra Pradesh, Southern India, are the subject of the present investigation. The area forms a part of the Nellare schist belt, the latter lying between the Cuddapah basin on the west and the Eastern Ghats belt on the east.

An area of 227 sq. km has been lithologically and structurally mapped on a scale of 1:51680 while a part of it (the central sector) has been structurally mapped in more detail on a scale of 1:15840. The metamorphites are represented by metasediments (including metapelites, quartzites, banded ferruginous quartzites, calc-silicate rocks and quartz-hornblende-biotite schists), numerous concordant bands of amphibolites, quartz-feldspathic gneisses, quartz-anthophyllite rock, meta-basaltic rocks and different vein rocks most of which were affected by multiple deformation and polymetamorphism.

The study of the structural elements reveal a complex tectonic history involving five phases of deformation of which the imprint of three phases ($D_1$, $D_2$ and $D_5$) is seen only on the mesoscopic scale while that of the other two ($D_3$ and $D_4$) is seen in the form of large macroscopic folds. The regional foliation ($S_1$) — axial planar to $F_1$ — is a dominant, pervasive planar element in the area while the development of other foliations, $S_2$ and $S_3$, was confined to narrow shear zones of the later folds ($F_3$ and $F_4$). Of the three regional folds established in the area, two (the Ayyavaripalle antiform in the eastern sector and the Kodikumpala-Meadu composite synform in the central sector) belong to the third deformational event while the macroscopic fold in the western sector
(the Vaggampalle overturned antiform) belong to the fourth phase of deformation. The former two were affected by \( F_4 \) resulting in mild curvatures to highly sinusus nature of the regional \( F_5 \) folds, the intensity of \( F_4 \) thus increasing from SE towards NW, reaching its climax in the formation of the Vaggampalle overturned antiform \( (F_4) \).

Laboratory investigations included petrographic study of about three hundred fifty thin sections of the different rock types, modal analyses of thin sections, \( U \)-stage study of most of the important minerals and the major element determination (chemical) for some of the rocks. The petrographic and mineralogic features of the rock types are described in detail. Based upon the field and the laboratory studies, the origin of the different rock types is discussed.

The metamorphic history of the area is established on the basis of the mineral parageneses of the rock types. It has been possible to demarcate the different Barrovian zones on the basis of the index minerals garnet, staurolite-kyanite and sillimanite from the metapelites. Metamorphism in the area took place under epidote-amphibolite and amphibolite facies conditions corresponding to Winklers (1974) low grade (upper part) and medium grade, respectively and conforming to Miyashiro's (1975) medium pressure basic type.

The time relations between the growth of the different mineral porphyroblasts and the deformational events are established based on some textural criteria. Five sets of metamorphic conditions (=stages)— \( M_1 \) to \( M_5 \)— are deciphered of which the most important were \( M_2 \) and \( M_3 \) (syn- and post-tectonic to \( D_1 \) deformation) during which most of the index
Minerals were formed. Metamorphism reached its climax during the $M_2$ stage. The main metamorphism was followed by a phase of retrogression marked by the chloritisation and muscovitisation of most of the minerals. Minor metamorphism—syn-tectonic to $D_3$ and $D_4$ deformations—was localised along the shear planes of some of the $F_3$ and $F_4$ folds.

The stratigraphic and geologic history of the area is established and an attempt is made to compare the present area as well as the Mellere schist belt with some adjacent Precambrian belts of Peninsular India.

The economic utility of some rocks and minerals of the area is discussed.