A B S T R A C T

The thesis embodies the results of detailed investigations of the Precambrian granitic rocks and associated metamorphites of Satpura Orogeny, occurring around Narganjo-Simultala-Lahabon (between Lat. 24°35' and 24°45'N ; Long. 86°30' and 86°40'E included in Survey of India toposheet no. 72 L/10 and 72 L/6) in parts of Monghyr, Santhal Parganas and Bhagalpur districts of Bihar, India with special reference to the mineralization.

An attempt has been made in the present work to outline the structural and petrological evolution of the metamorphites and gneisses, with imprints of deformation and metasomatic replacement leading to in-situ granitization and to correlate these studies with the mineralization of industrial non-metallic minerals like talc, graphite and vermiculite of the area.

The polymetamorphic sequence includes quartzites, mica schists, calc-silicates, ortho-amphibolites, migmatites and granite gneisses with pegmatites, aplites and quartz veins.

Detailed structural and geological maps of the area have been prepared on the scale of 2" : 1 mile (1 cm = 0.317 km). The regional strike of the foliation is NE-SW and the dip is

variable from 30° to 75° mainly towards NW. Non-diastrophic structures (except relict bedding) are not seen due to the intense shearing and granitization; where as, diastrophic structures are widespread throughout the terrain, which include planar and linear structures, faults and shear zones.

Diastrophic structures imprinted on the rocks indicate the presence of a series of buckled and flattened modified parallel or near similar folds of divergent trends and plunges. Structural analyses reveal a complex squeezing along NW-SE initiating overturned isoclinal plunging folds (F_1) with north-westerly dipping NE-SW axial planes (S_2) superposed with a probable time gap by plunging disharmonic folds of second generation (F_2) with sub-vertical axial planes (S_3) trending NNW-SSE. Conjugate folds and kink bands with kink planes (S_4) within mica schists striking NW-SE, intersect the crenulation cleavage (S_3) locally, ~~identifying a weak impulse of less pervasive deformation (F_3)~~. Kinking in feldspar porphyroclasts of mylonitic origin and the significant development of intrafolial folds in blasto-mylonite post date the F_2. ~~movements in relation to F_2~~.

Mylonitization while reflecting a tectonic slide, demarcates the wanning phase of F_2 deformation as indicated by the bending of garnet porphyroblasts of late F_1 origin and development of mylonitic lamination in the ~~comminuted~~ mylonite-gneisses with F_2 deformational structures. Pseudotachylyte

band commonly occur ~~as veins~~ within gneisses and schists. Microstructurally they consist of a dark fine grained matrix of quartz, albite-oligoclase and biotite, with a few isolated porphyroclasts of quartz, feldspar, sillimanite, zircon and almandine. The boundary with the surrounding gneisses and schists is sharp in the field but gradual transition was observed in thin sections. Biotite in the matrix has an extremely strong preferred orientation. Pseudotachylyte also demarcates the wanning phase of F_2 deformation with occasional overlapping of mylonitization and pseudotachylyte formation. The mylonites and pseudotachylytes indicate the presence of ENE-WSW trending shear zone which mainly controls the mineralization in this area.

The regional metamorphism (sillimanite-muscovite subfacies of almandine - amphibolite facies) was initially progressive in the sense, that the chlorite and the mica defining the axial plane schistosity (S_2) developed in the early stages of F_1 folding in contrast to the garnet porphyroblasts of later origin, with schistosity S_2 abutting against the mineral grains. Sillimanite is pre-kinematic in relation to F_2 and its appearence signifies a thermal peak of metamorphism which initiated a possible metatexis locally developing mobilized migmatites.

The regional granitization might have been chiefly responsible for effecting retrograde changes in rocks. The reversion of sillimanite to muscovite, diopside or augite to

amphibole, garnet or biotite to chlorite, preserved characteristically in the mylonites indicate an unequivocal link of retrogression with mylonitization.

Detailed petrographic study of the various rock types suggests a large scale modification of the pattern of regional metamorphism by migration and fixation of elements leading to in-situ granitization. The migmatites represent an intermediate stage of granitization of pre-existing metamorphites with relicts of resistant amphibolites remaining as unabsorbed paleosomes.

The study of geochemical variations based on modal variations, soda-potash analysis and chemical analysis of representative samples reveal, that granitization is chiefly due to alkali metasomatism (soda followed by potash).

Trace element analyses of metabasites (ortho-amphibolites), migmatites and gneisses point to a rise in the concentration of Ba, Pb and Li in the rocks with progressive granitization, in contrast to Mn, Ti, Ni, Cu and Cr which ~~record~~ underwend a decrease. Granitization had little or no effect on the distribution of Sr in the rocks of this ~~present~~ area.

Pegmatites and quartz veins show, that they owe their origin to metasomatic replacement and are indicators of granitization in phases.

The structural and lithological control of industrial minerals like graphite, talc and vermiculite of the area have been studied in detail. The graphite deposits are associated with sillimanite muscovite schist, vermiculite with the tremolite-actinolite schists and biotite gneiss and talc with sheared and migmatised contacts of tremolite-actinolite schist. The above deposits are mainly syn-to late-kinematic in relation to F_2 folds and are confined to the shear zone trending ENE-WSW. The detailed mineralogy and mineral paragenesis of the deposits have been studied with the help of X-ray diffraction patterns (XRD), Differential Thermal Analysis (DTA) and chemical analysis. The study may be helpful in order to evolve suitable benefication methods for their proper utilization in the different industries. The mode of occurrences and the origin of the above deposits have been briefly discussed.
