SUMMARY

From academic point of view Singhbhum Precambrian belt is one of the most attractive terrain in the Indian Precambrian shield. Structural, metamorphic and petrological studies were undertaken particularly with a view to a deeper understanding to the evolutionary history of the volcanic pile. This arcuate volcanic belt is developed along the spine of a Precambrian basin constituted by clastics, volcanioclastics and basic intrusives flanking the Singhbhum granitic platform. For a detailed study of the volcanic belt four separate sectors were chosen for the present investigation. In addition to these four sectors (Kunchia, Chandil, Khunti and Kunderkuti sectors) short field studies were also carried out in other parts of the volcanic belt (Sonapet valley, Hessadih and Bano areas) with a view to confirm the regional distribution of the volcanic members.

Field investigations reveal that the two broad litho-groups viz. the metasedimentary and the metavolcanic are closely associated and the former (comprising phyllites, mica schists and quartzites) occur to the north and south of linear outcrop of the volcanic belt. It is envisaged that a volcanic ridge might have separated the whole sedimentary basin into two parts on its either flanks.

Structural and petrographic studies suggest that both the broad lithologic groups have suffered a common deformational phase which resulted in east-west trending regional schistosity.
A pervasive low grade reconstitution within the rocks correspond to greenschist facies of metamorphism.

The compositional variation within the Dalma extrusives reflect a broad bimodality i.e., ultrabasic to basic types with a pyroclastic horizon in between. There is a strong correspondence between petrographic grouping and lithostratigraphy of the units - the ultrabasic being developed towards the base of the volcanic sequence and the basalts occupying the upper horizon of the lava pile. Present investigation encompasses petrology and geochemistry of the volcanics (ultrabasics, pyroclastics and basics). Detailed study of petrographic and mineralogical variations of the members in the suite constitute a major topic of the present investigation. Mineralogical study involves optical and chemical characters of the constituent minerals in the major rock members. Optical data at places are supplemented by X-ray study.

A good number of representative samples from different sectors and different lithounits have been analysed to study major element variation to identify the magma type and also to decipher the palaeotectonic setting of volcanism and thus of the whole metamorphic belt. In addition to the major element compositions, the trace elements (including rare earth elements) characteristics of the rocks and their chemical interrelations have been studied in detail to high light the petrogenetic
background of the assemblage.

Chemical studies reveal a large dominance of high magnesian volcanic members particularly towards the basal part of the sequence followed upward by a bulk of Mg rich, K poor basaltic flows (with wide pyroclastic horizon in between). Basaltic rocks, the youngest lava member, is dominantly tholeiitic in nature.

A general consistency of chemical characters of ultrabasic members with average composition comparable to common ultrabasic lava (i.e., picrite) attest to primary magmatic derivation of the rocks. This ultrabasic zone is overlain by the pyroclastics which reveals coarse fragmental components (volcanic clasts in agglomerates) which bear a close resemblance to ultrabasics whereas the matrix material is somewhat variable in character. A high magnesian stamp of the Dalma basalt with corresponding enrichment in Fe and depletion in K, Ti and P (compared to average 'all basalt') are the characteristic features. Such volcanic association of ultrabasic flows at the basal part followed upward by high magnesian basaltic lavas is characteristic of many greenstone belts of the world.

The compositions of Dalma basalts when projected on various discriminant diagram strongly suggest an oceanic environment though a feeble non-oceanic character can not be overlooked. The diagnostic trace element chemistry is closer
to, though not typical of MORB. The Dalma basalts reveal their enrichment in K, Rb and Ba relative to MORB but in respect of average basalts the Dalma basalts are distinctly depleted in these elements. But the REE distribution pattern in Dalma basalt, is comparable to East Pacific Rise basalts, pointing to their genetic relation with a spreading centre.

The significant compositional character of the Dalma basalts on discriminant diagram is transitional from MORB to IAT. The inferred transitional tectonic setting is often considered to be typical of spreading centre in a back arc situation. The tectonic setting for volcanism deciphered from geochemical studies is consistent with the evolutionary history of the whole metasedimentary belt of which the spine is defined by the Dalma volcanics. The combined data help to establish a Proterozoic marginal basin in this part of Indian shield.

Petrological and geochemical studies of the basalts and ultrabasic members further suggests advanced partial melting of the mantle source and the high thermal gradient required for such melting could be achieved possibly by crustal rift. The ultrabasic lava horizon marks the onset of rift tectonics accompanying moderate degree of mantle melting and the succeeding basic lavas having consequent depleted mantle controlled composition mark the spreading centre along the median zone of the marginal
basin. The coarse pyroclastics, at least in part reworked and developed along the lower part of the volcanic pile represent initiation of the development of mid-basinal furrow accommodating the pyroclastics.

So the Singhbhum Precambrian terrain is representing a fossil marginal basin, bounded to the north and northeast by Chotonagpur granulitic belt (site of an ancient volcanic arc) and is flanked to the south by an Archaean granitic platform. This may be recognised as the culminating phase in the course of early crustal evolution in this part of the Indian shield.
PANORAMIC VIEW OF AN AREA NEAR CHANDIL