Chapter - III

Petrography and Mineralogy

CHAPTER III :

3.1 INTRODUCTION : The geological setting of the Newara beach and laterites of the hinterland, along with the petrographical studies of the basalts, and mineralogical observations of the beach sands from the Newara is dealt with in this chapter.

3.2 GEOLOGY : Amongst the hard rocks of peninsular India, dark greenish black, homogenous looking basaltic traps occupy the most extensive western part of the Deccan Peninsula in the Maharashtra State. This Deccan trap basalt is a vast pile of volcanic lava flows of Creataceous-Eocene age, lying one over the other. These lava flows of Deccan trap have been classified into aa, pahoehoe, simple and compound types (Adyalkar 1984). The basaltic rocks are of tholeiitic type and they have a lateral spread over extensive area of the order of 500,000 sq.km. The studied area forms a part of this western part of the Peninsular India.

Basalts around Ratnagiri area have been studied by Mitchell and Cox (1988) from the point of petrography. According to them, these basalts belong to Ambenali formation. Kumar Sudesh and Rao (1982) noted well developed sheet joints in the basaltic hillocks at Bhanderpule, north of Newara.

In the investigated area, owing to the tropical and subtropical climatic conditions, these pre-exisiting rocks

i.e. tholeiitic basalts have been subjected to insitu lateritisation to form ferrugenous lateritic cappings. These coastal laterites have been investigated by Sahasrabudhe (1978) and classified into four main types based on their characters and petrography.

All the laterites in general, exhibit a porous, pitted, pisolithic and earthy appearance with redish yellow to brown colour. However, close examination in the field revealed wide variations in the colour, nature of their occurance and dispositions of different lithological units. Different varieties are recognised in the area on the basis of lithology as, 1. Vesicular Earthy Laterites : This variety mainly occurs at the top of the section throughout the area. It is prominently observed at Kalbadevi, Are, Kotwada, Newara, Bhanderpule, Ganapatipule, Varvada and Undi-Rill. It is characteristically vesicular in structure and much softer than other varities.

2. Pisolithic Laterites : The vesicular laterites are underlained by pisolithic laterites all over the area. At places especially near Malgund-Varvada, these are present at the top. It is brownish in colour.

3. Compact - Denser Laterites : This variety is present above the massive basalt and occur below the pisolithic laterites. They are mainly present around Newara.

4. Conglomeratic Laterites : The rock consists of subrounded to subangular pebbles. This variety is more

conspicuous near Jaigarh, north of Newara (plate 3.1).

Sahasrabudhe (1978) classified coastal laterites as i. Matured laterites, ii. Immatured laterites, iii. Re-worked laterites and iv. Induced laterites.

In the present area of study, the immature laterites are characteristically present. The immature laterite profile is developed at comparatively lower elevations. It consists of laterite duricrusts at the top and grade directly into weathered material without development of the lithomargic clays in between. This profile exhibits the relict texture of the parent rock. They are found near Newara, Ganapatipule and Varvada. The generalised sequence observed in the field for the laterite at Newara and Ganapatipule is depicted in fig.3.2 and the succession from the surface is given below

00.00 to 00.45 m : brownish vesicular hard laterite

00.45 to 02.25 m : pisolithic,conglomeratic laterite with subrounded pebbles.

02.25 to 04.25 m : slightly weathered lateritic deccan basalt.

Below 04.25 m : hard, massive deccan basalt.

This section is noticed at a distance of about 240 meters away from the beach.

The Quarternary sediments occuring as beach sands are found overlying the laterites of Pleistocene to Miocene age. These beach sands exhibit characteristics of marine

GEOLOGICAL MAP OF COASTAL TRACK AROUND THE NEWARA AREA, RATNAGIRI DIST., MAHARASHTRA

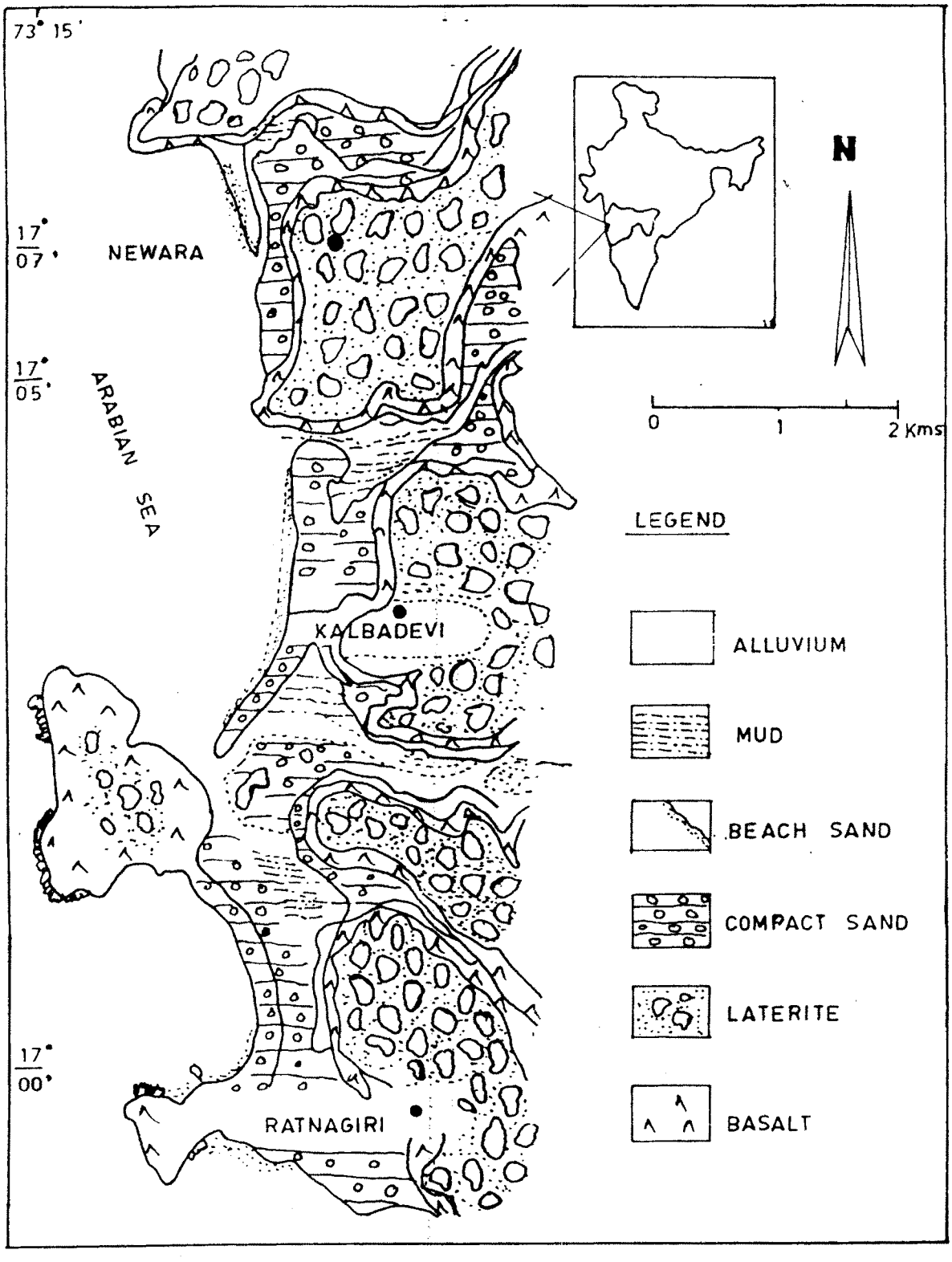

FIG. 3.1.

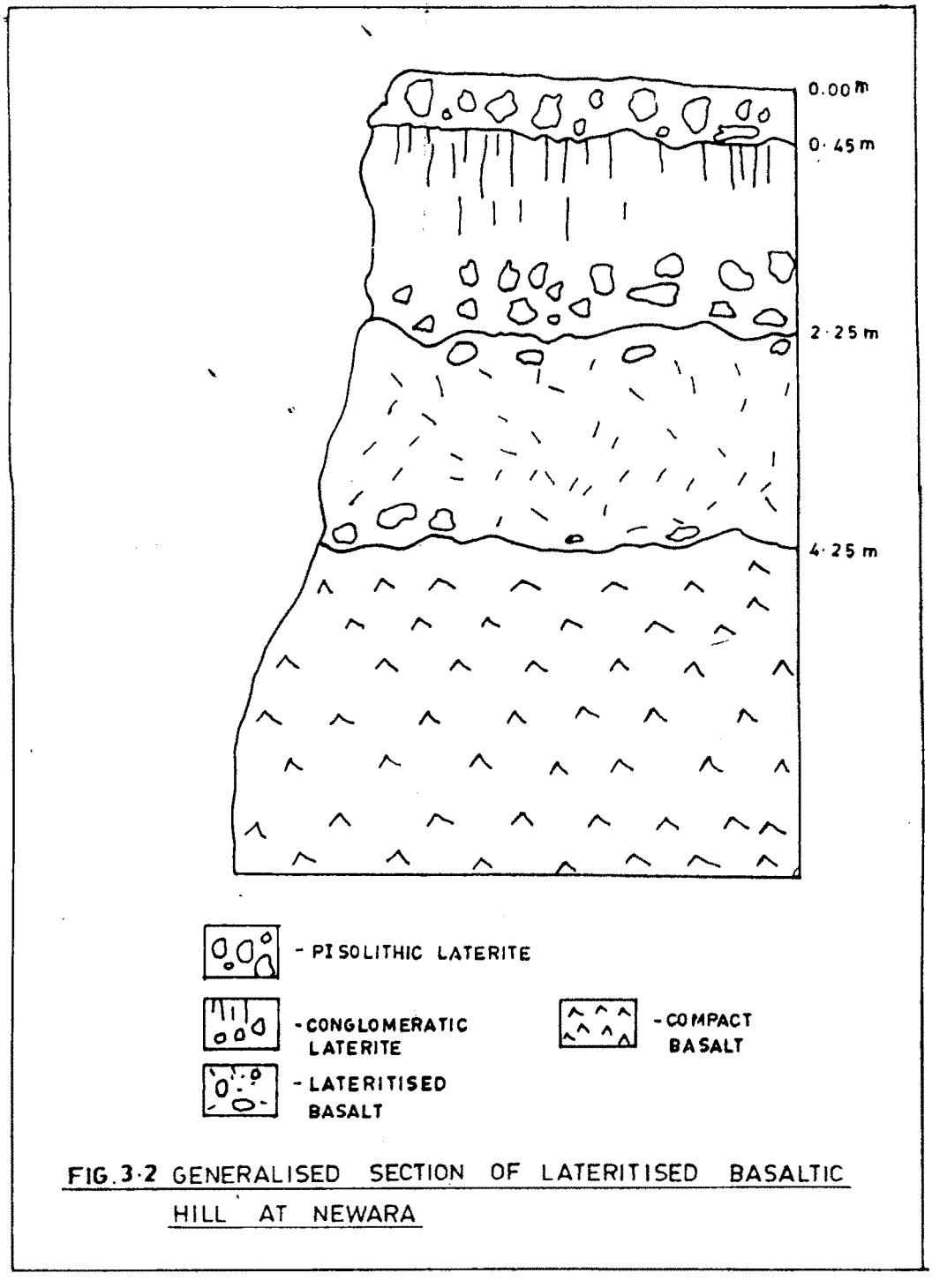

FIG. 3·2 GENERALISED SECTION OF LATERITISED BASALTIC HILL AT NEWARA

and dune environments. The black sand consisting of heavy minerals occur mostly in the marine environment.

Anon (1976) proposed the stratigraphic succession of the area and later this was modified by Siddiquie et.al (1976) is given below

ERA	GROUPS/SERIES	LITHOLOGY
Quaternary	Recent to subrecent	shore sands,dunes, soils,alluvium etc.
Tertiary	Pleistocene to Miocene	Littoral concrete, laterites.
Mesozoic	Lower Eocene to Upper Creataceous (?)	Deccan trap

3.3 PETROGRAPHY : The prominent rock types in the area are tholeiitic flood basalts, which are gently dipping towards west and characteristically bear the lateritic cappings. In hand specimens, these basalts do show some variations in their structures which have been revealed by their spheroidal weathering, amygdoloidal, vesicular and compact nature. The massive and compact basalt predominently observed in the present area is generally fine to medium grained and bears dark grey colour with occassionally brownish tint. Near Jaigarh and around Varvada region north of Newara, amygdoloidal basalts are prominently observed bearing white amygdals of secondary minerals. During the present study, thin sections of various basalts were observed under microscope and the petrography is discussed in the following paragraphs.

3.3a Massive Compact Basalt : All the thin sections of compact basalt generally show porphyritic and glomero-porphyritic textures to varying degree (plate 3.2) Phenocrysts of augite and plagioclase, occassionally exhibit ophitic to subophitic relationship. The groundmass is generally intergranular, however, in some cases the plagioclase laths show flow orienation. The groundmass exhibits conspicuous variation in grain size. The typical characters indicated by phenocrysts are summarised below :

i. Augite : Augite, in subhedral prisms and plates, occuring as phenocrysts,(plate 3.3) generally exhibit uniform extintion but some times they show undulose extinction and irregular growth pattern. These are medium in size and show high relief, 3rd order interference colours and are found to be associated with opaque grains-Ilmenite and Magnetite.

ii. Plagioclase felspars : Plagioclase constitutes a dominent phase among the phenocrysts. They occur as subhedral to euhedral lath shaped crystals in association with phenocrysts of augite (plate 3.2). These plagioclase grains exhibit high relief,repeated twinning and oblique extinction (12° - 15°) with grey interference colour.

The groundmass is essentially composed of clinopyroxene and plagioclase felspar grains with good amount of opaque oxides and glass. The clinopyroxenes occur as granular aggregates of small subhedral grains which are fresh, colourless and untwinned. The altered augite grains

generally exhibit brownish colour. Inclusions of glass are observed in some grains. The plagioclase felspars in the groundmass occur as small prismatic laths showing twinning and occasionally normal type of zoning. Opaque oxides essentially comprise magnetite and ilmenite in the form of minute dusty grains (plate 3.4). They show rapid rate of crystallisation. Glass is charged with these opaque oxides and also contain unidentified slender needles.

3.3b Amygdoloidal Vesicular Basalt : The rock specimens are characteristically greyish brown in colour, in which some vesicles are filled with quartz and zeolites. Petrographic study of thin sections of different samples of amygdoloidal basalt revealed lath shaped plagioclase phenocrysts with subhedral augite grains. In some cases, they are embeded in euhedral augite grains exhibiting ophitic texture. The groundmass is essentially made up of glass, fine grains of augite and plagioclase with opaque oxides.

3.3c Laterites : The microscopic studies of lateritic samples revealed inclusions of quartz and felspar grains in the opaque brown coloured matrix. The laterite consists of anhedral and amorphous grains, which are present either individualy or in the form of clusters.

3.4 MINERALOGY : The involvement of the basaltic rocks as a source for liberation and deposition of heavy minerals on beaches is confirmed by their set of mineralogy and the mineral characters. Therefore, it is unavoidable to know

the mineralogical details of beach sand to throw light on their provenance. The mineralogical studies were carried out and their salient features are described below. The sediments of the beach are composed of heavy and light fractions, in which the shell fragments are also not uncommon. The minerals observed in the trap rocks and beach sands have been tabulated considering their genetic relations. They are grouped as,

1. Basalts having i. augite, ii. plagioclase, iii. magnetite, iv. ilmenite and v. olivine etc. minerals are of primary origin and the minerals of secondary origin are i. quartz, ii. zeolite, iii. leucoxene and iv. laterite.

2. Beach sand consisting of resistant minerals like i. quartz, ii.ilmenite, iii. magnetite, iv. felspars, v.rutile, vi. leucoxene, vii. hematite and viii. laterite.

The beach sand samples from Newara, when observed under microscope have indicated the following mineral assemblages as per their abundance and their mineralogical characters are summarised below.

Opaque minerals : Ilmenite, magnetite, hematite, leucoxene and rutile.

Transparent minerals : Quartz, plagioclase, augite,calcite and zircon.

Shells : Calcareous shells of varying dimensions.

Opaque Minerals : Ilmenite : The prominent mineral in the sand is ilmenite which is steel black in colour (plate 3.5).

It is found to show variations in its abundance in the low-tide,high-tide, base of dune and dune environments. Under microscope, the grains of ilmenite were identified by their opaque nature and grey colour with brownish to white boarders showing blue tint. Ilmenite most closely resembles magnetite, from which it is very difficult to distinguish especially when the grains are very small and anhedral. Differentiating two, a reflected light microscope is more reliable. Three stages of ilmenite alterations are recognised under microscope.

Patchy ilmenite : Stage I : Patchy intergrowths of altered and unaltered ilmenite is the first indication of alteration. This stage is signified by the appearance of elongated, rounded stringers having reflectivity near to that of rutile. This type of alteration of ilmenite decreases anisotropism.

Mottled ilmenite : Stage II : This variety is commonly found as amorphous ilmenite. In this stage, the colour of ilmenite disappears. It is slightly grey and shows no internal reflections.

Leucoxene : Stage III : In some grains, the third stage of alteration has been indicated by the presence of leucoxene formation. (plate 3.6).These grains show brighter internal reflections under crossed nicols.

Magnetite : It occurs mainly as triangular, square, rhombic and sub-hedral grains. However, some of them even show

rounded, anhedral nature. It shows black colour with metallic lustre in reflected light.

Hematite : In richness, magnetite is followed by hematite, which occurs as anhedral and euhedral crystal and occassionally minute scales. It is well identified with reflected light microscope. It is anisotropic and distinguished from other opaques by red to deep red colours along thin edges of the grains.

Limonite : Most of the grains occur in amorphous nature and some times in fine grained nature and show dark shades of red, yellow or brown. Many grains are opaque to translucent.

Transparent Heavy Minerals : Tourmaline : In all grain mounts, tourmaline showed tabular, euhedral, stubby, columnar or even anhedral nature. (plate 3.7). All grains show characteristically pale green to pale pink pleochroism, high relief, elongate habit and parallel extintion.

Rutile : This mineral occurs as anhedral rounded nature. It is pale brown to reddish brown in grain mount and shows high relief.

Zircon : It occurs in all size fractions and shows sub-hedral to sub rounded nature. But rarely occurs as euhedral grains (plate 3.8).

Transparent Light Minerals : Quartz : This forms the major portion of the beach sediments. Quartz grains are rounded, sub rounded, and usually clear in appearence. Few grains show turbidity due to presence of minute inclusions of

opaque minerals or due to staining.

Plagioclase : These are present in very small portion amongst the lighter minerals. They are sub angular, lath shaped showing characteristically lamellar twinning.

Feldspar : The k-Feldspar as orthoclase is observed in very small proportion. It is sub-angular to sub-rounded in shape and show turbid appearance. The grains are generally fresh, clear and colourless in ordinary light and show grey inteference colour under cross nicols.

Calcite : This mineral as broken grains is colourless, and show low relief in polarised light. Twinkling is common in all grains.