CHAPTER - II

BACK GROUND INFORMATION

OUTLINE OF THE PRECAMBRIAN GEOLOGY OF RAJASTHAN

Precambrian geology of Rajasthan is ideally summarised by Krishnan (1968, PP. 117-118) in the following words :

"The characteristic feature of the country is the presence of several groups of rocks belonging to the Archaean and Pre-Cambrian, forming a folded mountain system running across it from the north of Delhi in the north-east to the Gulf of Cambay in the south-west. This mountain system was formed in Pre-Cambrian times, folded again in Post-Delhi (? Cambrian) and affected by uplift and faulting probably in

Mesozoic times. The central part of the Aravalli ranges is occupied by a great synclinorium composed of Delhi and Aravalli rocks. Trending roughly in the same direction as the ranges is the Great Boundary Fault of Rajasthan along which the Aravallis lie against the Vindhyans on the east. Because of the semi-arid nature of the country the rock exposures are good but in the west and south-west they are often engulfed in sandy alluvium and desert sands. The geology is of great complexity and at present all we can say is that the preliminary work, of which an account is given in the following pages, is liable to drastic revision in coming years.

The major formations of pre-Vindhyan age which have been classified in Rajasthan are shown below :

5. Malani suite of igneous rocks
4. Delhi System
3. Raialo Series
2. Aravalli System
1. Banded Gneissic Complex and Bundelkhand Gneiss.

The Archaeans consist of the Bundelkhand Gneiss and the Banded Gneissic Complex, the latter forming composite gneisses which include much undoubtedly original sediments. The Aravallis which are an enormously thick series of mainly argillaceous rocks are probably the equivalents of the

Dharwars of South India. The Raialos which may probably be more than 600 m. thick, are considered to be intermediate in age between the Aravallis and the Delhis. The Delhis, consisting of sandstones and shales, resemble the Cuddapahs and are probably about 6,000 m. thick. After the deposition and folding of the Delhis there occurred a series of igneous intrusions which include, the Erinpura, Jalor-Siwana and Idar granites as well as the Malani suite of volcanic and plutonic rocks. The Vindhyans which are considered to be partly of Cambrian age are younger than the succession represented by the rocks mentioned above.....".

The Bundelkhand Gneiss

The main exposure of this group occurs in the Berach valley between Chitor and Bhilwara. It is overlain by the Vindhyans in the south and supposed to be overlain by the Banded Gneissic complex elsewhere but the relationship of this to the Banded Gneiss is not known as the junction is covered by the Aravallis. In its typical form, it is a pink to reddish, medium grained, non-foliated, non-porphyritic granite but towards the west, near the junction of Berach and Began rivers, it gradually becomes well foliated. Hacket (1881), Heron (1936) and Gupta (1934) thought these rocks to be the oldest rocks of Rajasthan - an Archaean basement over which the subsequent metasedimentary sequence was deposited.

On the basis of petrographic similarity, it was conjectured that these rocks are identical with the Bundelkhand granites and gneisses of Madhya Pradesh. Based on the recent findings by Misra (1949), Saxena (1953), Jhingran (1958), Sarkar (1968), a lot of controversy has arisen regarding the age of Bundelkhand gneiss of Madhya Pradesh.

The Banded Gneissic Complex

A concise description of the Banded Gneissic Complex is given by Krishnan (1963, p.12) in the following words :

"A group of banded rocks composed of alternating bands of biotite gneiss, chlorite- and mica-schists and granite is exposed in several places in close association with the Aravallis, particularly in southern Mewar. They include also bands of hornblende schists and epidiorites which represent sills or flows of lava interbedded with the original sedimentary materials. The gneissic complex shows also veins of pegmatites and aplites. It would appear that granites, basic rocks and sediments of more than one age are mixed up in the banded gneisses, as they show decided variations in their characters in Ajmer, northern Mewar and in the north-western side of the Delhi Synclinorium-.....".

Heron (1935) considered the complex to be originally a sedimentary formation and correlated the gneissic or migmatitic rocks of (i) Mavli-Pipalkhunt (ii) Kishangarh - Darwal (iii) Beawar-Bagri (iv) Barr-Desuri and (v) Kankroli & Sarara-Ki-Pal areas with the Banded Gneissic complex. About this complex Raja Rao et al. (1971, P. 64) state that "Recent work has thus confirmed that the Banded Gneissic complex possesses an independent stratigraphic status as conceived by Heron and the entire unit is not a petrographic variant of the Aravalli rocks or younger sediments. This particularly is true of the complex in the type area, and the inliers at Sarar-Ki-Pal and at Kankroli".

Crookshank (1948), Niyogi (1965) and others, consider that the complex of Kishangarh-Darwal area represents granitised Aravalli rocks. Naha and his co-workers (1968, 1969) think the Darwal granite and adjacent migmatites as granitised product of metasediments and not the basement as Heron thought.

Raja Rao (1967), believes that the Gneissic complex of Barr-Desuri area is derived by migmatisation of the mica-schist during Erinpura granitic activities.

The Aravalli System

The Aravalli System is dominantly argillaceous in composition. The basal beds, which rest on Bundelkhand

Gneiss or the Banded Gneissic complex, are arkose and gritty quartzites, and these in turn, are overlain by shales and phyllites with which are associated some altered basic volcanics at places. These are overlain by limestones which occur in two facies, one being a lenticular ferruginous limestone as in Bundi and Mewar and the other black massive limestone as near Udaipur city. The rocks show increasing metamorphism as they are followed from east to west into the highly folded region. Recent work suggests that the Aravallis are not homogeneous as suggested by Heron (1953). In Udaipur-Zawar area :

(i) Poddar (1965, 1967) reported the sulphidic sapropelites with perfectly bedded pyrite, pyrrhotite, sphalerite-galena in the Hameta area.

(ii) Muktinath et al. (1967) and Raja Rao, (1968) found out phosphorite-dolomite-carbon phyllite chert with algal structure.

(iii) Poddar & Mathur (1965) revealed repetitious sequence of graywacke-slate-phyllite of flysch type.

In western Rajasthan the Aravalli rocks of Jodhpur, Bikaner and Pali districts pose the problem of their stratigraphic position. The base of these rocks is nowhere exposed and their relation with the Delhis is not still

determined. It is felt that the correlation of these rocks with Aravallis is rather arbitrary. It is not unlikely that the entire group of so-called Aravallis of this region showing absence of high-grade regional metamorphism, and intrusion of Post-Delhi granites, might be representing a younger or later phase of the Delhi cycle. In Palanpur and Sirohi districts, Coulson (1933), has correlated a group of metasedimentaries with Aravallis. These rocks are seen to have been involved in the Delhi orogeny and subsequently intruded by Erinpura granite, Malani granite and basic dykes of Post-Delhi age (Patel, 1971). Raja Rao et al. (1971), believe that these rocks belong perhaps to Delhi System.

Raialo Series

The Raialo Series rests unconformably over the Aravallis. Heron assumed that the Raialo rocks were deposited during the Eparchaean Interval and had no equivalent in India (1953, p. 22).

The marble formations of different areas which were correlated with the Raialo by Heron, have been assigned various stratigraphic positions by recent workers like Raja Rao (1967) and Gangopadhyay (1972). Naha and his colleagues (1969) have indicated that the Raialo marbles form a part of the sequence within which it occurs and this renders an independent stratigraphic status of Raialo rocks quite doubtful.

The Delhi System

The Delhi System lies over the older formations with a great unconformity and has a thickness of about 6,000 m. It extends right along the main axis of folding of the Aravalli mountains from near Delhi in the north, through Ajmer and Mewar to Idar and Palanpur in the south. The exposures in the north are patchy as they are interrupted by alluvium. The exposures are well developed and much broader in Ajmer-Merwara & Mewar areas, forming the main synclinorium that consists of two major synclines, separated by a tongue of sheared Pre-Aravalli gneisses. The western margin of this gneissic tongue, at places, is marked by a thrust fault. The western syncline of the synclinorium is profusely intruded by granitic rocks. They gradually increase southwestward until they almost obliterate and assimilate the Delhi sediments. These two synclines of the main synclinorium coalesce in the south. A few strips of the Delhis are also seen to the east of the synclinorium.

The general succession of the rocks of the Delhi System is given in the accompanying table (Table II-1).

The Delhi succession is fully developed in Alwar, where two extra horizons namely Kushalgarh Limestone (500 m) and Hornstone Breccia (small but variable thickness), intervene

Table II-1 - The General Succession of the Delhi System (Affer Krishnan, 1968).

Jodhpur	Main Synclinorium Mewar and Ajmer-Merwara	Chitor and Nimbahara		Jaipur	Alwar
Vindhyans of W. Rajasthan					
Malani igneous suite					
		Lower Vindhyanas			
Delhi System (Not present)	Calc-gneisses' Calc-schists' phyllites and biotite-schists'		Boundary Fault	Ajabgarh Series	Ajabgarh Series
	Quartzites Arkose-grits	Sawa Shales and grits	Jiran Sandstones	Alwar Series	Hornstone breccia Kushalgarh limestone Alwar Series
Raialo Series (Makrana marbles)	Raialo Series	Railo Series	----	----	Raialo Series

between the Alwar and Ajabgarh Series. The Alwar Series consisting of quartzites and arkose-grits are rather unevenly developed in the various exposures. The Ajabgarh Series consists of calc-gneisses, calc-schists, phyllites and biotite-schists. The calc-schists are thinly bedded flaggy biotitic limestones which, when metamorphosed, become schistose. The calc-gneisses, on the other hand, are coarse and contain much carbonate. They comprise mainly dark banded siliceous limestones, generally more massive and harder than calc-schists and show gneissic structure. According to Heron (1953)- "The lowest division of the Ajabgarh is usually in the form of a great thickness of biotite-schists abundantly intruded with pegmatite and aplite in great dykes and veins, and in lit-par-lit alternation. As a rule, there is as much igneous material present as sedimentary. The minimum state of metamorphism observed is that of phyllite, and excellent instances are seen of the trasition from phyllite through biotite-schist to composite gneiss formed by the interfoliar alternation of biotite-schist with aplite".

Recently Raja Rao et al. (1971), have raised several doubts about the validity of Heron's classification and have suggested modification in some localities regarding the stratigraphic position of the Delhi rocks and the underlying basement. According to Raja Rao et al. (1971), "the rock-groups of Lalsot ($26^{\circ}34'$: $76^{\circ}23'$) and Biana ($26^{\circ}55'$: $77^{\circ}51'$)

areas have been surmised to be older than the beds of the Alwar and Jaipur type areas". Basu (1962-63 G.S.I. Report) has grouped the metasediments in the Delhi System within which the Kishangarh nepheline syenite has been emplaced. Heron (1953) correlated these metasediments with the Banded Gneissic complex, while Niyogi (1965) correlated them with Aravalli System.

Granitic Rocks

According to Heron (1953), four phases of granitic activities in the Precambrian terrain of Rajasthan are as follows :

(iv) Malani
(iii) Post-Delhi but Pre-Malani (Erinpura Granite)
(ii) Post-Aravalli but Pre-Delhi
(i) Pre-Aravalli

According to him the Bundelkhand Granite is the Pre-Aravalli phase of granitic activity and the Post-Aravalli granites of northeastern Rajasthan having very limited extent represents the second phase, while the Erinpura Granite and the Malani igneous rocks are the third and fourth wide spread igneous activities of this terrain.

Sharma (1953) is of the opinion that there are only three phases of granitic activities - the first Post-Aravalli, the second Post-Delhi and the third Malani. According to

1. Epidiorites and hornblende-schists (Pre-Aravalli).

PRECAMBRIAN ROCKS OF GUJARAT

Beyond the southwestern border of Rajasthan the broad belt of Archaen rocks extends southwards into the north and central Gujarat. The rocks equivalent of Banded Gneissic Complex and Bundelkhand Gneiss are nowhere reported and the oldest rocks seen are the Aravallis which cover a large area.

Aravallis

According to Gupta & Mukerjee (1938), three principal types of Aravalli sediments are observed in Gujarat :

(iii) a succession of argillaceous beds of slaty, phyllitic and micaceous type, with arenaceous intercalations.

(ii) an impure calcareous sequence, generally dolomitic;

(i) a basal quartzitic formation;

The Aravalli rocks occupy quite a large tract around Shamlaji in Sabarkantha, and Baria and Santrampur in Panchmahals district. To the south these Aravallis are flanked by a narrow strip of gneissic terrain beyond which lies the Champaner Series. The rocks of this Series differ in many ways from the typical Aravallis in the north, but

a broad equivalence between the Champaners and Aravallis is now taken to be an accepted fact (Blanford, 1869; Fermor, 1936; Gupta & Mukerjee, 1938). Jambusaria (1971) who investigated the Champaner rocks around Shivrajpur in detail came to the conclusion that these were deposited in a distinct small marginal basin, separated by a barrier of crystalline basement.

Merh and Patel (1968) working in the Aravallis of Shamlaji-Bhiloda area in Sabarkantha, have recorded that the imprints of Delhi orogeny are much more pronounced in the Aravalli rocks, as a result of which the quartzite outcrops in that area, comprise a number of refolded antiforms. A perusal of the geological map of Gupta & Mukerjee (1938) clearly shows that the effect of late NNE-SSW (Delhi) folding progressively decreases southeastward; the older Aravalli folding being E-W.

Delhis

The Delhi System comprises the next prominent meta-sedimentary sequence, the Raialos of Rajasthan, being absent in Gujarat. The Delhis are exposed in the main synclinorium which extends from Ajmer through Mewar into Sirohi and Idar over a distance of more than 320 km. and its exposures in Gujarat are seen in Palanpur, Idar and Danta areas,

The Palanpur, Danta and northwest Idar Aravalli range is described by Heron & Ghosh (1938), as consisting of finger-like ridges, ultimately merging into scattered islands in the sand and alluvium, the bulk of the rocks consisting of the Ajabgarh Series and the Erinpura Granite.

Delhi rocks were first mentioned by Middlemiss (1921). Describing the geology of Idar area (Sabarkantha), he however, included all the quartzites in Delhis while the calc-gneiss, biotite-gneiss etc. were considered as Aravallis. Subsequently, Heron and his associates, reinterpreted the Precambrian sequence of north Gujarat, and considerably modified the findings of Middlemiss. Heron & Ghosh (1938) assigned Aravalli age to the quartzite occurring to the east of the Hatmati river and Alwar Series (Delhi System) to the quartzite occurring to the west of it. The Biotite-Schist stage of the Ajabgarh Series of Heron (1935) in Idar is represented by the "Biotite-gneiss" of Middlemiss (1921) and is resting over quartzite. This "Biotite-Schist" is overlain by the "Calc-schist" and "Calc-gneisses" stages (Heron, 1935) but there is no interbedding between the Biotite-schist and the calcareous rocks, and the junction between the two types is described as somewhat sharp. Mundeti Series of Middlemiss (1921) is exposed in a few small disconnected outcrops in the alluvium near Mundeti in Idar area. According to Heron & Ghosh (1938), the rocks of the Mundeti Series represent a less metamorphosed form of the Ajabgarh Calc-Schists, from

which they differ only in their finer and incipient crystallisation. The Kherod Amphibolite Limestone Series of Middlemiss (1921, pp. 49-53) represents both the Ajabgarh calc-gneisses and the limestones above them (Heron & Ghosh, 1938).

Granites

The Erinpura Granite which forms the great batholith of Mount Abu continues southward irregularly but with no interruption into Palanpur, Idar and Danta area. The age of the granitic rocks of Panchmahals in Central Gujarat is doubtful. Those occurring in association with Champaner Series are supposed to be Post-Champaner but Pre-Delhi (Hobson, 1926; Gupta & Mukerjee, 1938) whereas the granites of Godhra have been correlated with Erinpura Granite.

Recently, Crawford (1975), on the basis of geochronological studies, has stated that the Granites of Gujarat (including those of Godhra and Idar) are of the same age as those of Mount Abu and that all those occurrences of Erinpura Granite are contemporaneous with the Jalor-Siwana granites of Malani Igneous Suite.

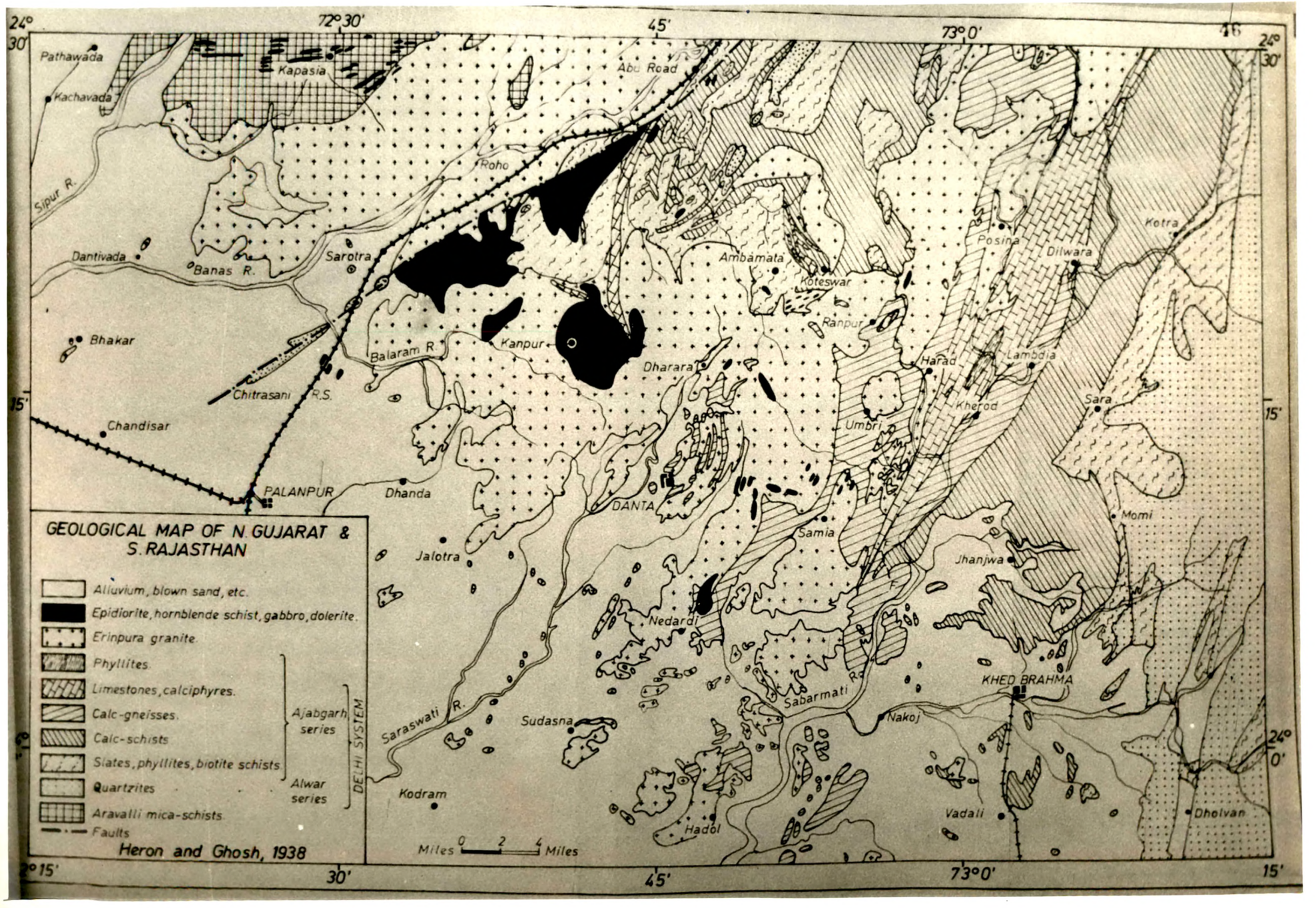
Basics

So far as the basic rocks are concerned, they belong to four episodes (Sharma, 1953) - Pre-Aravallis, Post-Aravalli

but Pre-Delhi, Post-Delhi but Pre-Erinpura and Post-Erinpura but Pre-Malani.

In a general way, the work of Heron & Ghosh (1938) on north Gujarat gives the most exhaustive account of the Delhi System and the associated igneous rocks. The geological succession worked out by Heron & Ghosh (Plate II.1) in the following table has provided the appropriate background to the author in his present investigations :

Recent		Alluvium, blown sand, river gravels.	
Malani		Olivine-dolerite and basalt dykes.	INTRUSIVES
		Oligoclase-dolerite dykes.	
		Gabbro and dolerite plugs.	
		Erinpura granite and pegmatite	
		Epidiorites and hornblende-schists.	
Delhi System	Ajabgarh Series	Phyllites.	
		Limestones.	
		Calc-gneisses.	
		Calc-schists.	
		Phyllites and biotite-schists.	
	Alwar Series	(Quartzites. Missing, but developed in adjacent areas).	
Aravalli System		Mica-schists and composite gneisses.	


24° 30'
72° 30'
45'
73° 0'
15'
24° 30'
Pathawada
Kapasia
Abu Road
Kachavada
Sipur R.
Roho
Dantivada
Banas R.
Sarotra
Ambamata
Koteswar
Posina
Dilwara
Kotra
Ranpur
Bhakar
Balaram R.
Kanpur
Dharara
Harad
Lambdia
Chitrasani R.S.
Kherod
Sara
Umbri
Chandisar
PALANPUR
Dhanda
DANTA
Momi
Samia
Jalotra
Jhanjwa
Nedardi
KHED BRAHMA
Sabarmati R.
Saraswati R.
Sudasna
Nakoj
Kodram
Hadol
Vadali
Dholvan
Miles 0 2 4 Miles
GEOLOGICAL MAP OF N. GUJARAT & S. RAJASTHAN
Alluvium, blown sand, etc.
Epidiorite, hornblende schist, gabbro, dolerite.
Erinpura granite.
Phyllites.
Limestones, calciphyres.
Calc-gneisses.
Calc-schists
Slates, phyllites, biotite schists.
Quartzites
Aravalli mica-schists.
Faults
Ajabgarh series
Alwar series
DELHI SYSTEM
Heron and Ghosh, 1938

According to Heron & Ghosh (1938), the Ambamata area incorporates the following rock formations :

Basalt dykes	Intrusives	Post-Erinpura
Erinpura granite and pegmatite		Erinpura
Epidiorite and hornblende-schists		Pre-Erinpura
Limestones	Ajabgarh Series	Delhi System
Calc-gneisses		
Calc-schists		
Phyllites and biotite-schists		

PREVIOUS WORK ON THE AMBAMATA AREA

Introduction

Ambamata area has attracted number of geologists since 1925. Ghhiber & Mathur (1925) were the first workers to visit this area. Later on, Sharma mapped this area and his work has been published in the form of a few papers (Sharma : 1931, 1939; Sharma & Purkayashtha : 1935; Sharma & Nandy: 1936). The area was surveyed and studied in detail by Heron & Ghosh (1938). A brief account of geology was published by Merh (1950). Heron (1953) has referred to this area in his compilation of study on Rajasthan. The correlation of the Pre-Vindhyan Igneous Rocks of Rajasthan

was discussed by Sharma (1953). Though the works of Heron (1953) and Sharma (1953) were mainly concerned with Rajasthan, they made references to the Precambrian terrain of Gujarat. Recently, detailed geological and geophysical work was carried out by the officers of the Geological Survey of India in connection with the basemental mineralisation and a number of papers on mineralisation have been published. A group discussion on the "Development of Base-Metal (Copper-Lead-Zinc) deposits in Rajasthan and Gujarat", sponsored by Geological Society of India and Geological Survey of India was held in October, 1975. In this discussion, references were made to the mineralised zone of Ambamata and Deri.

Earlier Work

The earliest detailed work in the study area is that of Sharma (1931). He gave the following stratigraphical succession :

Recent	.....	Soil and Alluvium
Younger intrusives		Microgranite and granite porphyry ~~porphyry~~ Granite
		Epidiorites and basaltic veins
Post-Delhi older intrusives (Post-Aravalli ?)		Granitoid and Schistose gneiss
		Schistose quartz porphyry

Sedimentaries (Aravalli ?)	Phyllite and Biotite Schist Quartzite Marble Crystalline Limestone Calc-gneisses

Coulson (1933) worked in the adjoining Sirohi area of Rajasthan and established that the :

(a) Delhis found in Sirohi belong to the Ajabgarh Series,

(b) basic activity was renewed either during, or shortly after, the laying down of these rocks,

(c) this activity was followed by the intrusion of Erinpura granite, with all its accompanying aplites and pegmatites,

(d) this granitic activity was followed by the younger basic activity.

Sharma & Nandy (1936) found that there were at least three phases of basic intrusives in the Precambrian terrain of Danta state.

The work of Heron & Ghosh (1938) however, is the most detailed one. They radically reversed the sequence suggested by Sharma, and considerably modified the regional picture worked out by Middlemiss (1921). Regarding the origin of 'Schistose Quartz Porphyry' of Sharma they could not come to any definite conclusion and this can be ascertained from

its description (p. 378) - "From these petrographical descriptions the balance of probability is that these rocks are arkose, but with the possibility that they might be porphyries. Against this is the fact that porphyries have never been found elsewhere in the Delhis, and they are much too low down in the Delhi sequence to be the effusives of the Erinpura granite,-which have nowhere been found". About the granitic activity, they further write (p. 398) - "Though in Idar the granite is unfoliated and coarse in grain, we have in Danta transitions from this later type to the fine-grained, more acid, foliated and streaky forms which are believed to have been earlier arrivals while compressive stresses were still in action...". These authors have modified the correlation stated by Sharma in putting the acid intrusions, including the granitoid gneisses into the Erinpura phase, and the metasedimentaries of Sharma (Aravallis) into the Ajabgarh Series. They have retained the basic rocks in the position (Pre-Erinpura Granite age) suggested by Sharma.

Merh (1950) expressed doubt about igneous origin of the "Schistose Quartz Porphyry" of Sharma (1931). He concluded that there were two basic intrusive activities - one shortly after laying down of Upper Delhi rocks, before the granitic activity, and the other after it. According to him the granitic activity comprising granite, microgranite, aplite and pegmatite corresponds to the Post-Delhi granites of the other parts of Rajasthan.

According to Heron (1953), in central Rajasthan, the lowest division of the Ajabgarh is usually in the form of biotite-schists intruded with pegmatites and aplites. Interfoliar alternation of biotite schist with aplite have given rise to composite gneiss. The calcareous sediments show variation due to their original impurities present in them. There is a great and varied assortment of basic intrusives, originally basalts etc. and now metamorphosed to epidiorites and hornblende-schists prior to the Erinpura granite. According to him the Granite welled up quietly, dissolving the rocks as it rose through them, and rules out the mechanism of forcible intrusion under pressure.

Recent work

During the last decade, the officers of the Geological Survey of India have carried out geological and geophysical investigations in Ambamata to locate the mineralised zone. Most of the recently published papers deal with one or other aspects of mineralisation and an outline of the work of various authors is given in the following paragraphs :

A note on the Ambamata base metal deposit was published by Shekar et al. (1969). The description of the mode of origin and occurrence given by them is as follows :
"Mesothermal base metal mineralization of replacement type

is associated with talc-schist and biotite-quartz-schist. Predominantly calcareous and argillitic metasediments of the region belonging to the Ajabgarh Series of Heron, along with the mainly arenaceous types of Ambaji area, are thrown into isoclinal folds plunging largely towards SSW followed by basic igneous activity and regional metamorphism. Later refolding has resulted in slightly overturned cross folds in fan pattern with axes ranging west to north, while at Ambaji they are directed towards N 60°W. The loci of ore deposition at Ambaji are a series of reverse strike faults traversing the southwestern limb of such a cross folded syncline. The main host rock, the talc schist, is considered to be metamorphosed product of pre-Erinpura basic-ultrabasic intrusion".

Chakravarty & Gupta (1975) in their paper stated that the mineralisation was controlled not only by structures, but also by deposition of sediments and co-precipitation of elements and this has lead to stratiform nature of mineralisation. Mineralisation was syn-sedimentary and subsequently remobilised.

According to Jayram (1975) there were two distinct metallogenic provinces - i) predominantly copper-rich province of hydrothermal affinity in northern Rajasthan and ii) predominantly syn-sedimentary lead-zinc (-copper) province in southern Rajasthan and northern Gujarat.

Kailasam (1975) gave a brief account of the geophysical exploration for base-metal deposit in Ambaji-Deri area and found out a major anomaly zone extending over several kilometres in this part of the area.

Das Gupta & Poddar (1975) concluded that primary sedimentary features are mostly obliterated from the metasedimentary rocks forming the mineralized zone and the sulphides have undergone poly-phase deformation and metamorphism, resulting in a second generation of discordant but stratabound sulphide bodies formed during endogenic transformation of the heterogeneous sulphidic rock masses.

A brief account of the mineralisation was given by Murty & Shekar (1975) in following words : "The multi-metal sulphide mineralisation is intimately associated with a well-defined zone of calc-magnesian rocks and their arenaceous variants occurring within a predominantly arenaceous metasedimentary sequence of the Upper Delhi Group. These rocks and the associated basemetal mineralised zones have been subjected to green-schist facies of regional metamorphism. They are marked by a series of North to North-north-east trending tight overturned folds and concordant faults corresponding to the main Delhi orogeny. Large scale emplacement of Erinpura granite has resulted in a second (local) phase of structural disturbance, which has modified

the earlier folds and given rise to a series of West and North-West trending folds and accompanying sympathetic faults".

Mitter (1975) stated that the Deri Base-metal deposit is the richest of the smaller deposits known in the country containing a high percentage of lead, zinc and copper.

Jain (1976) considered the Ambamata deposits to be restricted to the lead-zinc metallogenic domain and confined to the Delhi Supergroup of eugeosynclinal metasediments.

From the above back ground information it is clear that the concepts put forth by earlier previous workers for this area are not sound to-day, although their contributions (Sharma, 1931; Coulson, 1933 and Heron & Ghosh, 1938) form the basis for the reinvestigations. A lot of controversy is there among the recent workers as far as the mode of mineralisation is concerned. All these facts clearly indicate that the Ambamata area is one of the crucial areas of north Gujarat posing the problems of stratigraphy, structure, metamorphism, magmatism, mineralisation etc. and needs thorough reinvestigations.