

Chapter 2

CHAPTER - II

REVIEW OF THE PREVIOUS WORK

A. Classification and age assignment of Pondicherry Cretaceous-Lower Tertiary rocks.

The Pondicherry area marks the northern limit of the sediments laid down during the great Cenomanian marine transgression along the east coast of South India. The geological formations met with in the Pondicherry area may be grouped as follows:

Recent and Sub Recent	...	Coastal sands
Miocene - Pliocene	...	Cuddalore Sandstone
Paleocene - Eocene	...	Limestone
Cretaceous	...	Limestone Shale Marl

-----Unconformity-----

Archaeon - Charnockites

The rocks of this Pondicherry area with their rich biotic assemblages were investigated and classified by several workers from time to time. Kaye and Cunliffe (1842), Egerton (1844), Forbes (1846), Carter (1854), and Hunter (1858) were the earlier workers to study the lithology and paleontology of Pondicherry area. Blanford (1862, 1865)

Classification of the Cretaceous-Lower Tertiary rocks of Pondicherry								
Age	Cretaceous Stages in the Trichinopoly area	Blanford 1865	Warth 1895	Kossmat 1897	Rajagopalan, 1965		Age	
					Lithological units	Planktonic foraminiferal zones		European Stages
Cretaceous (Upper Albian - Danian)	Niniyur	Ariyalur	F	Nerinea beds	upper marlstone	<i>Globorotalia pseudoscutula</i> <i>Globorotalia formosa formosa</i>	Ypresian	
					discocyclinid limestone	<i>Globorotalia rex</i> <i>Globorotalia velascoensis</i>	Sparnacian	
					algal limestone	<i>Globorotalia whitei</i>	Thanetian	
					lower marlstone	<i>Globorotalia uncinata</i> <i>Globorotalia trinidadensis</i>	Danian	
	Ariyalur	Valudavur	E D C B A	Trigonarca Anisoceras (Valudavur)	Mettuveli formation	<i>Globotruncana gansseri</i>	Maestrichtian Upper Campanian	
					Valudavur formation	<i>Globotruncana tricarinata</i>		
	Trichinopoly							
	Uttatur							

Table - 1 . CRETACEOUS- EARLY TERTIARY SUCCESSION IN THE PONDICHERRY AREA
(RAJGOPALAN 1965)

Stoliczka (1873), Warth (1894), Kossmat (1897), Rama Rao (1939, 1940, 1953 and 1964), Rama Rao, Narayana Rao and Nagappa (1940), Sharma (1954), Sastry, Rao and Iqbaluddin (1963), Rajagopalan (1962, 1965, 1968), Murthy (1968) Samanta (1968), and Banerji (1968) have described and classified the Cretaceous and Early Tertiary rocks of Pondicherry area.

The earliest reference to the Cretaceous succession of Pondicherry area is by Blanford (1865), (Tab.1) who subdivided the rocks based on the lithology and fossil content into 2 subdivisions

B. Ariyalur Group - Equivalent to Ariyalur Group of Trichnopoly.

A. Valudavur Group - Equivalent to Uttatur Group of Trichnopoly

He recognised a distinct unconformity between these two groups. Warth (1895) established six lithological horizons (A to F) in this area. The lower three were equivalent to Valudavur Group and the upper three were correlated to Ariyalur Group of Blanford. Kossmat (1897) classified the Cretaceous succession of Pondicherry into three subdivisions (1) Anisoceras beds (2) Trigonarca beds and (3) Nerinea Beds, all equivalent to Ariyalur Group of Trichnopoly. He classified the succession as follows.

Ariyalur Nerinea Beds Horizon F
 Trigonarca Beds Horizon D and E
 Anisoceras Beds Horizon A, B and C
 Valudavur of Blanford

A separate status was given to horizon F as he noted that the fauna of this horizon had an individuality to its own. Furon and Lemoine (1939) described Nummulitic Series in the Pondicherry area and concluded that Nummulites occurring with Pondicherry area represent Middle Eocene and a part of Bartonian. Rama Rao (1939) reported the occurrence of Nummulites and Discocyclusina in certain limestones and suggested the existence of Paleocene rocks in Pondicherry. Again Rama Rao (1940, 1953 and 1964) made further studies on Cretaceous - Tertiary deposits of Pondicherry and based on the discovery of Discocyclusina and Nummulites (foraminifera), he strongly advocated the existence of a Palaeocene bed overlying the Cretaceous Series. Similarly, on the basis of foraminifera and algae recognised in Nerinea Beds, he confirmed that the Nerinea Beds are equivalent to the Niniyur Group and of the same age (Danian). Further, he also referred the investigations of other workers including Rajagopalan (1962) and Sastri et al (1963) and concluded that the Nerinea Beds as a whole are of Palaeocene age and finally concluded that the Trichnopoly - Pondicherry area consists of marine fossiliferous series of Late Cretaceous to Palaeocene

age and affords an opportunity to study the Cretaceous - Tertiary boundary. Sharma (1954) made a detailed study of Nerinea Limestone and indicated a Danian age to this formation. Sastry, Rao and Iqbaluddin (1963), based on their study of the coralline algae assigned Palaeocene age to the Nerinea Beds, which forms the most critical horizon from view point of K/T boundary. Rajagopalan (1964, 1965) from a detailed field study recognized three formal lithological units (1) Valudavur (2) Mettuvalli and (3) Pondicherry Formations being roughly equivalent to the three divisions of Kossmat (1897) and assigned Late Campanian to Maestrichtian age to Valudavur and Mettuvalli Formations and early Tertiary age to Pondicherry Formation. Again Rajagopalan (1968) made a restudy of Pondicherry Formation and based on reexamination of the associated Planktonic foraminiferal fauna confirmed the Paleocene age to the Pondicherry lithological unit. Gowda (1964) recognised two lithotypes in Pondicherry area - Karasur Shale and Karasur Limestone, approximately equivalent to horizons 'D' and 'E' (Senonian to Maestrichtian) of Warth's (1895) earlier classification). Murthy (1968) discussed the lithology of the three units of Pondicherry area and presented a lithological classification of Pondicherry rocks which more or less correspond to the division proposed by Kossmat and opined that the Nerinea Beds

of Kossmat, that is Horizon III constitute only the passage between the Cretaceous and the Eocene Systems. Samanta (1968) assigned Upper Paleocene-Early Lower Eocene age to the Discocyclina bearing Limestone of Pondicherry area based on his studies on the associated microfossils especially the index planktonic foraminiferal species. Banerji (1968) made a detailed foraminiferal biostratigraphical studies of the marine Late Cretaceous strata near Pondicherry and stated that the strata are correlated with the Lower Ariyalur Stage of Vridhachalam and Trichnopoly areas. He recognised five lithologic units P_1 to P_5 in the Late Cretaceous of Pondicherry which are approximately equivalent to the lower five horizons of Warth's earlier classification (1895). The important outcome of his investigation is the discovery of beds of Santonian to Early Campanian age in Pondicherry and Trichnopoly areas which were unreported from these areas. Venkatachalapathy (1972) based on his studies on planktonic foraminifera obtained from the Late Cretaceous to Early Tertiary deposits of Pondicherry extends the age of uppermost beds of Pondicherry upto Middle Eocene.

B. MICROBIOTAL INVESTIGATIONS

A survey of literature shows that very little palynological work has been carried out on the Upper

Creteceous-Lower Tertiary rock formations of Indian sub-continent. The earliest palynological work on Late Cretaceous -Early Tertiary sediments of India happens to be of Ghosh (1941) who recorded two winged pollen grains from an Eocene carbonaceous shale near Laitryngew is Assam. Later Sahni, Sitholey and Puri (1947) made a preliminary study of the plant microfossils from various Tertiary horizons of Assam and recorded several pteridophytic spores and pollens of gymnosperms and angiosperms and fungal mycelia and spores. Sen (1948) recorded smooth and ornamental trilete spores, acolpate and monocolpate pollen grains and a two winged pollen grain from Laitryngew coal of Cherra Sandstone of Assam coalfield. The abundant angiospermic remains represented by the pollen referable to Magnolia and Phoenix and associated woody fragments revealed a Tertiary age for the Cherra Sandstone.

Bose (1949) recorded a large number of pollen grains (Tri-Tetra-colporate) and a few gymnospermous pollens from Barmer Sandstones of Rajasthan. From the same Barmer district, he again (1952) recorded a large number of angiospermic pollen grains viz Triorites, Tricolporites, Tricolpites, Tetracolpites, Heptacolpites, Polyporites Triletes and fungal spores from dark carbonaceous clay and assigned a Tertiary age.

Rao and Vimal (1950) reported different kinds of Eocene spores and pollens from Palana lignites of Bikaner, Rajasthan. Mahabale (1950) studied two fossil genera Sausarospermum and Mussulites recovered by Sahni (1934) from the Deccan Intertrappean cherts at Sausar and Mohgaon Kalan, M.P. and confirmed that Massultites is a Massula and Sausarospermum is the megaspore of fossil Salvinia belonging to Tertiary age. Chitale (1951) recovered palynoflora from the Tertiary Mohgaonkalan Beds of the Deccan Intertrappeans series of the Chindwara district. 26 different kinds of spores and pollens recognised belong to pteridophytes, gymnosperms and angiosperms. He further (1957) reported additional fossil spores and pollens from the same beds of Deccan Intertrappean series. Dwivedi and Shukla (1958) made a detailed study of the morphology of the pollen grains of the silicified flower Sahnianthus parijai from the Deccan intertrappean beds of India. Trivedi (1959) described fossil pollen grains closely resembling the pollen of Acacia longifolia from a Tertiary tuffaceous limestone near Udaipur. He further (1962) reported additional pollen grains and fungal spores from the same beds.

Baksi (1962) recovered spores, pollens and other microfossils from the sediments exposed in the Simsang river section in south Shillong front, Assam and recognised four

distinct (Middle Eocene - Miocene) zones in this area. Biswas (1962) described many new genera and species of fossil spores and pollens from Mahadeo, Langpar, Cherra and Tura Formations, Assam ranging in age from Upper Cretaceous to Eocene and also discussed the palaeocological significance of the palynoflora. Chatterjee and Ghosh (1962) described fungal spores from the Eocene coal in Garo Hills, Assam. Pareek (1962) recorded various fungal Sclerotia and fungal spores from a palynological study of the Eocene Palana lignites in Rajasthan. Mathur, K. (1963) reported occurrence of Pediastrum cf. bifidites from the Eocene sediments of Himachal Pradesh. Mathur, Y.K. (1963) recovered spores and pollens from the gypseous shales of Matanomadh -Chhasra area in Western Kutch. Based on his palynofossil studies, he assigned Eocene age to the sediments and postulated a subtropical to Tropical climate.

Bose and Sah (1964) described palynofossils from carbonised shale samples from Laitryngew, Assam and assigned an Upper Cretaceous or Early Eocene age to the sediments. While Lukose (1964) described new species Schizaea kashmiriensis n.sp. from Wakkachu Travevse, Ladakh District, Jammu and Kashmir and assigned an Upper Mesozoic age.

Banerjee (1964) made a palynological investigation of Tura Formation of Simsang river section, Assam and recovered several spores and pollens. Based on his studies a Lower Tertiary (Middle to Upper Eocene) age is assigned to Tura Formation.

Baksi (1965) based on the results of his palynological investigation recognised four distinct palynological zones (I-IV) ranging in age from Middle Eocene to Miocene in the southern part of Shillong plateau (Barail Series). Varma and Srivastava (1965) described a new palynotaxa Pediastrum delicatites var. majus var. nov. from the cutting samples (Eocene to Miocene) of Ankleshwar Deep Well No. 65, Western India.

Banerjee (1966) described spores and pollen grains from Port Blair Formation (Paleogene), Baratang Island, Andamans and correlated with the ones of Paleogenes of Assam and indicated similarity of spores and pollens of these two areas throwing light on the their isoclimatic nature and similar type of vegetation.

Mathur Y.K. (1966) described spores and pollens recorded from the supratrappean rocks exposed in the vicinity of Matanomadh, western Kutch. Based on this palynological studies, he assigned a Palaeocene age to the sediments and ,

suggested that the sedimentation took place under subaquatic to terrestrial conditions.

Sen (1966) described fossil fungal remains of Microthyriaceae in the Eocene to Oligocene sediments of wells drilled in the western India and also recorded the associated pteridophytic spores, gymnospermous and angiospermous pollen grains and interpreted the paleoecological and palaeo climatological conditions prevailed during that period.

Banerjee (1967) reported palynofossils from the Baratang Formation in the middle Andaman Isles. The palynoflora indicated an Upper Cretaceous age to the formation and facilitated interpretation of paleoecological and paleoclimatological conditions during that period.

Again Banerjee and Misra (1968) described spores, pollens and phytoplankton recovered from subsurface sediments of the Cauvery Basin and assigned Middle to Upper Cretaceous age to the sediments. Venkatachala and Kar (1968) described a fossil pollen comparable to pollen of *Barringtonia* from the Laki sediments of Kutch, Gujarat, belonging to Eocene age and also envisaged tropical swampy environment for these sediments. Again Venkatachala and Kar (1968) presented a systematic palynology of spores and pollens recovered from the sediments of Bore hole No.14 drilled near Matanamadh,

Kutch, Gujarat and assigned Eocene age to the sediments. Banerjee and Misra (1968) recorded a rich assemblage of Cretaceous palynomorphs from a well drilled near Karikal, South India. They have compared the palynofossil assemblage recorded with upper to middle Cretaceous forms described from various parts of the world. From the assemblage they have inferred that the vegetation in their study area was of a temperate to subtropical, warm and humid nature growing in marshes as well as fresh water lakes or ponds. Saccate grains recorded, have suggested a more or less elevated topography which supported a temperature to subtropical gymnospermous vegetation.

Ghosh (1969) studied spore and pollen assemblage of Tertiary coals from Darranggiri and Rongrenggiri coal fields in the Garo Hills, Assam. The assemblage suggested a middle Eocene age for the Tura Sandstone Formation and indicated a warm humid climate in the study area.

Mahabale (1969) described two celled spores of a fossil fungus Diplodia rodei sp. nov from the Deccan intertrappean cherts (Eocene) of Mohgaonkolan, Chindwara district, Madhya Pradesh. Sah and Kar (1969) gave a systematic description of pteridophytic spores recovered from the core samples from the Laki Series of Kutch. A Paleocene to Lower Eocene age is

assigned to the Laki Series on the basis of the rich palynofloral assemblage and prevalence of moist tropical climate and an estuarine or nearshore environments of deposition are envisaged.

Salujha, Srivastava and Rawat (1969) made a palynological investigation of the Sabathu sediments exposed in Simla Hills. A total of 28 genera and 45 species of spores, pollen hystrichosphaerids and algal remains are recorded and illustrated and a Lower Eocene age is assigned to the sediments. A shallow marine depositional environment in a subtropical climate is envisaged for their study area. Jain and Subraraman (1969) recorded pteridophytic spores, gymnosperm pollen grains and other microplankton from grey shales collected from a limestone Quarry at Dalmiapuram, Trichnopoly District, South India. Based on their study they assigned a lower Cretaceous (Aptian) age to the Dalmiapuram Grey shale assemblage.

Baksi and Venkatachala (1970) described a new spore genus Meyeripollis naharkotensis Gen et. sp. nov. from the Tertiary sediments of Assam. They recorded the stratigraphic range of this genus as Upper Eocene - Miocene with a maximum occurrence in the Oligocene.

Banerjee, Misra and Koshal (1973) gave a brief account of the palynological studies carried out on the subcrops of Upper Assam. On the basis of palynofossils recorded, the subsurface sequence has been divided into three or four broad palynological zones. The lowest zone (Pal. Zone IV) has been dated as Middle to Upper Eocene on the basis of the common occurrence of certain spores and pollens. The other three zones have been dated as Oligocene to Recent. They have interpreted the paleoecological conditions based on the distributional pattern of the taxa. Baksi (1971) made a study of spores, pollen and associated microfossils of the subcrop sediments of Bengal basin ranging in age from Upper Cretaceous to Plio-Pleistocene. Based on his Palynological investigation he recognised seven distinct palynological assemblage zones, of which Zone I belongs to Upper Cretaceous age and Zones II and III belong to Palaeocene to Upper Eocene. Based on the evidences of palynological elements some inferences on the paleoecology of these flora and also paleogeography and paleotectonics of the area are discussed.

Venkatachala (1973) recorded palynological assemblages from Neyveli lignite and based on these evidences, he concluded that the lower limit of Neyveli lignite and the associated Cuddalore Sandstone extend upto Eocene. Jain, Kar and Sah (1973) described 22 species of dispersed spores and

pollen grains from a dark carbonaceous clay exposed in a well at the base of Barmer Hill, Rajasthan and assigned a Paleocene age for the Clay Bed.

Venkatachala and Sharma (1974) recognised 58 genera and 85 species of palynofossils including 43 new species from sub-surface sediments of Vridhachalam area, Cauvery basin. He recorded Neocomian assemblage from the Periyavadavadi shallow well; Aptian-Lower Albian assemblage in Periyavadavadi, Rupnarayanaliur and Puvanur wells; Lower Senonian age to assemblage 2 in the Puvanur well and Maestrichtian age to Scollardia conferta Zone in the Kallamedu well. Again Venkatachala and Sharma (1974) described palynological assemblages from the subsurface sediments of Pondicherry area and recognised 86 genera and 127 species of which 3 genera and 48 species are recorded as new ones. He assigned Upper Albian to Maestrichtian age to various zones occurring in Vridhachalam area.

Sah and Singh (1974) discovered rich palynofossil assemblages in the Tura Formation in the Garo Hills, Assam and based on their study on the lithology and palynology they assigned Lower Eocene age to Tura Formation. Sen and Sah (1974) studied Tertiary rocks in the Jowai - Badarpur Road section of the Shillong plateau, Assam. From a detailed

palynological study they indicated a palynological demarcation of the Eocene - Oligocene sediments in the area.

Koshal (1980) recorded palynofossils from the subsurface sediments of Dabka, Gujarat and recognised six palynozones and assigned Lower Eocene to Pleistocene age to the subsurface sequence. The Polospore assemblage recognized has suggested for the interpretation of tropical to sub-tropical climate having more or less flat topography in their study area.

Baksi and Deb (1980-81) made a systematic study of the palynology of the Upper Cretaceous subcrop sedimentary sequence of the Bengal basin and described thirty nine species of palynotaxa. They have established two distinct palynological assemblage zones a Lower Aquilapollenites indicus Zone and an Upper Mulleripollis Zone in their study area.

Koshal and Uniyal (1984) described the Paleocene - Early Eocene palynofossils in the sub-surface of North Cambay basin, Gujarat. The floral assemblage indicates coastal vegetation and transitional environment during deposition of the sediments in Paleocene - Early Eocene time in the sub-surface of North Cambay basin.

Nandi (1990) studied the palynomorphs recorded from the Upper Cretaceous sequences exposed on the Southern Shillong plateau, Meghalaya, North-eastern India and recognised six successive assemblage zones. The distributional pattern of the palynomorphs and phytoplanktons has facilitated for the interpretation of paleoecology and depositional environment in their study area.