

PALEOECOLOGY OF THE TERTIARY SEDIMENTS IN A MATWAN WELL, SOUTH GUJARAT

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ABSTRACT

Paleoecology has been interpreted with the help of frequency and diversity curves of microfauna. Four transgressive peaks corresponding to Early Eocene, Late Eocene—Early Oligocene, Early Miocene and Middle Miocene are noticed. Middle Eocene, Late Oligocene and partly Early Eocene sediments were deposited mainly in regressive waters of marginal marine nature. Seven biozones namely (1) *Nummulites burdigalensis*—*Leguminocythereis lutejensis* in Early Eocene, (2) *Operculina* sp.—*Rotalia* sp. in Middle Eocene, (3) *Nummulites fabianii*—*Discocyclina* sp. in Late Eocene, (4) *N. fabianii* (γ -form) in Early Oligocene, (5) *Rotalia*, sp., Miliolids and Gastropods in Late Oligocene—Early Miocene, (6) *Ammonia papillosus* in Early Miocene and (7) *Ammonia annectens* in Middle Miocene, are recognised.

INTRODUCTION

Frequency and diversity curves of microfossils have proved to be of help to infer the transgression and regression in the well section of a Matwan well. The basic idea being that the presence of marine fossils in good number indicates presence of a marine water and vice versa. So, the peaks on the frequency curve represent marine deposits. On the contrary, the flatness of the curve represents continental, non-marine or marginal marine deposition according to the nature of the curve and fauna. The use of diversity curve was introduced by Walton (in Imbri & Newell, 1964, pp 228-231, Text fig. 29). Irrespective of absolute values, the number of species increases in offshore direction. Hence, a peak on this curve indicates deeper marine environment of deposition, but paucity of species indicates shallow water or regression (ibid, p. 214).

On above basis the paleoecological interpretation has been carried out in the said well section. Besides, geological history has also been discussed in brief.

METHOD OF STUDY

10 gms samples of well cuttings and cores (wherever available) were processed at about 20 meters interval. Frequency (Total No. of forms) and diversity (No. of species) were obtained for each sample. These two parameters were plotted depthwise (Fig. 1). The environment curve was drawn on the basis of these two curves. Biozones were demarcated between first appearance and disappearance levels of key species. The Formations have been differentiated on the basis of electrologs, well

completion report, lithological and palaeontological data, and are shown in Figure 1.

PALEOECOLOGY

This location falls geologically in the southern Cambay basin. The basement formation is the Deccan Trap extrusive of Late Cretaceous/Paleocene period. It has been touched, here, at 2065 m. depth. Above it sedimentary deposition started from Paleocene period. About 50 m. sediments overlying it, constitute Vagadkhol Formation. They constitute carbonaceous shale, siltstone and trapwacke. They are devoid of animal fossils. (Sporadic fauna recorded in cutting samples are considered to have come from above). Some polospores like *Polyodiaceae Palmepollenites eocenicus* and *Dicolopites*, indicative of near shore continental environment, have been recorded.

Thus, the Vagadkhol formation was deposited in a near shore continental basin in Paleocene/Early Eocene period.

The marine water encroached this area for the first time in Early Eocene time and Cambay Shale Formation was deposited on the Vagadkhol Formation. Here, it is about 675 m. thick ranging in age from Early Eocene to Middle Eocene. It is represented by thick monotonous shale, which is black, pyritic, carbonaceous and at places silty with high organic content. Between 1800—2000 m. samples were not collected. 2000—2005 m. has yielded flora of marginal marine nature.

The interval 1580—1780 m. was deposited in transgressive waters of infralittoral zone with comparatively

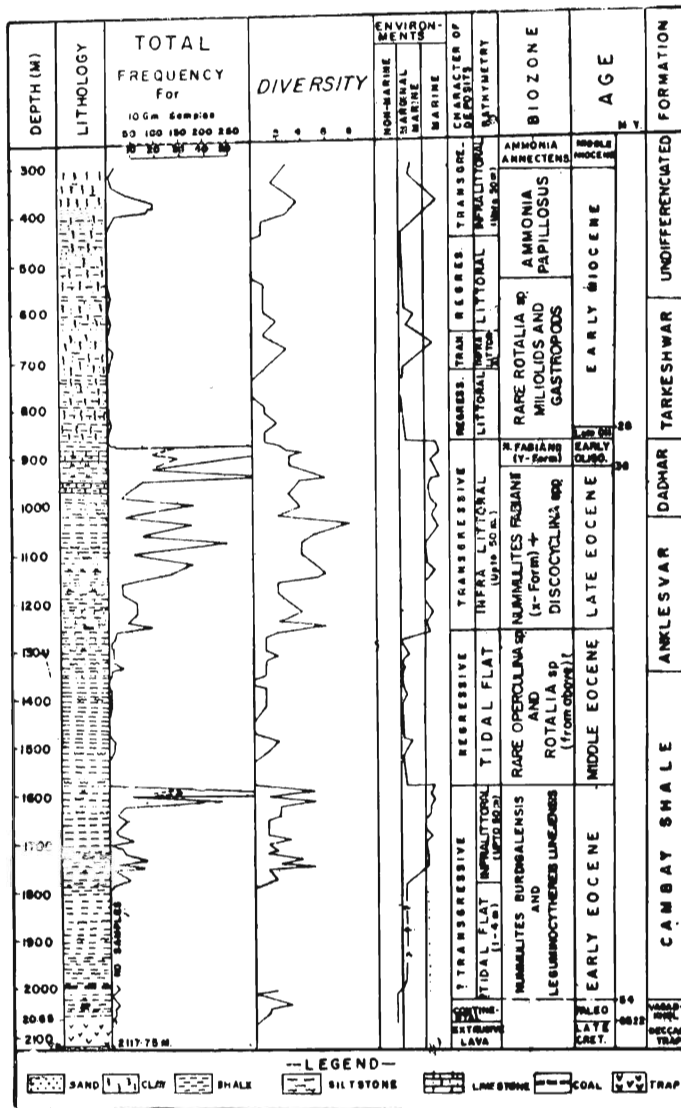


Fig. 1. Paleocology of the Tertiary Sequence encountered in Matwan Well Section.

calm bottom. *Nummulites burdigalensis* and *Leguminocythereis lunjensis* of Early Eocene are the leading fauna present in it.

The portion of Cambay Shale above this transgression has not yielded index fauna. A few *Operculina* sp. and *Rotalia* sp. have been recorded. Frequency and diversity is poor, indicating regression. From this section, some polo-spores like *Hystrichosphaerids*, *Nymphaeaceae* and *Potamogetonaceae* have been recorded. They indicate Middle Eocene age and shallow marine environment with intermingling of fresh water.

From the above, it may be concluded that out of about 675 m. of Cambay Shale at the present location, only about 200 m. (1580-1780 m.) was deposited in shallow marine, infralittoral waters and the rest was deposited in tidal flat marginal marine water.

About 80 m. sediments, overlying the Cambay Shale

are silty and shaly sands, belonging to the Middle Eocene regression. They indicate littoral environment of deposition.

The Late Eocene-Early Oligocene marine transgression started from 1260 m. and continued up to 880 m. This was of the largest duration. *Nummulites fabianii* (X-form) and *Discocyclus* sp. assemblage of Late Eocene and *Nummulites fabianii* (y-form) of Early Oligocene have been recorded in it. The lower portion of it is represented by Ankleshwar Formation and upper by Dadhar Formation. The sediments and fauna of this zone are indicative of infralittoral environment of deposition with well oxygenated warm water.

A long regression follows this Late Eocene—Early Oligocene transgression. Two small transgressive impulses have, however, been noticed in Early Miocene. 30 m. sediments overlying early Oligocene have been assigned Late Oligocene age on palynological basis. The first Early Miocene transgression has not yielded index fauna. The last Early Miocene transgression is represented by *Ammonia papillosus*. This is replaced by *Ammonia annectens* of Middle Miocene age around 315 m./depth. The transgressive Miocene sediments were deposited in infralittoral environment while regressive ones in littoral environment.

GEOLOGICAL HISTORY

At this location, sedimentation started on the Deccan Trap basement in the Paleocene period in continental freshwater environment. The resultant deposits are represented by Vagadkhol Formation. The sea encroached this area gradually in the Early Eocene time and Cambay Shale Formation was deposited in tidal flat environment, mainly. A portion of the Cambay Shale (1580—1780 m.) was deposited in shallow marine environment. After deposition of the Cambay Shale, the sea started encroaching this area again. The Ankleshwar and Dadhar Formations were deposited mainly in infralittoral waters in Late Eocene—Early Oligocene times.

Late Oligocene and Early Miocene sediments represented by Tarkeshwar Formation were deposited mainly in regressive phases. About 150 m. of the Tarkeshwar Formation was deposited in transgressive phase, as shown in Fig. 1. Early and Middle Miocene sediments above the Tarkeshwar formation up to 300 m. were deposited in littoral and infralittoral waters. Paleocology above 300 m. could not be interpreted due to lack of samples.

ACKNOWLEDGEMENT

The author is obliged to Shri C. K. R. Sastri, General Manager, ONGC, Western Region, Baroda for kind permission to publish this paper. He is specially thankful to Dr. S. Ramanathan, Chief Geologist for useful suggestions and guidance, without which the paper was

not possible in the present form and finally, his kind permission for publication. He is very much thankful to Shri D. K. Guha, Dy. Suptdg. Geologist for encouragement. Thanks are due to Dr. J. Pandey and Shri N. P. Singh, Sr. Geologists for discussion. He is highly thankful to Shri V. N. Koshal, Asstt. Palynologist for studying some samples for the paper.

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