BIOSTRATIGRAPHIC POSITION OF LATE OLIGOCENE STRATA IN THE VINJHAN-MIANI AREA OF KUTCH, GUJARAT, WESTERN INDIA

A. K. JAUHARI
Geology Department, Lucknow University, Lucknow 226 007

ABSTRACT

The Late Oligocene at Vinjan-Miani is represented by a sequence of thin horizons directly overlying the Middle Eocene rocks. The larger foraminiferal fauna recorded from them suggests that the late Oliogocene horizons in the present area range from zone P. 21 to zone P. 22 on planktonic foraminiferal zonation scheme of Blow[1].

INTRODUCTION

THE Middle Eocene rocks at Vinjhan-Miani are followed by a thin sequence of beds composed of hard, dark brown marls and soft, yellow marls referable to the latest part of Oliogocene epoch. The exposures of the above horizons are found 1 km. ENE of Khirasra village. The sequence is recorded as follows:—

TABLE I

Late Oliogcene	Soft, yellow marl bed ..... Hard, dark brown marl bed	1 m.
Middle Eocene	Dirty white and yellow, soft marl	2 m
	.....	
Eocene	Yellow, hard, fossiliferous limestone	4 m

PALAEONTOLOGY

Both the hard marl unit (lower unit) as well as soft marl unit (upper unit) express similarity in their megafossil content, *i.e.*, the bivalve shells, which show affinity with *Pecten*, are quite common in them. The foraminiferal composition, though much uniform so far as the major part of fauna is concerned, reveals some striking forms which make these beds as distinct units with respect to time. These units, besides containing a few important larger foraminifera, have yielded 31 species of smaller foraminifera, which are hardly of any stratigraphic interest. The names of the smaller foraminifers are as follows (Jauhari[4]): *Spiroloculina* sp., *Quinqueloculina barkhana* Mohan and Bhatt, *Quinqueloculina* aff. *Q. panamensis* Cushman, *Triloculina* sp. A., *Triloculina* sp. B, *Triloculina globosa* Jauhari, *Pyrgo bulloides* (d'Orbigny), *Miliola* sp., *Globulina inflata* Reuss, *Globulina* aff. *Globulina tropicale*, Petri, *Eoeponidella hemisphaerica* (Cushman), *Discorbis* aff. *D. propinqua* (Terquem) emend. Le Calvez, *Discorbis* sp., *Rotalia* sp., *Elphidium* cf. *Elphidium chilenum* Todd and Kniker, *Cibicidina* aff. *Cibicidina abnornis* (Pishvanova), *Cibicides blowi* n.sp., *Cibicides brahmai* n.sp., *Cibicides* sp. A., *Cibicides* sp. B., *Cibicides* sp. C., *Cibicides* sp. D., *Cibicides carinatus* (Terquem) emend. Le Calvez, *Cibicides lobatulus* (Walker and Jones), *Cibicides lobatulus constricta* n. subsp., *Cibicides megaloperforatus* Said and Kenawy, *Cibicides* aff. *Cibicides molacus* Poag, *Sphaerogypsina globulus* (Reuss), *Florilus sastrii* Jauhari, *Anonalinella* Kutchensis Singh and Saxena and *Anomalinella* sp.

So far as the larger foraminifera are concerned, the writer[4] observed the presence of *Spiroclypeus ranjanae*, *Lepidocyclina* (*Lepidocyclina*) sp., and *Miogypsinoides complanata* in the hard, dark brown marl unit (Lower unit) and that of *Spiroclypeus ranjanae* only in the soft, yellow marl unit (Upper unit). Pratap Singh (Personal communication), who recently examined the samples belonging to the above rock units, has noticed the presence of a few more forms which are of significance in biostratigraphic correlation. According to his observation, *Miogypsinoides bantamensis* is also present in the lower unit and continues above, whereas *Miogypsina gunteri* is an additional form in the upper unit besides *S. ranjanae* and *Miogypsinoides batamensis*. As a consequence, the hard, drak brown marl unit contains *Miogypsinoides complanata*, *Miogypsinoides bantamenasis*, *Spriroclypeus ranjanae* and *Lepidoscyclina* (*Lepidocyclina*) sp., whereas ths soft, yellow marl unit is characterized by *Spriroclypeus ranjanae*, *Miogypsinoides bantamensis* and *Miogypsina gunteri* (see Table II).

BIOSTRATIGRAPHIC CORRELATION

In Kutch, the Oligocene biostratigraphy has been attempted with the help of larger foraminifera. According to Raju *et al.*[5] three distinct larger foraminiferal zones representing Lattorfian, Rupelian and Chattian stages of the Oligocene can be established in Kutch.

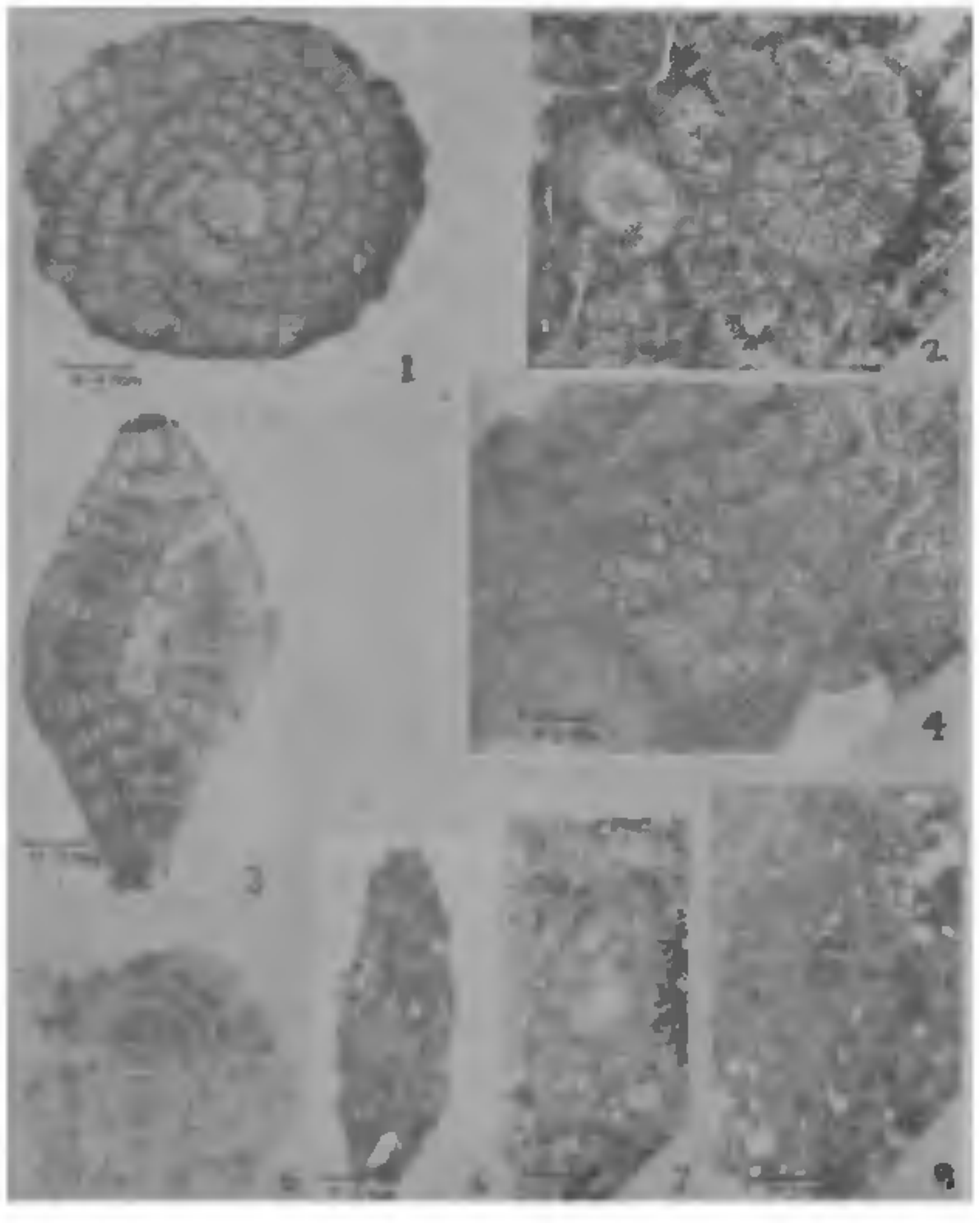
Miogypsinoides complanata zone
Nummulites intermedius-fichteli-Lepidocyclina (*Eulepidina*) assemblage zone
Nummulites intermedius-fichteli zone

Prior to discussing the biostratigraphic correlation, it is necessary to discuss the age of *Spiroclypeus ranjanae* present in great abundance in the horizons under study. Its age has been interpreted differently by different workers. Tewari[6] considered it Aquitarian in age. Chatterji and Mathur[2] observed that it ranged from Chattian to Aquitanian. Tewari and Singh[7] found

TABLE II

Epoch	Stage	Plank. Foram. zone	Lithounit	Microfauna
Late oligocene	Bormidian	P. 22	Soft, yellow marl unit	*Miogypsinoides bantamensis, spiroclypeus ranjanae* and *Miogypsina gunteri*
		P. 21	Hard, dark brown marl unit	*Migypsinoides complanata, M. bantamensis, Spiroclypeus ranjanae* and *Lepidocyclina* (*Lepidocyclina*) sp.

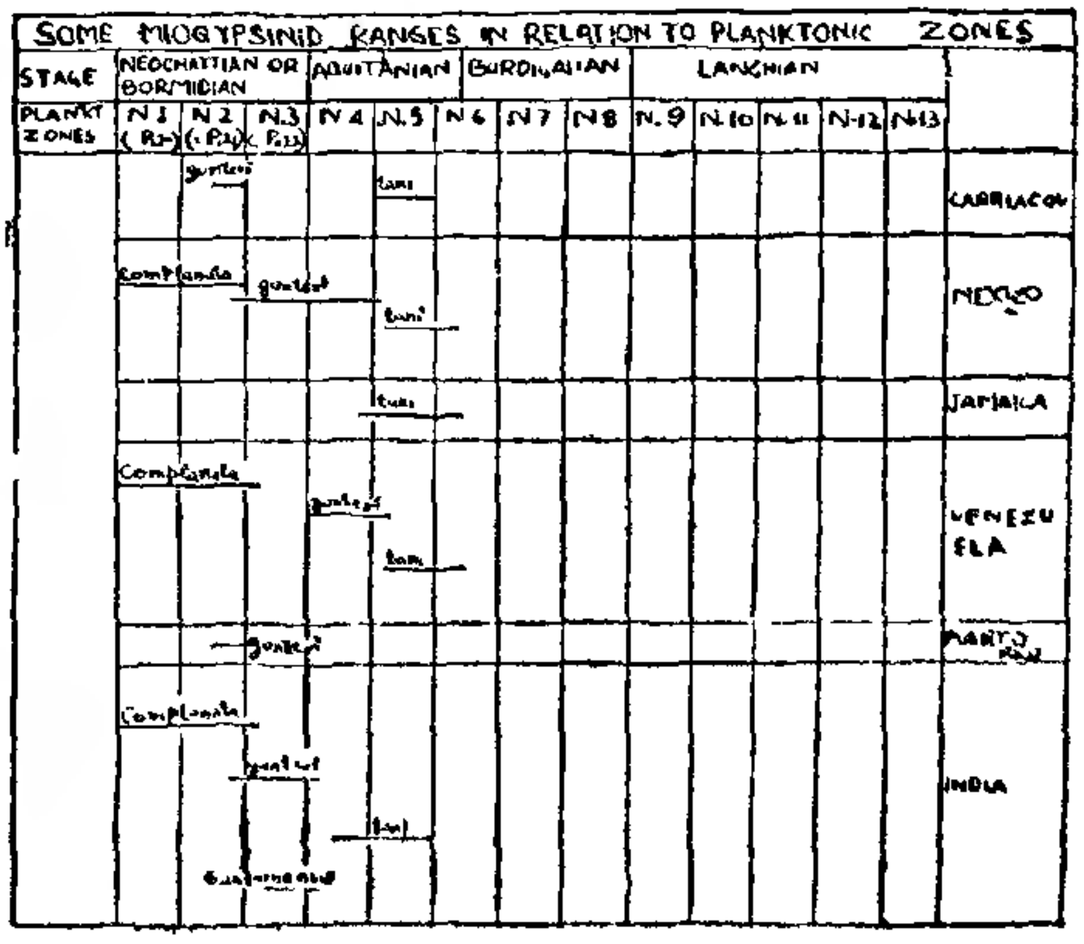
Spiroclypeus ranjanae in association with *Heterostegina* (*Vlerkina*) aff. *H.* (*V.*) *involutiformis* and *H.* (*V.*) *gajensis* and observed that since the bed (also called '*Spiroclypeus ranjanae* bed') containing these forms is seen below *Globigerinoides* datum line, *Spiroclypeus ranjanae* may very likely belong to Chattian-Bormidian stages (Late Oligocene). However, the recent work carried out in the Western Offshore region by Oil and Natural Gas Commission shows that *Spiroclypeus ranjanae* ranges from the top of zone P. 19 (*i.e.*, below the base of P. 20) to the top of zone N. 5 (Middle Oligocene to Early Miocene).



FIGS. 1–8. Figs. 1, 3. *Spiroclypeus ranjanae* Tewari. Fig. 1. Equatorial section, × 45; Fig. 3. Axial section, × 50. Figs. 2, 4. *Miogypsinoides complanata* (Schlumberger). Fig. 2. Equatorial section, × 65. Fig. 4. Equatorial section, × 50. Figs. 5–8. *Lepidocyclina* (*Lepidocyclina*) sp. Fig. 5. Equatorial section × 50. Fig. 6. Axial section, × 50. Fig. 7. Axial section, × 24. Fig. 8. Axial section, × 24.

From the preceding paragraph, it is obvious that *Spiroclypeus ranjanae*, though present in great abundance in both the rock units, does not provide as precise an age for the beds under study as the forms like *Miogypsinoides complanata, M. bantamensis* and *Miogypsina gunteri*. *Miogypsinoides complanata* which appears at the base of P. 20 goes to the top of P. 21; however, at places it has been found to continue to the earliest part of P. 22 only. *Miogypsinoides bantamensis* which has evolved from *M. complanata* makes its appearance at the latest part of P. 21 and disappears at the base of N. 4. *Miogypsina gunteri* (*Miogypsina* s.s.) ranges from the top of zone P. 21 to the base of zone N. 4. The zone P. 22 is characterised by the appearance of *Miogypsina* s.s. It lies below the *Globigerinoides* appearance level, *i.e.*, N. 4 which marks the base of Aquitanian (Early Miocene) (see Table III, see Clarke and Blow[3]).

TABLE III*



* Modified after Clarke and Blow[3].

The aforesaid biostratigraphic ranges of the larger foraminifera present in the rock units under study appear to be useful in defining the biostratigraphic position of these beds and in correlating them to

planktonic foraminiferal zones of Blow[1], to European stages, and to East Indian Letter Stage classification of the Tertiary (Clarke and Blow[3]). The hard, dark brown marl bed (Lower unit) which contains *Spiroclypeus ranjanae*, *M. complanata*, *M. bantamensis*, etc., is referable to zone P. 21 on the basis of *M. complanata*, while the soft, yellow marl bed (Upper unit) containing *M. bantamensis*, *S. ranjanae* and *Miogypsina gunteri* can be considered close to znoe P. 22 on the basis of *M. gunteri* and *M. bantamensis*. The zones P. 21 and P. 22 refer to the latter part of Bormidian stage of Late Oligocene. The lower and upper units can, therefore, be dated as Late Oligocene (Bormidian). In East Indian Letter Stage classification of Tertiary, the above rock units are also comparable with the latter part of "Lower" Te (Te 1–4).

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A NEW AND SIMPLE TECHNIQUE FOR AMNIOTIC INOCULATION OF CHICK EMBRYO

B. LALITHA RAO

National Institute of Virology, 20–A, Dr. Ambedkar Road, Pune 411 001, *India*

ABSTRACT

A new and simple technique of amniotic inoculation of chick embryo without the aid of transilluminated egg candler at the time of inoculation is described. The chief advantage of this technique is that it can be done in light and only a hole has to be made for inoculation whereas the earlier techniques of amniotic inoculation described have to be done in darkness or a flap of egg shell has to be removed before inoculation which are cumbersome and inconvenient. This new technique is as simple as the allantoic method of egg inoculation and hence it may be used for virological work. Amniotic route of chick embryo inoculation is commonly employed for isolation of influenza types A, B, C and mumps viruses and for passage of influenza isolates until they get adapted. Allantoic route of chick embryo inoculation is employed for isolation and antigen preparation of influenza types A and B. However, it is not suitable for isolation and antigen preparation of influenza type C which has to be done only by amniotic inoculation.

INTRODUCTION

THE method of cultivating many important viruses in embryonated hens' eggs has widened the scope of virological investigations and research which otherwise had to be carried out mainly in animals. There are four major routes of chick embryo inoculation allantoic, amniotic, yolk sac and chorioallantoic. In addition, intravenous, intraembryonic, intracerebral or intraocular methods of chick embryo inoculation (Rhodes and Van Rooyen[1]) are also used.

Amniotic route of inoculation is commonly used for primary isolation of influenza and mumps viruses and for the passage of influenza isolates until they become egg adapted and for production of influenza C antigens. By this route the virus inoculum is brought directly in contact with the embryo and its developing alimentary and respiratory tracts.

There are two methods of amniotic inoculations described earlier and are employed routinely. One is the open method in which a flap of shell is flipped off at the air sac end of the chicke mbryo and the shell membrane is swabbed with sterile liquid paraffin, the egg is held close to the transilluminated candler and the virus is inoculated. The inoculation by this method can also be done without the aid of transilluminated candler (Grist *et al.*[2]). In the second