PLANKTIC FORAMINIFERA AND CALCAREOUS NANNOPLANKTON BIOSTRATIGRAPHY OF THE NEOGENE OF MEXICO

ADDENDUM TO PART I — SOME ADDITIONAL MID-PLIOCENE LOCALITIES AND FURTHER DISCUSSION ON THE AGUEGUEXQUITE AND CONCEPCION SUPERIOR BEDS.

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The youngest exposed beds in Mexico of bathyal and outer neritic origin are the Agueguexquite, Filisola, Concepcion Superior, and Concepcion Inferior "Formations." Pioneer geologists referred these outcropping strata to various parts of the geological column, but planktic guide fossils now provide a precise basis for the assignment of these beds to Neogene Zone 20, approximately middle Pliocene, as recognized in the Initial Reports of the Deep Sea Drilling Program.

The above strata, in addition to older Neogene beds to be discussed in later parts of this series, comprise the Coatzacoalcos Formation, as erected by Spencer (1897, p. 23-25) for the marine clays that in some places rest upon decomposed gneisses and are exposed in highway, railway, pipeline, and stream cuts in the Isthmus of Tehuantepec. Later names, including Agueguexquite, Filisola, Concepcion Superior, and Concepcion Inferior, have been applied to paleontologic subdivisions of the Coatzacoalcos Formation (based on benthic foraminifera), and they are, therefore, invalid in a strict sense as names of formations.

Most of the planktic foraminifera and calcareous nannofossils that occur in the middle Pliocene of Mexico are not restricted to this portion of the geological column but have their evolutionary first occurrences in older sediments and continued to live into later Pliocene or Quaternary times. Some of the planktic microfossils, however, had either their incipience or their extinction during the middle Pliocene, and the concurrence of these forms in beds within middle and low latitudes indicates a stratigraphic position within Zone N. 20 (middle Pliocene). The following forms have been found particularly useful, as follows, for the recognition of Zone N. 20 in Mexico (fig. 1): The latest occurrence of the planktic foraminifera *Globorotalia (G.) margaritae* Bolli and Bermúdez and *Sphaeroidinellopsis subdehiscens subdehiscens* (Blow) is in Zone N. 20; the calcareous nannoplankton *Sphenolithus abies* Deflandre and *Reticulofenestra pseudoumbilica* (Gartner) are last seen in Zone N. 20; the incipience of two species of calcareous nannofossils, *Gephyrocapsa caribbeanica* Boudreaux and Hay and *Pleudoemiliania lacunosa* (Kamptner), occurred within Zone N. 20, and these forms became more abundant during the upper Pliocene and Quaternary.

Three additional sites have been visited and sampled subsequently to my report on the middle Pliocene, and they should be added to the localities already described under this heading (Akers, 1979). Two of the exposures (TU 1317 and TU 1318) are in the vicinity of TU 1025, which is the Concepcion Inferior of Contreras Velazques *et al.* (1956, p. 176), and were made accessible by new pipeline construction. The lithology at both additional localities is a medium gray clay with black, carbonaceous plant inclusions. Residues on a U. S. Standard Sieve Series, no. 200, are predominantly carbonaceous plant material with some small mollusks. See below for the lithology at TU 1321.

LOCALITY TU 1317

Pipeline cut on hill just west of Nueva Teapa on north side of Mexico Highway 180, state of Veracruz, Mexico. Collected, 1979, by H. E. and E. H. Vokes. The following planktic foraminifera were identified:

Biorbulina bilobata (d'Orbigny)
Globigerina decoraperta Takayanagi and Saito
Globigerinita glutinata (Egger)
Globigerinoides conglobatus conglobatus (Brady)
G. obliquus extremus Bolli and Bermúdez
G. quadrilobatus quadrilobatus (d'Orbigny)
Globoquadrina altispira altispira Bolli
Globorotalia (G.) cultrata menardii (Parker, Jones and Brady)
G. (G.) margaritae Bolli and Bermúdez
G. (Turborotalia) acostaensis acostaensis Blow

G. (T.) acostaensis humerosa Takayanagi and Saito
Hastigerina (H.) siphonifera siphonifera (d'Orbigny)
Orbulina universa d'Orbigny
Prosphaeroidinella parkerae Ujiie
Sphaeroidinellopsis subdehiscens subdehiscens (Blow)

A partial list of the calcareous nannofossils includes the following:

Discoaster browneri Tan
D. pentaradiatus Tan
D. surculus Martini and Bramlette
Pseudoemiliania lacunosa (Kamptner)
Sphenolithus abies Deflandre

LOCALITY TU 1318

Hill cut on pipeline northeast of Campo El Chapo, 4 kilometers south of Mexico Highway 180, at Nueva Teapa, state of Veracruz, Mexico. Collected, 1979, by H. E. and E. H. Vokes. The residue of this sample on a no. 200 sieve contains much chlorite and some echinoid fragments, in addition to carbonaceous material and mollusk fragments. The following planktic foraminifera were identified:

Globigerina decoraperta Takayanagi and Saito
Globigerinoides obliquus extremus Bolli and Bermúdez
G. obliquus obliquus Bolli
G. quadrilobatus quadrilobatus (d'Orbigny)
Globoquadrina altispira altispira Bolli
Globorotalia (G.) cultrata menardii (Parker, Jones and Brady)
G. (G.) margaritae Bolli and Bermúdez
G. (Turborotalia) acostaensis acostaensis (Blow)
G. (T.) acostaensis humerosa Takayanagi and Saito
Hastigerina (H.) siphonifera siphonifera (d'Orbigny)
Orbulina universa d'Orbigny

The following calcareous nannofossils were identified:

Discoaster pentaradiatus Tan
D. surculus Martini and Bramlette
Gephyrocapsa caribbeanica Boudreaux and Hay
Helicopontosphaera sellii Bukry and Bramlette
Pseudoemiliania lacunosa (Kamptner)
Reticulofenestra pseudoumbilica (Gartner)
Sphenolithus abies Deflandre

LOCALITY TU 1321

Kilometer 70 on the Trans-Isthmus railroad, south of Coatzacoalcos. The site is a railroad cut, both sides of the tracks, five kilometers north of Almagres, state of Veracruz, Mexico. Collected in 1979 by E. H. Vokes and W. H. Akers. The weathered lithology is a light buff clay. This locality was first collected (for mollusks) in 1895 by J. W. Spencer (1897, p. 14, 24), who cited it as "Kilometer 70." Dall (1898, p. 652-653) referred to Spencer's collection, estimating that the beds "were deposited in deep water, probably between one hundred and fifty and four hundred fathoms in depth, judging by analogous recent species." The locality was again visited in 1904, but the clay was so weathered that hardly a shell fragment could be found (Böse, 1910, p. 215). Dall (1898) and Toula (1910, 1911) described elements of the molluscan fauna collected earlier by Spencer. When the locality was visited in 1979 by the writer and E. H. Vokes, foraminifera and calcareous nannofossils were found in abundance, but no trace of the molluscan assemblage was seen. The following planktic foraminifera were identified at TU 1321:

Biorbulina bilobata (d'Orbigny)
Candeina nitida d'Orbigny
Globigerina bulloides bulloides d'Orbigny
Globigerinita glutinata (Egger)
Globigerinoides conglobatus conglobatus (Brady)
G. obliquus extremus Bolli and Bermúdez
G. obliquus obliquus Bolli
G. quadrilobatus quadrilobatus (d'Orbigny)
G. quadrilobatus sacculifer (Brady)
Globoquadrina altispira altispira Bolli
Globorotalia (G.) cultrata menardii (Parker, Jones and Brady)
G. (G.) margaritae Bolli and Bermúdez
G. (G.) miocenica Palmer
G. (G.) multicamerata Cushman and Jarvis
G. (Turborotalia) acostaensis humerosa Takayanagi and Saito
Hastigerina (H.) siphonifera siphonifera (d'Orbigny)
Orbulina universa d'Orbigny
Pulleniatina obliquiloculata (Parker and Jones)
Sphaeroidinellopsis subdehiscens subdehiscens (Blow)

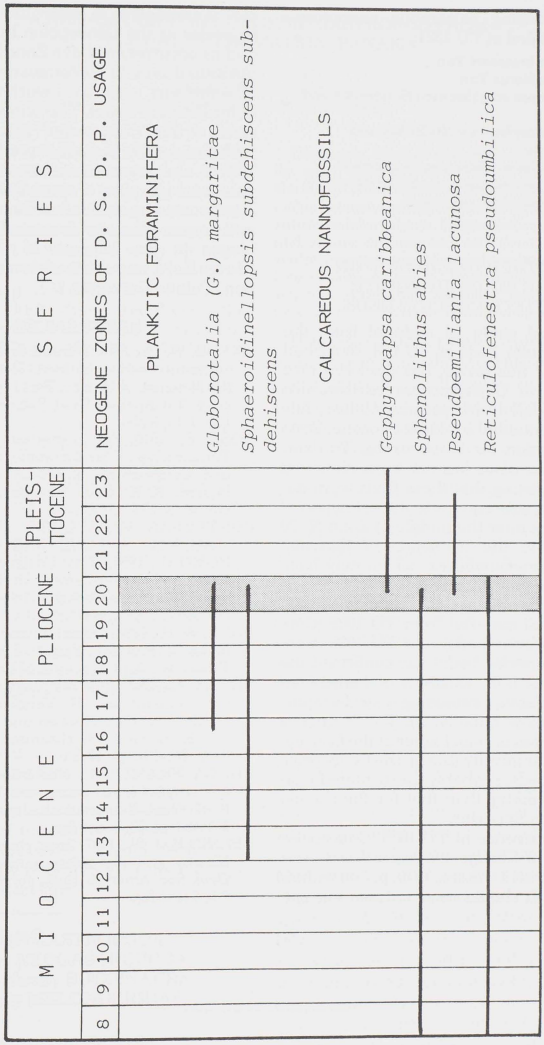

Fig. 1. Ranges of some planktic index fossils in the Neogene of Mexico. The concurrence of combinations of these forms indicates middle Pliocene as recognized in this series of reports.

The following calcareous nannofossils were identified at TU 1321:

Discoaster brouweri Tan
D. pentaradiatus Tan
Gephyrocapsa caribbeanica Boudreaux and Hay
Helicopontosphaera sellii Bukry and Bramlette
Pseudoemiliania lacunosa (Kamptner)
Reticulofenestra pseudoumbilica (Gartner)
Sphenolithus abies Deflandre

FURTHER DISCUSSION ON THE AGUEGUEXQUITE AND CONCEPCION BEDS

Additional study of material from the Agueguexquite beds at TU 638, described in Part I of this series, has disclosed rare specimens of *Gephyrocapsa caribbeanica* and *Reticulofenestra pseudoumbilica*, further substantiating a middle Pliocene, Zone N. 20, position for these strata. To date, *Sphenolithus abies* has not been identified here, suggesting that these beds were deposited just subsequent to the extinction of that species near the middle of Zone N. 20 but prior to the extinction of *Reticulofenestra pseudoumbilica*, which may have occurred higher in Zone N. 20.

Further review of data and examination of additional material from TU 1025 (Concepcion Inferior beds) and TU 1026 (Concepcion Superior beds) has confirmed the existence at both localities of *Pseudoemiliania lacunosa*, precluding a stratigraphic position below Zone N. 20. The frequency of *P. lacunosa* is even higher at the Concepcion Inferior locality than in the Concepcion Superior beds, probably due to more favorable bathymetry than that for the shoaler Concepcion Superior.

The occurrence at TU 1026 (Concepcion Superior) of *Globigerina nepenthes* was reported in Part I (Akers, 1979, p. 7-8) without comment. It should be noted that this species is anomalous in either the Concepcion Superior or the Concepcion Inferior beds, and its occurrence above Zone N. 19 can be attributed only to contamination or mixing of some sort, such as reworking from the older Encanto strata. The occasional occurrence of this "deep-water" planktic species with the neritic benthic assemblage at TU 1026 is also anomalous, moreover, from a paleoecologic point of view. This conclusion is supported by detailed studies on Pliocene and upper Miocene foraminiferal assemblages in the Isthmus of Tehuantepec (Barry Kohl, unpublished doctoral dissertation, Tulane University).

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