

CALIBRATION OF PALEOGENE PALYNOLOGICAL ZONES TO THE MARINE TIME SCALE

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Introduction

The most widely used palynological zonation scheme for the Paleogene of western Venezuela is that of Muller et al. (1987). This scheme presents no evidence for its calibration to the marine time scale but refers back to previous publications. The principal publication that relates the marine fossils to the pollen and spores of this period is Germeraad et al. (1968). This was written before the widespread application of nannofossils and dinoflagellates to biostratigraphic problems and is thus largely based on foraminiferal studies. In the present study we highlight some problems we have encountered in using the palynological zones as presently calibrated. This is very much a work in progress and presented here only for discussion as the authors are aware that other companies are making similar efforts.

Paleocene

Recent consultant reports of an outcrop and well section from Guasare and Marcelina Formations of the Perija have shown the co-occurrence of the dinoflagellate *Hystrichosphaeridium caiobensis* together with the pollen *Gemmastephanocolpites gemmatus* and *G. aff. G. gemmatus*. The dinoflagellate *H. caiobensis* is a junior synonym of *Apectodinium homomorphum* (according to the updated taxonomic revision of Lentin and Williams, 1983).

Germeraad et al. (1968) considered the species *G. gemmatus* restricted to the early to middle Paleocene. However, the reported range of *A. homomorphum* lies within late Paleocene to the middle Eocene (according to Haq et al., 1988).

Paleocene - Eocene

A recent analysis of samples from the outcrop section of the Paso Diablo Fm (equivalent to the Marcelina) has revealed the co-occurrence of the pollen species *Bombacidites annae* (restricted to the Paleocene by Germeraad et al., 1968) and the dinoflagellate species *Adnatosphaeridium multispinosum* (ranging from the early to the middle Eocene according to Williams and Bujak, 1985 and Williams et al., 1993).

Eocene

The species *Rugutricolporites felix* has been used as a key species indicating the Early Eocene Zone 17 (Muller et al., 1987). A recent review of unpublished company reports of the Lake Maracaibo area has shown that this species was observed in middle Eocene sediments.

Another source of controversy involves the observed first appearance of the species *Bombacacidites* sp. B (*sensu* Muller et al., 1987) and *B. soleiformis*. Both species constitute key species for the palynological Zones 19 and 20 of the lower to middle part of the middle Eocene. Recent studies in the eastern Lake Maracaibo area have shown these species to occur below of the first appearances of the nannofossils *Discoaster saipanensis* and *Reticulofenestra reticulata* (middle Eocene NP16). Studies of the Barinas Basin report these species occurring above the first appearances of the same nannofossil species. Furthermore, the spore species *Cicatricosisporites dorogensis* (reported to have its first appearance in the upper part of the middle Eocene Zone 22) have been observed co-occurring with the species *B. soleiformis*. Problems with the correct identification of the species of the genus *Bombacacidites* are the probable source of these discrepancies.

Integration of data derived from nannofossils, foraminifera and palynomorphs (including dinoflagellates) in the eastern Lake Maracaibo area, indicates that Zones 21 and 22 of the middle Eocene can be calibrated with the uppermost part of the Middle Eocene, Zone NP17. This indicates an age younger than that previously considered correct for these zones.

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TIME SCALE

				MULLER ET AL. 1987	
				24	
				23 - 18	
AGE Ma.		LATE	NP 18	P 15	
37				P 14	
38			NP 17	P 13	
39					
40					
41			NP 16C	P 12	
42			NP 16B		
43			NP 16B		
44			NP 15c	P 11	
45			NP 15b	P 10	
46			NP 15a		
47			NP 14b		
48			NP 14a	P 9	
49			NP 13	P 8	
50				P 7	
51			NP 12	P 6b	
52			NP 11	P 6a	
53			NP 10	P 5	
54			NP 9	P 4c	
55			NP 8	P 4b	
56					16 - 14
PALEOCENE		LATE	EARLY	MIDDLE	EOCENE SERIES
MARTINI 1971					BLOW 1969

PALYNOLOGICAL CALIBRATION

AGE Ma.	SERIES	STAGE	MARTINI 1971	BLOW 1969	FORAMINIFERAL & NANNOFOSSIL DATUMS	PALYNOLOGICAL DATUMS																			
					NP 15a	NP 14b	NP 14a	NP 13	NP 12	NP 11	NP 10	NP 9	NP 8	NP 7	NP 6	P 10	P 9	P 8	P 7	P 6b	P 6a	P 5	P 4c	P 4b	P 4a
48																									
49																									
50																									
51																									
52																									
53																									
54																									
55																									
56																									
57																									
	PALEOCENE	LATE	EARLY	MIDDLE																					
			EOCENE																						

LEGEND: LAD = LAST APPPEARANCE DOWNSIDE UP; FAD = FIRST APPPEARANCE DOWNSIDE UP; NP = NANNOPHYLLOPSIS PLATEAU; P = PALYNODEMA PLATEAU

NOTES:

- LAD R. GR. SOLDADOENSIS
- FAD GLOBIGERINATHESA SPP.
- B. ANNAE REPORTED TO BE RESTRICTED TO THE PREOECENE C. LISARNE AND F. PERFORATUS ZONES (GERMERRAD ET AL. 1988) OCCURS ABOVE THE THE FAD OF R. MULTISPINOSUM WHICH HAS A RANGE FROM THE EARLY TO MIDDLE EOCENE (WILLIAMS AND BUJAK, 1985)
- LAD OF G. GEMMATUS REPORTED ABOVE THE FAD OF H. CRIOBENSI IN THE PERIJÀ. THE LATTER IS CONSIDERED IN TAXON DATA BASE TO BE SYNONOMOUS WITH R. HOMOMORPHUM KNOWN TO FIRST OCCUR IN THE LATE PALEOCENE (HAG ET AL. 1988)

PALYNOLOGICAL CALIBRATION

AGE Ma.	SERIES	STAGE	MARTINI	FORAMINIFERAL & NANNOFOSSIL DATUMS	PALYNOLOGICAL DATUMS
			1971		
EOCENE	MIDDLE	LATE	NP 18	P 15	LAD R. MULTISPINOSUM LAD P. SUBTILE
				LAD H. SEMINULUM LAD C. GRANDIS *	
				LAD ACARININA SPP. *	
			NP 17	FAD G. ANGIPOROIDES FAD G. SEMIINVOLUTA LAD T. ROHRI LAD T. TOPILENSIS LAD "H". CF H. BOLIVARIANA LAD A. SPINULOFINFLATA LAD O. BECKMANNI *	FAD B. FOVEORETICULATUS FAD C. DOROGENSIS, BASE OF ZONE 22, SEEN IN THE CEUTA WELL AND RIO SANTA DOMINGO, BARINAS, WITH B. SOLEAFORMIS
				LAD H. DUMBELI LAD C. SOLITUS *	FAD R. GUIANENSIS, BASE OF ZONE 21 REFERENCE SECTION IN MISOR B SANDS ABOVE BG
			NP 16C	FAD O. BECKMANNI * LAD T. CERRO. POSSAGNOENSIS LAD T. CERRO. FRONTOSA LAD S. INREQUISPIRA LAD A. BROEDERMANI FAD R. RETICULATA *	FAD P. PORKDRNYI, BASE ZONE 21 SEEN SLIGHTLY BELOW R. GUIANENSIS
			NP 16B	FAD D. SRIPANENSIS LAD T. GRIFFINAE LAD L. ACUTUS FAD R. BISECTA FAD C. DISSIMILIS S. L. FAD R. UMBILICUS *	FAD B. SOLEAFORMIS, SIMILAR DISTRIBUTION PATTERN TO BOMBACACIDITES SP. B
			NP 16a	FAD P. PAPPILATUM FAD CHILOGUEMBELINA SPP. LAD C. GIGAS *	FAD H. CAMPANULA, A DATUM FOUND IN BARINAS AND LAKE MARACAIBO
			NP 15c	LAD L. MOCHLOPORUS	FAD BOMBACACIDITES SP. B IN LAKE MARACAIBO IT IS BELOW D. SRIPANENSIS AND R. RETICULATA BUT ABOVE IN BARINAS
			NP 15b	FAD G. CARCOSELLEENSIS FAD C. GIGAS *	FAD H. FLORIPES, SHOULD = BASE NP 16 BUT NOT SEEN THAT LOW
			NP 15a	LAD L. NASCENS	FAD S. NEPHROIDES