

## CALIBRATION OF PALEOGENE PALYNOLOGICAL ZONES TO THE MARINE TIME SCALE

Jason A. Crux and Omar Colmenares, Dpto. de Ciencias de la Tierra, INTEVEP, Apdo. 76343, Caracas 1070A, Venezuela.

### 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 A recent review of unpublished company reports of the Lake Maracaibo area has shown that this species was observed in middle Eocene sediments.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. soleaformis*. 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. soleaformis*. 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.

## References

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# TIME SCALE

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

# PALYNOLOGICAL CALIBRATION

AGE Ma.	SERIES	STAGE	MARTINI 1971	BLOW 1969	FORAMINIFERAL & NANNOFOSSIL DATUMS	PALYNOLOGICAL DATUMS
	EOCENE	MIDDLE	NP 13a	P 10	LAD A. CR. SOLDADOENSIS  FAD GLOBIGERINATHEKA SPP.	LAD R. FELIX, NO PUBLISHED DATA TO PROVE THAT THIS SPECIES IS RESTRICTED TO THE LOWER EOCENE, ORIGINALLY IT WAS CONSIDERED TO RANGE INTO THE MIDDLE EOCENE
48			NP 14b			
49			NP 14a	P 9		
50		NP 13				
51		EARLY	NP 12	P 8		
52				P 7		
53			NP 11	P 6b		B. ANNRE REPORTED TO BE RESTRICTED TO THE PALEOCENE C. LISANRE AND F. PERFORTUS ZONES (GERMERARD ET AL. 1988) OCCURS ABOVE THE THE FAD OF A. MULTISPINOSUM WHICH HAS A RANGE FROM THE EARLY TO MIDDLE EOCENE (WILLIAMS AND BUJAK, 1985)
54		NP 10	P 6a			
55		NP 9	P 5			
56		PALEOCENE	LATE	NP 8		P 4c
57	NP 8			P 4b		
	NP 7			P 4a		
			NP 6			

# PALYNOLOGICAL CALIBRATION

AGE Ma.	SERIES	STAGE	MARTINI 1971	BLOW 1969	FORAMINIFERAL & NANNOFOSSIL DATUMS	PALYNOLOGICAL DATUMS
37	Eocene	LATE	NP 18	P 15	LAD H. SEMINULUM LAD C. GRANDIS * LAD ACARININA SPP. *	LAD A. MULTISPINOSUM LAD P. SUBTILE
38		MIDDLE	NP 17	P 14	FAD G. ANGIPOROIDES FAD G. SEMIINVOLUTA LAD T. ROHRI LAD T. TOPILENSIS LAD "H". CF H. BOLIVARIANA LAD A. SPINULOINFLATA	FAD B. FOVEORETICULATUS FAD C. DOROGENSIS, BASE OF ZONE 22, SEEN IN THE CEUTA WELL AND RIO SANTA DOMINGO, BARINAS, WITH B. SOLEAFORMIS FAD R. GUIANENSIS, BASE OF ZONE 21 REFERENCE SECTION IN MISOR B SANDS ABOVE B6 FAD P. PORKORNYI, BASE ZONE 21 SEEN SLIGHTLY BELOW R. GUIANENSIS
39					LAD O. BECKMANNI *	
40					LAD A. PRIMITIVA LAD H. DUMBELI LAD C. SOLITUS *	
41			NP 16C	P 12	FAD O. BECKMANNI *	FAD B. SOLEAFORMIS, SIMILAR DISTRIBUTION PATTERN TO BOMBACACIDITES SP. B FAD H. CAMPANULA, A DATUM FOUND IN BARINAS AND LAKE MARRACIBO
42			NP 16B		LAD T. CERRO. FRONTALIS LAD G. INAEQUISPIRA LAD A. BROEDERMANNI FAD R. RETICULATA *	FAD BOMBACACIDITES SP. B IN LAKE MARRACIBO IT IS BELOW D. SAIPANENSIS AND R. RETICULATA BUT ABOVE IN BARINAS
43			NP 16A		FAD D. SAIPANENSIS LAD T. GRIFFINAE LAD L. ACUTUS FAD R. BISECTA	FAD H. FLORIPES, SHOULD = BASE NP 16 BUT NOT SEEN THAT LOW FAD S. NEPHROIDES
44			NP 15c		FAD C. DISSIMILIS S. L. FAD R. UMBILICUS *	
45			NP 15b	P 11	FAD P. PAPPILATUM FAD CHILOGUENBELINA SPP. FAD T. CERRO. POMEROLI LAD C. GIGAS *	
46			NP 15a	P 10	LAD L. MOCHLOPORUS FAD G. CARCOSELLENSIS FAD C. GIGAS *	
					LAD L. NASCENS	