

120928

Reprinted from:

Ch. Pomerol and I. Premoli-Silva (Editors), *Terminal Eocene Events*

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THE KALLO WELL AND ITS KEY-POSITION IN ESTABLISHING THE EO-OLIGOCENE BOUNDARY IN BELGIUM

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The Eo-Oligocene boundary-sequence in Belgium is represented by an alternation of clays and fine sands (a_1 , S_1 , a_2 , S_2 , a_3 and S_3), known as the "Kallo complex" (GULINCK, 1969a, b). This sequence, encountered in boreholes of northern Belgium, was established in the Kallo well, 10 km west of Antwerp, where it is best preserved and most complete (map-sheet 15/2, co-ordinates $x = 144.86$, $y = 217.84$). JACOBS (1978) redefined the "Kallo complex" in the Meetjesland region, some 50 km west of Kallo. It was subdivided in a lower Meetjesland Formation and an upper, thinner Zelzate Formation comprising the Bassevelde Sand and the Watervliet Clay Members. The presence of those units in the Kallo well has been established only recently (STEURBAUT in press; see also table). In this paper, STEURBAUT redefines the Zelzate Formation to include the Bassevelde Sand Member (= S_3), the Watervliet Clay Member (= a_4), and the Puisbroek Sand Member (= S_4) as a new subdivision.

The Kallo well boundary-sequence is of shallow marine origin and characterized by very low deposition rates and several breaks in sedimentation. Until now, nothing has been published on the heavy minerals, clay minerals, geochemistry or palaeomagnetism of this sequence, but various palaeontological aspects have already been described. The units intermediate between the Wemmel Sand Member and the Boom Clay Member were investigated for foraminifera (DROOGER, 1969: interval 87 to 178 m; HOOYBERGHS, 1967: interval 92 to 110 m), dinoflagellates (CHATEAUNEUF, 1980: 4 samples in the interval 86 to 160 m; DE CONINCK, work in progress) and pollen and spores (ROCHE & SCHULER, 1980). Calcareous nannofossils were studied by MARTINI (1969) (4 levels in the interval 82.70 to 174.00 m). The nannofossil results were discussed by CAVELIER (1979). Regarding the Eo-Oligocene boundary in Belgium, three major theories have been proposed. The first was formulated by GULINCK (1969a) on the base of sedimentological features and was recently adopted

TABLE

DISTRIBUTION OF CALCAREOUS NANNOFOSSILS IN THE KALLO WELL (27E-148) between 70 and 180m depth.					Species with stratigraphic importance										LEGEND									
LITHOLOGICAL SECTION OF THE KALLO WELL between 70 and 180m depth (after GULINCK, 1969a, slightly modified)	LITHOSTRATIGRAPHY (after GULINCK, 1969a)	LITHOSTRATIGRAPHY (STEURBAUT, in press)	NANNO-ASSEMBLAGES		NANNO-ZONES (MARTINI, 1971)	SAMPLES YIELDING NANNOFOSSILS (depth in m)	<i>Zygrhabdolithus crassus</i>	<i>Rhabdosphaera gladius</i>	<i>Pentaster isabonensis</i>	<i>Nannotriona fulgens</i>	<i>Ericsonia formosa</i>	<i>Reticulofenestra umbilica</i>	<i>Sphenolithus pseudoradians</i>	<i>Ericsonia subdisticha</i>	<i>Sphenolithus tribulosus</i>	<i>Reticulofenestra reticulata</i>	<i>Isthmolithus recurvus</i>	<i>Reticulofenestra bisecta</i>	<i>Cyclacallithus hirsutus</i>	<i>Pantopsphaera bukryi</i>				
			ABUNDANCE	PRESERVATION																				
70	Boom Clay	RUPEL FORMATION	Boom clay	not studied	NP 23	71.50																		
				○		P	74.00																	
				○		P	75.50																	
				●		M	76.00																	
				barren		○	M	83.00																
80				○	P	85.90																		
				○	P	86.40																		
				X	P	89.00																		
				barren																				
90				○	P	93.00																		
				○	P	94.00																		
				○	P	96.00																		
				○	P	97.00																		
				○	M	100.00																		
100				Ruisbroek sand																				
				no samples																				
110				Watervliet clay																				
				Bassevelde sand																				
120				barren																				
				○	M	124.00																		
				○	M	124.20																		
				○	M	124.50																		
				○	M	124.60																		
				○	M	125.00																		
130				Onderdijke Adegem clay																				
140				Buisputten sand																				
150				Zomergem clay																				
160				Onderdale sand																				
170				Ursel clay																				
				Asseclay																				
				Wemmel sand																				
180				Wemmel sand																				
				○	M	173.20																		
				○	M	177.00																		
				○	M	179.00																		

-  heavy clay
 -  silty clay
 -  clayey fine sand
 -  clayey silt
 -  fine sand
 -  sandstone
 -  sandstone layer
 -  nummulites
 -  vermiculations
- P = poor
M = moderate
● = abundant
○ = common
○ = few
X = rare

and slightly refined by GAEMERS (1984). According to these authors, the Zomergem Clay Member (= a_2) is the lateral equivalent of the Grimmertingen Sand Member and represents the basal part of the Lower Oligocene. Both other interpretations are supported by palaeontological data and suggest that the Grimmertingen Sand Member correlates with the Bassevelde Sand Member (= S_3). The age of both units, however, is still controversial. CAVELIER (1979) and CHATEAUNEUF (1980) suggested an Eocene age, while others (e.g. MARTINI, 1969 and ROCHE & SCHULER, 1980) proposed an Oligocene age.

The re-investigation of the Kallo well calcareous nannoflora (STEURBAUT in press, see also table) provides additional evidence for the identification of the Eo-Oligocene boundary in Belgium. It shows that during the interval Late Middle Eocene to Middle Oligocene a progressive impoverishment in nannospecies occurred, mainly due to a progressive decrease in temperature of the surface waters. A major change in nannoflora is recorded between the Late Eocene Bassevelde Sand Member (= NP 20) and the Early Oligocene Ruisbroek Sand Member (= NP 22). Between the middle part of the former, at -124 m, and the middle part of the latter, at -106 m, 18 m of decalcified clays and clayey sands occur, straddling the Eo-Oligocene boundary. This boundary lies within the Zelzate Formation, but, because of decalcification no precise limit can be drawn. Lithologically however, there is a break in sedimentation between the Watervliet Clay Member and the Ruisbroek Sand Member at -109 m (presence of a fine gravel layer), which might be connected indirectly with the Eo-Oligocene transition.

Correlation of the different members of the Zelzate Formation with the Lower Tongrian deposits of Eastern Belgium remains speculative. On the basis of its nannoflora, the Grimmertingen Sand Member has to be placed in the interval comprising the middle part of the Bassevelde Sand Member to the middle part of the Ruisbroek Sand Member. To what it corresponds exactly can be established only through the detailed analysis of the dinoflagellate associations (J. DE CONINCK, work in progress).

REFERENCES

- Cavelier, C., 1979. La limite éo-oligocène en Europe occidentale. *Sci. Géol.* Mém. 54, 280 pp.

- Chateauneuf, J.J., 1980. Palynostratigraphie et paléoclimatologie de l'Eocène supérieur et de l'Oligocène du Bassin de Paris. *Mém. B.R.G.M.*, 116, 357 pp.
- Drooger, C.W., 1969. Microfauna close to the Eocene-Oligocene boundary in the boring at Kallo. In : *Le Sondage de Kallo (au nord-ouest d'Anvers). Toelichtende Verhand. Geol. Kaart Mijnskaart België*, 11:9-27.
- Gaemers, P.A.M., 1984. Fish otoliths from the Bassevelde Sand (Late Tongrian) of Ruisbroek, Belgium, and the stratigraphy of the Early Oligocene of Belgium. *Meded. Werkgr. Tert. Kw. Geol.*, 21(1):13-57.
- Gulinck, M., 1969a. Le passage Oligocène-Eocène dans le sondage de Kallo et le Nord de la Belgique. In : *Colloque sur l'Eocène, Paris mai 1968. Mém. B.R.G.M.*, 69(III):193-196.
- Gulinck, M., 1969b. Coupe résumée des terrains traversés au sondage de Kallo et profil géologique NS passant par Woensdrecht-Kallo-Halle. In : *Le Sondage de Kallo (au nord-ouest d'Anvers). Toelichtende Verhand. Geol. Kaart Mijnskaart België*, 11:3-7.
- Hooberghs, H.J.F., 1976. Remarks on the Eocene/Oligocene boundary with some preliminary results of the study of Eocene/Oligocene planktonic foraminifera in Belgium. *Bull. Belg. Ver. Geol.*, 85(3):117-126.
- Jacobs, P., 1978. Litostratigrafie van het Boven-Eoceen en van het Onder-Oligoceen in Noordwest België. *Geol. Survey Belgium, Prof. Paper 1978/3*, 151, 92 pp.
- Martini, E., 1969. Calcareous nannoplankton from the Kallo well. In : *Le Sondage de Kallo (au nord-ouest d'Anvers). Toelichtende Verhand. Geol. Kaart Mijnskaart België*, 11:39-41.
- Roche, E. & Schuler, M., 1980. Etude palynologique du "Complexe de Kallo". *Geol. Survey Belgium, Professional Paper 1980/8*, 178, 13 pp.
- Sturbaut, E., in press. Late Middle Eocene to Middle Oligocene Calcareous nannoplankton from the Kallo well, some boreholes and exposures in Belgium and a description of the Ruisbroek Sand Member. *Bull. Belg. Ver. Geol.*, 8 tabl., 2 pl.