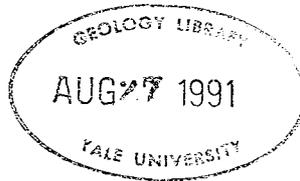


TWO SPECIES OF ASCIOCYTHERE SWAIN, 1952
(OSTRACODA) FROM THE UPPERMOST CRETACEOUS
IN BELGIUM AND THE NETHERLANDS

SPHYROPTERIS OBLIQUA (MARRAT) KIDSTON, A FOSSIL
FERN FRUCTIFICATION FROM THE WASTE DUMP OF THE
FORMER LAURA & VEREENIGING COAL MINE AT EYGELSHOVEN

LATE MAASTRICHTIAN ISOPOD AND DECAPOD
CRUSTACEA FROM HACCOURT (LIÈGE),
NORTHEASTERN BELGIUM

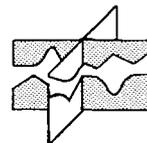


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**LATE MAASTRICHTIAN ISOPOD AND DECAPOD
CRUSTACEA FROM HACCOURT (LIÈGE),
NORTHEASTERN BELGIUM**

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4 text figures, 1 plate

CONTENTS	page
ABSTRACT	24
SAMENVATTING	24
1. INTRODUCTION	24
2. GEOGRAPHIC AND STRATIGRAPHIC SETTING	24
3. SYSTEMATIC PALAEOLOGY	26
4. ACKNOWLEDGEMENTS	30
5. REFERENCES	30

In commemoration of Dr Reinhard Förster (1935 - 1987)

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ABSTRACT

A small collection of isopod and decapod crustaceans (one species each) is described from the lower part of the Vijlen Member (Gulpen Formation) as exposed at the SA Ciments Portland Liégeois (CPL) quarry near Haccourt, province of Liège (NE Belgium). The age of this faunule is late Maastrichtian. The lobsters are referred to *Oncopareia bredai* Bosquet, 1854, originally described from the Kunrade Limestone facies of the Maastricht Formation (late Maastrichtian), while the isopod is tentatively assigned to the genus *Palaega*. The biostratigraphy and macrofauna of the Vijlen Member at this locality are briefly commented upon.

SAMENVATTING

Een kleine kollektie isopode en dekapode Crustacea (één soort elk) wordt beschreven uit het onderste deel van de Vijlen Kalksteen (Gulpen Formatie) zoals ontsloten in de groeve SA Ciments Portland Liégeois (CPL) bij Haccourt, provincie Luik (noordoost België). De ouderdom van deze faunule is laat Maastrichtien. De dekapode kreeften worden tot *Oncopareia bredai* Bosquet, 1854 gerekend, een soort die oorspronkelijk beschreven werd uit de Kunrade facies van de Maastricht Formatie (laat Maastrichtien), terwijl de isopode met enige twijfel ondergebracht wordt bij het genus *Palaega*. De biostratigrafie en makrofauna van de Vijlen Kalksteen zoals ontsloten in deze groeve worden kort besproken.

1. INTRODUCTION

Intensive collecting over a number of years from the lower part of the Vijlen Member (Gulpen Formation) as exposed at the SA Ciments Portland Liégeois (CPL) quarry near Haccourt has resulted in a small faunule of isopod and decapod crustaceans being available for study now. The isopod is here tentatively referred to *Palaega* and appears to be the first representative to be recorded from the Maastrichtian type area in its broad sense. The lobsters are assigned to *Oncopareia bredai* Bosquet, 1854, which was previously known only from the Kunrade Limestone facies of the Maastricht Formation as exposed in the eastern part of southern Limburg (The Netherlands). Its presence in the Vijlen Member is probably the stratigraphically oldest occurrence in the area. The biostratigraphy and fauna of this member are briefly commented upon mainly in the light of recent observations at the CPL quarry.

2. GEOGRAPHIC AND STRATIGRAPHIC SETTING

The 'Maastricht groep' of the Working Group on the Coniacian to Maastrichtian Stages (WGCMs) currently recognises three major key sections for the Upper Cretaceous of the Maastrichtian type area (SE Netherlands and NE Belgium). These can be combined so as to obtain a nearly complete, c. 145 m thick sequence, with the exception of the Santonian (?) early Campanian Aken (Aachen) Formation (Batten *et al.*, 1988) and the lower Maastrichtian.

At the SA Ciments Portland Liégeois (CPL) quarry, which is one of these key sections (the other two being the ENCI NV quarry south of Maastricht, stratotype of the Maastrichtian Stage as now defined, and the former Curfs quarry at Geulhem, Valkenburg aan de Geul) about 85 m of Upper Cretaceous deposits are exposed. Lithologies range from glauconitic, sandy/clayey silts to rather coarse-grained calcisiltites and fine- to medium-grained biocalcarenites. The quarry is situated some 10 km south of Maastricht, on the western bank of the River Maas valley in the municipality of Oupeye, province of Liège (Fig. 1), and is often referred to in the literature as 'Hallembaye' or 'Halembaye'.

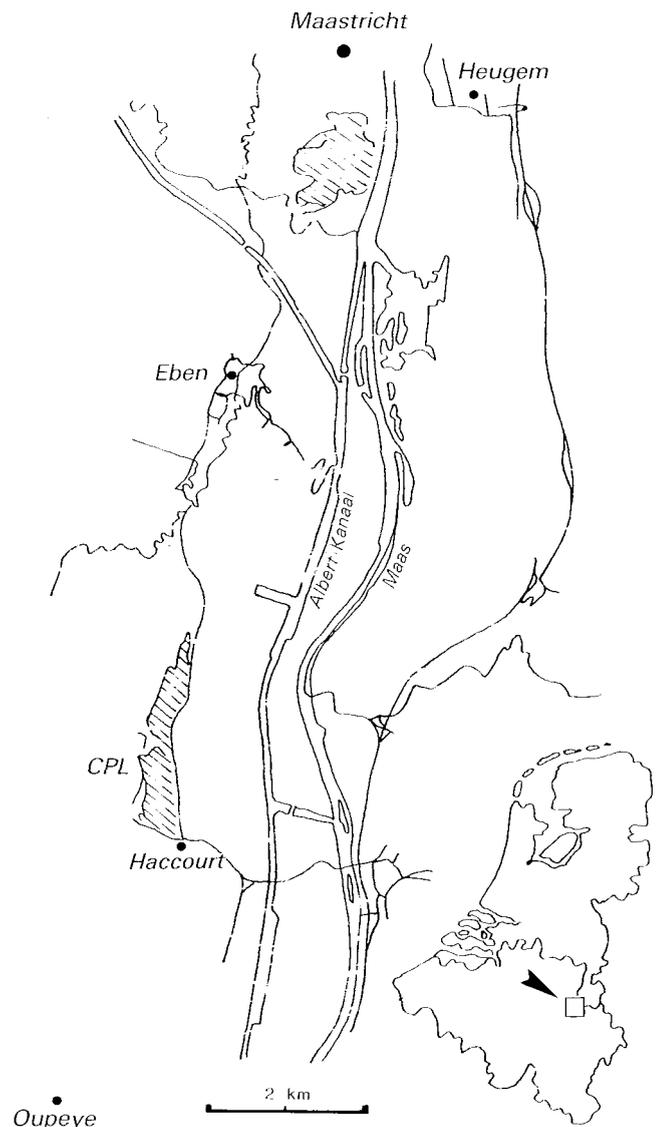


Fig. 1. Locality map of the Haccourt and Maastricht areas showing the location of the SA Ciments Portland Liégeois (CPL) quarry.

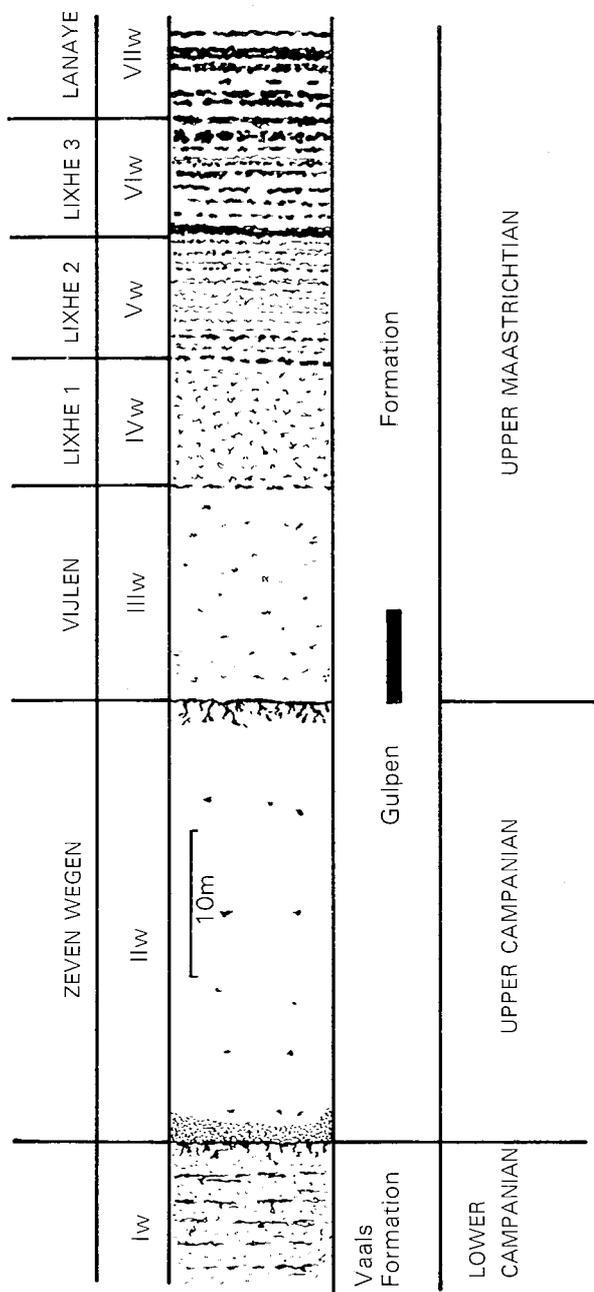


Fig. 2. Litho- and chronostratigraphy of the section exposed at the SA Ciments Portland Liégeois quarry (partly simplified). Bar indicates the stratigraphic provenance of the crustacean material described herein.

Unfortunately, quarrying has been stopped recently and plans are now being carried out to turn the quarry into a rubbish pit. One of the two deepest pits of the quarry in which the upper metres of the Vaals Formation and the lower part of the overlying Zeven Wegen Member of the Gulpen Formation were accessible, is now flooded, so that collecting is no longer possible.

The lithostratigraphic units of W.M. Felder (1975b) recognised in this quarry are here shown in Fig. 2. The early Campanian age of the Vaals Formation at this locality is now well established (see discussions in Christensen & Schmid, 1987 and Jagt, 1989). The overlying Zeven Wegen Member is of late Campanian

age (Jagt, 1988) and is capped by the Froidmont Horizon, with an underlying chalkstone (sensu Bromley & Gale, 1982). This horizon is a hardground of an erosive nature whose surface is strongly glauconitised and ferruginised and contains an omission suite of burrows and borings (Bromley, 1975; P.J. Felder *et al.*, 1980). Lower Maastrichtian (Beutenaken (*pars*) and Vijlen (*pars*) Members) are missing here: only rarely are remanié specimens of early Maastrichtian *Belemnella* (*Pachybelemnella*) and benthic foraminifers found (see e.g. Calembert, 1957, 1961; Calembert *et al.*, 1970, Hofker, 1956). The Vijlen Member at this locality reaches a thickness of c. 15 m; to the north the thickness increases to 25-50 m (W.M. Felder, 1975a; Albers *et al.*, 1978). This lithostratigraphic unit comprises here a coarse-grained calcisiltite, yellowish-grey in colour and more marly at its base and with a CaCO₃ content of 95% or more (Calembert, 1953). It contains small, scattered grey flints which become more common in the upper part, but which are not concentrated in distinct horizons, with the exception of the Lixhe Horizon, which forms the base of the overlying Lixhe 1 Member. The flints are an indication of thorough bioturbation (P.J. Felder *et al.*, 1980).

Albers & W.M. Felder (1979, p. 73) recorded from the uppermost 1.5 m or so of the Vijlen Member the occurrence of the benthic forams *Bolivinooides draco* (Marsson, 1878) and *Gavelinella danica* (Brotzen, 1945), which they considered to indicate the upper lower Maastrichtian (benthic foram zone D of Hofker, 1966). In addition, they referred to occasional finds of '*Belemnella occidentalis*' (see Deroo, 1966), which indicate a late early Maastrichtian age as well. However, Deroo (1966, fig. 5) literally stated, 'Marne argileuse gris jaunâtre à silex gris épars; rares *Belemnella* ex gr. *junior*, à la base, localement quelques *Belemnella occidentalis*.' In other words, representatives of *Belemnella* are exclusively known from the very base of this member, which otherwise yields *Belemnitella* gr. *junior* Nowak, 1913 only (Schmid, 1959; Robaszynski *et al.*, 1985a,b; personal observations). This group is generally accepted as indicating the lower upper Maastrichtian (Jeletzky, 1951; Schulz & Schmid, 1983; Schmid, 1959, 1982; Christensen, 1988). Apart from the belemnites, biota of biostratigraphic and correlative value include mainly ammonites, inoceramid bivalves and microfossils. Ammonites comprise scaphitids, baculitids and pachydiscids (see Robaszynski *et al.*, 1985b; Jagt & Kennedy, 1989). The inoceramid bivalve *Spyridoceras tegulatus* (von Hagenow, 1842) is a valuable marker species in the North Temperate Realm (see discussions in Dhondt, 1982, 1983a,b; Abdel-Gawad, 1986). A few, rather poorly preserved specimens are now known from the Vijlen Member at the CPL quarry, which, together with the occurrence of *B. gr. junior*, *Hoploscaphites constrictus* (J. Sowerby, 1817) and *Acanthoscaphites varians* (Lopuski, 1911) would indicate that at least the lower part of this member is correlatable with the *tegulatus/junior* Zone of Schulz & Schmid (1983) and Schulz *et al.* (1984).

Benthic forams (see Meessen in Robaszynski *et al.*, 1985b) are more useful for regional correlations than

for correlations over longer distances. Detailed age assignments on the basis of planktonic forams, nanoplankton and dinoflagellates for this member at this locality are not feasible either (see Robaszynski *et al.*, 1985b).

Pollock (1974, p. 99) indicated that the 'Craie grise' proper (= Vijlen Member in current lithostratigraphic terms) contained an indigenous *Belemnella occidentalis* Zone fauna, and that the presence of *Echinocorys limburgica* permitted correlation of this unit with the 'Grey Chalk' of Trimmingham, Norfolk (see Peake & Hancock, 1970). From the data presented here, it will appear that this correlation and age assignment are questionable.

The overlying Lixhe 1-3 and Lanaye Members (Fig. 2) are definitely late Maastrichtian in age and are probably correlatable with part of the *tegulatus/junior* and *argentea/junior* Zones of Schulz & Schmid (1983). A detailed account of the biostratigraphy and the faunas of the members of the Gulpen Formation as exposed at this quarry is now in preparation. For discussions of particular groups of macrofossils the reader is referred to Jagt & Michels (1987), Dhondt & Jagt (1987, 1989) and Jagt & Collins (1989).

3. SYSTEMATIC PALAEONTOLOGY

All studied specimens are deposited in the US National Museum of Natural History, Washington DC 20560 (USNM registration numbers, ex J.W.M. Jagt Coll.)

Order : Isopoda Latreille, 1817
Suborder : Flabellifera G.O. Sars, 1882
Family : Cirolanidae Dana, 1852
Genus : ?*Palaega* Woodward, 1870
Type species : - *Palaega carteri* Woodward, 1870

?*Palaega* sp.
Plate 1, figs 1-3; text-fig. 3

Material:
Sole specimen, USNM 444295, consists of part and counterpart of the last pereonite, 5 pleonites and pleotelson.

Description:
Small to moderate sized palaegid; last pereonite with shallow, transverse sulcus, pleonites and pereonites with coarse pustulose ornamentation, directed posteriorly; pleotelson less strongly ornamented.

Pereonite longer (c. 3.5 mm) and narrower (c. 11.3 mm) than pleonites, with pustulose surface laterally and pitted surface axially; shallow transverse sulcus dividing somite into anterior and posterior regions, the anterior about twice as long as the posterior. Lateral termination apparently without distally directed spine.

Pleonites about as long (c. 1.9 mm) as anterior portion of pereonite and becoming narrower posteriorly; first two equally wide (c. 13.3 mm) and last three markedly narrower (c. 12.1, 12.0, 10.2 mm, anterior to posterior); all terminate laterally as sharp, posteriorly directed pleura, apparently decreasing in

length posteriorly. Pleonites ornamented by pustules which are most elevated, and best defined, on their posterior margins; pustules most prominent laterally, becoming smaller and less numerous axially, surface pitted axially.

Pleotelson slightly wider (c. 8.3 mm) than long (c. 6.5 mm), tapering distally but distal margin is not preserved; axial keel extends at least 3/4 total length of pleotelson, becoming less prominent posteriorly. Remaining surface smoother than pleonites with subtle crenulate sculpture.

Remarks:
Wieder & Feldmann (1989) recently reexamined the type species of *Palaega*, *P. carteri* Woodward, 1870, and concluded that *Bathynomus* A. Milne Edwards, 1879 was a junior subjective synonym of *Palaega*. Additionally, they named a new species of giant isopod, *P. goedertorum*, and suggested that there were a total of four fossil species groups that could be placed in the genus with confidence. Other species, such as '*P.*' *scrobiculata* von Ammon, 1882, possessed sessile, dorsal eyes and were not appropriately referable to *Palaega* (Wieder & Feldmann, 1989, p. 79).

This specimen can tentatively be referred to *Palaega*, based upon the overall outline, possession of five free pleonites with posteriorly directed pleura; and the presence of a large, semicircular pleotelson which is slightly wider than long (Richardson, 1905; Hessler, 1969). Unfortunately, the placement cannot be made with certainty because the specimen lacks the cephalic region and the posterior margin of the pleotelson. Diagnostic morphology is exhibited in both areas.

Palaega carteri, described from the Cretaceous Chalk of Great Britain, is similar to the specimen in question although there are sufficient differences to suggest that the Haccourt specimen cannot be referred to the type species. The latter is somewhat larger; each pleonite is punctate, rather than pustulose, and bears a distinct, narrow, smooth posterior rim; and the pleotelson is broader, relative to the width of the last free pleonite, than it is on ?*P.* sp. Thus, it would appear that this specimen represents a unique species. However, it is not appropriate to name a new species until such time as more complete material is available.

Order : Decapoda Latreille, 1803
Suborder : Pleocyemata Burkenroad, 1963
Infraorder : Astacidea Latreille, 1803
Family : Nephropidae Dana, 1852
Subfamily : Homarinae Huxley, 1879
Genus : *Oncopareia* Bosquet, 1854
Type species : - *Oncopareia bredai* Bosquet, 1854

Oncopareia bredai Bosquet, 1854
Plate 1, figs 4-6; text-fig. 4

Material:
Four specimens in white chalk, none well preserved. Cuticle exfoliating over portions of specimens, probably between exocuticle and endocuticle, as indicated by relative thicknesses of laminae. Cuticle

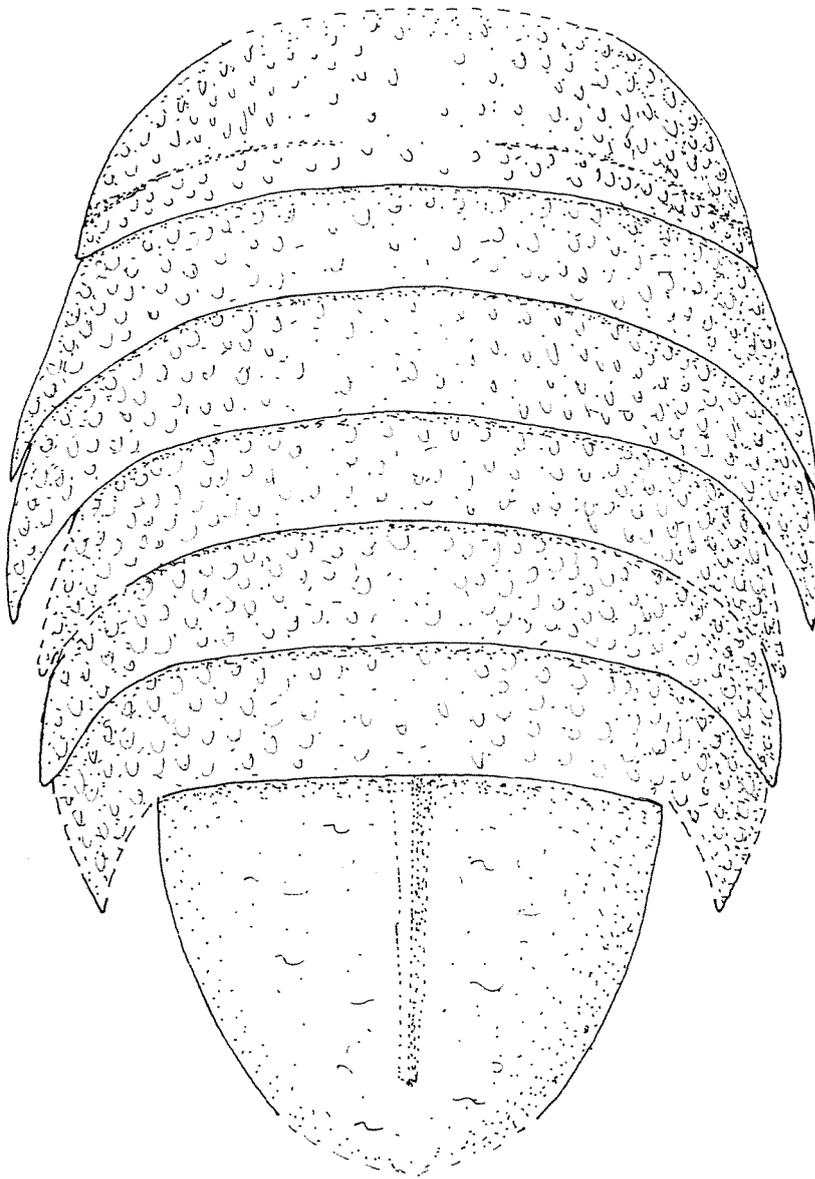


Fig. 3. Reconstruction of the last pereonite, pleonites, and pleotelson of ?*Palaega* sp. (USNM 444295). Scale bar equals 1 cm.

absent over portions of all specimens, leaving only internal and external moulds. USNM 444296: nearly complete cephalothorax and abdomen, thoracopod fragments. USNM 444297: incomplete abdomen, uropods. USNM 444298: anterior portion of cephalothorax, fragments of abdomen, uropods, and thoracopods. USNM 444299: fragmentary cephalothorax and chelipeds.

Description:

Rostrum slightly down-curved, with at least one spine near distal end (USNM 444298). Orbits shallow; margin bounded by a prominent, wide ridge extending from rostrum to base of orbit (USNM 444296 and 444298). Anterior margin below orbit sinuous, forming shallow reentrant at elevation of antennal groove. Large antennal spine behind anterior projection of margin at base of orbit (USNM 444296). Post-cervical groove well impressed, curving downwards and forwards from near midlength on dorsal

surface; termination meets hepatic groove. Hepatic groove makes symmetrical arc, merges with cervical and antennal grooves. Adductor testis region delineated by hepatic groove, not elevated above carapace surface (USNM 444296). Cervical groove well defined, sigmoidal, continues anteriorly as antennal groove which extends nearly to anterior margin (USNM 444296 and 444298). Intercervical groove shallower than postcervical groove; originates from or near postcervical groove and terminates midway between postcervical and cervical grooves. Posterior margin bordered by a broad marginal furrow and prominent marginal rim broader laterally than ventrally (USNM 444296). Surface of cephalothorax, except for grooves, covered with fine, anteriorly-directed granules coarsening slightly posteriorly (USNM 444296 and 444298). Granules on antero-dorsal region of cephalothorax of one specimen (USNM 444299) aligned to form terraces.

Chelipeds slender, slightly heterochelous. Right

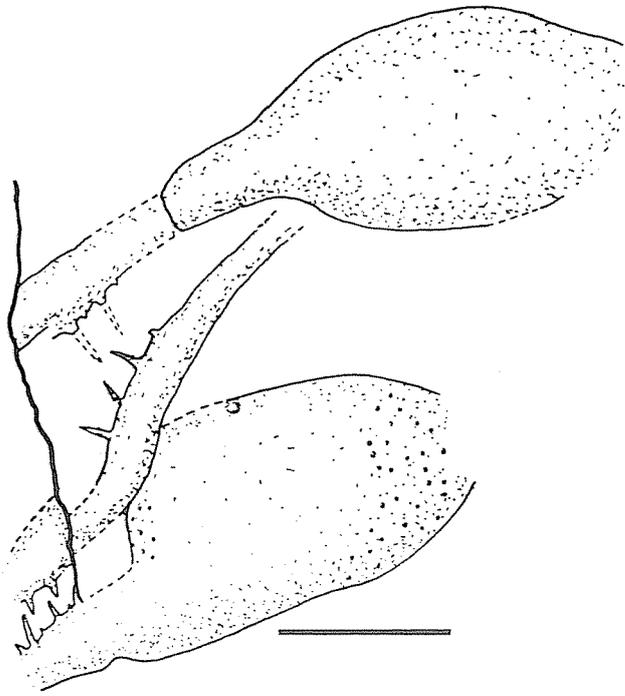


Fig. 4. Reconstructed chelipeds of *Oncopareia bredai*. Scale bar is 1 cm.

palm bulbous, left palm longer, more cylindrical (USNM 444299). Fixed and movable fingers of both chelipeds slender, of approximately equal width. One very coarse denticle at bases of fixed and movable fingers of left cheliped; otherwise, denticles of two distinct sizes, alternating large and small (USNM 444299). One surface of left cheliped granulose (USNM 444296, 444298, 444299), with at least one marginal spine (USNM 444298). Other surface pitted (USNM 444298). Granulation on outer surface of left cheliped coarsens ventrally (USNM 444296) and proximally (USNM 444299). Two large circular pits near base of movable finger contain at least 13 setal pores each (USNM 444298).

Abdomen, including telson, more than $1.5 \times$ length of cephalothorax (88 mm) (USNM 444296). Surface of abdomen much smoother than cephalothorax; generally finely pitted but with some granulations (USNM 444296 and 444297). Abdomen bears lateral keel on somites two through, at least, four (USNM 444296 and 444297), with prominent node at posterior end of keel on each pleuron. Pleurae short, that of somite 3 broadly cordate, fifth pleuron rounded, sixth pointed, all directed slightly posteriorly (USNM 444296 and 444297). Borders of pleurae raised. Caudal fan very large relative to abdomen (USNM 444296). Posteriormost segment of uropod small.

Remarks:

No specimen is completely preserved, but a composite description was developed with the following limitations. The morphology of the rostrum, the dorsal region of the carapace, and the chelipeds, are poorly known. No sterna have been observed. Some denticles on fingers of both claws are preserved, but the proximal portions of the fingers are either covered or so poorly preserved that the movable and fixed

fingers cannot be distinguished. No distal terminations have been observed. The two fingers on the left cheliped of specimen USNM 444299 can probably be distinguished indirectly, however, on the basis of palm ornamentation. One surface is granulose, the other is pitted, and these probably correspond to the outer and inner cheliped surfaces, respectively.

Specimen USNM 444296 is probably an exuvia. The abdomen is rotated under the cephalothorax, which has moved vertically, exposing the endophragmal skeleton. Although much of the endophragmal skeleton is preserved, its fragmented condition obscures the sites of branchial insertions and most other details of morphology.

The genus *Oncopareia* was erected by Bosquet (1854), who described the type species, *O. bredai*, from the Kunrade Limestone (Maastricht Formation, late Maastrichtian) of Kunrade (southern Limburg, The Netherlands). Many similar forms with slender claws bearing acicular dentition have been described subsequently (Mertin, 1941; Jakobsen & Collins, 1979). These are almost exclusively deep water lobsters with thin carapaces, and as a result, much of this material consists only of cheliped fragments (Mertin, 1941). This has led to considerable taxonomic confusion at both the generic and species levels, prompting Mertin to revise the taxonomy of these lobsters. He declared (p. 178) *Nymphaeops* Schlüter, 1862, *Ischnodactylus* Pelseneer, 1886, *Stenocheles* Fritsch, 1887, ? *Thaumastocheles* Wood Mason, 1873, part of *Hoploparia* and *Homarus*, and *Enoplocyrtia paucispina* Schlüter, 1868, to be subjective synonyms of *Oncopareia*.

Mertin (p. 178) cited the following characteristics as defining the genus *Oncopareia*: 1) a spiny rostrum; 2) a well-developed hepatic groove and a branchio-cardiac groove which originates and turns upwards from the postcervical groove; 3) lateral ridges on the edges of the rostrum, behind the eye sockets, and behind the lower orbital spine; 4) a partially granular carapace; 5) a slender abdomen with lateral ridges; 6) short, rounded pleurae with raised margins; 7) a trapezoidal pleuron of the second somite which is not significantly widened; 8) the abdomen surface with only flattened, round bumps and small depressions, and lacking transverse furrows; 9) a wide caudal fan; 10) a short posteriormost segment of the uropod; 11) noticeably heterochelous chelipeds with fingers which terminate very much like hooks; one cheliped having short, thick palms that taper distally, and long, slender fingers bearing long acicular dentition, and the other cheliped with longer, cylindrical palms and shorter, powerful fingers with short, wide dentition.

Whereas Mertin did not consider the nature of the cervical groove to be a generic characteristic, Glaessner's (1969, p. R459) abbreviated definition of *Oncopareia* included that only the ventral portion of the cervical groove is present, as illustrated by Figures 8 and 9 in Mertin (1941). Glaessner also noted that the postcervical groove is distinct, as did Mertin but in different terms. The postcervical and hepatic grooves converge smoothly and, externally, the boundary between them is arbitrary. Mertin considered the hepatic groove as extending well dorsal of that defined

by Glaessner. In this paper, the terminology of Glaessner is used.

The specimens are referred confidently to the genus *Oncopareia* on the basis of their slender cheliped fingers with acicular dentition, partially granular carapace, laterally keeled but otherwise relatively smooth abdomen bearing short pleurae with raised margins, the cordate outline of their second epimere, their wide caudal fan, and the proximity of the diaeresis to the posterior margin. Carapace morphology supports this generic classification but is, by itself, less conclusive due to similarities in groove patterns between *Oncopareia* and other nephropid genera, such as *Hoploparia*. There is a tremendous range of variation in groove pattern among species of *Oncopareia* (Mertin, 1941, figs 8 and 9), and the groove patterns on some species are very dissimilar from those of the specimens in this study. In fact, the groove patterns present on our specimens are more similar to that of some hoploparids than to some oncopareids. Mertin (1941, p. 180) previously noted the similarity in groove patterns between the two genera.

Mertin (1941, p. 170) considered rounded pleurae to be a generic characteristic. However, his line drawings clearly depict the pleurae of the type species, *O. bredai*, and others, as distinctly pointed (Mertin, 1941, fig. 9e), even more so than the sixth pleuron of the studied specimens.

Although incompletely known, the carapace on our specimens is definitely most similar to that of the type species (Bosquet, 1854, pl. 10, figs 5, 6'). The carapace of *O. bredai*, as drawn by Mertin (1941, fig. 9e) differs from our specimens in lacking an intercervical groove and possessing what may be a shorter cervical groove. Also, *O. bredai* possesses a branchiocardiac groove, an inferior groove which merges with the antennal groove, and longitudinal ridges on the anterodorsal region of the carapace which are not preserved on our specimens. These last characters are difficult to interpret because the dorsal portion of the cephalothorax is missing. Unfortunately, the carapace of *O. esocinus* (Fritsch) is unknown, so it is not possible to compare this structure. That of *O. cf. O. esocinus*, from the Lower Senonian of Salzberg (Mertin, 1941, fig. 8c), is similar to that of our specimens, but not as much so as *O. bredai*.

The abdomen of our specimens is similar to *O. bredai* (Bosquet, 1854, pl. 10, fig. 6) and also *O. esocinus* (Fritsch, 1887) from the Upper Turonian of Bohemia (Fritsch & Kafka, 1887, fig. 59; pl. 4, fig. 7). In both species, each somite has one prominent lateral keel. *Oncopareia esocinus* also bears a node at the posterior end of the keel. The raised pleural margin observed on our specimens is illustrated on *O. esocinus* but not on *O. bredai*. In neither species is the outline of the pleural margin identical to that of our specimens. The pleurae of *O. esocinus* are rounded. Those of *O. bredai*, of which only the first four are known, terminate in posteriorly-directed points. The margins of pleurae 3, 5 and 6 on our specimens are cordate, rounded and pointed, respectively. Although purely speculative, it is possible that differences in pleuron outline are attributable to sexual dimorphism

as documented in the abdomen of *Hoploparia stokesi* (Ball, 1960; Tshudy & Feldmann, 1988).

Comparison of chelipeds of our specimens to the single chelipeds illustrated by Mertin may be misleading because the chelipeds of *Oncopareia* are defined as heterochelous. In the study collection, fingers of the poorly preserved chelipeds (text-fig. 4) are nearly identical, and the palms are only slightly different. The chelipeds of *Oncopareia bredai* as described by Bosquet (1854) resemble those of our specimens in several aspects. The palms bear marginal spines, and their upper surfaces are granulose. The proportions of the palms are similar in the two groups although, perhaps, those of Bosquet's material may be more rectangular in their proximal and distal terminations. Unfortunately, the fingers of *O. bredai* in the type series are incompletely known, so that a comparison of dentition is not possible. The fingers and dentition of our specimens are most similar to the single cheliped of *O. esocinus* (Mertin, 1941, fig. 10i) from the Upper Turonian of Bohemia. With regard to palm shape, the specimens are most similar to *O. inacquidens* (Pelseneer) (Mertin, 1941, fig. 10o).

In light of the subtlety of the differences between the type series of *O. bredai* and the specimens in question, it seems most reasonable to refer these specimens from the lower upper Maastrichtian of Haccourt, to *O. bredai* from Upper Senonian (Mertin, 1941, p. 183 = Maastrichtian) rocks of the same region. One of us (JWMJ) has recently cursorily checked Bosquet's (1854) original material in the collections of the Institut royal des Sciences naturelles de Belgique at Brussels (registration number of Bosquet's entire collection is I.G. 4285). Seeing that Bosquet did not select a type specimen for his *O. bredai*, it would seem advisable to designate a lectotype from the type lot, since it appears that Bosquet's Fig. 5 on Pl. 10 is a composite. The illustration is reversed as well. Reillustration of the type series and designation of a lectotype will be deferred to another occasion.

Stratigraphic range:

Oncopareia bredai was previously known only from the Kunrade limestone facies of the Maastricht Formation (late Maastrichtian, see Felder & Bless, 1989) as exposed in the eastern part of southern Limburg (The Netherlands). In this respect, Jakobsen & Collins (1979, p. 63) are mistaken in stating that it came from the Danian (early Palaeocene) of Limburg. It should be stressed that there are also records of this species from early Campanian strata (Hervien of authors, corresponding to the Vaals Formation in current lithostratigraphic terminology) (e.g. Bosquet in Staring, 1860; Bosquet in Dewalque, 1868; Ubaghs, 1879) in extensive lists without illustrations. It is quite possible that these records in fact relate to *O. coesfeldiensis* (Schlüter, 1862) (Schlüter, 1862, pl. 13, figs 3, 6; Mertin, 1941, pl. 3, figs 2-7; text-figs 9a, 10b-d, k m), which is also known from the Vaals Formation at the CPL quarry (Jagt & Bongaerts, 1986).

4. ACKNOWLEDGEMENTS

The management of the SA Ciments Portland Liégeois cement company is thanked for allowing one of us (JWMJ) access to their quarry over the past few years. Bosquet's original material in the collections of the Institut royal des Sciences naturelles de Belgique (Brussels) could be studied through the courtesy of Dr A.V. Dhondt, for which we are grateful. P.H. Kessels (Heerlen) is thanked for his help in the preparation of the plate.

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5. REFERENCES

- ABDEL-GAWAD, G.I., 1986. Maastrichtian non-cephalopod mollusks (Scaphopoda, Gastropoda and Bivalvia) of the Middle Vistula Valley, Central Poland - *Acta geologica polonica*, 36 (1-3), 69-224, 48 pls.
- ALBERS, H.J. & FRIDER, W.M., 1979. Litho-, Biostratigraphie und Palökologie der Oberkreide und des Alttertiärs (Präobersanton-Dan Paläozän) von Aachen-Südlimburg (Niederlande, Deutschland, Belgien). In: Wiedmann, J. (Ed.) - *Aspekte der Kreide Europas*, International Union of Geological Sciences, Series A, 6, 47-84. Stuttgart.
- ALBERS, H.J., FELDER, W.M., FRIDER, P.J., KUYL, O.S., VAN AMEROM, H.W.J., BOSCH, P.W. & MEESSEN, J.P.M.T., 1978. Lithology and stratigraphy of Upper Cretaceous of the Belgium-Dutch borderland west of the River Meuse - *Paläontologische Gesellschaft-Palaeontological Association, Joint Annual Meeting, Maastricht, Excursion C*, 50-100.
- AMMON, I. VON, 1882: Ein Beitrag zur Kenntniss der fossilen Asseln - *Sitzungsberichte der mathematisch physikalischen Classe der königlichen Bayerischen Akademie der Wissenschaften*, 12, 507-551.
- BALL, H.W., 1960: Upper Cretaceous Decapoda and Serpulidae from James Ross Island, Graham Land - *Falkland Islands Dependencies Survey, Scientific Report*, 24, 30 pp.
- BATTEN, D.J., DUPAGNE KIVIUS, J. & LISIFER, J.K., 1988: Palynology of the Upper Cretaceous Aachen Formation of northeast Belgium. In: Streef, M. & Bless, M.J.M. (Eds) - *The Chalk District of the Euregio Meuse-Rhine. Selected papers on Upper Cretaceous deposits*, 95-103, 2 pls. Natuurhistorisch Museum Maastricht/Laboratoires de Paléontologie de l'Université d'Etat à Liège.
- BOSQUET, J., 1854: Les crustacés fossiles du terrain crétacé du Limbourg - *Verhandelingen uitgegeven door de commissie belast met het vervaardigen eener geologische beschrijving en kaart van Nederland. Tweede Deel*, 10-137 (1-127), 10 pls. Haarlem (A.C. Kruseman).
- BOSQUIT, J. in Staring, W.C.H., 1860: De Bodem van Nederland. De zamenstelling en het ontstaan der gronden in Nederland ten behoeve van het algemeen beschreven. Tweede deel, pp. 361-418. Haarlem (A.C. Kruseman).
- BOSQUET, J., 1868: Liste des fossiles du massif crétacé du Limbourg. In: Dewalque, G. - *Prodrome d'une description géologique de la Belgique*, pp. 355-387. Liège (J.-G. Carmanne).
- BROMLEY, R.G., 1975: Trace fossils at omission surfaces. In: Frey, R.W. (Ed.) - *The study of trace fossils*, 399-428. New York (Springer).
- BROMLEY, R.G. & GALT, A.S., 1982: The Lithostratigraphy of the English Chalk Rock - *Cretaceous Research*, 3 (3), 273-306.
- CALEMBERT, L., 1953: Sur l'extension régionale d'un hard ground et d'une lacune stratigraphique dans le Crétacé supérieur du Nord-Est de la Belgique - *Bulletin de l'Académie royale de la Belgique, Classe des Sciences*, (5) 39, 724-733.
- CALEMBERT, L., 1957: Le problème de l'étage maastrichtien, en Belgique et dans les territoires limitrophes - *Bulletin de l'Académie royale de la Belgique, Classe des Sciences*, (5) 43, 284-298.
- CALEMBERT, L., 1961: Carrière de Hallembaye (Carrière de la S.A. Les Ciments Liégeois à Hallembaye) - *Guide excursions du 7ième Colloque Européen de la Micropaléontologie, Pays-Bas et Belgique, Bruxelles 1961*, 8, 4 pp.
- CALEMBERT, L., MEIJER, M. & MONJOIE, A., 1970: Le Crétacé supérieur sous la plaine alluviale de la Meuse entre Lixhe et l'anaye (Liège) - *Annales de la Société géologique de Belgique*, 93, 51-63.
- CHRISTENSEN, W.K., 1988: Upper Cretaceous belemnites of Europe: state of the art. In: Streef, M. & Bless, M.J.M. (Eds) - *The Chalk District of the Euregio Meuse-Rhine. Selected papers on Upper Cretaceous deposits*, 5-16. Natuurhistorisch Museum Maastricht/Laboratoires de Paléontologie de l'Université d'Etat à Liège.
- CHRISTENSEN, W.K. & SCHMID, F., 1987: The Belemnites of the Vaals Formation from the C.P.L. Quarry at Hallembaye in Belgium - *Taxonomy, Biometry and Biostratigraphy Geologisches Jahrbuch*, A 94, 3-37, 3 pls.
- DEBOO, G., 1966: Cytheracea (Ostracodes) du Maastrichtien de Maastricht (Pays Bas) et des régions voisines; résultats stratigraphiques et paléontologiques de leur étude - *Mededelingen van de Geologische Stichting*, (C) V 2 (2), 197 + 42 pp., 27 pls.
- DHONDT, A.V., 1982: Bivalvia (Mollusca) from the Maastrichtian of Hemmoor (NW Germany) and their Palaeobiogeographical Affinities - *Geologisches Jahrbuch*, A 61, 73-107, 5 pls.
- DHONDT, A.V., 1983a: Negulated Inoceramids and Maastrichtian Biostratigraphy - *Newsletters on Stratigraphy*, 12 (1), 43-53.
- DHONDT, A.V., 1983b: Campanian and Maastrichtian Inoceramids: A review - *Zitteliana*, 10, 689-701.
- DHONDT, A.V. & JAGT, J.W.M., 1987: Bivalvia uit de Kalksteen van Vijlen in Hallembaye (België) - *Grondboor en Hamer*, 41 (3-4) (8e Limburg-nummer), 78-90.
- DHONDT, A.V. & JAGT, J.W.M., 1989: Upper Cretaceous *Liopistha* species in North Western Europe - *Bulletin de l'Institut royal des Sciences naturelles de la Belgique, Sciences de la Terre*, 58 (1988), 187-197, 2 pls.
- FELDER, P.J. & BLESS, M.J.M., 1989: Biostratigraphy and ecostratigraphy of Late Cretaceous deposits in the Kunrade area (South Limburg, St. Netherlands) - *Annales de la Société géologique de Belgique*, 112 (1), 31-45.
- FELDER, P.J., FELDER, W.M. & BROMLEY, R.G., 1980: The type area of the Maastrichtian Stage. In: Birkelund, T. & Bromley, R.G. (Eds) - *The Upper Cretaceous and Danian of NW Europe*, 26th International Geological Congress, Paris, Guide to excursion A 69, 118-137. Paris.
- FELDER, W.M., 1975a: Lithostratigraphische Gliederung der Oberen Kreide in Süd Limburg (Niederlande) und den Nachbargebieten. Erster Teil: Der Raum westlich der Maas, Typusgebiet des 'Maastricht' - *Publikaties van het Natuurhistorisch Genootschap in Limburg*, 24, 43 pp.
- FELDER, W.M., 1975b: Lithostratigrafie van het Boven-Krijt en het Danio Montien in Zuid Limburg en het aangrenzende gebied. In: Zagwijn, W.H. & van Staalduinen, C.J. (Eds) - *Toelichting bij geologische overzichtskaarten van Nederland*, 63-75. Haarlem (Rijks Geologische Dienst).
- FRITSCH, A. & KAFKA, J., 1887: Die Crustaceen der böhmischen Kreideformation, 53 pp., 10 pls. Praha (Fr. Řivnač).
- GLAESSNER, M.F., 1969: Decapoda. In: Moore, R.C. (Ed.) - *Treatise on Invertebrate Paleontology, Part R, Arthropoda 4 (2)*, R 400-R 533. Boulder (Geological Society of America) and Lawrence (University of Kansas Press).
- HRSSELER, R.R., 1969: Peracarida. In: Moore, R.C. (Ed.) - *Treatise on Invertebrate Paleontology, Part R, Arthropoda 4 (1)*, R 360-R 393. Boulder (Geological Society of America) and Lawrence (University of Kansas Press).
- HOFKER, J., 1956: Les Foraminifères de la zone de contact Maestrichtien Campanien dans l'Est de la Belgique et le Sud des Pays Bas - *Annales de la Société géologique de Belgique*, 80, B 191-B 233, 14 pls.
- HOFKER, J., 1966: Maastrichtian, Danian and Paleocene Foraminifera. The Foraminifera of the type-Maastrichtian in South Limburg, Netherlands, together with the Foraminifera of the underlying Gulpen Chalk and the overlying calcareous sediments; the Foraminifera of the Dansk Kalk and the overlying Greensands and Clays as found in Denmark - *Palaeontographica, Supplement A*, 10, 3/6 pp., 86 pls.
- JAKOBSEN, S.I. & COLLINS, J.S.H., 1979: Decapod Crustacea from the Palaeocene of Zealand, Denmark - *Proceedings of the Geologists' Association*, 90 (2), 61-64.
- JAGT, J.W.M., 1988: Some stratigraphical and faunal aspects of the Upper Cretaceous of southern Limburg (The Netherlands) and contiguous areas. In: Streef, M. & Bless, M.J.M. (Eds) - *The Chalk District of the Euregio Meuse-Rhine. Selected papers on Upper Cretaceous deposits*, 25-39, 3 pls. Natuurhistorisch Museum Maastricht/Laboratoires de Paléontologie de l'Université d'Etat à Liège.

- JAGT, J.W.M., 1989: Ammonites from the early Campanian Vaals Formation at the CPI quarry (Haccourt, Liège, Belgium) and their stratigraphic implications. *Mededelingen van de Rijks Geologische Dienst*, 43 (1), 1-33, / pls.
- JAGT, J.W.M. & BONGAERTS, H.L., 1986: Kreeftresten uit de Formatie van Vaals (Onder-Campanian, Boven Krijt) in de groeve Ciments Portland Liégeois, Haccourt, Liège (B.). *Natuurhistorisch Maandblad*, 75 (4), 76-80.
- JAGT, J.W.M. & COLLINS, J.S.H., 1989: Upper Cretaceous cirripedes from N.L. Belgium. *Proceedings of the Geologists' Association*, 100 (2), 183-192.
- JAGT, J.W.M. & KENNEDY, W.J., 1989: *Acanthoscaphites varians* (Lopuski, 1911) (Ammonoidea) from the Upper Maastrichtian of Haccourt, NE Belgium. *Geologie en Mijnbouw*, 68 (2), 237-240.
- JAGT, J.W.M. & MICHELS, G.P.H., 1987: *Cyclaster platynatus* Kutscher, 1978: an addition to the echinoid fauna from the late Maastrichtian of NL Belgium. *Geologie en Mijnbouw*, 66 (1), 57-63.
- JELIZKY, J.A., 1951: Die Stratigraphie und Belemnitenfauna des Obercampan und Maastricht Westfalens, Nordwestdeutschlands und Dänemarks, sowie einige allgemeine Gliederungs-Probleme der jüngeren borealen Oberkreide Eurasiens - Beihefte zum Geologischen Jahrbuch, 1, 142 pp., / pls.
- MERTIN, H., 1941: Decapode Krebse aus dem subhercynen und Braunschweiger Emscher und Unteresenon, sowie Bemerkungen über einige verwandte Formen in der Oberkreide - *Nova Acta Leopoldina*, neue Folge, 10 (no. 68), 149-264, 8 pls.
- MILNE EDWARDS, A., 1879: Sur un isopode gigantesque des grandes profondeurs de la mer - *Comptes Rendus de l'Académie des Sciences*, Paris, 83, 21-23.
- PEAKE, N.B. & HANCOCK, J.M., 1970: The Upper Cretaceous of Norfolk (reprint with addenda and corrigenda). In: Farwood, G.P. & Funnell, B.M. (Eds) - *The Geology of Norfolk*. Transactions of the Norfolk Norwich Naturalists' Society, 19, 293-339, 339A-339J.
- POLLOCK, R.E., 1974: Spring Field Meeting to Maastricht, Netherlands. *Proceedings of the Geologists' Association*, 85 (1), 93-102.
- RICHARDSON, H., 1905: A monograph on the isopods of North America. *United States National Museum Bulletin*, 54, 177 pp.
- ROBASZYNSKI, I., BLESS, M.J.M., FELDER, P.J., FOUCHER, J.C., LEGOUX, O., MANIVIT, H., MELLSSEN, J.P.M.T. & VAN DER TUUK, L.A., 1985a: La limite Campanien-Maastrichtien dans le Limbourg belgo néerlandais. *Géologie Méditerranée*, 10 (3-4) (1983), 59-72.
- ROBASZYNSKI, I., BLESS, M.J.M., FELDER, P.J., FOUCHER, J.C., LEGOUX, O., MANIVIT, H., MELLSSEN, J.P.M.T. & VAN DER TUUK, L.A., 1985b: The Campanian-Maastrichtian boundary in the chalky facies close to the type Maastrichtian area - *Bulletin des Centres de Recherches et Exploration-Production Elf-Aquitaine*, 9 (1), 1-113, 22 pls.
- SCHLÜTER, C., 1862: Die Macruren Decapoden der Senon- und Cenoman-Bildungen Westfalens. *Zeitschrift der deutschen geologischen Gesellschaft*, 14 (4), 702-749, pls 11-14.
- SCHMID, F., 1959: Biostratigraphie du Campanien-Maastrichtien du NE de la Belgique sur la base des Bélemnites. *Annales de la Société géologique de Belgique*, 82, B 235-B 256.
- SCHMID, F., 1982: Das erweiterte Unter-/Ober Maastricht-Grenzprofil von Hemmoor, Niederelbe (NW Deutschland). *Geologisches Jahrbuch*, A 61, 7-12.
- SCHULZ, M.G., ERNST, G., ERNST, H. & SCHMID, F., 1984: Coniacian to Maastrichtian stage boundaries in the standard section for the Upper Cretaceous white chalk of NW Germany (Lägerdorf-Kronsmoor-Hemmoor): Definitions and proposals - *Bulletin of the geological Society of Denmark*, 33 (1-2), 203-215.
- SCHULZ, M.-G. & SCHMID, F., 1983: Das Ober Maastricht von Hemmoor (N Deutschland): Faunenzonen-Gliederung und Korrelation mit dem Ober-Maastricht von Dänemark und Limburg - *Newsletters on Stratigraphy*, 13 (1), 21-39.
- TSHUDY, D.M. & FELDMANN, R.M., 1988: Macruran decapods, and their epibionts, from the López de Bertodano Formation (Upper Cretaceous), Seymour Island, Antarctica. In: Feldmann, R.M. & Woodburne, M.O. (Eds) *Geology and paleontology of Seymour Island, Antarctica*. Geological Society of America Memoir 169, 291-301.
- UBAGHS, C., 1879: Description géologique et paléontologique du sol du Limbourg avec Catalogue général des fossiles du terrain crétacé, coupe de la superposition des couches, et Descriptions de quelques grands vertébrés de la craie supérieure de Maastricht, 275 + ii pp., / pls. Roermond (J.J. Romen & Fils).
- WIEDER, R.W. & FELDMANN, R.M., 1989: *Palaega goedertorum*, a fossil isopod (Crustacea) from late Eocene to early Miocene rocks of Washington State - *Journal of Paleontology*, 63 (1), 73-80.
- WOODWARD, H., 1870: Contributions to British fossil Crustacea. *Geological Magazine*, 7 (11), 493-497, pl. 22.

PLATE 1

- 1-3 ?*Palaega* sp. (USNM 444295). Part, 1, and counterpart, 2 and 3, of the sole specimen showing last pereonite, pleonites and pleotelson. Bar scale equals 1 cm. Compare text-fig. 3.
- 4-6 *Oncoporeia bredai* Bosquet, 1864. 4 is USNM 444296, moulted carapace, endophragmal skeleton, abdomen, and caudal fan; 5 is USNM 444298, anterior portion of carapace, proximal elements of left cheliped, and caudal fan; 6 is USNM 444299, ventral view of palm of right cheliped preserved mostly as exterior mould, and proximal portions of fingers of left and right chelipeds. Scale bar is 1 cm.

