

Devonian Proetidae (Trilobita) from the Ardennes Massif (Belgium, N France) and the Eifel Hills (W Germany)

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VIERSEN, A.P. VAN & PRESCHER, H., 2008 – Devonian Proetidae (Trilobita) from the Ardennes Massif (Belgium, N France) and the Eifel Hills (W Germany). In: STEURBAUT, E., JAGT, J.W.M. & JAGT-YAZYKOVA, E.A. (Editors), Annie V. Dhondt Memorial Volume. *Bulletin de l'Institut royal des Sciences naturelles de Belgique, Sciences de la Terre*, 78: 9-29, 5 figs, 5 pls, Brussels, October 31, 2008 – ISSN 0374-6291.

Abstract

New data are presented on trilobites of the family Proetidae (subfamilies Proetinae, Dechenellinae, Cornuproetinae) from the Devonian of the Ardennes Massif and the Eifel Hills (Rhenohercynian zone). Preliminary stratigraphic distributions of the Proetidae from the southern border of the Dinant Synclinorium are introduced. Eight taxa are recorded, namely: *Gerastos prox lessensis* n. ssp., *Gerastos catervus* (VAN VIERSEN, 2006), *Gerastos* sp. B, *Dohmiella tenuiornata* n. sp., *Dechenella daumeriesi* n. sp., *Dechenella* sp. A, *Cornuproetus cornutus* ssp. 2, and *Diademaproetus?* sp. In addition, *Dohmiella stumporum* n. sp. and *Gerastos* sp. A are described from the Eifel. The genus *Rhenocynproetus* BASSE, 2002 is regarded as a junior subjective synonym of *Gerastos* GOLDFUSS, 1843.

Keywords: Trilobites, Proetidae, Devonian, Ardennes, Eifel.

Résumé

De nouvelles données sont présentées sur les trilobites de la famille des Proetidae (sous-familles des Proetinae, des Dechenellinae et des Cornuproetinae) du Dévonien du Massif des Ardennes et des collines de l'Eifel (zone rhéno-hercynienne). Une distribution stratigraphique préliminaire des Proetidae sur le bord méridional du Synclinorium de Dinant est proposée. Huit taxa sont reconnus, à savoir *Gerastos prox lessensis* n. ssp., *Gerastos catervus* (VAN VIERSEN, 2006), *Gerastos* sp. B, *Dohmiella tenuiornata* n. sp., *Dechenella daumeriesi* n. sp., *Dechenella* sp. A, *Cornuproetus cornutus* ssp. 2 et *Diademaproetus?* sp. En complément, *Dohmiella stumporum* n. sp. et *Gerastos* sp. A sont décrites dans la région de l'Eifel. Le genre *Rhenocynproetus* BASSE, 2002 est considéré comme un synonyme plus récent de *Gerastos* GOLDFUSS, 1843.

Mots-clefs: Trilobites, Proetidae, Dévonien, Ardennes, Eifel.

Introduction

The family Proetidae (proetids) encompasses a large group of trilobites in the Devonian of the Ardennes. Early Devonian trilobite faunas in this region are low in diversity, and dominated by the families Acastidae and Homalonotidae. The appearance of Proetidae during the Middle Devonian here is relatively late when compared to abundant Early Devonian occurrences elsewhere, e.g. in Bohemia (ŠNAJDR, 1980) and Morocco (ALBERTI, 1969). In the Ardennes, the stratigraphically earliest confirmed records of Proetidae come from the lower Eifelian (Couvin and Jemelle Formations), which more or less coincides with putative initial migration of trilobites from Gondwana towards the northern margin of the Rheic Ocean (SCHRAUT & FEIST, 2004) and the development of shallow-water carbonate deposition in the Ardennes (CRÔNIER & VAN VIERSEN, 2007). Claimed occurrences of proetids in the upper Emsian of Belgium (e.g. MAILLIEUX, 1933; ASSELBERGHS, 1946) have not been confirmed but are possible given that they were recently reported from upper Emsian strata in adjacent regions (e.g. Proetinae and Cornuproetinae from Luxembourg by BASSE, 2002 and BASSE & FRANKE, 2006). Throughout the Eifelian, family Proetidae is represented in the Ardennes by a substantial variety of species comprising at least six genera (Fig. 1). Diversity of the family declined significantly in this region at around the Eifelian–Givetian boundary while only *Gerastos* and *Dechenella* are known with certainty to continue into the Givetian.

The proetid fauna of the Devonian of the Ardennes has been documented inadequately which is due mainly to a 60-year intermission of research on Devonian trilobites there. Although occurrences of proetids are frequently reported in the older literature (e.g. MAILLIEUX, 1904, 1919, 1933, 1938; RICHTER &

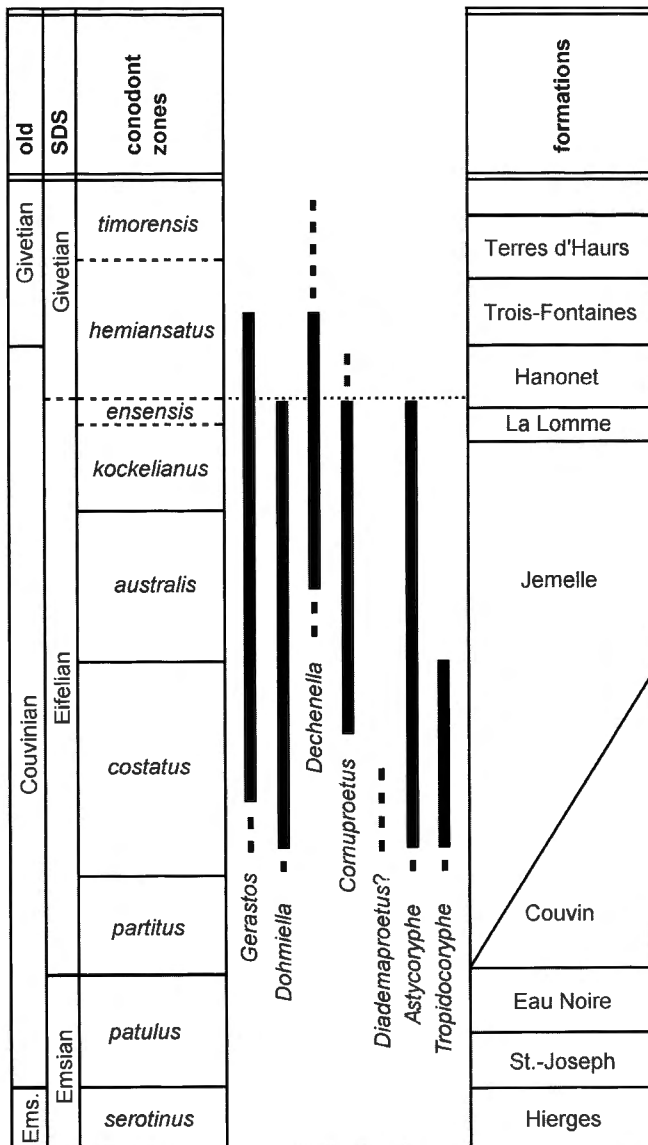


Fig. 1 — Generalised overview of stratigraphic units on the southern border of the Dinant Synclinorium (Belgium, northern France) (after BULTYNCK & DEJONGHE, 2001, fig. 5). Indications of old (Belgian) stratigraphic divisions are auxiliary. Continuous lines indicate known stratigraphic ranges of proetid trilobite genera; broken lines are tentative ranges. For occurrences in other formations and further explanation on these stratigraphic ranges, see under Systematic palaeontology.

RICHTER, 1918; VAN TUIJN, 1927; ASSELBERGHS, 1946), examination of some of the original specimens by one of us (A.V.) led us to the conclusion that genera and species have not been properly discriminated [e.g. the van Tuijn Collection (VAN TUIJN, 1927) from the Ferrières area (Fig. 2), Natuurmuseum Nijmegen, the

Netherlands, in 2004]. Recent collecting by the authors at Devonian outcrops on the southern border of the Dinant Synclinorium (Belgium, northern France) has yielded a wealth of new trilobite material which has enabled us to recognise a number of new proetid species and subspecies, some of which are described herein. In addition, one new species is recorded from Eifelian strata in the Eifel.

Locations and stratigraphy

Ardennes Massif (southern border of Dinant Synclinorium) *Loc002, Resteigne*

Abandoned quarry at Resteigne, Belgium. Trilobites come from the basal part of the Hanonet Formation, just below the Eifelian–Givetian boundary (*Polygnathus ensensis* conodont Zone). This locality was recently discussed and indicated on a map by VAN VIERSEN (2007b) who recorded several trilobite species from it and provided references to additional literature sources. Trilobites from the uppermost Eifelian at this locality include: *Calycoscutellum goolaertsii* VAN VIERSEN, 2007b, *Nyterops hollandi* VAN VIERSEN, 2007b, *Dechenella daumeriesi* n. sp., *Dohmiella tenuiorata* n. sp., *Gerastos prox lessensis* n. ssp., *Hypsipariops?* sp., *Cyphaspis* sp. [= *Otarioninae* gen. & sp. indet. of VAN VIERSEN (2007b)], and *Astycoryphe* sp. Accompanying macrofauna (det. H.P.): Brachiopods: abundant occurrences of *Gypidula abunda* STRUVE ssp. and *Invertrypa* cf. *kelusiana* (STRUVE); *Primipilaria pripilaroides* STRUVE, *Productella subaculeata* (MURCHISON), *Desquamatia (Synatrypa)* cf. *subzonata* (BIERNAT), and *Atryparia* cf. *instita* COPPER. Gastropods: “*Loxonema*” sp., *Omphalocirrus* sp., and *Bellerophon* sp. Cephalopods, as well as crinoid ossicles and crowns belonging to *Abbraviatocrinites* BOHATÝ are common.

Loc004, Jemelle

Embankment south of the Jemelle railway station, Belgium (see MAGREAN & VAN VIERSEN, 2005). Trilobite specimens come from argillaceous limestones belonging to the Jemelle Formation (*Polygnathus partitus* – *ensensis* conodont zones), Chavées Member; middle Eifelian. The rich macrofauna is highly diverse in trilobites which are represented here by at least 21 species: *Koneprusia maillieuxi* MAGREAN, 2006, *Kettneraspis bayarti* VAN VIERSEN, 2007a, *Radiaspis* cf. *comes* (BASSE, 1998), *Ceratarges* cf. *armatus* (GOLDFUSS, 1839), *Eifliarges* sp. cf. *Eifliarges* sp. of BASSE in BASSE & MÜLLER (2004) [= *Eifliarges caudimurus* (sic) of MAGREAN (2006)], *Cornuproetus cornutus* ssp. 2 (see below), *Gerastos* sp., *Dohmiella* sp. 1 of VAN VIERSEN (2006b), *Tropicoryphe* sp. cf. *Tropicoryphe* n. sp. G of BASSE (2002), *Astycoryphe senckenbergiana* RICHTER & RICHTER, 1919, *Cyphaspis* sp. B and *Cyphaspis?* sp. C of VAN VIERSEN & PRESCHER (2007), *Cyphaspis* cf. *hoepfneri* (KOWALSKI, 1990), *Phacops* cf. *imitator* STRUVE, 1970, *Pedinopariops* cf. *brongniarti* (STEININGER, 1831), *Pedinopariops* sp., *Geesops*

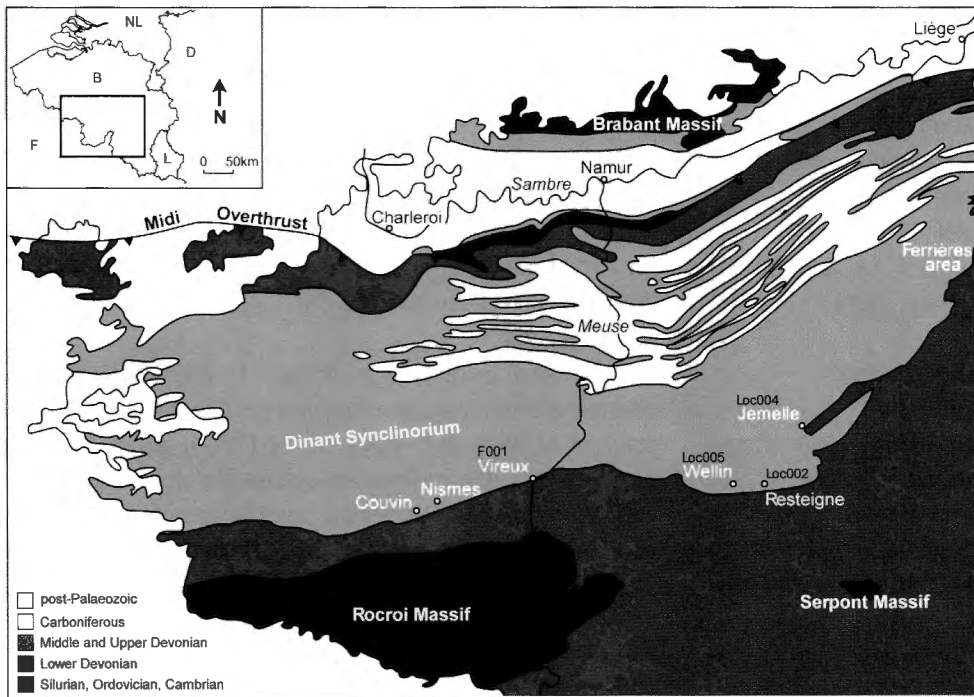


Fig. 2 — Generalised geological map of the Ardennes (after BULTYNCK & DEJONGHE, 2001, fig. 1).

sp., *Asteropyge* cf. *comes* BASSE, 2003, *Calycoscutellum* sp., *Scutellum* sp., and *Scabriscutellum canaliculatum* (GOLDFUSS, 1843) [= *Scabriscutellum vogeli* ARCHINAL, 1994 fide BASSE in BASSE & MÜLLER (2004)].

Loc005, Wellin

Quarry “Les Limites”, just north of Wellin, Belgium. Trilobites come from the X Formation (*Polygnathus ensensis* – ?*hemiansatus* conodont zones); upper Eifelian to ?lower Givetian. This formation comprises crinoidal and reefal limestones, and has yielded rich coral and stromatoporoid faunas. According to COEN-AUBERT *et al.* (1991) the X Formation is a local unit in the Wellin area where it separates the Jemelle Formation from the Hanonet Formation. It is absent about four kilometres to the east, in the Resteigne area, where the Hanonet Formation directly overlies the Jemelle Formation. A few kilometres to the west, in the Ponderôme area, coral-rich beds are found approximately at what would be the summit of the Jemelle Formation, which might be interpreted as corresponding to the X Formation. Further to the west from there, the latter unit appears to be absent. COEN-AUBERT *et al.* (1991) mentioned a number of trilobite occurrences but did not provide any names. One species, *Dechenella* sp. A, is recorded herein; other proetid trilobite specimens that are in our possession will be described at a later time.

F001 “Mur des douaniers”, Vireux-Molhain

Road cut near Vireux-Molhain, northern France. The outcrop has been assigned to the early Eifelian (*Polygnathus costatus* conodont Zone) Vieux Moulin Member of the Jemelle Formation by DUMOULIN & BLOCKMANS (2008). The site and its trilobite fauna were recently discussed in detail by CRÔNIER & COURVILLE (2006), VAN VIERSEN (2006a, 2008),

and CRÔNIER & VAN VIERSEN (2008).

Eifel

Gerolstein01, Lissingen

Temporary site (1998 to 1999) near Lissingen, by the road between Gerolstein and Müllenhorn; coordinates are r: (25)45440, h: (55)65280 (Blatt Gerolstein, topographical map 1:25,000). Specimens come from the lower part of the Bildstock Member (*Polygnathus costatus* conodont Zone), Ahrdorf Formation; middle Eifelian. Trilobites include *Dohmiella stumporum* n. sp., *Gerastos* sp. A (see below), *Phacops* sp., *Ceratarges* sp., *Scabriscutellum* sp., and *Cyphaspis* sp. Numerous small brachiopods were recovered that belong to (det. H.P.): *Kransia parallelepiped* (BRONN), *Athyris gutta* (SPRIESTERSBACH), *Dicamara prunulum* (SCHNUR), and *Oligoptycherhynchus ellipticus* (SCHNUR).

Systematic palaeontology

The following prefixes are used for type numbers of specimens: IRSNB (Institut royal des Sciences naturelles de Belgique); PLI (Katholieke Universiteit Leuven); SMF (Forschungsinstitut und Naturmuseum Senckenberg, Frankfurt-am-Main). All figured specimens were coated with ammonium chloride sublimate prior to photography. Morphological terminology essentially follows that of WHITTINGTON & KELLY (1997). Stratigraphic ranges are given below for the occurrences of individual proetid genera in Middle Devonian strata on the southern border of the Dinant Synclinorium (Belgium, northern France). Data were

obtained during ongoing fieldwork and thus the ranges are preliminary, and their boundaries may be extended upwards or downwards in the future. Occurrences of members of subfamily Tropicocoryphinae are indicated in Fig. 1; they will be treated in a forthcoming paper.

Family Proetidae SALTER, 1864
 Subfamily Proetinae SALTER, 1864
 Genus *Gerastos* GOLDFUSS, 1843

= *Rhenocynproetus* BASSE, 2002

Type species: Proetus cuvieri STEININGER, 1831, from the Ahrdorf Formation (Eifelian) of the Eifel. GIBB (2005, p. 158) stated that the holotype of *Gerastos cuvieri* was figured by KOWALSKI (1990, figs 9, 10). According to RICHTER & RICHTER (1956) Steininger's collections, including the holotype of *Gerastos cuvieri*, were lost in Trier and so these authors selected and illustrated a neotype. KOWALSKI's (1990) figures are of two individuals, neither of which is the neotype.

Discussion

ADRAIN (1997) placed *Devonoproetus* LÜTKE, 1990 in synonymy of *Proetus* STEININGER, 1831 because its type species, *Proetus (Proetus) talenti* CHATTERTON, 1971, is a member of *Proetus*. BASSE (2002) reassigned a number of Eifelian species from the Rhenish Mountains that had formerly been included in *Devonoproetus* to his new genus *Rhenocynproetus* (type species *Devonoproetus doernbergensis* BASSE, 1996), and provided a revised diagnosis. EDGEcombe & WRIGHT (2004) briefly commented on *Devonoproetus* and *Rhenocynproetus* but focused their discussions on relationships of these taxa with *Proetus* and *Longiproetus* CAVET & PILLET, 1958. We find *Rhenocynproetus* to be exceedingly similar to *Gerastos*, of which it is likely to be a synonym. Although the type species of *Rhenocynproetus* is different from the type species of *Gerastos* in a number of aspects (BASSE, 2002), many characters that define *Rhenocynproetus* according to the latter author are either variable or intermediate with *Gerastos*. This is exemplified by several species described in the literature that are clearly morphologically intermediate between these two genera (see below). In addition, a number of diagnostic characters of *Rhenocynproetus* are shared by other proetines, including stratigraphically older species of *Proetus* (see, e.g., OWENS, 1973) and *Gerastos* (see, e.g., ŠNAJDR, 1980), and likely to be plesiomorphic. These include a shallow border furrow, relatively well-developed lateral occipital lobes, inconspicuous S1 to

S3 and eye socle, convex cephalon, and absence of a preglabellar field. Interestingly, there are no species assigned to *Rhenocynproetus* that co-occur with *Gerastos* species. This is even the case in successive strata at some localities where species of one genus are seemingly 'replaced' by species of the other and we hypothesise that other processes might have been involved, such as adaptations to the environment that induced a 'Gerastos-like' or 'Rhenocynproetus-like' morphology.

Contrary to numerous reports in the old literature, there is currently no proof for the occurrence of *Gerastos cuvieri* in Belgium. MAILLIEUX (1933, pl. 5, fig. 88) figured an outstretched specimen but his drawing is either imprecise or it depicts another taxon as it differs from the German species in a number of important characters (for instance, the glabella of the illustrated specimen does not overhang the anterior border at all, the eyes are relatively small, and the cephalic outline is rather different). These differences might be explained by the fact that in the Jemelle Formation, one of the chief units to yield Eifelian *Gerastos* specimens in the Ardennes, they are commonly preserved as tectonically deformed, internal moulds. There is one species from Belgium, *Gerastos dhondti* MAGREAN, 2007 from the upper Eifelian of the Couvin area, that is known from well-preserved material and which is very similar to *Gerastos cuvieri*. According to MAGREAN (2007), both RICHTER & RICHTER (1956) and BASSE (2002) assumed that late Eifelian *Gerastos prox* (RICHTER & RICHTER, 1956) descended from middle Eifelian *Gerastos cuvieri*. Based on its occurrence in the upper Eifelian, MAGREAN (2007) considered *Gerastos dhondti* to be a 'missing link' between the other two. BASSE (2002, p. 18), however, stated that *Gerastos cuvieri* and *Gerastos prox* are too dissimilar to assume that the latter is a descendant of the former. Because *Gerastos dhondti* is very similar to *Gerastos cuvieri* we do not regard it as being intermediate between this species and *Gerastos prox*. Furthermore, we note that RICHTER & RICHTER (1956) observed that *Proetus (Proetus) granulatus* of KIELAN (1954) from the Eifelian–Givetian boundary of the Holy Cross Mountains is also exceedingly similar to *Gerastos cuvieri*. It is obvious that the relationships of these species are far from resolved and that they will require further investigation.

The names *Gerastos laevigatus* GOLDFUSS, 1843 and *Gerastos granulatus* GOLDFUSS, 1843 (recorded from Belgium e.g. by MAILLIEUX, 1904, 1919) were traditionally employed respectively for *Gerastos* specimens with a smooth or granulate glabella (RICHTER & RICHTER, 1956). *Gerastos laevigatus*, which was

originally designated as the type species of *Gerastos* by GOLDFUSS (1843), is a junior synonym of *Gerastos cuvieri* (see VOGDES, 1890). RICHTER & RICHTER (1956) argued that *Gerastos granulatus* is a juvenile form of *Gerastos cuvieri* and therefore, that they are synonyms. BASSE (1996) elaborated on consistent co-occurrences of these species in the Devonian of the Rhenish Mountains east of the Rhine, implicitly suggesting that RICHTER & RICHTER's (1956) assumption is correct. Accurate distributions of trilobites at the type locality of these species ('Trilobitenfelder' of Gees, Eifel) are being resolved for the first time (H.P., work in prep.), based on extensive field data gathered during collecting at the site before it was closed in the mid 1980s. As a preliminary note it is stated that *Gerastos granulatus* occurs at Gees in slightly lower beds than *Gerastos cuvieri*, and that these taxa do not co-occur there. The argument that one is a juvenile form of the other is rejected on the basis of their separate occurrences at the type locality, and without any evidence to suggest otherwise we consider both taxa to be valid.

Occurrence

Lower Eifelian to lower Givetian; Jemelle, X (Wellin area), Hanonet, and Trois-Fontaines Formations.

Gerastos catervus (VAN VIERSEN, 2006) (Pl. 1, Figs 6, 9, 10, 14)

- 1982 *Longiproetus cultrijugati* – STRUVE, p. 478.
 1991 *Gerastos* sp. – GIBOUT, p. 7, unnumbered figs.
 1995 *Proetus* sp. – BLONDIEAU, pl. 9, fig. 8.
 2004 *Rhenocynproetus* sp. – BASSE in BASSE & MÜLLER, p. 24.
 2006 *Gerastos cuvieri* (STEININGER) – CRÔNIER & COURVILLE, figs 1C1, 1C2.
 *2006a *Rhenocynproetus catervus* VAN VIERSEN, p. 66, pl. 2, figs 1-8.
 v2008 *Rhenocynproetus catervus* VAN VIERSEN – CRÔNIER & VAN VIERSEN, figs 3.10, 3.11.

Material

One topotypical external mould of a partial cephalon (PLI-05) plus silicone cast (PLI-06), from locality "Mur des douaniers", Vireux-Molhain (F001), Ardennes, France; Vieux Moulin Member of Jemelle Formation, lower Eifelian (= type horizon).

Discussion

In describing *Rhenocynproetus catervus*, VAN VIERSEN (2006a) did not discuss its relationship with *Gerastos* species and only compared it to morphologically similar members of *Rhenocynproetus*. Later, VAN VIERSEN

(2006b, p. 230) stated that "[...] *Rhenocynproetus catervus* shows cephalic features usually found in *Gerastos* including the steep inclination of the frontal lobe and the absence of genal spines". The intermediate morphology of this and other species (e.g. *Rhenocynproetus?* sp. of BASSE, 2002) between *Rhenocynproetus* and *Gerastos*, along with other reasons (see above), suggests that these genera are synonyms.

Comparison

The new material shows several details of the cephalic morphology of this species in addition to those mentioned in the original description. Coeval *Gerastos cultrijugati* (RICHTER & RICHTER, 1918) from the Eifel, with which the French species has been confused in the past and which is known from ample well-preserved specimens, bears a number of similarities to *Gerastos catervus* such as the elongated, projectile shaped glabella and similarly flexed facial sutures. The cephalon of the French species differs principally as follows: larger eyes; well-developed subocular ridge; more compact (exsag.) librigena with shorter distance between eye and genal corner; transversally running posterior border furrows; absence of granules on librigenal field; less inflated lateral border. Prolongation of the librigena into a thorn or spine was believed by VAN VIERSEN (2006a) to be among features that distinguished *Gerastos cultrijugati* from his species. The new specimen illustrated here shows that *Gerastos catervus* can have a genal thorn, although it is shorter than that of the German species.

Gerastos prox (RICHTER & RICHTER, 1956)

Assigned taxa

Gerastos prox lessensis n. ssp., *Gerastos prox* ssp. of BASSE (1996), *Gerastos prox* n. ssp. P of BASSE (2002).

Gerastos prox lessensis n. ssp. (Pl. 1, Figs 1-5, 7, 8, 11-13, 15-17)

- 2007 *Gerastos prox* (RICHTER & RICHTER) – MAGREAN, p. 34, pl. 2, figs 1-3.
 v2007b *Gerastos* cf. *prox* (RICHTER & RICHTER) – VAN VIERSEN, p. 20, pl. 3, figs 1, 2, 4, 5, 7-9, 11.

Derivation of name

After its occurrence near the Lesse river which is adjacent to the Resteigne quarry.

Holotype

Cranidium IRSNB a12442 (VAN VIERSEN, 2007b, pl. 3, figs 7-9).

Type locality

Southwestern slope of the Resteigne quarry (Loc002), Belgium.

Type horizon

Basal part of Hanonet Formation, uppermost Eifelian.

Paratypes

One incomplete cephalon (IRSNB a12575), four cranidia (IRSNB a12576-a12579), two librigenae (IRSNB a12580, a12581), two pygidia (IRSNB a12444, a12582), one partial pygidium (IRSNB a12445).

Diagnosis

A subspecies of *Gerastos prox* with the following characteristic features: anterior cephalic border smoothly rounded in dorsal view; axial furrow running more or less exsagittally lateral to S1, converging from lateral to anterior half of L2 anteriorly; weakly vaulted (tr.) librigenal field with indistinct subocular ridge.

Discussion

The anterior cephalic border of the nominate subspecies protrudes medially as if it were deflected anteriorly by the glabella. This is clearly visible in the holotype cephalon (RICHTER & RICHTER, 1956, pl. 3, fig. 17a) and was also described by BASSE (2002, p. 20) on the basis of his material. *Gerastos prox lessensis* n. ssp. has a smoothly rounded anterior border that instead of medially following the anterior prolongation of the glabella, is clearly overhung by it. Other features that distinguish *Gerastos prox prox* from our subspecies include the abaxially rounded glabella near S1; wider (tr.) glabella anterior to S0 relative to length (sag.); more strongly vaulted (tr.) librigenal field bearing an inflated subocular ridge that is always accentuated by a single row of tubercles (these tubercles are commonly very small and more randomly scattered in the subspecies from Resteigne).

MAGREAN (2007) illustrated an incomplete trilobite from the upper Eifelian of Resteigne that he identified as *Gerastos prox*. Although MAGREAN's specimen is severely damaged, its provenance and overall similarity suggest that it belongs to *Gerastos prox lessensis* n. ssp.

Gerastos sp. A

(Pl. 3, Figs 15, 17, 18)

Material

One pygidium (IRSNB a12583), from locality Gerolstein01, Lissingen, Bildstock Member of Ahrdorf Formation, middle Eifelian.

Discussion

The single pygidium from locality Gerolstein01 is almost indistinguishable from that of *Gerastos cuvieri* which is abundant in the superjacent Flesten Member of the Ahrdorf Formation at its nearby type locality. Potential differences include the medially elevated pygidial border and much shallower inter-ring furrows of *Gerastos* sp. A.

Gerastos sp. B

(Fig. 3)

Material

One external mould of an articulated specimen plus silicone cast (IRSNB a12584), from a pile of loose rocks at Loc002, Resteigne, probably moved here from works at a nearby location. Presumably middle Eifelian part of Jemelle Formation.

Discussion

This specimen is preserved as an external mould in an argillaceous limestone that is very similar to that typically found in the middle part of the Jemelle Formation on the southern border of the Dinant Synclinorium, such as at site Loc004. We believe that

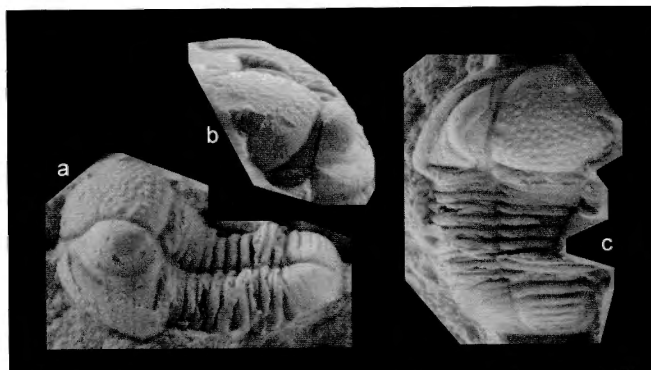


Fig. 3 — *Gerastos* sp. B (IRSNB a12584); from Resteigne (Loc002), ?Jemelle Formation, ?middle Eifelian. Lateral (a), anterior (b) and dorsal (c) views on silicone cast of articulated specimen, x 6.

the specimen may originate from this unit.

The silicone mould that is illustrated herein resembles *Gerastos cuvieri* forma B of BASSE (2002) from the middle Eifelian of the Eifel but is principally different (as far as it has not been affected by longitudinal tectonic deformation) in having anteriorly more convergent preocular sutures and less vaulted (tr.) genal fields.

Genus *Dohmiella* LÜTKE, 1990

Type species: Proetus (Euproetus) dohmi RICHTER & RICHTER, 1918, from the Junkerberg Formation (Eifelian) of the Eifel.

Discussion

Dohmiella is a distinctive proetid in the Ardennes and Eifel, primitively with conspicuously rich prosopon that always includes median nodes or occasionally spines on the thoracic and especially the pygidial axis (we believe that these structures are a potentially robust synapomorphy to unite *Dohmiella* species). The genus emerges in the fossil record in lower Eifelian strata in the Ardennes and Eifel, and persists here until around the Eifelian–Givetian boundary. It is known outside these regions from upper Eifelian strata in the Holy Cross Mountains and in Bohemia but has not been recorded from extensively commercially exploited Devonian strata in Morocco, or from elsewhere. There are several Bohemian proetids that may be considered possible ancestors of *Dohmiella*. These include the type species of *Bohemiproetus*, *B. bohemicus* (HAWLE & CORDA, 1847) (see, e.g., ŠNAJDR, 1980, pl. 6, figs 1, 3-5, 8-10, 12-14), which shares the broad, dorsally flattened, subtrapezoidally outlined pygidial border that is covered with densely spaced, small granules, and furthermore, although perhaps less compelling, the overall morphology of the cephalon. Still, none of the Early Devonian proetids from Bohemia appear to have developed median axial protuberances and so the occurrence of *Dohmiella* here seems to be restricted to the upper Eifelian.

Oehlertaspis lardeuxi (PILLET, 1972), a proetid from the Emsian of the Massif armoricain, shares the presence of median tubercles on the pygidial axial rings with *Dohmiella*. *Oehlertaspis* differs in a number of characters which include the exceedingly short (sag., exsag.) cranidial border, subexsagittally directed preocular sutures, smaller number of pygidial axial rings (5 to 6), and generally very dissimilar prosopon of the glabella, thorax (always lacking median axial tubercles), and pygidium. These differences suggest

that *Oehlertaspis* is not particularly closely related to *Dohmiella*. The type and only other presently assigned species of *Oehlertaspis*, *O. rondeaui* (OEHLERT & OEHLERT, 1890), does not show any sign of median tubercles on the pygidial axis and so the tubercular condition of *Oehlertaspis lardeuxi* might turn out to be autapomorphic.

A fairly large number of species have been assigned to *Dohmiella*, the majority of which come from Eifelian strata in the Eifel (LÜTKE, 1990; BASSE, 2002; BASSE in BASSE & MÜLLER, 2004; VAN VIERSEN, 2006b). Our investigations have shown that this genus is represented in the Ardennes and Eifel by a much greater variety of species than was hitherto assumed. In addition to the descriptions of two species in the present paper, material of a number of other undocumented species is in our possession that will be described elsewhere.

Occurrence

Lower to upper Eifelian; Couvin (Couvin area), Jemelle, and Hanonet Formations.

Dohmiella tenuiornata n. sp.

(Pl. 2, Figs 1-19)

v2006b *Dohmiella* sp. 2 – VAN VIERSEN, p. 234, pl. 3, fig. 2.

v2007b *Dohmiella* sp. 2 – VAN VIERSEN, p. 21, pl. 3, fig. 10.

Derivation of name

From *tenuis* (Lat.: feeble) and *ornatus* (Lat.: ornament), after the dorsal ornament which is relatively weakly expressed for a *Dohmiella* species.

Holotype

Cranidium IRSNB a12585 (Pl. 2, Figs 1-3).

Type locality

Southwestern slope of the Resteigne quarry (Loc002), Belgium.

Type horizon

Basal part of Hanonet Formation, uppermost Eifelian.

Paratypes

Three cranidia (IRSNB a12586-a12588), two librigenae (IRSNB a12589, SMF 58587), three pygidia (IRSNB a12590-a12592).

Diagnosis

Preocular suture smoothly rounded near δ ; convex near γ and β . Lateral occipital lobes small, weakly inflated, and devoid of prosopon. Pygidial border very weakly

vaulted, and downwardly sloped towards margin, especially medially. Bladder-like median tubercles present on anterior four or five pygidial axial rings. Anterior five to six lateral axial lobes bearing a coarse, large tubercle posteriorly on adaxial margin.

Description

Cranidium. Long (sag.) glabella; about 1.5 times longer (sag.) than wide (tr.). Occipital ring long (sag.); hardly increasing in height posteriorly; bearing weakly expressed, small tubercles, and a median tubercle positioned slightly posterior to halfway (sag.). S0 relatively shallow for a *Dohmiella* species; running transversally; abaxially bifurcated and embracing teardrop-shaped (tr.) lateral occipital lobe. S1 moderately impressed anteriorly; anteromedially shallow, making a convex curve posteriorly, and from there running obliquely posteriorly towards sagittal line, visible here mainly due to absence of tubercles. S2 represented by a fine, short, nearly transverse line. Glabella of subrectangular outline between S0 and S1; bearing small, weakly inflated tubercles of subtriangular to rounded outlines between S0 and S2; abaxial margins slightly yet markedly indented (tr.) by S1 and S2. Axial furrows broad and slightly convergent between S1 and S2; narrower from point opposite δ and smoothly converging towards sagittal line. Anterior border moderately (in larger specimens) to very (in smaller specimens) long (sag.); of great dorsoventral height; dorsally somewhat flattened; partially overhung by glabella; inner half of dorsal surface is smooth, outer half bears at least five parallel marginal terrace ridges.

Librigena: see VAN VIERSEN (2006b, p. 234). In addition to this, librigenal thorn can be short and sharply pointed in some specimens (but see discussion below).

Thorax is unknown.

Pygidium weakly vaulted (sag., tr.); about 1.5 times wider (tr.) than long (sag.). Posterior margin runs subtransversely medially. Border very broad, even for a *Dohmiella* species; bearing densely and evenly spaced granules, and two parallel marginal terrace ridges visible dorsally. Shallow, narrow border furrow, the inner margin of which is discernible in that most pleurae slope steeply downwards. Five pairs of pleurae. Antermost pleural furrow is deep, especially near halfway (tr.) along pleural field; distally distinct where first pleura continues onto lateral border. Second, third and fourth pleural furrows (counting from anterior) moderately impressed. Interpleural furrows faint but continuous (discernible under oblique lighting). Pleural fields covered with closely spaced, fine granules. Coarse, larger granules situated just abaxial of halfway point (tr.)

across the pleurae. On internal moulds these parts of the pleurae are clearly swollen, while this is less so where cuticle is present. (Similar granulose, swollen structures are also apparent on pygidia of many congeners, demonstrably in illustrations provided with the original description of *Dohmiella dewildei* VAN VIERSEN, 2006 from the lower Eifelian of Nismes, Ardennes.) Axis is comprised of seven, broadly M-shaped (dorsal view) rings plus terminal piece. Numerous tubercles are present in basically the same arrangement on each ring, consisting of a posterior transverse row of larger tubercles, and randomly scattered smaller ones anterior to these. Terminal axial piece is covered with closely spaced granules. Rings 1 to 3 (counting from anterior) each bear a large, bladder-like swollen median tubercle that is also clearly discernable on internal moulds; ring 4 and occasionally also ring 5, bears a smaller median tubercle. No median tubercles are present on rings 6 and 7 or on terminal piece. Lateral axial lobes well-defined by presence of several relatively large tubercles.

Discussion

VAN VIERSEN (2006b, 2007b) described the librigena of this species from Resteigne and noted that the genus is very rare here. Intensive collecting from the Hanonet Formation in the Resteigne quarry has yielded complementary specimens, notably from crinoid-rich beds.

Librigenal thorns or spines are displayed by all *Dohmiella* species whereas their presence in *Gerastos* varies both interspecifically and intraspecifically. At least four *Dohmiella* species from the lower to upper Eifelian of the Ardenno-Rhenish mountains show moderate to major intraspecific variation of the length of these prolongations (*Dohmiella dewildei*, *Dohmiella prescheri* VAN VIERSEN, 2006b, *Dohmiella tenuiornata* n. sp., and *Dohmiella stumporum* n. sp.) and so we do not attribute much taxonomic value to their morphology.

Comparisons

The new species bears a resemblance to *Dohmiella bacchus* BASSE, 2002 from the upper Eifelian of the Eifel. BASSE's species differs from ours principally in having a shorter (sag., exsag.) anterior border; relatively shorter (sag.) glabella; much more smoothly rounded preocular sutures near γ and β ; deeper S0; the anterior two pairs of pygidial pleural furrows deepest; narrower pygidial border that is much more uniformly vaulted. Unfortunately, BASSE (2002) did not provide a detailed description for his species and the limited resolution of his images (BASSE, 2000, 2002) does not permit further comparison at this time.

One small (juvenile?) cranidium of *Dohmiella tenuiornata* n. sp. (Pl. 2, Fig. 15) is very similar to a small cranidium from the lowermost Givetian of the Eifel figured and identified as *Dohmiella* cf. *bacchus* by BASSE (2002, pl. 11, fig. 227). Both specimens have a long (sag.) anterior border and a narrow (tr.), convex (sag., exsag.) glabella that does not overhang anteriorly. These features are present to a lesser extent in larger specimens of *Dohmiella tenuiornata* n. sp. and apparently also *Dohmiella bacchus*, and are restricted to some but not all terminal taxa of *Dohmiella* at around the Eifelian–Givetian transition when other proetines that occur in the Ardenno–Rhenish mountains (e.g. *Gerastos* and *Longiproetus*, should the latter genus continue to be recognised) maintained their compact (sag., exsag.), more vaulted cephalic morphology. The somewhat ‘unconventional’ morphology of these *Dohmiella* species may reflect an adaptation to their environment, i.e., an ecological niche. All the same, it did not save *Dohmiella* from its demise shortly afterwards during the earliest Givetian whereas *Gerastos* persisted at least until in the middle Givetian (BASSE, 1996; BASSE & LEMKE, 1996).

***Dohmiella stumporum* n. sp.**

(Pl. 3, Figs 1–14, 16; Pl. 4, Figs 6–14)

Derivation of name

Named after Diethelm and Maria Stump (Mürtenbach), who have made a significant contribution to the knowledge of trilobites and crinoids from the Eifel during the past 30 years.

Holotype

Pygidium IRSNB a12593 (Pl. 3, Figs 1, 2, 4).

Type locality

Temporary outcrop near Lissingen (Gerolstein01), Eifel.

Type horizon

Bildstock Member of Ahrdorf Formation, middle Eifelian.

Paratypes

Three cranidia (IRSNB a12594–a12596), three librigenae (IRSNB a12597–a12599), three pygidia (IRSNB a12600–a12602).

Diagnosis

Surface of librigenal field entirely covered with small pits that occasionally alternate with sparse tubercles posterolateral of eye. Subocular ridge sharply

demarcated abaxially. Prominent median tubercles present on anterior four to five pygidial axial rings.

Discussion

This species is morphologically similar to *Dohmiella prescheri* from the Nohn Formation (lower Eifelian) of the Eifel. In addition to their overall similarities, both species share a number of particular features such as the similarly vaulted glabella and cephalic border; glabella that slightly overhangs anterior border and that is constricted (tr.) near S2; small distance between eye and lateral border. Besides the diagnostic characters listed above, the new species is different from *Dohmiella prescheri* as follows: smaller eyes; moderately strongly curved preocular suture between γ and β ; posteromedial tubercles on glabella anterior to S0 are clearly more spaced; lateral flanks of pygidial axis bear multiple, small, pointed tubercles; more strongly vaulted pygidial border; absence of median tubercles on pygidial axial rings 6 and 7, which, instead have numerous granules present.

Dohmiella stumporum n. sp. also bears a resemblance to *Dohmiella dewildei* but many aspects of its morphology differ from the Belgian species in the same way as *Dohmiella prescheri* (see VAN VIERSEN, 2006b, p. 233).

Subfamily Dechenellinae PŘIBYL, 1946

Genus *Dechenella* KAYSER, 1880

Type species: Phillipsia verneuili BARRANDE, 1852, from the Lough or Cürten Formations (Givetian) of the Eifel.

Occurrence

Upper half Eifelian to lower Givetian; Jemelle, X (Wellin area), Hanonet, Trois-Fontaines, and Terres d’Hairs Formations.

***Dechenella daumeriesi* n. sp.**

(Pl. 4, Figs 1–3; Pl. 5, Figs 1–15)

2007b *Dechenella* sp. – VAN VIERSEN, p. 21, pl. 3, fig. 12.

Derivation of name

Named after Guy Daumeries (Gilly), whom we thank for sharing his valuable knowledge on the Devonian macrofauna of the Ardennes.

Holotype

Cranidium IRSNB a12603 (Pl. 5, Figs 1–3).

Type locality

Southwestern slope of the Resteigne quarry (Loc002), Belgium.

Type horizon

Basal part of Hanonet Formation, uppermost Eifelian.

Paratypes

One cephalon (IRSNB a12604), one cranidium and a pygidium on a single rock slab (IRSNB a12605), two librigenae on a single rock slab (IRSNB a12606), two pygidia (IRSNB a12607-a12608), two pygidia on a single rock slab (IRSNB a12609).

Diagnosis

Dorsal surface of cephalon and pygidium almost entirely covered with small pits; posterior part of cranidium bearing few small pits; pygidial axis smooth; pygidial border anteriorly bearing posteroventrally oriented terrace ridges. Pygidial border broad medially to posterolaterally.

Discussion

BASSE (2002) identified a large variety of *Dechenella* species from latest Eifelian to middle Givetian strata in the Eifel that he divided into groups designated A to E and “miscellaneous”, although he did not provide a key to distinguish between them. BASSE (2002) split the pygidial axes of *Dechenella* species into different categories, also designated A to E, and diagnosed each of these. BASSE’s respective groups and categories A to E were assigned different species and we focused our studies on his classification of pygidial axes, which is traceable. According to BASSE (2002, p. 10) his category C is diagnosed as follows (German transl.): “Almost every ring clearly protrudes anteriorly; median “bridge” is restricted to posterior part of axis; rings are moderately ridge-like and indistinctly separated from one another. Characteristic taxon: *Dechenella verneuili*.” Our specimens of *Dechenella daumeriesi* n. sp. all show this configuration of the pygidial axis and they are also generally very similar to *Dechenella verneuili*. This species was redescribed by BASSE (2002, p. 38) and to avoid repetition here, the species from Resteigne is contrasted with it. *Dechenella daumeriesi* n. sp. principally differs from the German species (in addition to the diagnostic features listed above) in having much more sharply flexed preocular sutures and relatively far abaxially positioned β ; longer librigenal spines; broadly rounded, posteromedially somewhat truncated (sag., exsag.) pygidium with wider (tr.) pleural fields.

Dechenella sp. A

(Pl. 4, Figs 4, 5)

1995 *Dechenella verneuili* – BLONDIEAU, pl. 17, figs 1, 2.

Material

One incomplete pygidium (IRSNB a12610), from Loc005, Wellin, Ardennes, X Formation, upper Eifelian.

Discussion

This species is similar in age to *Dechenella daumeriesi* n. sp. which occurs only a few kilometres east from Wellin, in Resteigne. Even though this single specimen is poorly preserved, it can easily be differentiated from the species from Resteigne by its more numerous pygidial axial rings and pleurae. Additional material will be required to describe it fully.

Subfamily Cornuproetinae RICHTER, RICHTER & STRUVE in MOORE, 1959

Genus *Cornuproetus* RICHTER & RICHTER, 1919

Type species: Gerastos cornutus GOLDFUSS, 1843, from the Ahrdorf Formation (Eifelian) of the Eifel.

Occurrence

Middle Eifelian; Jemelle Formation. Furthermore, in the lower part of the Hanonet Formation (upper Eifelian); possibly also in the lower Givetian part of this formation.

Cornuproetus cornutus spp. 2

(Fig. 4)

v2005 *Cornuproetus* (*Cornuproetus*) *cornutus cornutus* (GOLDFUSS) – MAGREAN & VAN VIERSEN, p. 89, pl. 1, figs 1-7.

Material

One external mould of a partial cephalothorax plus silicone cast (IRSNB a12611), from Loc004, Jemelle, Ardennes, Belgium, Chavées Member of Jemelle Formation, middle Eifelian.

Discussion

MAGREAN & VAN VIERSEN (2005) recorded two internal moulds of complete specimens that they considered to be conspecific with topotypical *Cornuproetus* (*Cornuproetus*) *cornutus cornutus* from the Eifel. A silicone cast of a partial cephalothorax is recorded here which reveals some details of prosopon. Despite the similarities with the subspecies from the Eifel, the

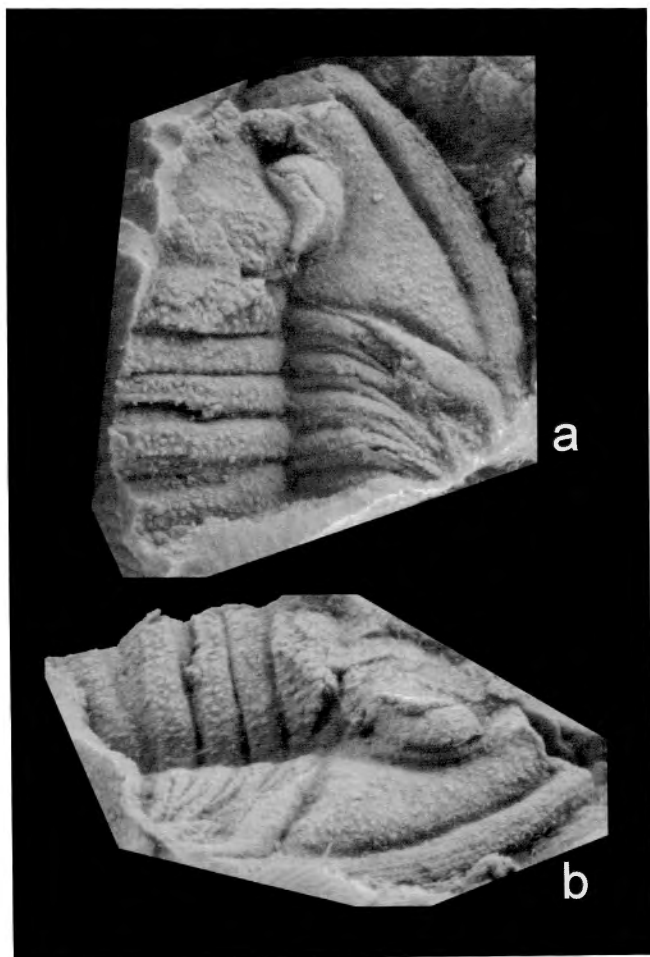


Fig. 4 — *Cornuproetus cornutus* ssp. 2 (IRSNB a12611); from Jemelle (Loc002), Chavées Member of Jemelle Formation, middle Eifelian. Dorsal and lateral views on silicone cast of partial cephalothorax, x 6.

specimens from Jemelle are probably best treated under open nomenclature until better preserved material becomes available.

Genus *Diademaproetus* ALBERTI, 1964

Type species: Proetus holzapfeli NOVÁK, 1890, from the Günteröder Limestone (Eifelian) of the Rhenish Mountains east of the Rhine.

Occurrence

Questionably in the lower Eifelian (Jemelle Formation).

Diademaproetus? sp.

(Fig. 5)

- 1991 *Longiproetus cultrijugati* – GIBOUT, p. 7, unnumbered figs
 2004 *Cornuproetus (Diademaproetus)* sp. – BASSE in BASSE & MÜLLER, p. 24.
 2006 Proetidae – CRÔNIER & COURVILLE, fig. 1C10.
 2006a *Cornuproetus (Cornuproetus)* – VAN VIERSEN, p. 63.
 2008 *Cornuproetus (Diademaproetus)* sp. – CRÔNIER & VAN VIERSEN, fig. 3.9.

Material

One external mould of a partial cephalothorax plus silicone cast (IRSNB a12612), from “Mur des douaniers” near Vireux-Molhain (F001), Ardennes, France; Vieux Moulin Member of Jemelle Formation, lower Eifelian.

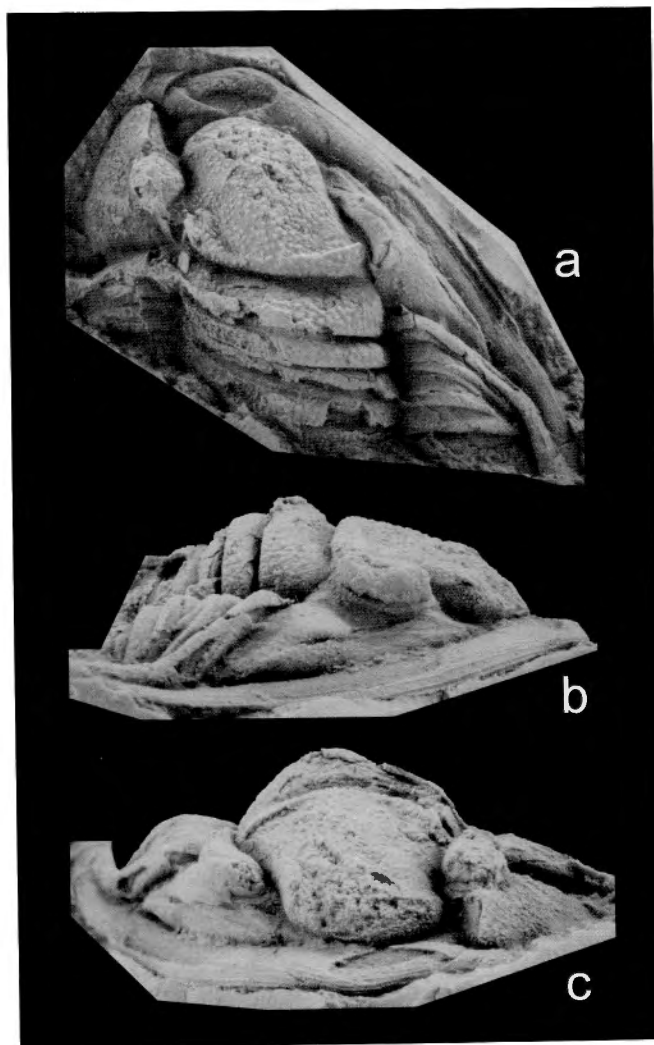


Fig. 5 — *Diademaproetus?* sp. (IRSNB a12612); from Vireux-Molhain (F001), Vieux Moulin Member of Jemelle Formation, lower Eifelian. Dorsal, lateral, and anterior views on silicone cast of partial cephalothorax, x 3.

Discussion

Generic assignment of representatives of *Cornuproetinae* from Vireux-Molhain has proved difficult because trilobites from this locality are usually poorly preserved as tectonically deformed, internal moulds. They have been variably assigned in the literature to the closely related genera *Cornuproetus* and *Diademaproetus*. The new specimen that is recorded here represents the only external mould that we have come across and even though it is tectonically skewed, it does show some indications of its original morphology. According to CHATTERTON *et al.* (2006, p. 38) *Diademaproetus* is diagnosed (among other features) by a broad, flat cephalic border, and a distinct preglabellar field between the glabella and the anterior border, usually with an anteromedian cephalic projection. Our specimen seems to show these characters to a certain extent which would point to membership of *Diademaproetus* rather than *Cornuproetus*. Even if our tentative assignment is correct, we do not exclude the possibility that both these genera occur at the 'Mur des douaniers', given that co-occurrences are known at other localities in the Rhenohercynian (e.g. the 'Trilobitenfelder' of Gees).

Acknowledgements

E.N.K. Clarkson (The University of Edinburgh) and R.M. Owens (National Museum of Wales) kindly reviewed the manuscript. L. Indenherberge (Zonhoven) donated a specimen for study. R. Speijer and S. Goolaerts (both Geo-Instituut, Katholieke Universiteit Leuven) provided access to a specimen in the university collection. E. Defour (Heusden-Zolder) made silicone casts of several specimens. J. Lippe (Natuurmuseum Nijmegen) provided access to the Van Tuijn Collection. J. Savelsbergh (Aachen) shared with us details on trilobite distributions in the Eifel. We are indebted to these persons for their help.

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Typescript submitted: March 27, 2008
Revised typescript received: July 25, 2008

Explanation of the plates

PLATE 1

Gerastos prox lessensis n. ssp.

Trilobites from the Hanonet Formation (upper Eifelian) of Resteigne Loc002, Belgium.

- Figs 1-4 — Incomplete cephalon. IRSNB a12575. 1: dorsal view, x 7; 2: lateral view, x 7; 3: anterior view, x 7; 4: oblique anterolateral view, x 7.
- Fig. 5 — Librigena. IRSNB a12580. Lateral view, x 5.
- Fig. 7 — Librigena. IRSNB a12581. Lateral view, x 7.
- Figs 8, 11 — Tectonically deformed cranidium. IRSNB a12577. 8: dorsal view, x 6; 11: lateral view, x 7.
- Figs 12-13 — Cranidium. IRSNB a12576. 12: anterior view, x 6; 13: dorsal view, x 7.
- Figs 15-17 — Pygidium. IRSNB a12582. 15: lateral view, x 8; 16: posterior view, x 8; 17: dorsal view, x 8.

Gerastos catervus (VAN VIERSEN, 2006)

Trilobites from the Jemelle Formation (lower Eifelian) of Vireux-Molhain “Mur des douaniers” F01, France.

- Figs 6, 9, 10, 14 — Silicone cast of external mould of partial cephalon. PLI-06. 6: dorsal view, x 8; 9: lateral view, x 8; 10: anterior view, x 8; 14: oblique anterolateral view, x 8. (Note that frontal part of glabella is incomplete left and right to sagittal line and thus that its outline in lateral view is inaccurate.)

PLATE 2

Dohmiella tenuiornata n. sp.

Trilobites from the Hanonet Formation (upper Eifelian) of Resteigne Loc002, Belgium.

- Figs 1-3 — Holotype cranidium. IRSNB a12585. 1: dorsal view, x 11; 2: lateral view, x 11; 3: anterior view, x 11.
- Fig. 4 — Librigena. IRSNB a12589. Lateral view, x 5.
- Figs 5, 8-9 — Pygidium. IRSNB a12590. 5: oblique posterolateral view, x 8; 8: dorsal view, x 7; 9: oblique posterior view, x 7.
- Figs 6-7, 10 — Pygidium. IRSNB a12591. 6: dorsal view, x 8; 7: oblique posterolateral view, x 8; 10: oblique posterior view, x 8.
- Figs 11-12 — Pygidium (tip of anterior part of axis is slightly displaced). IRSNB a12592. 11: oblique posterolateral view, x 9; 12: posterior view, x 9.
- Figs 13-14, 16 — Cranidium. IRSNB a12586. 13: dorsal view, x 10; 14: anterior view, x 10; 16: lateral view, x 10.
- Fig. 15 — Small cranidium. IRSNB a12587. Dorsal view, x 12.
- Figs 17-19 — Cranidium. IRSNB a12588. 17: lateral view, x 8; 18: dorsal view, x 8; 19: anterior view, x 8.

PLATE 3

Dohmiella stumporum n. sp.

Trilobites from the Ahrdorf Formation (middle Eifelian) of Lissingen Gerolstein01, Germany.

- Figs 1-2, 4 — Holotype pygidium. IRSNB a12593. 1: dorsal view, x 7; 2: lateral view, x 5; 4: posterior view, x 7.
- Figs 3, 5-6 — Pygidium. IRSNB a12600. 3: dorsal view, x 7; 5: lateral view, x 7; 6: posterior view, x 7.
- Figs 7-8 — Small pygidium. IRSNB a12601. 11: dorsal view, x X; 8: lateral view, x 11.
- Figs 9, 12, 14, 16 — Pygidium. IRSNB a12602. 9: dorsal view, x 7; 12: posterior view, x 7; 14: lateral view, x 7; 16: oblique posterolateral view, x 7.
- Fig. 10 — Librigena. IRSNB a12597. Lateral view, x 6.
- Fig. 11 — Librigena. IRSNB a12598. Lateral view, x 7.
- Fig. 13 — Librigena. IRSNB a12599. Lateral view, x 7.

Gerastos sp. A

Trilobites from the Ahrdorf Formation (middle Eifelian) of Lissingen Gerolstein01, Germany.

Figs 15, 17-18 — Pygidium. IRSNB a12583. 15: posterior view, x 7; 17: lateral view, x 7; 18: dorsal view, x 7.

PLATE 4

Dechenella daumeriesi n. sp.

Trilobites from the Hanonet Formation (upper Eifelian) of Resteigne Loc002, Belgium.

Figs 1-2 — Pygidium. IRSNB a12609. 1: dorsal view, x 6; 2: oblique posterior view, x 6.

Fig. 3 — Two right librigenae. IRSNB a12606. Dorsal view, x 5.

Dechenella sp. A

Trilobites from the X Formation (upper Eifelian) of Wellin Loc005, Belgium.

Figs 4-5 — Pygidium. IRSNB a12610. 1: dorsal view, x 4; 2: posterior view, x 3.

Dohmiella stumporum n. sp.

Trilobites from the Ahrdorf Formation (middle Eifelian) of Lissingen Gerolstein01, Germany.

Figs 6-8 — Cranidium. IRSNB a12594. 6: dorsal view, x 6; 7: lateral view, x 6; 8: anterior view, x 6.

Figs 9-11 — Cranidium. IRSNB a12595. 9: dorsal view, x 6; 10: lateral view, x 6; 11: anterior view, x 6.

Figs 12-14 — Tectonically deformed cranidium. IRSNB a12596. 12: dorsal view, x 8; 13: lateral view, x 8; 14: anterior view, x 8.

PLATE 5

Dechenella daumeriesi n. sp.

Trilobites from the Hanonet Formation (upper Eifelian) of Resteigne Loc002, Belgium.

Figs 1-3 — Holotype cranidium. IRSNB a12603. 1: dorsal view, x 8; 2: anterior view, x 8; 3: oblique lateral view, x 8.

Figs 4-6 — Pygidium. IRSNB a12607. 4: oblique posterior view, x 7; 5: dorsal view, x 7; 6: lateral view, x 7.

Fig. 7 — Pygidium. IRSNB a12608. Dorsal view, x 9.

Figs 8-11 — Tectonically crushed cephalon. IRSNB a12604. 8: oblique anterior view, x 6; 9: dorsal view, x 6; 10: oblique anterolateral view, x 6; 11: lateral view, x 6.

Fig. 12 — Pygidium (associated with a mostly exfoliated cephalon of *Nyterops hollandi* [not figured], a second pygidium of *Dechenella daumeriesi* n. sp. [Pl. 4, Figs 1-2] and two presumably conspecific, disarticulated thoracic segments and a small librigena). IRSNB a12609. Dorsal view, x 6.

Figs 13, 15 — Pygidium (associated with a conspecific cranidium [Pl. 5, Fig. 14]. IRSNB a12605. 13: dorsal view, x 4; 15: close-up of anomalous pleura, x 8.

Fig. 14 — Cranidium with damaged anterior border. IRSNB a12605. Dorsal view, x 4.

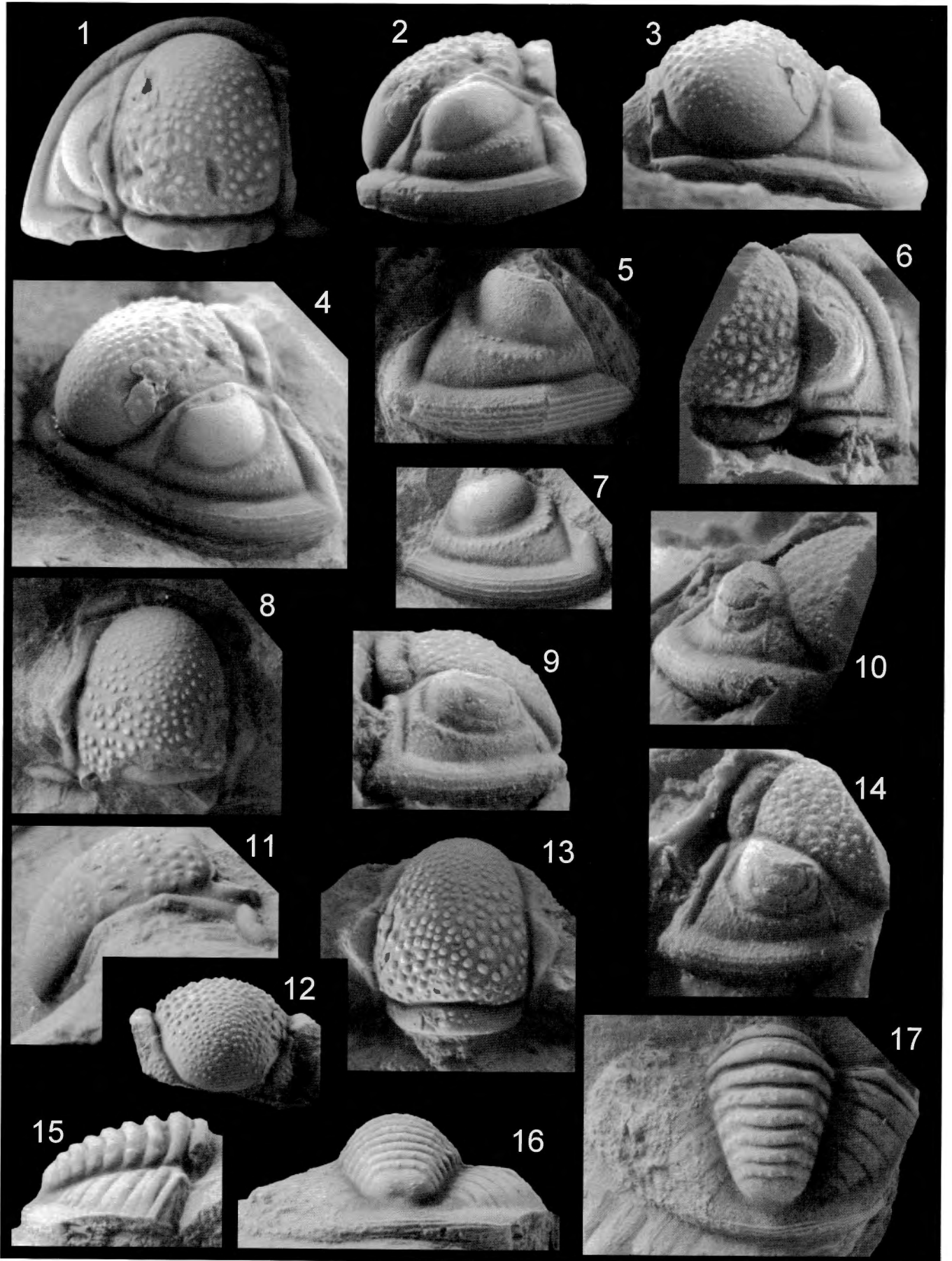


PLATE 1

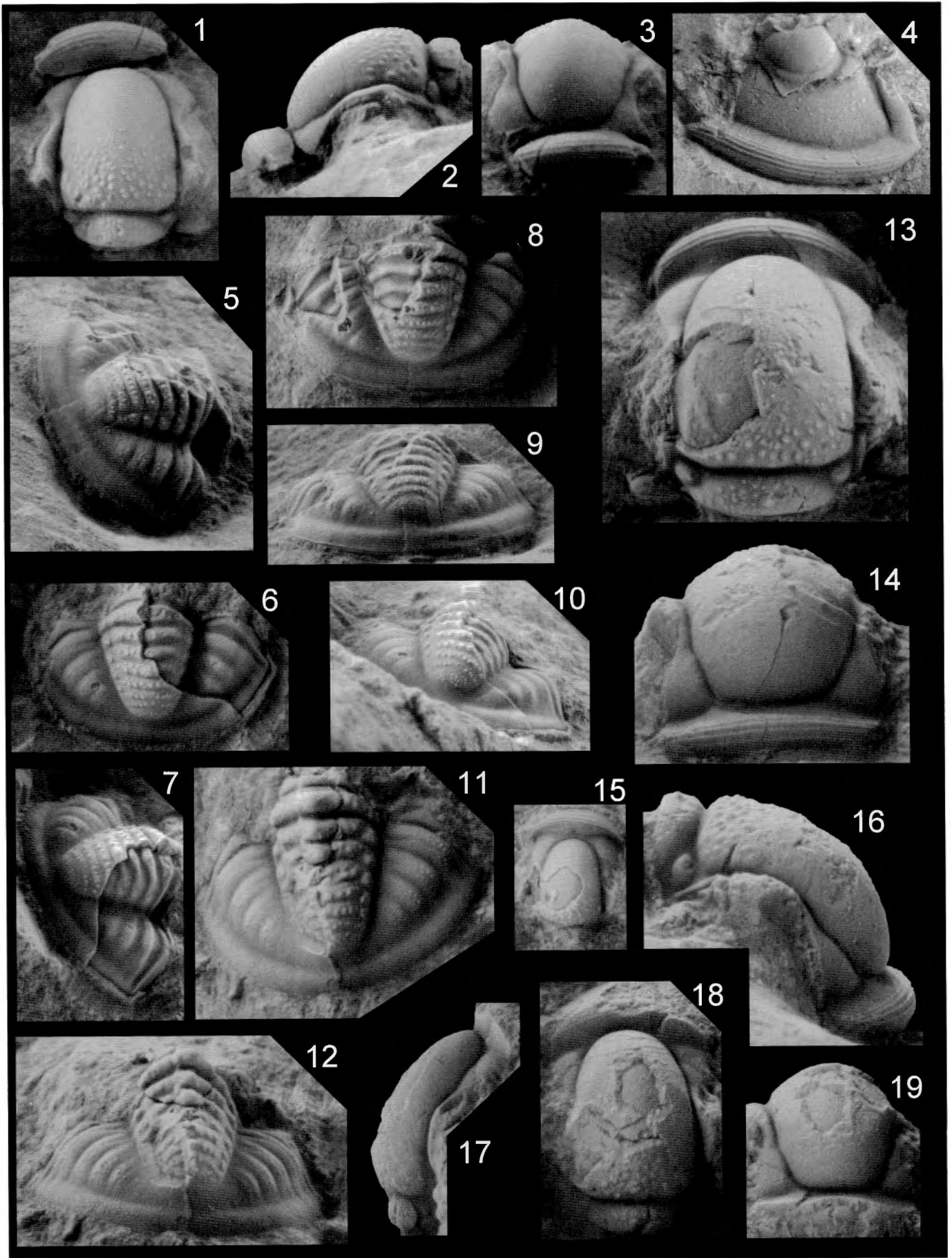


PLATE 2

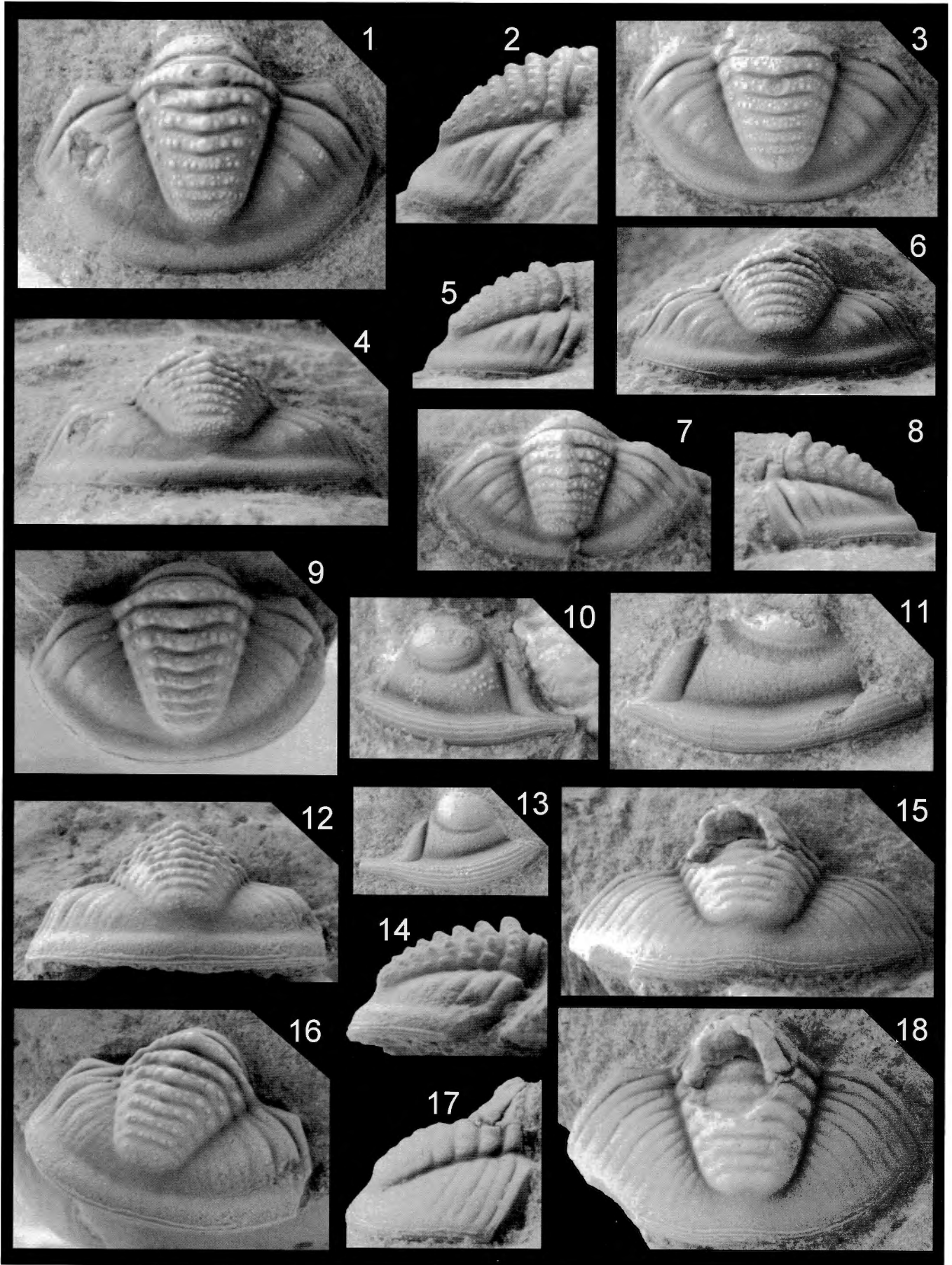


PLATE 3

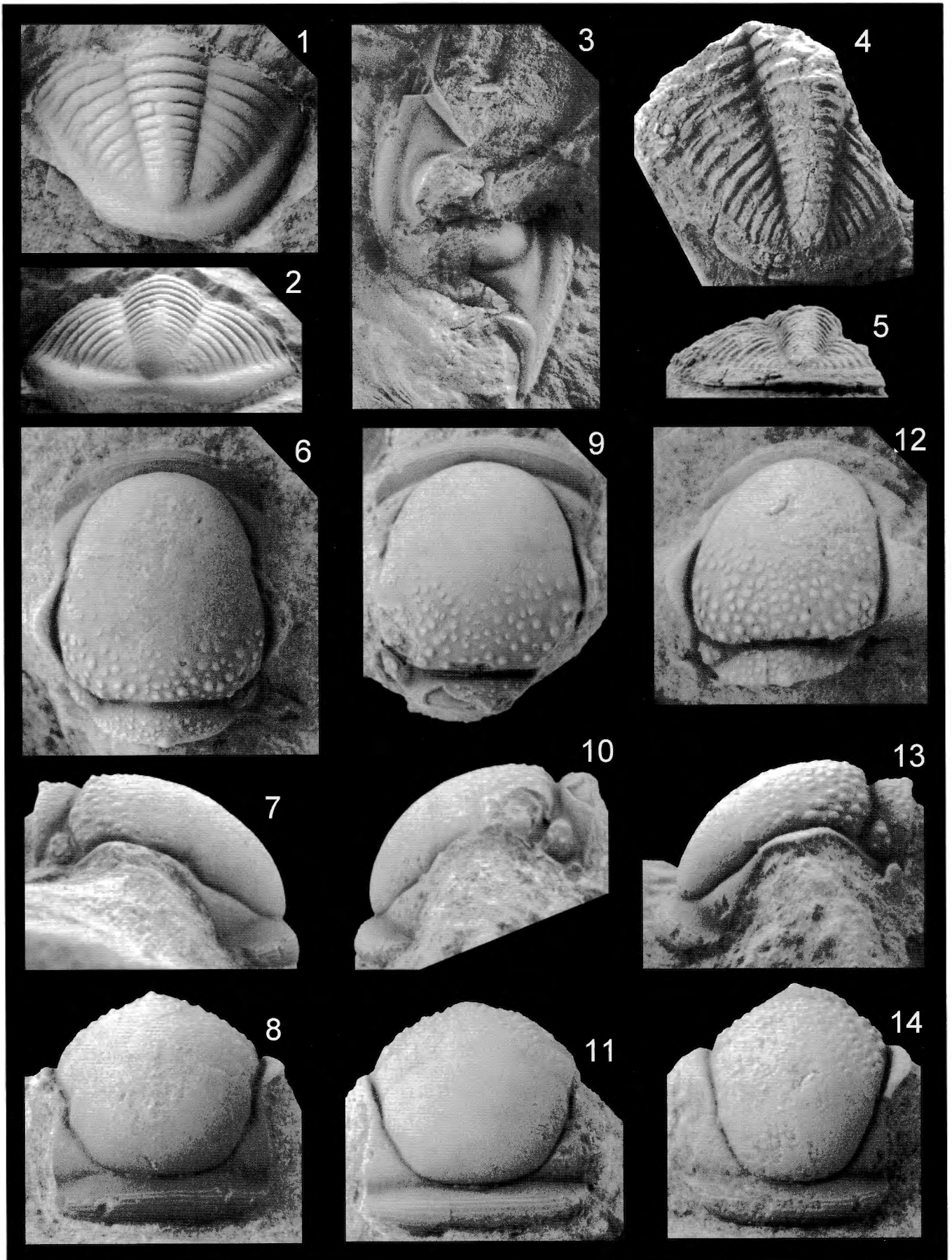


PLATE 4

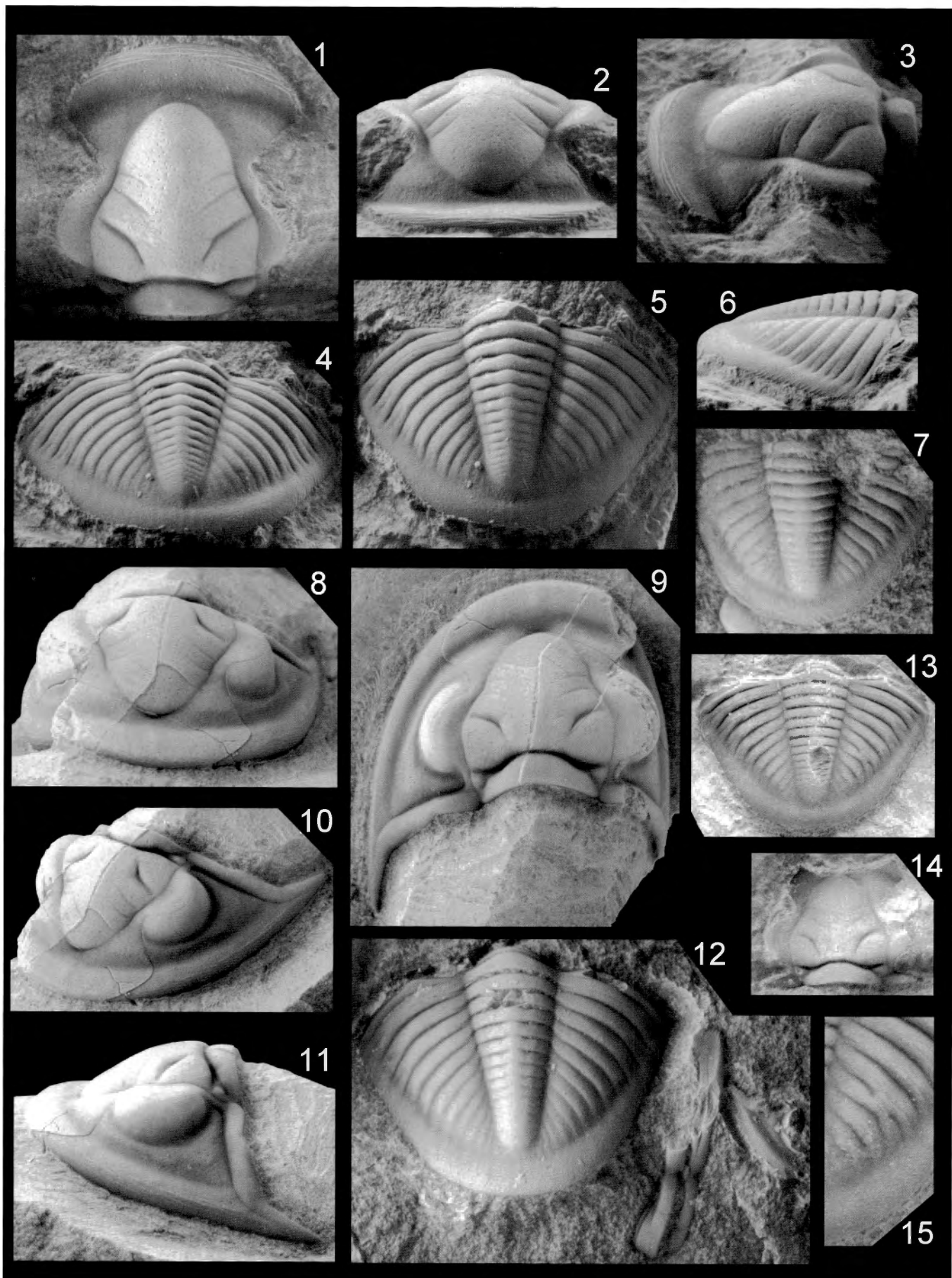


PLATE 5

