

# FIRST RECORD OF THE ODONTOPLEURID TRILOBITE *KONEPRUSIA* FROM THE LOWER EIFELIAN OF VIREUX-MOLHAIN (NORTHERN FRANCE), WITH REMARKS ON THE ASSOCIATED TRILOBITE FAUNA

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(3 figures)

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**ABSTRACT.** *Koneprusia* sp. A is recorded from the lower Eifelian (Jemelle Formation) of Vireux-Molhain, northern France. The taxon is exceedingly rare and was hitherto not known to occur here. Two articulated carapaces as well as a fragmentary specimen are described. *Koneprusia* sp. A is closely related to several Eifelian *Koneprusia* species from the Rhenohercynian. All of these forms share (1) a triangular positioning of tubercles (two on anterior band and one in between behind these on posterior band) on the pleurae of (at least) the five posteriormost thoracic segments and (2) obliquely and backwardly curved thoracic posterior pleural spines with swollen and pustulose bases. Observations on the cephalic and thoracic morphology of *Koneprusia* suggest that the recently emended diagnosis of this genus needs slight modification. Lastly, the co-occurrence in Vireux-Molhain of *Koneprusia* sp. A and a second odontopleurid trilobite belonging to the genus *Kettneraspis* is discussed. Contrary to some previous reports, the genus *Leonaspis* is not assumed to occur here also.

**KEYWORDS:** Trilobita, Odontopleuridae, Middle Devonian, Eifelian, France.

**RESUME.** Première observation du trilobite odontopleuridé *Koneprusia* dans l'Eifélien de Vireux-Molhain (nord de la France), avec remarques sur la faune trilobite associée. Le genre *Koneprusia* est mis en évidence pour la première fois dans l'Eifélien inférieur (Formation de Jemelle) de Vireux-Molhain, dans le nord de la France, à travers la découverte d'une espèce indéterminée: *Koneprusia* sp. A. Ce taxon est extrêmement rare, ce qui explique que sa présence dans cette localité ait été ignorée jusqu'à présent. Deux spécimens complets et en connexion ainsi qu'un spécimen fragmentaire sont décrits. *Koneprusia* sp. A présente de grandes similitudes avec plusieurs espèces du même genre trouvées dans le Massif Rhénan. En outre, toutes ces formes ont en commun (1) une disposition triangulaire des trois tubercules (deux sur la bande antérieure et un sur la bande postérieure) présents sur les plèvres des cinq (au moins) derniers segments thoraciques et (2) la présence au niveau du thorax, d'épines pleurales postérieures recourbées vers l'arrière et dont les bases sont renflées et couvertes de tubercules. Quelques observations faites sur la morphologie du céphalon et du thorax chez *Koneprusia* invitent à réviser légèrement la diagnose de ce genre. Enfin, la présence dans ce gisement de Vireux-Molhain d'une seconde espèce de trilobite odontopleuridé appartenant au genre *Kettneraspis* est également évoquée. La présence, supposée par certains, du genre *Leonaspis* dans cette localité est quant à elle écartée.

**MOTS-CLES:** Trilobita, Odontopleuridae, Dévonien moyen, Eifélien, France.

## 1. Introduction

During visits to the Geo-Instituut of the Katholieke Universiteit Leuven between 2004 and 2006, I was given the opportunity to examine Eifelian trilobites from a famous fossil locality near the village of Vireux-Molhain (northern France) that is known as the 'Mur des douaniers'. Among this material were the remains of two spiny trilobites that belong to *Koneprusia*, an odontopleurid genus that was not known to occur at this site. Both specimens are external moulds which is conspicuous since usually only internal moulds are available in collections from here. In 2006, Mr. G. Daumeries (Gilly) sent me photographs of what appeared to be another specimen, an internal mould in the collection of the Musée de l'Iguanodon (Bernissart). Examination of the original

material confirmed that it belongs to the same species as the two external moulds from Leuven. The three specimens are assigned to *Koneprusia* sp. A and represent all that is currently available of this rare taxon. Among the more than 2000 trilobites from Vireux-Molhain that I examined in private and institutional collections there had been no sign of it.

## 2. Material and methods

Two specimens are housed by the Geo-Instituut of the Katholieke Universiteit Leuven (Belgium), abbreviated 'PLI'. One further specimen is housed by the Musée de l'Iguanodon (Bernissart, Belgium) where it is part of a small collection (Cornu Coll.) of provisionally unnumbered trilobites that all came from Vireux-Molhain. Although

the museum does not have a catalogue system yet, their *Koneprusia* specimen is one of two complete specimens available of this rare taxon and thus its inclusion in the present paper is indispensable.

Silicone casts were made of the two external moulds. All specimens were coated with ammonium chloride sublimate prior to photography.

### 3. Geological setting

'Mur des douaniers': road cut just west of the French village of Vireux-Molhain, near the Belgian border (Fig. 1). The site is famous for the profusion of complete trilobite specimens that it has yielded but was declared a protected area by French authorities in the mid 1990s. Although being desirable items to collectors, the trilobites of this locality are mostly poorly documented and much confusion exists around their age and identity. Several attempts have been made to name species in the literature (e.g. Waterlot *et al.*, 1973; Gibout, 1991; Blondieau, 1995) as well as on a panel that was placed at the site by French authorities. Unfortunately, these endeavours mostly resulted in the adoptions of names of stratigraphically younger species from the German Eifel.

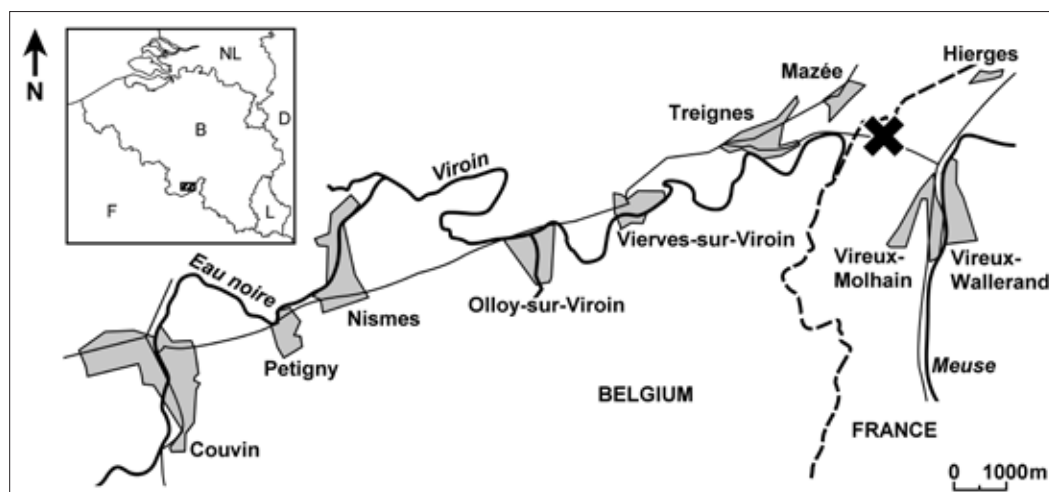
Struve (1982) was the first to address this problem and reassigned claimed records of "*Phacops latifrons*" and "*Phacops potieri*" to *Geesops sparsinodosus gallicus* Struve, 1982. This worker also mentioned several species that he assumed co-occur with *G. sparsinodosus gallicus* here, namely "*Comura (Comura) cometa*", "*Metacanthina?* sp." (both Asteropyginae), "*Pedinopariops (Pedinopariops) cf. richterianus*" and "*Longiproetus cultrijugati*" (*ibid.*, p. 478). The present author has not seen specimens that he would confidently assign to any of these taxa. It is difficult to designate the commonly poorly preserved internal moulds of Asteropyginae from this site to a species or even a genus without external moulds to make casts of. Prosopon was regularly used in the descriptions of Devonian asteropygines from the adjacent Rhenish Slate Mountains (e.g. Basse, 1998, 2003) and it is not nearly as detailed in internal moulds as it is dorsally on the cuticle. The strongly vaulted *Pedinopariops* specimens all seem to have been affected by tectonic deformation (also stated by

Struve, 1982, p. 479) and are almost exclusively known from internal moulds. In their case only a generic assignment can be made.

Van Viersen (2006a) reassigned records of "*Longiproetus cultrijugati*", "*Gerastos cuvieri*" and "*Gerastos sp.*" to *Rhenocynproetus catervus* Van Viersen, 2006a and discussed differences between his new species and *Rhenocynproetus cultrijugati* (Richter & Richter, 1918a) (the latter species has been included in *Proetus* Steininger, 1831, *Longiproetus* Cavet & Pillet, 1958 and *Gerastos* Goldfuss, 1843 by previous workers). In addition, Van Viersen (2006a) reassigned records of "*Ceratarges armatus*" to *Ceratarges cognatus* Van Viersen, 2006a and records of "*Otarion ceratophthalmus*" (sic) to *Cyphaspis* n. sp. A. This author also redescribed *Thysanopeltella (Septimopeltis) magnispina* (Maillieux, 1938) and provided a preliminary list of genera that are represented at the locality by yet to be described species.

According to information on the panel at the site the outcrops belong to the St. Joseph Formation, a unit that is of late Emsian age (see Bultynck & Dejonghe, 2001). The occurrences of the trilobites *Septimopeltis* Přibyl & Vaněk, 1971 and *Geesops* Struve, 1972 however, strongly suggest an Eifelian age. Furthermore, Schraut (2000) considered the outcrops to be of early Eifelian age based on the occurrence of the goniatite *Pinacites jugleri*. According to Van Viersen (2006a) and Crônier & Van Viersen (in press) these outcrops correspond to the basal part of the Jemelle Formation (*Polygnathus costatus* conodont Zone).

West of Vireux-Molhain the lower part of the Jemelle Formation is replaced by the Couvin Formation (Bultynck *et al.*, 1991, 2000; Bultynck & Dejonghe, 2001). The rich trilobite fauna of the lower part of the Couvin Formation near Nismes (Fig. 1) is slightly older (transition *Polygnathus partitus* – *Polygnathus costatus* conodont zones) than that of the 'Mur des douaniers'. Despite being stratigraphically and geographically close, both trilobite faunas are actually very different. Only the geographically widely distributed genera *Ceratarges* Gürich, 1901, *Cyphaspis* Burmeister, 1843 and *Scabriscutellum* Richter & Richter, 1956 are present at both localities (see Van Viersen, 2006a, 2006b).



**Figure 1.** Locality 'Mur des douaniers' west of the town of Vireux-Molhain, north France. The site is indicated by a cross.

#### 4. Systematic palaeontology

Morphologic terminology essentially follows that of Whittington & Kelly (1997). The term ‘posterior portion’ was applied by Ramsköld (1991) to the fused second and third axial rings of the pygidium.

-Family Odontopleuridae Burmeister, 1843

Remarks: Classification of the trilobite orders Lichida Moore and Odontopleurida Whittington (both in Moore, 1959) is still open to debate. Although some workers seem to accept the Odontopleurida with Odontopleuridae in it (e.g. Chatterton & Ludvigsen, 2004; Calner *et al.*, 2006; Chatterton *et al.*, 2006), others (e.g. Thomas & Holloway, 1988; Fortey, 2001) point out strong similarities between lichid and odontopleurid protaspides which might justify inclusion of odontopleurides in Lichida. The discussion of higher systematics is beyond the scope of this work and designations above family level are therefore omitted.

-Subfamily Koneprusiinae Vaněk & Pek, 1987

-Genus *Koneprusia* Prantl & Přibyl, 1949

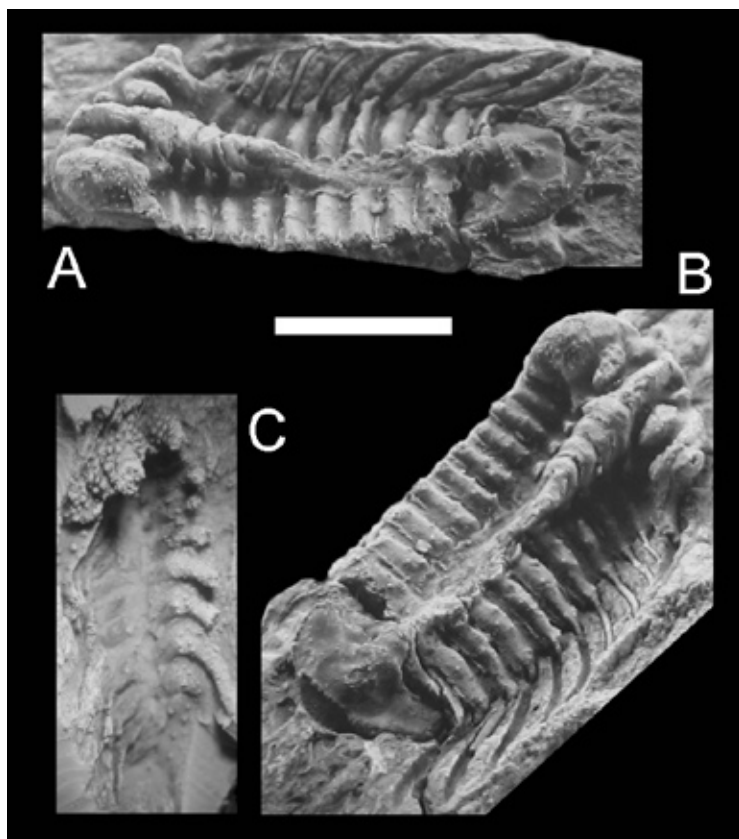
-Type species: *Acidaspis fuscina* Novák, 1883, from the Acanthopyge Limestone (Eifelian) of the Czech Republic, by original designation.

Diagnosis (emend.). See Chatterton *et al.* (2006, pp. 56–57), with exclusion of the presence of an eye ridge (5.1), the possible development of L3 (5.1), and distally upward and usually inward curved thoracic posterior pleural spines (5.2).

Remarks: *Koneprusia* is rare in the Ardennes and Eifel, which is suggested by the exceptionally small number of specimens that have been described in the literature. The closely related genus *Isoprusia* Bruton, 1966 is not known to occur in these regions with certainty. Ramsköld (1991) illustrated cranidia of *Acidaspis* (*Pseudomonaspis*) *bucco* Richter & Richter, 1918b from Auburg near Gerolstein (Junkerberg Formation, middle Eifelian), Eifel, that he assigned to *Isoprusia* (*sensu lato*). This species was later tentatively included in *Koneprusia* by Basse (2004). *Acidaspis* (*Ceratocephala?*) *sandbergeri* Richter & Richter, 1917 and a cranidium that was assigned to *Koneprusia?* sp. by Basse *in Basse & Heidelberg* (2002) (both from the Givetian Massenkalk of the Lahn Syncline, Right Rhenish Slate Mountains) are very similar and possibly conspecific but the holotype cephalon of the first is too poorly preserved for comparison. The generic classification of all three species remains ambiguous without pygidia available which are needed to make a definite designation (also see 5.1).

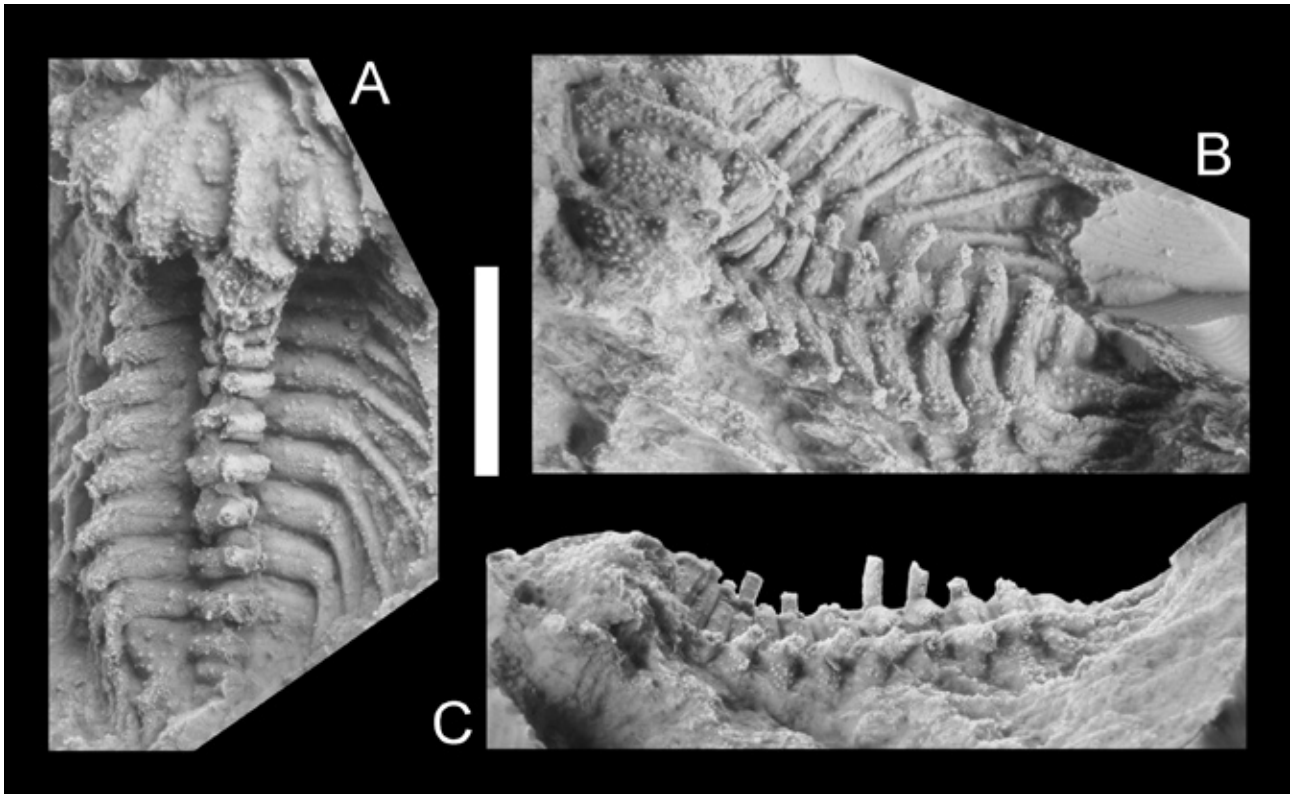
*Koneprusia* sp. A (Figs 2, 3)

Material. External mould of articulated carapace (PLI-01) plus silicone cast (PLI-02). External mould of fragmentary specimen (PLI-03) plus silicone cast (PLI-04). Internal mould of articulated carapace, unnumbered, Cornu Coll., Musée de l’Iguanodon, Bernissart. All from the basal part of the Jemelle Formation (lower Eifelian), ‘Mur des douaniers’, Vireux-Molhain, France.



**Figure 2.** *Koneprusia* sp. A, basal part of Jemelle Formation, lower Eifelian, Middle Devonian, ‘Mur des douaniers’, Vireux-Molhain, France. Internal mould of articulated specimen (Cornu Coll., Musée de l’Iguanodon) in oblique lateral (A) and dorsal (B) view. Silicone cast (PLI-04) of tectonically distorted external mould of fragmentary specimen (PLI-03) in oblique lateral (C) view, showing right lateral portions of cephalon, thorax and pygidium. Scale bar = 5 mm.





**Figure 3.** *Koneprusia* sp. A, basal part of Jemelle Formation, lower Eifelian, Middle Devonian, ‘Mur des douaniers’, Vireux-Molhain, France. Silicone cast (PLI-02) of external mould of articulated specimen (PLI-01) in dorsal (A), oblique lateral (B) and lateral (C) view. Scale bar = 5 mm.

#### 4.1. Description

##### 4.1.1. Cephalon

Cephalon entirely covered with densely spaced tubercles except for occipital ring which laterally bears only several pustules. Lateral border of cephalon devoid of marginal spines (as far as librigenae are preserved in the available specimens). Genal spines are broken off in all three specimens. L1 and L2 prominent. L3 developed as small bulge lateral to anterior glabellar lobe. Longitudinal glabellar furrow deep (possibly enhanced by lateral tectonic deformation (4.2)); weakly impressed only from near halfway (exsag.) along L3 and towards anterior. Lateral glabellar furrows S1 and S2 deep. S1 slightly narrower (exsag.) than S2. S3 faintly impressed.

##### 4.1.2. Thorax

Thorax is comprised of ten segments each with a single dorsal spine positioned medially (tr.) on anterior half of axial ring. All pleurae show a weakly impressed, transverse sulcus that distally fades before reaching pleural spine. The pleurae of at least segments 4 to 10 (numbered from front to rear) bear three tubercles, two of which proximally on anterior band and one in between behind them on posterior band so that together they form an isosceles triangle. Anterior pleural spines directed straight downward and bearing densely arranged, coarse granules; only anterior pleural spine of segment 10 is directed obliquely backward and downward. Posterior pleural

spines all entirely covered with coarse granules; their bases are swollen and covered with pustules (faint in anterior pleurae but increasingly discernible towards posterior, and also visible in internal moulds (Figs 2A, B)). Posterior pleural spines associated with the anteriormost thoracic segments curve upward and slightly backward; towards posterior of thorax these spines become more and more obliquely backwardly directed. Posterior pleural spines of segments 1 to 8, probably also 9, have backwardly flexed tips. In lateral view the posterior pleural spines in the posterior part of the thorax do not rise much above the axial lobe. Tenth posterior pleural spine pair runs subhorizontally and faintly converges proximally; distally it rises and smoothly diverges.

##### 4.1.3. Pygidium

Pygidial contour subtriangular. The area posterior of the axis is not preserved in the external moulds but there is a weak impression of a posteromedial protrusion ventrally on the pygidium in the internal mould (Fig. 2A) which possibly represents the remains of a median border spine here. First axial ring bearing several pustules and corresponding laterally to backwardly diverging pleural ridges. Pleural ridges proximally weakly vaulted and bearing few pustules; distally they gain height and are extended into a pair of major border spines that are covered with coarse granules. Posterior portion laterally distinctly defined by broad (tr.), firmly impressed axial furrows. Two tubercles present anteriorly on pleural field: one just

abaxial to anterior part of pleural ridge and another between here and lateral border. Several seemingly randomly positioned pustules and granules are positioned posterolaterally on pleural field, just abaxial to posterior part of pleural ridge.

#### 4.2. Discussion

The general resemblance between the two articulated carapaces (Figs 2, 3) is remarkable. The arched (tr.) axial lobe clearly gave way to lateral tectonic deformation much more easily than the horizontal pleural fields and as a result, the thorax and glabella of both specimens are strikingly slender (tr.). There is a slight shift of the thoracic pleurae along the sagittal line in both specimens which resulted in a misalignment of the left and right pleura of each segment. Since the two articulated specimens respectively concern an internal and an external mould, one must consider the remote possibility that they represent the same individual, especially since the conditions in which they were collected at the 'Mur des douaniers' are unknown. Nevertheless, differences in the width (tr.) of the right fixigena between both specimens (Fig. 2B vs. Fig. 3A) and the tilting of the anterior few thoracic rings (Fig. 2A vs. Figs 3B, C) provide undisputable evidence for their unique provenances.

The taxon from Vireux-Molhain is assigned to the genus *Koneprusia* primarily because of the presence of unpaired median spines on all ten thoracic axial rings (among *Koneprusiinae* this condition is only known from *Koneprusia* although not from all of its species: e.g. *Koneprusia* sp. of Ramsköld, 1991) and furthermore for having pygidial axial furrows that are shallow lateral of first axial segment and deep lateral of posterior portion. In addition, *Koneprusia* sp. A shares several distinct features with three other Eifelian *Koneprusia* species from the Rhenohercynian which are all obviously closely related (5.2). *Koneprusia* sp. A is described here under open nomenclature because of the unsatisfactory preservation of the only three specimens that are available. The swollen bases of the anterior two pairs of thoracic posterior pleural spines seem to be a feature that is unique to this species but more material will be needed to confirm this. In addition, the material that is known of two of three closely allied Rhenohercynian species does not permit a detailed comparison with the French taxon. Future collections of all four taxa may warrant the description of *Koneprusia* sp. A as a new species.

## 5. Morphology of *Koneprusia* species from the Ardennes and Eifel

### 5.1 Cephalon

Ramsköld (1991) solved much of the confusion surrounding *Koneprusia* and the closely related *Isoprusia*, which had mainly been caused by the poor knowledge about the type species of *Koneprusia* and the small number of species known from both cranidia and pygidia. With the limited amount of articulated material that was available at the time, Ramsköld (1991) attached diagnostic

value only to pygidial characters because the few cranidia that could be ascribed to *Koneprusia* with certainty were mostly similar to those of *Isoprusia*.

Since then, articulated specimens of *Koneprusia* have been recorded from the Devonian of Morocco, Germany, Belgium and now also France. Two new species were described from the middle Eifelian of Sauerland (*Koneprusia eox* Basse, 1998; Ohle Formation) and the Belgian Ardennes (*Koneprusia maillieuxi* Magrean, 2006; Jemelle Formation); both however, on the basis of moderately well-preserved and poorly illustrated material. The cephalon of Magrean's (2006) single specimen which according to that author is disarticulated, is actually *in situ*. Nevertheless, it is severely tectonically deformed and provides little useful information on the cephalic morphology of *Koneprusia*. Rückert (2005), in an informal publication, figured a well-preserved complete specimen from the famous 'Trilobitenfelder' (=trilobite fields) of Gees near Gerolstein (Ahrdorf Formation, middle Eifelian), Eifel, that he named "*Koneprusia* spec. nov." (ibid., p. 343, unnumbered figs). This specimen has a long median pygidial border spine, a character that was identified in a cladistic analysis of the subfamily *Koneprusiinae* as a synapomorphy of *Koneprusia* by Ramsköld (1991). Its cephalic morphology can thus be unambiguously attributed to this genus. The species greatly resembles coeval *K. maillieuxi* from Belgium with which it shares distinct features such as a subsemicircular (as against the commonly subtriangular) pygidial outline. Both species may turn out to be conspecific when better preserved material of *K. maillieuxi* becomes available.

Chatterton *et al.* (2006) described a new species *Koneprusia dahmani* from the upper Emsian (Timrhahn Formation) of Morocco on the basis of excellently preserved material. These workers tentatively included cephalic characters in the generic diagnosis of *Koneprusia*, having available to them three species from the Moroccan Lower Devonian that were all known from articulated material. These characters are: cephalon with short marginal spines; L1 and L2 are prominent, L3 may or may not be apparent; S0 is much shallower medially than distally; eye ridges are present; occipital spine is long and curved; prominent genal spines project above dorsolaterally proximally, and curve backward and inward distally.

With the illustrations of *Koneprusia* n. sp. of Rückert available we now have a well-preserved specimen from the northern margin of the Rheic Ocean to compare with the Gondwanan species that were referred to by Chatterton *et al.* (2006). The cephalon of *K. n. sp.* of Rückert is generally similar to that of *K. dahmani*. It shows the following features in particular: L3 present although not distinctly separated from frontal glabellar lobe; S0 somewhat shallower medially than distally (not fully prepared); eye ridges present; occipital spine long and curved; prominent genal spines that are similar to those of *K. dahmani*.

The cephalic features that were included in the diagnosis of *Koneprusia* by Chatterton *et al.* (2006) appear to be valid for all of the species that can be assigned to this

genus with certainty using pygidial characters. Eye ridges however, are found in many trilobite taxa and according to Fortey & Whittington (1989) they appear to be homologous in all trilobites (also see remarks by Ramsköld & Edgecombe, 1991). These structures may be secondarily lost (e.g. in blind phacopids) but in odontopleurids they are long retained and they are common to koneprusiines (e.g. *Isoprusia mydlakia* Bruton, 1966, *Laethoprusia brikelos* (Chatterton *et al.*, 1979), *Laethoprusia salax* Ramsköld, 1991). This suggests that the presence of eye ridges is the plesiomorphic condition for Koneprusiinae. The development of L3 in some *Koneprusia* species is again discernible in *I. mydlakia* (Bruton, 1966, p. 333, pl. 57: 13; Vaněk & Pek, 1987, p. 262) and furthermore in *L. brikelos*. Therefore, the present author suggests that it is better to remove both these characters from the diagnosis of *Koneprusia* as they apparently do not allow for unambiguous discrimination between this genus and the morphologically similar *Isoprusia*.

## 5.2 Thorax

The diagnosis of *Koneprusia* by Chatterton *et al.* (2006) states that the thoracic posterior pleural spines distally curve upward and usually inward. Indeed this feature seems to characterise the Gondwanan species that were referred to by these workers but it turns out not to be present in a group of Eifelian *Koneprusia* species from the northern margin of the Rheic Ocean that includes *K. eox*, *K. maillieuxi*, *K. n. sp.* of Rückert and *K. sp. A*. Instead, the posterior pleural spines of these taxa curve upward and backward, and most have distinctly backward and occasionally inward flexed tips; towards the posterior, each spine is more obliquely backward directed than the previous. The tenth pair of posterior pleural spines distally diverges in *K. sp. A* and *K. n. sp.* of Rückert but it is not known from *K. maillieuxi* and *K. eox* due to poor preservation. In addition, the thoraxes of these four Rhenohercynian species share two other features that are absent in their Moroccan relatives: (1) There is a triangular positioning of tubercles proximally on the pleurae: two on anterior band and one in between behind these on posterior band. This arrangement is clearly present in all four species but due to inadequate preservation of most of the material can only universally be confirmed in the posterior five thoracic segments. (2) The posterior pleural spines of most thoracic segments have swollen, pustulose bases. *K. sp. A* has this on all segments and even in internal moulds and both *K. maillieuxi* and *K. n. sp.* of Rückert show it on segments 3 to 10. In the single incomplete cephalothorax of *K. eox* that was illustrated in one photograph by Basse (1998, pl. 12: 21) the posteriormost segments are disarticulated and one or more possibly hidden under the cephalon. It may be assumed that the missing posteriormost segments of this specimen will also have shown these swollen, pustulose areas since they are well developed on the remaining posterior segments. The function of the swellings is not known. Possibly, they served as a fortification of the attachment points of the long posterior

pleural spines which would have made these less vulnerable to breaking off.

The question rises of whether or not to include this strictly Rhenohercynian group of species in *Koneprusia*. A formal status is currently not proposed mainly because scant information is available about the thoraxes of representatives of *Koneprusia* from other regions (e.g. Bohemia). Such an assignment is furthermore impracticable because of the complete lack of well-preserved material in institutional collections to base a new taxon on that can properly accommodate these species.

## 6. Note on the Odontopleurinae of the ‘Mur des douaniers’

The occurrence of a representative of the odontopleurine genus *Leonaspis* Richter & Richter, 1917 at the ‘Mur des douaniers’ was cited by Van Viersen (2006a) on the basis of an unnumbered drawing in Gibout (1991) and a panel placed at the site by French authorities. This drawing shows four spines between the pygidial major border spines: one of the features commonly used to discriminate *Leonaspis* from *Kettneraspis* Prantl & Přibyl, 1949. This latter taxon has long been confused with *Leonaspis* but shows only two spines here (see Ramsköld & Chatterton, 1991; Adrain & Ramsköld, 1997). Recently, the present author studied additional trilobite specimens from Vireux-Molhain in private collections all of which show two spines between the pygidial major border spines and thus probably belong to *Kettneraspis*. Moreover, they closely resembled Eifelian *Kettneraspis* species recorded from the adjacent Belgian Ardennes (Van Viersen, 2007) and German Eifel (Ramsköld & Chatterton, 1991; Basse, 1998, 2004).

The identity of the material that was used as a model for the drawing of *Leonaspis* from Vireux-Molhain is uncertain. According to Ramsköld & Chatterton (1991) *Leonaspis* is an exclusively Gondwanan taxon that never crosses the Rheic Ocean. Recently, a new species *Leonaspis heisdorfensis* was recorded by Basse (2004) from Üxheim (Heisdorf Formation, upper Emsian), Eifel. A cranidium from Reideschbach (basal part of upper Tonschiefer-Abfolge, lowermost Emsian), Luxembourg, identified by Basse *et al.* (2006) as *Leonaspis?* sp. is probably also congeneric. This indicates that *Leonaspis* does in fact occur on the northern margin of the Rheic Ocean. It is possible that the French drawing was based on a very rare species that the present author has not had the opportunity to examine specimens of. Still, this would imply an unusual co-occurrence of *Kettneraspis* and *Leonaspis* here, especially since *Leonaspis* does not appear to reach the Eifelian in the adjacent Rhenish Slate Mountains (pers. comm. with M. Basse in 2006) and no substantiated records exist of it from Belgium (Van Viersen, 2007). It seems more likely that in an attempt to complement the commonly inadequately preserved material from Vireux-Molhain, illustrations of *Leonaspis* from other regions were used to reconstruct the French species and that it actually belongs to *Kettneraspis*.



## 7. Conclusion

*Koneprusia* sp. A is a rare component of the early Eifelian trilobite fauna of the 'Mur des douaniers'. Although it is obviously closely related to several other (middle Eifelian) Rhenohercynian *Koneprusia* species, the few inadequately preserved specimens that are available of *K.* sp. A do not permit detailed description and comparisons.

At present, the trilobite fauna of the 'Mur des douaniers' is still unsatisfactorily documented. Several taxa have been formally recorded but most others remain to be described. Hardly anything is known about the exact provenances of trilobites in extant collections and as a consequence there is no overview available on crucial data such as the stratigraphic distributions of species at this site (Crônier & Van Viersen, in press). What is more is that some of the material in collections may not even have come from this locality since several species are also known to occur northwest of Vireux-Molhain, near the Belgian towns of Treignes and Mazée (see Struve, 1982 for Phacopininae; pers. comm. with G. Daumeries, Gilly, concerning Cornuproetinae). New fieldwork at the 'Mur des douaniers' and thus access to the site are required to obtain data that will enable a much needed comprehensive analysis of its trilobite fauna.

## 8. Acknowledgements

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## 9. References

ADRAIN, J.M. & RAMSKÖLD, L., 1997. Silurian Odontopleurinae (Trilobita) from the Cape Phillips Formation, Arctic Canada. *Journal of Paleontology*, 71: 237-261.

BASSE, M., 1998. Trilobiten aus mittlerem Devon des Rhenohercynikums: III. Proetida (3), Phacopida (2), Lichida (Lichoidea, Odontopleuroidea) und ergänzende Daten. *Palaeontographica (A)*, 249(1-6): 1-162.

BASSE, M., 2003. Eifel-Trilobiten 2. Phacopida 1. Goldschneck-Verlag, Korb, 198 pp.

BASSE, M., 2004. Lichida Moore 1959. In BASSE, M. & MÜLLER, P., *Eifel-Trilobiten III. Corynexochida, Proetida (2), Harpetida, Phacopida (2), Lichida*. Quelle & Meyer Verlag, Wiebelsheim, 92-141.

BASSE, M. & HEIDELBERGER, D., 2002. Devonische Gastropoda und Trilobita aus der Lahn-Mulde (Rheinisches Schiefergebirge). *Jahrbuch des Nassauischen Vereins für Naturkunde*, 123: 67-103.

BASSE, M., MÜLLER, P. & FRANKE, C., 2006. Neue Daten zu den Trilobiten aus dem frühen Unteremium (Ulmen-Unterstufe; Unterdevon) vom Reideschbaach (Luxemburg; Givonne-Oesling-Antiklinorium; Rhenohercynikum). *Senckenbergiana lethaea*, 86(2): 243-259.

BLONDIEAU, M., 1995. Minéraux et fossiles de la région de Rochefort, Han-sur-Lesse et de ses environs. *Tellin*, 59 pp.

BRUTON, D.L., 1966. A new odontopleurid trilobite genus from the Devonian of Bohemia. *Palaeontology*, 9(2): 330-345.

BULTYNCK, P., COEN-AUBERT, M., DEJONGHE, L., GODEFROID, J., HANCE, L., LACROIX, D., PRÉAT, A., STAINIER, P., STEEMANS, P., STREEL, M. & TOURNEUR, F., 1991. Les formations du Dévonien moyen de la Belgique. *Mémoires pour servir à l'explication des Cartes Géologiques et Minières de la Belgique*, 30: 1-105.

BULTYNCK, P., COEN-AUBERT, M. & GODEFROID, J., 2000. Summary of the state of correlation in the Devonian of the Ardennes (Belgium - NE France) resulting from the decisions of the SDS. *Courier Forschungsinstitut Senckenberg*, 225: 91-114.

BULTYNCK, P. & DEJONGHE, L., 2001. Devonian lithostratigraphic units (Belgium). In BULTYNCK, P. & DEJONGHE, L. (eds), Guide to a revised lithostratigraphic scale of Belgium, *Geologica Belgica*, 4/1-2: 39-69.

BURMEISTER, P., 1843. Die Organisation der Trilobiten aus ihren lebendigen Verwandten entwickelt; nebst einer systematischen Übersicht aller seither beschriebenen Arten. Reimer, Berlin, 147 pp.

CALNER, M., AHLBERG, P., AXHEIMER, N. & GUSTAVSSON, L., 2006. The first record of *Odontopleura ovata* (Trilobita) from Scandinavia: part of a middle Silurian intercontinental shelly benthos mass occurrence. *GFF*, 128: 33-37.

CAVET, P. & PILLET, J., 1958. Les trilobites des calcaires à Polypiers siliceux (Eifélien) du synclinal de Villefranche-de-Conflent (Pyrénées-orientales). *Bulletin de la Société Géologique de France*, 6(8): 21-37.

CHATTERTON, B.D.E., FORTEY, R.A., BRETT, K.D., GIBB, S.L. & MCKELLAR, R.C., 2006. Trilobites from the upper Lower to Middle Devonian Timrhannhart Formation, Jbel Gara el Zguilma, southern Morocco. *Palaeontographica canadiana*, 25: 1-177.

- CHATTERTON, B.D.E., JOHNSON, B.D. & CAMPBELL, K.S.W., 1979. Silicified Lower Devonian trilobites from New South Wales. *Palaeontology*, 22(4): 799-837.
- CHATTERTON, B.D.E. & LUDVIGSEN, R., 2004. Early Silurian trilobites of Anticosti Island, Québec, Canada. *Palaeontographica canadiana*, 22: 1-264.
- CRÔNIER, C. & VIERSEN, A.P. VAN (in press). The 'Mur des douaniers', an exceptionally well-preserved Early Eifelian fossil site. *Bulletin de la Société géologique de France*.
- FORTEY, R.A., 2001. Trilobite systematics: the last 75 years. *Journal of Paleontology*, 75(6): 1141-1151.
- FORTEY, R.A. & WHITTINGTON, H.B., 1989. The Trilobita as a natural group. *Historical Biology*, 2: 125-138.
- GIBOUT, B., 1991. La faune fossile de la Réserve Naturelle de Vireux-Molhain. Office National des Forêts, 14 pp.
- GOLDFUSS, A., 1843. Systematische Übersicht der Trilobiten und Beschreibung einiger neuen Arten derselben. *Neues Jahrbuch für Mineralogie, Geognosie, Geologie und Petrefaktenkunde*, 1843: 537-567.
- GÜRICH, G., 1901. Ueber eine neue *Lichas*-Art aus dem Devon des Neu-Süd-Wales und über die Gattung *Lichas* überhaupt. *Neues Jahrbuch für Mineralogie, Geologie und Paläontologie. Beilage-Band*, 14: 519-539.
- MAGREAN, B., 2006. Revision of some Devonian trilobites from Belgium. The genera *Astycoryphe*, *Tropidocoryphe*, *Eifliarges* and *Koneprusia*. *Bulletin de l'Institut royal des Sciences naturelles de Belgique*, 76: 67-77.
- MAILLIEUX, E., 1938. Le Couvinien de l'Ardenne et ses faunes. *Mémoires du Musée royal d'Histoire naturelle de Belgique*, 83: 1-57.
- MOORE, R. (ed.), 1959. Treatise on Invertebrate Paleontology. Part O, Arthropoda 1. Geological Society of America and University of Kansas Press, Boulder and Lawrence, xix + 560 pp.
- NOVÁK, O., 1883. Zur Kenntnis der böhmischen Trilobiten. Beiträge zur Paläontologie Österreich. *Ungarns und des Orients*, 3: 23-63.
- PRANTL, F. & PŘIBYL, A., 1949. Studie o trilobitech nadčeledi Odontopleuracea nov. superfam. *Rozpravy státního geologického ústavu ČSR*, 12: 1-221. [1-110 Czech, 111-115 Russian, 117-221 English.]
- PŘIBYL, A. & VANĚK, J., 1971. Studie über die Familie Scutelluidae Richter et Richter (Trilobita) und ihre phylogenetische Entwicklung. *Acta Universitatis Carolinae - Geologica*, 4: 361-394.
- RAMSKÖLD, L., 1991. The perforated trilobite *Laethoprusia* gen. nov., and the phylogeny of *Koneprusia* and *Isoprusia* (Odontopleuridae, Koneprusiinae). *Transactions of the Royal Society of Edinburgh: Earth Sciences*, 82: 125-141.
- RAMSKÖLD, L. & CHATTERTON, B.D.E., 1991. Revision and subdivision of the polyphyletic '*Leonaspis*' (Trilobita). *Transactions of the Royal Society of Edinburgh: Earth Sciences*, 82: 333-371.
- RAMSKÖLD, L. & EDGECOMBE, G.D., 1991. Trilobite monophyly revisited. *Historical Biology*, 4: 267-283.
- RICHTER, R. & RICHTER, E., 1917. Über die Einteilung der Familie Acidaspidae und über einige ihrer devonischen Vertreter. *Centralblatt für Mineralogie, Geologie und Paläontologie*, 1917: 462-472.
- RICHTER, R. & RICHTER, E., 1918a. Neue *Proetus*-Arten aus dem Eifler Mitteldevon. *Centralblatt für Mineralogie, Geologie und Paläontologie*, 1918(3): 64-70.
- RICHTER, R. & RICHTER, E., 1918b. Paläontologische Beobachtungen im Rheinischen Devon. I. Über einzelne Arten von *Acidaspis*, *Lichas*, *Cheirurus*, *Aristozoë*, *Prosocoelus*, *Terebratula* und *Spirophyton* aus der Eifel. *Jahrbuch des Nassauischen Vereins für Naturkunde, Wiesbaden*, 70: 143-161.
- RICHTER, R. & RICHTER, E., 1956. Grundlagen für die Beurteilung und Einteilung der Scutelluidae (Tril.). *Senckenbergiana lethaea*, 37(1): 79-124.
- RÜCKERT, A., 2005. Alte Funde – neue Erkenntnisse. Betrachtungen über Gerolsteiner Trilobiten. *Fossilien*, 22(6): 340-347.
- SCHRAUT, G., 2000. Eine neue Unterart von *Phacops* (*Phacops*) *sparsinodosus* Struve 1970 aus dem Mittel-Devon von Marokko. *Senckenbergiana lethaea*, 80(2): 525-535.
- STEININGER, J., 1831. Bemerkungen über die Versteinerungen, welche in dem Uebergangs-Kalkgebirge der Eifel gefunden werden. Beilage zum Gymnasial-Programmschrift zu Trier, Trier, 44 pp.
- STRUVE, W., 1972. Beiträge zur Kenntnis der Phacopina (Trilobita), 8: *Phacops*-Arten aus dem Rheinischen Devon. 2. Untergattungszuweisung. *Senckenbergiana lethaea*, 53(5): 383-403.
- STRUVE, W., 1982. Neue Untersuchungen über *Geesops* (Phacopinae; Unter- und Mittel-Devon). *Senckenbergiana lethaea*, 63(5): 473-495.
- THOMAS, A.T. & HOLLOWAY, D.J., 1988. Classification and phylogeny of the trilobite order Lichida. *Philosophical transactions of the Royal Society of London, Series B, Biological Sciences*, 321(1205): 179-262.
- VANĚK, J. & PEK, I., 1987. Genus *Koneprusia* (Trilobita) from the Devonian of Central Bohemia. *Casopis pro mineralogii a geologii*, 32(3): 261-270.
- VIERSEN, A.P. VAN, 2006a. New Middle Devonian trilobites from Vireux-Molhain (Ardennes, northern France). *Senckenbergiana lethaea*, 86(1): 63-75.
- VIERSEN, A.P. VAN, 2006b. *Dohmiella* Lütke 1990 (Trilobita) a valid proetid genus, with two new species from Belgium and Germany. *Senckenbergiana lethaea*, 86(2): 229-241.



VIERSEN, A.P. VAN (2007). *Kettneraspis*, *Radiaspis* and *Ceratarges* (Trilobita) from the Middle Devonian of the Rochefort area (Ardennes, Belgium). *Scripta Geologica*, 134: 1-18.

WATERLOT, G., BEUGNIES, A., BONTE, A., CHARLET, J.-M. & CORSIN, P. (1973). Ardenne. In WATERLOT, G., BEUGNIES, A. & BINTZ, J. (eds), *Ardenne, Luxembourg. Guides Géologiques Régionaux*. Masson & Cie, Paris, 9-134.

WHITTINGTON, H.B. & KELLY, S.R.A. 1997. Morphological terms applied to Trilobita. In KAESLER, R.L. (ed.), *Treatise on invertebrate paleontology, Part O, Arthropoda 1. Trilobita, revised. Volume 1: Introduction, Order Agnostida, Order Redlichiida*. Geological Society of America and University of Kansas Press, Boulder and Lawrence, 313-329.