Yuepingia? sp., a ceratopygid trilobite from the upper Cambrian (Furongian) of Scandinavia

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A single pygidium found in an ice-rafted loose boulder of coquinoid bituminous limestone represents an 'exotic' trilobite hitherto unknown from the Scandinavian Alum Shale Formation. The limestone, found on the east coast of Jutland, Denmark, also contains *Leptoplastus paucisegmentatus, Parabolina spinulosa* and *Orusia lenticularis* and derives from the upper Cambrian (Furongian) *Leptoplastus paucisegmentatus* Zone of Västergötland, south-central Sweden. The 'exotic' pygidium shows closest resemblance to the ceratopygid *Yuepingia glabra*, described from Alaska, and is treated as *Yuepingia*? sp. The Laurentian *Y. glabra* occurs in the *Ptychaspis-Prosaukia* Zone which corresponds in age to the Scandinavian *Leptoplastus* Superzone.

Keywords: Ceratopygid trilobite, Furongian, Alum Shale, Cambrian, Scandinavia.

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The majority of glacial erratic boulders of Cambrian age found in Denmark and northern Germany derive from the Swedish provinces Västergötland, Scania and Öland and from the Danish island of Bornholm. They comprise sandstones, limestones and conglomerates as well as rare siltstones and shales, but which generally did not survive the long transportation. The Middle Cambrian–Tremadocian Alum Shale Fm is represented mostly by limestones, including the common so-called anthraconites (bituminous limestone/'orsten'), which occur as concretions and beds in the formation. The Furongian is represented almost exclusively by these bituminous limestones, which are often richly fossiliferous.

During the Furongian the major part of the Baltic platform was covered by a shallow sea with prevailing dysoxic conditions at the sea floor. The Furongian faunal assemblages are always monotonous and dominated by olenid trilobites adapted to this environment, in addition to a few agnostid taxa. Olenids often occur in great profusion, but with only 1–3 species occurring together. The fauna has been described from Sweden (e.g. Westergård 1922, 1939, 1944, 1947; Ahlberg *et al.* 2006; Terfelt 2003, 2006), Norway (Henningsmoen 1957a and references therein) and Bornholm, Denmark (notably Poulsen 1923). The same biofacies, dominated by olenid trilobites, is also known from Wales, eastern Canada and Argentina (e.g. Harringston & Leanza 1957, Holland 1971). Based on the abundant and short-ranging trilobites, a detailed biostratigraphic zonation has been established for Scandinavia (Westergård 1922, 1947; Henningsmoen 1957a). It was recently revised by Terfelt *et al.* (2008), who elevated the subzones of previous authors to zonal rank. In the present paper we treat the traditional Furongian zones of Westergård (1947) and Henningsmoen (1957a) as superzones (compare Terfelt *et al.* 2008, 2010).

In addition to the extremely abundant olenid-agnostid fauna, sparse 'exotic' trilobites, which are regarded as 'immigrants' from other biogeographic areas, are occasionally also found in the Alum Shale Fm and glacial erratic boulders of this unit (Westergård 1922, 1947; Henningsmoen 1957b; Buchholz 1998, 2005; Weidner 2001; Weidner & Żylińska 2005; Terfelt & Ahlgren 2007, 2009). These 'immigrants' are rare in the *Olenus* and *Parabolina* superzones and extremely rare in the *Leptoplastus* and *Peltura* superzones. The *Acerocare* Superzone has not yet yielded any 'exotic'

taxa. The 'immigrants' are potentially important for biostratigraphic correlation out of Baltica, providing a loose 'ghost stratigraphy' with ties to other continents (e.g. Westergård 1947; Terfelt & Ahlgren 2007; present paper).

In the present paper a trilobite new to the Alum Shale biofacies is described; the genus is elsewhere known from China and Alaska. The specimen was found in an erratic bituminous limestone boulder representing the basal *Leptoplastus paucisegmentatus* Zone of the Furongian *Leptoplastus* Superzone. The lithology and fossil assemblages of the local ice-rafted Cambrian boulders at As Hoved on the east coast of Jutland (Fig. 1) and the common presence of Kinnediabase clearly indicates that the material derives from the province of Västergötland, south-central Sweden (see also Houmark-Nielsen 1987, pp. 24–27).

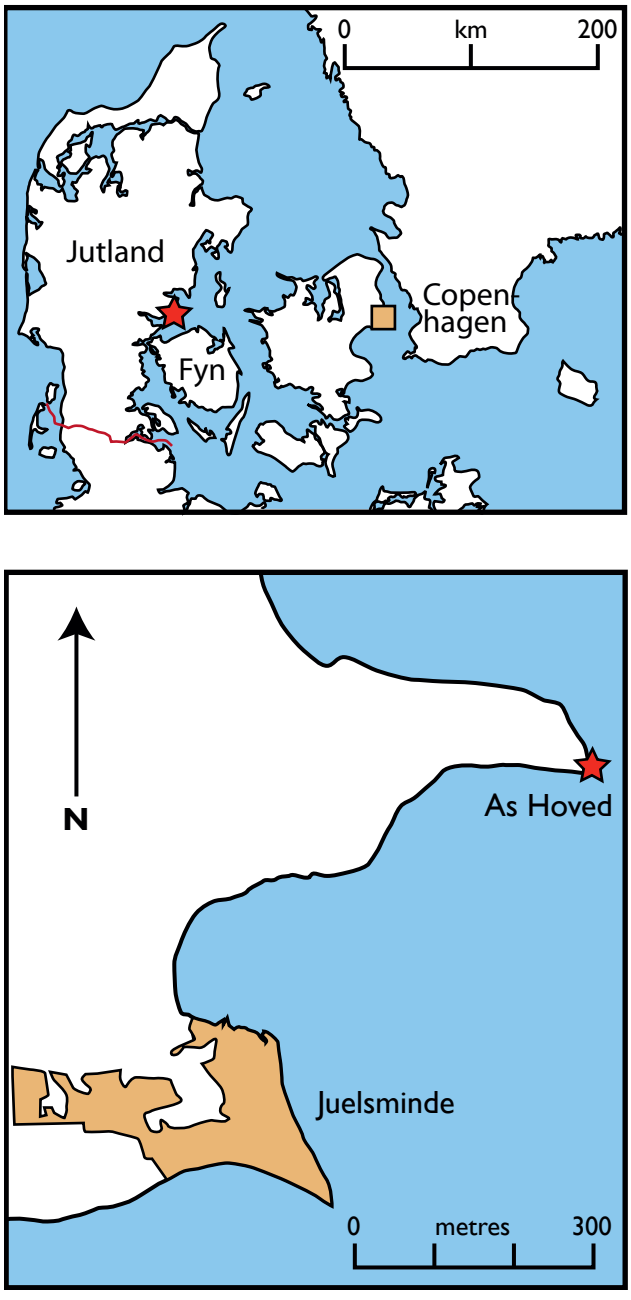

Figure 1. Map showing location of As Hoved shortly north of Juelsminde in eastern Jutland, Denmark. The ice-rafted boulder was found at UTM N 55° 44′ 43.93″, E 10° 4′ 18.10″.

Superfamily ASAPHOIDEA Burmeister, 1843

Family Ceratopygidae Linnarsson, 1869

Genus *Yuepingia* Lu, 1956

Yuepingia? sp.

Fig. 2: A–B

Material: One pygidium from an ice-rafted boulder found at As Hoved (Palsgård) cliff north of Juelsminde, Denmark (Fig. 1). The specimen is deposited at the Geological Museum, University of Copenhagen, as MGUH 29.196.

Accompanying fauna and age: *Leptoplastus paucisegmentatus* Westergård, 1922 (Fig. 2C–D), *Parabolina spinulosa* (Wahlenberg, 1818) and *Orusia lenticularis* (Wahlenberg, 1818). The faunal assemblage is unequivocally indicative of the *Leptoplastus paucisegmentatus* Zone of the Furongian *Leptoplastus* Superzone (see Westergård 1947; Henningsmoen 1957a; Terfelt *et al.* 2008, 2010).

Description: The spine-less pygidium is 4.2 mm long, semi-circular in outline and has a width:length ratio of about 1.6. The axis is strongly convex and consists of 6 or 7 rings (the anterior part of the specimen is damaged) in addition to the terminal piece and the articulating halfring. The axis occupies approximately 28% of the total width (tr.) at the first segment; it tapers evenly rearwards to about half the width at the posterior extremity. The axis is rather long, occupying approximately 80% of the total pygidial length (sag.), but extends only to the inner edge of the border; a postaxial ridge continues across the border. The axial furrows are distinct; the segmentation of the pleural fields is only very faintly discernible under oblique light. The border is weakly concave, descending quite steeply outwards, broadening slightly rearwards. The inner edge of the border is demarcated by a well-defined paradoublural ridge.

Remarks: The pygidium displays several general characteristics also seen in pygidia of ceratopygid

Yuepingia Lu, 1956, *Aplotaspis* Henderson, 1976 and *Charchaqia* Troedsson, 1937 and the asaphid *Golasaphus* Shergold, 1972.

Representatives of these genera occur in China, Australia and Alaska (Troedsson 1937; Lu *et al.* 1965; Palmer 1968; Shergold 1972; Henderson 1976). They all possess a spine-less, more or less semi-circular pygidium with a rather narrow and long convex axis delimited by distinct axial furrows; the axial and particularly the pleural fields show only faint segmentation and the border is relatively wide.

The specimen described in this paper has some features which differ from most representatives of the genera listed above: the weakly concave border is steeply sloping outwards and broadening slightly rearwards, the inner edge of the border is marked by a low but distinct paradoublural ridge, the axis does not extend beyond this ridge, but a faint postaxial ridge continues across the border. These features are shared with *Yuepingia glabra* (see Palmer 1968, pp. B56–57, pl. 13, figs 13, 16) described from the Hillard Peak area of Alaska. The associated Franconian–2 fauna includes species characteristic of the Laurentian *Ptychaspis-Prosaukia* Zone, which is considered coeval with the Scandinavian *Leptoplastus* Superzone (Geyer & Shergold 2000). The fauna also contains species with Asian affinities. It occurs in limestones deposited seawards of the continental shoreline in the outer detrital belt (Palmer 1968). The only apparent difference between the pygidium of *Y. glabra* and the specimen at hand concerns the axis, which in *Y. glabra* is almost totally effaced with only the anterior ring being discernible.

The type species of *Yuepingia, Y. niobiformis* Lu, 1956 from China (see Lu *et al.* 1965, pl. 102, fig. 13), has in comparison with the Scandinavian specimen a wide pygidium (width:length ratio 1.9 vs 1.6) with an axis extending onto the border, a strongly concave border and a slightly more pronounced segmentation of the pleural fields. We consider it questionable whether *Y. glabra* actually belongs to *Yuepingia* taking the different border outline, the shorter axis and the presence of a postaxial ridge into consideration. For this reason we treat the specimen at hand as *Yuepingia*? sp. The discussion of possible affinities would also greatly benefit from knowing the associated cranidium.

Hughes & Rushton (1990) suggested that *Yuepingia* Lu, 1956 is a junior synonym of *Haniwoides* Kobayashi, 1935, but see Choi *et al.* (2008, p. 196).

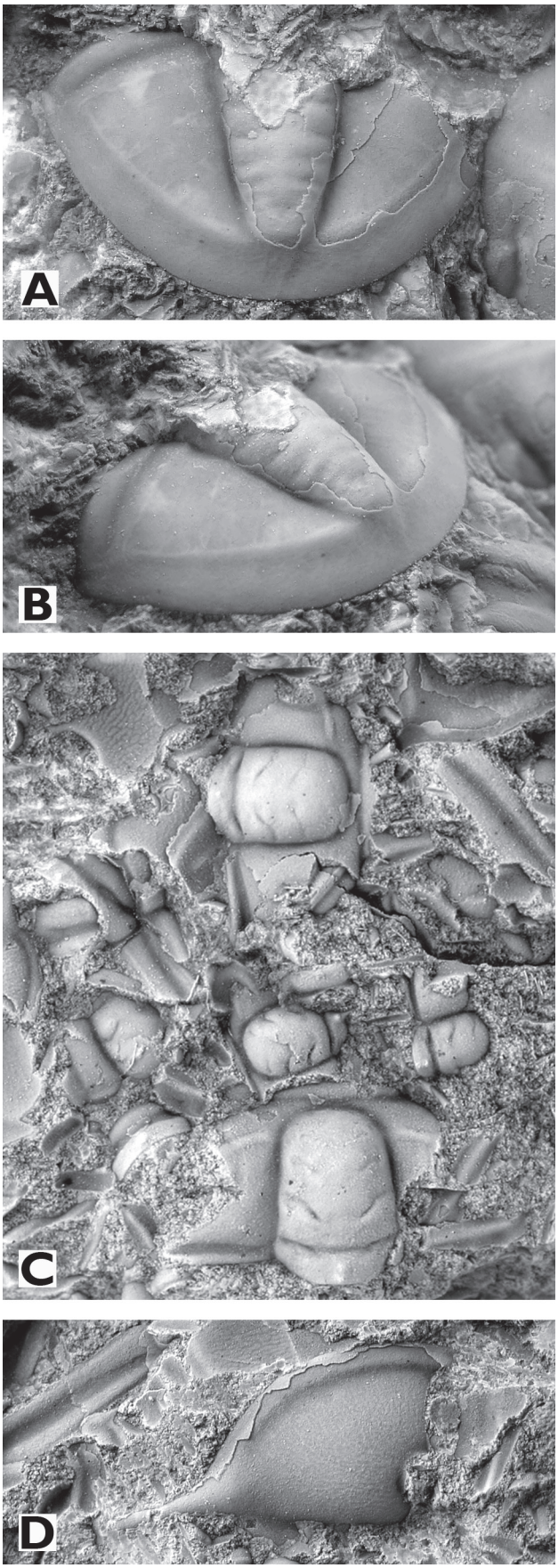

Figure 2. Trilobites from the erratic boulder found at As Hoved, east coast of Jutland, Denmark, all ×10. A–B. *Yuepingia*? sp., pygidium, MGUH 29.196 (A: Dorsal view, B: Oblique side view). C–D. *Leptoplastus paucisegmentatus* Westergård, 1922 (C: Group of cranidia, MGUH 29.197; D: Free cheek, MGUH 29.198).

The discussed Scandinavian pygidium also resembles that of *Golasaphus momedahensis* Shergold, 1972, in which, however, the pygidial width:length ratio approximates 2, and the axis is considerably narrower (cf. Shergold 1972, pl. 11, figs 1–5). *Yuepingia*? sp. may also be compared with the pygidium of *Aplotaspis erugata* (Whitehouse, 1939), as figured by Henderson (1976, pl. 49, figs 1, 3, 4), but which differs by having a strongly concave, wide border. *Aplotaspis* Henderson, 1976 was by Bao & Jago (2000) regarded as a junior synonym of *Charchaqia* Troedsson, 1937. Pygidia of *Charchaqia* (see *Charchaqia glabrescens* Peng, 1992, fig. 55 C, F; *Charchaqia halli* Jago, 1991, see also Bao & Jago 2000, pl. 2, figs 1–3, 6) differ from *Yuepingia*? sp. by having a longer, more strongly tapering axis.

The Scandinavian representatives of Asaphidae described from the *Peltura scarabaeoides* Superzone of the Alum Shale Fm (Westergård 1922, 1939), i.e. *Promegalaspides* and *Niobe* (*Niobella*), are readily distinguished from *Yuepingia*? sp. Species of *Promegalaspides* thus have an axis with strong segmentation and a concave, narrow border, whilst *Niobe* (*Niobella*) has a wide, strongly concave border. The oldest representative of the Asaphidae in Scandinavia is *Eoasaphus superstes* (Linnarsson, 1875), which is known only from one specimen found in the *Parabolina brevispina* Zone (Westergård 1922, pl. 2, fig. 20). The pygidial axis of this species resembles that of *Yuepingia*? sp., but the border is concave and the pleural fields exhibit faint segmentation.

Along with published as well as unpublished occurrences of *Anomocare*, *Drepanura*, *Elkanaspis*, *Irvingella*, *Jasmundia, Macropyge*, *Maladioidella, Pedinocephalus* as well as other genera of the Pterocephaliidae in the Alum Shale Fm (Westergård 1947; Henningsmoen 1957b; Buchholz 1998, 2005; Weidner & Żylińska 2005; Terfelt & Ahlgren 2007, 2009) the new finding provides another loose intercontinental biostratigraphic tie point, in this case with Laurentia.

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References

Ahlberg, P., Månsson, K., Clarkson, E. N. K. & Taylor, C.M. 2006: Faunal turnovers in the upper Cambrian *Leptoplastus* Zone at Andrarum, southern Sweden. Lethaia 39, 97–110.

Buchholz, A. 1998: Jasmundia - eine neue Trilobitengattung aus einem oberkambrischen Konglomerat-Geschiebe Vorpommerns (Norddeutschland). Archiv für Geschiebekunde 2, 379–386.

Buchholz, A. 2005: Notizen zu einigen bemerkenswerten Trilobiten-Funden aus oberkambrischen Geschieben der Stufen 4 und 5 (*Leptoplastus*- und *Peltura*-Stufe) Mecklenburg-Vorpommerns (Nordwestdeutschland). Der Geschiebesammler 38, 15–32.

Bao, J.-S. & Jago, J. B. 2000: Late late Cambrian trilobites from near Birch Inlet, south-western Tasmania. Palaeontology 43, 881–917.

Choi, D. K., Kim, E.-Y. & Lee J. G. 2008: Upper Cambrian polymerid trilobites from the Machari Formation, Yongwol, Korea. Geobios 41, 183–204.

Geyer, G, & Shergold, J. H. 2000: The quest for internationally recognized divisions of Cambrian time. Episodes 23, 188–195.

Harrington, H. J. & Leanza, A. F. 1957: Ordovician trilobites of Argentina. Department of Geology, University of Kansas Special Publication 1, 1–276.

Henderson, R. A. 1976: Upper Cambrian (Idamean) trilobites from Western Queensland, Australia. Palaeontology 19, 325–364.

Henningsmoen, G. 1957a: The trilobite family Olenidae with description of Norwegian material and remarks on the Olenid and Tremadocian Series. Skrifter utgitt av Det Norske Videnskaps-Akademi i Oslo, I. Matematisk-Naturvidenskapelig Klasse 1957(1), 303 pp.

Henningsmoen, G. 1957b: A Trilobite with North American affinities from the Upper Cambrian of Sweden. Bulletin of the Geological Institutions of the University of Uppsala 37, 167–172.

Holland, C.H. (ed.) 1971: Lower Palaeozoic rocks of the New World, Volume 1, Cambrian of the New World. Wiley-Interscience, New York, 456 pp.

Houmark-Nielsen, M. 1987: Pleistocene stratigraphy and glacial history of the central part of Denmark. Bulletin of the Danish geological Society 36, 1–189.

Hughes, N. C. & Rushton, A. W. A. 1990: Computer-aided restoration of a Late Cambrian ceratopygid trilobite from Wales and its phylogenetic implications. Palaeontology 33, 429–445.

Jago, J. B. 1991: *Charchaqia halli*, a new species of Late Cambrian Trilobite from south-western Tasmania. Geological Society of India, Memoir 20, 131–139.

Lu, Y., Chang, W., Chu, C., Chien, Y. & Hsiang, L. 1965: Chinese fossils of all groups, Trilobita. Vol. 1, 1–362; vol. 2, 363–766. Science Publication Co., Peking. [In Chinese].

Palmer, A. R. 1968: Cambrian Trilobites of East-Central Alaska. U.S. Geological Survey Professional Paper 559-B, 1–115.

Peng, S. 1992: Upper Cambrian biostratigraphy and trilobite faunas of the Cili-Taoyuan area, northewestern Hunan, China. Memoirs of the Association of Australasian Palaeontologists 13, 1–119.

Poulsen, C. 1923: Bornholms Olenuslag og deres Fauna. Danmarks geologiske Undersøgelse, II Række, 40, 1–83.

Shergold, J. H. 1972: Late Upper Cambrian trilobites from the Gola Beds, western Queensland. Bureau of Mineral Resources, Geology and Geophysics, Bulletin 112, 1–127.

Terfelt, F. 2003: Upper Cambrian trilobite biostratigraphy and taphonomy at Kakeled on Kinnekulle, Västergötland, Sweden. Acta Palaeontologica Polonica 48, 409–416.
Terfelt, F. 2006: Review of uppermost Furongian trilobites from Scania, southern Sweden, based on type material. Palaeontology 49, 1339–1355.
Terfelt, F. & Ahlgren, J. 2007: *Macropyge* (*Promacropyge*) Scandinavica new species; the first macropyginid trilobite recorded from the Furongian of Baltica. Journal of Paleontology 81, 1516–1522.
Terfelt, F. & Ahlgren, J. 2009: The first remopleuridioidean trilobite and the earliest *Parabolinella* species recorded in the Furongian of Scandinavia. Journal of Paleontology 83, 299–306.
Terfelt, F., Ahlberg, P. & Eriksson, M. E. 2010: Complete record of Furongian trilobites and agnostoids of Scandinavia – a biostratigraphical scheme. Lethaia 10.1111/j.1502-3931.2009.00211.x.
Terfelt, F., Eriksson, M. E., Ahlberg, P. & Babcock, L. E. 2008: Furongian Series (Cambrian) biostratigraphy of Scandinavia – a revision. Norwegian Journal of Geology 88, 73–87.
Troedsson, G. T. 1937: On the Cambro-Ordovician faunas of Western Quruq tagh, Eastern T'ien-shan. Palaeontologica Sinica 106, 1–74.
Weidner, T. 2001: Vier Funde von Trilobiten der Familie „Pterocephaliidae" aus dem Oberkambrium Schwedens in Geschieben aus Dänemark. Der Geschiebesammler 34, 61–68.
Weidner, T. & Żylińska, A. 2005: "Exotic" trilobites from the Upper Cambrian Alum shales of Sweden. Meeting proceedings Lundadagarna i Historisk Geologi och Paleontologi IX. GFF 127, 60 (abstract).
Westergård, A. H. 1922: Sveriges Olenidskiffer. Sveriges Geologiska Undersökning Ca 18, 1–205.
Westergård, A. H. 1939: On Swedish Cambrian Asaphidae. Sveriges Geologiska Undersökning C 421, 1–16.
Westergård, A. H. 1944: Borrningar genom Skånes Alunskiffer 1941-1942. Sveriges Geologiska Undersökning C 459, 1–45.
Westergård, A. H. 1947: Supplementary notes on the Upper Cambrian trilobites of Sweden. Sveriges Geologiska Undersökning C 489, 1–34.