

Early Cambrian trilobites from northern Scandinavia

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Ptychopariid trilobites from the uppermost local Lower Cambrian north of the lake Torneträsk, northern Swedish Lappland, and eastern Troms, northern Norway, are described. The available material consists of only eleven incomplete cranidia, collected by T. Vogt in 1915 from three localities in the autochthonous sequence of the Scandinavian Caledonides. The cranidia are referred to two species: *Ellipsocephalus* cf. *gripi* and *Strenuaeva inflata*. The former was collected from a somewhat lower level than the latter. In addition a fragmentary meraspis cranidium is described and questionably referred to the genus *Ellipsocephalus*.

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Along the eastern margin of the Scandinavian Caledonides, Lower Cambrian trilobites have been recorded from a variety of localities. The majority of these localities are situated in the narrow strip of autochthonous sediments of the Caledonian Front. However, important trilobite localities are also known in the allochthonous sequence, e.g. the classical locality of Tømten, Ringsaker, Norway, and the locality in the overthrust nappe of the mountain Luopakke, south of the lake Torneträsk, northern Sweden (see Ahlberg 1979).

North of Torneträsk, northern Swedish Lappland, and in eastern Troms, northern Norway, Lower Cambrian trilobites have been recorded from three principal localities in the autochthonous sediments (Vogt 1967) (Fig. 1):

1. South of the mountain Vaivantjåkka, north of Torneträsk, northern Swedish Lappland. The locality is situated in a small brook about 2 km E of the mouth of the rivulet Vakkejåkka (Vakkejokk, Ortojokk).
2. The southeasternmost part of the mountain Doarrovarre, eastern Troms, northern Norway.
3. A small brook about 1 km S of Frihetsli in the valley Dividalen, eastern Troms, northern Norway.

In addition, a fragmentary trilobite larva is known from a boulder at Røkskar, south of the lake Altevattnet, eastern Troms.

South of Torneträsk, Lower Cambrian trilobites are known from the uppermost local Lower Cambrian of Luopakke (layer 23, profile II,

Moberg 1908) in the autochthonous sequence. These have been described by Moberg (1908) and Ahlberg & Bergström (1978) and comprise the following species: *Strenuaeva inflata* Ahlberg & Bergström, 1978, *Comluella? lapponica* Ahlberg, 1979 and *Proampyx triangularis* Ahlberg & Bergström, 1978. Lower Cambrian trilobites have also been obtained from the overthrust rocks of Luopakke (see Ahlberg 1979), and they are closely comparable to the trilobites from the autochthonous sequence of Luopakke.

Eight specimens of trilobites are known from Doarrovarre and Frihetsli. They were obtained from a calcareous bed (member F 3, Vogt 1967) on top of a sequence of shales underlying the alum shales. This fossiliferous impure limestone has a maximum thickness of 1.7 m, and it is regarded as the top of the local Lower Cambrian (Vogt 1967:14). Apart from trilobites, this bed has also yielded some inarticulate brachiopods, in Vogt (1967) referred to *Obolus* cf. *favosus* (= *Glyptias* cf. *favosa*). Probably all trilobite specimens can be referred to *Strenuaeva inflata*, known from Luopakke. As indicated by the fauna, the lithology and the position in the sequence, member F 3 of Vogt (1967), is correlatable with the trilobite-bearing bed (layer 23, profile II, Moberg 1908) in the autochthonous sequence of Luopakke. The alum shale overlying the fossiliferous limestone has not yielded any fossils and it is not certain whether it is Middle or Late Cambrian in age.

From the locality at Vaivantjåkka two trilobite cranidia associated with obolellid? and lingulid brachiopods have been collected at a somewhat lower level (member F 1, Vogt 1967) than the

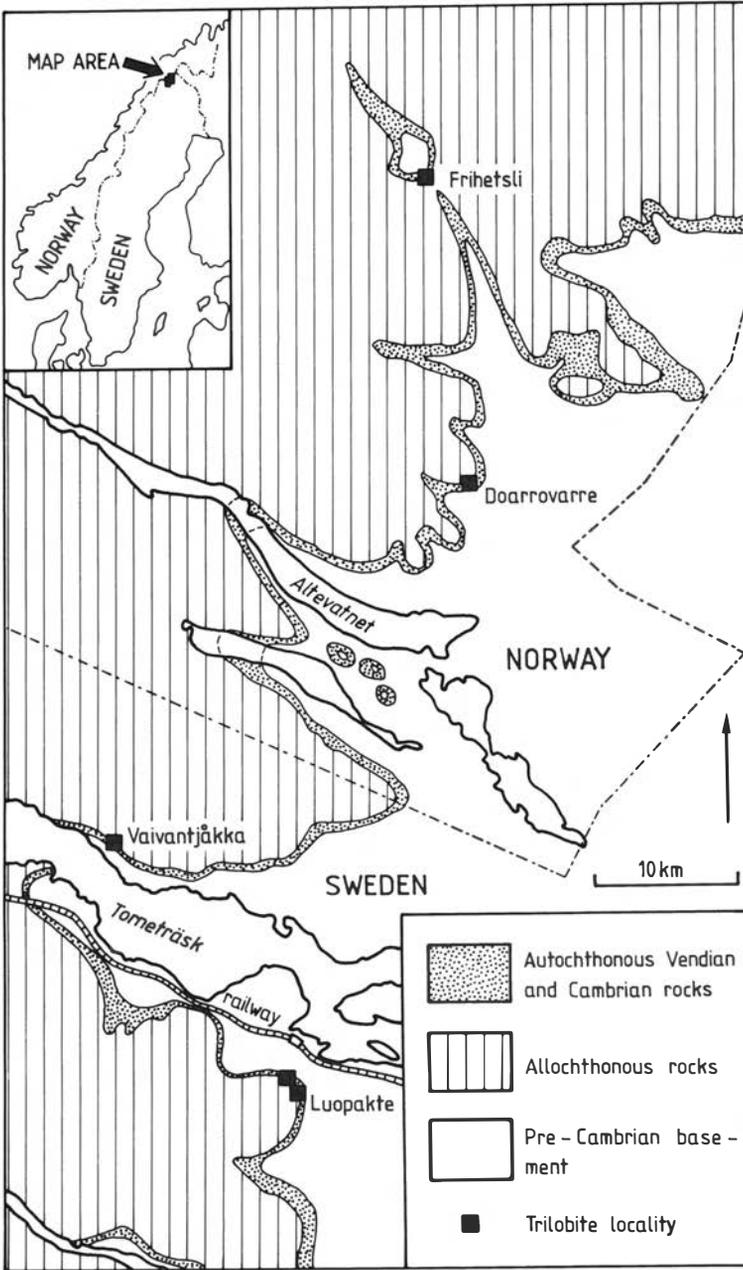


Fig. 1. Simplified geological map of the Torneträsk area, northern Swedish Lapland, and south-eastern Troms, northern Norway, showing the distribution of autochthonous Cambrian and Vendian rocks and the position of trilobite localities. The distribution of rocks slightly modified after Vogt (1967, pl. 1) and Kulling (1964, pl. 1).

faunas above. One of the cranidia is here referred to *Ellipsocephalus cf. gripi* (Kautsky 1945). The other is too fragmentary for identification.

For further information regarding the collecting sites, and the geology and stratigraphy of the Troms area, northern Norway, the reader is

referred to Vogt (1967). The Caledonian geology in the northern part of the Swedish Lapland has been treated by Kulling (1960, 1964). The geology and stratigraphy of the autochthonous Cambrian rocks of the Scandinavian Caledonides are summarized by Martinsson (1974:233-238).

		NORTHERN SWEDISH LAPPLAND (Luopakte)							EASTERN TROMS, NORTHERN NORWAY						
Middle ? Cambrian		alum shale (layer 24, profile II, Moberg 1908) 72 m							alum shale (member G, Vogt 1967) variable thickness						
Lower Cambrian	Upper Shale F. (Kulling 1960, 1964)	marly shale and limestone (layer 23, profile II, Moberg 1908) 1.7 m Trilobites: <i>Strenuaeva inflata</i> <i>Comluella? lapponica</i> <i>Proampyx triangularis</i> Inarticulate brachiopods							marly shale and limestone (member F3, Vogt 1967) 0-1.7 m Trilobites: <i>Strenuaeva inflata</i> Inarticulate brachiopods						
		green shale (layers 21-22, profile II, Moberg 1908) 16 m							green shale (member F2, Vogt 1967) 11-46 m						
		impure limestone (layer 20, profile II, Moberg 1908) 0.5 m No fossils encountered							impure limestone (member F1, Vogt 1967) 0-0.5 m Trilobites: <i>Ellipsocephalus cf. gripi</i> Inarticulate brachiopods						
Vendian		sandstones and shales, probably with several unconformities Approx. 100 m <i>Platysolenites</i> in the Lower Cambrian, <i>Vendotaenia</i> sp. in the Vendian							sandstones and shales, probably with several unconformities 50-150 m <i>Platysolenites</i> in the Lower Cambrian						
		crystalline basement							crystalline basement						

Fig. 2. Generalized stratigraphic table of the autochthonous sequence in northern Swedish Lappland (Luopakte) and eastern Troms, northern Norway, showing the distribution of selected fossils. The occurrence of *Vendotaenia* sp. according to personal communication by G. Vidal, 1979. *Ellipsocephalus* cf. *gripi* and inarticulate brachiopods recorded from member F 1 of Vogt (1967), from the locality at Vaivantjåkka, north of Torneträsk, northern Swedish Lappland, have been included in the Troms section because of the stratigraphic importance.

Systematic palaeontology

Material. – 11 cranidia and some indeterminable fragments. All the material was collected by T. Vogt in 1915. Since then no additional specimens have been added, and the collection of Vogt forms the basis for this paper.

Preservation. – Most cranidia are preserved as internal or external moulds. Two specimens are preserved with the exoskeleton. Remnants of the exoskeleton are present in three cranidia. The majority of the cranidia are probably affected by dorso-ventral compression, and in a few cases they have also undergone tectonic distortion to some extent.

Repository. – All figured specimens except the holotype of *Strenuaeva inflata* are deposited in Palaeontologisk museum, Oslo, Norway (catalogue numbers preceded by PMO). The unfigured material is also housed in that museum. The cited specimen of *S. inflata* is in the collections of the Geologiska institutionen, Lunds universitet, Lund, Sweden.

Terminology. – Morphological terms used are in accordance with Harrington, Moore & Stubblefield (in Moore 1959). The symbols used in the synonymy lists are explained by Matthews (1973:717–718).

Order PTYCHOPARIIDA Swinerton, 1915

Superfamily SOLENOPLEURACEA Angelin, 1854

Family SOLENOPLEURIDAE Angelin, 1854

Subfamily ELLIPSOCEPHALINAE Matthew, 1887

Genus *Ellipsocephalus* Zenker, 1833

Ellipsocephalus cf. *gripi* (Kautsky, 1945)

Fig. 3, C

□ v 1967 *Ellipsocephalus* sp., Vogt: 22, 25. □ v 1974 *Ellipsocephalid*, Martinsson: 236 (line 37). □ cf. v 1978 *Ellipsocephalus gripi* (Kautsky, 1945), Ahlberg & Bergström: 15–17, pl. 1, figs. 6–7, 10 (List of synonyms). □ cf. v 1979 *Ellipsocephalus* cf. *gripi* (Kautsky, 1945), Ahlberg: 8–9, fig. 3H.

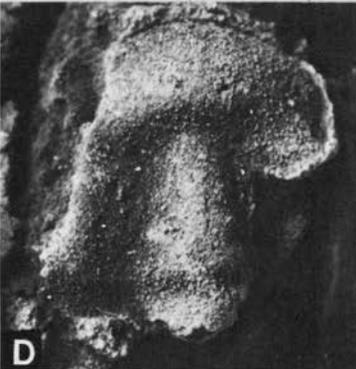
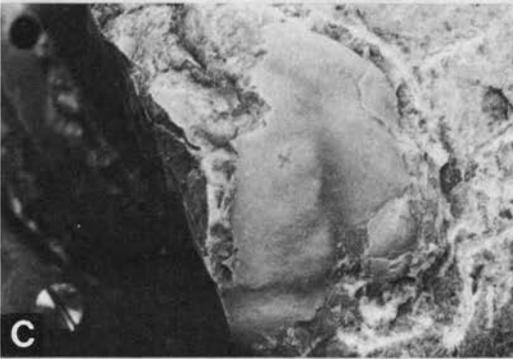
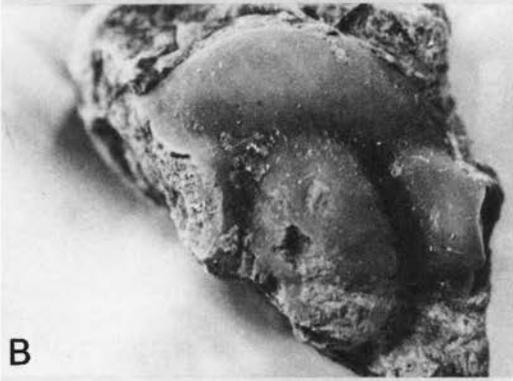
Material. – The right half of a single cranidium, preserved as an internal mould with remnants of the exoskeleton.

Description. – The glabella tapers gently forwards and occupies about two-thirds the total cranidial length. Three pairs of lateral glabellar furrows are evident, none of them deeply incised. The dorsal furrows are only slightly impressed and the glabella is set off from the fixigenae mainly by its convexity. The occipital ring is sagittally comparatively wide. The occipital furrow is distinct, wide and bowed forward medially. The frontal area is convex and slopes down to the anterior margin. The cranidium is evenly rounded anteriorly. The anterior sections of the facial suture diverge forwards. The fixigena is incomplete but seems to be more or less horizontal. Distinct eye ridges are not present.

Measurements. – Length (sag.) of cranidium 16.6 mm; length (sag.) of glabella 10.5 mm; length (sag.) of occipital ring 2.5 mm; width (sag.) of occipital furrow 1.0 mm.

Remarks. – The frontal area seems to be slightly shorter (sag.) and the occipital ring is comparatively longer (sag.) than in specimens of *E. gripi* from the type locality at Aistjakk, east of the village of Laisvall, northern Sweden. Furthermore, the present cranidium does not display a raised rectangular field on the fixigena, as in internal moulds of Aistjakk material of *E. gripi*.

Fig. 3. All figured specimens have been whitened with magnesium oxide prior to photography. Otherwise the prints are not retouched. □ A, B. *Strenuaeva inflata* Ahlberg & Bergström, 1978. □ A. Holotype cranidium, internal mould. Stereo pair. Layer 23, profile II, Luopakke, northern Sweden (Moberg 1908). Coll. J. Bergström, 1977. LM LO 5330 T. ×4.8. □ B. Incomplete cranidium with the exoskeleton. Obliquely distorted. Stereo pair. Member F 3 (Vogt 1967) at Doarrovare, eastern Troms, northern Norway. PMO 47143. ×8.4. □ C. *Ellipsocephalus* sp. *gripi* (Kautsky, 1945). Internal mould of an incomplete cranidium. Stereo pair. Member F 1 (Vogt 1967), at Vaivantjåkka, north of Torneträsk, northern Sweden. On the posterior part of the fixigena there is an internal mould of a lingulid brachiopod. PMO 25112. ×4.1. □ D, E. *Strenuaeva inflata*? Member F 3 (Vogt 1967) south of Frihetsli, eastern Troms, northern Norway. □ D. Internal mould of an incomplete cranidium with a strongly tapered glabella. PMO 103.671. ×7.6. □ E. Incomplete cranidium with remnants of the exoskeleton, transversely compressed. PMO 47129. ×5.9. □ F. *Ellipsocephalus*? sp. Incomplete meraspis cranidium. Boulder at Røkskar (probably derived from member F 1 of Vogt 1967), south of Altevatnet, eastern Troms, northern Norway. Latex cast from external mould. PMO 47151. ×23.



A closely comparable form is known from the allochthonous sequence of Luopakte (see Ahlberg 1979:8, fig. 3H), but it is also provided with a longer frontal area and a shorter occipital ring than the present cranium.

Occurrence. – Member F 1 (Vogt 1967) at Vainantjåkka, north of Torneträsk, northern Swedish Lapland.

Ellipsocephalus? sp.

Fig. 3, F

Material. – An external mould of an incomplete meraspis cranium. The occipital ring and parts of the fixigenae are not preserved.

Description. – The cranium is wider than long. The posterior portion of the glabella is parallel-sided, narrow, and separated from the fixigenae by well impressed dorsal furrows. The glabella is expanded anteriorly and reaches to the inner margin of the anterior border furrow. However, the anteriorly expanded part of the glabella is ill defined. Distinct transglabellar furrows are not present. The anterior border is narrow and well defined. It is of uniform width. Behind the border there is a wide and distinct anterior border furrow. The fixigenae are gently convex. Eye ridges are not apparent. The palpebral furrow is wide (tr.) and distinct.

Measurements. – Axial length of cranium (estimated) 1.0 mm; width of cranium at eyes (estimated) 1.4 mm; width of posterior part of glabella 0.3 mm.

Remarks. – It cannot be assigned with certainty to any genus or species. However, in general it bears resemblance to Kautsky's (1945) 'stage II and III' in the ontogeny of *Ellipsocephalus gripi*. For this reason it is questionably referred to the genus *Ellipsocephalus*. The cranium was reported as a fragmentary pygidium by Vogt (1967:22, 34).

Occurrence. – It was collected from a loose boulder (probably very local) in a brook a couple of km W of Røkskar, south of Altevätnet, eastern Troms, northern Norway. According to Vogt (1967:22, 34) the lithology indicates member F 1. A lingulid brachiopod is known from the same boulder.

Genus *Strenuaeva* Richter & Richter, 1940

Strenuaeva inflata Ahlberg & Bergström, 1978

Fig. 3, A–B, D–E?

- v. 1908 *Arionellus primævus* Brögger, Moberg, pl. 1, fig. 3.
- ?v 1908 *Arionellus primævus* Brögger, Moberg, pl. 1, fig. 2.
- v 1967 *Strenuella (Arionellus) primaeva* Br., Vogt: 40. □ ?v 1967 *Strenuella (Arionellus) primaeva* Br., Vogt: 42. □ v. 1974 *Strenuaeva primaeva*, Martinsson: 236 (line 19). □ v 1974 *Strenuaeva primaeva*, Martinsson: 236 (line 40). □ v.* 1978 *Strenuaeva inflata* n.sp., Ahlberg & Bergström: 20, pl. 2, figs. 5–6. □ ?v 1979 *Strenuaeva* sp., Ahlberg: 9–11, fig. 3A–F.

Material. – One incomplete cranium with the exoskeleton. It is slightly obliquely distorted. Seven incomplete crania are doubtfully assigned to the species.

Type data. – The holotype cranium from the uppermost local Lower Cambrian (layer 23, profile II, Moberg 1908) in the autochthonous sequence of Luopakte, northern Sweden, was illustrated by Ahlberg & Bergström 1978, pl. 2, fig. 5. It is reillustrated herein.

Remarks. – Particularly one specimen (Fig. 3, B) measuring 5.1 mm in length agrees well with the description given by Ahlberg & Bergström (1978:20). However, the fixigenae are not as inflated and the dorsal furrows are not as impressed as in the specimens from the type locality, but this may be due to dorso-ventral compression. Furthermore, all known specimens of *S. inflata* from the type locality are preserved as internal moulds, and this can also explain the lower relief in the present cranium, which is preserved with the exoskeleton. However, the shape of the inflated part of the fixigenae (they are curved and narrow forwards) indicates that the specimen in question must be referred to *S. inflata*. In addition to the description of Ahlberg & Bergström (1978) it can be noted that terrace lines are present on the exterior surface of the exoskeleton along the anterior margin. Otherwise the surface seems to be smooth. Unfortunately the occipital ring in the specimen is too poorly preserved to show any sculpture.

The specimens questionably referred to the species differ mainly in having considerably lower facial topography than the specimens from the type locality, but this may be the effect of compression. Besides flattening, the majority of

these specimens are probably also sagittally elongated (the L-form of Henningsmoen 1960) due to tectonic distortion. They are very similar to transversely compressed specimens of the form referred to *Strenuaeva* sp. from the allochthonous sediments of Luopakte (see Ahlberg 1979), and without hesitation they belong to the same species. A typical character in some well preserved cranidia from the allochthonous sequence of Luopakte is the prosopon of fine raised lines on the occipital ring (Ahlberg 1979, fig. 3E). Also one specimen (Fig. 3, E) in the collection of Vogt exhibits traces of similar lines on the occipital ring. The other specimens are too fragmentary to show any similar details.

Occurrence. – Member F 3 (Vogt 1967) at the southeasternmost part of Doarrovare and at Frihetsli in Dividalen.

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