



FIGURE 7—1. Thoracic segments of *Montezumaspis cometes* (Fritz, 1995) n. gen. compared with those of small and large holaspides of *M. parallela* (2 and 3).

central longitudinal ridge on posterior axial rings (T6–T13). T3 amplipleural, slightly longer (exsag.) than adjacent segments, with deep, broad, triangular pleural furrow that is rounded distally. T3 has short, narrow pleural spine with thornlike base, tip aligned with middle of T4 on small holaspides and anterior part of T4 on large ones (Fig. 7). Anterolateral margin of pleural spine on T5 directed at an angle from sagittal axis varying from 32° on small to 18° on large specimens. T2 similar to T3. T1 narrower (tr.) with short, more laterally directed slightly thornlike pleural spine. Segments posterior to T6 have smoothly sentate pleural spines. Behind axial spine on T13, thorax has four segments (Fig. 6.9), thorax and axis taper more rapidly than anterior part of thorax, pleurae outward-directed (65° from sagittal axis) to backward-directed (15° from sagittal axis) on last segment, pleural furrow a shallow pit at axis on forward two segments, obsolete on last two, all four have wide anterior ridges. Pleural spines short, backward-directed.

Pygidium (Fig. 6.9) trapezoidal, expanding posteriorly with broadly rounded posterolateral margins, anterior width equal to pygidial length. Axis triangular, apex backward, strongly elevated at apex two-thirds distance to posterior margin, with central portion of axis depressed, shallow lateral pits near anterior faintly suggest a single segment. A much larger (4.5 mm, Fig. 6.8), isolated pygidium also belongs to this species, axis rounded instead of sharply elevated, central portion of axis depressed with faint pits suggesting a single segment. Articulating ring widest (sag.)

at center tapering to lateral margins of axis, defined by distinct furrow with steep rise to pygidium.

Nine small cephalo, three with attached thorax, are provisionally assigned as meraspides of this species. Cephalic length ranges from 1.5 to 3.3 mm, outline ranges from nearly circular to somewhat parabolic anteriorly, with transverse posterior margin. Preglabellar field (sag.) much wider than border in small cephalo (Fig. 6.7) to nearly equal to border width (sag.) on larger cephalo. LA round, slightly expanded. S0 strong, shallow across midline. L0 slightly extended posteriorly with small node or tiny spine. Ocular lobe long, contacting LA posterolaterally (contacting LA laterally on smallest cephalo), separated from LA by distinct axial furrow. Extraocular area approximately same width as interocular area. Intergenal ridge present, continues as interocular ridge on small cephalo. Intergenal spine large on small cephalo, located at proximal third of distance to genal angle which is somewhat advanced. Thorax narrow, with slightly amplipleural third segment; 12 segments observed on specimens with 3.1–3.3 mm cephalo (Fig. 6.6).

Material examined.—Over 100 cephalo, 9 complete specimens, and 17 miscellaneous pieces including hypostomes (in field collections).

Occurrence.—Montenegro Member of the Campito Formation, from the northern Montezuma Range (sections MN-f 163, 166–168, 168, 172, 181, and 188; MN-h 213.5, 214–216, 216.5, 220–240, and 226; MS 167.5, 175, 185–187, 195.5, and 199; MS-S 14.7, 29, and 34) and from the Fish Lake Valley area (FLVS-N 6). Type material from Montenegro Member at Barrel Spring, Walcott's 1f collection (Fig. 2.6).

Discussion.—*Montezumaspis parallela* occurs commonly with *M. cometes* but is often larger; available cephalo (120) average 11.7 mm in length with maximum cephalic length of 64 mm. *Montezumaspis cometes* cephalo (76) average 8.9 mm in length with a maximum of 39 mm. Over 80% of the specimens of *M. parallela* occurs in collections with *M. cometes*, in the ratio of 10:7. Monospecific collections are nearly all less than five specimens.

Difficulty was encountered in separating over 170 isolated cephalo of these two species due to often confusing overlap in the range of critical characters. Obviously much of the problem lies in the compacted condition of all but a few specimens which causes considerable variation in the condition of the glabellar furrows, lobes, and even the shape of the LA, as well as distorting the cephalic shape, particularly the condition of the posterior margin. Additional problems probably are caused by nonisometric growth along the holaspide trajectory. Distinct differences in the thorax from the earlier to later instars are present (Fig. 7). On *M. parallela* the axial width increases, the angle and length of the pleural spine decreases, and the length of the T13 axial spine increases considerably with advancing age. Finally, much of the variability appears to be intraspecific due to lability of many of the critical characters (Hughes, 1994).

The cephalo of *Montezumaspis parallela* differs from that of *M. cometes* in the following characters: ocular lobes evenly curved, but much less than a half-circle and located much closer to the axial furrow. Anterior shape of cephalo more parabolic than semicircular. LA narrow, approximately width of L0, not distinctly wider; also somewhat pointed anteriorly rather than well rounded. Glabella practically parallel-sided rather than slightly narrower at S1. Thick occipital spine arises from a longitudinal ridge in the posterior half of L0 compared with slender spine originating at the posterior margin of L0. The anterior ocular line (Raw, 1937; Palmer and Repina, 1993) is rarely observed whereas it is commonly seen on *M. cometes*. *M. parallela* is more easily distinguished from *M. cometes* by the characters of the thorax. The pleural spines of *M. cometes* are distinctly outward-directed

(Fig. 7), the thorax is wider, the pleural furrows are more rectangular, and there is a node or spine on all thoracic rings ahead of T13. The prominent spine on T13 is more like a telson on *M. parallela* while on *M. cometes* it is a longer-than-normal axial spine. The axis of the pygidium of *M. parallela* is more sharply triangular and more strongly elevated posteriorly with the central portion of the axis depressed when compared with the pygidium of *M. cometes*.

Cephalo of *M. parallela* can be distinguished from cephalo of *Palmettaspis consorta* in having a parallel-sided rather than expanding glabella, longer ocular lobes and longer, less advanced genal spines (Fritz, 1995). *Montezumaspis parallela* can resemble the narrow form of *Esmeraldina rowei* but is differentiated by the presence of a preglabellar field, low anterior and lateral border, wide extraocular areas, and genal spines directed straight back.

Among the Baltic species, *M. parallela* most resembles *Holmia* sp. Moczydłowska et al., 2001, from the Grammajukku Formation of Sweden, which is reported to be "one of the oldest Baltoscandian olenellids." The small cephalon (Moczydłowska et al., 2001, fig. 7a) bears a striking resemblance to the meraspid cephalon shown in Figure 6.6 with unfurrowed ocular lobes contacting the LA with a shallow furrow. *Montezumaspis parallela* differs from *Holmia* sp. in having the ocular lobes closer to the glabella, in lacking the faint ocular furrow in larger specimens, and in having an amplipleural third thoracic segment. *Montezumaspis parallela* also resembles *Kjerulfia orientalis* (Orłowski, 1974), in having a parallel-sided glabella, wide extraocular area, and amplipleural third thoracic segment (Ebbestad et al., 2003). *Kjerulfia orientalis* differs from *M. parallela* in having furrowed ocular lobes and a wide L3 configured much like *Holmia kjerulfi* (Linnarsson, 1873). Fritz (1995) discusses differences between *M. parallela* and "*Holmia*" *ljungneri* Kautsky, 1945. (Note that Ahlberg et al., 1986, regard the generic position of the latter species to be unresolved.) The lack of ocular furrows and the shallow furrow separating the ocular lobe from the LA on small cephalo of *Holmia* sp. and *Holmia glabra* Orłowski (1974, p. 11 and pl. 2, fig. 8) suggest an early ontogenetic kinship between the Baltic holmiids and *M. parallela*.

The arrangement of S2 and L3 on the glabella of *M. parallela* is perhaps significant. L3 is wider (exsag.) than L2 and configured somewhat like a wide letter M, resulting in a short S2 furrow that often does not reach the axial furrow. This arrangement is not present on *M. cometes* or on species of *Esmeraldina*, *Palmettaspis*, or *Grandinasus* n. gen. The M-like L3 is well developed on many of the Baltic holmiids typified by *Holmia kjerulfi*, but in that species S2 extends to the axial furrow. The reduction of S2 to a short slitlike furrow separated from the axial furrow is a feature of much younger forms such as *Olenellus* Hall, 1861. The large thoracic axial spine of *M. parallela* is an unusual feature that is not repeated among the olenelline trilobites until early in the *Olenellus* Zone. These unique features on *M. parallela* suggest the possibility that this species may be very close to an ancestral form for not only the western Laurentian holmiids, but also for geographically distant and considerably younger forms as well.

MONTEZUMASPIS COMETES (Fritz, 1995)
Figures 7.1, 8.1–8.10

- Esmeraldina? cometes* FRITZ, 1995, p. 716, figs. 5.3, 9.8, 10.3–10.5.
Palmettaspis cometes (FRITZ, 1995). LIEBERMAN, 1999, p. 76–77 (coded), 85.
?Fallotaspsis cf. tazemmourtsensis NELSON AND HUPÉ, 1964, p. 40; NELSON AND DURHAM, 1966, pl. 2, fig. 1.
?Fallotaspsis sp. NELSON, 1976, pl. 1, lower left corner.

Emended diagnosis.—Preglabellar field equal to sagittal length of anterior border on small specimens ranging to virtually absent

on large specimens. Glabella slightly narrowed at S2. LA broadly rounded anteriorly and slightly wider (tr.) than L0. Ocular lobes semicircular. Occipital spine arises at posterior margin of L0. Axial rings of thorax have nodes or small spines. Lateral margins of pleural spines outward-directed, about 45° to sagittal axis.

Description.—Fritz's (1995) description of this species is based on two cephalo, 23.4 mm (holotype) and 9.0 mm long. Several new articulated, but smaller, specimens, with cephalo 5–6 mm long, provide additional information on this species.

Preglabellar field equal to sagittal length of anterior border on small specimens ranging to virtually absent on large specimens. LA one-third length (sag.) of glabella including L0. On full-relief specimen, glabella arched transversely with the highest point in lateral profile near L0. On smaller specimens LA expands anteriorly from contact of ocular lobe, on larger specimens maximum width of LA is at contact with ocular lobe. Anterior contact of ocular lobe merges with LA with only a slight to moderate depression. Faint anterior ocular line is present on most specimens (Fig. 8.5, 8.10). Width (tr.) between distal margins of ocular lobes one-fifth greater than glabellar length (sag.). Interocular area one-half to three-quarters of the width (tr.) of extraocular field. Polygonal network on dorsal surface observed on larger specimens only.

Hypostome nearly circular, domed, with length about one-third of cephalic length, natant, margins cannot be examined on available material. Isolated large hypostomes described as *M. parallela* may be from *M. cometes*.

Thorax nearly parallel-sided to T13, width (tr.) of this sector at T3 one-third greater than sagittal length which is slightly longer (sag.) than cephalon; prominent, broad-based spine on T13 which is three-fifths length of anterior part of thorax. Axis three-tenths thoracic width including pleural spines, with node or small spine on axial rings. Pleural furrows are deep, rectangular with lateral ridges, rounded distally. Pleural spine thornlike on anterior segments outward-directed, tip of spine opposite the anterior third of the succeeding segment (Fig. 7.1). Pleural spine sentate and outward-directed posterior to about T8. Anterolateral margin of pleural spine on T5 directed at 43° from sagittal axis. T3 is slightly wider (exsag.) than adjacent segments. T1 distinctly narrower (tr.) than T2 with short, outward-directed pleural spine. Thorax behind large axial spine tucked under on some specimens; consists of four narrow (sag.) segments one-third as wide (sag.) at axis as T13. Pleural region laterally directed on T14 and curved posteriorly on T17.

Pygidium small, with flat, posterolateral finlike projections, posterior margin indeterminate. Axis subtriangular, slightly elevated, a little over twice as wide (tr.) as long with three pairs of faint pits marking central portion, width (tr.) between pits increases posteriorly. Length (sag.) of pygidium is only about one-fifteenth cephalic length (Fig. 8.2).

A specimen with a cephalon 2.4 mm long and 11 thoracic segments is interpreted as a meraspid of this species, other meraspid cephalo range from 1.6 to 3.1 mm. Cephalo are similar to *M. parallela* except that cephalon is much wider, width (tr.) one and two-thirds to two times cephalic length (Fig. 8.3, 8.4) and genal spine is outward-directed. L0 has small spine. Ocular lobes widely spaced and contact LA on lateral (on smaller specimen) or posterolateral margin. Interocular area has prominent longitudinal interocular ridge continuous with intergenal ridge. Spines occur on all thoracic axial rings (Fig. 8.3).

Material examined.—A total of 82 cephalo and cephalic fragments plus five complete specimens (in field collections).

Occurrence.—Montenegro Member of the Campito Formation, from the northern Montezuma Range (sections MN-f 163, 166–168, and 181; MN-h 213.5, 214–216, 216.5, and 226; MS 167.5, 168, and 175; and MS-S 29 and 34) and from the Slate Ridge