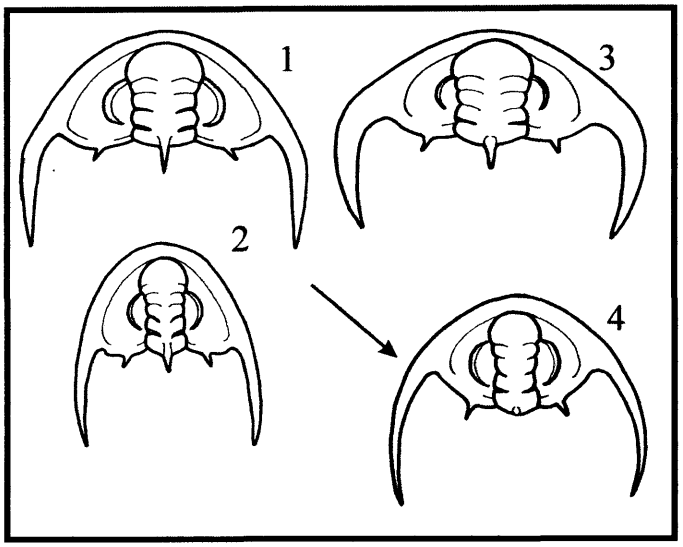

FIGURE *10*—Line drawings of cephala of *Esmeraldina* Resser and Howell, 1938, based on material from the Montezuma Range, *1*, typical *Esmeraldina rowei*; *2*, *E. rowei* narrow form; *3*, *E. rowei* wide form; and *4*, *E. elliptica* n. sp.

addition to the availability of even more complete material, bed-by-bed collecting, and single-bedding-plane variability studies.

The three cephalic forms of *E. rowei* are compared as follows:

1. The cephalon of the narrow form (Fig. 10.2) is parabolic in shape, width (measured outside the genal spines laterally from L0) is one-half greater than cephalic length. The width of the typical form (Fig. 10.1) is about twice the cephalic length, while on the wide form (Fig. 10.3) the cephalic width is nearly three times cephalic length due to the unusual genal spines.
2. On the typical form the genal angle aligns with the anterior part of L0; there is a notable change in curvature of the genal spine to more nearly parallel the axis which occurs just posterior to the posterior margin of the cephalon. Width at the base of the genal spine measured perpendicular to the spine axis is one-half greater than length (sag.) of L0. On the narrow form, the genal spines are long, approximately equal to cephalic length, curving uniformly from genal angle to approach thorax at tip, width near genal angle one-tenth more than length (sag.) of L0. On the wide form, genal spines very wide at base, four-fifths greater than length (sag.) of L0, somewhat advanced, genal angle aligns with S0. At base, spine slightly outward-directed then curving smoothly back as spine tips approach thorax; sagittal length only about one-sixth greater than cephalic length.
3. On some of the narrow forms, the posterior margin of the cephalon is transverse abaxially from the intergenal spine then curves distinctly forward near the genal angle (Fig. 9.5, 9.9).
4. On the wide form the intergenal spine is stout and triangular, shorter than on the other forms (Fig. 9.4).
5. On the narrow form, the occipital spine arises as narrow ridge on posterior two-thirds of L0 continuing to small spine seldom longer than one-half length (sag.) of L0; while on the wide form the occipital spine is slightly longer than L0 (sag.) originating at posterior third of L0; a pair of elevations lateral to occipital spine occur which become distinct nodes on larger cephala.
6. On the narrow form the ocular lobes are closer to the glabellar axial furrow (Fig. 9.5), while on the wide form the ocular lobes are somewhat outward-directed (Fig. 9.4).
7. Finally, on the wide form, the LA is wider and the axial furrow is shallower at L1 than on typical *E. rowei*.

The narrow form shows the greatest transition with the typical *E. rowei*, appears at the same stratigraphic position, and occurs through much of the range of typical *E. rowei*. The external sculpture of the narrow form has about 80 fine granules per mm^2 on a large cephalon, in the type suite of *E. rowei* three cephala have about 60 granules per mm^2, but some typical *E. rowei* and all the wide form cephala have as few as eight coarse granules per mm^2. This variation in external sculpture may be due to dimorphism or may be a response to subtle environmental changes (Palmer, 1965).

The thorax on medium to large typical *E. rowei* is parallel-sided through about T10 then rapidly tapered to the pygidium, while the thorax on the wide form is evenly tapered. The thorax of the narrow form is distinctly narrower than typical *E. rowei*.

The pygidium is even more confusing; on the lectotype it appears to have three pairs of short spines with the end of the axis close to the posterior margin (Fritz, 1995, fig. 6.12). An isolated example of a similar pygidium is shown in Figure 9.7. However a pygidium attached to a typical *E. rowei* thorax (Fig. 9.8) has a smooth posterior margin and a space of one-fourth the pygidial length behind end of the axis. Isolated pygidia in a collection dominated by the narrow form are small, trapezoidal, anterior width (tr.) three-fifths posterior width, length (sag.) two-thirds anterior width (Fig. 9.12). Axis wide, transverse width is approximately equal to pygidial length (sag.), one axial ring. Articulating half ring arcuate, wide and smooth centrally. Terminal piece parallel-sided, rounded posteriorly, reaching posterior margin, transversely elevated, two lateral pits define an anterior pseudo-ring, with a triangular, backward-pointing ridge in center of large bulbous area. Pleural areas triangular, posterior margin transverse, slightly indented at axis, apparently lacking spines, rounded at posterolateral corners. A low ridge, essentially a border, proceeds posteriorly to curve adaxially near posterior margin. Using the proportions known from the lectotype, these pygidia are from individuals with a cephalon about 38 mm long, about the size of the largest cephalon found in this collection. The assignment of pygidia will remain questionable until more articulated material is available.

The narrow form is often more common than the typical form in the early part of the range of *E. rowei*. The wide form is most common at MN-f 199 where it is two-thirds as frequent as the accompanying typical *E. rowei*. Otherwise it is rare in the upper part of the *E. rowei* range.

Hughes (1994, p. 59) cites two causes of size-independent intraspecific variation: "(1) genetic polymorphism among local populations, each of which are developmentally-canalized ... and (2) a genetically flexible (i.e., poorly-canalized) genotype, producing ecophenotypic variation." The wide variation within *E. rowei* is not likely to be environmentally or ecologically related because there is minimal lithological variation in the rocks yielding these trilobites. The observed variation in *E. rowei* is likely genetic polymorphism as suggested by the continuation of the wide morphotype in a succeeding form, *Grandinasus patulus* n. gen. and sp.

McMenamin's (1987, fig. 5.4) specimen, IGM 3652 (Institute of Geology Museum, México, D. F.), from the upper part of Member 2, Puerto Blanco Formation, Cerro Rajòn, Sonora, Mexico, is a parabolic cephalon with dorsally elevated border and no preglabellar field. Based on these features, this poor specimen is questionably assigned to *E. rowei*, probably the narrow morphotype, rather than to *Fallotaspis* Hupé, 1953a.