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M. J. M. Bless (*).—ON A CASE OF DIMORPHISM IN THE LAST JUVENILE STAGE OF A HOLLINID OSTRACODE FROM THE NAMURIAN B-C OF THE LA CAMOCHA MINE (GIJON, N. SPAIN)

One sample from the La Camocha Coal Mine (Gijón, N. Spain), kindly placed at the disposal of the author by Dr. R. H. Wagner (Sheffield, U. K.), has yielded a very interesting hollinid ostracode. The rather well-preserved specimens are believed to be comparable to *Hollinella? avonensis* (LATHAM, 1932) from the Upper Limestone Group (Namurian A) of Scotland. Detailed examination of the material has led to the conclusion that some of the «adult» forms probably belong to the last immature stage because of their size and the relative width of the velum in presumable males.

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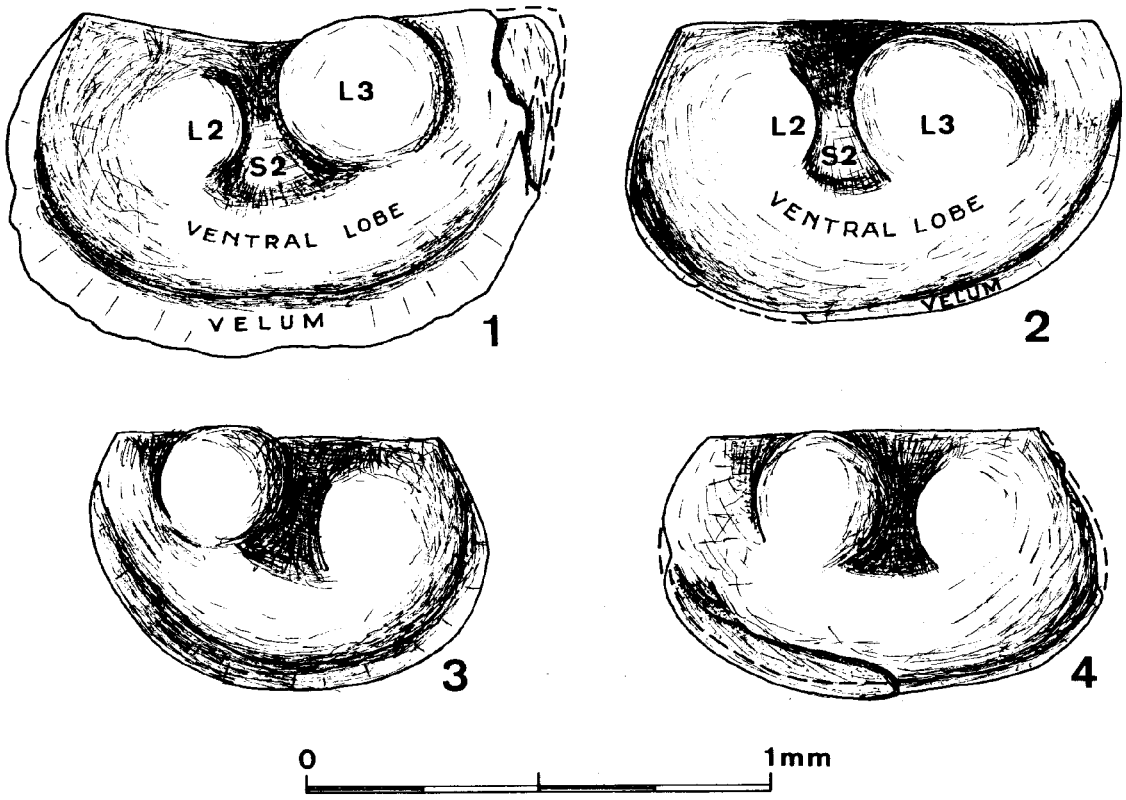


Fig. 1-4. *Hollinella?* cf. *avonensis* LATHAM, 1932. 1) Left view of presumable male of 9th instar. RW 1152-46. 2) Left view of presumable female of 9th instar. RW 1152-5. 3) Right view of presumable male of 8th instar. RW 1152-41. 4) Right view of presumable female of 8th instar. RW 1152-42.

A wide-spread opinion among ostracode specialists holds that well-developed dimorphism should only occur in the adult stage. It is suggested, however, that pre-adult dimorphism may be rather common in several families of ostracodes.

The present sample was collected by Dr. R. H. Wagner in the La Camocha Mine at sample location RW 1152. This is a marine band overlying a coal seam at 18.60 m below the workable coal seam «H». According to NEVES (1964), this marine band should be placed in the Namurian B-C. Unfortunately, the location is no longer accessible since that part of the mine has been abandoned.

The author is indebted to Dr. R. H. Wagner for provision of the ostracode sample and for his useful information. The assistance of Mr. L. R. Funcken and Mr. H. M. J. Ruyters in the preparation of figures and tables is gratefully acknowledged.

Systematic description.

Order PALAEOCOPIDA Henningsmoen, 1953
Sub-order BEYRICHICOPINA Scott, 1961
Family HOLLINIDAE Swartz, 1936
Genus HOLLINELLA Coryell, 1928

Hollinella? cf. *avonensis* (LATHAM, 1932)
Figs. 1-16

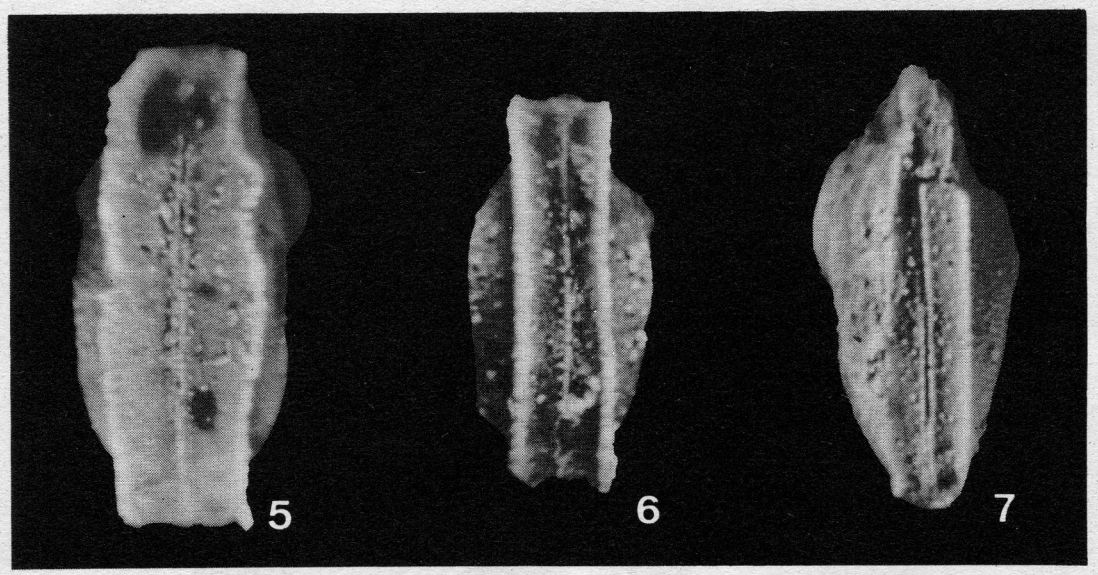


Fig. 5-7. *Hollinella?* cf. *avonensis* LATHAM, 1932. 5) Ventral view of presumable male of 9th instar. RW 1152-46. 6) Ventral view of presumable male of 8th instar. RW 1152-51. 7) Ventral view of presumable female of 8th instar. RW 1152-45.

M a t e r i a l: About 100 carapaces and single valves, partly damaged.

D i a g n o s i s: A hollinellid species with velum along practically the entire free margin, gradually diminishing in width at the posterior end. Surface smooth to granulose. Dimorphism distinct.

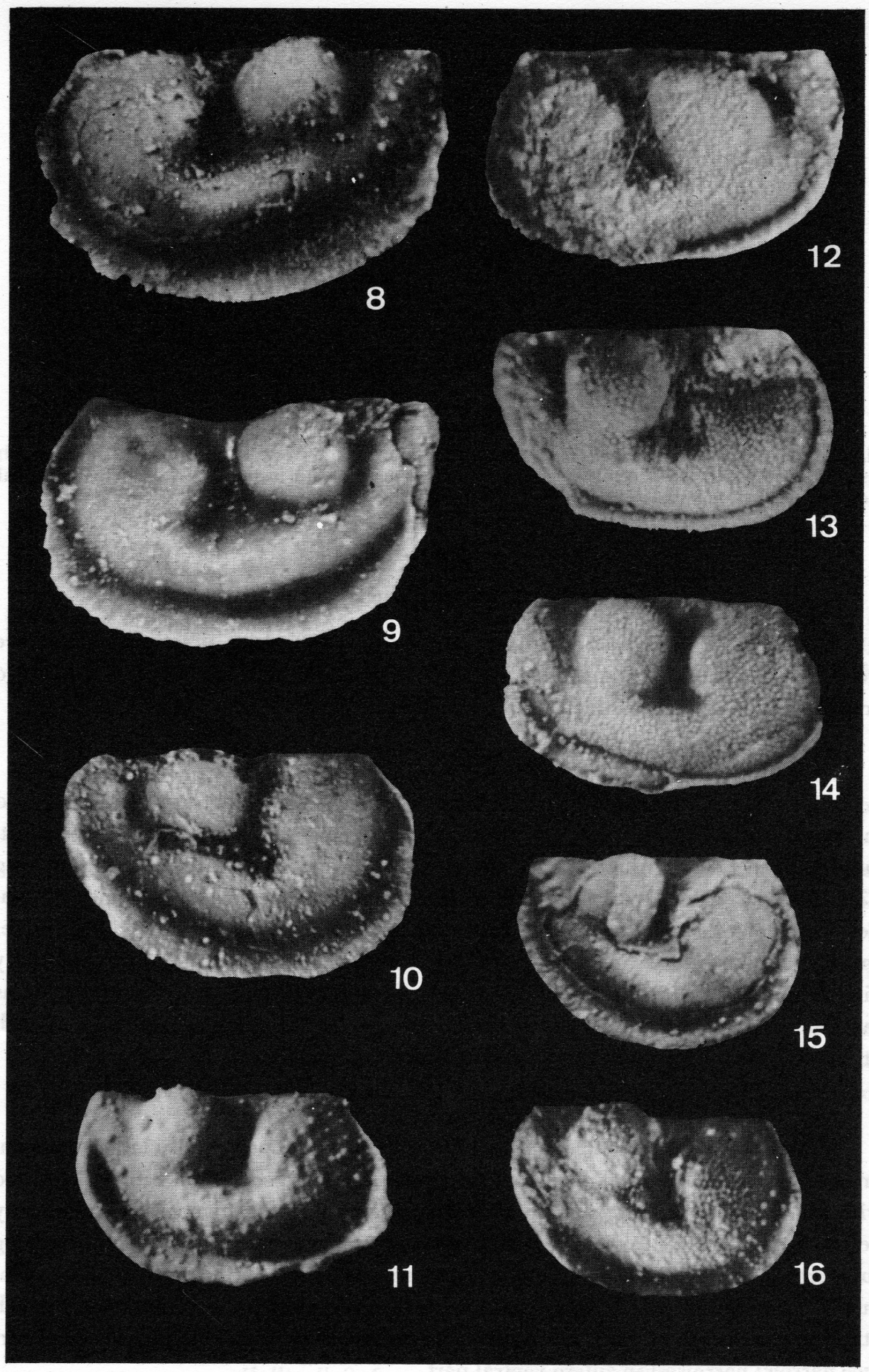
D e s c r i p t i o n

M a l e: L1 inconspicuous swelling just below dorsal border; best developed in largest specimens. L2 small; little node, partly merging with L1. L3 prominent, bulbous. Ventral lobe ridge-like; confluent with L1 and inconspicuous L4, bordering L3 ventrally. S2 deep, narrow. Surface smooth, in some specimens with fine granulation. Some papillae may be present, especially in posterior part. Velum relatively wide; smooth; bordering free margin up to posterior section; in posterior part, gradually diminishing in width. The velum of the largest specimens is usually twice as wide as that of the small forms (see remarks). The two velar structures are parallel to each other along their entire length. Sub-velar surface wide, smooth.

Dimensions: see tables I-III.

F e m a l e: L2 confluent with L1. L3 bulbous, proportionally larger than im-presumable males. Ventral lobe low ridge-like swelling; confluent with L1/L2 and with L3. S2 deep, narrow. Surface commonly granulose, rarely smooth. Papillae may be present, especially in posterior part of carapace. Velum narrow; smooth; running sub-parallel to free margin; extending from anterior to posterior part of valves; gradually diminishing in width in posterior end. Frills slightly curving towards each other in antero-ventral part of carapace, but not incurved individually. Sub-velar surface narrow; narrowest in antero-ventral part.

Dimensions: see tables I-III.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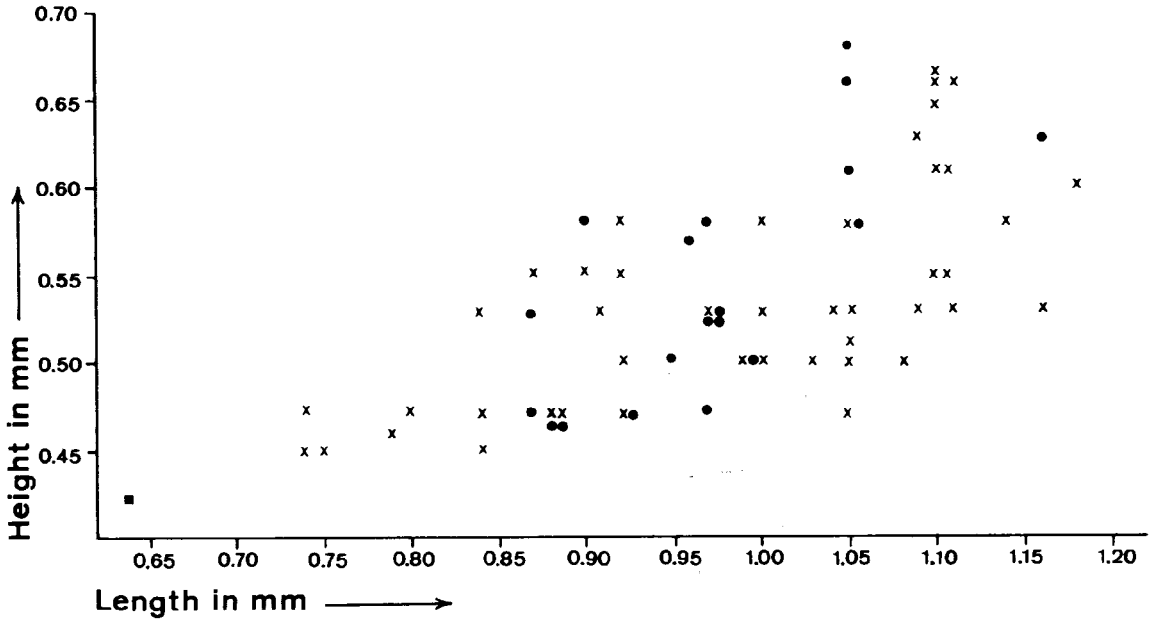


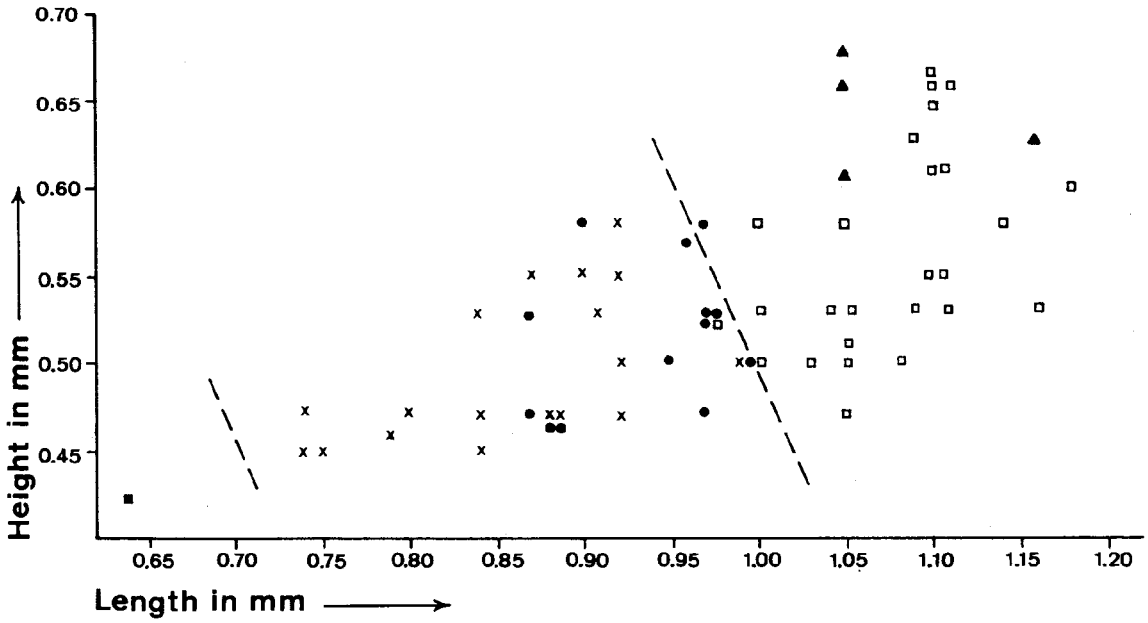
- Juvenile specimen
- Presumable male
- Presumable female

Table I. Height vs. length diagram for *Hollinella?* cf. *avonensis* (LATHAM 1932).

Remarks: Most of the specimens investigated (about 75) have been recovered from a small slab of shale (about 10 × 5 × 2 cm). Although there is an extreme variation in size, they are believed to belong to a single species. They may, however, be separated into two different instars because of the following.

Just like other crustaceans, ostracodes have a discontinuous growth. During each growth period, apart from important changes in its internal and carapace morphology, the animal increases to about twice its former volume (PRZIBRAM 1931). This means that the theoretical value of the linear growth factor for a spherical ostracode form is exactly 1.25992 in each moulting stage (KESLING 1952*a*). Thus, in the ideal case, an ostracode with, for instance, a length of 1.10 mm should have developed from a form 0.87 mm long. Similarly, a specimen with a length of 1.00 mm should have developed from one 0.79 mm long, etc. Investigations by SPJELDNAES (1951), MARTINSSON (1957) and BLESS (1968) on the ontogeny of some palaeocopid ostracodes revealed lower values (1.10 - 1.20) for the linear growth factor of the last moulting stage in several species. This is due to a proportionally larger increase in the volume of the lobes (especially the L3 and ventral lobe) or some other feature (development of crumina in BEYRICHIDAE). Superficial examination of table I shows that if the foregoing

Fig. 8-16. *Hollinella?* cf. *avonensis* LATHAM, 1932. 8) Left valve of presumable male of 9th instar. RW 1152-23a. 9) Left view of presumable male of 9th instar. RW 1152-46. 10) Right view of presumable male of 9th instar. RW 1152-50. 11) Right view of presumable male of 8th instar. RW 1152-51. 12) Left view of presumable female of 9 th instar. RW 1152-5. 13) Right view of presumable female of 8th instar. RW 1152-45. 14) Right view of presumable female of 8th instar. RW 1152-42. 15) Right valve of presumable male of 8th instar. RW1152-20. 16) Right view of presumable male of 8th instar. RW 1152-41.



- ▪ Juvenile specimen of 7th instar
- x Presumable male of 8th instar
- • Presumable female of 8th instar
- □ Presumable male of 9th instar
- ▲ Presumable female of 9th instar

Table II. Height vs. length diagram for *Hollinella?* cf. *avonensis* (LATHAM 1932). Note regular distribution of males and females in contrast to table I.

is true, the presumable males and females may well belong to at least two different instars, in spite of the fact that both instars show well-developed dimorphism. This is in contrast to the prevalent opinion that clear dimorphism should only be exhibited in the adult instar (KESLING 1952*b*; MARTINSSON 1962). There are, however, numerous observations which support the hypothesis that several ostracode species developed at least certain external dimorphic structures in the last immature instars. This does not necessarily mean that these juvenile forms were able to reproduce themselves.

HERRIG (1966), in his study on Upper Cretaceous Ostracodes, demonstrated that dimorphic characteristics are already developed in some podocopid ostracodes in the seventh instar. BLESS, JORDAN & MICHEL (1969) described two instars of the

INSTARS	Number of specimens	Height domicilium in mm	Mean height domicilium in mm	Length domicilium in mm	Mean length domicilium in mm	Width of velum in mm	Mean width of velum in mm	Linear growth-factor of height	Linear growth-factor of length	H/L-ratio
MALES 9th INSTAR	27	0.47–0.66	0.558	0.97–1.18	1.071	0.05–0.18	0.113	1.135	1.246	0.521
FEMALES 9th INSTAR	5	0.58–0.68	0.632	1.05–1.16	1.072	0.05	0.053	1.204	1.156	0.589
NINETH INSTAR (males and females)	32	0.47–0.68	0.569	0.97–1.18	1.071			1.127	1.209	0.531
MALES 8th INSTAR	18	0.45–0.58	0.492	0.74–0.99	0.859	0.05–0.09	0.076			0.573
FEMALES 8th INSTAR	12	0.47–0.58	0.525	0.87–0.97	0.927	0.03–0.05	0.032			0.531
EIGHTH INSTAR (males and females)	30	0.45–0.58	0.505	0.74–0.99	0.886			1.214	1.390	0.570
SEVENTH INSTAR	1	0.42		0.64						0.656

Table III. Mean dimensions of *Hollinella?* cf. *avonensis* (LATHAM 1932).

hollinid *Jordanites cristinae* (BLESS 1967) both with distinct dimorphism, from a Westphalian location in the Netherlands. In *Tetrasacculus stewartae*, a Lower Carboniferous hollinid, BENSON & COLLINSON (1958) distinguished two instars with clear dimorphism. Also, *Tetrasacculus sigmoides* from the Middle Devonian of Poland (ADAMCZAK 1968) seems to have pronounced dimorphisin in at least two instars. ADAMCZAK shows two female specimens, one with four loculi and a smaller one with only three loculi (ADAMCZAK 1968, pl. XIX, figs. 1-2). The smallest «adult» specimens of *Hollinella? camoni* BLESS, 1968 from the Lower Stephanian of Spain may also represent juvenile forms with well-developed dimorphism, because they fall in the same size range as specimens of the next-to-last (immature) instar.

An attempt has been made to separate the present specimens into two size groups, in principle distinguishable by some external features. This seems possible only for the presumable males (= tecnomorphs). With a single exception (a male with length = 0.97 mm; height = 0.47 mm), all male forms with a domicilium longer than 0.96 mm have a very wide velum (usually > 0.10 mm), whereas those with a domicilium less than 0.96 mm long show a velum with a distinctly smaller width (usually < 0.10 mm). Because the females are presumed to be somewhat larger, specimens with a domiciliar length less than 1.00 mm are assigned to the smaller instar. This division, although subjective, seems rather useful as shown in table II. Table III clearly shows that the present specimens may indeed belong to two different instars, the smaller forms being immature with well-developed dimorphism.

Whereas practically all females are distinctly granulose, only a few male specimens have a distinct granulose ornamentation. It is not clear whether this is also a dimorphic feature. It may be that this is a phenotypic characteristic, indicating that the dimorphs lived in different environments. However, the fact that they have been found together in the same sample does not support such a hypothesis. In *Jordanites cristinae*, BLESS, JORDAN & MICHEL (1969) also detected a difference in the ornamentation of the carapace between males and females. This phenomenon has not been recognized, thus far, in other hollinids.

H.? cf. *avonensis* is distinguished from *H.? camoni* and *H.? claycrossensis* BLESS & CALVER, 1969, by its surface ornamentation. *H.? avonensiformis* POZNER, 1951 and *H.? sokolovi* POZNER, 1951, both from the Visean of the Moscow Basin (Russia), have a vertically elongated L2, which is separated from the L1 by a distinct S1. As pointed out by BLESS & CALVER (1969), the generic assignment of hollinellid ostracodes with a velum gradually dying out in the postero-ventral part of the valves to the genus *Hollinella* is doubtful. In typical species of *Hollinella* the velum is rather wide in its postero-ventral termination, often even widened by a distinct spur.

Occurrence: *H.?* cf. *avonensis* has been found in a 70 cm marine band of slightly calcareous shale in association with abundant nuculoids and *Bellerophon*, and a few pectinids and myalinids. A few ostracodes of the genera *Geisina*, *Paraparchites* and *Bairdia* have been recovered from the same sample. This assemblage is characteristic for the «*Myalina* facies» of CALVER (1968) and the «lamellibranch facies» of BLESS (1969), which are practically equivalent.

Deposition of material: The material has been stored with the paleontological collections of the Geologisch Bureau v. h. Mijngebied, Heerlen, Netherlands.

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M.ª Victoria Argüelles (*) e I. Corrales Zarauza (*).—ESTUDIO SEDIMENTOLOGICO DE LAS CONDICIONES DE TRANSPORTE DE LAS ARENISCAS ESTEFANIENSES DEL W DE ASTURIAS Y N DE LEON

La finalidad de este trabajo es el estudio de las condiciones de transporte de las areniscas estefanienses, localizadas en los manchones de Cangas de Narcea, Rengos y Villablino.

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