Contribution to the Triassic ostracode faunas of the Betic Zone (southern Spain)

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Ostracodes are reported for the first time from epimetamorphic, strongly tectonized Triassic rock sequences from the internal part of the Betic Cordilleras. Three ostracode-zones have been established. The lower and middle zones are attributed to the Late Ladinian (Longobardian) and the upper zone to the Early Carnian (Cordevolian). Several new species and subspecies are described *(Acratina muelleri, Judahella pulchra posterospinosa, Falloticythere mulderae, F. rondeeli, Lutkevichinella? egeleri, Mostlerella blumenthali blumenthali, M. b. minuta, Leviella sohni)* and a new genus *(Falloticythere)*. The microfaunas — and especially the ostracodes — appear to be very helpful for a precise dating of the Triassic sequences in the Betic Zone. This has allowed several new conclusions to be drawn concerning the stratigraphy, mode of deposition and the tectonics of the Triassic sequences.

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Introduction

Within the Internal or Betic Zone of the Betic Cordilleras, the Alpine fold-belt of southern Spain, various tectonic complexes are recognized. They can be grouped within four superimposed complexes which in ascending order are: (1) Nevado-Filabride complex, (2) Ballabona-Cucharón complex, (3) Alpujarride complex, and (4) Malaguide complex (Egeler & Simon, 1969a, b; see Fig. 1). The Triassic is the only system from which sediments are known in all units of the Betic Zone; consequently, for a reconstruction of the palaeogeography, one has no other choice than to concentrate on the Triassic sequences. In this connection inter alia a systematical program for the dating of these sequences with the aid of microfaunas was started. Several hundred carbonate rock samples have been dissolved in diluted formic acid. Most residues of the carbonate rocks of the Ballabona-Cucharón and Alpujarride complexes were found to contain microfaunas. The fact that the Triassic sequences of the Nevado-Filabride rocks have yielded no fauna is understandable, as the rocks have suffered medium-grade Alpine metamorphism. Until now only a few samples of carbonate rocks from the Triassic of the Malaguide complex have been dissolved. In only a few cases is a very poor microfauna present. In this publication special attention is paid to the ostracode faunas of the Ballabona-Cucharón and Alpujarride complexes. Some early results for the Triassic microfauna of the Betic Zone have been published by van den Boogaard (1966; see also Simon, 1966a) and by van den Boogaard & Simon (1973) for conodonts, and by Kozur & Simon (1972) for holothurian sclerites.

Acknowledgements

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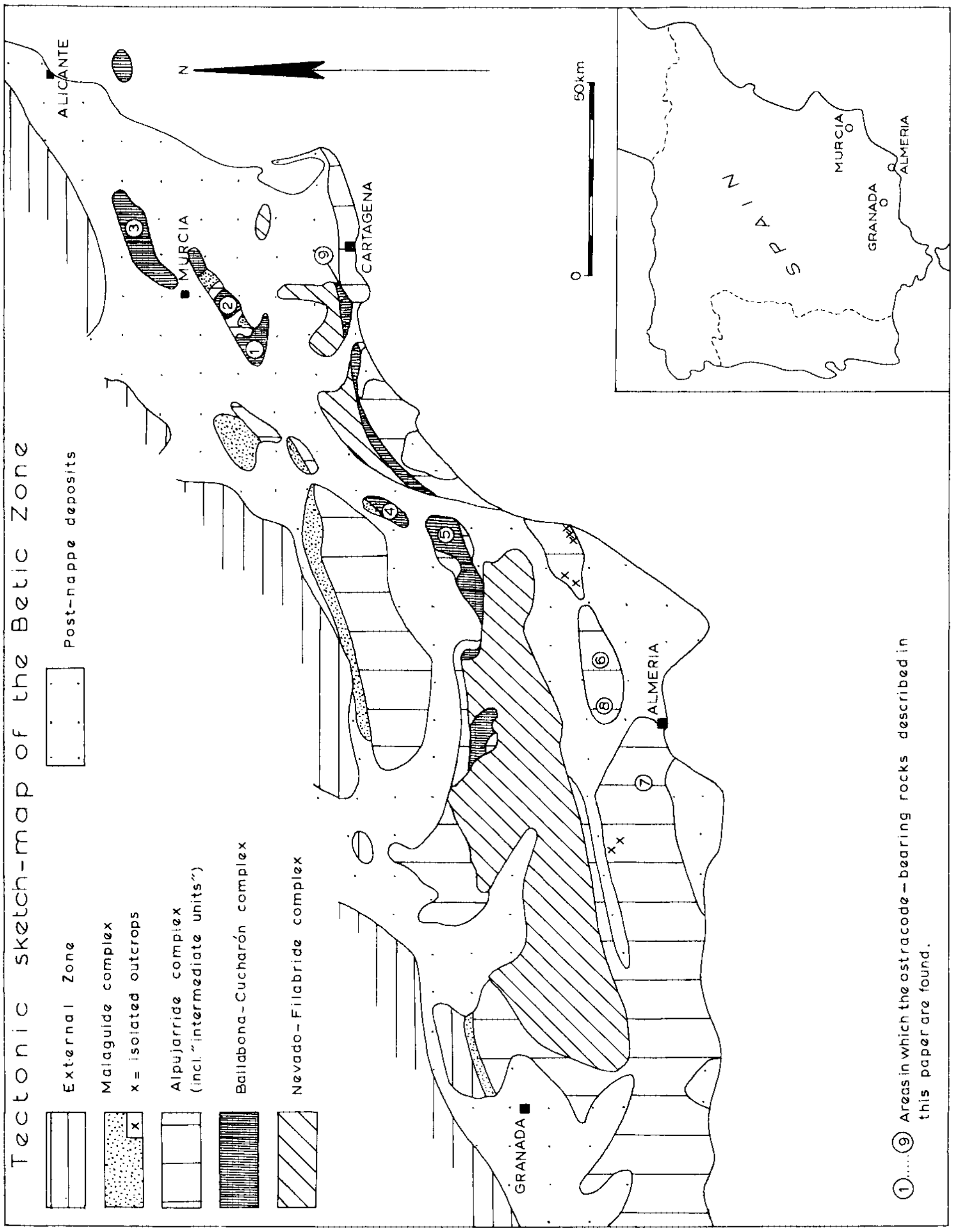

Fig. 1. Map showing the areas in which the ostracode-bearing rocks, described in this paper are found.

Geological setting of the ostracode-bearing sequences

SIERRA DE CARRASCOY (AREA 1 OF FIG. 1)

In the Sierra de Carrascoy three superimposed tectonic complexes can be distinguished (Kampschuur, 1972a; see Fig. 2). Ostracode-bearing carbonate rocks have been found in the Ballabona-Cucharón complex, which comprises two tectonic units, viz. the Romero unit (below) and the Carrascoy unit (above). Simplified colomnar sections of these units are given in Fig. 3, together with the stratigraphical position of the ostracode-bearing rocks. The rocks of the Romero unit have been argued to be essentially Permo-Triassic to Middle Triassic in age on the basis of the lithological succession, the macrofauna and the conodonts (Simon, 1966a, 1966b, 1967; Van den Boogaard, 1966). Until now it was assumed — on lithological grounds — that the sediments of the Carrascoy unit had a Triassic age. The fact that a more exact age of the rocks of the latter unit could not be given, gave rise to two hypotheses concerning the relationship with the Romero unit. According to the first hypothesis the tectonic contact between the Romero unit and the Carrascoy unit (or its equivalents elsewhere in the Ballabona-Cucharón complex) merely represented a detachment plane (Simon, 1966b). That implied that the rock sequences of the two units initially formed a continuous stratigraphical succession, the rocks of the Carrascoy unit being younger than those of the Romero unit. According to the second hypothesis the Romero unit and the Carrascoy unit represented two "independent" nappes and the age of the rocks of the Carrascoy unit remained "more open".

SIERRA DEL PUERTO (AREA 2 OF FIG. 1)

The three tectonic complexes from the Sierra de Carrascoy can also be recognized in the Sierra del Puerto (Kampschuur, 1972b; see Fig. 2). Until now only carbonate rocks from the Romero unit have been examined for the presence of microfauna. A simplified columnar section of the Romero unit with the stratigraphical position of the ostracode-bearing samples is given in Fig. 4. In the Sierra del Puerto the higher part of the Fuente Aledo formation (i.e. the section above the tres bancos member) is named the Puerto member. It shows a different lithological development with respect to the sequence above the tres bancos member of the Romero unit from the Sierra de Carrascoy (i.e. the variegated carbonate member). Only the basal part of the latter member (i.e. keybed 1) and the basal part of the Puerto member have the same lithological development and can be directly correlated.

SIERRA DE ORIHUELA (AREA 3 OF FIG. 1)

In this mountain range several tectonic elements, all of which belong to the Ballabona-Cucharón complex, can be recognized (Egeler et al., in prep.; van den Boogaard & Simon, 1973). The Orihuela unit, forming the backbone of the mountain range, represents the highest of these elements (see Fig. 5). Fig. 7 gives a schematic columnar section of this unit, with the stratigraphical position of the ostracode-bearing samples. In the region north and northwest of the town

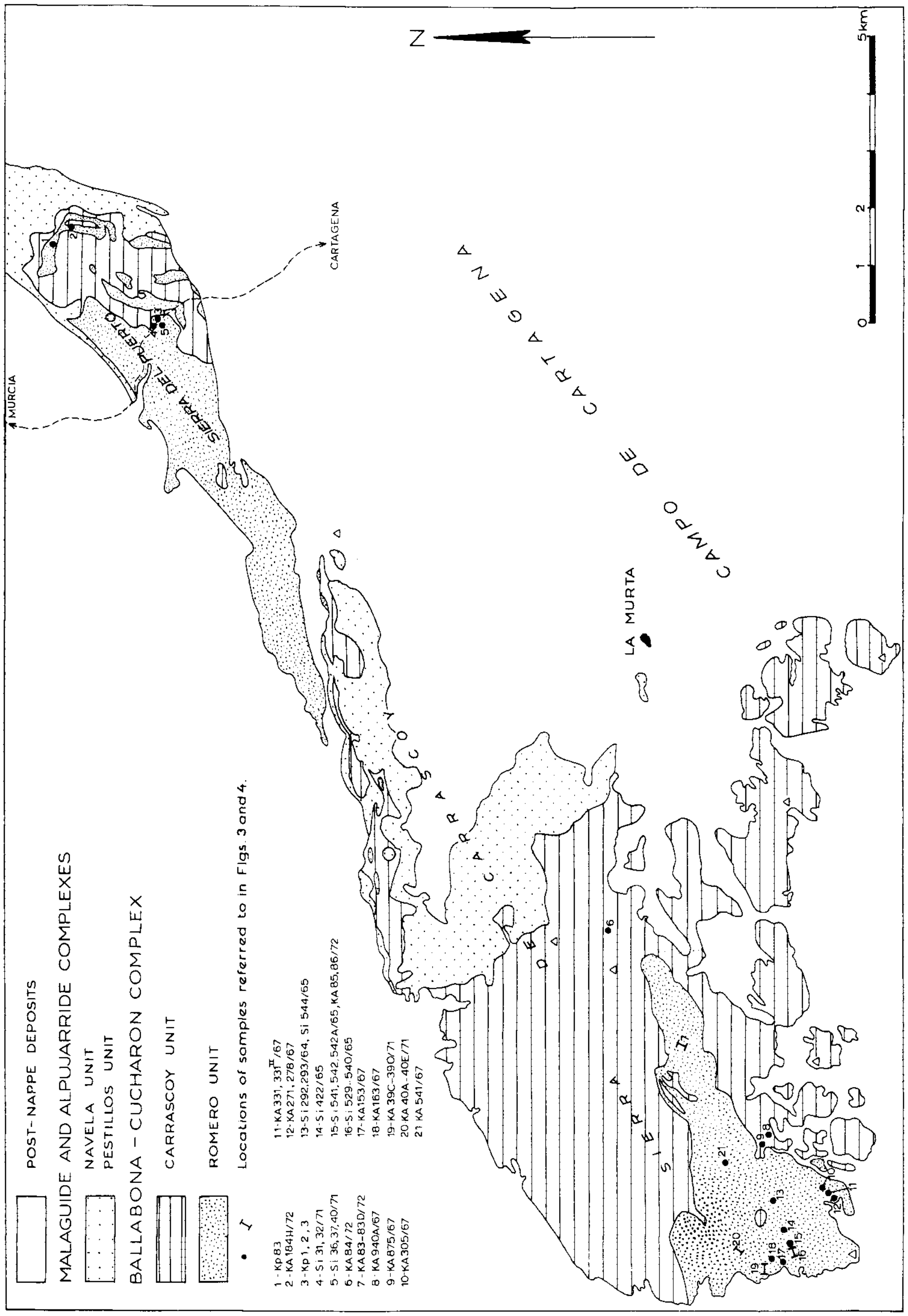

Fig. 2. Tectonic sketch-map of the Sierras de Carrascoy and del Puerto (areas 1 and 2 of Fig. 1). After Kampschuur (1972a, b).

of Orihuela, the Orihuela unit tectonically overlies the Tunnel unit. Fig. 6 gives a composite columnar section of this unit, indicating the stratigraphical position of the ostracode-bearing samples. The Tunnel unit can be correlated with the Romero unit, on the basis of the lithostratigraphy combined with the macro- and microfaunas:

Tunnel unit, Sierra de Orihuela	Romero unit, Sierra de Carrascoy
upper carbonate sequence (members B – F)	variegated carbonate member
upper carbonate sequence (member A)	tres bancos member
purple slate member	green slate member
lower carbonate sequence	upper part of the Palas member

SIERRA DE ENMEDIO (AREA 4 OF FIG. 1)

In the Sierra de Enmedio two tectonic units can be distinguished, viz. the Enmedio unit and the overlying Umbria unit (Düring, 1973; see Fig. 8). These units belong to the Ballabona-Cucharón complex and to the Malaguide complex respectively. The Enmedio unit is the tectonic counterpart of the Romero unit from the Sierra de Carrascoy (area 1). The reader is referred to Fig. 9 for a composite columnar section of the Enmedio unit. The ostracode-bearing sample Du U 19 has the same stratigraphical position as the samples Si 542/65, Si 541/65, Ka 85/72 etc. from keybed 1 of the variegated carbonate member of the Romero unit from the Sierra de Carrascoy. On the basis of marked resemblances in lithostratigraphy, member A of the Medro formation can be correlated with the green slate member and the uppermost part of the Palas member from the Romero unit of the Sierra de Carrascoy. Member B of the Medro formation corresponds to the tres bancos member and the lower part of the variegated carbonate member (keybed 1 and ? keybed 2).

SIERRA DE ALMAGRO (AREA 5 OF FIG. 1)

In the Sierra de Almagro rocks of three superimposed tectonic complexes can be distinguished (Simon, 1963; Egeler & Simon, 1969a; see also Fig. 10). The lowermost of these complexes is the Ballabona-Cucharón complex which comprises three tectonic units, viz, the Almagro unit, the Cucharón unit and the Ballabona unit. Marked lithostratigraphical resemblances warrant a correlation of the Almagro unit and the overlying Cucharón unit (Sierra de Almagro) with the Romero unit and the Carrascoy unit (Sierra de Carrascoy), respectively. The following correlation can be established (see Figs. 3 and 11):

Almagro unit (area 5)	Romero unit (area 1)
member B	keybed 1 (and ? keybed 2)
member A	tres bancos member
slates	green slate member
lower limestones and dolomites	Palas member
quartzite formation	Pocito formation

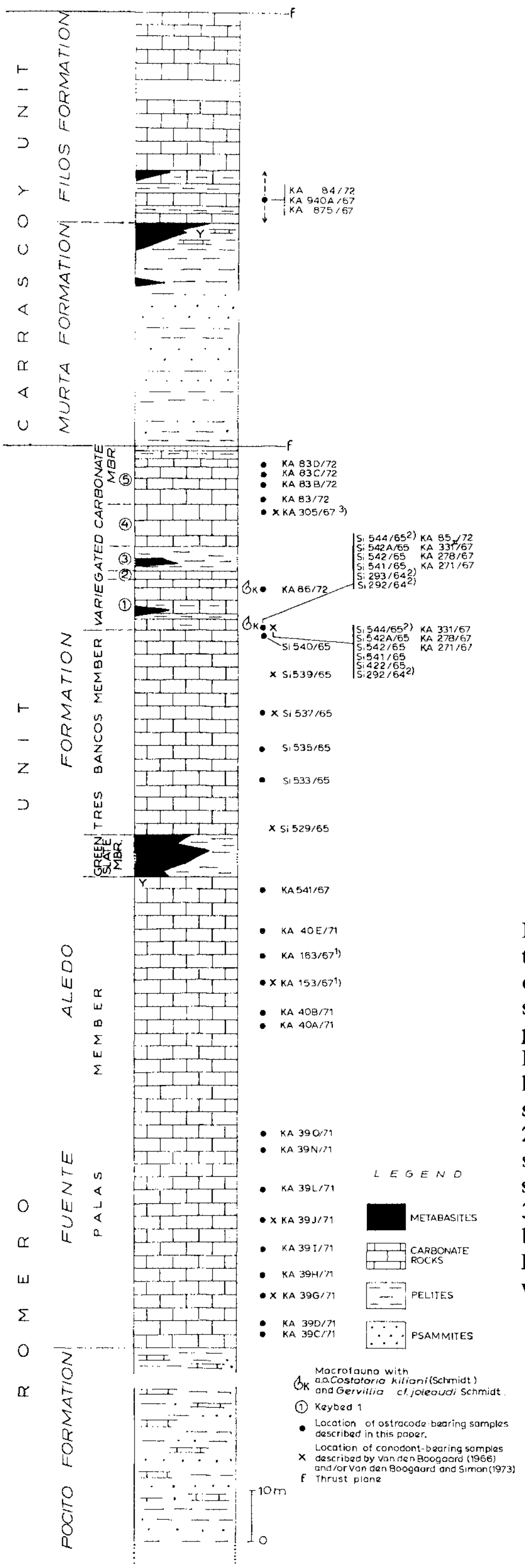

Fig. 3. Composite columnar section of the Romero and Carrascoy units, Sierra de Carrascoy (area 1). After Kampschuur (1972a). 1) The stratigraphic position of the samples Ka 153/67 and Ka 163/67 may be somewhat lower or higher in the Palas member. 2) The stratigraphic position of the samples Si 292/64, Si 293/64 and Si 544/65 may be somewhat higher in keybed 1. 3) The stratigraphic position of sample Ka 305/67 may be somewhat lower in keybed 4. In the publication by Van den Boogaard & Simon (1973), this sample was erroneously attributed to keybed 1.

The rock sequences of the Ballabona unit have been correlated with those of the Cucharón unit (Simon, 1963, 1964, 1966b; Egeler & Simon, 1969a). The ostracode-bearing samples Ka 210b/72 and Ka 210c/72 have been taken from the higher part of the upper limestones and dolomites of the Almagro unit (see Fig. 11). This part of the sequence can be correlated with keybed 1 (and keybed 2?) of the variegated carbonate member of the Romero unit from the Sierra de Carrascoy (area 1).

SIERRA ALHAMILLA (AREA 6 OF FIG. 1)

The Sierra Alhamilla mainly consists of rocks of the Alpujarride complex. Rocks belonging to higher tectonic elements, i.e. 'intermediate units', occur locally (see area 8). The Alpujarride complex in the Sierra Alhamilla consists of a basement of Palaeozoic (and older?) age and a cover of Permo-Triassic phyllites and quartzites overlain by Triassic carbonate rocks. Weppe & Jacquin (1966, p. 107) distinguish the following lithological succession in the carbonate sequence:

top:	e) fossiliferous marls	10 m
	d) limestones	10 m
	c) upper dolomites	20 m
	b) middle dolomites	60 m
	a) lower dolomites	30 – 40 m

The ostracode-bearing sample Si 783/67 has been taken from the uppermost part of member (d) or the lowermost part of member (e).

SIERRA DE GADOR (AREA 7 OF FIG. 1)

According to Jacquin (1970) the Sierra de Gador consists of several tectonic units. The ostracode-bearing sample Si 45/71 has been taken from the Gador nappe, which forms part of the Alpujarride complex. This nappe consists of a basement of Palaeozoic micaschists with a cover of Permian and Triassic rocks. Jacquin (op. cit.) divided the cover-sequence into four parts, from top to base: t_3 mainly limestones and marls; some intercalations of dolomites, pelites, gypsum and metabasites; t_{2_b} mainly dolomites and limestones; t_{2_a} mainly (marly) limestones; t_1 phyllites and quartzites.

The total thickness of the Gador nappe is very variable, the maximum thickness being 600 – 700 m. The ostracode-bearing sample Si 45/71 (see Fig. 12) has been taken from the higher part of member t_3. In a previous paper (van den Boogaard & Simon, 1973) conodonts were described from member t_{2_b} (see p. 18).

SIERRA ALHAMILLA (AREA 8 OF FIG. 1)

The ostracode-bearing samples Ba 116, Ba 122 etc. have been taken from a 5 – 10 m thick carbonate sequence, which overlies a reddish coloured sequence of sandstones, shales and conglomerates, with a thickness of a few metres (Barkey, 1962). The outcrop is situated approx. 900 m NNE of the Cortijo Las Palmas.

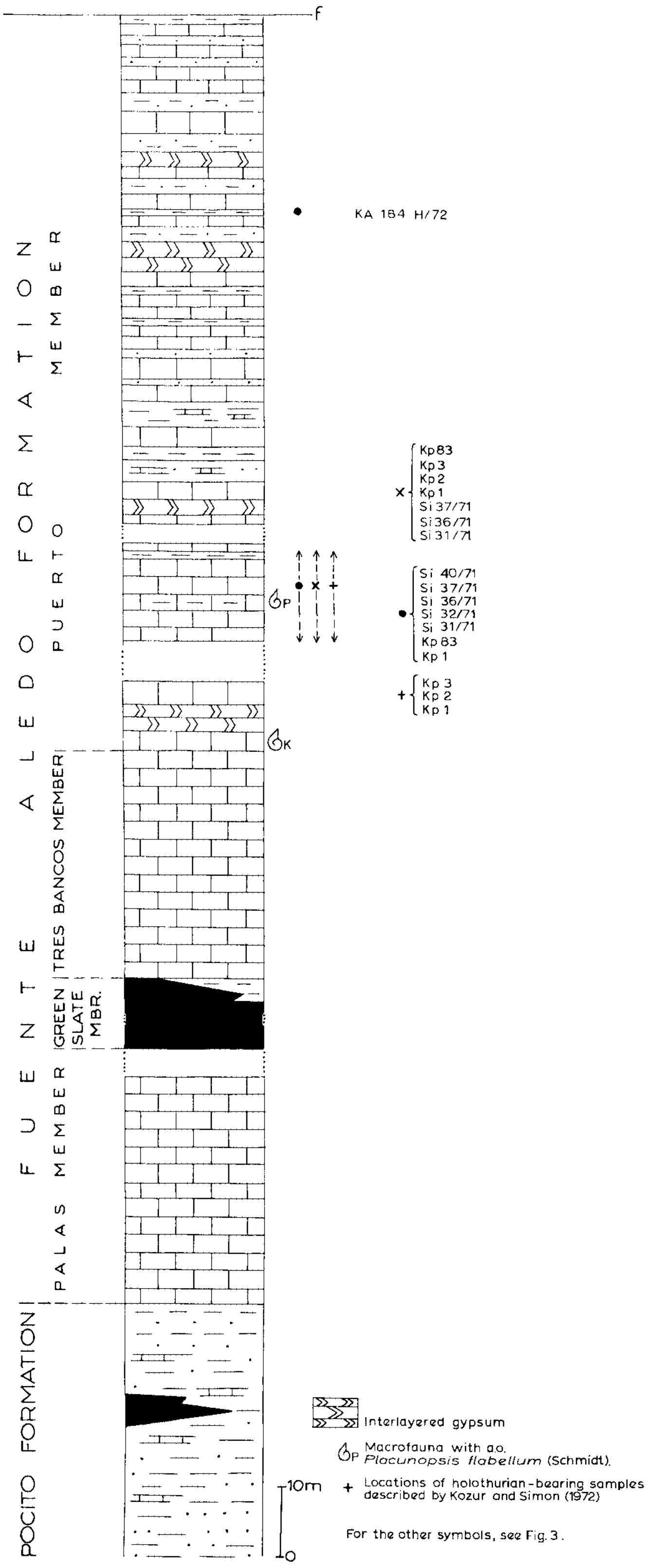

Fig. 4. Composite columnar section of the Romero unit, Sierra del Puerto (area 2). After Kampschuur (1972b).

These rocks belong to an 'intermediate unit'. This unit and analogous ones elsewhere in the Betic Zone are considered to represent transitional elements between 'typically Alpujarride' and 'typically Malaguide' units (see Egeler & Simon, 1969a).

PERIN REGION (AREA 9 OF FIG. 1)

The ostracode-bearing sample Si 757/67 (see Fig. 13) has been taken from the lowermost part of a carbonate sequence (minimum thickness several tens of metres) overlying a few metres of phyllitic rocks. These rocks are tentatively incorporated in the Perin unit, which tectonically overlies meso-metamorphic rocks of the Nevado-Filabride complex. In view of the absence of detailed geological maps of the region under consideration, it is still uncertain to which tectonic complex the Perin unit belongs. It is possible that this unit is to be correlated with the Peñas Blancas unit, present west of Perin, and tentatively incorporated by Egeler & Simon (1969a, p. 62) in the Ballabona-Cucharón complex. The opinion of Espinosa et al. (in press) that the rocks of the Perin unit belong to the Nevado-Filabride complex cannot be maintained in view of the degree of Alpine metamorphism which is markedly lower than that commonly found in the Nevado-Filabride complex.

Some remarks on the fossil content of the ostracode-bearing sequences

AREA 1

Macrofauna — In keybed 1 of the variegated carbonate member the following macrofossils have been reported (Kampschuur, 1972a): *Costatoria kiliani* (Schmidt) Pl. 1 fig. 3, *Elegantinia* cf. *sublaevis* (Schmidt) and *Gervillia* cf. *joleaudi* Schmidt. The latter fossil also occurs in keybed 5. In the basal part of the Filos formation of the Carrascoy unit *Aviculopecten* sp. has been found.
Microfauna — The reader is referred to the enclosure and Fig. 3 for the microfauna content. In sample Ka 83 F/72 from keybed 5 of the variegated carbonate member which is situated approx. 3 m above the ostracode-bearing sample Ka 83 D/72, holothurian sclerites (i.a. *Theelia krystyni* Kozur & Simon, 1972) have been found. Van den Boogaard & Simon (1973) described conodonts from the Fuente Aledo formation. Samples Ka 153/67, Ka 39G/71 and Ka 39J/71 from the Palas member contain *Pseudofurnishius huddlei* van den Boogaard & Simon, 1973 (Fig. 14d). In carbonate rocks from the tres bancos member occurs (see Fig. 3) *Pseudofurnishius murcianus* van den Boogaard, 1966 (samples Si 529/65, Si 537/65 and Si 539/65). In the variegated carbonate member *P. murcianus* (Fig. 14a, b) has been reported (samples Si 292/64, Si 422/65, Si 541/65, Si 542/65, Si 542A/65, Si 544/65, Ka 271/67, Ka 278/67, Ka 331/67 and Ka 305/67). Sample Ka 875/67 from the basal part of the Filos formation of the Carrascoy unit contains only a single indeterminable fragment of a conodont.

AREA 2

Macrofauna — In the basal part of the Puerto member, which can be correlated with keybed 1 of the variegated carbonate member of the Romero unit in the Sierra de Carrascoy, the following fossils have been found (Kampschuur, 1972b): *Costatoria kiliani* (Schmidt), *Elegantinia* cf. *sublaevis* (Schmidt) and *Gervillia* cf. *joleaudi* Schmidt. *Placunopsis flabellum* Schmidt occurs in the same horizon as sample Si 36/71.

Microfauna — For the microfauna content the reader is referred to the enclosure and Fig. 4. Holothurian sclerites are present in samples Ka 184 H/72, Kp 1, Kp 2, Kp 3 and Kp 83. In sample Ka 184 H/72 the following holothurians occur: *Kuehnites schallreuteri* Kozur & Simon (Plate 3, fig. 1), *Theelia tubercula tubercula* Kristan-Tollmann, *T. guembeli* Kristan-Tollmann, *T. zankli* Kozur & Simon (Plate 3, figs. 3, 4), *Acanthotheelia oertlii* Kozur & Simon and *A. mostleri brouweri* Kozur & Simon (Plate 3, fig. 8). The holothurian fauna of the sample Kp 1 consists of the following species: *Acanthotheelia oertlii* (Plate 3, fig. 12), *A. ladinica* Kozur & Mostler (a single, somewhat dubious specimen), *A. mostleri mostleri* Kozur & Simon (Plate 3, figs. 5, 6), *A. mostleri brouweri*, *A.* cf. *spinosa* Frizzell & Exline, *Kuehnites schallreuteri* Kozur & Simon (Plate 3, fig. 2), *Theelia krystyni*

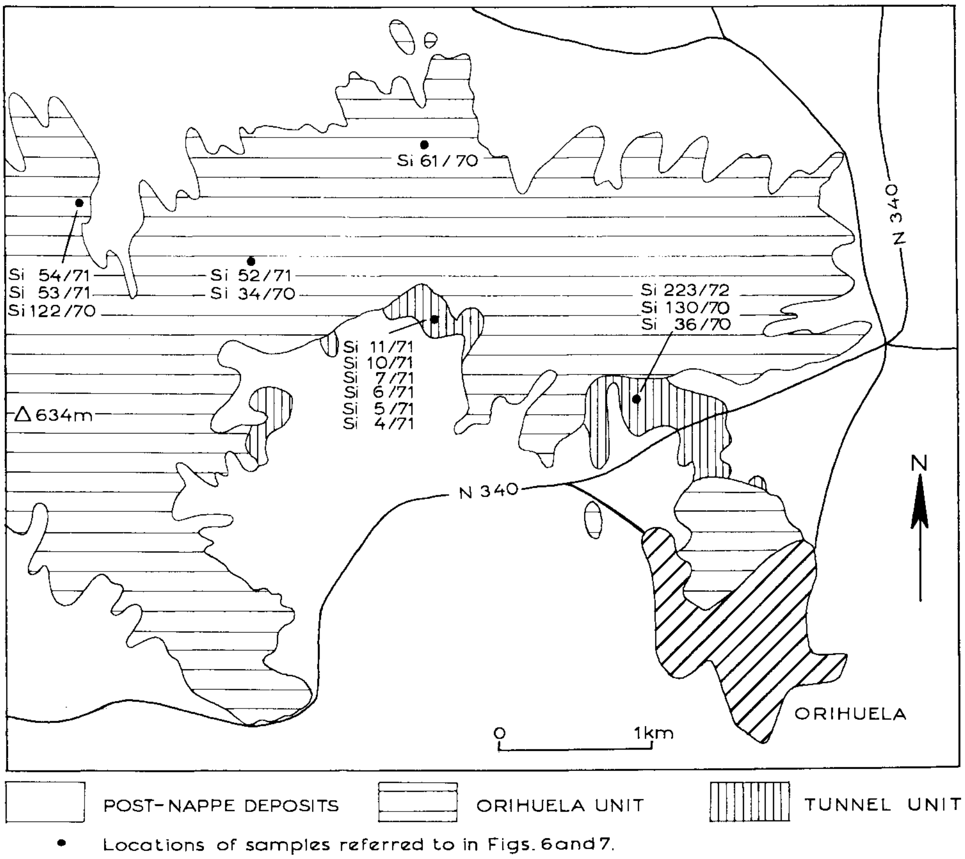

Fig. 5. Tectonic sketch-map of the eastern Sierra de Orihuela (area 3). After Egeler et al. (in prep.).

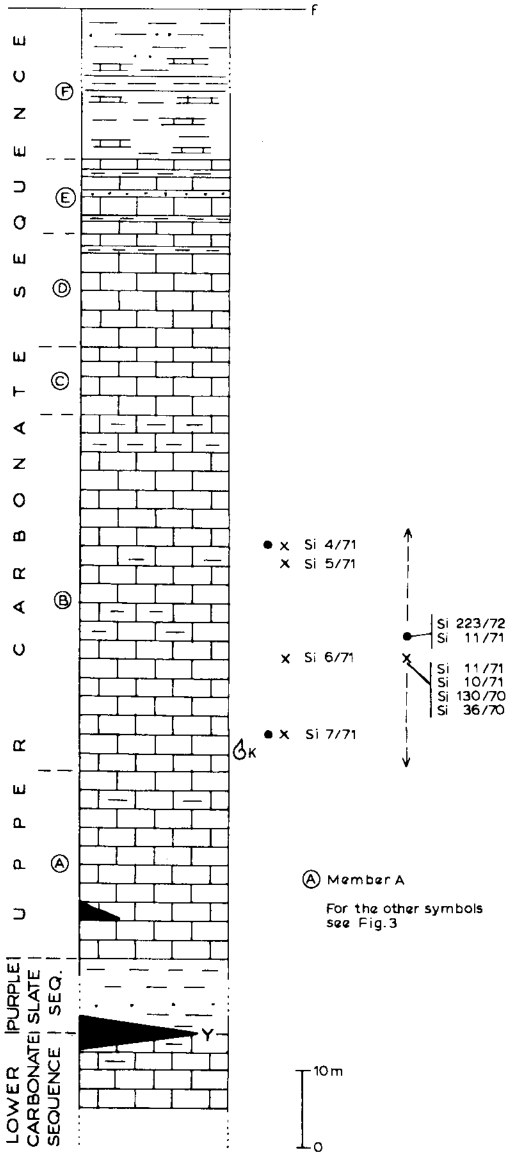

Fig. 6. Composite columnar section of the Tunnel unit, Sierra de Orihuela (area 3). After Egeler et al. (in prep.).

Kozur & Simon (Plate 3, fig. 14) and *T. magnidentata* Kozur & Simon (Plate 3, fig. 13). Sample Kp 2 consists of the following species. *A. mostleri brouweri* and *K. schallreuteri*. Sample Kp 3, which was taken from a horizon approximately ten metres above samples Kp 1 and Kp 2, contains: *A. mostleri brouweri* (Plate 3, fig. 7), *Theelia* cf. *krystyni*, *Theelia pralongiae* Kristan-Tollmann and *T. tubercula tubercula* (Plate 3, figs. 9, 10) (see Kozur & Simon, 1972). In the Puerto member *Pseudofurnishius murcianus* has been found in samples Si 31/71, Si 36/71, Si 37/71, Kp 1, Kp 2, Kp 3 and Kp 83 (van den Boogaard & Simon, 1973).

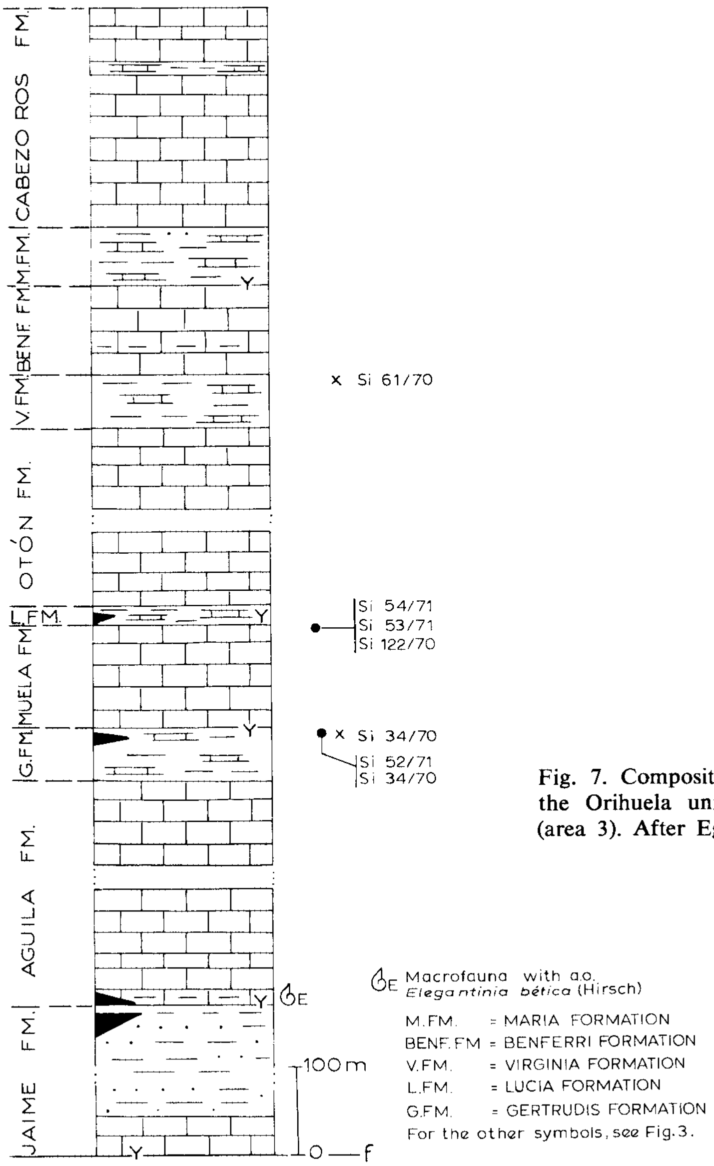

Fig. 7. Composite columnar section of the Orihuela unit, Sierra de Orihuela (area 3). After Egeler et al. (in prep.).

AREA 3

Tunnel unit

Macrofauna — In the basal part of member B of the upper carbonate sequence marly carbonate rocks with *Costatoria kiliani* (Schmidt) and *Gervillia* cf. *joleaudi* Schmidt occur.

Microfauna — The reader is referred to the enclosure and Fig. 6 for the microfauna content of the carbonate rocks of member B of the upper carbonate sequence. Van den Boogaard & Simon (1973) described *Pseudofurnishius murcianus* from carbonate rocks of member B of the upper carbonate sequence

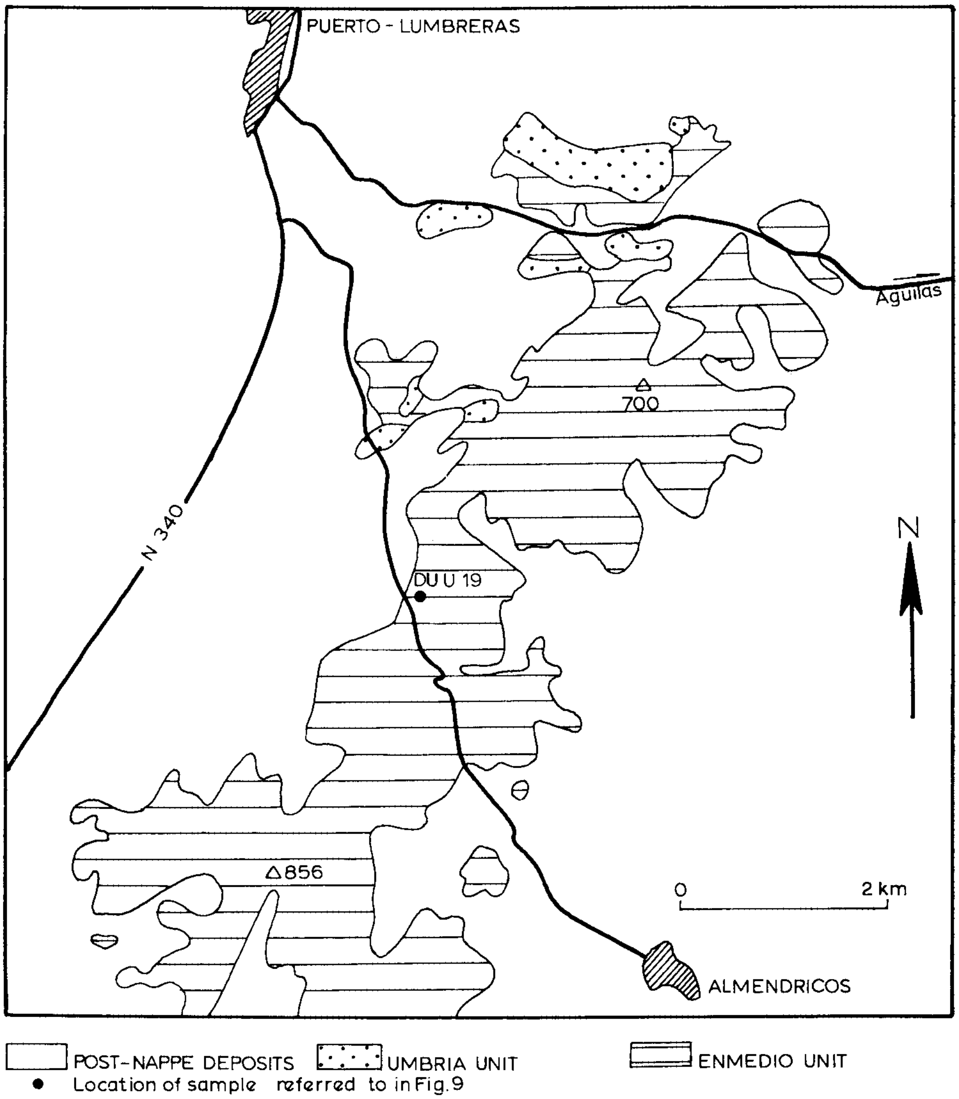

Fig. 8. Tectonic sketch-map of the Sierra de Enmedio (area 4). After Düring (1973).

(samples Si 36/70, Si 130/70, Si 4/71, Si 5/71, Si 6/71, Si 7/71, Si 10/71 en Si 11/71).

Orihuela unit

Macrofauna — In the basal part of the Aguila formation lamellibranchs have been found. According to Dr F. Hirsch (Jerusalem, personal communication) they represent i.a. *Elegantinia betica* (Hirsch) (Pl. 1, fig. 5).

Microfauna — See the enclosure and Fig. 7 for the microfauna content. *Pseudofurnishius murcianus* has been found in samples Si 34/70 (a single specimen) and Si 61/70 from the uppermost parts of the Gertrudis and Virginia formations, respectively (van den Boogaard & Simon, 1973).

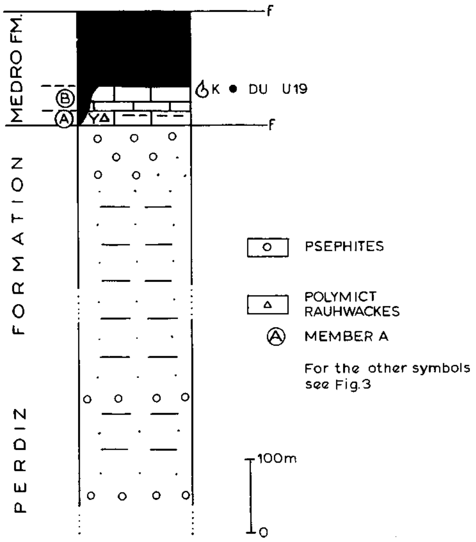

Fig. 9. Composite columnar section of the Enmedio unit, Sierra de Enmedio (area 4). After Düring (1973).

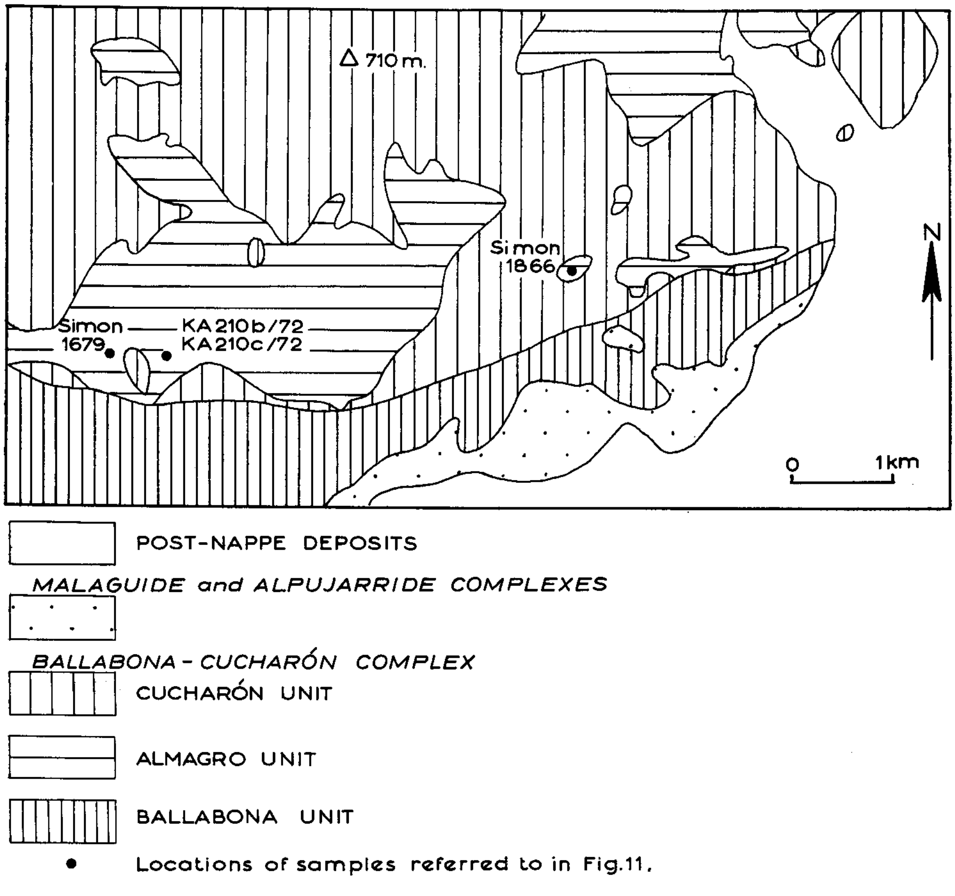

Fig. 10. Tectonic sketch-map of the southern Sierra de Almagro (area 5). After Simon (1963).

AREA 4

Macrofauna — In the same horizon as sample Du U 19 lamellibranchs occur, i.a. *Costatoria kiliani* (Schmidt).
Microfauna — See the enclosure. One indeterminable conodont-fragment has been found in the residue of sample Du U 19.

AREA 5

Macrofauna — In member B from the upper limestones and dolomites *Costatoria kiliani* (Schmidt) and *Gervillia* cf. *joleaudi* Schmidt have been found (see van den Boogaard & Simon, 1973; see also Simon, 1963).
Microfauna — Van den Boogaard (1966; see also Simon, 1966a) described *Pseudofurnishius murcianus* from samples Simon 1679 and Simon 1866 of member B of the upper limestones and dolomites (see also the enclosure and Fig. 11).

AREA 6

Macrofauna — From the basal part of sequence (e) of the Alpujarride unit *Elegantinia betica* (Hirsch) has been reported (Hirsch, 1966). Furthermore, badly

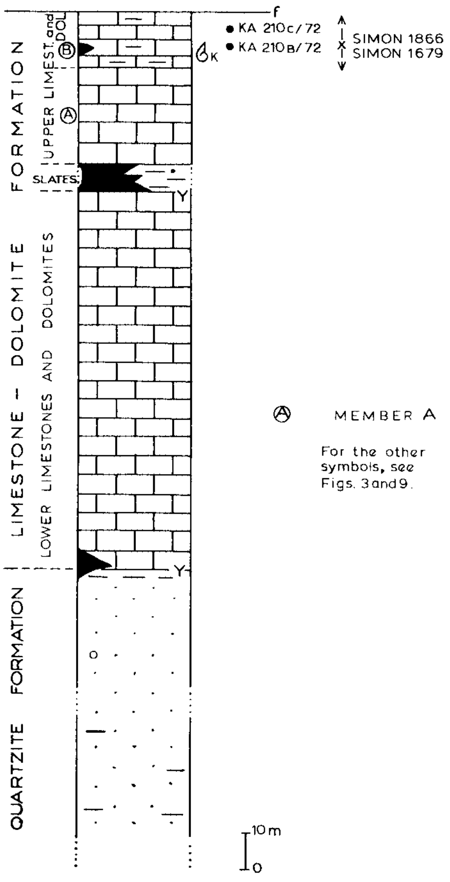

Fig. 11. Composite columnar section of the Almagro unit, Sierra de Almagro (area 5). After Simon (1963).

preserved specimens of "*Myophoria* sp. nov. ? aff. *goldfussi* von Alberti" were described. According to Hirsch these specimens seem to be identical to the fossils figured in Simon (1963, plate g, fig. 3 and plate i, fig. 1). Subsequent investigations showed that the afore-mentioned specimens of Simon represent *Costatoria kiliani* (Schmidt).

Microfauna — See the enclosure. Conodonts from sample Si 783/67 are fragmented and unrecognizable.

AREA 7

Macrofauna — The following macrofossils from the Gador nappe are mentioned by Jacquin (1970): a) uppermost part of member t_3: lamellibranchs (i.a. "*Myophoria*" sp.) and gastropods; b) from the ? middle part of member t_2: "*Nautilus*" sp. and gastropods.

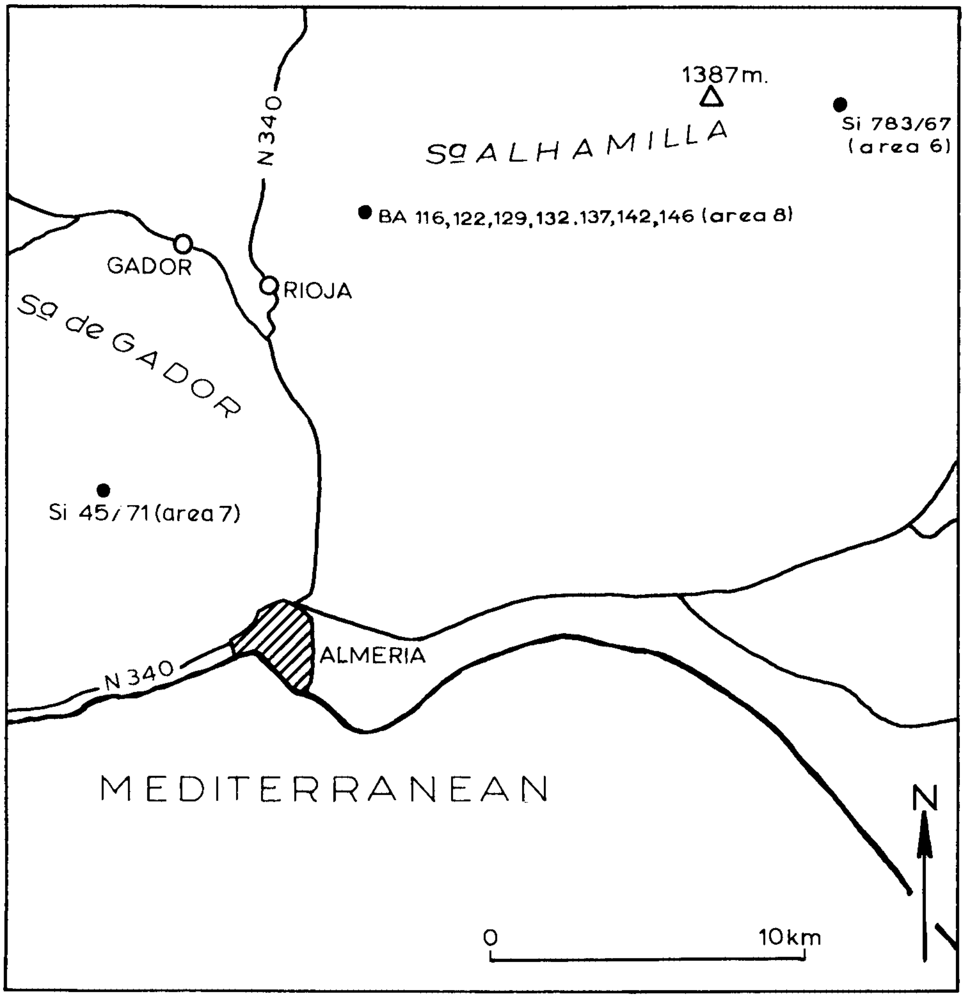

Fig. 12. Locations of ostracode-bearing samples of areas 6, 7 and 8.

Microfauna — Jacquin (1970; see also 1965) described the Foraminifera *Dentalina, Frondicularia, Nodosaria* and *Glomospira* from the uppermost part of member t_{2_b}. He also mentioned that algae (probably solenopores) occur in the same part of the member. From the same bed in which "*Nautilus*" sp. has been found, van den Boogaard & Simon (1973) reported conodonts, viz. *Pseudofurnishius murcianus* and *Tardogondolella mungoensis mungoensis* (Diebel, 1956) (Fig. 14c). The conodonts from sample Si 45/71 are indeterminable.

AREA 8

Macrofauna — *Elegantinia betica* (Hirsch) (Pl. 1, fig. 4) was described (Hirsch, 1966) from the carbonate sequence which yielded samples Ba 116, Ba 122 etc.
Microfauna — See the enclosure.

AREA 9

Macrofauna — Only indeterminable lamellibranchs have been found in the ostracode-bearing carbonate rocks.
Microfauna — See the enclosure. The conodonts from sample Si 757/67 are indeterminable.

Environmental and stratigraphical use of the investigated ostracode faunas

The Middle and Upper Triassic ostracodes, especially the Cytherocopina and the Platycopida, are represented by a large number of short-lived species which are very useful for stratigraphical subdivision. Ostracodes can only be used as guide fossils when their phylogeny is known because the appearance and disappearance of species from a fauna may also be caused by environmental factors. For example, partial or complete changes in the composition of a fauna may be induced by changes in salinity or in depth of water (cf. Kozur, 1971a, b; 1972d). For regionally restricted domains with similar, or almost similar, facies successions certain environmentally controlled ostracode associations may be significant stratigraphically. An example of this is provided by *Reubenella fraterna* (Reuss) which occurs abundantly in the middle and upper *Mostlerella blumenthali* Zone but which is absent not only from the *Falloticythere mulderae* and *Falloticythere rondeeli* Zones but also from the lower *Mostlerella blumenthali Zone.* Most ostracode faunas in the region studied are marine but an exceptional feature is that the Bairdiidae are conspicuously absent from conodont-bearing euhaline sediments [for the meaning of terms such as euhaline and hyposaline the reader is referred i.a. to the publications of Hiltermann (1966) and Kozur (1971b)]. This strongly indicates that during the Late Ladinian and Early Carnian the western Mediterranean basin had a rather restricted faunal exchange with the open oceans due to the presence of ecological barriers (e.g., areas with fluctuating salinity).

A short description of the biological characteristics of the facies types present is given below.

Deep neritic environments (≧ 100 m) have only been demonstrated for sample Ba 129 (area 8), in which *Acratina* cf. *goemoeryi* (Kozur, 1970) and *Acratina muelleri* n. sp. are abundant. In the Triassic the genus *Acratina* only occurs abundantly where the water depths were 100 m or more. However, *Acratina muelleri* may occasionally occur in much lower water depths (≧ 30 m). Apart from abundantly occurring *Acratina muelleri* sample Ba 142 only contains thin-shelled ostracodes and thus could still represent water depths of about 100 m. Samples Ba 116, Ba 122 and Ba 137 contain infrequent *Acratina muelleri;* types diagnostic of either shallow or deep water are absent. It is assumed that these samples indicate water depths between 50 and 100 m.

Sample Si 757/67 (area 9) contains richly sculptured shallow water ostracodes and very rarely *Acratina muelleri.* A water depth of 20 – 50 m is assumed for this sample. All the samples discussed so far contain euhaline faunas. The remaining samples, some of which are rich in euryhaline ostracodes, indicate water depths not greater than 30 m and often considerably less. The large proportion of euryhaline types and especially the commonly occurring faunas exclusively (or almost exclusively) composed of *Reubenella fraterna* (Reuss) are an indication that facies conditions were strongly different from those which

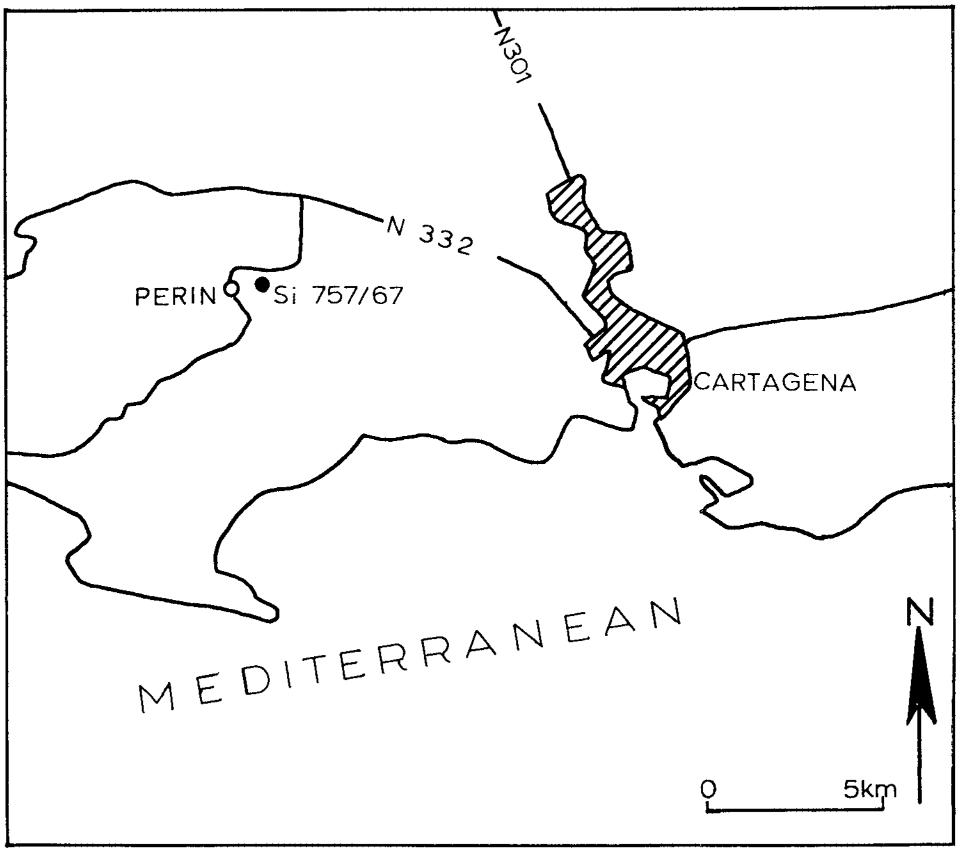

Fig. 13. Location of ostracode-bearing sample Si 757/67 (area 9).

existed in the open oceans. Probably the very shallow sea basins temporarily experienced higher salinities or greater salinity fluctuations than those of the open oceans. Accompanying microfaunas also indicate this. For example, the number of species of Foraminifera is much reduced in comparison with faunas of the same age from Tethyan shallow water deposits of the Austro-Alpine, Dinarian and Asiatic faunal provinces. The Foraminifera consist mostly of primitive types which occur periodically in the German Basin in sediments indicative of slightly higher than normal salinities or of salinity fluctuation. The conodont faunas are also quite different from those of the open oceans. The complete absence of *Gondollela* is very surprising. Kozur (1971a) and Kozur & Mostler (1971) proved that *Gondollela* is absent from all shallow water deposits whose salinities are indicated to have been permanently or periodically higher than normal in the Lower

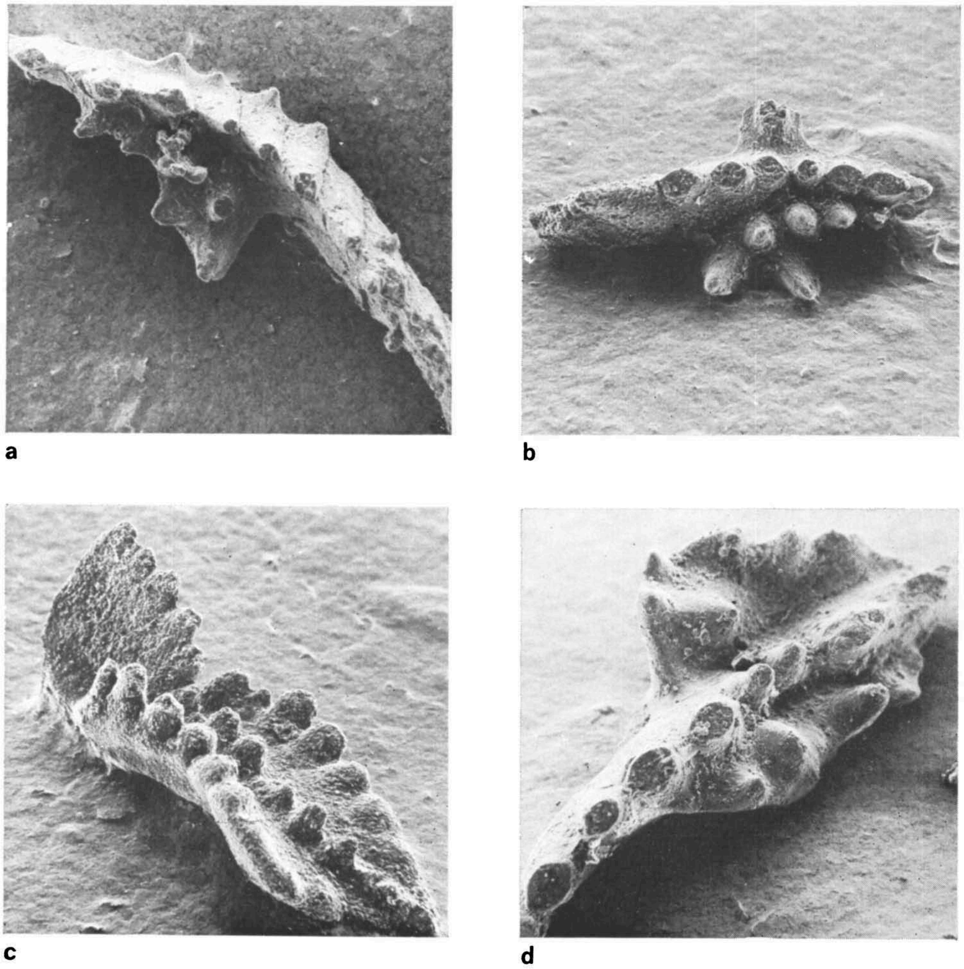

Fig. 14. a - d. Scanning electron micrographs after van den Boogaard & Simon, 1973, Scripta Geol. 16, Plate 1 and 2.
a. *Pseudofurnishius murcianus* van den Boogaard, approx. 125 x.
b. *Pseudofurnishius murcianus* van den Boogaard, approx. 110 x.
c. *Tardogondolella (Metapolygnathus) mungoensis mungoensis* (Diebel), approx. 76 x.
d. *Pseudofurnishius huddlei* van den Boogaard & Simon, approx. 110 x.

Muschelkalk of the German Basin and in the Austro-Alpine and Dinarian faunal provinces (the Dinarian faunal province was until now incorporated as a southern subprovince within the Austro-Alpine faunal province). Other conodonts do occur in such sediments, as shown in the central and western German Basin for the Lower Muschelkalk.

The faunas of samples Si 122/70, Si 53/71 and Si 54/71 (area 3) are undoubtedly hyposaline. They only contain abundant, small thick-shelled *Lutkevichinella* of a single species. Such ostracode faunas are very typical of Middle Triassic hyposaline sediments. For example, they persist in the higher parts of the German Middle Muschelkalk until the initiation of gypsum precipitation (cf. Kozur, 1971b). It is almost impossible to precisely locate such samples in the stratigraphical sequence except, of course, where they are under- or overlain by rocks which yield important guide fossils. Thus the attribution of samples such as Si 122/70, Si 53/71 and Si 54/71 from the Muela formation of the Orihuela unit in the Sierra de Orihuela to the *Falloticythere mulderae Zone* is uncertain.

Within the area studied there are also very great changes in the ostracode faunas due to environmental factors. These changes may lead to premature conclusions regarding stratigraphical subdivision if they are not given due consideration. Eliminating these facies differences, the development from *Falloticythere mulderae* through *Falloticythere rondeeli* to *Mostlerella blumenthali* is absolutely decisive. Using this phylogenetic sequence, which has been proved to be continuous, one can establish the following three zones:

Falloticythere mulderae Zone

Definition — range of *Falloticythere mulderae* without *Falloticythere rondeeli.*
Lower limit — first occurrence of *Falloticythere mulderae.*
Upper limit — first occurrence of *Falloticythere rondeeli.*
Important ostracode species — *Falloticythere mulderae* n. sp., *Judahella tsorfatia* Sohn, 1968, *Leviella sohni* n. sp., *Lutkevichinella ? egeleri* n. sp., *Triassocypris* sp.
Stratigraphic range — (higher) Longobardian excluding latest Longobardian.
Regional distribution — Betic Zone (SE Spain); Nevada (U.S.A.).
Remarks — *Falloticythere mulderae* is present in many samples of the *F. mulderae* Zone and is there by far the most abundant species. Its first occurrence is environmentally controlled. The upper limit of the zone is without any question biostratigraphically fixed and is marked by the first occurrence of *Falloticythere rondeeli.* The latter species develops gradually from *Falloticythere mulderae.* The highly developed last representatives of *Falloticythere mulderae* occur sparsely in the lower *F. rondeeli* Zone in which *Falloticythere rondeeli* is the dominant species. *Lutkevichinella? egeleri* is also very characteristic for the *F. mulderae* Zone. It occurs abundantly in many samples and apparently tolerates relatively high salinities. Although it does not belong to a known phylogenetic sequence, it can be used for stratigraphical subdivision because it was previously never found in the *F. rondeeli* Zone nor in the numerous samples from quite different facies of the *M. blumenthali* Zone. *Triassocypris* sp. is also rather common and persists into the *F. rondeeli* Zone. It is, however, only represented by somewhat dubious specimens in the lower part of the *M. blumenhali* Zone. In a few samples of the *F. mulderae* Zone *Judahella tsorfatia* Sohn, 1968 and *Leviella sohni* n. sp. occur. One can unequivocally attribute the *F. mulderae* Zone to the Longobardian.

Judahella tsorfatia occurs in the Longobardian, and perhaps also in the Fassanian throughout the entire West-Mediterranean faunal province (sensu Kozur & Mostler, 1972b.). In the German Basin and in the Asiatic faunal province this species was only found between the Olenekian and the Upper Pelsonian. *Judahella tsorfatia* has never been found in horizons younger than the Longobardian. *Leviella sohni* is known from the Ladinian of the Grantsville Formation of Nevada (U.S.A.). The conodont association of the *F. mulderae* Zone contains *Pseudofurnishius huddlei* van den Boogaard & Simon, 1973 without *Pseudofurnishius murcianus* van den Boogaard, 1966. According to Kozur (1972a; *P. huddlei* was referred to as *Pseudofurnishius* n. sp.) this fauna can be assigned to the late Longobardian. From the sample Si 34/70 (area 3), van den Boogaard & Simon (1973) mention a single specimen of *Pseudofurnishius murcianus*. On the basis of the ostracode fauna one should expect *Pseudofurnishius huddlei* in this part of the sequence. One can not exclude the possibility that *P. huddlei* and *P. murcianus* coexist in the higher part of the *F. mulderae* Zone.

Falloticythere rondeeli Zone

Definition — range of *Falloticythere rondeeli* n. sp. without *Mostlerella blumenthali* n. sp.
Lower limit — first occurrence of *Falloticythere rondeeli.*
Upper limit — first occurrence of *Mostlerella blumenthali* and *Leviella sohni.*
Important ostracode species — *Falloticythere rondeeli* n. sp., *Falloticythere mulderae* (only in the lower part, always highly developed types), *Acratina muelleri* n. sp., *Acratina* cf. *goemoeryi* (Kozur, 1970), *Judahella tsorfatia* Sohn, 1968, *Leviella sohni* n. sp. and *Triassocypris* sp.
Stratigraphic range — latest Longobardian.
Regional distribution — Betic Zone (SE Spain), Nevada (U.S.A.),? Israel.
Remarks — Both the lower and upper limits are palaeontologically defined by the phylogenetic sequence *Falloticythere mulderae - Falloticythere rondeeli - Mostlerella blumenthali.* The boundaries between these zones are fixed by the first appearence of each new species *(F. rondeeli* for the lower boundary and *M. blumenthali* for the upper boundary). The transition from *Leviella sohni* to *Leviella bentori* Sohn, 1968 is also of very great importance. This first species occurs until the uppermost *F. rondeeli* Zone and evolves into very primitive specimens of *L. bentori* Sohn, 1968, in the lower M. *blumenthali* Zone. The sculptured ostracodes are predominant both in the *F. rondeeli* Zone and in the *F. mulderae* Zone. *Falloticythere rondeeli* is often very abundant. Only in the upper part of the zone, where *F. rondeeli* already shows resemblances to *M. blumenthali,* it is scarce. Here the highly developed representatives of *Leviella sohni* are dominant. *Judahella tsorfatia* is also relatively numerous. Under favourable conditions (deeper water) *Acratina muelleri* is very numerous. Its true range is not known because in the Betic Zone this facies has until now only been demonstrated for the *F. rondeeli* Zone. Therefore, this species is only of very restricted use for stratigraphical subdivision at the present time. Outside the Betic Zone *Acratina* cf. *goemoeryi* and *A. muelleri* were found in the Ladinian of Slovakia and Hungary. The *F. rondeeli* Zone in this paper is assigned to the latest Longobardian. *Leviella sohni* and *Judahella tsorfatia* do not extend as far as the Cordevolian outside the Betic Zone. This is more meaningful

because in the lower Carnian of Israel and in the lower *M. blumenthali* Zone of the Betic Zone *Leviella bentori* is already present having evolved through a phylogenetic succession from *Leviella sohni*. Consequently, the first occurrence of either *Mostlerella blumenthali* or *Leviella bentori* can be used for the definition of the boundary between the *F. rondeeli* and *M. blumenthali* Zones. *Falloticythere rondeeli* probably also occurs in the uppermost Longobardian of Israel. Sohn (1968) described 'steinkerns' under the name of Cytheracea undet. (without illustrations) directly from the base of the limestone gypsum member of Makhtesh Ramon. These probably belong to the genus *Falloticythere* and possibly to *Falloticythere rondeeli*. Sohn (1968) on the one hand attributed the limestone gypsum member to the Ladinian (e.g. in the description of the Cytheracea undet.) and on the other hand placed this member from its base upwards into the Carnian (op. cit., p. 9). From the studies of Huddle (1970) it can be gleaned that *P. murcianus* and *P. huddlei* coexist in the middle part of the limestone gypsum member of Makhtesh Ramon, where they are accompanied by *Metapolygnathus mungoensis*. Huddle did not differentiate between the two species but from the illustrations is is clear that typical specimens of *P. huddlei* occur in the middle limestone gypsum member. The illustrated specimens of *M. mungoensis* from the middle limestone gypsum member correspond in their stage of development to those from the upper Longobardian of Hungary; such large forms of this species are no longer present in the Cordevolian sequences. Therefore one can still attribute the largest part of the limestone gypsum member of the Sa'haronim Formation of Makhtesh Ramon to the Longobardian. The upper part of the limestone gypsum member with *Clionitites* could be attributed to the Cordevolian but Tozer (1971) stated that *Clionitites* had already appeared in the Longobardian. The very probable occurrence of *Falloticythere rondeeli* in the lower part of the limestone gypsum member of Makhtesh Ramon does not support an assignment of any part of the *F. rondeeli* Zone to the Cordevolian. On the contrary, it strengthens its attribution to the latest Longobardian.

Mostlerella blumenthali Zone

Definition — range of *Mostlerella blumenthali* n. sp.
Lower limit — first occurrence of *Mostlerella blumenthali* and *Leviella bentori.*
Upper limit — at this moment it is not yet possible to fix it biostratigraphically. It can probably be defined by the first occurrence of *Mostlerella nodosa parva* Kozur, 1971.
Important ostracode species — *Mostlerella blumenthali blumenthali* n. sp. *Mostlerella blumenthali minuta* n. subsp. (only in the lower part), *Leviella bentori* Sohn, 1968, *Judahella pulchra posterospinosa* n. subsp. (only in the lower and middle part), *Reubenella fraterna* (Reuss, 1867), *Paracypris* ? sp.
Stratigraphic range — Early Cordevolian.
Regional distribution — West-Mediterranean faunal province (sensu Kozur & Mostler, 1972b).
Remarks — *Mostlerella blumenthali* occurs indeed in many samples of the *M. blumenthali* Zone but is usually only sparsely represented. It is occasionally abundant only in the lower part of the *M. blumenthali* Zone where it occurs together with numerous primitive representatives of *Leviella bentori* and a few very highly developed representatives of *F. rondeeli* (transitional forms to *M.*

blumenthali). The subspecies *Mostlerella blumenthali minuta* is here more numerous than *M. blumenthali blumenthali* whilst the otherwise predominant *Reubenella fraterna* is absent from the lower part of this zone. The lower *M. blumenthali Zone* can be easily distinguished from the middle and from the upper *M. blumenthali* Zone by the last appearance of *F. rondeeli,* the occurrence of *M. blumenthali minuta,* the great abundance of very primitive representatives of *L. bentori* and especially by the absence of *R. fraterna.* Further investigations may establish the lower *M. blumenthali* Zone as a separate subzone. The middle and upper *M. blumenthali* Zones are characterized by the mass occurrence of *R. fraterna,* while all other species are subordinate. This is undoubtedly due to environmental causes. It should be noted, however, that *R. fraterna* is absent from the lower *M. blumenthali* Zone and also from the *F. rondeeli* and *F. mulderae* Zones. This is so even under conditions identical in facies to those which existed in the middle and upper *M. blumenthali* Zones and even where Cytherellidae such as *Leviella sohni* or *Leviella bentori* occur in great abundance. From this point of view the mass occurrence of *Reubenella fraterna* is of considerable stratigraphical use in the middle and upper *M. blumenthali* Zone. The middle and upper parts of the *M. blumenthali* Zone can be easily recognized by the presence of *R. fraterna,* even when the index species *Mostlerella blumenthali* is absent. Of course, this conclusion is only valid for the Betic Zone. In the Dinarian province *R. fraterna* occurs in great abundance in the Lower Carnian and is frequent in the Upper Carnian. In the Austro-Alpine province it has until now only been reported from Tuvalian deposits. In the German province *R. fraterna* occurs rarely on both sides of the Cordevolian/Julian boundary ('Bleiglanz-Bank'); in the Tuvalian ('Lehrberg-Schichten') it is very abundant in hyposaline deposits.

The exact position of the *M. blumenthali* Zone within the international Triassic subdivision is currently debated. According to Sohn (1968) *Leviella bentori* occurs for the first time in the basal limestone member of the Carnian in the Makhtesh Ramon region. While the assignment of this member to the basal Carnian is very likely, from an orthochronological point of view it is not completely established. The genus *Mostlerella* is a characteristic guide fossil of the Carnian and was until now not recorded from the Longobardian. The *Frankites sutherlandi* Zone (upper Longobardian) is not yet sufficiently investigated in the appropriate facies to exclude the possibility that the genus *Mostlerella* first occurs in the latest Longobardian. In the upper (and middle?) *M. blumenthali* Zone only *Pseudofurnishius murcianus* is present and not *P. huddlei.* This fauna belongs to the lower Cordevolian *P. murcianus* Assemblage-Zone of Kozur (1972a). In North America *Mosherella newpassensis* (Mosher, 1968), the successor of *Pseudofurnishius murcianus,* occurs in the lower Carnian. If one will not accept a late Ladinian age for part of the *P. murcianus* Assemblage-Zone, then the *P. murcianus* Assemblage-Zone must represent the basal Cordevolian. Other fossils also indicate that at least the upper part of the *M. blumenthali* Zone belongs to the Cordevolian. Thus, *Reubenella fraterna* is the dominant species in the southern Alpine Lower Carnian and here still frequently occurs in the Upper Carnian. Where deposition was accompanied by higher than normal salinities, all other ostracode species are reduced in favour of *Reubenella fraterna.* Thus considerable parallels appear between the environments in the Dinarian faunal province (southern Alps) and those in the West-Mediterranean faunal province (Betic Zone). *Theelia tubercula* Kristan-Tollmann, a guide fossil of the southern Alpine Cordevolian (not from the very base of the Cordevolian) occurs (cf. Kozur & Simon, 1972) in the samples Ba 518 (area 8), Kp 3 (area 2) and Si 46/71 (Sierra de Lujar; see Kozur & Simon, 1972 and van den Boogaard & Simon, 1973), which all belong to the (upper) *M. blumenthali* Zone. Thus one can accept with certainty a Cordevolian age for the upper *M. blumenthali* Zone (variegated carbonate member and chronostratigraphical equivalents). The lower and middle parts of the *M. blumenthali* Zone (tres bancos member and chronostratigraphical equivalents) belong to the Cordevolian or to the late Longobardian *Frankites sutherlandi* Zone. Until the questions raised have been answered, the complete *M. blumenthali* Zone is for reasons of expediency here attributed to the early Cordevolian. However, the possibility cannot be excluded that at least the lower *M. blumenthali* Zone (without *Reubenella fraterna)* has a late Longobardian age. A precise definition of the Longobardian/Cordevolian boundary will only be possible after a precise investigation of the Ladinian/Carnian limit in the ammonoid-bearing section of Makhtesh Ramon or in similar sections. The reason for this is that the section from Makhtesh Ramon can be correlated exactly with the sequences of the Betic Zone (the same faunal province; cf. Kozur & Mostler, 1972b and Hirsch, 1972) with the aid of conodonts and ostracodes. The careful study of the ostracode faunas of Nevada (U.S.A.) and their stratigraphic range can also contribute much to the exact definition of the Ladinian/Carnian boundary in the Betic Zone, because the sedimentation realm of Nevada was connected directly with the Mediterranean faunal province (cf. Kozur, in press). By far the larger part of the afore-mentioned Betic sequences can be classified exactly within the international Triassic subdivision with the aid of microfossils. Apart from the question whether the Ladinian/Carnian boundary is placed at the base of the *M. blumenthali* Zone, as here maintained, or at the base of the higher *M. blumenthali* Zone, for practical reasons only two ranges for the definition of the Ladinian/Carnian boundary in the Betic Zone come into consideration: (1) the first occurrence of *Mostlerella blumenthali* and *Leviella bentori* as assumed in the present paper or (2) the first appearance of *Reubenella fraterna.* The differences of the true Ladinian/Carnian boundary from these horizons can only be so small that one of the two horizons should be used in the future for the definition of the Ladinian/Carnian boundary.

The contribution of the macrofossils of the Betic Zone towards a correlation with the international Triassic subdivision is far less than that of the microfossils. On the other hand some macrofossils certainly have a stratigraphic value for the Betic Zone. The following faunas can be distinguished:
Horizon with *Placunopsis flabellum* Schmidt
Horizon with *Costatoria kiliani* (Schmidt) and *Gervillia* cf. *joleaudi* Schmidt
Horizon with *Elegantinia betica* (Hirsch)

In the Sierras de Orihuela (area 3, Orihuela unit) and Alhamilla (area 8) *Elegantinia betica* (Hirsch) (Pl. 1, figs. 4, 5) was until now not found above the *F. rondeeli* Zone (see p. 14, 18). In the Sierra de los Filabres (Serón region), it has been found in carbonate fragments within tectonic breccias of the Tetica unit of the Ballabona-Cucharón complex (Dr L. Leine, pers. com.; see also Leine, 1966, 1968). Other carbonate fragments contain ostracodes *(Reubenella fraterna)* of the *M. blumenthali* Zone. However, it is impossible to establish the stratigraphical relationship between the carbonates with *Elegantinia betica* and these ostracodes of the *M. blumenthali* Zone because of the extreme tectonic disordering of the sequences. It is possible that they have a different age.

In the Alpujarride succession of the Sierra Alhamilla (area 6), *Elegantinia* *betica* has been reported from the basal part of member (e) (see p. 16). According to Hirsch (1966) the accompanying macrofauna contains fossils similar to those described by Simon (1963) from the Sierra de Almagro and later identified as *Costatoria kiliani* (Schmidt). Sample Si 783/67 was taken from about the same level as that which yielded *E. betica* and contains *Reubenella* cf. *avnimelechi* Sohn, 1968 and dubious specimens of *Mostlerella* cf. *blumenthali*. However, the preservation of the latter species is so bad that a definite determination has not been possible. The absence of *Reubenella fraterna* excludes these rocks from the middle and upper parts of the *M. blumenthali* Zone. The microfauna would suggest a position within the lower *M. blumenthali* Zone or possibly within the upper *F. rondeeli* Zone. The imprecisely known stratigraphical relationships between the bed with *Elegantinia betica* and the bed which yielded sample Si 783/67 (see p. 16) also hinder the solution of this problem. The detailed study of a section of the upper part of member (d), the basal part of member (e), and the definite determination of the macrofauna associated with *E. betica* will probably solve these questions.

In conclusion, *Elegantina betica* (Hirsch) is tentatively considered not to occur above the lower *M. blumenthali* Zone in the Betic Zone and is possibly restricted to lower zones.

The horizon with *Costatoria kiliani* (Schmidt) and *Gervillia* cf. *joleaudi* in the Betic Zone is always accompanied by the same ostracode association (very abundant *Reubenella fraterna* and sparse *Mostlerella blumenthali).* This indicates that the horizon with *Costatoria kiliani* and *Gervillia* cf. *joleaudi* always occurs in the same stratigraphical level in the Betic Zone. In the well-investigated sequences of the Sierra de Carrascoy (area 1) the fauna with *Costatoria kiliani* (Pl. 1, fig. 3) occurs in the basal part of the variegated carbonate member (key-bed 1). Faunas with *C. kiliani* have also been found in correlatable horizons of the Ballabona-Cucharón complex of the Betic Zone (Sierra del Puerto, Sierra de Orihuela, Sierra de Enmedio, Sierra de Almagro). *C. kiliani* and *G.* cf. *joleaudi* are mentioned by Schmidt (1935; see also Foucault, 1971) from Longobardian sequences in parts of Spain outside the Betic Zone. Schmidt (op. cit., p. 140) attributed the Longobardian to the Middle Ladinian, and the Cordevolian to the Upper Ladinian. Unfortunately neither the Longobardian age of the sequences in question nor the exact ranges of the two species has been established with certainty. For example, Tronkov (1973) mentions *Gervillia* aff. *joleaudi* from unequivocal Pelsonian sequences in NW Bulgaria, whilst types resembling *Costatoria kiliani* are present in the Cordevolian "Grenzdolomit" of the German Basin.

A third macrofauna horizon occurs in the upper *M. blumenthali* Zone and is characterized by *Placunopsis flabellum* Schmidt. The accompanying ostracode fauna with *Reubenella fraterna* can be incorporated in the *M. blumenthali* Zone. The stratigraphical position of the fauna with *Placunopsis flabellum* above the fauna with *Costatoria kiliani* and *Gervillia* cf. *joleaudi* (see Fig. 4), favours its incorporation in the upper *M. blumenthali* Zone. The latter conclusion is supported by the Cordevolian holothurian fauna of sample Kp 3 which contains *Theelia tubercula tubercula* Kristan-Tollmann. Samples Kp 1 and Kp 2 from which *Theelia tubercula* is absent but otherwise have a holothurian fauna similar to that of Kp 3, possibly occur in a horizon somewhat below the level with *Placunopsis flabellum.* Sample Ba 518 from the Sierra Alhamilla (Alfaro region; see van den Boogaard, 1966; Simon, 1966a; Kozur & Simon, 1972; van den Boogaard & Simon, 1973), contains *Placunopsis flabellum* together with a typical

Cordevolian holothurian association with numerous *Theelia tubercula* (see Plate 3, figs. 11, 15). Thus sample Ba 518 can be attributed to the upper *M. blumenthali* Zone although it contains no ostracodes. Rather well-preserved specimens of *Placunopsis flabellum* Schmidt (Plate 1, figs. 1, 2) have been found together with *Pseudofurnishius murcianus* at a presumably analogous stratigraphic level in the Bermejo unit of the Ballabona-Cucharón complex in the western Sierra de Orihuela (van den Boogaard & Simon, 1973).

Summarizing the macrofauna data one can say that in the Betic Zone the lower horizon with *Elegantinia betica* is essentially Longobardian and that the upper horizon with *Placunopsis flabellum* is Cordevolian. Furthermore, the horizon with *Costatoria kiliani* and *Gervillia* cf. *joleaudi* can be attributed to the Cordevolian or uppermost Longobardian, depending on the age attributed to the *M. blumenthali* Zone.

In addition some remarks will be made regarding the age of the ostracode faunas in individual sections and correlation between the sections of different tectonic units.

The best investigated section comes from the Sierra de Carrascoy (area 1, see Fig. 3). This section is a type-locality for both the *F. mulderae* and *M. blumenthali* Zones. The ostracode faunas of the Palas member show the typical association of the *F. mulderae* Zone with numerous *Falloticythere mulderae* and *Lutkevichinella? egeleri*. The conodont association with *Pseudofurnishius huddlei* (blade and bar conodonts are not considered), the index-species of the *P. huddlei* Zone, indicates the upper Longobardian. In the sample Ka 541/67 (uppermost Palas member) highly developed representatives of *Falloticythere mulderae* with similarities to *F. rondeeli* are already present. Therefore the Palas member should be restricted to the *F. mulderae* Zone. Ostracodes have been found neither in the green slate member nor in the lower part of the tres bancos member. However, numerous *Reubenella fraterna* are present in the middle tres bancos member (Si 533/65). This fauna can be attributed to the base of the middle *M. blumenthali* Zone. In the upper part of the tres bancos member (sample Si 540/65) *Mostlerella blumenthali* has been found for the first time. The highly developed types of *Mostlerella blumenthali* occur in this part of the sequence and persist as far as the upper variegated carbonate member. *M. blumenthali* and *Reubenella fraterna* occur in the lower Filos formation and indicate the middle to upper *M. blumenthali* Zone. In general the middle and upper *M. blumenthali* Zone cannot be distinguished on the basis of ostracodes. The middle *M. blumenthali* Zone may only be distinguished where *Judahella pulchra posterospinosa* and *Reubenella fraterna* occur together. This is because the first mentioned species occurs in the lower and middle *M. blumenthali* Zone and the latter in the middle and upper *M. blumenthali* Zone. Consequently on the basis of the ostracodes the rocks of the Filos formation cannot be older than those of the variegated carbonate member and are most probably younger (see further p. 29).

The type-locality of the *F. rondeeli* Zone is situated in the Sierra Alhamilla (area 8) except for its uppermost part. Most interesting is the stratigraphical position of the *F. rondeeli* Zone with respect to the above-mentioned section from the Sierra de Carrascoy. In the uppermost Palas member *Falloticythere mulderae* persists although these specimens are highly developed and show clear similarities to *F. rondeeli*. This permits the supposition that the *F. rondeeli* Zone corresponds with the green slate member from which no ostracodes are known in the Sierra de Carrascoy. Only the upper part of the *F. rondeeli* Zone (with highly developed representatives of *F. rondeeli,* which are very similar to *Mostlerella blumenthali)* could correspond to the basal tres bancos member. The uppermost *F. rondeeli* Zone is represented in sample Si 757/67 (area 9) by highly developed representatives of *F. rondeeli* and abundant *Leviella sohni.* The correlation of the carbonate rocks, which yielded sample Si 757/67, with those of the basal part of the tres bancos member might imply that the phyllitic rocks of the Perin unit are correlatable with the green slate member of the Romero unit from the Sierra de Carrascoy.

Sample Si 45/71 (area 7) is only a little younger than sample Si 757/67. However, it unequivocally belongs to the *M. blumenthali* Zone. The following facts support the slight chronological difference between these two samples. Some representatives of *Leviella sohni* from sample Si 757/67 are already highly developed and closely similar to *Leviella bentori* (clearly curved middle-ridge). In sample Si 45/71 all representatives of *Leviella bentori* are very primitive and still clearly similar to *Leviella sohni.* Very primitive representatives of *Mostlerella blumenthali blumenthali,* still showing clear similarities to *F. rondeeli,* also occur in this sample together with a few representatives of *F. rondeeli.* The latter are very highly developed and represent transitional types to *M. blumenthali.* In sample Si 757/67 the representatives of *F. rondeeli* are also already highly developed and show similarities to *M. blumenthali.* Sample Si 45/71 must be older than sample Si 533/65 (middle tres bancos member, area 1) because *Reubenella fraterna* is absent in the former sample. Consequently the part of the sequence which yielded Si 45/71 can be correlated with a part of the lower tres bancos member. The basal part of this member probably belongs to the higher part of the *F. rondeeli* Zone and the *M. blumenthali* Zone begins somewhat above its base.

From the Sierra de Orihuela (area 3) several microfauna-bearing samples are available. The microfauna of the basal part of the Aguila formation only comprises lateral shields of ophiuroids. The macrofauna comprising *Elegantinia betica* (Hirsch) indicates a Longobardian age. In sample Si 34/70 (uppermost part of the Gertrudis formation of the Orihuela unit) the presence of numerous specimens of *Falloticythere mulderae* indicates that this part of the section belongs to the *F. mulderae* Zone. From approximately the same level sample Si 52/71 yields *Triassocypris* sp. which is mainly restricted to the *F. mulderae* and *F. rondeeli* Zones. From the uppermost part of the Muela formation, overlying the Gertrudis formation, samples Si 122/70, Si 53/71 and Si 54/71 yielded numerous specimens of *Lutkevichinella* all of which unquestionably belong to a single species. The absence of other ostracodes from these samples may have been due to hyposaline conditions. If we are here dealing with *Lutkevichinella? egeleri* (the preservation is too bad for a definite species determination), the Muela formation could be correlated with the Palas member of area 1. The Lucia formation which overlies the Muela formation would then correspond with the green slate member of area 1. Van den Boogaard & Simon (1973) mention a conodont fauna of the *P. murcianus* Assemblage-Zone from the uppermost part of the Virgina formation (sample Si 61/70, see Fig. 7). Thus this part of the succession can be attributed to the early Cordevolian.

In member B of the upper carbonate sequence of the Tunnel unit of the Sierra de Orihuela (area 3, see also Fig. 6) an ostracode fauna with *Mostlerella blumenthali* and *Reubenella fraterna,* which indicates the middle to upper *M. blumenthali* Zone, has been found (sample Si 7/71). This view is supported by the macrofauna (with *Costatoria kiliani* and *Gervillia* cf. *joleaudi)* which occurs in the basal part of member B, and also by the conodont fauna from carbonate rocks of member B. On basis of the micro- and macrofauna and of marked similarities in lithostratigraphy, the upper carbonate sequence of the Tunnel unit can be correlated with the tres bancos and variegated carbonate members of area 1. The purple slate and the lower carbonate sequences should be correlated with the green slate member and the higher part of the Palas member respectively.

Samples with abundant ostracodes and holothurian sclerites are available from the Sierra del Puerto (area 2). It should be noted that only the Puerto member was investigated micropalaeontologically. The ostracode fauna (sample Si 31/71) with abundant *Reubenella fraterna* and *Lutkevichinella* sp. indicates a shallow sea environment with salinities temporarily higher than normal. The holothurian faunas of the samples Kp 1, Kp 2 and Kp 3 were described by Kozur & Simon (1972). In sample Kp 3 the Cordevolian *Theelia tubercula tubercula* occurs. In sample Ka 184H/72 this species is represented together with *Acanthotheelia oertlii, A. mostleri brouweri, A. mostleri mostleri, Theelia guembeli, T. krystyni* and *T. zankli. Costatoria kiliani* occurs in the basal part of the Puerto member and somewhat higher in the sequence a horizon with *Placunopsis flabellum* is found. The micropalaeontologically investigated part of the Puerto member belongs to the upper *M. blumenthali* Zone and on the basis of the holothurians can be attributed to the Cordevolian.

From the Enmedio unit of the Sierra de Enmedio (area 4) only one sample (DU U 19) has been examined. It has been taken from a horizon with *Costatoria kiliani* and on the basis of the occurrence of *Reubenella fraterna* may be placed in the middle to upper *M. blumenthali* Zone. The higher part of member B, which yielded sample Du U 19, has the same lithostratigraphy as keybed 1 of the variegated carbonate member of the Sierra de Carrascoy.

The samples Ka 210 B/72 and Ka 210 C/72 were collected from member B of the upper limestones and dolomites of the Almagro unit of the Sierra de Almagro (area 5). Member B can be correlated, on the basis of very marked resemblances in lithostratigraphy, with keybed 1 (and ? keybed 2) of area 1. Likewise in these samples numerous *Reubenella fraterna* occur, whereas the accompanying macrofauna comprises *Costatoria kiliani* and *Gervillia* cf. *joleaudi.*

The position of sample Si 783/67 (area 6) within the stratigraphical scheme is not completely certain. Questionable specimens of *Mostlerella blumenthali* occur. Their preservation is so bad that an exact determination cannot be made. *Reubenella* cf. *avnimelechi* is also present. The absence of *Reubenella fraterna* excludes the middle and upper *M. blumenthali* Zone. At the earliest, it would seem that we are dealing here with the lower *M. blumenthali* Zone, in which one would normally expect numerous *Leviella bentori.* The investigation of further samples from this section will probably solve this problem.

Tectonic and stratigraphic implications

As can be concluded from the foregoing, the age of several rock sequences of the Betic Zone has been very precisely established for the first time with the aid of microfauna. Several stratigraphical and tectonic conclusions can be drawn from this new information.

As already pointed out (see geological setting, area 1), the stratigraphical relationship between the rocks of the Romero and Carrascoy units was uncertain until now. In this respect the age of the carbonate rocks of the basal part of the Filos formation is crucial. According to the first hypothesis the rocks of the Carrascoy unit originally represented the stratigraphical continuation of the Romero unit, i.e. the rocks of the Carrascoy unit consequently being younger than those of the variegated carbonate member of the Romero unit. According to the second hypothesis the Romero and Carrascoy units represent two comparable major tectonic units. Thus one would expect the rocks of the basal Filos formation to have approximatively the same age as those of the basal part of the Fuente Aledo formation. The ostracodes found in the basal part of the Filos formation show that these rocks are in any case not older than those of the variegated carbonate member. No further conclusions can be drawn at the present time since a definite subdivision of the *M. blumenthali* Zone — to which the rocks in question belong — has not yet been established. However, field and laboratory observations do give further valuable help for establishing the relationship between the rocks of the two units. In the upper part of the carbonate sequences of the Romero unit and its equivalents (areas 1, 2, 3, 4 and 5) there occur intercalations of pelitic, psammitic and (in the case of area 2) gypsiferous rocks. Macroscopically as well as microscopically these rocks strongly resemble those of the Murta formation of the Carrascoy unit and its equivalents (cf. also Simon, 1963, 1966b). Moreover, in the lower part of the Cucharón formation of the Cucharón unit in the Sierra de Almagro (correlatable with the Murta formation of the Romero unit) there occur carbonate intercalations which are indistinguishable from those of the upper part of the Romero unit or its equivalents. All these data strongly favour the opinion that the rock sequences of the Romero and Carrascoy units and their equivalents originally belonged to a single continuous succession. It is assumed that during the second phase of nappe movements (deformation phase 2 of Kampschuur, 1972a) a major 'internal' detachment took place approximatively at the top of the Fuente Aledo formation and its equivalents, giving rise to two tectonic units. Acceptance of this hypothesis requires an original fourfold subdivision for the Triassic sequence of the 'Romero-Carrascoy' unit and its equivalents. In ascending stratigraphical order the sequence would consist of psammites and pelites (Pocito formation and equivalents), carbonate rocks (Fuente Aledo formation and equivalents), pelites and psammites (Murta formation and equivalents) and, finally, carbonate rocks (Filos formation and equivalents). This stratigraphic scheme shows conspicuous resemblance to that of the Nevado-Filabride complex (cf. Egeler et al., 1971, figs. 2a – c). From the Triassic lithostratigraphical development it can be concluded that the Ballabona-Cucharón complex is far more closely related to the Nevado-Filabride complex than to the Alpujarride complex.

In the eastern Sierra de Orihuela (area 3) two tectonic units have been distinguished in the field (Egeler et al., in prep.). The study of the ostracodes from carbonate sequences below and above their thrust-contact unequivocally proves that they are two major tectonic units, and that they are not due to a 'décollement" within an originally continuous succession.

Until now the boundary between the psammitic "Buntsandstein" (Pocito formation and equivalents) and the overlying carbonates of the 'Muschelkalk' (Fuente Aledo formation and equivalents) in the Ballabona-Cucharón complex was placed on lithostratigraphical grounds at the limit of the Lower and Middle

Triassic (see i.a. Simon, 1963; Egeler & Simon, 1969a, b; Egeler et al., 1971). Our investigations in area 1 (see Fig. 3), however, have revealed that this boundary lies in the Upper Ladinian (Longobardian). Following this discovery, a systematic micropalaeontological investigation of the carbonate rocks of the basal part of the carbonate sequences of the Alpujarride and Malaguide complexes has been started. In the Alpujarride units, for instance, all authors have until now assumed that the contact of the pelite-psammite sequence with the overlying carbonates can be correlated with the Lower/Middle Triassic boundary. This is amongst others based on the presence of algae, assumed to be indicative of the Anisian, in the basal parts of Alpujarride carbonate sequences from the Sierra de Baza (Fallot et al., 1954). Furthermore the study of the Triassic carbonate rocks of the Alpujarride and Malaguide complexes, and of the 'intermediate' elements between, can give valuable information concerning the intriguing question whether these Triassic sequences have an 'Alpine twofold' scheme or a 'German fourfold' scheme (see further Roep, 1972).

A rather unexpected result of our micropalaeontological studies is that we have not been able to prove in the Ballabona-Cucharón and Alpujarride complexes ages younger than the Early Carnian (Cordevolian). Up to the present time Norian fossils have only been described from the Sierra de Baza (northwestern Sierra de los Filabres) and from the La Calahorra region (northern Sierra Nevada). Those fossils (algae: *Griphoporella curvata)* occur in the highest parts of what are probably Alpujarride sequences (Fallot et al., 1954). However, the attribution of the upper parts of the carbonate sequences of the 'Nieves' unit and the 'Casares' unit (province of Málaga; Dürr, 1967) and of the Alpujarride complex between Málaga and Motril (Boulin, 1968) to the Norian is questionable in our opinion, as the palaeontological evidence is insufficient. In the future we intend to collect samples from all those localities and determine if there is any microfauna which might allow further comment on the ages of the rocks in question.

With the exception of sample Ba 129 (area 8), all the ostracodes from the studied carbonate sequences indicate that the rocks were deposited under shallow water conditions (less than 100 m deep).

Summarizing, it can be said that the available results show that the ostracodes are decisively important when palaeoecological and biostratigraphical questions are to be solved in the Betic Zone. They are just as important for tectonic analysis. In the Betic Zone, as in other regions, it appears that the precision of conclusions can be considerably improved by investigations of both microfaunas (in this case ostracodes, conodonts and holothurian sclerites) and macrofaunas (in this case lamellibranchs). The results up till now show that further micropalaeontological investigations are most promising for the stratigraphical and tectonic analysis of the Triassic of the Betic Zone.

Systematic descriptions of the Ostracoda (by H. Kozur)

The ostracodes differ strongly in their state of preservation. Generally the valves are silicified but in some cases they are pyritized. The latter are rather well preserved and a study of some of their internal structures (inner lamella, hinge) is possible. The silicified valves are occasionally well preserved but more commonly they are so strongly recrystallised that only highly ornamented specimens can be identified precisely.

The described specimens are stored in the Staatliche Museen, Schloss Elisabethenburg at Meiningen, German Democratic Republic, except for the specimens which have a number preceded by RGM. The latter are stored in the Rijksmuseum van Geologie en Mineralogie, Leiden, The Netherlands.

Superorder PODOCOPAMORPHES Kozur, 1972
Order PODOCOPIDA Sars, 1866
Suborder CYPRIDOCOPINA Jones, 1901, emend. Kozur, 1972
Superfamily MACROCYPRIDACEA Müller, 1912
Family ACRATIIDAE Gründel, 1962

Genus *Acratina* Egorov, 1953

Type-species — *Acratina pestrozvetica* Egorov, 1953.

Acratina sp. aff. *goemoeryi* (Kozur, 1970)

Fig. 15a.

Distribution — carbonate sequence, intermediate unit of Sierra Alhamilla (sample Ba 129; area 8). Similar specimens are known from the Lower Ladinian of Hungary and from the Lower Ladinian "Reifling Limestone" of Slovakia.
Habitat — marine, deep neritic.

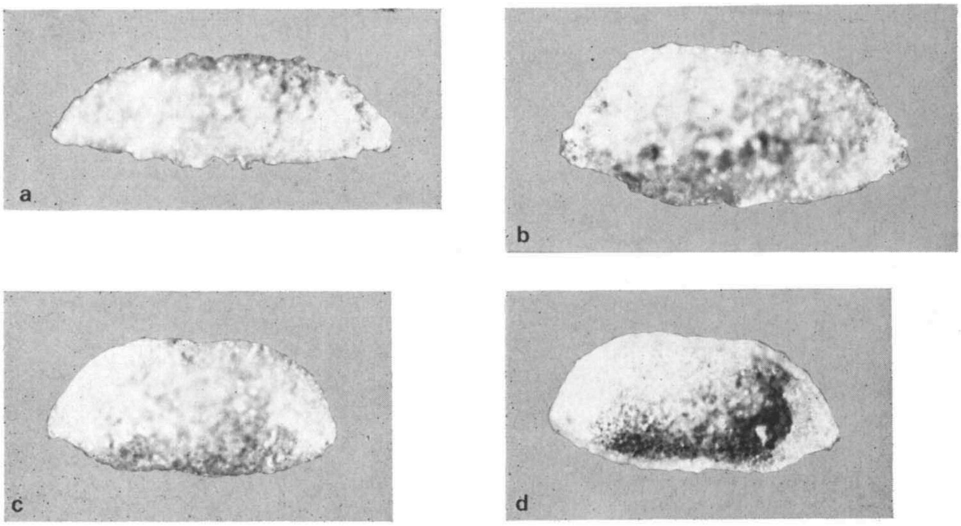

Fig. 15. a. *Acratina* sp. aff. *goemoeryi* (Kozur, 1970), RV, 55 x. Sample Ba 129.
b - d. *Acratina muelleri* n. sp., 55 x. Sample Ba 142.
b. LV, holotype, c. LV, outer view. d. LV, inner view.

Acratina muelleri, n. sp.
Fig. 15 b, c, d.

Name — in honour of Prof. Dr. K. J. Müller, Bonn.
Holotype — the specimen M X/20, Fig. 15b.
Type-locality — Sierra Alhamilla (area 8).
Type-horizon — carbonate sequence (sample Ba 142).

Diagnosis — carapace nearly equivalved, smooth. The greatest height is in the anterior third. Anterior margin acuminate above the ventral line. Dorsal margin slightly convex, in the middle part straight. Posterior end acuminate above the ventral line but not elongated. Ventral margin straight, in the middle part sometimes gently concave. Hinge simple, with furrow in the LV. Inner lamella broad anteriorly, narrow elsewhere. Vestibule wide anteriorly and very narrow posteriorly. Sexual dimorphism distinct. Females higher than males. Moreover, in males the anterior end is more protruded.
Habitat — marine, below 30 m water depth.

Measurements

♀♀	♂♂
l = 835 - 850 µm	l = 820 - 840 µm
h = 380 - 390 µm	h = 315 - 338 µm
l/h = 2.10 - 2.20	l/h = 2.40 - 2.60

Distribution — frequent in the carbonate sequence of the 'intermediate unit' of the Sierra Alhamilla (samples Ba 116, Ba 122, Ba 129, Ba 137, Ba 142; area 8). Very rare in the carbonate sequence, Perin unit of the Perin region (sample Si 757/67; area 9).

Comparisons — *Acratina muelleri* n. sp. is distinguished from all other species of *Acratina* by the lack of an elongated posterior end.

Superfamily CYPRIDACEA Baird, 1845
Family PARACYPRIDIDAE Sars, 1923

Genus *Triassocypris* Kozur, 1970
Type-species — *Macrocypris? pusilla* Kozur, 1968.

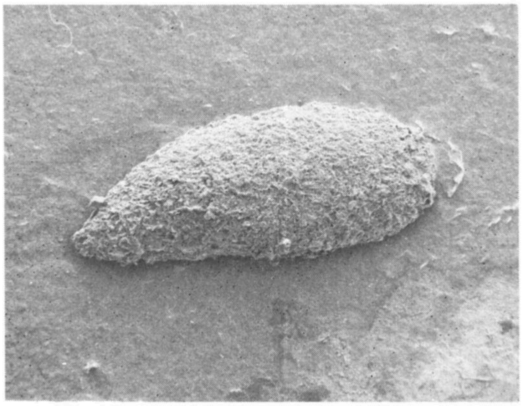

Fig. 16. *Triassocypris* sp., RV, scanning electron micrograph, 75 x. Specimen RGM 186 543 from sample Ka 39G/71.

Triassocypris sp.
Fig. 16.

Remarks — specimens with pointed posterior end, strongly extended below. Assigned to *Triassocypris* Kozur, 1970, a very common ostracode genus of the German and Tethyan Middle Triassic.
Distribution — frequent in the Late Ladinian *Falloticythere mulderae* Zone. Some similar forms occur in the lower part of the *Mostlerella blumenthali* Zone.

Genus *Aglaiocypris* Sylvester-Bradley, 1946
Type-species — *Aglaia pulchella* Brady, 1868

Aglaiocypris? n. sp.
Fig. 17 a, b, c.

Remarks — this species probably belongs to a new genus, similar to *Paracypris* Sars, 1866, but with narrowly rounded posterior margin and only with moderately broad inner anterior and posterior lamellae.
Distribution — carbonate sequence, 'intermediate unit' of Sierra Alhamilla (sample Ba 116; area 8).

Genus *Paracypris* Sars, 1866
Type-species — *Paracypris polita* Sars, 1866

Paracypris? sp.
Fig. 18 a, b.

Remarks — this species occurs frequently in the *Mostlerella blumenthali* Zone and has also been found in the Upper Ladinian and Lower Carnian of Israel.

Suborder CYTHEROCOPINA Gründel, 1967
Superfamily CYTHERACEA Baird, 1850 emend. Kozur, 1973
Family GLORIANELLIDAE Schneider, 1960 emend. Kozur, 1970
Subfamily JUDAHELLINAE Sohn, 1968

Remarks — Sohn (April 1968) has established the family Judahellidae with the genera *Judahella* Sohn, 1968, *Cornigella* Warthin, 1930, *Mauryella* Ulrich & Bassler, 1923 as a family of the Palaeocopida. Knüpfer & Kozur (April 1968)

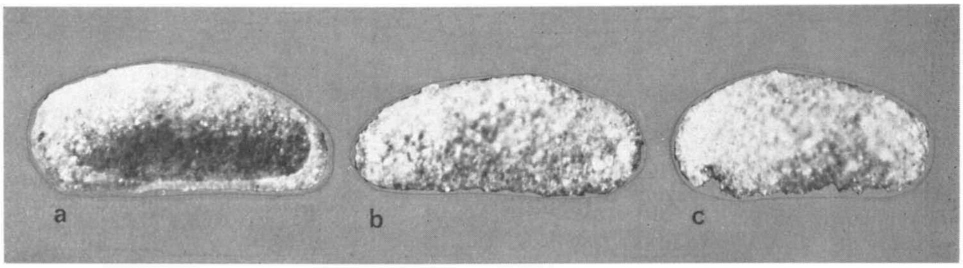

Fig. 17. *Aglaiocypris?* n. sp., 60 x. Sample Ba 116. a. RV, inner view. b. RV, outer view. c. LV, outer view.

have described the new genus *Ophthalmonodella* (here regarded as junior synonym of *Judahella)* which has typically cytherid adductor muscle scars. Kozur (1970b) has regarded *Judahella* as a subgenus of *Triassinella* Schneider, 1956 but later Kozur (in: Bunza & Kozur, 1971) restored *Judahella* to the generic rank. *Judahella* is closely related to *Triassinella* Schneider, 1956 and some specimens of *Judahella* pulchra (Knüpfer & Kozur, 1968) are hard to separate from *Triassinella.* The Upper Triassic species of *Judahella* described by Kozur (in: Bunza & Kozur, 1971) justify the generic rank of *Judahella.* This genus was referred to the Glorianellidae by Kozur (1970b). *Cornigella* and *Mauryella* are not related to *Judahella* and do not belong to the Cytherocopina. The Judahellidae Sohn are here regarded as subfamily of the Glorianellidae. In addition to the nominate genus (including subgenus *Costahella* Kozur, 1970) the subfamily Judahellinae encloses the Triassic genus *Trodocythere* Kozur, 1971.

Genus *Judahella* Sohn, 1968
Type-species — *Judahella tsorfatia* Sohn, 1968

Judahella tsorfatia Sohn, 1968
Pl. 2, figs. 1, 2.

Distribution — Palas member of Fuente Aledo formation, Romero unit of the Sierra de Carrascoy (sample Ka 39 0/71; area 1) and carbonate sequence, Perin unit of the Perin region (sample Si 757/67; area 9). Fassanian (?), Longobardian Substage (Upper Ladinian) of Provence. Uppermost Olenekian (uppermost Scythian) - Pelsonian Substage (Middle Anisian) of the German Basin.

Judahella pulchra posterospinosa n. subsp.
Pl. 2, figs. 3, 4.

Name — after the marginal spines at the posterior and posteroventral margins.
Holotype — the specimen M X/22, Pl. 2, Fig. 3.
Type-locality — Sierra de Gador (area 7).
Type-horizon — member t_3 (sample Si 45/71).

Diagnosis — subspecies of *Judahella pulchra* (Knüpfer & Kozur, 1968) with spinose posterior and posteroventral margins. The greatest spine is located at the posterior cardinal angle. Anterior and posteroventral margins with denticles or tubercles.

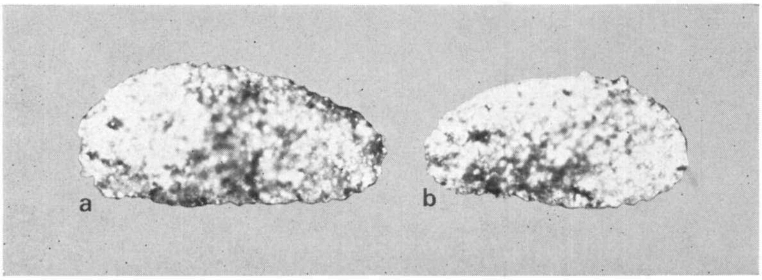

Fig. 18. *Paracypris?* sp., 60 x. Samples Ka 83 C/72. a. LV. b. RV.

Remarks — the second and fourth dorsal node are often small and the fourth is sometimes absent.

Measurements
l = 495 - 560 μm
h = 237 - 303 μm
l/h = 1.70 - 1.98

Distribution — member t_3, Gador unit of the Sierra de Gador (sample Si 45/71; area 7) and tres bancos member of the Fuente Aledo formation, Romero unit of Sierra de Carrascoy (sample Si 540/65; area 1).
Comparisons — the new subspecies differs from *Judahella pulchra pulchra* (Knüpfer & Kozur, 1968) in having spinose posterior and posteroventral margins.

Subfamily CYTHERISSINELLINAE Schneider, 1960

Genus *Falloticythere* n. gen.

Type-species — *Falloticythere mulderae* n. gen. n. sp.

Name — in honour of the late Prof. Dr Paul Fallot.
Diagnosis — carapace small, subequivalved, LV only a litte larger than RV. Outline subrectangular to subtriangular. Surface punctate to finely reticulate and marked by a strong blunt to pointed ventrolateral spine with broad wing-like base. The anteroventral, anteromedian, and also sometimes the posteroventral nodes are low and indistinct. Sulcus present. Hinge lophodont with weak terminal teeth in the RV. Inner lamellae moderately broad anteriorly, but narrow ventrally and posteriorly. Vestibula very narrow. Sexual dimorphism very pronounced.
Distribution — Upper Ladinian of West-Mediterranean faunal province. The following species are assigned to *Falloticythere: Falloticythere mulderae* n. gen. n. sp., *Falloticythere rondeeli* n. gen. n. sp.
Comparisons — *Mostlerella* Kozur, 1971 has a strongly developed posterodorsal node, very broad alae, but no ventrolateral spine. Transitional forms occur *(Falloticythere rondeeli - Mostlerella blumenthali* n. sp.). *Lutkevichinella* Schneider, 1956 has a similar shape, the same size, and a related hingement, but differs in that it lacks a ventrolateral spine and nodes.
Triassinella Schneider, 1956 differs in that it has a less prominent and more posteriorly situated spine and in that it lacks nodes. Moreover, the RV of *Triassinella* strongly overreaches the LV dorsally and the LV overlaps the RV ventrally.

Falloticythere mulderae n. gen. n. sp.
Fig. 19a, b, d.; Pl. 2, figs. 9 - 13.

Name — in honour of Mrs C. W. H. Mulder-Blanken, Amsterdam.
Holotype — the specimen M X/25, Pl. 2, fig. 9.
Type-locality — Sierra de Carrascoy (area 1).
Type-horizon — Palas member of the Fuente Aledo formation (sample Ka 40 B/71).

Diagnosis — a species of *Falloticythere* without posteroventral node. Ventrolateral spine very pronounced.

Description — carapace small, subequivalved. Outline subtriangular (♂♂) to subrectangular (♀♀). Dorsal margin long, straight. Anterior margin broadly rounded. Ventral margin straight, ventral outline in lateral view gently convex (♂♂) or straight (♀♀). Ventral margin curves upwards toward the posterior in the ♂♂, but is subparallel in the ♀♀. Surface finely pitted. Ventrolateral spine very large; sometimes long and pointed, in other cases moderately long and blunt. Basal part of the spine very broad and often wing-like. In front of the ventrolateral spine is a small low node above which a second indistinct and very low node can sometimes be observed. Sulcus S_2 in the upper part often distinct but in the lower half already indistinct; S_1 indistinct. Between the sulci a low node is often present. Hingement and internal marginal structures as for the genus. Sexual dimorphism pronounced. Females larger.

Measurements

♀♀	♂♂
l = 550 – 650 μm	l = 429 – 512 μm
h = 264 – 275 μm	h = 237 – 286 μm
l/h = 2.00 – 2.36	l/h = 1.63 – 1.86

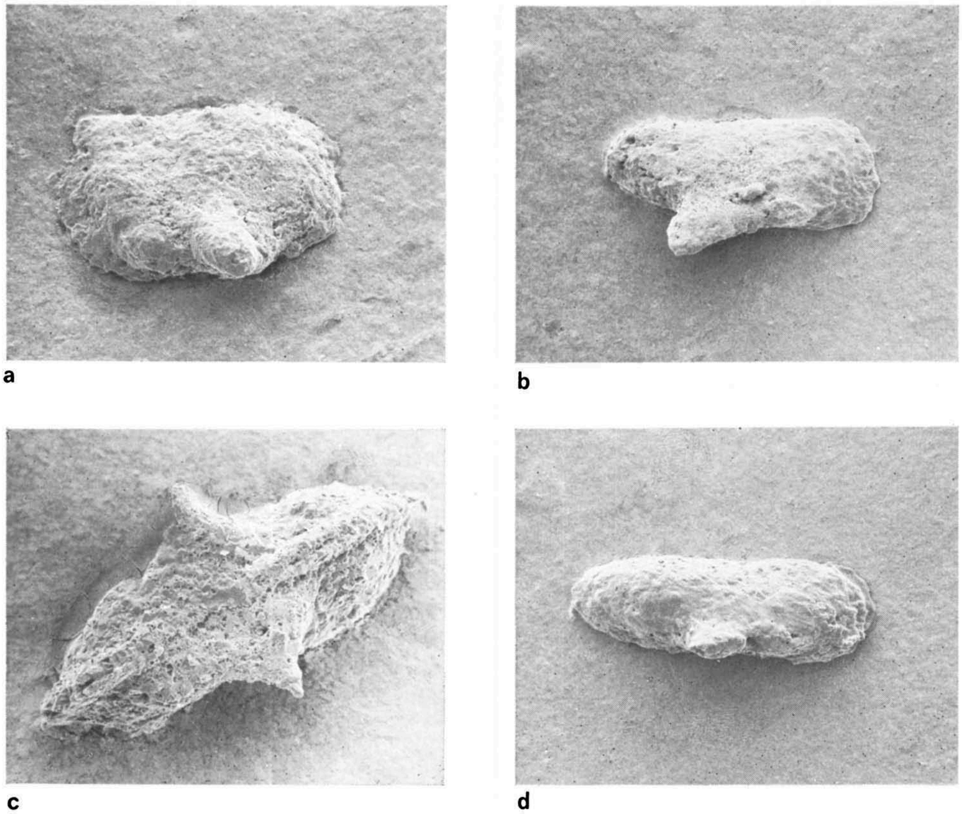

Fig. 19. a, b, d. *Falloticythere mulderae* n. gen. n. sp., scanning electron micrographs, 68 x. Sample Si 45/71. a. LV, ♂, RGM 186 537. b. RV, ♀, somewhat depressed, RGM 186 536. d. RV, ♀, deformed, RGM 186 535.

c. *Falloticythere rondeeli* n. gen. n. sp., scanning electron micrograph, 135 x, Specimen RGM 186 538 from sample Ba 122.

Distribution — Palas member of the Fuente Aledo formation, Romero unit of the Sierra de Carrascoy; Gertrudis formation, Orihuela unit of the Sierra de Orihuela.

Comparisons — *Falloticythere rondeeli* n. sp. differs in having a small posteroventral node and a more distinct mid-anterior to anteromedian node. The anteroventral node is often indistinct in this species.

Falloticythere rondeeli n. gen. n. sp.
Fig. 19c; Pl. 2, figs. 14 - 19, 21.

Name — in honour of Dr H. E. Rondeel, Amsterdam.
Holotype — the specimen M X/26, Pl. 2, fig. 14.
Type-locality — Sierra Alhamilla (area 8).
Type-horizon — carbonate sequence (sample Ba 142).

Diagnosis — a species of *Falloticythere* with small posteroventral node.
Description — outline, hingement, internal marginal structures and sexual dimorphism as in *Falloticythere mulderae.* Surface pitted or faintly reticulated. Moderately long to short ventrolateral spine with broad wing-like base. Anteroventral node low and often indistinct. Anteromedian to mid-anterior node low but distinct. Round posteroventral node is small but distinct in females. In males the posteroventral node is indistinct or absent. In females the posterodorsal parts of the carapace are swollen but no node is present. Sulcus broad, low and indistinct.

Measurements

♀♀	♂♂
l = 523 - 600 µm	l = 396 - 440 µm
h = 247 - 275 µm	h = 210 - 231 µm
l/h = 1.90 - 2.31	l/h = 1.80 - 2.00

Distribution — very frequent in the carbonate sequence, 'intermediate unit' of Sierra Alhamilla (area 8). Rare in the lowermost part of the *Mostlerella blumenthali* Zone (area 7; sample Si 45/71); uppermost Ladinian of Israel.
Comparisons — see also *Falloticythere mulderae* n. sp.
Falloticythere rondeeli n. sp. is a transitional form between *Falloticythere mulderae* n. sp. and *Mostlerella blumenthali* n. sp. In the latter species the ventrolateral spine is reduced to a pointed posteroventral end of ventral alae and a distinct node has developed posterodorsally. The anteromedian to mid-anterior node is more pronounced than in *Falloticythere rondeeli* n. sp.

Genus *Lutkevichinella* Schneider, 1956
Type-species — *Lutkevichinella bruttanae* Schneider, 1956

Lutkevichinella? egeleri n. sp.
Pl. 2, figs. 5 - 8.

Name — in honour of Prof. Dr C. G. Egeler, Amsterdam.
Holotype — the specimen M X/28, Pl. 2, fig. 5.
Type-locality — Sierra de Carrascoy (area 1).
Type-horizon — Palas member of the Fuente Aledo formation (sample Ka 40 A/71).

Diagnosis — carapace tumid with deep and long sulcus and long posteromedian and ventrolateral swellings.

Description — carapace small. RV overreaches LV at dorsal margin and LV overlaps RV at ventral margin. Dorsal margin moderately long and straight. Anterior and posterior margins rounded and often somewhat truncated, anterodorsally and posterodorsally. Posterior margin only a little lower than the anterior one. Ventral outline gently convex in lateral view but the ventral margin is straight. Ventral area very broad and longitudinally ribbed. Lateral surface pitted and separated from the ventral area by a gentle swelling especially in the mid-ventral and posteroventral positions. A deep and long sulcus is situated approximately in the middle part of the valves and reaches from the dorsal margin up to the ventrolateral swelling. Behind this sulcus a horizontally elongated posteromedian swelling is situated. This swelling is usually low and may be either very distinct or indistinct. Inner lamella moderately broad with a small anterior vestibule. Hinge incompletely known. In the RV a median furrow is visible. Sexual dimorphism distinct. Males longer and more slender than females.

Measurements

♀♀	♂♂
l = 440 – 473 μm	l = 512 – 528 μm
h = 264 – 325 μm	h = 265 – 286 μm
l/h = 1.46 – 1.67	l/h = 1.81 – 1.96

Distribution — Palas member of the Fuente Aledo formation, Romero unit of the Sierra de Carrascoy (area 1), (?) Muela formation, Orihuela unit of the Sierra de Orihuela (area 3).

Comparisons — this species probably belongs to a new genus but the preservation of the specimens is too bad for the establishment of a new genus (internal characteristics are not well known).

Lutkevichinella spp.

Remarks — at least two different species of *Lutkevichinella* occur in the investigated Upper Ladinian and lowermost Carnian material of which one is apparently new. The preservation of these specimens is too bad for exact specific determinations.

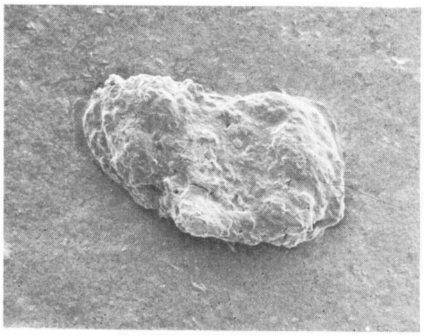

Fig. 20. *Mostlerella blumenthali blumenthali* n. sp., scanning electron micrograph, 75 x. RV, ♂, specimen RGM 186 544 from sample Ka 271/67.

Family MOSTLERELLIDAE Kozur, 1973

Genus *Mostlerella* Kozur, 1971

Type-species — *Mostlerella nodosa,* Kozur, 1971.

Mostlerella blumenthali n. sp.

For details see the description of the nominate subspecies.

Mostlerella blumenthali blumenthali n. subsp.

Fig. 20; Pl. 2, figs. 25 - 28.

Name — In honour of the late Dr M. Blumenthal.
Holotype — the specimen M X/27, Pl. 2, fig. 28.
Type-locality — Sierra de Carrascoy (area 1).
Type-horizon — uppermost part of the tres bancos member of the Fuente Aledo formation (sample Si 540/65).

Diagnosis — a small species of *Mostlerella* with subrectangular to subtriangular outline, with small alae and without a ventral ridge.
Description — carapace small to medium-sized, subequivalved. Lateral outline subrectangular (♀♀) to subtriangular (♂♂). Dorsal margin long and straight. Anterior margin broadly rounded. Posterior margin somewhat (♀♀) to very much lower (♂♂) than anterior margin and narrowly rounded. Ventral margin straight. Surface pitted to faintly reticulated, with prominent posterodorsal node and distinct mid-anterior to anteromedian node. Further smaller and sometimes indistinct nodes are located anteroventrally, posteroventrally, and anterodorsally (eye tubercle). The moderately broad alae end mid-ventrally to posteroventrally in a large pointed node. Duplicature rather narrow, sometimes with very narrow anterior vestibule. Hinge lophodont. Distinct sexual dimorphism. Females somewhat larger, more subrectangular and with higher posterior end than males.

Measurements

♀♀	♂♂
l = 495 - 560 µm	l = 391 - 424 µm
h = 220 - 248 µm	h = 226 - 270 µm
l/h = 2.00 - 2.50	l/h = 1.55 - 1.83

Distribution — variegated carbonate member and the uppermost part of the tres bancos member of the Fuente Aledo formation, Romero unit of the Sierra de Carrascoy (area 1); member B of the upper carbonate sequence, Tunnel unit of the Sierra de Orihuela (area 3); possibly in the uppermost part of member (d) or the basal part of member (e) of the Alpujarride unit of the Sierra de Alhamilla (area 6); member t_3, Gador unit of the Sierra de Gador (area 7).
Comparisons — see also *Falloticythere rondeeli* n. sp.
Mostlerella nodosa parva from the Middle Cordevolian to Julian substages of Hungary is similar in the size and arrangement of the nodes, but differs in having a subtriangular to triangular outline and distinct ventral ridge.

Mostlerella blumenthali minuta n. subsp.
Pl. 2, figs. 22 - 24.

Name — according to the minute size for the genus *Mostlerella.*
Holotype — the specimen M X/30, Pl. 2, fig. 22.
Type-locality — Sierra de Gador (area 7).
Type-horizon — member t_3 (sample Si 45/71).

Diagnosis — a very small subspecies of *Mostlerella blumenthali* n. sp. A low but sharp ventral ridge runs from a short, blunt mid-ventral to posteroventral spine towards the anteroventral portion. It there bends upwards to the anteromedian to mid-anterior node and ends anterodorsally. The posterodorsal node and the indistinct posteroventral node tend to join with the ventrolateral spine by an indistinct ridge. All other characteristics as in *Mostlerella blumenthali blumenthali* n. sp.

Measurements

♀♀	♂ (only one specimen)
l = 385 - 418 μm	l = 363 μm
h = 171 - 187 μm	h = 220 μm
l/h = 2.12 - 2.45	l/h = 1.65

Distribution — member t_3 of the Sierra de Gador (sample Si 45/71; area 7).
Comparisons — *Mostlerella blumenthali blumenthali* n. sp. is larger and has no ridges at the lateral surface.
Mostlerella nodosa parva Kozur, 1971 is larger and the ventral ridge does not join with the anteromedian node. Moreover the posterodorsal node is larger in this species.

Order PLATYCOPIDA Sars, 1866
Superfamily CYTHERELLACEA Sars, 1866
Family CYTHERELLIDAE Sars, 1866
Subfamily RECYTELLINAE Gramm, 1969

Remarks — the Triassic genera of the superfamily Cytherellacea Sars, 1866 were revised in detail by Kozur (1972b). According to the latter the following synonyms exist within the Triassic Recytellinae: *Cavussurella* Gramm, 1969 and *Recytella* Gramm, 1970 are junior synonyms of *Reubenella* Sohn, 1968. *Orlovicavina* Gramm, 1969 is the junior synonym of *Issacharella* Sohn, 1968. *Recytelloidea* Gramm, 1970 is a junior synonym of *Leviella* Sohn, 1968.

Kristan-Tollman (1973) made a further revision of the genera *Reubenella* and *Leviella.* She considered, like Kozur (1972b), that *Recytelloidea* was a younger synonym of *Leviella,* and *Recytella* a younger synonym of *Reubenella.* She made no remarks about the *Cavussurella, Orlovicavina* and *Issacharella.*

Genus *Leviella* Sohn, 1968
Type-species — *Leviella bentori* Sohn, 1968

Leviella bentori Sohn, 1968
Fig. 21a.

Remarks — the present specimens from the sample Si 45/71 (t_3 of the Sierra de Gador, area 7) have a well-developed subcentral pit but the surrounding U-shaped ridge is still indistinct. The present specimens seem to be somewhat more primitive than the type material of Sohn (1968) and seem to be transitional forms between *Leviella sohni* n. sp. and *Leviella bentori* Sohn, 1968.

Leviella sohni n. sp.
Fig. 21b – d.

1968 *Leviella* n. sp. - Sohn, pl. 3, figs. 4, 5.

Name — in honour of Prof. Dr I. G. Sohn, Washington.
Holotpye — the specimen M X/21, Fig. 21b.
Type-locality — Perin region (area 9).
Type-horizon — carbonate sequence (sample Si 757/67).

Diagnosis — a species of *Leviella* Sohn, 1968 with a short, straight to slightly curved ridge in the mid-height of the carapace. This ridge has no contact with

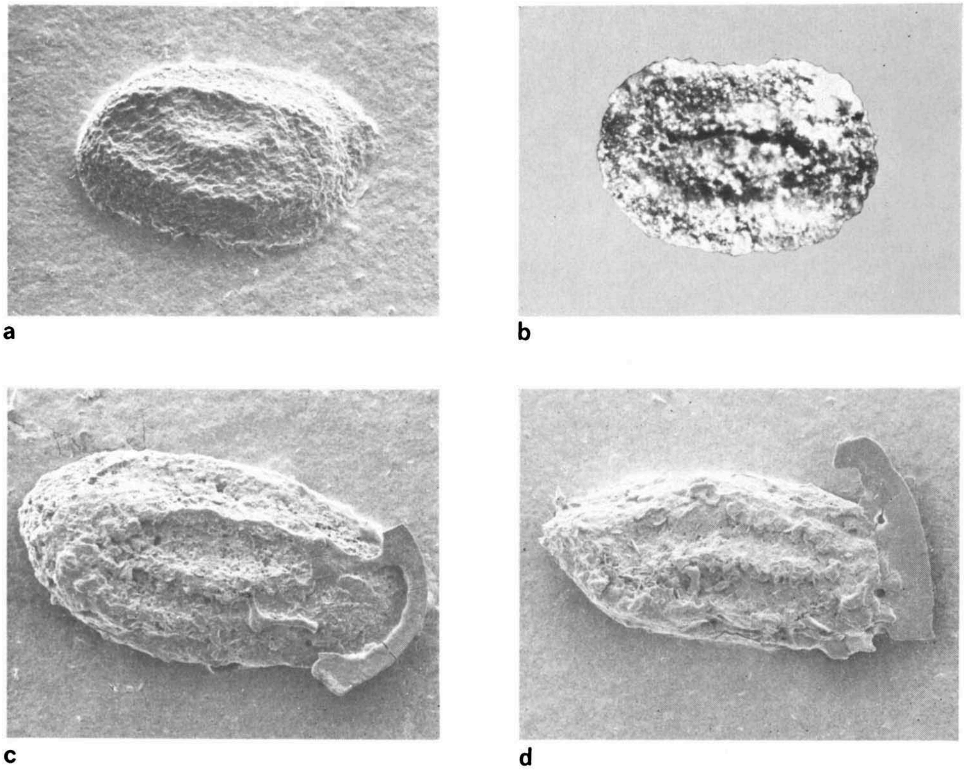

Fig. 21. a. *Leviella bentori* Sohn, 1968, scanning electron micrograph, 70 x. LV, specimen RGM 186 546 from sample Si 45/71.
b – c. *Leviella sohni* n. sp. Sample Si 757/67.
b. RV, holotype, dorsal margin below, 55 x. c. RV, scanning electron micrograph, 70 x, specimen RGM 186 549.
d. Scanning electron micrograph, 70 x, specimen RGM 186 548.

the surrounding unbroken ridge.
Description — RV larger than LV. Anterior and posterior margins broadly rounded and equally high. Dorsal margin gently convex, sometimes straight. Ventral margin straight, slightly concave or (seldom) slightly convex. Lateral surface smooth, with an unbroken ridge distinctly removed from, and subconcentric with, the outer margin. In the mid-height of the carapace there is a short, straight to slightly curved ridge which has no contact with the surrounding continuous ridge. Hinge holosolen with contact furrow in the RV. Distinct sexual dimorphism by posterior swelling of the female carapace.
Habitat — marine, shallow neritic.

Measurements
l = 660 - 715 µm
h = 375 - 450 µm
l/h = 1.50 - 1.76

Distribution — Palas member of the Fuente Aledo formation, Romero unit of the Sierra de Carrascoy (samples Ka 39 H/71, Ka 39 J/71, Ka 39 O/71; area 1); carbonate sequence of the Perin unit of the Perin region (sample Si 757/67; area 9). (Upper) Ladinian of Nevada, U.S.A.
Comparisons — *Leviella bentori* Sohn, 1968 is distinguished by an U-shaped ridge which joins with the dorsal portion of the surrounding lateral ridge. In *Leviella unicostata* (Bolz, 1970) the surrounding lateral ridge lies at, or near to, the outer margin. The central ridge is distinctly curved.

Genus *Reubenella* Sohn, 1968
Type-species — *Reubenella avnimelechi* Sohn, 1968

Synonyms — *Cavussurella* Gramm, 1969 and *Recytella* Gramm, 1970.

Reubenella cf. *avnimelechi* Sohn, 1968
Fig. 22a.

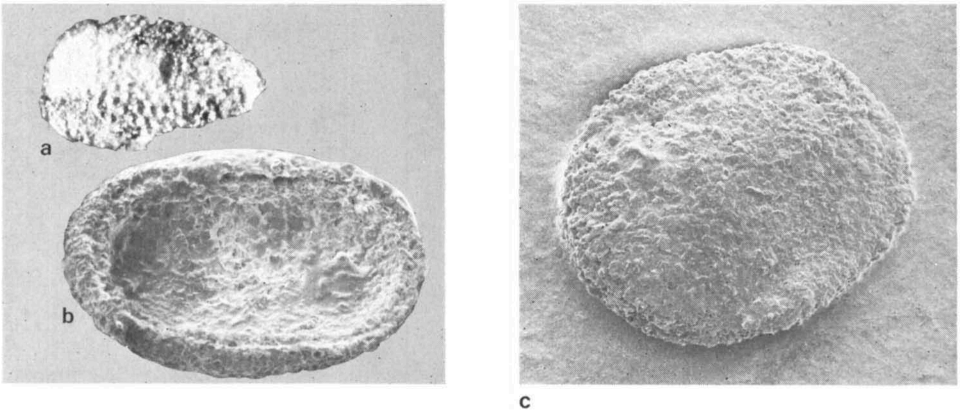

Fig. 22. a. *Reubenella* cf. *avnimelechi* Sohn, 1968, RV, 54 x, sample Si 783/67.
b - c. *Reubenella fraterna* (Reuss, 1867), scanning electron micrographs, 68 x. b. RV, ♀, inner view, dorsal margin below, sample Ka 271/67. c. RV, with distinct swellings and depressions in the mid-dorsal and mid-ventral part; somewhat deformed, specimen RGM 186 550.

Remarks — only 2 damaged specimens and one juvenile specimen were found in sample Si 783/67 (Alpujarride unit of the Sierra Alhamilla, area 6). The specific determination is uncertain.
Distribution — In Israel *Reubenella avnimelechi* Sohn, 1968 occurs in the Upper Ladinian. In the Dinarian faunal province *Reubenella avnimelechi* occurs also in the Carnian.

Reubenella fraterna (Reuss, 1867)
Fig. 22b – c; Pl. 4, figs. 1 - 10.

1866 *Bairdia subcylindrica* Sandberger - Sandberger, p. 41.
1867 *Cythere fraterna* Reuss — Reuss, p. 283, fig. 7.
1869 *Cytherella subcylindrica* Sandb. — Gümbel, p. 189, pl. 6, fig. 35.
1963 *Cytherella sandbergeri* nom. nov. - Coryell, p. 750.
1968 *Reubenella sandbergeri* (Coryell) — Sohn, p. 57.
1973 *Reubenella subcylindrica (Sandberger)* — Kristan-Tollman, p. 356-357, pl. 6, fig. 3; pl. 8, figs. 1 — 4; pl. 9, figs. 1, 3, 5, 6.
1973 *Reubenella subcylindrica* (Sandb.) - Kristan-Tollmann & Hamedani, pl. 9, fig. 9.
1973 *Reubenella ivisensis* n. sp. - Kristan-Tollmann & Hamedani, p. 205-209, pl. 7, figs. 1 — 6; pl. 9, figs. 1 — 4, 6, 7; pl. 10, figs. 1, 2; pl. 11, figs. 2, 4; pl. 12, fig. 8.

Description — carapace middle-sized, strongly inequivalved. RV very much larger than LV, overreaches and overlaps the latter all the way around. Outline of the RV elliptical. Dorsal margin convex. Anterior margin as high as the posterior one and sometimes a little higher. Both ends are broadly rounded. Ventral outline convex in lateral view; ventral margin straight. Dorsal margin of LV gently convex, ventral outiline straight in lateral view. Lateral surface smooth to faintly pitted. An indistinct subcentral pit or short sulcus is clearly visible in juvenile stages. In adults this pit or short sulcus is generally invisible. In most specimens from the Betic Zone no swellings and depressions occur in the mid-dorsal and mid-ventral parts of the RV. In some specimens indistinct swellings can be observed in the mid-dorsal and sometimes also in the mid-ventral parts of the RV where they are accompanied by indistinct depressions. In some Lower Carnian samples of the Betic Zone (all from the Sierra del Puerto, e.g. Si 36/71, Si 40/71), all specimens have swellings and depressions in the mid-dorsal and generally also in the mid-ventral parts of the RV (these specimens are also on average a little larger). In most specimens from these samples the swellings and depressions are very distinct but there are transitional forms in all stages between specimens with distinct swellings and depressions and specimens where they are indistinct. Hinge holosolen. Hinge furrow in the RV. Distinct kloedenellid sexual dimorphism.

Measurements
l = 770 - 880 μm
h = 490 - 815 μm
l/h = 1.43 - 1.60

Remarks — *Bairdia subcylindrica* Sandberger, 1866 is a younger primary homonym of *Bairdia subcylindrica* (Münster, 1830). Therefore Coryell (1963) and Sohn (1968) are quite correct in changing the name *Bairdia subcylindrica* Sandberger, 1866. Kristan-Tollmann (1973, p. 357) does not agree with the rules of ICZN in rejecting the new name for *Bairdia subcylindrica* Sandberger proposed by Coryell (1963). According to Gümbel (1869, p. 183) *Cythere fraterna* Reuss 1867 is probably a junior synonym of *Cytherella subcylindrica* (Sandberger) and the present authors agree with Gümbel. The holotype of *Cythere fraterna* Reuss is most probably a left valve of *Bairdia subcylindrica* Sandberger, 1866. Therefore the valid name *Cytherella sandbergeri* Coryell, 1963 is replaced here by the older valid name *Cythere fraterna* Reuss, 1867. *Bairdia subcylindrica* Sandberger, 1866 as a junior primary homonym for *Bairdia subcylindrica* (Münster, 1830) is invalid if the latter species was assigned to *Bairdia* before Sandberger (1866) established his *Bairdia subcylindrica.* The assignment of *Cytherella sandbergeri* Coryell, 1963 to *Reubenella* by Sohn (1968) is correct. Kristan-Tollmann also placed this species within *Reubenella* (as *Reubenella subcylindrica).* However, this was without reference to the former assignment by Sohn (1968). Kristan-Tollmann (in Kristan-Tollman & Hamedani, 1973) established the new species *Reubenella ivisensis.* To the relationships between *Reubenella "subcylindrica"* and *Reubenella ivisensis* Kristan-Tollmann (1973, p. 357) has given the following remarks: "Enge Beziehungen bestehen zu *Reubenella ivisensis* . . ., welche aber viel gedrungener wirkt, weil sie kürzer, höher und dicker ist als *R. subcylindrica. R. ivisensis* hat den Dorsalrand noch höher gewölbt, und die für *R. subcylindrica* charakteristische Delle ober- und unterhalb des Medianfeldes sowie wulstige Verdickungen im Mittelteil des Dorsal- und Ventralrandes fehlen bei *R. ivisensis* ganz. Der Sexualdimorphismus ist bei *R. ivisensis* im Gegensatz zu *R. subcylindrica* äusserlich kaum ausgeprägt". According to measurements from the photos of *R. "subcylindrica"* and *R. ivisensis* in the paper by Kristan-Tollmann & Hamedani (1973) the ratio l/h is 1.48 – 1.57 in *R. "subcylindrica"*, and 1.40 – 1.53 in *R. ivisensis.* All photos of the RV of *R. ivisensis* show a depression in the subdorsal parts and a swelling in the middle part of the dorsal margin as well developed as in *R. "subcylindrica"*. The only difference between the two species is that the posterior swelling of the female carapaces in the *R. "subcylindrica"* type is more easily seen at the outer part of the valves than in the *R. "ivisensis"* type. However, this is a phenotypic difference. In the Lower Carnian euhaline-marine sediments (e.g. Bakony, Hungary) only specimens of the *"subcylindrica"* type occur. In rather hyposaline Lower Carnian sediments (e.g. Betic Zone) we can find only the thicker-shelled and generally smaller *"ivisensis" type.* The posterior swelling in the outer part of the valves of females is not so readily visible as in the *"subcylindrica"* type but the size of the corresponding posterior hollow on the inner side of the valves is almost the same. The differences between the *"subcylindrica"* and *"ivisensis"* types can also be observed in the Upper Carnian of other regions. For example the *"subcylindrica"* type occurs in the euhaline-marine sediments of the Balaton Highland and the *"ivisensis"* type in the rather hyposaline Opponitz beds from Austria. The degree of development of the dorsal (sometimes also ventral) swellings and subdorsal (sometimes also ventral) depressions could be phenotypic characteristics (as in *Hungarella limbata,* see Urlichs, 1971). Specimens without any thickenings or depressions in the dorsal (and ventral) parts of the RV could perhaps be regarded as separate subspecies. Unfortunately, the holotype of *Reubenella ivisensis* is illustrated by drawings and it is not clear, whether the subdorsal depression and mid-dorsal thickening is absent, as figured by Kristan-Tollman & Hamedani (1973), or present. Kristan-Tollman (in Kristan-Tollmann & Hamedani, 1973) has apparently omitted the depression and swelling in the mid-dorsal parts of *R. ivisensis* from her drawing. With changes of facies *"subcylindrica"* and *"ivisensis"* types alternate with the former type dominating in euhaline sediments and the latter type in more hyposaline sediments. Moreover, all transitions occur between the two types in the whole known stratigraphic range of *Reubenella fraterna* (Reuss). Thus *R. ivisensis* Kristan-Tollmann & Hamedani, 1973 is a younger synonym of *R. fraterna* (Reuss, 1867). Further investigations must decide whether specimens without a depression or swelling in the mid-dorsal and mid-ventral parts of the RV can be separated as a subspecies. If they can be separated, *R. ivisensis* becomes a younger synonym of *R. fraterna* (Reuss, 1867) and forms with depressions and swellings may be separated as *Reubenella fraterna sandbergeri* (Coryell, 1963).

Résumé

Des ostracodes ont été signalés pour la première fois dans des séquences Triasiques épimétamorphiques fortement tectonisées dans la partie interne des Cordillères Bétiques. Trois zones d'Ostracodes ont été établies. Les zones inférieure et moyenne sont attribuées au Ladinien supérieur (Longobardien) et la zone supérieure au Carnien inférieur (Cordevolien). Plusieurs nouvelles espèces et sous-espèces sont décrites. La microfaune, et en particulier les Ostracodes, parait être très utile pour la datation précise des séquences triasiques de la Zone Bétique. Ceci a permis d'elaborer plusieurs nouvelles conclusions sur la stratigraphie, mode de déposition et tectonique des séquences triasiques.

Resumen

Por primera vez se señala la presencia de Ostrácodos en series de rocas triásicas, epimetamórficas, muy tectonizadas, procedentes de la zona interna de las Cordilleras Béticas. Se establecen tres zonas de Ostrácodos. Las zonas inferior y media se atribuyen al Ladiniense superior (Longobardiense) y la zona superior al Carniense inferior (Cordevoliense). Se describen varias nuevas especies y subespecies. La microfauna — y especialmente los Ostrácodos — parecen ser muy útiles para establecer una datación muy precisa de las series triásicas en la Zona Bética: lo que ha permitido sacar conclusions acerca de la estratigrafía, sedimentación y tectónica de las series triásicas.

Zusammenfassung

Zum ersten Mal werden Ostracoden aus epimetamorphen, tektonisch stark beanspruchten triassischen Gesteinsfolgen der inneren Teile der Betischen Kordillere beschrieben. Es wurden drei Ostracoden-Zonen aufgestellt. Die untere und mittlere Zone wird zum Oberladin (Longobard) gestellt, die obere zum Unterkarn (Cordevol). Mehrere neue Arten und Unterarten werden beschrieben. Die Mikrofaunen — besonders die Ostracoden — sind sehr wichtig für eine präzise Einstufung der

Triasfolgen der Betischen Zone. Ihre Untersuchung erlaubte, mehrere neue Rückschlüsse hinsichtlich der Stratigraphie, der Ablagerungsbedingungen und der Tektonik der untersuchten Triasfolgen zu ziehen.

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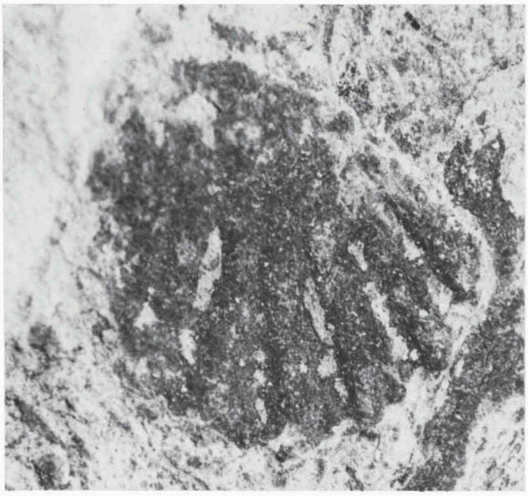
PLATE 1

1. *Placunopsis flabellum* Schmidt (4.3 x). Sample Si 769/1, Bermejo unit, Sierra de Orihuela.
2. *Placunopsis flabellum* Schmidt (2.7 x). Sample Si 133/70, Bermejo unit, Sierra de Orihuela.
3. *Costatoria kiliani* (Schmidt) (2.6 x). Sample Si 422/65, Romero unit, variegated carbonate member, keybed 1, Sierra de Carrascoy (area 1).
4. *Elegantinia betica* (Hirsch) (4 x), holotype. Sample Ba 522, intermediate unit, Sierra Alhamilla (area 8). See also Hirsch (1966b).
5. *Elegantinia betica* (Hirsch) (2.5 x). Sample Si 51/73, Orihuela unit, basal part Aguila formation, Sierra de Orihuela (area 3).

PLATE 1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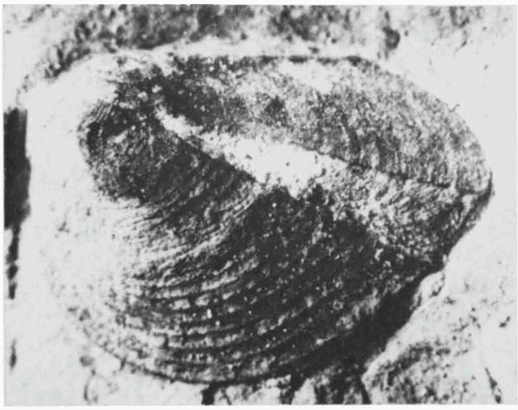
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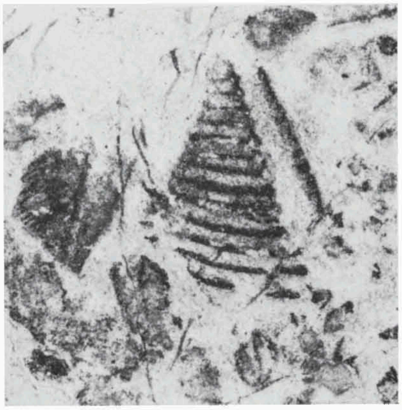
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PLATE 2

(all figures about 60 x)

1, 2. *Judahella tsorfatia* Sohn, 1968, fig. 1: LV, ♀, fig. 2. RV, ♂, both from sample Si 757/67

3, 4. *Judahella pulchra posterospinosa* n. subsp., LV, sample Si 45/71, fig. 3. holotype.

RV, sample Ka 40 A/71, fig. 8. LV, sample Ka 40 A/71.
5 - 8. *Lutkevichinella ? egeleri* n. sp., fig. 5: RV, holotype, sample Ka 541/67, figs. 6, 7:

9 - 13. *Falloticythere mulderae* n. gen. n. sp., fig. 9. LV, ♀, holotype, sample Ka 40 B/71, fig. 10. LV, ♂, sample Ka 40 B/71; fig. 11: LV, juvenile specimen, sample Ka 541/67; fig. 12: LV, ♂, sample Ka 541/67; fig. 13: LV, ♀, sample Ka 40 B/71.

14 - 19. *Falloticythere rondeeli* n. gen. n. sp., fig. 14: LV, ♀, holotype, sample Ba 142; fig. 15: RV, juvenile specimen, sample Ba 142; fig. 16: LV, ♀, sample Ba 142; fig. 17: LV, ♂, sample Ba 142; fig. 18: RV, ♀, sample Ba 122; fig. 19: carapace, ♀, sample Ba 122, a) dorsal view, b) ventral view.

20. Transitional form between *Falloticythere rondeeli* n. gen. n. sp. and *Mostlerella blumenthali blumenthali* n. sp., RV, ♀, sample Si 45/71.

21. *Falloticythere rondeeli* n. gen. n. sp. ♂, very highly developed specimen, sample Si 45/71.

22 - 24. *Mostlerella blumenthali minuta* n. subsp., LV, sample Si 45/71; fig. 22: ♂, holotype; fig. 23: ♂, fig. 24: ♀.

25 - 28. *Mostlerella blumenthali blumenthali* n. sp., fig. 25: carapace, sample Si 540/65, a) dorsal view, b) ventral view; fig. 26: LV, ♀, holotype, sample Si 540/65; fig. 27: RV, ♀, somewhat oblique lateral view, sample Ka 83 C/72; fig. 28: LV, ♂, sample Ka 83 C/72.

PLATE 2

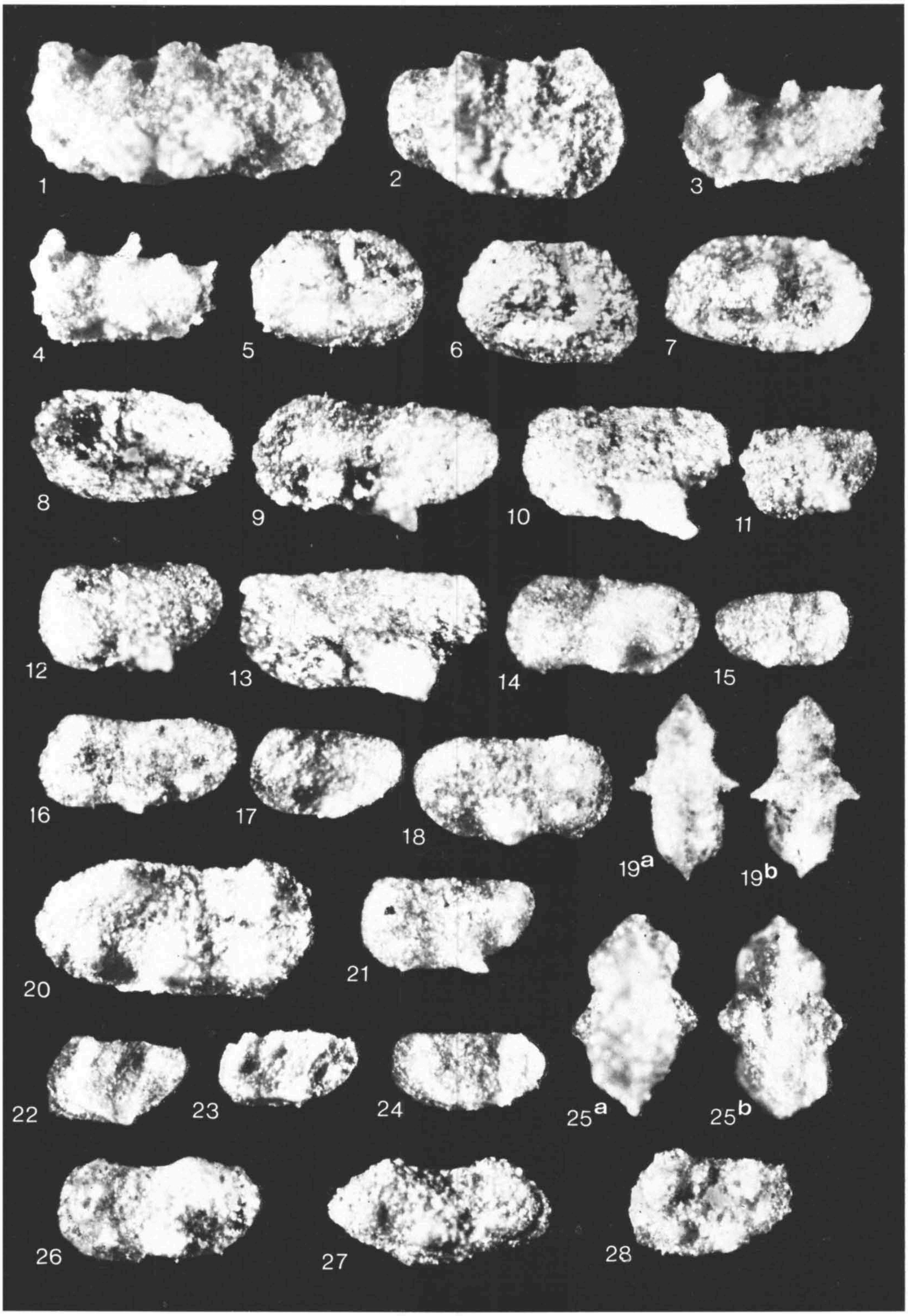
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PLATE 3

(all figures about 110 x, fig. 1 about 100 x)

1, 2. *Kuehnites schallreuteri* Kozur & Simon, 1972, fig. 1: sample Ka 184 H/72; fig. 2: sample Kp 1.

3, 4. *Theelia zankli* Kozur & Simon, 1972, upper view, sample Ka 184 H/72.

5, 6. *Acanthotheelia mostleri mostleri* Kozur & Simon, 1972, upper view, sample Kp 1; fig. 5 with some similarities to *A. mostleri brouweri* Kozur & Simon, 1972.

7, 8. *Acanthotheelia mostleri brouweri* Kozur & Simon, 1972, fig. 7: sample Kp 3; fig. 8: sample Ka 184 H/72, specimen with strong similarity to *A. anisica* Mostler, 1968, distinguished from this species above all by strongly convex hub.

9 - 11. *Theelia tubercula tubercula* Kristan-Tollmann, 1963, fig. 9: upper view, sample Kp 3; fig. 10: lower view, sample Kp 3; fig. 11: upper view, sample Ba 518.

12. *Acanthotheelia oertlii* Kozur & Simon, 1972, upper view, sample Kp 1.

13. *Theelia magnidentata* Kozur & Simon, 1972, upper view, sample Kp 1.

14. *Theelia krystyni* Kozur & Simon, 1972, lower view, sample Kp 1.

15. *Theelia barkeyi* Kozur & Simon, 1972, sample Ba 518, a) upper view, b) lower view.

PLATE 3

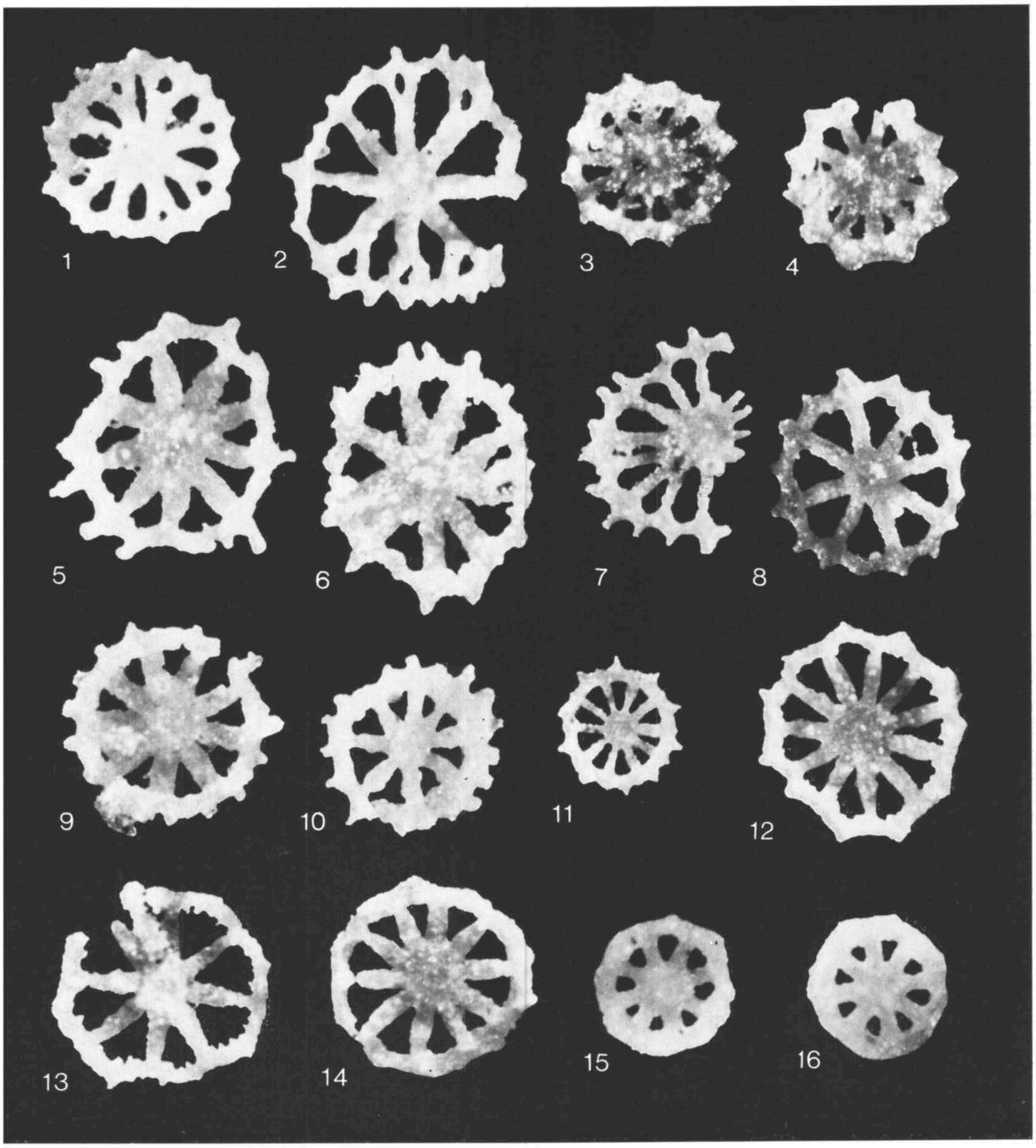

PLATE 4

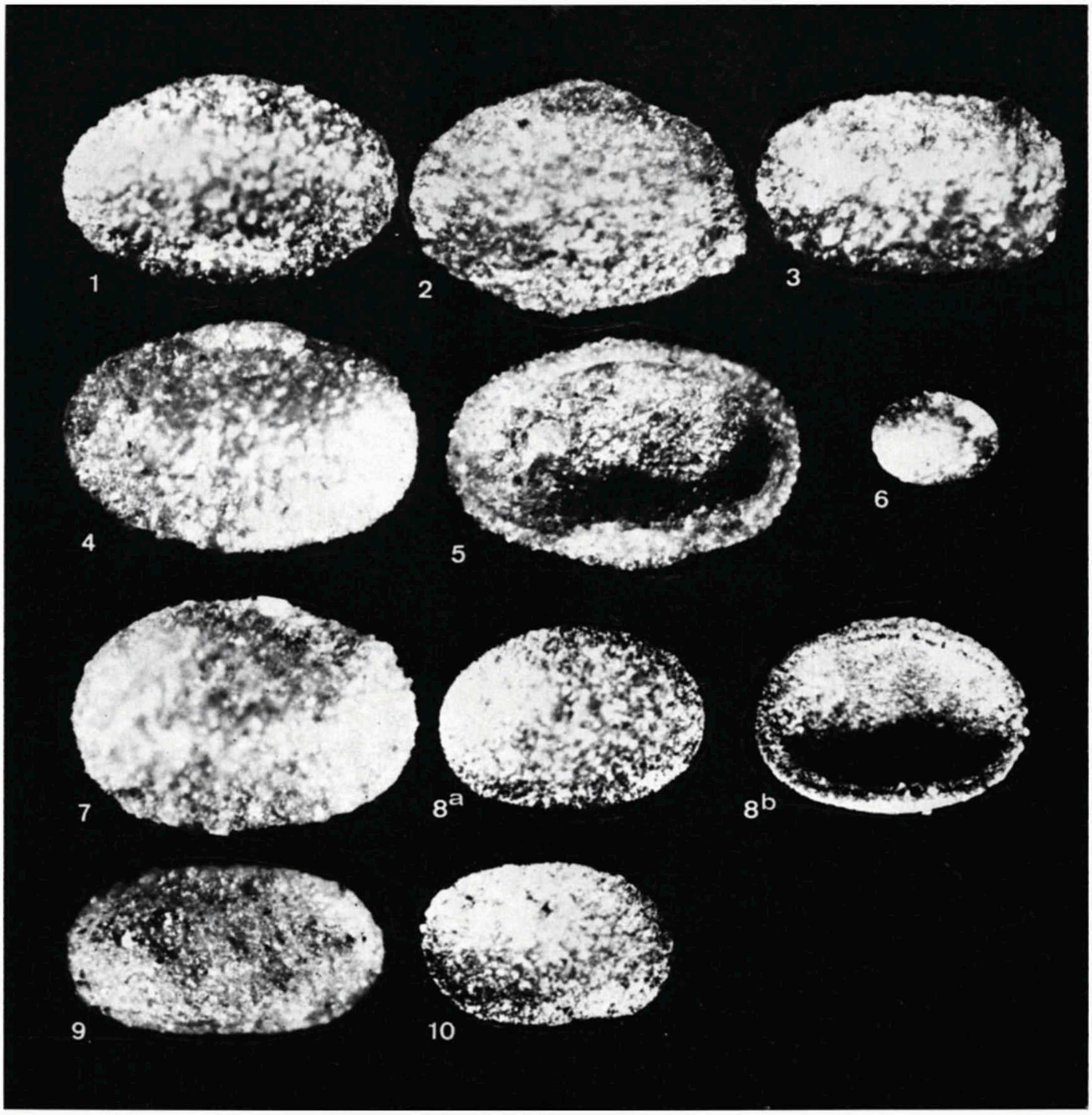

PLATE 4

(all figures about 60 x)

1 – 10. *Reubenella fraterna* (Reuss, 1867), figs. 1, 2, 4, 5: RV with distinct swellings and depressions in the mid-dorsal and mid-ventral parts; figs. 1, 2: ♂; figs. 4, 5: (inner view), ♀: fig. 3: LV, ♀; all from the sample Si 40/71; fig. 6: RV, juvenile specimen, sample Si 541/65; figs. 7, 8: RV without any swelling and depression in the mid-dorsal and mid-ventral parts; fig. 7: ♀, sample Ka 267/67; fig. 8: ♂, sample Ka 267/67, a) outer view, b) inner view; fig. 9: LV, sample Ka 267/67; fig. 10: LV, sample Si 541/65.

ENCLOSURE KOZUR ET AL., CONTRIBUTION TO THE TRIASSIC OSTRACODE FAUNAS OF THE BETIC ZONE, SCRIPTA GEOL., 23 (1974)

DISTRIBUTION OF OSTRACODES AND RELATIVE QUANTITIES OF OTHER FAUNAL ELEMENTS

AREA	SAMPLE	OSTRACODES	CONODONTS	FORAMINIFERA	HOLOTHURIAN SCLERITES	FISH REMAINS	GASTROPODS	ECHINODERMS	REMAINS OF CRUSTACEANS OTHER THAN OSTRACODES	*Falloticythere mulderae* Zone							*Falloticythere rondeeli* Zone									*Mostlerella blumenthali* Zone									
										Falloticythere mulderae	*Judahella tsorfatia*	*Leviella sohni*	*Lutkevichinella ? egeleri*	*Lutkevichinella* sp. 1)	*Triassocypris* sp.	*Cytherellidae* (gen. and sp. indet.)	*Falloticythere rondeeli*	*Falloticythere mulderae* 2)	*Acratina muelleri*	*Acratina* cf. *goemoeryi*	*Judahella tsorfatia*	*Leviella sohni*	*Triassocypris* sp.	*Aglaiocypris* sp.	*Lutkevichinella* sp.	*Mostlerella blumenthali blumenthali*	*Mostlerella blumenthali minuta*	*Leviella bentori*	*Judahella pulchra posterospinosa*	*Reubenella fraterna*	*Reubenella* cf. *avnimelechi*	*Paracypris ?* sp.	*Falloticythere rondeeli* 2)	*Triassocypris* sp.	*Lutkevichinella* sp.
SIERRA DE CARRASCOY (1)	KA 84/72	□				○	○		○																					X					
	KA 940 A/67	○				○	○		○																	X				X		X			
	KA 875/67	□	○																							X						X			
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	KA 83 D/72	□	○			○																								X					X
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	KA 83 B/72	□		○		○			○																					X					
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	KA 305/67	□	○	○		○	○		○																					X		X			
	KA 86/72	□	○			○	○		○																	X				X					
	Si 544/65	□	□			□	○		□																	X				X					
	Si 542 A/65	□	□			□	○		□																					X					
	Si 542/65	□	□	○		□	□		□																					X					
	Si 541/65	□	○			□	○		□																					X					
	Si 293/64	□	○			○																				X				X					
	Si 292/64	□	○	○		○	□		□																					X					
	KA 85/72	□				○			○																					X					
	KA 331 II/67	□		○		○																				X				X					
	KA 278/67	□	○	○		○	○		□																					X					
	KA 271/67	□	○	○		○			○																	X				X					
	Si 540/65	□		□																						X			X	X		X	X?		
	Si 537/65	□	○	○																										X		X			
	Si 535/65	□																												X					X
	Si 533/65	○																												X					X
	KA 541/67	□		○		○				X			X		X																				
	KA 40 E/71	□		○						X			X																						
	KA 163/67	○		○		□			□	X			X		X																				
	KA 153/67	□	○	□		□			○						X																				
	KA 40 B/71	□				○				X			X																						
	KA 40 A/71	□		○		○				X			X																						
	KA 39 O/71	□		○		○	○				X	X	X			X																			
	KA 39 N/71	□							○	X			X																						
	KA 39 L/71	□											X																						
	KA 39 J/71	□	○	□		○	○					X				X																			
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	KA 39 G/71	□	○			□							X		X																				
	KA 39 D/71	○				○							X		X																				
	KA 39 C/71	□		○		□			□				X																						
Sª DEL PUERTO (2)	KA 184 H/72	○			□				□																					X					
	Si 40/71	□				○	○																							X					
	Si 37/71	□	□			□	□																							X					
	Si 36/71	□	○			○	○		○																					X					
	Si 32/71	○																												X					
	Si 31/71	□	○			□	○																							X		X			X
	Kp 83	○	□	○	○	○			○																					X					
	Kp 1	○	○		○	□			□																					X					
Sª DE ORIHUELA (3)	Si 54/71	○												X																					
	Si 53/71	□				○	○							X																					
	Si 122/70	□				□								X																					
	Si 52/71	□		□		□									X																				
	Si 34/70	□	○	□		○				X																									
										TECTONIC							CONTACT																		
	Si 223/72	○						□																						X					
	Si 11/71	○	○	○		○		○	○																					X					
	Si 7/71	□	○			○																				X				X					
	Si 4/71	□	○			○																								X					
(4)	DU U 19	□	○			○			□																					X					
(5)	KA 210 C/72	○				○																								X					
	KA 210 B/72	□				□			□																					X					
(6)	Si 783/67	□	○	○		□																				X?					X				
(7)	Si 45/71	□	○			○																				X	X	X	X			X	X		
Sª ALHAMILLA (8)	BA 146	○				○											X																		
	BA 142	□		○		○											X		X						X										
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	BA 129	○		○		○	○										X		X	X			X		X										
	BA 122	○		○		○											X	X	X																
	BA 116	○															X		X					X	X										
(9)	Si 757/67	□	○	□		□	□										X		X		X	X	X												

□ = ABUNDANT ○ = SCARCE X = PRESENT

1) POSSIBLY *Lutkevichinella ? egeleri*
2) HIGHLY DEVELOPED TYPES