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NEW DATA ON THE LOWER CAMBRIAN TRILOBITES OF CORTIJOS DE MALAGON (SPAIN)

M.ª D. Gil Cid* and J. B. Jago**

RESUMEN

En este trabajo se describe la fauna de trilobites del Cámbrico inferior de las areniscas de los Cortijos de Malagón en el SE español. Comprende *Realaspis* (?) sp., *Kingaspis* (?) sp.; cf. *Latoucheia* sp. y *Lusatiops* aff. *ribotanus.* Richter y Richter, 1948.

Palabras clave: *Cámbrico, Trilobites, Cortijos.*

ABSTRACT

A Small trilobite fauna from the late Lower Cambrian Sanstones from Los Cortijos de Malagon of Southern Spain is described herein. This fauna includes the following taxa: *Realaspis* (?) sp.; Kingaspis (?) sp.; cf. *Latoucheia* sp. and *Lusatiops* aff. *ribotanusd,* Richter and Richter, 1948.

Key words: *Cambrian, Trilobites, Cortijos.*

General remark on the Lower Cambrian of the Toledo Mountains geographical and geological estting of the outcrops

The Lower Cambrian Locality of Cortijos de Malagón is situated in the South east of the Toledo Mountains, within the Ciudad Real Province. Casiano de Prado found in 1855 the called «primordial Fauna» in the sandstone which namend *Sandstone with Ellipsocephallus;* Douville, in 1911 gave a section in the Cortijos with three term (figs. 1 and 2).

3. Quartzites with *Bilobites* and *Cruziana* dipping east.
2. Grey Sanstones with *Fucoides.*
1. Stratigraphical gap.
1. Samdstone with *Ellipsocephalus pradoanus,* AN-S stricke 40°-50° east dip.

Casiano de Prado in 1934 gave outcrop in Porzuna; in 1955 Hans-Klaus Weggen in this Dissertation named «Stratigraphie und Tektonik der Südlichen Montes de Toledo» devotes in the II (second) chapter part A Cambrian and subpart A-b the Stratigraphy of Cortijos de Malagón. In this section there are five stratigrafhical units from top to bottom:

5. Fossiliferous sandstones.
4. Quartzite series.
3. Sandstone-shale alternation.
2. Green sandstone with plenty of shale.
1. Clear green bigth argillite.

The unit 5 of weggen is what holds our interest as we found in it the Trilobite fauna object of this study. In figure 3 we point the levels where the fossil faune is found included in the unit 5.

Relative stratigraphic position of the Cambrian rocks of Cortijos de Malagón

The Cortijos de Malagón section yielded a fauna of trilobites (Sdzuy, 1961) and molluscos (Gil Gil, 1981) of late Lower Cambrian age; perharps comparable with the Celtiberian Lower Cambrian sequence (NE Spain) Sdzuy, 1971, p. 757, pointed on the possible relation beetween *Realaspis* and *Onaraspis* of Australia with the «middle Cambrian Without Paradoxides» (Sensu Opik, 1968). This is equivalent to the Bilbilian stage (Sdzuy, 1971) (=unterkambarium C of Lotze, 1961) characterized by Protolenidae,

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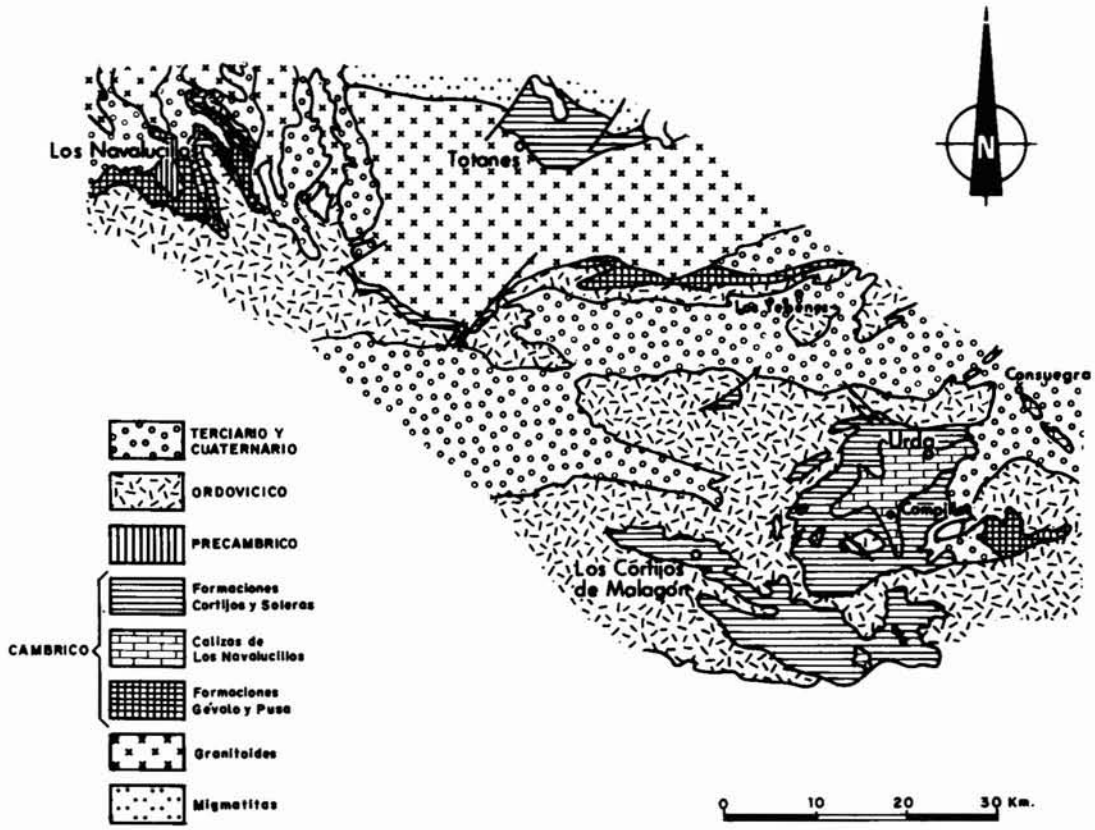

Fig. 1.—Geological squetch of the zone near to Cortijos de Malagón and his relative position respect to other outliers of lower Cambrian of the Toledo Monts. (Totanes, Los Navalucillos). Aparicio (19711), Roiz 91979), Martín Escorza (1976).

Fig. 2.—Geographical localization of the outcrops of the «Cortijos de Malagón» (Ciudad Real).

Elliosocephalidae, Redlichidae, and the absence of Olenelidae.

After Sdzuy 1971, the Cortijos fauan could be equivalent in the Iberian Ranges to the Daroca Sandstone (Realaspis Pseudolensus-Kingaspis -*zone*) beloging to the Bilblilian stage.

This could be correlated with Aquiliz in the Anit-Atlas of Marruecos and Lena in Siberia. In the Iberian peninsula and within the pre-Ordovician succession of the Toledo Mountains, the trilobites fauna of Cortijos represent the highest Cambrian fossiliferois levels.

Deposit of material: Departemento de Paleontología. Facultad de Ciencias Geológicas. Universidad Complutense de Madrid.

Systematic palaeontology

All fossils described below have undergone tectonic distortion. The terminology used herein with respect to distortion is the same as that used by Jago (1976) which is based on Henningsmoen (1960). With the exception of the specimen shown in pl. 2, fig. 12, all photographs are of latex or silicone rubber casts whitened with magnesium oxide. The specimen shown in pl. 2, fig. 12 isa preserved in fine sandstone. The terminology used below is after Harrington *et al.* (1959).

Order REDLICHIIDA Richter, 1933
Suborder REDLICHIINA Harrington, 1959
Family REDLICHIIDAE Poulson, 1927
Genus Realaspis Sdzuy, 1961.

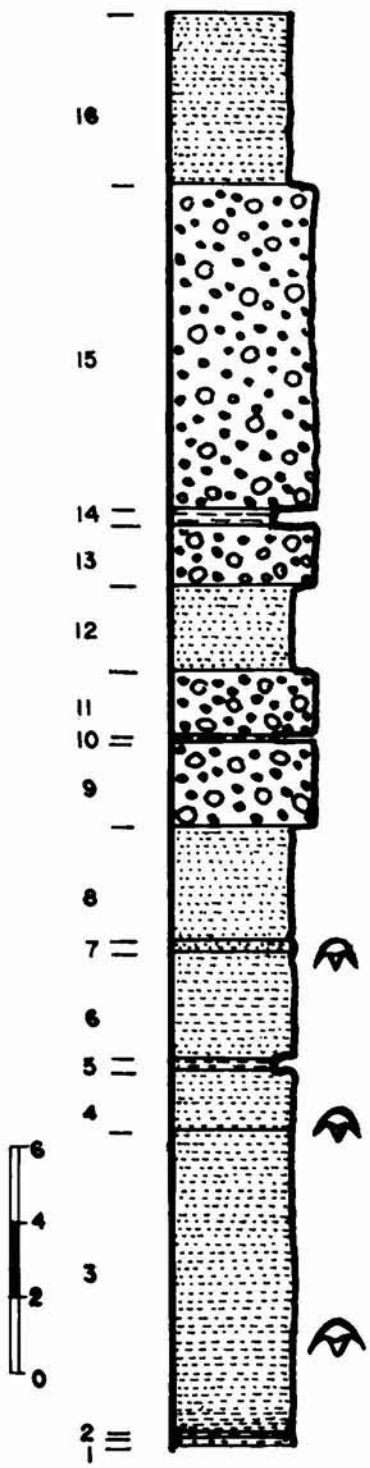

Fig. 3.—Stratigraphical section of the group 5 of Weggen showing the fossiliferous levels with trilibites.

Type Species: Realaspis strenoides Sdzuy 1961, p. 254. pl. 4, figs. 1-34, text-fig. 3.

Diagnosis: See Sdzuy 1961, p. 535.

Realaspis (?) sp.
Pl. 2, figs. 2, 5, 10

Remarks: Two poorly preserved cranidia (CO71, CO79) and one poorly preserved pygidium (CO88) are placed with some hesitation in *Realaspis.* The type species of *Realaspis, R. strenoides* was described by Sdzuy (1961) from Los Cortijos. The two cranidia figured herein are similar to those figured as *R. strenoides* by Sdzuy (1961, p. 4) in that the galbella extends to the interior border furrow. The pygidium figured herein (Pl. 2, fig. 10) is similar to those figured by Sdzuy (1961 pl. 4, figs. 18-24) for *R. strenoides.*

Family ELLIPSOCEPHALIDAE Matthew, 1887
Subfamily KINGASPIDINAE Hupé, 1953
Genus Kingaspis Kobayashi, 1935

Type Species: Anomocare campbelli King, 1923, p. 511, figs. 3-4

Diagnosis: See Hupé, 1953, p. 253.

Discussion: Kobayashi 91935, p. 196) erected *Kingaspis* based on specimens described by King (1923) as *Anomocare campbelli* from the eastern side of the Dead Sea. Richter and Richter 91941b) subsequently described *campbelli* from the same area, but included it in *Palaeolenus.* Sdzuy (1961, pl. 16, figs. 1a-d) refigured some of the Richter's material as *Kingaspis campbelli.* Parnes (1971) described and figured two cranidia of *Kingaspis campbelli* from the Negev.

Hupé (1953, p. 252) discussed the genus in some detail and erected two subgenera, *Kingaspis (Kingaspis)* and *K. (Kingaspidoides)* with the differentiation between the subgenera based on the presence of an occipital spine in *K. (Kingaspidoides)* and the absence of one in *K. (Kingaspis).* Hupé (1953, p. 254) described several specimens from the upper part of the Lower Cambrian of Morocco as *K. (Kingaspis) campbelli,* but as noted by Parnes (1971, p. 202) and represent a different species.

Hupé (1953,p. 255) described two other species within *K. (Kingaspis), K. (K.) brevifrons* and *K. (K.) alatus.* An inspection of rubber casts of the holotypes of both *K. (K) campbelli* and *K. (K) brevifrons* indicates that they are very similar. However, the holotype of *brevifrons* appears to showw the base of a broken occipital spine and hence would belong in *Kingaspidoides* under Hupe's subgeneric classification. However, in all other respects *brevifrons* is so close to *campbelli* that it is clear that they should be placed in the same subgenus. This also suggests that Hupe's subgeneric divisions are of little value. The new species described by Hupe as *K. (Kingaspis) alatus* has much wider and deeper axial furrows than *campbelli* as well as having a glabella which does not show an anterior expansion. Hence it is probable that *alatus* does not belong in *Kingaspis* but rather in another genus of the Ellipsocephalidae.

Hupé (1953) erected two species which he placed in his new subgenus *Kingaspidoides*, i.e. *K. (K.) armatus* and *K. (K.) triangularis*. Of the three cranidia figured as *k. (K.) armatus*, that figured by Hupé as pl. 11, fig. 13 seems to have a glabella which tapers evenly forwards rather than having an anterior expansion; if this is the case then this specimen does not belong in *Kingaspis*.

Hupé (1953) erected a new subfamily, the Kingaspidinae which included the two subgenera of *Kingaspis* as well as *Mesetaia*, a move followed by Henningsmoen (1959) and Repina (1966). Sdzuy (1961) described *Kingaspis velatus* and *K.* cf. *velatus* from the Lower Cambrian of Spain. They are poorly preserved and do not add anything to the concept of the genus; however they are briefly discussed below in the discussion of *Kingaspis* (?) sp. Sdzuy (1961, p. 307) suggested that the species included by Hupé (1953) in *Kingaspidoides* might be better placed with *Strenuella* in the Ellipsocephalinae. Sdzuy included *Kingaspis* in the Palaelolininae.

Orlowski (1964) described a new species of *Kingaspis, K. henningsmoeni* from the Middle Cambrian *Paradoxises oelandicus* Zone from Poland. Orlowski included the Kingaspidinae in the Ellipsocephalidae as did Bergstr̈om (1973). However, Bergstrom included the Ellipsoceephalidae within the Ptychopariida, unlike previous authors such as Hupé (1953), Henningsmoen (1959), and Repina (1966) who placed the Kingaspidinae within the redlichiids.

Ahlberg and Bergstr̈om (1978, p. 9) suggest that *Kingaspis* has a «primitive» appearancee because it has 4 to 5 glabellar furrows and eye ridges which merge with the glabella without being terminated by the dorsal furrows. However, an inspection of a rubber cast of the specimens of *K. campbelli*, originally figured by King (1923, figs. 3, 4b) and of the holotype of *K. brevifrons* originally figured by Hupé (1953, pl. 11, fig. 8) suggests that the eye ridges may be terminated by the axial furrow. The rather effaced nature of the specimens does not allow certainty with regard to this point. However, the situation with respect to the ehe ridges merging with the glabellarl anterior is by no means as clear cut as woulld be suggested by the figures of *Kingaspis* given by Hupé (1953, fig. 63A), Henningsmoen (1959, fig. 148, 12) and Ahlberg and Bergstrom (1978, fig. 3).

Kingaspis (?) sp.
Pl. 1, figs. 1-8

Material: About twenty poorly preserved cranidia and possibly one librigena are assigned to this species.

Description: Length of gently convex glabella (including occipital ring) is about 0.75 that of cranidium. Between the palpebral lobes glabella has width abaout 0.5 that of cranidium. Glabella tapers slightly forwards to a slightly expanded bluntly rounded anterior. Axial and preglabellar furrows very gently impressed. Preglabellar field slopes gently down to very shallow border furrow, which is visible in only a few specimens (e.g. CO156, Pl. 1, fig. 3). Narrow borderr. Shallow occipital furrow. Four faintly developed lateral glabellar furrows visible on some specimens (e.g. CO90, Pl. 1, fig. 1). Small centroposteriorly placed palpebral lobes; very shallow palpebral furrow. Poorly developed eye ridges. Palpebral areas of fixigenae almost flat; shallow posterior border furrow. Preocular sections of facial suture slightly divergent; postocular sections of facial suture diverge slightly. The poorly preserved librigena (CO153, Pl. 1, fig. 8) may belong in this species.

Discussion: The specimens included in this species are rather effaced as well as being considerably distorted. The considerable tectonic distortion undergone by the specimens can be seen by comparing the two specimens on CO90 (Pl. 1, figs. 1 and 2), which are oriented at right angles on the rock slab. Hence it is felt that they should not be definitely assigned to any previously described genus or species. However, they could well belong in *Kingaspis* in which genus they are tentatively placed. Characters which suggest assignment to *Kingaspis* are the effaced nature of the cranidium and the slightly expanded nature of the anterior part of the glabella. The length and width of the glabella in relation to those of the cranidium are also similar to previously described species of *Kingaspis* such as *K. campbelli* and *K. brevifrons*.

Sdzuy (1961, p. 310) described *Kingaspis* cf. *velatus* from los Cortijos. It is not certain if the specimens described herein belong in the same species as *Kingaspis* cf. *velatus* of Sdzuy due to the poorly preserved nature of both Sdzuy's specimens and those figured here. Similarly it is difficult to make a meaningful comparison of *Kingaspis* (?) with *Kingaspis velatus* as described by Sdzuy (1961, p. 308, pl. 15, figs. 1-8).

Kingaspis (?) sp. differs from both *Pseudolenus weggeni* and *P. glaber* of Sdzuy (1961) from los Cortijos in that the glabella of both *weggeni* and *glaber* are more tapered and the anterior of the glabella more sharply rounded thant that of *Kingaspis* (?) sp. The glabella of *Kingaspis* (?) is more effaced than that of *P. weggeni*.

Family PROTOLENIDAE Richter and Richter, 1948

Subfamily PROTOLENINAEE Richter and Richter, 1948

Genus Latoucheia Hupé, 1953

Type Species: Protolenus latouchei Cobbold 1910, p. 42, pl. 7, figs. 1-6.

Diagnosis: See Hupé 1953, p. 218.

Discussion: Cobbold (1910, 1931) and Lake (1934) described *Protolenus latouchei* from Shropshire, England. Based on this material plus specimens from Morocco, Hupé 91953, p. 48) erected a new subgenus of *Protolenus*, viz *P. (Latoucheia)* with *P. (L) latouchei* as the subgenotype, a move followed by Henningsmoen

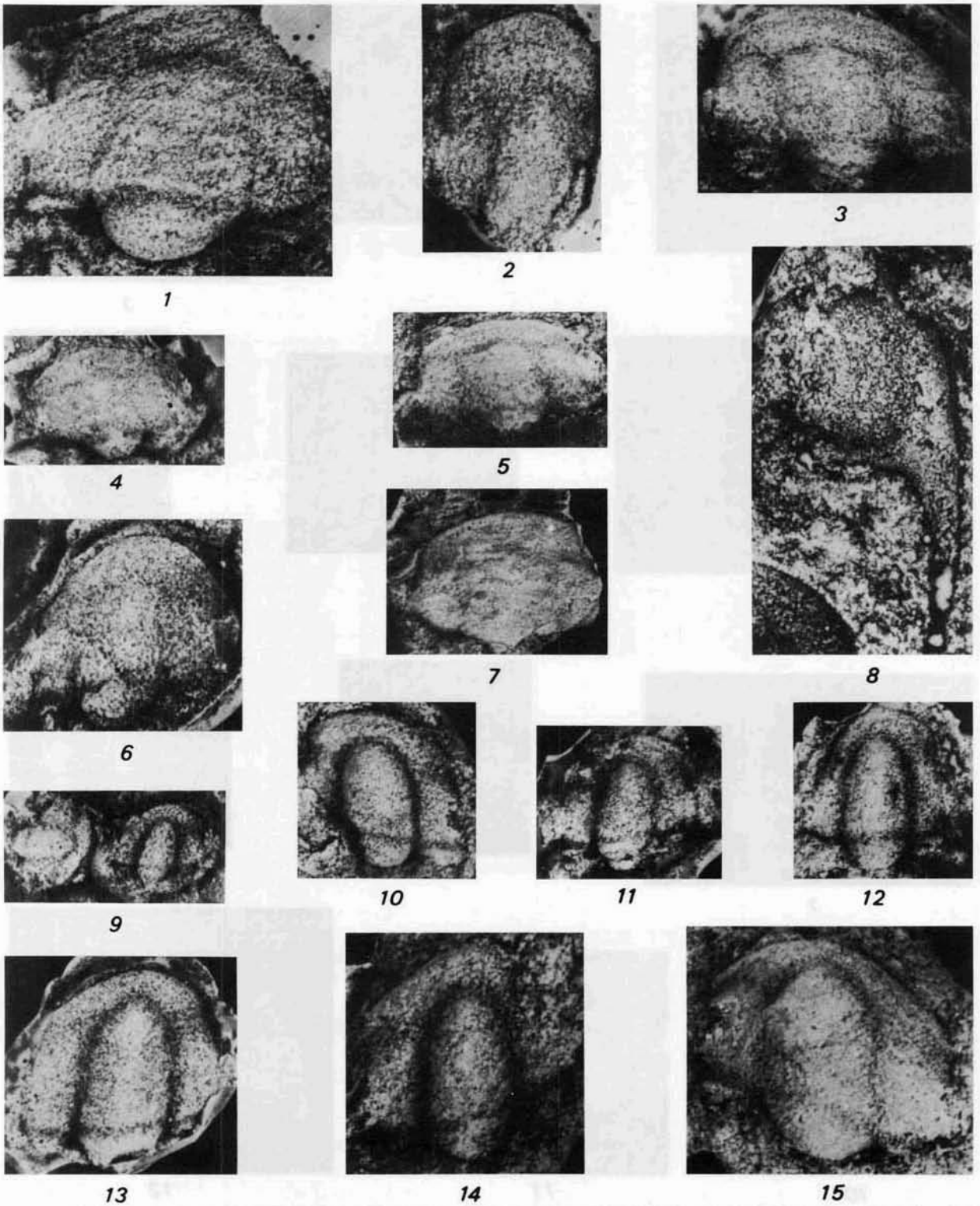

Plate 1.—1-8 *Kingaspis* (?) sp. 1, CO90, cranidium, internal mould; W form, x3. 2,CO90, cranidium, itnernal mould; L form, x3. 3,CO156, cranidium, internal mould; W form, x2. 4,CO75, cranidium, internal mould; W form, x3. 5,CO64, cranidium, internal mould, W form, x2.5. 6,CO86, cranidium, internal mould; intermediate distortion, x2.5. 7,CO78, cranidium, external mould, W form, x2. 8, CO153, librigena, internal mould, x3.—9-15. cf. *Latoucheia* sp. 9, CO154, two cranidia, internal moulds, intermediate distortion, x2. 10, CO65, cranidium, external mould, intermediate distortion, x2. 11, CO81, cranidium, internal mould, W form, x2. 12, CO82, cranidium, internal mould, L. form, x2. 13, CO84, cranidium, internal mould, intermediate distortion, x2 14, CO65, cranidium, external mould, intermediate distortion, x3. 15, CO65, cranidium, external mould, intermediate distortion, x4.

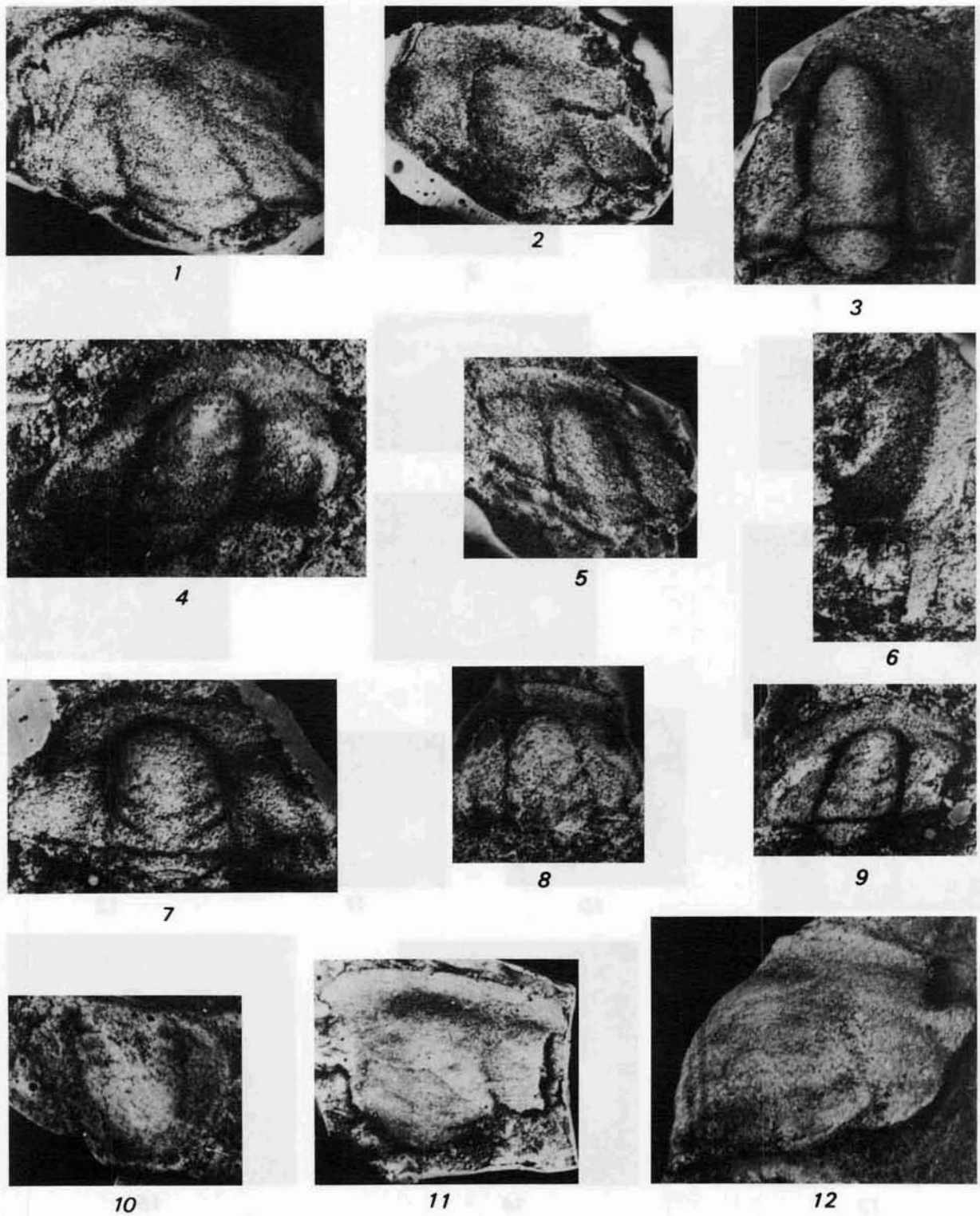

Plate 2.—1, 3-4, 6-9. *Lusatiops* cf. *ribotanus*. 1, CO69, cranidium, internal mould, intermediate distortion, x2. 3, CO158, cranidium, internal mould, L. from, x3. 4, CO61, cranidium, external mould, intermediate distortion, x4. 6, CO152, librigena, internal mould, x3. 7, CO72, cranidium, internal mould, W form, x3, 8, CO156, cranidium, internal mould, W form, x3. 9, CO151, cranidium, internal mould, intermediate distortion, x2.—2, 5, 10. *Realaspis* (?) sp. 2, CO79, cranidium, internal mould, intermediate distortion, x2. 5, CO71, cranidium, internal mould, intermediate distortion, x2.5. 10, CO88, pygidium, internal mould, intermediate distortion. x3. 11-12. Cranidium, gen. et sp. indet. 11, CO66, internal mould, x2. 12, CO89, internal mould, x2.

(1959). Repina (1966, p. 122) regarded *Latoucheia* as a separate genus, which suggestion is followed herein.

cf. *Latoucheia* sp.
pl. 1, figs. 9-15

Material: About eight poorly preserved cranidia are assigned to this species.

Description: Allowing for distortion the cranidium is probably about as wide as is long. Length of strongly convex glabella (including occipital ring) about 0.8 that of cranidium; between the palpebral lobes glabellaa width about 0.5 that of cranidium. Posterior half of glabella is parallel sided; glabellalr anterior is broadly rounded. Axial and preglabellar furrows moderately impressed, shallow forwards. Very short preglabellar field. Border differentiated from anterior areas of fixigenae by very shallow border furrow which fades adaxially. Moderately impressed occipital furrow shallows adaxially. Lateral glabellar furrows almost completely effaced; there appear to be up to three pairs of very weakly developed lateral glabellar furrows in some specimens. Course of facial suture unclear although preocular sections appear to be divergent. Eye ridges poorly developed. Palpebral and posterior areas of fixigenae slope gently down to shallow posterior border furrow.

Discussion: The preservation of these specimens is such that erection of a new species or assignment to an existing species cannot be justified. However, the shape of the glabella and the position and path of the eye ridges; where visible, and the shape of the occipital ring suggest possible affiliation with *Latoucheia*. Some of the specimens are mcuh larger than those described from England (Cobbold, 1910, 1931; Lake, 1932) and Morocco (Hupe, 1953). The glabella of cf. *Latoucheia* sp. extends further forwards than that of either *L. latouchei* or *L. l. tichkaensis*. The lateral glabellar furrows of cf. *Latoucheia* sp. are more effaced than those of the published material, but this could be a function of preservaiton. It should be noted that the apparent expansion of the glabella in specimen CO65 (pl. 1, fig. 15) is due to the nature of the distortion of the specimen; the glabella inthis specimen in fact tapers evenly forwards.

Genus Lusatiops Richter and Richter, 1941

Type Species: Protelenus lusaticus Schwarsbach, 1934, p. 24, pl. 2, pp. 20, 21; pl. 2, figs. 22-31.

Diagnosis: See Richter and Richter, 1941a, p. 43.

Lusatiops cf. *ribotanus* Richter and richter, 1948
pl. 2, figs. 1, 3-4, 6-9

Material: About twenty cranidia and one librigena are assigned to this species. All specimens are poorly preserved. The specimens range from being rather flattened to moderately convex.

Description: Allowing for distortion the cranidium is probably about as wide as is long. Length of moderately convex glabella (including occipital ring) about 0.75-0.85 that of cranidium; between the palpebral lobes glabellar width is abaout 0.35-0.45 that of cranidium. Glabella tapers gently forwards to broadly rounded glabellar anterior. Axial and preglabellar furrows gently to deeply impressed depending on the preservation. Preglabellar furrows shallower than axial furrow. Very short preglabellar field slopes gently down to very gently impressed border furrow. Border slightly elevated above preglabellar field. Moderately impressed occipital furrow shallowest at centre. Three clearly developed pairs of lateral glabellar furrows; all are gently impressed and directed posteriorly. Shallow palpebral furrows. Long curved palpebral lobes extend from opposite the occipital furrow to where they meet the axial furrow just to anterior of the 3p furrows. A poorly developed parafrontal band may be present in CO72 (pl. 2, fig. 7), CO 156 (pl. 2, fig. 8) and CO151 (pl. 2, fig. 9). Anterior areas of fixigenae slope gently down to border furrow. Palpebral and posterior areas of fixigenae almost flat, but slope gently down to moderately impressed posterior border furrow. Narrow posterior border. Preocular sections of facial suture diverge slightly; postocular sections of facial suture nowhere well preserved.

The poorly preserved librigena assigned to this species has a wide border and a genal spine of unknown length.

Discussion: The specimens dealt with here are very similar to those described and figured as *Lusatiops ribotanus* by Richter and Richter (19148, p. 32, pl. 1, figs. 1-6) and by Sdzuy (1961, p. 284, pl. 8, figs. 2-14). They are also similar to latex clasts of *L. ribotanus* from the type locality, which were sent to JBJ by Prof. E. Liñan. However, because none of the specimens in question are particularly well preserved there remains some doubt that all specimens to indeed belong to *L. ribotanus*. Hence they are referred to *Lusatiops* cf. *ribotanus*.

Cranidia, gen. et sp. indet
pl. 2, figs. 11-12

Material: Two poorly preserved partial cranidia (CO66, CO89).

Remarks: These two cranidia have shallow axial, occipital and lateral glabellar furrows. There is a wide border. The eye ridges meet the axiala furrows close to the glabellar anterior. The preglabellar field is very short. These cranidia are too poorly preserved to warrant assignment to an existing genus or species.

Age of faunas

Lorze (1961), Sdzuy (1961, 1971) and Gil Cid (1973) have all considered the Los Cortijos faunas to be of Late Early Cambrian age. However, as shown by Sdzuy (1971, table 1) and Gil Cid (1973, table 1) the Los Cortijos faunas are not of latest Early Cam-

brian age. They occur in the lower part of the Bilbiliense Stage, the highest stage of the Spanish Lower Cambrian proposed by Sdzuy (1971). The problem of the position of the boundary between the Middle and Upper Cambrian on the Iberian Peninsula has been discussed by Liñan and Gozalo (1986, p. 85) who state that at Murero (Cordillera Iberica) the top of the Upper Cambrian sequence is characterized by the presence of several species of *Hamotelenus including H-ibericus, Alueva* and *Perrector* (?) *altus.* These species occur higher is the Lower Cambrian sequence than do those from Los Cortijos (see Sdzuy 1971, table 1, and Lotze 1961, p. 186).

None of the species described herein can be assigned to a previously described species and hence an exact age can not be obtained from the present study. However, some remarks are worth making on the subject.

Kingaspis velatus Sdzuy (1961, p. 308) is found low in the Lower Cambrian of Spain as shown by Lotze 91961, p. 186) where it is recorded as *Palaeolenus velatus.* As noted above *Kingaspis* cf. *velatus* has previously been recorded from Los Cortijos.

The three species described by Hupé (1953) as *Kingaspis cambelli, K. brevifrons* and *K. alatus* all occur close to the top of the Early Cambrian In Morocco. *Kingaspis campbelli* from the Dead Sea area is also of Late Early Cambrian age. Orlowski (1964) described *K. henningsmoeni* from the early Middle Cambrian *Paradoxides oelandicus* Zone of Poland.

Lusatiops ribotanus is found low in the Lower Cambrian along with *Kingaspis velatus* (see Lotze 1961, p. 186), but *Lusatiops* sp. of Sdzuy (1961) is found towards the top of the Lower Cambrian (Lotze 1961, p. 1816). In Morrocco, Hupé (1960, table 1) records *Lusatiops* from the upper part of the Early Cambrian (top of Tasousekhtien substage and Aguilizien substage) and the verry basal part of the Middle Cambrian. Hupé (1960, p. 81) lists an undescribed species of *Lusatiops* from the basal Middle Cambrian and records *L.* cf. *lusaticus* from the very top of the Early Cambrian. Associated with *Lusatiops* cf. lusaticus at this level in Morocco is *Latoucheia latouchei,* which is recorded by Hupé (1960, p. 81) as *Protolenus latouchei.*

In England, Rushton (1974, p. 97) records *Latoucheia* from the Protolenus Limestone, which falls within the Protolenid-Strenuellid Zone, the highest Lower Cambrian Zone in Britain (Cowie *et al.,* 1972, p.. 10).

In conclusionit would appear that the combination of *Kingaspis* (?) sp., *Lusiatops* cf. *ribotanus* and cf. *Latoucheia* sp. suggests a Late Early Cambrian age for the Los Cortijos area. This supports the earlier conclusion of Sdzuy (1971) and of Gil Cid (1973, table 1).

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