Late Carnian (Tuvanian, Tropites dilleri zone) ostracods (Crustacea) from the Mufara Formation (Monte Scalpello, Central-Eastern Sicily, Italy)

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Sylvie Crasquin, Francesco Sciuto, Agatino Reitano. Late Carnian (Tuvanian, Tropites dilleri zone) ostracods (Crustacea) from the Mufara Formation (Monte Scalpello, Central-Eastern Sicily, Italy). *Annales de Paléontologie*, 2018, 104 (2), pp.129-142. 10.1016/j.annpal.2018.03.001 . hal-02108580v2

HAL Id: hal-02108580

<https://hal.science/hal-02108580v2>

Submitted on 17 Dec 2020

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1 Late Carnian (Tuvalian, *Tropites dilleri* zone) ostracods (Crustacea) from the Mufara
2 Formation (Monte Scalpello, Central-Eastern Sicily, Italy).

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4
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11 Abstract

12 Ostracod association from the Upper Triassic (*Tropites dilleri* zone of the Carnian stage) of
13 the sedimentary succession (Mufara Formation) exposed along the east side of Monte Scalpello
14 (Catenanuova, central eastern Sicily) have been studied for the first time. The specimens, silicified,
15 are rare but well preserved and often consist of complete carapaces. They belonging to eight
16 families: Healdiidae, Cavellinidae, Bairdiidae, Acratiidae, Bythocyprididae, Pontocyprididae,
17 Judahellidae, Glorianellidae.

18 Twenty - three taxa have been listed; the family Bairdiidae is the most represented among all
19 the others with fifteen species. Four species are new: *Bairdia scaliae* n. sp., *Acratia maugerii* n. sp.,
20 “*Anchistrocheles*” *gemmellaroi* n. sp. and *Judahella?* *montanarii* n. sp. Other species are left in
21 open nomenclature because of the lack of specimens.

22 Résumé

23 L'association d'ostracodes de la succession sédimentaire du Trias supérieur (Carnien,
24 *Tropites dilleri* zone, Mufara Formation) affleurant du côté oriental du Monte Scalpello
25 (Catenanuova, Sicile centre-orientale) a été étudiée pour la première fois. Les spécimens, silicifiés,
26

sont rares mais bien conservés et se composent souvent de carapaces complètes. Les espèces appartiennent à huit familles: Healdiidae, **Cavellinidae**, Bairdiidae, Acratiidae, Bythocyprididae, Pontocyprididae, Judahellidae, Glorianellidae. La famille Bairdiidae est la plus représentée avec quinze espèces sur les vingt-trois répertoriées. Quatre espèces sont nouvelles: *Bairdia scaliai* n. sp., *Acratia maugeri* n. sp., “*Anchistrocheles*” *gemmellaro* n. sp. et *Judahella? montanarii* n. sp. D'autres espèces sont laissées en nomenclature ouverte.

Keywords: Ostracods: Late Triassic, Neo-Tethys, Central-Eastern Sicily, Mount Scalpello, Mufara Formation, palaeoenvironmental reconstruction, new species.

Mots-clefs: Ostracodes: Trias supérieur, Néotéthys, Sicile centre-orientale, Mont Scalpello, Formation Mufara, paléoenvironnement, nouvelles espèces.

1. INTRODUCTION

After the first studies on Mesozoic sediments cropping out in the Monte Scalpello area carried out since the early 19th century ([Calcara, 1840, 1845](#); [Nelli, 1899a, b](#); [Marinelli, 1899](#); [Gemmellaro, 1860, 1904](#)), the Upper Triassic fauna of "Clay-calcareous-arenaceous alternation" ("Flysch Carnico" *Auct.*), best referring to the "Mufara Formation" ([Schmidt di Friedberg and Trovò, 1962](#)) of the "Monte Judica Group" (Scalia, 1909) have been the subject of numerous palaeontological detailed studies on invertebrates: the molluscs have been studied by [Scalia \(1907, 1909, 1910, 1912, 1914\)](#), the cnidaria by [Maugeri Patanè \(1934\)](#), the ammonites by [Lentini \(1974\)](#), the foraminifers, chaetetids, sphinctozoans and other organisms by [Carrillat and Martini \(2009\)](#).

So far, ostracods (Crustacea) coming from the Mufara Formation in the Monte Scalpello area never have been studied; the only references to these organisms are found in [Lentini \(1974\)](#) which refers about a high level of the Mufara Formation rich in *Bairdiidae* and in [Carrillat and Martini \(2009\)](#) which cite, only the presence of this organisms.

The present paper, therefore, wants to be a first contribution to the knowledge of the ostracod fauna of the Mufara Formation clays outcropping in the Monte Scalpello area.

Furthermore, this analysis is an important step in the knowledge of the recovery of ostracod fauna after the Permian – Triassic massive extinction. The data on Middle and early Late Triassic are rare.

2. MATERIALS AND METHODS

Monte Scalpello is located (Fig. 1) in central eastern Sicily in the right side of Dittaino River

Fig. 1. Geographical location of the sampling area. Localisation géographique de la zone d'étude.

to the south east of the town of Catenanuova (EN), 40 Km west of Catania (F 633 IV NO of the Carta d'Italia alla scala 1: 25.000). It is inserted, as part of the “Monte Judica Units” (Lentini, et al., 1987), along the northern margin of the Gela Foredeep, in the geodynamic context (Fig. 2) of the southern end of Fig. 2. Structural scheme of the central Mediterranean area with the location of the study area (after Grasso, 2001 modified). Schéma structural de la Méditerranée centrale avec la localisation de la zone d'étude (d'après Grasso, 2001 modifié).

the Maghrebian – Sicilian-Southern Apennine nappes and as such, it would dwarf the mildly folded foreland (Hyblean Plateau) (Lentini et al., 1987; Grasso, 2001 inter alias).

The Monte Scalpello area is lithologically characterized by a Mesozoic-Cainozoic sediments complex belonging to the so-called Imerese Succession (Lentini et al., 1987; Montanari, 1987; inter alias) or Imerese-Sicano Succession (Carrillat and Martini, 2009; Di Paolo et al., 2012). This sedimentary succession settled inside the pelagic Imerese Basin which had formed during the Mesozoic extensional phases and which was delimited by the Panormide Carbonate Platform to the west and the Trapanese Carbonate Platform to the east and to the south (Fig. 3) (Catalano and D'Argenio, 1982; Montanari, 1987; Speranza and Minelli, 2014).

79 Fig. 3. Schematic palaeogeographic reconstruction of Pangaea and Neo-Tethys in Late Triassic times (after Speranza &
80 Minelli (2014), Golonka, 2007 and Preto et al., 2010 modified). Reconstruction paléogéographique schématique de la
81 Pangée et de la Néo-Téthys à la fin du Trias (d'après Speranza & Minelli, 2014; Golonka, 2007 et Preto et al., 2010
82 modifié).

83

84 The Imerese Basin, therefore, is represented by the transitional pelagic facies between the
85 Panormide and Trapanese shelf facies, on the one hand, and the bathyal facies of the Neo-Tethys,
86 on the other (Fig. 3).

87 The Imerese succession of Monte Scalpello (Fig. 4) starts with the “Carnian Flysh”
88 (Auctorum) or, according to [Schmidt di Friedberg and Trovò \(1962\)](#), the Mufara Formation. This
89 unit, outcropping in the southern slopes of the mount, is prevalently constituted by dark grey clays
90 rich in ammonites with rare interbedded levels of fossiliferous calcarenites and fibrous calcite with
91 *Halobia* spp. imprints.

92

93 Fig. 4. Geological map of the Monte Scalpello area (after Lentini, 1974 and Di Paolo et al. 2012, modified). Carte
94 géologique de la région de Monte Scalpello (d'après Lentini, 1974 and Di Paolo et al. 2012, modifié).

95

96 The detailed stratigraphic attribution of Mufara Formation has been the subject of different
97 opinions since the beginning of the twentieth century; [Calcara, 1841, 1845](#); [Nelli \(1899a, b\)](#),
98 [Gemmellaro \(1904\)](#), [Scalia \(1907; 1909; 1910 – 1914\)](#), [Maugeri Patanè \(1934\)](#), [Lentini \(1974\)](#) and
99 [Dal Sasso et al. \(2014\)](#) assigned these sediments to the Late Triassic (Carnian).

100

101 [Fig. 5. Carnian Ammonoid zones. \(After Lucas, 2010\). Zones à Ammonoïdés du Carnien \(d'après Lucas,](#)
102 [2010\)](#)

103

104 [Lentini \(1974\)](#), on the basis of the ammonites fauna found, attributes the lowest levels of
105 Monte Scalpello section, to the *Trachyceras aonoides* ammonite zone of the Early Carnian;

106 nevertheless the presence of *Tropitidae* among the specimens coming out from this levels, excludes
107 that this formation belongs to the Early Carnian (Lucas, 2010; [Jenks et al., 2015](#)).

108 The subsequent sedimentary layers are attributed, again by [Lentini \(1974\)](#), to the *Tropites*
109 *subbullatus* zone; nevertheless the contemporary presence of specimens of *Trachyceratidae*
110 (*?Neoprotrachyceras*, *Trachysagenites*, *Pamphagosirenites*) found by the authors of the present
111 paper, and specimens of *Tropitidae*, suggests that both this fossiliferous horizons can be referred to
112 the *Tropites dilleri* zone ([Lucas, 2010; Jenks et al., 2015](#)). A confirmation of this datum comes from
113 [Carrillat and Martini \(2009\)](#) who, mostly on the basis of the foraminifers, refers the same clays of
114 Mufara Formation outcropping at Monte Gambanera, nine kilometers to the south of the studied
115 area, to the upper part of the Late Carnian (*Tropites subbullatus*/*Anatropites spinosus* zones).
116 According to [Jenks et al. \(2015\)](#) the base of Tuvanian Substage (upper part of the Carnian Stage) is
117 characterized by the appearance and radiation of the *Tropitidae*. Therefore the presence of
118 *Tropitidae* reported already by [Gemmellaro \(1904\)](#), [Scalia \(1909\)](#) and [Lentini \(1974\)](#) remove all
119 doubts about the attribution of this sedimentary levels out cropping, to the Tuvanian substage (Late
120 Carnian, *Tropites dilleri* zone) (Fig. 5).

121 Over the Mufara Formation follow conformably the Upper Triassic cherty limestone with
122 *Halobia*, the Jurassic - Cretaceous radiolarian cherts and unconformably the Eocene - Oligocene
123 limestone ("Scaglia"). The stratigraphic sequence is finally closed by Oligocene - Miocene clays
124 and glauconitic sandstones.

125 For the present work twenty kilograms of sediments were collected from one stratigraphic
126 level of the Mufara Formation cropping out in contrada Paraspura, two hundred meters southwest
127 of Masseria Mannino (37°32'56.86''N; 14°40'30.64''E) along the east side of Monte Scalpello,
128 (Figs. 1, 4). Sediments were routinely washed, dried in oven and sieved. Then, ostracod specimens
129 were picked out from the > 63µm fraction. The ostracod specimens were examined and measured
130 under a stereomicroscope, then photographed under an LMU Tescan Vega II SEM. The material is
131 housed in the Palaeontological Museum of the University of Catania. The repository number of the

132 holotypes and the paratypes are given in the systematic descriptions.

133

134

135 **3. RESULTS**

136 The sample taken results to be constituted mostly by pelitic sediments, indeed almost the
137 entire sediment is passed over the 63µm sieve. The poor washing residue (about 100 grams)
138 provided in order of abundance, gastropods, brachiopods, bivalves and crinoids, echinoids skeletal
139 fragments and small size ammonites. Microfauna is very poor in foraminifers represented
140 prevalently by the genera *Glomospira* and *Hemidiscus*; ostracods, the majority of which is
141 constituted by juvenile forms, are relatively abundant.

142

143

144 **Systematic palaeontology**

145 Ostracods from a sample of clay of the Mufara Formation taken at the base of Monte
146 Scalpello are systematically listed. The specimens belong to the Order Metacopida Sylvester-
147 Bradley, 1961 and Podocopida Sars, 1866, and eight families Healdiidae Harlton, 1933,
148 Cavellinidae Egorov, 1950, Bairdiidae Sars, 1866, Acratiidae Gründel, 1962, Bythocyprididae
149 Maddocks, 1969, Pontocyprididae Müller, 1894, Judahellidae Sohn, 1968, Glorianellidae Snejder,
150 1960.

151 Abbreviations. L: length; H: height; T: thickness; RV: right valve; LV: left valve; DB:
152 dorsal border; VB: ventral border; AB: anterior border; PB: posterior border; PVB: postero-ventral
153 border; AVB: antero-ventral border; PDB: postero-dorsal border; PVB: postero-ventral border.

154

155 Class Ostracoda Latreille, 1806

156 Order Metacopida Sylvester-Bradley, 1961

157 Suborder Metacopina Sylvester-Bradley, 1961

158 Superfamily Healdioidea Harlton, 1933

159 Family Healdiidae Harlton, 1933

160 Genus *Ogmoconchella* Gründel, 1964 emend Michelsen, 1975

161 Type species: *Healdia aspinifera* Drexler, 1958

162 *Ogmoconchella felsooersensis* (Kozur, 1970)

163 Fig. 6 a - b

164 1970 *Healdia* (*Healdia*) *felsooersensis* n. sp. - Kozur, p. 409, pl. 3, fig. 13, pl.4, figs; 1 - 6

165 1995 “*Hungarella*” *felsooersensis* (Kozur, 1970) – Monostori, p. 40 - 41, pl. 1, figs. 2 - 4

166 1996 *Healdia* (*Healdia*) *felsoorensis* Kozur, 1970 - Crasquin-Soleau and Gradinaru, pl. 9,
167 fig. 14

168 2013 *Healdia* (*Healdia*) *felsooersensis* Kozur, 1970 - Sebe et al., pl. 4, fig. 14

169 2013 *Hungarella problematica* (Méhes, 1911) - Monostori and Toth, p. 308, Pl. 4, Figs. 14 -
170 17

171 **Material:** 2 complete carapaces.

172 **Dimensions** (figured specimen): L= 790-810 µm; H= 580 µm; T= 380 µm.

173 **Stratigraphic and geographic range:** Early Anisian of Felsőörs, Balaton Highland,
174 Hungary (Kozur, 1970, Monostori, 1995), Early Anisian of Dobrogea, Romania (Sebe et al., 2013),
175 Late Carnian (*Tropites dilleri* zone), Mufara Formation outcropping in the east side of Monte
176 Scalpello (37°32'56.86''N; 14°40'30.64''E), Sicily, Italy (this work).

177 **Remarks:** A great confusion exists in the systematics of Late Permian – Triassic Healdiidae
178 genera *Hungarella* – *Ogmoconcha* – *Ogmochonchella*.

179 Some authors consider *Hungarella* Méhes, 1911 (which has not type material –Monostori,
180 1995, p. 40) and *Ogmoconcha* Triebel, 1941 as synonyms (Moore, 1961; Anderson, 1964). Shaver (*in*
181 Moore 1961) and Sohn (1968) don't agree with this synonymy. In fact the two genera are extremely

182 close. The third genus *Ogmoconchella* was introduced by Gründel (1964) and emended later by
183 Michelsen (1975) mainly on the presence of a spine at PVB. We use here this character to attribute the
184 species *felsooersensis* to *Ogmoconchella*.

185

186 Genus *Healdia* Roundy, 1926

187 Type species *Healdia simplex* Roundy, 1926

188 *Healdia?* sp.

189 Fig. 6 c - d

190 **Material:** 2 complete carapaces.

191 **Dimensions:** fig. 6c: L = 660 µm; H = 580 µm; fig. 6d: L = 680 µm, T = 310 µm.

192 **Stratigraphic and geographic ranges:** Late Carnian (*Tropites dilleri* zone), Mufara
193 Formation outcropping in the east side of Monte Scalpello (37°32'56.86''N; 14°40'30.64''E),
194 Sicily, Italy (this work).

195 **Remarks:** In right lateral view, the carapace has all the characteristics of the genus *Healdia*.
196 However the dorsal view is very far from this genus. Indeed, here the carapace is biconvex with a
197 maximum of thickness at mid-L (in *Healdia* genus the posterior part of the carapace is truncated)
198 and here there is only one spine at RV (in *Healdia* genus spines are present at PVB of both valves)
199 As far as the muscle scars cannot be observed, the figured specimens are dubiously attributed to the
200 genus *Healdia*.

201 Superfamily Cavellinoidea Egorov, 1950

202 Family Cavellinidae Egorov, 1950

203 Genus *Bektasia* Özdikmen, 2010

204 Type species. *Reubenella avnimelechi* Sohn, 1968

205 *Bektasia* sp.1

206 Fig. 6 e

207 **Material:** 1 carapace.

Dimensions: L = 662 μm ; H = 420 μm

Stratigraphic and geographic range: Late Carnian (*Tropites dilleri* zone). Mufara Fm

outcropping in the east side of Monte Scalpello (37°32'56.86''N; 14°40'30.64''E), Sicily, Italy

(this work).

Remarks: this specimen could be compared to *Bektasia subcylindrica* (Sandberg, 1866) in

Kristan-Tollmann, 1973 from the Carnian of North Italy (Kristan-Tollmann, 1973) which has a

similar lateral outline but has a shorter ADB and deeper sulci.

Order Podocopida Sars, 1866

Suborder Bairdiocopina Gründel, 1967

Superfamily Bairdioidea Sars, 1866

Family Bairdiidae Sars, 1866

Genus *Hiatobairdia* Kristan-Tollmann, 1970

Type species *Hiatobairdia subsymmetrica* Kristan-Tollmann, 1970

Hiatobairdia subsymmetrica Kristan-Tollmann, 1970

Fig. 6 f - h

1970 *Hiatobairdia subsymmetrica* n. gen. n. sp. - [Kristan-Tollmann](#), p. 268, pl. 35, figs. 1 - 3.

1976 *Hiatobairdia subsymmetrica* Kristan-Tollmann, 1970 - [Tollmann, 1976](#), p. 276, pl. 163, fig.

14.

1978 *Hiatobairdia subsymmetrica deformis* n. sp. - [Kristan-Tollmann](#), p. 83, pl. 4, figs. 1 - 7

1979 *Hiatobairdia subsymmetrica* Kristan-Tollmann, 1970 - [Kristan-Tollmann et al., p. 147, pl. 6,](#)

fig. 4.

Material: 3 complete carapaces.

Dimensions (specimen figured in fig. 6 f): L = 1040 μm ; H = 520 μm .

284 *dilleri* zone); Mufara Formation outcropping in the east side of Monte Scalpello (37°32'56.86''N;
285 14°40'30.64''E), Sicily, Italy (this work)

286

287

288 ***Bairdia* sp. 1**

289 Fig. 6 n - o

290 **Material:** 2 carapaces

291 **Dimensions:** L = 830 µm; H = 480 µm

292 **Stratigraphic and geographic range:** Late Carnian (*Tropites dilleri* zone), Mufara
293 Formation of east side of Monte Scalpello (37°32'56.86''N; 14°40'30.64''E), Sicily, Italy (this
294 work).

295

296 ***Bairdia balatonica* Méhes, 1911**

297 Fig. 6 p

298 1911 *Bairdia balatonica* n. sp. - Méhes, p. 13 - 14, pl. 1, figs. 8 - 11

299 1911 *Bairdia badayi* n. sp. - Méhes, p. 17 - 18, pl. 1, figs. 29 - 30

300 ?1965 *Bairdia balatonica* Méhes var. 1911 - Széles, p. 414, fig. 4

301 1965 *Bairdia dadayi* Méhes, 1911 - Széles, p. 412 - 413, fig. 1

302 1978 *Bairdia* cf. *balatonica* Méhes - Kristan-Tollmann, p. 81, pl. 1, figs. 1 - 3

303 1995 *Bairdia balatonica* Méhes, 1911 - Monostori, p. 42, pl. 2, fig. 1 (non figs. 2 and 3)

304 2011 *Bairdia balatonica* Méhes, 1911 - Forel and Crasquin, p. 252, fig. 5 A

305 2013 *Bairdia balatonica* Méhes, 1911 - Monostori and Tóth, p. 309, figs. 1 - 5

306 **Material:** 1 carapace

307 **Dimensions:** L = 860 µm; H = 545 µm

308 **Stratigraphic and geographic range:** Spathian - Anisian of South Tibet (Forel and
309 Crasquin, 2011), Anisian (Monostori, 1995), Ladinian (Monostori and Tóth, 2013) and Early

310 Carnian (Méhes, 1911; Széles, 1965;) of Hungary, Early Carnian of Southern Alps, Italy (Kristan-
311 Tollmann, 1978), Late Carnian (*Tropites dilleri* zone). Mufara Formation outcropping in the east
312 side of Monte Scalpello (37°32'56.86''N; 14°40'30.64''E), Sicily, Italy (this work)

313

314 ***Bairdia scaliai* n.sp.**

315 Fig. 6 q - r

316 **Etymology:** The species is named in memory of Salvatore Scalia (1874-1923),
317 palaeontologist at Catania University, for his scientific engagement in the Mesozoic fauna of Monte
318 Scalpello.

319 **Material:** four complete carapaces.

320 **Holotype:** complete carapace figured in Fig. 6 r (PMC. O 17 H 11/4/2017), dimensions: L =
321 740 µm; H = 445 µm

322 **Paratype:** complete carapace figured in Figure 5 q (PMC. O 65-67 P 10/4/2017).

323 **Type locality:** East side of Monte Scalpello (37°32'56.86''N; 14°40'30.64''E),
324 Catenanuova, Sicily, Italy

325 **Type horizon:** Late Carnian (*Tropites dilleri* zone) in the dark grey clays of the Mufara
326 Formation.

327 **Diagnosis:** A species of *Bairdia* with compact carapace AB with large radius of curvature,
328 PB short, with small radius of curvature and maximum of curvature located high, all dorsal parts
329 regularly arched, strong overlap at DB.

330 **Description:** Carapace compact (H/L = 0.57 – 0.58); DB regularly arched with PDB, DB
331 and ADB in a regular arc of a circle at LV, ADB slightly concave at RV; AB with large radius of
332 curvature with maximum of curvature located a little below mid - H, a very fine ridge underlines the
333 AB; VB quite horizontal to very slightly concave; PB short, with very small radius of curvature and

334 maximum of curvature located around lower 1/3 of H, presence of the very thin ridge along the PB;
335 bairdiid beak poorly expressed but present; strong overlap of LV on RV along all the dorsal margin
336 with maximum at DB; overlap weak on all other parts of the carapace; surface smooth.

337 **Remarks:** This species is quite different from all the other species recognized in the
338 Triassic. It could be compared to *Bairdia jeancharlesi* Forel, 2011 from the Smithian – Anisian of
339 Tibet (Forel and Crasquin, 2011) but here the PB is shorter and the AB has a larger radius of
340 curvature. *Bairdiacypris triassica* Kozur, 1971 from Late Anisian of Hungary (Kozur, 1971) has the
341 same radius of curvature at PB and AB but L is really greater.

342 **Stratigraphic and geographic range:** Late Carnian of Sicily, Italy.

343
344 *Bairdia cf. finalyi* (Méhes, 1911)

345 Fig. 6 s

346 **Material:** 2 carapaces

347 **Dimensions:** figured specimen L = 858 µm; H = 570 µm

348 **Stratigraphic and geographic range:** Late Carnian (*Tropites dilleri* zone). Mufara
349 Formation in the east side of Monte Scalpello; (37°32'56.86''N; 14°40'30.64''E), Sicily, Italy (this
350 work).

351 **Remarks:** The present specimens are very close to *Bairdia finalyi* (Méhes, 1911) from the
352 Smithian – Ladinian of Balaton Highland, Hungary (Méhes, 1911; Kozur, 1971; Monostori, 1995),
353 West Carpathians (Salaj and Jendrekova, 1984), Guangxi, South China (Crasquin et al., 2006),
354 Tibet (Forel and Crasquin, 2011). They differ only by a larger radius of curvature of AB here.

355

356 *Bairdia? sp. 2*

357 Fig. 6 t

358 **Material:** 1 carapace

Dimensions: L = 843 µm; H = 357 µm

Stratigraphic and geographic range: Late Carnian (*Tropites dilleri* zone). Mufara

Formation outcropping in the east side of Monte Scalpello (37°32'56.86''N; 14°40'30.64''E),

Sicily, Italy (this work).

Remark: this specimen has a remarkable and characteristic AB truncated in ventral part but there is not enough material to go further in the description.

***Bairdia* sp. 3**

Fig. 6 u

Material: 2 carapaces

Dimensions: figured specimen L = 800 µm; H = 440 µm

Stratigraphic and geographic range: Late Carnian (*Tropites dilleri* zone. Mufara

Formation outcropping in the east side of Monte Scalpello (37°32'56.86''N; 14°40'30.64''E),

Sicily, Italy (this work).

Remarks: these specimens are very close to the specimens presented by [Mette and Mohat-Aghai \(1999; Pl. 4; fig .4 - 5\)](#) as *Bairdia* sp. 7 from the Rhaetian of Tyrol in Austria. All these specimens could belong to a new species. The generic attribution is just at the limit between the two genera *Bairdia* and *Urobairdia*. As the ventral "blade" from AB to PB, characteristic of *Urobairdia*, is not clearly shown, we chose to let it in genus *Bairdia*.

Figure 6. Carnian ostracods from Monte Scalpello. Scale bar 200µm. Ostracodes du Carnien du Monte Scalpello.

Barre d'échelle 200µm.

Genus ***Ptychobairdia*** Kollmann, 1960

Type species *Ptychobairdia kuepperi* Kollmann, 1960

***Ptychobairdia kristanae* Kollmann, 1960**

Fig. 7 a

1960 *Ptychobairdia kristanae* n. g. n. sp. - Kollmann, p. 99 - 100, pl. 25, figs. 6 - 9.

1960 *Ptychobairdia medwenitschi* n. g. n. sp. - Kollmann, p. 101 - 102, pl. 26, figs. 1 - 11.

1963 *Ptychobairdia kristanae* Kollmann - Kollmann, p. 181

Material: 1 carapace

Dimensions: L = 1180 µm; H = 763 µm

Stratigraphic and geographic range: Late Carnian (*Tropites dilleri* zone). Mufara

Formation outcropping in the east side of Monte Scalpello (37°32'56.86''N; 14°40'30.64''E) (this work), Rhaetian - Early Jurassic of Austria (Kollmann, 1960; 1963).

Remarks: The types figured by Kollmann (1960, Pl. 25, figs 6 - 9) have a ventral bulge more pronounced than here but intraspecific variations are very common in bairdiids

Genus *Bairdiacypris* Bradfield, 1935

Type species *Bairdiacypris deloi* Bradfield, 1935

Bairdiacypris cf. *aequisymmetrica* Mette, Honigstein et Crasquin .,2014

Fig. 7 b

Material: 1 incomplete carapace

Dimensions: L = 905 µm; H = 390 µm

Stratigraphic and geographic range: Late Carnian (*Tropites dilleri* zone). Mufara

Formation outcropping in the east side of Monte Scalpello (37°32'56.86''N; 14°40'30.64''E), Sicily, Italy (this work).

Remarks: the specimen discovered here is quite close to *Bairdiacypris aequisymmetrica* Mette et al., 2014 from the Middle Anisian of Austria (Mette et al., 2014) by the general outline of the carapace. Unfortunately, the PB is broken here and the doubt stays.

Bairdiacypris cf. *mirautae* Crasquin-Soleau and Gradinaru, 1996

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(Fig. 7 c)

Material: 1 carapace.

Dimensions: L = 730 µm; H = 350 µm.

Stratigraphic and geographic range: Late Carnian (*Tropites dilleri* zone). Mufara Fm.

outcropping in the east side of Monte Scalpello (37°32'56.86''N, 14°40'30.64''E) Sicily, Italy (this work).

Remarks: the specimen discovered here is quite close in general outline to *Bairdiacypris mirautae* Crasquin-Soleau and Gradinaru, 1996 from the Early Anisian of Dobrogea (Romania; Crasquin-Soleau and Gradinaru, 1996) and Ladinian of Hungary (Monostori and Tóth, 2013). Here the carapace is shorter and the PB is less tapering.

Genus *Anchistrocheles* Brady and Norman, 1889

Type species *Anchistrocheles fumata* Brady, 1890

***“Anchistrocheles” gemmellaroi* n. sp.**

Fig. 7 d - f

Etymology: The species is named in memory of the palaeontologist Gaetano Giorgio Gemmellaro (1832-1904).

Material: Seven complete carapaces (three adults and four juveniles).

Holotype: A complete carapace (fig. 7 e), PMC. O 18 H 10/4/2017 (L = 742 µm; H = 440µm).

Paratypes: Two complete carapaces (fig. 7 d: L = 690 µm; H = 420 µm and fig. 7 f: L = 800 µm; H = 490) and other not figured (PMC. O 68-73 P 10/4/2017).

Type locality: East side of Monte Scalpello (37°32'56.86''N; 14°40'30.64''E), Sicily, Italy

Type level: Late Carnian (*Tropites dilleri* zone) in the dark grey clays of the Mufara Formation.

436 **Diagnosis:** A species attributed to “*Anchistrocheles*”, with bairdioid carapace sub
437 trapezoidal, with rows of spines at AB, PVB and PB, flanks parallel in dorsal view.

438 **Description:** Bairdioid carapace sub trapezoidal in lateral view, with DB, PDB and ADB
439 straights at both valves; AB with large radius of curvature; ventral margin concave at both valves;
440 PB short and with a small radius of curvature; AB, PVB and PB strongly compressed laterally,
441 without reticulation and ornamented with marginal spines at both valves; LV overlaps RV all
442 around the carapace with maximum at dorsal parts; In dorsal view, flanks parallel (like in
443 *Orthobairdia* genus), extremities strongly compressed laterally, a small sulcus is observable in front
444 of mid-L; surface reticulated and small tubercles are observed on the surface in ADP and DP.

445 **Remarks:** This species is attributed to the genus “*Anchistrocheles*”. It is clear that is not this
446 genus which is a recent one and for which the specific determinations are made on soft parts. This
447 generic attribution with “?” was used in the past, particularly for Triassic - Jurassic specimens
448 exhibiting row of spines along AB and PB (Carnian, Late Triassic of Turkey ([Forelet al., 2018](#));
449 Rhaetian, Late Triassic of Austria ([Bolz, 1971](#)), Sinemurian, Early Jurassic of Germany and
450 Switzerland ([Beher et al., 2001](#); [Beher, 2004](#)), Bathonian, Early Jurassic of France ([Sheppard, 1981](#)
451 [PhD MS](#)). A revision of all these species and of the definition of a new genus is in preparation
452 ([Crasquin and Forel](#), work in progress).

453 “*Anchistrocheles*” *gemmellaroi* n. sp. could be compared to *Bairdia marginosulcata* Bolz,
454 1971 from the Late Norian – Rhaetian of Austria ([Bolz, 1971](#)) which presents a biconvex carapace
455 in dorsal view and a smaller radius of curvature at AB. The new species is very close from
456 *Anchistrocheles? spinosa* from the Bathonian, Middle Jurassic of North-Western France with the
457 flanks parallel and compressed extremities in dorsal view, with spines along AB and PVB and PB.
458 This species was described and illustrated in the PhD thesis of [Sheppard \(1981\)](#). It seems that this
459 species was never published and is considered here as invalid. “*Anchistrocheles*” *gemmellaroi* n.
460 sp. has a AB with larger radius of curvature, and dorsal parts straighter.

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Genus *Nodobairdia* Kollmann, 1963.

Type species *Nodobairdia mammillata* Kollmann, 1963

Nodobairdia mammillata Kollmann, 1963

Fig. 7 g

1963 *Nodobairdia mammillata* n. g. n. sp. - Kollmann, p. 174, pl. 7, figs. 6 - 15

1971 *Nodobairdia mammillata* Kollmann, 1963 - Kristan-Tollmann, p. 63, pl. 1, fig. 1

1971 *Triebelina (Nodobairdia) triassica* n. sp. - Bolz 1971, p. 216, pl. 16, figs. 229 – 232

1978 *Nodobairdia mammillata* Kollmann, 1963 - Kristan-Tollmann, p. 84, pl. 8, figs. 1 - 6

Stratigraphic and geographic range: Late Ladinian of Alps, Austria (Kollmann, 1963; Kristan-Tollmann, 1971), Late Carnian of Alps, Austria (Kristan-Tollmann, 1978). *Tropites dilleri* zone of the Mufara Formation outcropping in the east side of Monte Scalpello (37°32'56.86''N; 14°40'30.64''E) Sicily, Italy (this work); Norian – Rhaetian of Alps, Austria (Bolz, 1971).

Family Acraatiidae Gründel, 1962

Genus *Acratia* Delo, 1930

Type species –*Acratia typica* Delo, 1930

Acratia maugeri n. sp.

Fig. 7 h - j

1991 *Acratia* sp. - Kristan-Tollmann, p. 196, pl. 1, fig. 1

2013 *Acratia goemoeryi* (Kozur, 1970) - Monostori and Tóth, p. 6-7, pl. 4, only fig. 2

Etymology: The species is named in memory of Giuseppe Maugeri-Patanè palaeontologist in Catania University for his scientific engagement in Mesozoic palaeontology.

Material: Three complete carapaces.

Holotype: One complete carapace (fig. 7h, j), PMC. O 19 H 10/4/2017 (L = 1110 µm; H = 490 µm).

Fig. 7 k

Material: 1 carapace.

Dimensions: L = 568 µm; H = 300 µm.

Stratigraphic and geographic range: Late Carnian (*Tropites dilleri* zone), of the Mufara Formation outcropping in the east side of Monte Scalpello (37°32'56.86''N; 14°40'30.64''E), Sicily, Italy (this work).

Remarks: a specimen attributed with doubt (this genus is a Recent one defined on soft parts) to the genus *Bythocypris*. It is quite close to *Bythocypris* sp. B in Bolz, 1971 from the Norian - Rhaetian of Austria which has a very similar outline except here a VB more convex. We have not enough material to go further in determination.

Superfamily Cypridoidea Baird, 1845

Family Pontocyprididae Müller, 1894

Genus *Pontocypris* Sars, 1866

Type species *Cypris serrulata* Sars, 1863

Pontocypris rara Méhes, 1911

Fig. 7 l

1911. *Pontocypris rara* n.sp. –[Méhes, 1911](#), p.13, pl. 1, fig.5

Material: 1 carapace.

Dimensions: L = 662 µm; H = 288 µm.

Stratigraphic and geographic range: Late Carnian of Balaton Highland, Hungary ([Méhes, 1911](#)) and Monte Scalpello (*Tropites dilleri* zone), (37°32'56.86''N, 14°40'30.64''E) Sicily, Italy (this work).

Family Judahellidae Sohn, 1968

Genus *Judahella* Sohn, 1968

Type species *Judahella tsorfatia* Sohn, 1968

Judahella? montanarii n. sp.

Fig. 7 m - n

Etymology: The species. is named in memory of Loris Montanari geologist in Catania

University. **Material:** Two complete carapaces.

Holotype: A complete carapace figured in Fig. 7m (PMC O 20 H 10/4/2017) (L = 450 µm; H = 200 µm).

Paratype: A complete carapace figured in fig. 7n (PMC O 76 P 10/4/2017).

Type locality: East side of Monte Scalpello (37°32'56.86''N; 14°40'30.64''E), Sicily, Italy.

Type level: Late Carnian (*Tropites dilleri* zone) in the dark grey clays of the Mufara Formation.

Diagnosis: *Judahella? montanarii* n. sp. is characterized by subrectangular elongate carapace with a long straight DB ended by a caudal process, presence of lateral ridges and tubercles on valve surface.

Description: Lateral view: small carapace elongate subrectangular (Fig. 7m, n); long straight DB ended by a short caudal process. Upper part of AB straight with an angle of 110° with DB; maximum of convexity of AB located below mid-H; VB slightly convex, surface of valves are ornamented by large ridges and nodes reticulated; dorsal ridges overpass hinge line; the largest and strong ridge is arched and shows variable thickness through its length; it begins in the antero-dorsal margin, moves downwards until reaching the centre of the ventral margin and back again towards the postero-dorsal margin initially curved and then straight and facing forward. Another thinner ridge is present along the outer edge of the anterior margin of the valves. Two stubby nodes are present in the posterior dorsal and in the central anterior area.

Dorsal view: hinge line long and straight; caudal process strongly compressed laterally;

ridges and nodes very prominent by absence of ventro-lateral swollen process

Remarks: The new species is attributed to *Judahella*? The doubt comes from the presence of the posterior caudal process never described in the genus. The present specimens could be compared to *Judahella tsorfatia* Sohn, 1968 from the Ladinian of Eastern France (Sohn, 1968) by their similar subrectangular lateral outline. But here the nodes are gathered in ridges and there is a caudal process. *Judahella tuberculifera* (Gümbel, 1869) from Carnian of Italian Alps (Gümbel, 1869; Lieberman, 1979), Anisian – Ladinian of Poland (Styk, 1958), Ladinian of France (Sohn, 1968), Anisian of Germany (Knüpfer and Kozur, 1968), Ladinian of Spain (Kozur et al., 1974) and Anisian of South China (Kristan-Tollmann, 1983) has a general dorsal outline which can evoke the new species.

Family Glorianellidae Snejder, 1960 emend. Kozur 1970

Genus *Mockella* Bunza and Kozur, 1971

Type species *Mockella marinae* (Kozur, 1970)

Mockella muelleri Bunza and Kozur, 1971

Fig. 7 o - p

1971 *Mockella muelleri* n. sp. - Bunza and Kozur, p. 8 - 9, pl. 1, fig. 12

Material: 2 carapaces, 1 figured.

Dimensions: L = 390 µm; H = 235 µm (figured specimen).

Stratigraphic and geographic range: Late Carnian of Tyrol, Austria (Bunza and Kozur, 1971) and east side of Monte Scalpello (37°32'56.86''N, 14°40'30.64''E) Sicily, Italy (this work).

Fig. 7. Carnian ostracods from Monte Scalpello. Scale bar= 200µm (a – l); 100µm (m – p). Ostracodes du Carnien du Monte Scalpello. Barre d'échelle 200µm (a-l), 100µm (m-p).

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589 **Conclusion.**

590 Carnian Ostracods are known worldwide, from Alaska (Sohn, 1968), Alps (Kristan-
591 Tollmann, 1969, 1978; Kollmann, 1963), Austria (Kristan-Tollmann, 1971, 1973, 1988; Bunza and
592 Kozur, 1971), British Columbia (Arias and Lord, 2000), Germany (Gründel, 1965; Bunza and
593 Kozur, 1971), Hungary (Kristan-Tollmann et al., 1991; Kozur 1971, 1972; Bunza and Kozur, 1971),
594 Indonesia (Kristan-Tollmann and Hasibuan, 1990), Israel (Sohn, 1968; Gerry et al., 1988; Bunza
595 and Kozur, 1971); Italy (Kristan-Tollmann, 1971, 1973, 1982, 1983; Liebermann, 1979), Slovenia
596 (Kolar-Jurkovsek ,1990) and Turkey (Forel et al., 2018). The turn-over between Palaeozoic and
597 Mesozoic ostracod fauna is long, at least 14 My, began in the early Late Permian (in the Early
598 Wuchiapingian) and is considered to be ended in the Anisian (Crasquin and Forel, 2013). However,
599 some Palaeozoic genera are still present in the Carnian: three Kirkbyidae (*Carinaknightina*,
600 *Kirkbya*, *Tubulikirkbyia*?) in Turkey deep environment (Forel et al., 2018) and *Acratia*, discovered
601 as well in Turkey (Forel et al., 2018) whose presence is confirmed here.

602 The paleoecological interpretation of the Carnian ostracods association of Monte Scalpello
603 is not easy. It is necessary to consider both the structure, composition and taphonomic
604 characteristics of the association found, as well as the sedimentological characteristics of the
605 sedimentary Unit and its position in the palaeogeographic context at that time.

606 First of all the strong shelled forms and absence of typical deep water species it would seem
607 to indicate a not deep waters association. From the taphonomic point of view, it is very interesting
608 to note that the ostracods specimens are predominantly represented by integer carapaces and rare
609 valves. This could suggest a rapid burial *in situ* in a high sedimentation rates environment, since the
610 valves, after the death of the specimens, tend to open in a few hours (Guernet & Lethiers, 1989).
611 Similar taphonomic characteristics were also found by Pokorný (1964) and Oertli (1971) for pelitic
612 layer associations deposited in extremely rapid distal sedimentation basins.

613 Another important datum concerns the size of all the found skeletal remains. Gastropods,
614 bivalves, crinoids and brachiopods remains are all of the same little size; also the ostracod
615 thanatocoenosis structure is characterized by abundance of juveniles and rare adults; according to
616 van Harten (1986), all that would suggest strong phenomena of dimensional selection and,
617 therefore, displaced of faunas and sediments ().

618 From the sedimentological point of view the study area is characterized by the extreme
619 abundance of pelitic sediments with interbedded sandy levels sometimes rich in oolites. Sometimes
620 this sediments shown in the outcrop, particular sedimentary structures as parallel lamination, wavy
621 lamination and vortices structures, all features that make one think of a high-energy sedimentation
622 environment.

623 From a palaeogeographic point of view, the Mufara Formation outcropping in the studied
624 area, is located inside the pelagic Imerese Basin that is delimited by the carbonate platforms of
625 Complesso Panormide to the west and the Complesso Trapanese to the east and to the south (Fig. 3)
626 (Catalano and D'Argenio, 1982; Montanari, 1987; Speranza and Minelli, 2014). All the materials
627 produced by the erosion of the carbonate platforms were conveyed in this basin (Carillat and
628 Martini, 2009).

629 On the basis of all these data it is possible to hypothesize for the ostracods association an
630 environment characterized by high sedimentation rates and high depositional energy, features that
631 controls strongly, today as in the past, the colonization of the bottom as well as the composition and
632 structure of the populations (cf. Di Geronimo & Robba, 1989; Sciuto, 2014). According to Carillat
633 and Martini (2009), the Monte Scalpello area, it could be a probably, distal turbiditic sedimentary
634 environment not necessarily very deep (Fig. 8). The collection of further faunistic and
635 sedimentological data (whose finding and observation is made extremely difficult by the intense
636 agricultural activity) can lead to more detailed information on the Triassic palaeo-environment of
637 the Monte Scalpello area.

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Fig. 8. Schematic palaeoenvironmental model for the Late Carnian Mufara Formation (see also Fig. 3). Modèle paléoenvironnemental schématique de la Formation Mufara du Carnien supérieur (voir également fig. 3)

Declaration of interest.

The authors declare that they do not have any links of interest.

Acknowledgements

The authors are grateful to the reviewers and the editors for detailed suggestions and comments to the manuscript. Thanks are due also to Mr. Alfio Viola (Electronic Microscopy Laboratory, University of Catania) for SEM photos assistance. Catania Palaeoecological Research Group contribution n° xxx.

REFERENCES

Anderson, F.W., 1964. Rhaetic ostracoda. Bulletin of the Geological Survey of Great Britain 21, 133-174.

Arias, C., Lord, A., 2000. Upper Trias marine ostracoda from the Queen Charlotte Islands British Columbia Canada. Revista Española de Micropaleontologia 32, 175-192.

Behr, E., 2004. Ostracodenfauna und Biostratigraphie im Ober-Sinemurium von Süddeutschland und der Nordschweiz. Stuttgarter Beiträge zur Naturkunde Serie B (Geologie und Paläontologie) 349, 1–170.

663 Beher, E., Franz, M., Schweizer, V., 2001. Zur Ostracodenfauna des Ober-Sinemurium und
 664 untersten Unter-Pliensbachium im Gebiet von Tuningen (Baden-Württemberg). Neues
 665 Jahrbuch für Geologie und Paläontologie, Abhandlungen 219, 329–391.
 666 Bolz, H., 1971. Die Zlambach-Schichten (alpine Obertrias) unter besonderer Berücksichtigung der
 667 Ostrakoden, 1: Ostrakoden der Zlambach-Schichten, besonders Bairdiidae. Senckenbergiana
 668 Lethaea 52, 129–283.
 669 Brady, G. S., 1880. Report on the Ostracoda dredged by H.M.S. Challenger during the Years 1873-
 670 1876. In: Report on the scientific results of the voyage of H.M.S. Challenger. Zoology 1, 1-
 671 184.
 672 Brady, G. S., 1890. On Ostracoda collected by H.B. Brady, Esq., L.L.D., F.R.S. in the South Sea
 673 Islands. Transactions of the Royal Society of Edinburgh: Earth Sciences 35, 489-525.
 674 Brady, G. S., Norman, A. M., 1889. A Monograph of the Marine and Freshwater Ostracoda of the
 675 North Atlantic and of North Western Europe. Sect I. Podocopa. Scientific Transactions of
 676 the Royal Dublin Society 2, 63-270.
 677 Bradfield, H. H., 1935. Pennsylvanian ostracods of the Ardmore Basin, Oklahoma. Bulletin of
 678 American Paleontology 22, 1-145.
 679 Bunza, G., Kozur, H., 1971. Beiträge zur Ostracodenfauna der tethyalen Trias. Geologisch-
 680 Paläontologische Mitteilungen Innsbruck 1, 1–76.
 681 Calcara P., 1840. Monografie dei generi *Clausilia* e *Bulimo*, coll'aggiunta di alcune nuove specie di
 682 conchiglie siciliane esistenti nella collezione della Sig. Teresa Gargotta in Salinas, 54 p.
 683 Calcara, P., 1845. Cenno sui molluschi viventi e fossili della Sicilia da servire di supplement ed
 684 insieme di critiche osservazioni all'opera di R. A. Philippi.. Reale stamperia e Libreria
 685 Palermo 65 p

686 Carrillat, A., Martini, R., 2009. Palaeoenvironmental reconstruction of the Mufara Formation
687 (Upper Triassic, Sicily): High resolution sedimentology, biostratigraphy and sea-level
688 changes Palaeogeography, Palaeoclimatology, Palaeoecology 283, 60-76.

689 Catalano, R., D'Argenio, B., 1982. Schema geologico della Sicilia occidentale. In R. Catalano and
690 B. D'Argenio (eds.) Guida alla geologia della Sicilia occidentale. Guide geologiche
691 regionali, Memorie Società Geologica Italiana suppl. A 24, 9-41.

692 Crasquin, S., Forel, M.B., 2013. Ostracods (Crustacea) through Permian - Triassic events. Earth-
693 Science reviews 137, 52-64

694 Crasquin, S., Forel, M.-B., Feng, Q., Yuan, A., Baudin, F., Collin, P. Y., 2010. Ostracods
695 (Crustacea) through Permian-Triassic boundary in South China: the Meishan stratotype
696 (Zhejiang Province). Journal of Systematic Palaeontology 8, 331-370.

697 Crasquin-Soleau, S., Galfetti, T., Bucher, H., 2006. Early Triassic ostracods from South China.
698 Rivista Italiana di Paleontologia e Stratigrafia 112 (1), 55-75.

699 Crasquin-Soleau, S., Gradinaru, E., 1996. Early Anisian ostracode fauna from the Tulcea unit
700 (Cimmerian North Dobrogean orogeny, Romania). Annales de Paléontologie 82, 59–116.

701 Dal Sasso, C., Insacco, G., Chiarenza, A. A., Di Franco, D., Reitano, A., 2014. First record of
702 *ichthyosaurus* in Sicily (Upper Triassic of Monte Scalpello, Catania province). Rivista
703 Italiana di Stratigrafia e Paleontologia 120 (1), 71-82.

704 Delo, D.M., 1930. Some Upper Carboniferous ostracods from the Shale Basin of Western Texas.
705 Journal of Paleontology 4, 152–178.

706 Di Geronimo, I., Robba, E., 1989, The structure of benthic communities in relation to basin
707 stability. Memorie dell' Accademia dei Lincei 80, 341-352.

708 Di Paolo, L., Aldega, L., Corrado, S., Mastalerz, M., 2012. Maximum burial and unroofing of Mt.
709 Judica recess area in Sicily: implication for the Apenninic–Maghrebien wedge dynamics.
710 Tectonophysics 530–531, 193–207.

711 Drexler, E., 1958. Foraminiferen und Ostracoden aus dem Lias von Siebeldingen/Pfalz.
712 Geologisches Jahrbuch 75, 475–554.

713 Egorov, V. G., 1950. Ostrakody franskogo iarusu Russkoi platformy, 1. Kloedenellidae: Moscow-
714 Leningrad Vses. Neft. Nauchno-Issled. Geol. Razved. Inst., Moscov, Filial, 140 p.

715 Forel, M. B., Crasquin, S., 2011. In the aftermath of the Permian-Triassic boundary mass
716 extinction: ostracod new species and genus from South Tibet. *Geodiversitas* 33, 247–263.

717 Forel, M.B., Tekin, U.K., Okuyucu, C., Bedi, Y., Tuncer, A., Crasquin, S., 2018. Discovery of a
718 long-term refuge for ostracods (Crustacea) after the end-Permian extinction: a unique
719 Carnian (Late Triassic) fauna from the Mersin Melange, southern Turkey. *Journal of*
720 *Systematic Palaeontology* 16 (3).

721 Gemmellaro, G. G., 1860. Cenno sopra taluni organici fossili del Turoniano e Nummulitico di
722 Judica. *Atti Accademia Gioenia di Scienze Naturali in Catania* 2 (15), 268-284.

723 Gemmellaro, G. G., 1904. I Cefalopodi del Trias Superiore della regione occidentale della Sicilia.
724 *Giornale di Scienze Naturali ed Economiche di Palermo* 24, 319 p.

725 Gerry, E., Honigstein, A., Rosenfeld, A., Hirsch, F., Eshet, Y., 1988. The Carnian salinity crisis:
726 ostracods and palynomorphs as indicators of palaeoenvironment. In R. Whatley & C.
727 Maybury (eds.) *Ostracoda and global events*. Chapman & Hall, London, 87–99.

728 Golonka, J., 2007. Late Triassic and Early Jurassic palaeogeography of the world. *Palaeogeography,*
729 *Palaeoclimatology, Palaeoecology* 244, 297–307.

730 Grasso, M., 2001. The apenninic- Maghrebien orogen in southern Italy, Sicily and adjacent areas. In
731 Vai, G. B., Martini, I. P. (eds.) *Anatomy of an Orogen: The Apennines and Adjacent*
732 *Mediterranean Basins*. Kluwer Acad. Publ. GB, 255-286

733 Gründel, J., 1962. Zur Taxionomie der Ostracoden der *Gattendorfia* Stufe Thüringens. *Freiderger*
734 *Forschungshilfe C* 151, 51-105.

735 Gründel, J., 1964. Zur Gattung *Healdia* (Ostracoda) und zu einigen verwandten Formen aus dem
 736 unter Jura. *Geologie* 13, 1- 469
 737 Gründel, J., 1965. Zwei neue Ostracoden-Arten aus dem unteren Keuper Thüringens.
 738 *Palaeontologische Zeitschrift* 39, 234-239.
 739 Gründel, J., 1967. Zur Grossgliederung der Ordnung Podocopida G. W. Müller, 1894. *Neues*
 740 *Jahrbuch für Geologie und Paläontologie, Monatshefte* 6, 321-332
 741 Guernet, C. & Lethiers, F., 1989, Ostracodes et recherche des milieux anciens: possibilités et
 742 limites: *Bulletin de la Société Géologique de France* 8 (5), 577-588.
 743 Gümbel, C.W., 1869. Über Foraminiferen, Ostracoden und mikroskopische Tier-Überreste in den
 744 St. Cassianer und Raibler Schichten. *Jahrbuch Geologischen Reichsanstalt* 19, 175–186.
 745 Harlton, B. H., 1933. Micropaleontology of the Pennsylvanian Johns Valley Shale of Ouachita
 746 Mountains, Oklahoma and its relationships to the Mississippian Caney Shale. *Journal of*
 747 *Paleontology* 7, 3–29.
 748 Harten, D. van, 1986. Use of ostracodes to recognize dowslope contamination in
 749 paleobathymetry and a preliminary reappraisal of the paleodepth of Prasas Marls
 750 (Pliocene), Crete, Greece. *Geology* 14, 856-859.
 751 Jenks, J. F., Monnet, C., Balini, M., Brayard, A., Meier, M., 2015. Biostratigraphy of Triassic
 752 Ammonoids. In Klug, C. et al. (eds.), *Ammonoid Paleobiology: From macroevolution to*
 753 *paleogeography*, *Topics in Geobiology* 44, 329-388.
 754 Knupfer, J., Kozur, H., 1968. Eine neue Ostracodengattung aus der Trias des germanischen
 755 Binnenbeckens. *Monatsberichte der Deutschen Akademie der Wissenschaften Berlin* 10,
 756 322–331.
 757 Kolar-Jurkovsek, T., 1990. Microfauna of Middle and Upper Triassic in Slovenia and its
 758 biostratigraphic significance. *Geologija* 33, 21–170.
 759 Kollmann, K., 1960. Ostracoden aus der alpinen Trias Österreichs. I *Parabairdia* n. g. und
 760 *Ptychobairdia* n. g. (Bairdiidae). *Jahrbuch der Geologischen Bundesanstalt* 5, 79–105.

- 761 Kollmann, K., 1963. Ostracoden aus der alpinen Trias. II.- Weitere Bairdiidae. Jahrbuch der
762 Geologischen Bundesanstalt Wien 106, 121-203.
- 763 Kozur, H., 1970. Neue Ostracoden-Arten aus dem Obersten Anis des Bakonyhochlandes (Ungarn).
764 Berichte des naturwissenschaftlich-medizinischen Vereins in Innsbruck 58, 384-428.
- 765 Kozur, H. 1971. Die Bairdiacea der Trias. Teil 3: Einige neue Arten triassischer Bairdiacea und
766 Bemerkungen zur Herkunft der Macrocyprididae (Cypridacea). Geologisch
767 Paläontologische Mitteilungen Innsbruck 1, 1–18.
- 768 Kozur, H. 1972. Die Bedeutung triassischer Ostracoden für stratigraphische und paläoökologische
769 Untersuchungen. Mitteilungen der Gesellschaft für Geologie und Bergbaustudien 21, 623–
770 660.
- 771 Kozur, H., Kampschuur, W., Mulder-Blanken, C. W. H., Simon, O. J., 1974. Contribution to the
772 Triassic ostracode faunas of the Betic Zone (southern Spain). Scripta Geologica 23, 1-57.
- 773 Kristan-Tollmann, E., 1969. Zur stratigraphischen Reichweite der Ptychobairdien und
774 Anisobairdien (Ostracoda) in der alpinen Trias. — Geologica et Palaeontologica 3, 81—95.
- 775 Kristan-Tollmann, E., 1970. Einige neue Bairdien (Ostracoda) aus der alpinen Trias. Neues
776 Jahrbuch für Geologie und Paläontologie 135, 268-310.
- 777 Kristan-Tollmann, E. 1971. Weitere Beobachtungen an skulptierten Bairdiidae (Ostracoda) der
778 alpinen Trias. Neues Jahrbuch für Geologie und Paläontologie 139, 57-87.
- 779 Kristan-Tollmann, E., 1973. Zur phylogenetischen und stratigraphischen Stellung der triadischen
780 Healdiiden (Ostracoda) II. Erdöl-Erdgas-Zeitschrift 89, 150-155.
- 781 Kristan-Tollmann, E., 1978. Bairdiidae (Ostracoda) aus den obertriadischen Cassianer Schichten
782 der Ruones-Wiesen bei Corvara in Südtirol. Schriftenreihe der Erdwissenschaftlichen
783 Kommissionen, Österreichische Akademie der Wissenschaften 4, 77–104.
- 784 Kristan-Tollmann, E., 1982. Bemerkungen zur triadischen Ostracoden-Gattung *Mostlerella*. Neues
785 Jahrbuch für Geologie und Paläontologie 9, 560–572.

- 786 Kristan-Tollmann, E., 1983. Ostracoden aus dem Oberanin von Leidapo bei Guiyang in Süd China.
787 Neue Beiträge zur Biostratigraphie der Tethys-Trias, 121–176.
- 788 Kristan-Tollmann, E., 1988. Coccolithen aus den Älteren Allgäuschichten (Alpiner Lias, Sinemur)
789 von Timor, Indonesien. Geologische und Paläontologische Mitteilungen Innsbruck 15, 71-83.
- 790 Kristan-Tollmann, E., 1991. Ostracods from the Middle Triassic Sina Formation (Aghdarband
791 Group) in NE-Iran. Abhandlungen der Geologischen Bundesanstalt 38, 195–200.
- 792 Kristan-Tollmann, E., Tollmann, A., Hamedani, A., 1979. Beiträge zur Kenntnis der Trias von
793 Persien. I. Revision der Triasgliederung, Rhäfazies im Raum von Isfahan und Kössener
794 Fazieseschlag bei Waliabad SE Abadeh. Mitteilungen der Gesellschaft der Geologie und
795 Bergbaustudenten in Österreich 70, 119-186.
- 796 Kristan-Tollmann, E., Hasibuan, F. 1990. Ostracoden aus der Obertrias von Misol (Indonesien).
797 Mitteilungen der Österreichischen Geologischen Gesellschaft, 82, 173–181.
- 798 Latreille, P.A., 1806. Genera crustaceorum et insectorum secundum ordinem naturalem in familias
799 disposita, iconibus exemplisque plurimis explicata. Parisiis et Argentorati, 303 p.
- 800 Lentini, F., 1974. Caratteri stratigrafici e strutturali della zona di Monte Judica (Sicilia Orientale).
801 Rivista Mineraria Siciliana 145–147, 71–96.
- 802 Lentini, F., Grasso, M., Carbone, S., 1987. Introduzione alla geologia della Sicilia e guida
803 all'escursione. 60 pp. Catania.
- 804 Lieberman, H. M., 1979. Die Bivalven- und Ostracodenfauna von Raibl und ihr stratigraphischer.
805 Verhandlungen der Geologischen Bundesanstalt 2, 85–131.
- 806 Lucas, S. G., 2010. The Triassic timescale: an introduction. In LUCAS, S. G. (ed.) The Triassic
807 Timescale. Geological Society, London, Special Publications 334: 1–16.
- 808 Maddocks, R.F., 1969. Revision of Recent Bairdiidae. Bulletin of the United States National
809 Museum 295, 1-126.

- 810 [Marinelli, O. 1899. Osservazioni geologiche sopra i terreni secondari del gruppo del M. Judica in](#)
811 [Sicilia. Atti della Reale Accademia Nazionale dei Lincei, Rendiconti della Classe di Scienze](#)
812 [Fisiche, Matematiche e Naturali 5, 8 \(1\), 404-412.](#)
- 813 [Maugeri Patanè, G., 1934. Sopra alcuni coralli del Trias superiore di M. Scalpello \(Enna\)](#)
814 [Relationes Consessuum Societatis Gioieniae Catinensis Naturarum Scientiarum 67, 9 p.](#)
- 815 [McCoy, F., 1844. A synopsis of the characters of the Carboniferous Limestone fossils of Ireland.](#)
816 [Dublin University Press, Dublin, 207 pp.](#)
- 817 [Méhes, G., 1911. Über Trias-Ostrakoden aus dem Bakony. Resultate der Wissenschaftlichen.](#)
818 [Erforschung des Balatonsees, 1-38.](#)
- 819 [Mette, W., Mohtat-Aghai, P., 1999. Ostracods and foraminifera from Upper Triassic intrashelf](#)
820 [basin deposits in the Northern Calcareous Alps. Geologisch Paläontologische Mitteilungen](#)
821 [Innsbruck 24, 45–77.](#)
- 822 [Mette, W., Honigstein, A., Crasquin, S., 2014. Deep-water ostracods from the Middle Anisian](#)
823 [\(Reifling Formation\) of the Northern Calcareous Alps \(Austria\). Journal of](#)
824 [Micropalaeontology 34, 71–91.](#)
- 825 [Michelsen, O., 1975. Lower Jurassic biostratigraphy and ostracods of the Danish Embayment.](#)
826 [Danmarks Geologiske Undersøgelser, Raekke 2 104, 1–287.](#)
- 827 [Monostori, M., 1995. Environmental significance of the Anisian Ostracoda fauna from the Forras](#)
828 [Hill near Felsoors \(Balaton Highland, Transdanubia, Hungary\). Acta Geologica Hungarica](#)
829 [39, 37-56.](#)
- 830 [Monostori, M., Tóth, E., 2013. Ladinian \(Middle Triassic\) silicified ostracod faunas from the](#)
831 [Balaton Highland \(Hungary\). Rivista Italiana di Paleontologia e Stratigrafia 119, 303–323.](#)
- 832 [Montanari, L., 1987. Lineamenti stratigrafico - paleogeografici della Sicilia durante il Ciclo Alpino.](#)
833 [Memorie della Società Geologica Italiana 38, 361-406.](#)

- 834 Moore, R. C., 1961. Treatise of Invertebrate Paleontology. Part Q. Arthropoda 3, Crustacea,
835 Ostracoda: Geological Society of America and University of Kansas Press, 442p.
- 836 Muller, G. W. 1894. Die Ostracoden des Golfes von Neapel und der angrenzenden Meeres
837 Abschnilte. Fauna und Flora des golfes von Neapel 21, 1–404.
- 838 Nelli, B., 1899a. Il Raibliano del Monte Judica nella provincia di Catania, Atti della Reale
839 Accademia Nazionale dei Lincei, Rendiconti della Classe di Scienze fisiche, matematiche e
840 naturali 5, 8(1), 91 – 92
- 841 Nelli, B., 1899b. Il Raibl nei dintorni di M. Judica. Bollettino della Società Geologica Italiana 18
842 (2), 211-223.
- 843 Oertli, H. J., 1971. The aspect of ostracode faunas - a possible new tool in petyroleum
844 sedimentology: Bulletin du Centre de Recherches de Pau 5, suppl.: 137-151.
- 845 Özdikmen, H., 2010. Substitute names for three genera of Ostracoda (Crustacea). Munis
846 Entomology and Zoology, Scientific note 5, 315
- 847 Pokorný, V., 1964. Some paleoecological problems in marine ostracode faunas, demonstrated
848 on the Upper Cretaceous ostracodes of Bohemia, Czechoslovakia: Pubblicazioni della
849 Stazione Zoologica di Napoli 33 Suppl.: 462-479.
- 850 Preto, N., Kustatscher, E., Wignall, P. B., 2010. Triassic climates. State of the art and perspectives.
851 Palaeogeography, Palaeoclimatology, Palaeoecology 290, 1–10.
- 852 Reuss, A. E., 1869. Zur fossilen Fauna der Oligocänschichten von Gaas. Sitzungsberichte der
853 österreichischen Akademie der Wissenschaften, mathematisch-naturwissenschaftliche
854 Klasse Abt.1. 59 (3), 446-488.
- 855 Roundy, P. V., 1926. Mississippian formations of the Saba County, New York and its fauna. United
856 States Geological Survey, Professional Paper 146, 5–8.
- 857 Salag, J., Jendrejakova, O., 1984. Ecology and facial relation of some groups of Triassic
858 foraminifers and ostracods of stratigraphic importance. Geologický Zborník – Geologica
859 Carpathica 35(2), 231-240.

- 860 Sandberg, F., 1866. Die Stellung der Raibler Schichten in dem frankischen und schwabischen
861 Keuper. *Neues Jahrbuch für Mineralogie, Geologie und Paläontologie*, 41.
- 862 Sars, M., 1863. Bemaerkninger over fire norske Hydroider. *Forhandlinger i Videnskabs-selskabet i*
863 *Christiania* 1862, 25-39.
- 864 Sars, G. O., 1866. Oversight af Norges marine Ostracoder. *Forhandlinger i Videnskabs-Selskabet i*
865 *Christiania*, 1865, 1-130.
- 866 Scalia, S., 1907. I fossili del Trias superiore dell'Acquanova e di Paraspura. *Bollettino dell'*
867 *Accademia Gioenia di Scienze Naturali in Catania* 2 (1-2), 10-12.
- 868 Scalia, S., 1907. La fauna del Trias superiore del gruppo montuoso di Judica. *Bollettino dell'*
869 *Accademia Gioenia di Scienze Naturali in Catania* 2 (3-4), 17-25.
- 870 Scalia, S., 1909. Il gruppo di M. Judica. *Bollettino della Società Geologica Italiana* 28, 269-340.
- 871 Scalia, S., 1910-1914. La fauna del Trias superiore del gruppo del M. Judica: Parti 1-3. *Atti*
872 *dell'Accademia Gioenia di Scienze Naturali in Catania* 5 (3-5-7), p. 51+58+25.
- 873 Schmidt di Friedberg, P., Trovò, A., 1962. Contribution à l'étude structurale du groupe du Monte
874 Judica (Sicile orientale). *Bulletin de la Société Géologique de France* 4(5), 754-759.
- 875 Sciuto, F., 2014. Initial report on ostracod fauna from the Messina Straits (Ionian Sea, northeastern
876 Sicily). *Bollettino della Società Paleontologica Italiana* 53 (2), 121-134.
- 877 Sebe, O., Crasquin, S., Gradinaru, E., 2013. Early and Middle Anisian (Triassic) deep-water
878 ostracods (Crustacea) from North Dobrogea (Romania). *Revue de Paléobiologie* 32, 509-
879 529.
- 880 Sheppard, L. S., 1981. Middle Jurassic Ostracoda from Southern England and Northern France.
881 Unpublished PhD thesis, University of London: 358 pp.
- 882 Schornikov, E. I., Michailova E. D., 1990. Ostracods Bythocytheridae at early stage of
883 development. Comparative morphology, paleoecology and evolutionary pathways. Nauka,
884 Moskva, 1–280 p.
- 885 Snejder, G. F., 1960. Fauna ostracod nizne triasovych otlozenij Prikaspijskoj nizmennosti. *Trudy*
886 *Kiuge* 5, 287-303.
- 887 Sohn, I. G., 1968. Triassic Ostracodes from Makhtesh Ramon, Israel. *Bulletin of the Geological*
888 *Survey of Israel* 44, 1–71.

889 Speranza, F., Minelli, L., 2014. Ultrathick Triassic dolomites control the rupture behavior of the
890 central Apennine seismicity: Evidence from magnetic modeling of the L'Aquila fault zone.
891 *Journal of Geophysical Research: Solid Earth* 119, 1-15. ,

892 Sylvester-Bradley, P. C., 1961. Suborder Metacopina Sylvester-Bradley, n. suborder. Q358–359. In
893 Moore, R. C. (ed.). *Treatise of invertebrate paleontology. Part Q, Arthropoda 3, Crustacea,*
894 *Ostracoda.* Geological Society of America, Boulder, CO and University of Kansas Press,
895 Lawrence, KS, 442 pp.

896 Styk, O., 1958. Triassic microfauna in the neighbourhood of Chrzanow and the northwestern part of
897 the Mesozoic periphery of the Swiety Kryzys Mts. *Bulletin Poland Instytut Geologiczny*
898 121, *Micropalaeontological researches in Poland* 3, 163-176.

899 Széles, M., 1965. Ostracodák a Bakonyi Nosztori-Volgy felsokarni rétegeiből. *Földtani közlöny*45,
900 412-417.

901 Tollmann, A., 1976. *Analyse des klassischen nordalpinen Mesozoikums. Monographie des*
902 *Nördlichen Kalkalpen* 2, 1-580.

903 Ulrichs, M., 1970. Variability of some Ostracods from the Cassian beds (Alpine Triassic)
904 depending on the ecology. *Bulletin du Centre Recherches de Pau – SNPA* 5, 695-715.

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908 Captions. Légendes

909 Fig. 1. Geographical location of the sampling area. Localisation géographique de la zone
910 d'étude.

911

912 Fig. 2. Structural scheme of the central Mediterranean area with the location of the study area
913 (after Grasso, 2001 modified). Schéma structural de la Méditerranée centrale avec la
914 localisation de la zone d'étude (d'après Grasso, 2001 modifié)

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916 Fig. 3. Schematic palaeogeographic reconstruction of Pangaea and Neo-Tethys in Late
917 Triassic times (after Speranza & Minelli (2014), Golonka, 2007 and Preto et al., 2010

modified). Reconstruction paléogéographique schématique de la Pangée et de la Néo-Téthys à la fin du Trias (d'après Speranza & Minelli, 2014; Golonka, 2007 et Preto et al., 2010 modifié).

Fig. 4. Geological map of the Monte Scalpello area (after Lentini, 1974 and Di Paolo et al. 2012, modified). Carte géologique de la région de Monte Scalpello (d'après Lentini, 1974 et Di Paolo et al. 2012, modifié)

Fig. 5. Carnian Ammonoid zones (after Lucas 2010 modified). Zones à ammonioïdés du Carnien (d'après Lucas 2010, modifié).

Figure 6. Carnian ostracods from Monte Scalpello. Scale bar 200µm. Ostracodes du Carnien du Monte Scalpello. Barre d'échelle 200µm.

a - b. *Ogmoconchella felsooersensis* (Kozur, 1970). **a.** Complete carapace, right external lateral view; **b.** Complete carapace, dorsal view.

c - d. *Healdia* sp. **c.** Complete carapace, right external lateral view; **d.** Complete carapace, dorsal view.

e. *Bektasia* sp. 1. Complete carapace, left external lateral view.

f - h. *Hiatobairdia subsymmetrica* Kristan-Tollmann, 1970. **f.** Complete carapace, right external lateral view; **g.** Complete carapace, right external lateral view; **h.** Complete carapace, dorsal view.

i - j. *Bairdia* cf. *humilis* Monostori, 1995. **i.** Complete carapace, right external lateral view; **j.** Complete carapace, dorsal view.

k - l. *Bairdia* cf. *deformata* Kollmann, 1963. **k.** Complete carapace, right external lateral view; **l.** Complete carapace, dorsal view.

m. *Bairdia cassiana* (Reuss, 1869), complete carapace, right external lateral view.

n, o. *Bairdia* sp. 1. Complete carapace, right external lateral view.

p. *Bairdia balatonica* Méhes, 1911. Complete carapace, right external lateral view.

946 q - r. *Bairdia scaliai* n. sp. **q**. Paratype, complete carapace, left external lateral view; **r**. Holotype,
 947 complete carapace, right external lateral view.
 948 s. *Bairdia* cf. *finalyi* (Méhes, 1911). Complete carapace, right external lateral view.
 949 t. *Bairdia*? sp. 2. Complete carapace, right external lateral view.
 950 u. *Bairdia* sp. 3. Complete carapace, right external lateral view.
 951
 952 Fig. 7. Carnian ostracods from Monte Scalpello. Scale bar = 200µm (a – l); 100 µm (m – p).
 953 Ostracodes du Carnien du Monte Scalpello. Barre d'échelle 200 µm (a - l), 100 µm
 954 (m - p).
 955 a. *Ptychobairdia kristinae* Kollmann, 1960. Complete carapace, right external lateral view.
 956 b. *Bairdiacypris* cf. *aequisymmetrica* Mette et al., 2014. Complete carapace, right external lateral
 957 view .
 958 c. *Bairdiacypris* cf *mirautae* Crasquin-Soleau and Gradinaru, 1996. Complete carapace, right
 959 external lateral view.
 960 d - f. “*Anchistrocheles*” *gemmellaroi* sp. nov. **d**. Paratype, complete carapace, left external lateral
 961 view ,
 962 **e**. “*Anchistrocheles*” *gemmellaroi* sp. nov. Holotype, complete carapace, right external lateral view.
 963 **f**. Paratype, complete carapace, dorsal view.
 964 g. *Nodobairdia mammillata* Kollmann, 1963. Complete carapace, right external lateral view.
 965 h - j. *Acratia maugerii* n. sp. **h**. Holotype, complete carapace, right external lateral view; **i**. Paratype,
 966 complete carapace, left external lateral view; **j**. Paratype, complete carapace, dorsal view.
 967 k. *Bythocypris*? sp. 1. Complete carapace, right external lateral view.
 968 l. *Pontocypris rara* Méhes, 1911. Complete carapace, left external lateral view.
 969 m - n. *Judahella*? *montanarii* n. sp. **m**. Holotype, left valve, external lateral view; **n**. Paratype,
 970 complete carapace, dorsal view.

971 o - p. *Mocklella muelleri* Bunza and Kozur, 1971. **o**. Complete carapace, left external lateral view;
972 p. Complete carapace, dorsal view.

973

974 Fig. 8. Schematic palaeoenvironmental model for the Late Carnian Mufara Formation basin
975 (see also Fig. 3). Modèle paléoenvironnemental schématique de la Formation Mufara du Carnien
976 supérieur (voir également fig. 3)

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Late Triassic paleogeography