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S. Crasquin, Francesco Sciuto, Agatino Reitano, Rosa Maria Coco. Late Triassic (Tuvalian – Carnian, Tropites subbullatus/Anatropites spinosus zones) ostracods from Monte Gambanera (Castel di Iudica, Central-Eastern Sicily, Italy). *Bulletin de la Société Géologique de France*, 2020, 10.1051/bsgf/2020031 . hal-02990524

HAL Id: hal-02990524

<https://hal.science/hal-02990524>

Submitted on 9 Nov 2020

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2 Late Triassic (Tuvalian–Carnian, *Tropites subbulatus/Anatropites* 3 *spinosa* zones) ostracods from Monte Gambanera 4 (Castel di Iudica, Central-Eastern Sicily, Italy)

5 Sylvie Crasquin^{1,*}, Francesco Sciuto^{2,*}, Agatino Reitano³ and Rosa Maria Coco²

6 ¹ CR2P – CNRS, MNHN, Sorbonne Université, 4, Place Jussieu, T. 46-56, E.5, F-75252 Paris Cedex 05, France

7 ² Palaeoecological Research Group, Department of Biological, Geological and Environmental Science, Catania University,
8 Corso Italia, 55, Catania 95129, Italy

9 ³ Natural History Museum, via degli Studi 9, 97013 Comiso, Ragusa, Italy

10 Received: 28 October 2019 / Accepted: 2 July 2020

11 **Abstract** – Ostracod associations coming from the Upper Triassic (*Tropites subbulatus/Anatropites*
12 *spinosa* zone of the Tuvalian substage) clays and sandstones of the Mufara Formation outcropping along
13 the west side of Monte Gambanera (Castel di Iudica, central-eastern Sicily) have been analysed for the first
14 time. The specimens are relatively abundant, silicified, well preserved and often preserved as complete
15 carapaces. Over 200 specimens have been determined. They belong to the families Healdiidae, Bairdiidae,
16 Bythocyprididae, Acratiidae, Cytheruridae, Limnocytheridae, Candonidae, Cavellinidae, Polycopidae and
17 Thaumatocyprididae. Thirty-seven species are identified of which nine species are new: *Hungarella foreliae*
18 n.sp., *Hungarella siciliensis* n.sp., *Bairdia andrecrasquinii* n.sp., *Bairdia gabaneraensis* n.sp.,
19 *Ptychobairdia iudicaensis* n.sp., *Ptychobairdia leonardoi* n.sp., *Petasobairdia jeandercourtii* n.sp.,
20 *Kerocythere dittainoensis* n.sp. and *Mockella barbroae* n.sp.

21 **Keywords:** Ostracods / systematic / Late Triassic / Neo-Tethys / Central-Eastern Sicily / Mount Gambanera / Mufara
22 Formation

23 **Résumé – Ostracodes du Trias supérieur (Tuvalien, Carnien, zones à *Tropites subbulatus/***

24 *Anatropites spinosa*) de Monte Gambanera (Castel di Iudica, Sicile Centre Est, Italie). Pour la
25 première fois est ici analysée une association d'ostracodes provenant du Trias supérieur (zones à *Tropites*
26 *subbulatus/Anatropites spinosa* du sous étage Tuvalien) dans les argiles et grés de la Formation Mufara
27 affleurant le flanc ouest du Mont Gambanera (Castel di Iudica, Sicile Centre Est). Les spécimens, silicifiés,
28 sont relativement abondants, bien préservés et les plus souvent retrouvés sous formes de carapaces
29 complètes. Plus de 200 spécimens ont été identifiés. Ils appartiennent aux familles Healdiidae, Bairdiidae,
30 Bythocyprididae, Acratiidae, Cytheruridae, Limnocytheridae, Candonidae, Cavellinidae, Polycopidae and
31 Thaumatocyprididae. Trente-sept espèces sont reconnues dont neuf sont nouvelles: *Hungarella foreliae* n.sp.,
32 *Hungarella siciliensis* n.sp., *Bairdia andrecrasquinii* n.sp., *Bairdia gabaneraensis* n.sp., *Ptychobairdia*
33 *Iudicaensis* n.sp., *Ptychobairdia leonardoi* n.sp., *Petasobairdia jeandercourtii* n.sp., *Kerocythere*
34 *dittainoensis* n.sp. et *Mockella barbroae* n.sp.

35 **Mots clés :** ostracodes / systématique / Trias supérieur / Néo-Téthys / Sicile centre est / Mont Gambanera / Formation
36 Mufara

40 41 1 Introduction

42 This is the second contribution on the Late Triassic ostracod
43 fauna of the Mufara Formation outcropping in central eastern
44 Sicily. Previously the ostracod fauna of the *Tropites dilleri*

45 zone of the Tuvalian substage outcropping at Monte Scalpello
46 has been analysed (Crasquin *et al.*, 2018).

47 Now, a sedimentary level which is stratigraphically higher
48 than the previous one and referable to the *Tropites subbulatus/*
49 *Anatropites spinosa* zone of the Tuvalian substage, has been
50 identified at the western side of the Monte Gambanera, nine
51 kilometres south of Monte Scalpello (Fig. 1). The samples
52 provided a rich and mostly well-preserved ostracod fauna.

*Corresponding author:
sylvie.crasquin@sorbonne-universite.fr



Fig. 1. Geographical location of Monte Gammabana, Sicily, Italy and sample locality.

2 Geological setting and studied samples

Monte Gammabana is a modest relief located in central eastern Sicily (F 269 III NE of the Carta d'Italia alla scala 1:25 000) to the southeast of the town of Castel di Iudica (EN), about 40 kilometres west of Catania (Fig. 1). Structurally Monte Gammabana is part of the ‘‘Monte Judica Units’’ (Lentini et al., 1987) and is inserted along the northern margin of the Gela Foredeep, in the geodynamic context of the southern end of the Maghrebian–Sicilian Southern Apennine nappes (Fig. 2) (Lentini et al., 1987; Grasso, 2001 inter alias).

In the Monte Gammabana area, the outcropping sediments are assigned to the Neo-Tethyan Mesozoic-Cenozoic complex which belongs 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). The Imerese Basin, where these sedimentary successions were deposited, was delimited by the Panormide Carbonate Platform to the west and the Trapanese Carbonate Platform to the east and south (Catalano and D’Argenio, 1982; Montanari, 1987; Speranza and Minelli, 2014). In this basin, therefore, occurs a transitional facies between the Panormide and Trapanese shelf facies, on the one hand, and a deep marine facies of the Neo-Tethys, on the other. The sedimentary succession of Monte Gammabana (Fig. 2) starts with the ‘‘Carnian Flysch’’ (Auct.) or the Mufara Formation (Schmidt di Friedberg and Trovò, 1962). This unit, outcropping in the

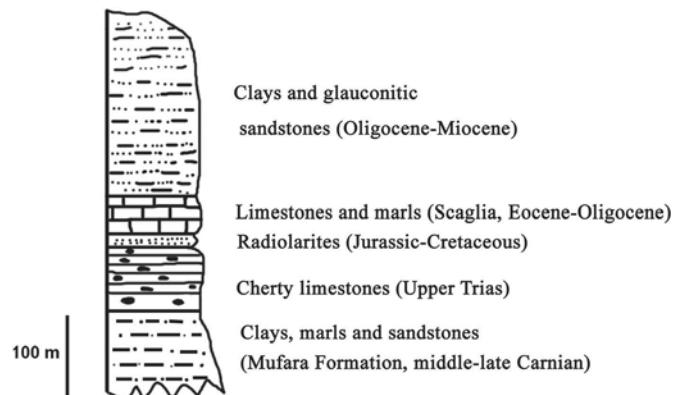


Fig. 2. Stratigraphic series of Monte Gammabana, Sicily, Italy.

southern slopes of the mount, mainly consists of dark grey pelites, which locally contain rare ammonites, with rare interbeds of fossiliferous calcarenites and fibrous calcite with *Halobia* spp. imprints. The Mufara Fm. has been analysed since the beginning of the nineteenth century by Calcara (1840, 1845), Nelli (1899a, b) and subsequently by Gemmellaro (1904), Scalia (1907a, b, 1909, 1910–1914), Maugeri Patanè (1934) and Lentini (1974). These latter authors attributed these sediments to the Carnian (Late Triassic).

Stratigraphically, the Mufara Fm. outcropping at Monte Scalpello, can be referred to the *Tropites dilleri* zone of the Tuvalian substage (Crasquin et al., 2018) due to the presence of Trachyceratidae (?*Neoprotrachyceras*, *Trachysagenites*, *Pamphagosirenites*) and Tropitidae. A foraminifera, conodont and palynomorph biostratigraphical analysis, allowed to attribute the levels of the Mufara Fm. outcropping at Monte Gammabana to the *Tropites subbulatus/Anatropites spinosus* zone of the Tuvalian substage (Fig. 3) (Carrillat, 2001; Carrillat and Martini, 2009). In this stratigraphic horizon, cropping out near masseria Balconere at the west side of Mount Gammabana, two levels consisting of slightly silty clays have been sampled (Fig. 1). As they are stratigraphically very close and the number of specimens is quite low, we consider here the ostracod assemblages of both samples in all. They represent the ostracod association of the present study.

Twenty kilograms of sediments were collected from each of the two stratigraphic levels. Sediments were routinely washed, dried in oven and sieved. Then, ostracod specimens were picked out from the 63 µm fraction. The ostracod specimens were examined and measured under a stereomicroscope, then photographed under an LMU Tescan Vega II SEM. The material is housed in the Palaeontological Museum of the University of Catania. The repository number of the specimens are given in the systematic descriptions and/or in plate explanations. Over 200 specimens have been picked out from the two samples. The specimens are silicified, quite well preserved and often consist of complete carapaces.

3 Systematic palaeontology

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

STAGE	SUB STAGE	Ammonoid zones (Tethyan)
CARNIAN -227 ma	Tuvalian	Anatropites spinosus
		Tropites subbullatus
		Tropites dilleri
	Julian	Austrotrachyceras austriacum
		Trachyceras aonoides
		Trachyceras aon
-237 ma		Daxatina canadensis

Fig. 3. Carnian ammonoid zones in Monte Scalpello (Crasquin et al., 2018) and Monte Ganganera (present study) (after Lucas, 2010 modified).

dorsal border; ADB: antero-dorsal border. We follow here the general classification of Moore (1961) and Horne et al. (2002).

Class Ostracoda Latreille, 1806

Subclass Podocopa Müller, 1894

Order Metacopida Sylvester-Bradley, 1961

Suborder Metacopina Sylvester-Bradley, 1961

Superfamily Healdoidea Harlton, 1933

Family Healdiidae Harlton, 1933

The systematics of Mesozoic Healdiidae is quite complicated and an important revision is necessary. We can't do it here because we have not enough material and most of the discrimination between the genera were based on muscles scars which are not preserved in the present material. However, we try to establish a way to distinguish the Triassic Healdiidae genera when only the external characters of carapaces are available. Therefore we follow the work of Kristan-Tollmann (1973, 1979). The Palaeozoic forms are considered to belong to the subfamily Heidiinae Harlton, 1933. The Triassic forms

belong to Hungarellinae Kristan-Tollmann, 1971 and Liassic ones to the subfamily Pseudohealdiinae Gründel, 1964 (Kristan-Tollmann, 1971).

Subfamily Hungarellinae Kristan-Tollmann, 1971

In the Subfamily Hungarellinae, seven genera have been described so far: *Triadiohealdia* Kristan-Tollmann, 1971; *Aneisohealdia* Kristan-Tollmann, 1971; *Labratella* Gramm, 1970; *Hungarella* Méhes, 1911; *Ogmoconchella* Gründel 1964 emend Michelsen, 1975; *Signohealdia* Kristan-Tollmann, 1971; *Torohealdia* Kristan-Tollmann, 1971.

A great confusion exists in the systematics of Late Permian–Triassic Healdiidae genera *Hungarella*–*Ogmoconcha*–*Ogmoconchella*. Some authors consider *Hungarella* Méhes, 1911 (which has no type material—Gerry and Kozur, 1973; but the Hungarian original material in under revision by E. Tóth, pers. com.) and *Ogmoconcha* Triebel, 1941 as synonyms (Moore, 1961; Anderson, 1964). Shaver (in Moore 1961), Sohn (1968) and Kristan-Tollmann (1971, 1977a, b) don't agree with this synonymy. In fact, the two genera are close but the valves are strongly dissymmetric in shape in *Hungarella*. The third genus, *Ogmoconchella* was introduced by Gründel (1964) and emended by Michelsen (1975) mainly due to the presence of a spine at PVB. In a recent revision, Forel and Crasquin (submitted) considered that until the relationship of *Ogmoconcha* and *Hungarella* is clarified, *Hungarella* should only be used for Triassic species to avoid artificially rooting *Ogmoconcha* down to the Triassic. Morphologically, the left and right valves of *Hungarella* are asymmetrical contrary to those of *Ogmoconcha* (Kristan-Tollmann, 1977a, b; Lord, 1982): in the absence of observable central muscle scars, all Triassic occurrences of *Ogmoconcha* and *Ogmoconchella* are re-attributed to the genus *Hungarella*.

Genus *Hungarella* Méhes, 1911

Type species *Bairdia problematica* Méhes, 1911

Hungarella forelae n.sp.

(Plate 1A)

2018 *Ogmoconchella felsooersensis* (Kozur, 1970); Crasquin et al. : 133, figs. 6A-B.

Etymology. Dedicated to Dr. Marie-Béatrice Forel, Muséum national d'Histoire naturelle, Paris.

Material. Four complete carapaces.

Holotype. One complete carapace, collection number PMC O 21 H 13/10/2019, Plate 1A

Paratype. One complete carapace, collection number PMC O 77 P 13/10/2019, Crasquin et al., 2018, fig. 6A.

Diagnosis. A species of *Hungarella* with triangular shape carapace, a posteroventral spine at RV, delicate flattening in blade shape at anterior border of RV.

Description. Massive carapace with a symmetric triangular shape; quite symmetric relative to H max; shape of left and right valves similar; LV is significantly larger than RV and radius of curvature of PB smaller than anterior one; LV overlaps RV all around the carapace with minimum at PVB; maximum of H located in front of or at mid L; maximum of L at mid H or a little below; VB quite straight; presence of a very fine flattening all around the AB of RV in blade shape; small spine more or less distinct at PVB of RV; dorsal view biconvex with valves almost symmetric in shape and W max at or just behind mid L; surface seems to be smooth.

Dimensions. L = 706–919 µm; H = 529–622 µm (see Fig. 4).

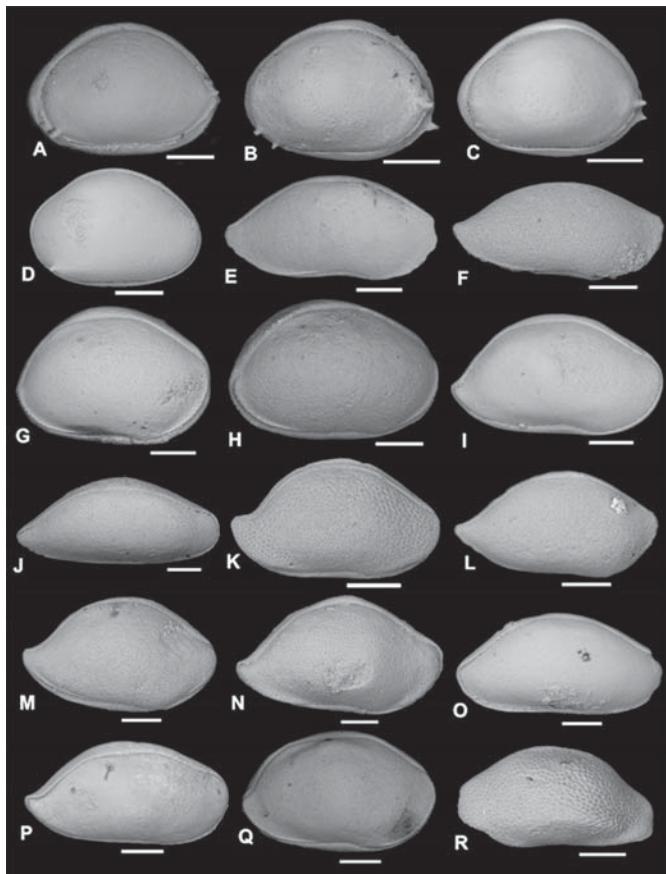


Plate 1 Ostracods from Late Triassic (Tuvalian-Carnian) of Monte Gambanera, Sicily, Italy. All the specimens are stored in the Palaeontological Museum of the University of Catania. The repository numbers are given as PCM (Palaeontological Museum Catania) O (Ostracods) X H (number of holotype) or XP (number of paratype) or FS X (Figured Specimen number) registration date. Scale bars = 200 μm . A: *Hungarella forelae* n. sp. A: holotype, right lateral view of a complete carapace, PMC O 21 H 13/10/2019; paratype figured in Figure 6A (Crasquin et al., 2018). B-C: *Hungarella siciliensis* n. sp. B: holotype, right lateral view of a complete carapace, PMC O 22 H 13/10/2019; C: paratype, right lateral view of a complete carapace, PMC O 78 P 13/10/2019. D: *Hungarella* sp. A: right lateral view of a complete carapace, PCM O FS49. E-F: *Bairdia andrecrasquini* n. sp. E: holotype right lateral view of a complete carapace, PMC O 23 H 13/10/2019; F: paratype, right lateral view of a complete carapace, PMC O 79 P 13/10/2019. G-H: *Bairdia gambaneraensis* n. sp. G: holotype, right lateral view of a complete carapace, PMC O 24 H 13/10/2019; H: paratype, right lateral view of a complete carapace, PMC O 80 P 13/10/2019. I: *Bairdia cassiana* (Reuss, 1869). Right lateral view of a complete carapace, PCM O FS50. J: *Bairdia* cf. *monostorii* Forel and Grădinaru, 2018. Right lateral view of a complete carapace, PCM O FS51. K: *Bairdia* sp. I sensu Crasquin et al., 2018. Right lateral view of a complete carapace, PCM O FS52. L: *Bairdia* sp. A. Right lateral view of a complete carapace, PCM O FS53. M: *Bairdia* sp. B. Right lateral view of a complete carapace, PCM O FS54. N: *Bairdia* sp. C. Right lateral view of a complete carapace, PCM O FS55. O: *Bairdia* sp. D. Right lateral view of a complete carapace, PCM O FS56. P: *Bairdia* sp. E. Right lateral view of a complete carapace, PCM O FS57. Q: *Bairdia* sp. F. Right lateral view of a complete carapace, PCM O FS58. R: *Hiatobairdia subsymmetrica* Kristan-Tollmann, 1970. Lateral view of a left valve, PCM O FS59.

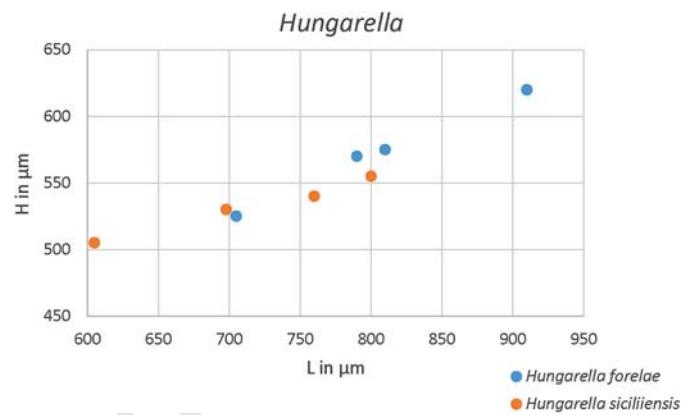


Fig. 4. Height (H)/length (L) diagram of figured specimens of the two new *Hungarella* species. In blue: *H. forelae* n. sp.; in orange: *H. siciliensis* n. sp.

Occurrence. Tuvalian–Carnian, *Tropites dilleri* zone (Crasquin et al., 2018) and *Tropites subbulatus/Anatropites spinosus* zones, Monte Gambanera, Central-Eastern Sicily, Italy (this study).

Remarks. The present specimens are close to *Ogmoconchella felsooersensis* (Kozur, 1970) from the early Anisian of Hungary (Kozur, 1970, Monostori, 1995) and Romania (Sebe et al., 2013). In a previous paper (Crasquin et al., 2018) two of the present specimens were attributed to this *O. felsooerensis*. Based on the new material this determination was revised and they are attributed to *Hungarella forelae*. Here the carapace is more triangular with a smaller radius of curvature of PB; the blade at AB is also more expressed here. The specimens described by Forel et al. (2019b; Plate 4, particularly fig. E, K) as *Hungarella gommerii* Forel, 2019 from the Carnian of Sichuan (South China) are very close to our specimens. However, the Sichuan specimens are smaller (biggest one $\approx L = 600 \mu\text{m}$, $H = 400 \mu\text{m}$) and show a smaller radius of curvature at both extremities. The largest specimen of *H. forelae* (Fig. 4) presents some morphological variability: overlap less important, at RV: the blade is located only at the ventral part of AB and occurrence of a small spine at the upper part of it, at LV: anteroventral blade seems to be also present. We consider that these morphological variations could be the expression of ontogenetic variations but some doubt remains.

Hungarella siciliensis n. sp.

(Plate 1B and 1C)

Etymology. The species name refers to Sicily where the locus typicus is located.

Material. Four complete carapaces.

Holotype. One complete carapace, collection number PCM O 22 H 13/10/2019, Plate 1B.

Paratype. One complete carapace, collection number PCM O 78 P 13/10/2019, Plate 1C.

Diagnosis. A species of *Hungarella* with triangular shape carapace, two posteroventral spines at RV, flattening in blade shape plus a spine at anterior border of RV, spine at AB of LV.

Description. Massive stocky carapace with a symmetric triangular shape; quite symmetric relative to H max; general shape of valves similar, but LV is significantly larger than RV and radius of curvature of PB smaller than anterior one; LV overlaps RV all around the carapace with minimum at PVB;

maximum of H located at mid L or in front of mid L; maximum of L at mid H or a little below mid H; VB quite straight; presence of a very fine flattening at AB of RV in blade shape and a spine located near the maximum of convexity of AB; two more or less distinct spines at PVB of RV; one spine at AB of LV; dorsal view biconvex with valves almost symmetric in shape and W max at or just behind mid L; surface seems to be smooth.

Dimensions. L = 606–760 µm; H = 503–533 µm (see Fig. 4).

Occurrence. Tuvalian–Carnian, *Tropites subbulatus*/ *Anatropites spinosus* zones, Monte Gambanera, Central-Eastern Sicily, Italy (this work).

Remarks. *Hungarella siciliensis* n.sp. is very close to *H. forelae* n.sp.. The shapes of the valves are similar. The main differences between the two species is the presence of 2 spines at PVB of RV, presence of a spine at AB of both valves and the less distinct “blade” at the AB of *H. siciliensis* n.sp.. We can't exclude that these differences are due to morphological variability of *H. forelae* n.sp. (sexual or ontogenetic). However, for the time being we have not enough specimens to settle this question.

Hungarella sp. A

(Plate 1D)

Material. One complete carapace.

Dimensions. H = 538 µm; L = 775 µm.

Occurrence. Tuvalian–Carnian, *Tropites subbulatus*/ *Anatropites spinosus* zones, Monte Gambanera, Central-Eastern Sicily, Italy (this study).

Order Podocopida Sars, 1866

Suborder Bairdiocopina Gründel, 1967

Superfamily Bairdiodea Sars, 1866

Family Bairdiidae, Sars 1866

Genus *Bairdia* McCoy, 1844

Type species *Bairdia curta* McCoy, 1844

Bairdia andrecrasquini n. sp.

(Plate 1E and 1F)

Etymology. In memory and honour of Dr. André Crasquin, father of the first author.

Material. Three complete carapaces and one broken carapace.

Holotype. One complete carapace, collection number PMC O 23 H 13/10/2019 (Plate 1E).

Paratype. One complete carapace, collection number PMC O 79 P 13/10/2019 (Plate 1F).

Diagnosis. A species of *Bairdia* with an elongated carapace, flattened AB and PB, and a ventral ridge along the posterior part of the VB and PB.

Description. Bairdioid carapace, quite elongated (H/L = 0.44); DB straight at RV and slightly convex at LV; ADB and PDB straight and quite symmetric with respect to DB; AB with large radius of curvature and maximum located above mid-H, AB strongly flattened laterally; VB slightly concave; PB slender and pointed, maximum of curvature located at lower 1/3 of H, strongly flattened laterally; presence of the ventral ridge which begins in posterior part of VB and runs along PB.

Remarks. This species is quite original and differs from all other ones by the specific characters (flattened AB and PB, and a ventral ridge along the posterior part of the VB and PB.). The shape of carapace is comparable to *Bairdia* sp. 4 sensu Forel

et al. (2019b) from the Carnian of China and to *Bairdia liviae* Forel and Grădinaru, 2018 from the Anisian of North Dobrogea, Romania (Forel and Grădinaru, 2018) but this last species does not show the specific characteristics.

Dimensions. H = 372–415 µm; L = 372–415 µm.

Occurrence. Tuvalian, *Tropites subbulatus*/ *Anatropites spinosus* zones, Monte Gambanera, Central-Eastern Sicily, Italy (this study).

Bairdia gambaneraensis n. sp.

(Plate 1G and 1H)

2018 *Bairdia* cf. *deformata* Kollmann, 1963; Crasquin et al.: 134, fig. 6K-L.

Etymology. Referring to the locus typicus Monte Gambanera, Sicily, Italy.

Material. Four complete carapaces.

Holotype. One carapace, collection number PMC O 24H 13/10/2019 (Plate 1G).

Paratype. One complete carapace, collection number PMC O 80 P 13/10/2019 (Plate 1H).

Diagnosis. A species of *Bairdia* with a very compact carapace, a continuously arched dorsal border and flattened and crenulated ventral parts of AB and PB.

Description. Bairdioid carapace, quite short (H/L = 0.6–0.7), LV overlaps RV all around the carapace with minimum at AB and anterior part of VB; LV: all the dorsal part regularly arched; AB with large radius of curvature with maximum at mid-H, VB almost straight; BP with large radius of curvature with maximum at lower 1/3 of H; PDB arched; RV: DB straight, ADB straight with an angulation of 145°–150° against DB; AB with large radius of curvature; AVB and PVB flattened laterally in its very external part and with very fine crenulation; VB slightly concave; bairdioid beak quite absent; PDB straight with an angle of 125°–130° with DB; Presence of a shoulder on medio-dorsal part of LV; carapace biconvex and quite slender in dorsal view.

Dimensions. L = 886–910 µm; H = 600–643 µm.

Occurrence. Tuvalian, *Tropites dilleri* zone (Crasquin et al., 2018), *Tropites subbulatus*/ *Anatropites spinosus* zones, Monte Gambanera, Central-Eastern Sicily, Italy (this work).

Remarks. *Bairdia gambaneraensis* n.sp. is similar to *Bairdia deformata* Kollmann, 1963 from the Rhaetian of Austria. The carapace of the present material is longer and presents a shoulder at LV. The new species has exactly the same general shape of valves as *B. penovoidea* Bolz, 1971 from Late Norian–Rhaetian of Austria and differs from this species only by a larger AB, a longer DB and the ventral crenulation of AB and PB.

Bairdia cassiana (Reuss, 1869)

(Plate 1I)

1869 *Cythere cassiana* n.sp.; Reuss: 108.

1869 *Bairdia cassiana* (Reuss, 1869); Gümbel: 180, pl. 5, figs. 18–19.

1958 *Bairdia cassiana* (Reuss, 1869); Styk: 171, fig. 3/1.

1970 *Bairdia cassiana* (Reuss, 1869); Ulrichs: 705–706, pl. 1, figs. 1–2.

1978 *Bairdia cassiana* (Reuss, 1869); Kristan-Tollmann: 81, pl. 1, fig. 4; pl. 6, fig. 6.

1991 *Bairdia cassiana* (Reuss, 1869); Kristan-Tollmann et al.: 200, pl. 1, fig. 5.

1995 *Bairdia cassiana rotundidorsata* n.ssp.; Monostori: 42, Pl. 2, figs. 4–5.

363	1996 <i>Bairdia (Rectobairdia) garciai</i> n.sp.; Crasquin-	424
364	Soleau and Grădinaru: 77–78, pl. 2, figs. 5, 8.	425
365	2013 <i>Bairdia cassiana</i> (Reuss, 1869); Monostori and Tóth:	426
366	310, pl. 2, figs. 7, 8, 10.	427
367	2014 <i>Bairdia cassiana</i> (Reuss, 1869); Mette et al.: pl. 2,	428
368	fig. 1.	429
369	2014 <i>Bairdia cassiana</i> (Reuss, 1869); Monostori and Tóth:	430
370	26, pl. 1, fig. 14.	431
371	2018 <i>Bairdia cassiana</i> (Reuss, 1869); Crasquin et al.: 134,	432
372	fig. 6M.	433
373	2019a <i>Bairdia cassiana</i> (Reuss, 1869), Forel et al., in	434
374	press, figs. 4F–H.	435
375	Material. Four complete carapaces.	436
376	Dimensions. H = 486–533 µm; L = 840–948 µm.	437
377	Occurrence. Early Carnian, Late Triassic, Southern Alps,	438
378	Italy (Reuss 1869; Gümbel 1869; Ulrichs 1970; Kristan-	439
379	Tollmann 1978); Carnian, Late Triassic, Święty Krzyż	440
380	Mountain, Poland (Styk, 1958); Carnian, Late Triassic,	441
381	Transdanubian Range, Hungary (Kristan-Tollmann, 1991);	442
382	Late Anisian, Middle Triassic, Balaton Highland, Hungary	443
383	(Monostori, 1995); Early Anisian, Middle Triassic, North	444
384	Dobrogea, Romania (Crasquin-Soleau and Grădinaru, 1996);	445
385	Ladinian, Middle Triassic, Balaton Highland, Hungary	446
386	(Monostori and Tóth, 2013, 2014); Middle Anisian, Middle	447
387	Triassic, Northern Calcareous Alps, Austria (Mette et al.,	448
388	2014); Carnian, Late Triassic, Karavanke Mountains, Slovenia	449
389	(Forel et al., 2019b); Tuvalian–Carnian, <i>Tropites dilleri</i> zone	450
390	(Crasquin et al., 2018) and <i>Tropites subbulatus/Anatropites</i>	451
391	<i>spinosis</i> zones, Monte Ganganera, Central-Eastern Sicily,	452
392	Italy (this study).	453
393	<i>Bairdia cf. monostorii</i> Forel and Grădinaru, 2018	454
394	(Plate 1J)	455
395	2018 <i>Bairdia cf. humilis</i> Monostori, 1995; Crasquin et al.:	456
396	134, figs. 6i-j.	457
397	Material. One complete carapace and one broken	458
398	carapace.	459
399	Dimensions. (complete carapace) H = 311 µm;	460
400	L = 806 µm.	461
401	Remarks. Forel and Grădinaru (2018) renamed <i>Bairdia</i>	462
402	<i>humilis</i> Monostori, 1995 in <i>Bairdia monostorii</i> nom. nov.	463
403	Occurrence. Tuvalian–Carnian, <i>Tropites dilleri</i> zone	464
404	(Crasquin et al., 2018) and <i>Tropites dilleri</i> zone (Crasquin	465
405	et al., 2018) and <i>Tropites subbulatus/Anatropites spinosus</i>	466
406	zones, Monte Ganganera, Central-Eastern Sicily, Italy (this	467
407	study).	468
408	<i>Bairdia</i> sp.1 sensu Crasquin, Sciuto, Reitano, 2018	469
409	(Plate 1K)	470
410	2018 <i>Bairdia</i> sp. 1; Crasquin et al.: 134, fig. 6N-O	471
411	Material. One complete carapace and one right valve.	472
412	Dimensions. (complete carapace) H = 462 µm;	473
413	L = 800 µm.	474
414	Remarks. This species of <i>Bairdia</i> is characterized by the	475
415	BD which is underlined by a blade, and by the reticulation of	476
416	the carapace. The upper part of PB is quite horizontal and its	477
417	radius of curvature is small. This could be a new species.	478
418	Occurrence. Tuvalian–Carnian, <i>Tropites dilleri</i> zone	479
419	(Crasquin et al., 2018) and <i>Tropites subbulatus/Anatropites</i>	480
420	<i>spinosis</i> zones, Monte Ganganera, Central-Eastern Sicily,	481
421	Italy (this study).	482
422	<i>Bairdia</i> sp. A	483
423	(Plate 1L)	484
	Material. Two complete carapaces.	
	Dimensions. H = 400–440 µm; L = 785–882 µm.	
	Occurrence. Tuvalian–Carnian, <i>Tropites subbulatus/Anatropites spinosus</i> zones, Monte Ganganera, Central-Eastern Sicily, Italy (this study).	
	<i>Bairdia</i> sp. B	
	(Plate 1M)	
	Material. One complete carapace.	
	Dimensions. H = 600 µm; L = 1000 µm.	
	Occurrence. Tuvalian–Carnian, <i>Tropites subbulatus/Anatropites spinosus</i> zones, Monte Ganganera, Central-Eastern Sicily, Italy (this study).	
	<i>Bairdia</i> sp. C	
	(Plate 1N)	
	Material. One complete carapace.	
	Dimensions. H = 643 µm; L = 1147 µm.	
	Remarks. This species is characterized by its triangular shape, the flattening of the ventral borders and the reticulated surface. The PB has a very small radius of curvature.	
	Occurrence. Tuvalian–Carnian, <i>Tropites subbulatus/Anatropites spinosus</i> zones, Monte Ganganera, Central-Eastern Sicily, Italy (this study).	
	<i>Bairdia</i> sp. D	
	(Plate 1O)	
	Material. One complete carapace.	
	Dimensions. H = 496 µm; L = 1014 µm.	
	Occurrence. Tuvalian–Carnian, <i>Tropites subbulatus/Anatropites spinosus</i> zones, Monte Ganganera, Central-Eastern Sicily, Italy (this study).	
	<i>Bairdia</i> sp. E	
	(Plate 1P)	
	Material. One complete carapace.	
	Dimensions. H = 476 µm; L = 953 µm.	
	Remarks. This elongated species shows a blade underlying the BD.	
	Occurrence. Tuvalian–Carnian, <i>Tropites subbulatus/Anatropites spinosus</i> zones, Monte Ganganera, Central-Eastern Sicily, Italy (this wor	
	<i>Bairdia</i> sp. F	
	(Plate 1Q)	
	Material. Two complete carapaces.	
	Dimensions. H = 600–615 µm; L = 885–953 µm.	
	Remarks. This compact species (H/L = 0.64–0.67) has a flattened BP and AB and a shoulder at the dorsal part of the right valve.	
	Occurrence. Tuvalian–Carnian, <i>Tropites subbulatus/Anatropites spinosus</i> zones, Monte Ganganera, Central-Eastern Sicily, Italy (this study).	
	<i>Genus Hiatobairdia</i> Kristan-Tollmann, 1970	
	Type species: <i>Hiatobairdia subsymmetrica</i> Kristan-Tollmann, 1970	
	<i>Hiatobairdia subsymmetrica</i> Kristan-Tollmann, 1970	
	(Plate 1R)	
	1970 <i>Hiatobairdia subsymmetrica</i> n. gen. n. sp.; Kristan-Tollmann: 268, pl. 35, figs. 1–3.	
	1976 <i>Hiatobairdia subsymmetrica</i> Kristan-Tollmann, 1970; Tollmann: 276, pl. 163, fig. 14.	
	1978 <i>Hiatobairdia subsymmetrica deformis</i> n. sp.; Kristan-Tollmann: 83, pl. 4, figs. 1–7.	
	1979 <i>Hiatobairdia subsymmetrica</i> Kristan-Tollmann, 1970; Kristan-Tollmann et al.: 147, pl. 6, fig. 4.	

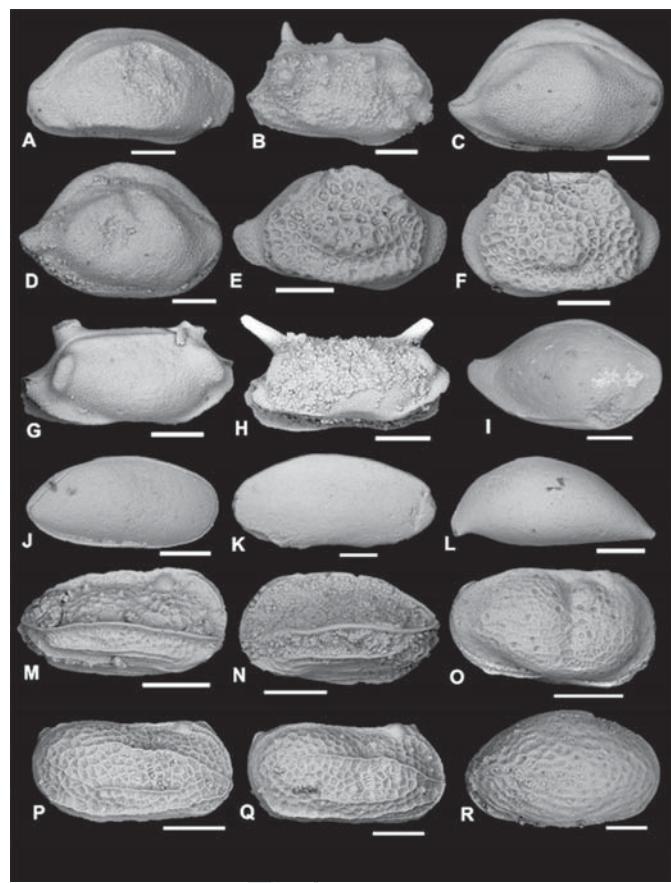


Plate 2. Ostracods from Late Triassic (Tuvalian-Catian) of Monte Gambanera, Sicily, Italy. All the specimens are stored in the Palaeontological Museum of the University of Catania. The repository numbers are given as PMC (Paleontological Museum Catania) O (Ostracods) X H (number of holotype) or X P (number of paratype) or FS X (Figured Specimen number) registration date. Scale bars = 200 µm except P-Q, R = 100 µm. A: *Hiatobairdia* sp. A: Right lateral view of a complete carapace, PMC O FS60. B: *Mirabairdia pernodosa* Tollmann, 1963. Right lateral view of a complete carapace, PMC O FS61. C-D: *Ptychobairdia iudicaensis* n. sp. C: holotype, right lateral view of a complete carapace, PMC O25 H 13/10/2019; D: paratype, right lateral view of a complete carapace, PMC O 81 P 13/10/2019. E-F: *Ptychobairdia leonardoi* n. sp. E: holotype, lateral view of a right valve, PMC O 26 H 13/10/2019; F: paratype, lateral view of a left valve, PMC O 82 P 13/10/2019. G-H: *Petasobairdia jeandercourtii* n. sp. G: holotype, right lateral view of a complete carapace, PMC O 27 H 13/10/2019; H: paratype, left lateral view of a complete carapace, PMC O 83 P 13/10/2019. I: *UrobaIRDIA angusta* Kollmann, 1963. Right lateral view of a complete carapace, PCM O FS62. J: *Bairdiacypris triassica* Kozur, 1971c. Right lateral view of a complete carapace, PCM O FS63. K: *Bythocypris* sp. A. Left lateral view of a complete carapace, PCM O FS64. L: *Acratia maugerii* Crasquin et al., 2018. Left lateral view of a complete carapace, PCM O FS65. M-N: *Kerocythere dittainoensis* n. sp. M: holotype, lateral view of a right valve, PMC O 28 H 13/10/2019; N: paratype, lateral view of a left valve, PMC O 84 P 13/10/2019. O: *Renngartenella sanctaeccrasis* Kristan-Tollmann, 1973 (♂). Right lateral view of a complete carapace, PCM O FS66. P-Q: *Mockella barbroae* n. sp. P: holotype, right lateral view of a complete carapace, PMC O 29 H 13/10/2019; Q: paratype, right lateral view of a complete carapace, number PMC O 85 P13/10/2019. R: *Simeonella brotzenorum* Sohn, 1968. Lateral view of a right valve, PCM O FS67.

2018 *Hiatobairdia subsymmetrica* Kristan-Tollmann, 1970; Crasquin et al.: 134, figs. 6F–H.

Material. Three left valves.

Dimensions. H = 412–569 μm ; L = 812–969 μm .

Occurrence. Early Carnian of South Tyrol, Italy (Tollmann, 1976; Kristan-Tollmann, 1978); Rhaetian of Austrian Alps (Kristan-Tollmann, 1970) and Central Iran (Kristan-Tollmann *et al.*, 1979); Tuvalian–Carnian *Tropites dilleri* zone (Crasquin *et al.*, 2018) and *Tropites subbulatus/Anatropites spinosus* zones, Monte Gambanera, Central-Eastern Sicily, Italy (this study).

Hiatobairdia sp. A
(Pl. 1, 2A)

(Plate 2A)

Material. One complete carapace and one right valve.

Dimensions. (complete carapace) H = 533 μ m;
 $L = 948 \mu\text{m}$.

Remarks. This species has a straight DB and presents a ridge at the dorso-median part of the RV.

Occurrence. Tuvalian–Carnian, *Tropites subbullatus*/ *Anatropites spinosus* zones, Monte Gambanera, Central-Eastern Sicily, Italy (this study).

Genus *Mirabairdia* Kollm 1963

Type species *Mirabairdia pernodososa* Kollmann, 1963

Mirabairdia pernodos Kollmann, 1963

(Plate 2B)

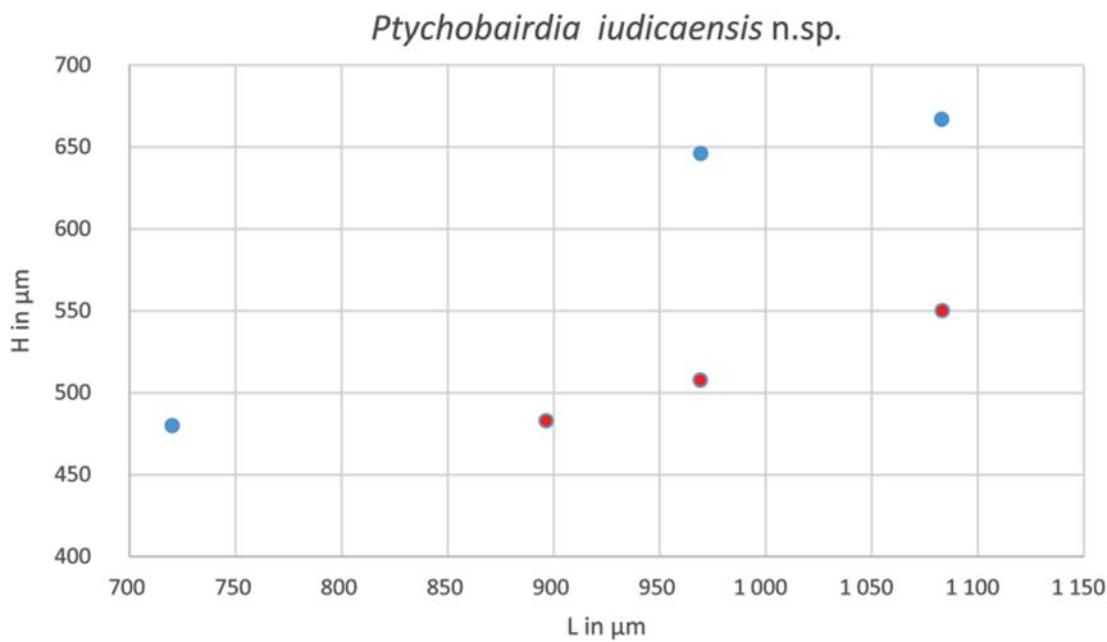


Fig. 5. Height (H)/length (L) Diagram for *Ptychobairdia iudicaensis* n.sp. In red: right valves; in blue left valves.

509 1963 *Mirabairdia pernoldosa* n. sp.; Kollmann: 177–178,
 510 pl. 1, figs. 1–2, pl. 8, figs. 1–6.
 511 1971a *Triebelina (Mirabairdia) pernoldosa illyrica* n.spp.;
 512 Kozur: 17, fig. 1G.

513 1971a *Triebelina (Mirabairdia) balatonica* n. sp.; Kozur:
 514 15–16, figs. 2I, 3C.
 515 1971 *Mirabairdia pernoldosa* Kollm.; Kristan-Tollmann:
 516 text-fig. 1/8.

517 1984 *Triebelina (Mirabairdia) pernoldosa illyrica* Kozur;
 518 Salaj and Jendrejáková: pl. 2, figs. 1–4.
 519 2014 *Triebelina (Mirabairdia) pernoldosa* (Kollmann,
 520 1963); Monostori and Tóth: 27–28, pl. 2, figs. 7–8.

521 **Material.** One complete carapace, 13 RV and 2 LV.

522 **Dimensions.** (complete carapace and LV) H (without
 523 spines) = 453–507 μm ; L = 826–923 μm .
Occurrence. Anisian, Western Carpathians, Slovakia
 524 (Salaj and Jendrejáková, 1984; Kozur, 1971a); Anisian,
 525 Balaton Highland, Hungary (Kozur, 1971a); Ladinian,
 526 Dolomites, South Tirol, Italy, (Kristan-Tollmann, 1971);
 527 Ladinian, Northern Calcareous Alps, Cassian beds, Austria
 528 (Kollmann, 1963); Ladinian E-Bakony, Hungary (Monostori
 529 and Tóth, 2014); Tuvalian–Carnian, *Tropites subbulatus*/
 530 *Anatropites spinosus* zones, Monte Gambera, Central-
 531 Eastern Sicily, Italy (this study).

532 **Genus *Ptychobairdia* Kollmann, 1960**

533 Type species *Ptychobairdia kuepperi* Kollmann, 1960

534 *Ptychobairdia iudicaensis* n. sp.

535 (Plate 2C and 2D)

536 **Etymology.** From the locus typicus Castel di Iudica, Sicily,
 537 Italy.

538 **Material.** Four complete carapaces.

539 **Holotype.** One complete carapace, collection number
 540 PMC O 25 H 13/10/2019 (Plate 2C).

541 **Paratype.** One complete carapace, collection number
 542 PMC O 81 P 13/10/2019 (Plate 2D).

543 **Diagnosis.** A species of *Ptychobairdia* with a reticulated
 544 carapace which is flattened laterally all around except at the
 545 ventral part; LV significantly higher than RV, presence of
 546 vertical sulci at antero-dorsal part of the carapace.

547 **Description.** Carapace massive, high ($H/L = 0.6$); surface
 548 reticulated;

549 LV: Flattened laterally all around with maximum at DB and
 550 PB; BD strongly arched; AB with quite large radius of
 551 curvature and maximum at mid H; VB almost straight; BP with
 552 a very small curvature; two vertical sulci in dorsal part; LV
 553 strongly overlapping RV all around with maximum at BD.

554 RV: Strongly flattened all around except in ventral part;
 555 presence of a sulcus in AD part; BD long; AB with quite small
 556 radius of curvature; VB gently concave at its anterior part; BP
 557 very slender; DB, ADB, AVB, PVB, PDB straight.

558 **Remarks.** *Ptychobairdia iudicaensis* n. sp. is comparable
 559 with *P. oberhauseri* Kollmann, 1960 from the Rhaetian of
 560 Austria (Kollmann, 1960) and the Carnian–Norian of Queen
 561 Charlotte Island, Canada (Arias and Lord, 2000). The latter
 562 species is longer, has a smaller AB and shows a horizontal
 563 sulcus. *P. iudicaensis* n.sp. differs from *P. kristanae* Kollmann,
 564 1960 from the Rhaetian–Early Jurassic of Austria (Kollmann,
 565 1960, 1963) and the late Carnian of Sicily (Crasquin et al.,
 566 2018) by its reticulated carapace and the RV being clearly
 567 smaller than LV.

568 **Dimensions.** L = 720–1083 μm ; H = 480–667 μm (see
 569 Fig. 5).

570 **Occurrence.** Tuvalian–Carnian, *Tropites subbulatus*/
 571 *Anatropites spinosus* zones, Monte Gambera, Central-
 572 Eastern Sicily, Italy (this study).

573 ***Ptychobairdia leonardoi* n. sp.**

574 (Plate 2E and 2F)

575 **Etymology.** Dedicated to Leonardo Reitano, son of
 576 Agatino Reitano.

577 **Material.** Six right valves, eight left valves.

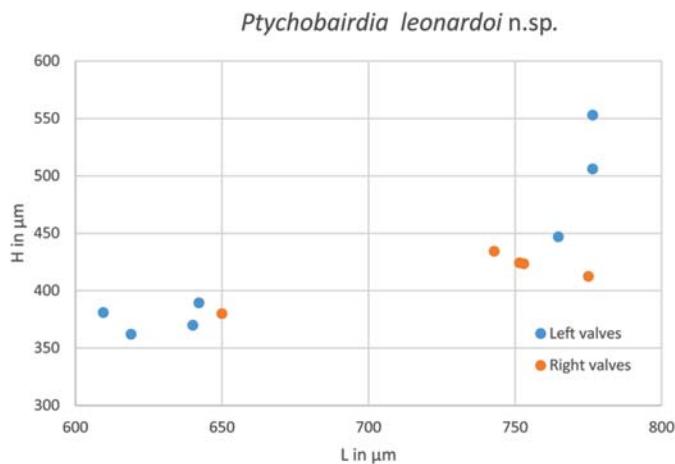


Fig. 6. Height (H)/length (L) diagram for *Ptychobairdia leonardoi* n. sp. In blue: left valves; in red: right valves.

Holotype. One right valve, collection number PMC O 26 H 13/10/2019 (Plate 2E).

Paratype. One left valve, collection number PMC O 82 P 13/10/2019 (Plate 2F).

Diagnosis. A species of *Ptychobairdia* with a short coarse reticulated carapace, strongly compressed and finely reticulated AB and PB and a central node.

Description. Carapace with massive coarse reticulation, flattened laterally at AB and PB; DB straight at both valves and parallel to VB; ontogenetic modifications of DB: at RV with nodules or blade at biggest specimens, at LV development of shoulders at each extremities in largest specimens; AB and PB with small radius of curvature, flattened laterally and covered by a fine reticulation; VB straight to slightly concave, with development of adventral structure; presence of a big node in median part of the carapace.

Remarks. *Ptychobairdia leonardoi* n. sp. differs from other species by the specific characters. *Margarobairdia zapfei* Kristan-Tollmann 1983 from the Anisian of South China (Kristan-Tollmann, 1983) has a similar valve shape but a different ornamentation.

Dimensions. L = 610–776 μm; H = 362–553 μm (see Fig. 6).

Occurrence. Tuvalian–Carnian, *Tropites subbulatus*/ *Anatropites spinosus* zones, Monte Gambanera, Central-Eastern Sicily, Italy (this study).

Genus *Petasobairdia* Chen and Shi, 1982

Type species *Petasobairdia bicornuta* Chen and Shi, 1982

Petasobairdia jeandercourtii n.sp.

(Plate 2G and 2H)

Etymology. Dedicated to past Pr. Jean Dercourt, who was the mentor of the first author.

Material. One broken carapace and three left valves.

Holotype. One broken carapace, collection number PMC O 27 H 13/10/2019 (Plate 2G).

Paratype. One left valve, collection number PMC O 83 P 13/10/2019 (Plate 2H).

Diagnosis. A species of *Petasobairdia* with a long reticulated carapace and elongated nodes at ADB and PDB of both valves.

Description. Carapace long ($H/L \approx 0.4$), reticulated, strongly laterally compressed along AB, AVB, VB, PVB, PB; DB long and straight at both valves; presence of an elongated node at ADB and PDB of both valves; LV with two big horns with large base at each extremities of DB.

Dimensions. (holotype and paratype without spines) H = 348–373 μm; L = 826–853 μm.

Occurrence. Tuvalian–Carnian, *Tropites subbulatus*/ *Anatropites spinosus* zones, Monte Gambanera, Central-Eastern Sicily, Italy (this study).

Remarks. *Petasobairdia jeandercourtii* n. sp. is comparable to *P. bicornuta* Chen and Shi, 1982 from the Late Permian of Hubei Province (Chen and Shi, 1982) which has a much shorter DB. *P. longispinosa* (Kozur, 1971a, b, c) from Anisian of Slovakia (Kozur, 1971a), Anisian and Middle Triassic of Romania (Salaj and Jendrekova, 1984; Crasquin-Soleau and Grădinaru, 1996; Sebe et al., 2013), Anisian of Austria (Mette et al., 2014), Ladinian of Hungary (Monostori and Tóth, 2013) and Carnian of Southern Turkey (Forel et al., 2017) has a shorter DB and doesn't have AD and PD nodes.

Genus *Urobairdia* Kollmann, 1963

Type species: *Urobairdia austriaca* Kollmann, 1963

Urobairdia angusta Kollmann, 1963

(Plate 2I)

1963 *Urobairdia angusta* n.g. n. sp.; Kollmann: 167, pl. 6, figs. 1–4.

1965 *Urobairdia angusta* Kollmann, 1963; Széles: 414, pl. 6, fig. 5.

1995 *Bairdia (Urobairdia) angusta recta* n. ssp.; Monostori: 43, pl. 3, figs. 3–4.

2010 *Urobairdia angusta* Kollmann, 1963; Zorn: 271–272, pl. 6, figs. 12–15.

2013 *Bairdia (Urobairdia) angusta* Kollmann, 1963; Monostori and Tóth: 7, pl. 1, figs. 10–12.

2014 *Bairdia (Urobairdia) angusta* Kollmann, 1963; Monostori and Tóth: 25–26, Pl. 1, fig. 14.

Material. Two complete carapaces

Dimensions. H = 440–500 μm; L = 826–871 μm.

Occurrence. Late Norian, Zlambach Formation, Austria (Kollmann, 1963; Zorn, 2010); Anisian, Felsőörs, Hungary (Monostori, 1995); Carnian, Nosztori Valley, Hungary (Széles, 1965); Ladinian-Carnian, Balaton Highland, Hungary (Monostori and Tóth, 2013, 2014); Tuvalian–Carnian, *Tropites subbulatus*/*Anatropites spinosus* zones, Monte Gambanera, Central-Eastern Sicily, Italy (this study).

Genus *Bairdiacypris* Bradfield 1931

Type species: *Bairdiacypris deloi* Bradfield, 1935.

Bairdiacypris triassica Kozur, 1971a, b, c

(Plate 2J)

1911 ?*Bairdia silicula* Jones; Méhés: 16–17, pl. 1, figs. 19–

21 1971 *Bairdiacypris triassica* n.sp.; Kozur: 5–6, figs. 2H–L

2013 *Bairdiacypris triassica* Kozur, 1971a, b, c; Monostori and Tóth: 313–314, pl. 3, figs. 7–8

2014 *Bairdiacypris triassica* Kozur, 1971a, b, c; Monostori and Tóth: 25, pl. 1, fig. 12

2017 *Bairdiacypris triassica* Kozur, 1971c; Forel et al.: fig. 10U

Material. Two complete carapaces

Dimensions. H = 361–374 μm; L = 774–812 μm

Occurrence. Early Carnian, Balaton highland, Hungary (Méhés, 1911; Kozur, 1971c), Ladinian, Nosztori Valley, Hungary (Monostori and Tóth, 2013); Ladinian–Carnian, Balaton Highland (Monostori and Tóth, 2014), Carnian, Mersin, Turkey (Forel et al., 2017); Tuvalian–Carnian, *Tropites subbulatus/Anatropites spinosus* zones, Monte Ganganera, Central-Eastern Sicily, Italy (this study) 
 Family Bythocyprididae Maddocks, 1969
 Genus *Bythocypris* Brady, 1880
 Type species: *Bythocypris reniformis* Brady, 1880
Bythocypris sp. A
 (Plate 2K)
Material. Two complete carapaces and two LV.
Dimensions. H = 433–500 µm; L = 775–1090 µm.
Occurrence. Tuvalian–Carnian, *Tropites subbulatus/Anatropites spinosus* zones, Monte Ganganera, Central-Eastern Sicily, Italy (this study) 
 Family Acritidae Gründel, 1962
 Genus *Acratia* Delo, 1930
 Type species: *Acratia typica* Delo, 1930.
Acratia maugerii Crasquin et al., 2018
 (Plate 2L)
 1991 *Acratia* sp.; Kristan-Tollmann: 196, pl. 1, fig. 1.
 2013 *Acratia goemoeryi* (Kozur, 1970); Monostori and Tóth: 6–7, pl. 4, only fig. 2.
 2018 *Acratia maugerii* n.sp.; Crasquin et al.: 137–138, fig. 7H–J.
Material. One complete carapace and two LV.
Dimensions. H = 373–464 µm; L = 866–1066 µm.
Occurrence. Late Ladinian of NE Iran (Kristan-Tollmann, 1991), Balaton Highland, Hungary (Monostori and Tóth, 2013); Tuvalian–Carnian, *Tropites dilleri* zone (Crasquin et al., 2018) and *Tropites subbulatus/Anatropites spinosus* zones, Monte Ganganera, Central-Eastern Sicily, Italy (this study) 
 Superfamily Cytheroidea Müller-Baird, 1850
 Family Cytheridae Müller, 1894
 Subfamily Cytherurinae Müller, 1894
 Genus *Kerocythere* Kozur and Nicklas, 1970
 Type species *Cythere raibiana* Gümbel, 1869
Kerocythere dittainoensis n.sp.
 (Plate 2M and 2N)
Etymology. Referring to the Dittaino river which flows near to the locus typicus.
Material. Four complete carapaces.
Holotype. One complete carapace, collection number PMC O 28 H 13/10/2019 (Plate 2M).
Paratype. One complete carapace, collection number PMC O 84 P 13/10/2019 (Plate 2N).
Diagnosis. A species of *Kerocythere* Kozur and Nicklas, 1970 with a subrectangular reticulate carapace, presence of a lateral thick ridge which ascends at PB and occurrence of ventral ridges, one thick and several thinner ones parallel to VB.
Description. Carapace subrectangular, almost equivalve; BD long and straight, presence of a ridge on each side of hinge; presence of an eye spot; AB with large radius of curvature with maximum located below mid-H, flattened laterally and smooth; VB almost straight; PB with small radius of curvature with maximum around mid H, upper and lower part quite straight; H max at anterior angle; L max at PB; sulcus more or

less developed in anterior 1/3 of L; surface reticulated and ornamented with possible pustules and ridges: one lateral, thick, reaching from antero-ventral part of the carapace up to PB, ascending in posterior part; group of ventral ridges, one thick parallel to VB and several (at least three) below.

Dimensions. L = 651–731 µm; H = 309–376 µm.

Occurrence. *Tropites subbulatus/Anatropites spinosus* zones, Monte Ganganera, Central-Eastern Sicily, Italy (this study).

Remarks. *Kerocythere dittainoensis* n.sp. could be compared to *Kerocythere reticulata* Kristan-Tollmann, 1972 from early Carnian of the Dolomites (Italy). This species doesn't show the ventral group of ridges but has one ridge at the AD part of the carapace following the AB. The new species is also close to *Kerocythere tricostata* Forel, 2017 from the middle Carnian of southern Tauride-Anatolide platform (Turkey; Forel et al., 2017). At the present material the lateral ridge is longer, ascends at its posterior part and the surface is reticulated 

Family indet.

Genus *Renngartenella* Schneider 1957 (in Mandelstam et al., 1957)

Renngartenella sanctaecrusis Kristan-Tollmann, 1973
 (Plate 2O)

1973 *Renngartenella sanctaecrucis* Kristan-Tollmann; Kristan-Tollmann and Hamedani: 215, 217–219, pl. 8, figs. 1–6; pl. 11, figs. 1, 3, 5, 6; pl. 12, fig. 10.

1979 *Renngartenella sanctaecrucis* Kristan-Tollmann, 1973; Liebermann: 215, pl. 5, fig. 2.

1982 *Renngartenella sanctaecrucis* Kristan-Tollmann, 1973; Basha: pl. 1, fig. 15.

1990 *Renngartenella sanctaecrucis* Kristan-Tollmann, 1973; Gerry et al.: 96, pl. 1, figs 11–13.

1994 *Renngartenella sanctaecrucis* Kristan-Tollmann, 1973; Monostori: 320, 322, figs 5/5–7.

2001 *Renngartenella sanctaecrucis* Kristan-Tollmann, 1973; Keim et al.: fig. 8C.

2014 *Renngartenella sanctaecrucis* Kristan-Tollmann, 1973; Monostori and Tóth: 29–30, pl. 3, figs. 10–12.

2019a *Renngartenella sanctaecrucis* Kristan-Tollmann, 1973; Forel et al.: fig. 7T-U, in press.

Material. Ten carapaces.

Dimensions. H = 316–439 µm; L = 567–900 µm.

Occurrence. Julian, early Carnian, Heiligkreuz Formation, Italy (Kristan-Tollmann and Hamedani, 1973); Carnian, Late Triassic, Italian Alps (Lieberman, 1979); Cordevolian, Carnian, Jordan (Basha, 1982); Carnian, Israel (Gerry et al., 1990); Carnian, Balaton Highland, Hungary (Monostori 1994; Monostori and Tóth, 2014); Carnian, Dolomites, Northern Italy (Keim et al., 2001); Carnian, Karavanke Mountains, Slovenia (Forel et al., 2019b); Tuvalian–Carnian, *Tropites subbulatus/Anatropites spinosus* zones, Monte Ganganera, Central-Eastern Sicily, Italy (this study) 

Superfamily Cypridoidea Baird 1845

Family Limnocytheridae Klü, 1938

Genus *Mockella* Bunza and Kozur, 1971

Type species: *Mockella muelleri* Bunza and Kozur, 1971; subsequent designation (Kozur, 1973)

Mockella barbroae n. sp.

(Plate 2P and 2Q)

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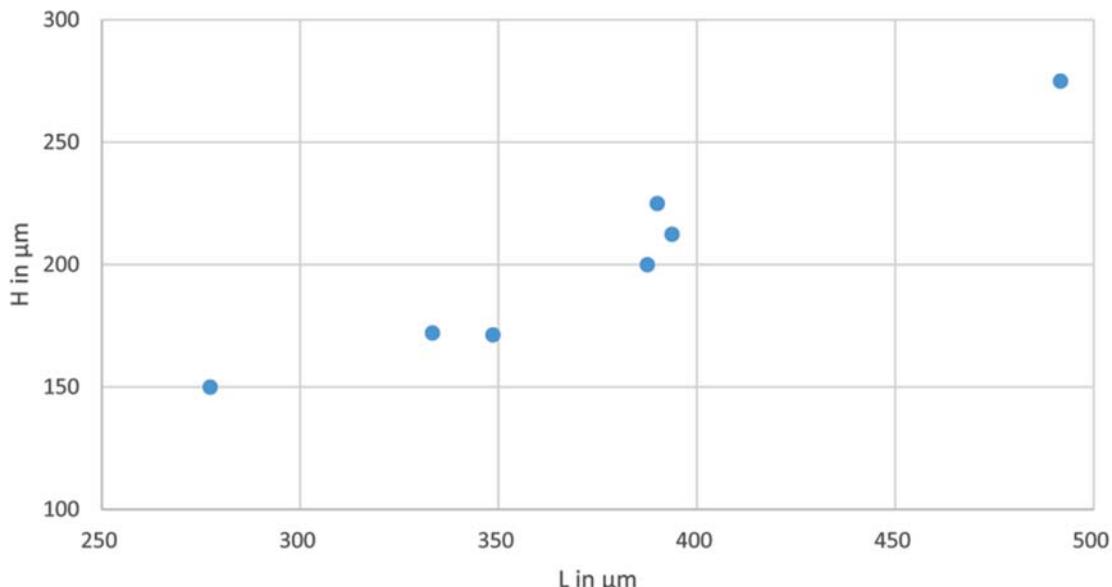
Mockella barbroae n.sp.

Fig. 7. Height (H)/length (L) diagram for *Mockella barbroae* n. sp.

2018 *Mockella muelleri* Bunza and Kozur, 1971, Crasquin et al.: 139, figs. 70-P.

Etymology. Personal dedication of the first author to Mrs. Barbro Lamy, in token of friendship and affection.

Material. Seven complete carapaces and two carapaces from Crasquin et al., 2018

Holotype. One complete carapace, collection number PMC O 29 H 13/10/2019 (Plate 2P).

Paratype. One complete carapace, collection number PMC O 85 P 13/10/2019 (Plate 2Q).

Diagnosis. A species of *Mockella* with a long subrectangular carapace and a well-developed rib all around the carapace.

Description. Carapace sub rectangular, long ($H/L = 0.535$); eye spot well developed; AB with maximum of curvature located low between mid-H and lower 1/3 of H; VB straight; PB equivalent to AB in heteromorphs and smaller in tecnomorphs with maximum of curvature located above mid-H; anteromedian sulcus located in front of mid-L; posterior lobe well developed; anterior lobe less distinct; presence of a distinct ridge all around the carapace including BD; presence of additional ridges on lateral surface of the valves:

- a median ridge which begins at maximum of curvature of AB and precedes on the posterior lobe; this ridge is high and stands out on the surface;
- a lateral ridge below the lobes parallel to VB;
- a small ridge in upper part of AB and below the eye spot.

The valve surface is reticulated with 4 small pustules distributed parallel to AB; in dorsal view, the flanks are parallel. Sexual dimorphism present, expressed by the thickness of the posterior part of the carapace in heteromorphs.

Dimensions. $L = 270\text{--}492 \mu\text{m}$; $H = 150\text{--}275 \mu\text{m}$ (see Fig. 7).

Occurrence. Late Carnian (*Tropites dilleri* zone), Murfa Formation, Sicily, Italy Tuvalian–Carnian (Crasquin et al., 2018) and Tuvalian–Carnian, *Tropites subbulatus/Anatropites spinosus* zones, Monte Gambanera, Central-Eastern Sicily, Italy (this study).

Remarks. *Mockella barbroae* n.sp. is very close to *M. muelleri* Bunza and Kozur, 1971 from the late Carnian of Tyrol, Austria (Bunza and Kozur, 1971) and the Carnian of Monte Cammarata, Sicily (Cafiero and De Capoa Bonardi, 1982). In the study on the Mufara Formation (Crasquin et al., 2018) we attributed the specimens to the latter species. The very well preserved present material enabled us to review our attribution. At the present specimens the BP is larger, the median ridge ends at the posterior lobe and doesn't reach the BP; an additional ridge is present below the lobes and the flanks are parallel in dorsal view

Genus *Simeonella* Sohn, 1968

Type species: *Simeonella brotzenorum* Sohn, 1968.

Simeonella brotzenorum Sohn, 1968

(Plate 2R)

1968 *Simeonella brotzenorum* n. sp.; Sohn: 23–24, pl. 2, figs. 1–4, 6–8, 12–22.

1971 *Simeonella brotzenorum alpina* n. ssp.; Bunza and Kozur: 4–5, pl. 1, figs. 5–7, 13.

1971 *Simeonella brotzenorum* n. sp. n. ssp.; Bunza and Kozur: 5–6, pl. 1, fig. 3.

1973 *Simeonella brotzenorum* Sohn, 1968; Kristan-Tollmann and Hamedani: text-fig. 13/2.

1974 *Simeonella brotzenorum* Sohn, 1968; Hirsch and Gerry: pl. 2, figs. 1–2.

1979 *Simeonella brotzenorum* Sohn, 1968; Lieberman: 103, pl. 5, figs. 6–7.

1979 *Simeonella brotzenorum alpina* Bunza and Kozur, 1971; Styk: 119, pl. 28, figs. 9–10.



Plat 3. Ostracods from Late Triassic (Tuvalian-Carnian) of Monte Ganganera, Sicily, Italy. All the specimens are stored in the Palaeontological Museum of the University of Catania. The repository numbers are given as PCM (Palaeontological Museum Catania) O (Ostracods) FS X (Figured Specimen number) registration date. A, B, C, D: Scale bars=200 µm; E, F, G, H, I: scale bars=100µm. A: *Paracypris?* cf. *redcarenensis* (Blake, 1876). Lateral view of a right valve, PCM O FS68. B: *Paracypris?* sp. A. Right lateral view of a complete carapace, PCM O FS68. C: *Bektasia* sp. A. Right lateral view of a complete carapace, PCM O FS69. D: *Bektasia* sp. B. Right lateral view of a complete carapace, PCM O FS70. E: Podocopida gen. sp. indet. Lateral view of a right valve, PCM O FS71. F: *Polycope baudi* Crasquin-Soleau and Grădinaru 1996. Lateral view of a complete carapace, PCM O FS72. G: ?*Polycope densoreticulata* Monostori and Tóth, 2013. Lateral view of a complete carapace, PCM O FS73. H: *Polycope* sp. A. Lateral view of a complete carapace, PCM O FS74. I: *Thaumatomma?* sp. A. Right lateral view of a complete carapace, PCM O FS75.

- 866 1982 *Simeonella brotzenorum* Sohn, 1968; Basha: pl. 1,
867 fig. 11.
868 1990 *Simeonella brotzenorum* Sohn, 1968; Gerry et al.: 95,
869 pl. 1, figs. 3–5.
870 1994 *Simeonella brotzenorum nostorica* n. ssp; Monostori:
871 324–325, text-fig. 6/1–6.
872 2001 *Simeonella brotzenorum nostorica* Monostori, 1994;
873 Keim et al.: fig. 8B.
874 **Material.** Two carapaces.
875 **Dimensions.** H = 269–296 µm; L = 446–488 µm.
876 **Occurrence.** Ladinian to Carnian, Makhtesh Ramon,
877 Israel (Sohn, 1968; Hirsch and Gerry, 1974; Gerry et al., 1990);
878 Carnian, Northern Calcareous Alps, Austria (Bunza and
879 Kozur, 1971; Kristan-Tollmann and Hamedani, 1973);
880 Carnian, Julian Alps, Italy (Lieberman, 1979; Keim et al.,
881 2001); Carnian, Poland (Styk, 1958), Carnian, Jordan Valley,
882 Jordan (Basha, 1982); Carnian, Balaton Highland, Hungary
883 (Monostori, 1994; Monostori and Tóth, 2014); Tuvalian–
884 Carnian, *Tropites subbulatus/Anatropites spinosus* zones,
885 Monte Ganganera, Central-Eastern Sicily, Italy (this work)
886 Family Candonidae Kaufmann, 1900
887 Genus *Paracypris* Sars, 1866

	<i>Paracypris? cf. redcarenensis</i> (Blake, 1876)	888
	(Plate 3A)	889
	Material. One complete carapace.	890
	Dimensions. H=257 µm; L=561 µm.	891
	Occurrence. Tuvalian–Carnian, <i>Tropites subbulatus/</i> <i>Anatropites spinosus</i> zones, Monte	892
	Gambanera, Central-Eastern Sicily, Italy (this study)	893
	<i>Paracypris?</i> sp. A	894
	(Plate 3B)	895
	Material. One carapace.	896
	Dimensions. H=442 µm; L=631 µm.	897
	Occurrence. Tuvalian–Carnian, <i>Tropites subbulatus/</i> <i>Anatropites spinosus</i> zones, Monte Gambanera, Central- Eastern Sicily, Italy (this study)	898
	Order Platycopida Sars, 1866	899
	Suborder Platycopina Sars, 1866	900
	Superfamily Cavellinoidea Egorov, 1950	901
	Family Cavellinidae Egorov, 1950	902
	Genus <i>Bektasia</i> Özdikmen, 2010	903
	Type species: <i>Reubenella avnimelechi</i> Sohn, 1968.	904
	<i>Bektasia</i> sp. A	905
	(Plate 3C)	906
	Material. One carapace.	907
	Dimensions. H=477 µm; L=787 µm.	908
	Occurrence. Tuvalian–Carnian, <i>Tropites subbulatus/</i> <i>Anatropites spinosus</i> zones, Monte Gambanera, Central- Eastern Sicily, Italy (this study)	909
	<i>Bektasia</i> sp. B	910
	(Plate 3D)	911
	Material. One carapace.	912
	Dimensions. H=545 µm; L=763 µm.	913
	Occurrence. Tuvalian–Carnian, <i>Tropites subbulatus/</i> <i>Anatropites spinosus</i> zones, Monte Gambanera, Central- Eastern Sicily, Italy (this study)	914
	Order, genus and species indet.	915
	Podocopida gen. sp. indet.	916
	(Plate 3E)	917
	Material. One carapace.	918
	Dimensions. H=188 µm; L=364 µm.	919
	Occurrence. Tuvalian–Carnian, <i>Tropites subbulatus/</i> <i>Anatropites spinosus</i> zones, Monte Gambanera, Central- Eastern Sicily, Italy (this study)	920
	Subclass Myodocopa Sars, 1866	921
	Order Myodocopida Sars, 1866	922
	Superfamily Polycopidea Sars, 1866	923
	Family Polycopidae Sars, 1866	924
	Genus <i>Polycope</i> Sars, 1866	925
	<i>Polycope baudi</i> Crasquin-Soleau and Grădinaru 1996	926
	(Plate 3F)	927
	1996 <i>Polycope baudi</i> n.sp.; Crasquin and Grădinaru: 15–16, figs. 1–3.	928
	2013 <i>Polycope baudi</i> Crasquin and Grădinaru 1996; Sebe et al.: pl. 1, fig. 1.	929
	Material. Two carapaces.	930
	Dimensions. H = 330–328 µm; L = 357–376 µm.	931
	Occurrences. Early – middle Anisian, Uzum Bair, Dobro- gea, Roumania (Crasquin-Soleau and Grădinaru, 1996; Sebe et al., 2013); Tuvalian–Carnian, <i>Tropites subbulatus/</i> <i>Anatropites spinosus</i> zones, Monte Gambanera, Central-Eastern Sicily, Italy (this study).	932

- 948 ?*Polycope densoreticulata* Monostori and Tóth, 2013
 949 (Plate 3G)
 950 2013 *Polycope densoreticulata* n.sp.; Monostori and Tóth:
 951 5, pl. 1, figs. 4–7.
 952 **Material.** Three carapaces.
 953 **Dimensions.** H = 204–293 µm; L = 231–306 µm.
 954 **Occurrence.** Ladinian, Balaton Highland, Hungary
 955 (Monostori and Tóth, 2013); Tuvalian–Carnian, *Tropites*
 956 *subbulatus/Anatropites spinosus* zones, Monte Ganganera,
 957 Central-Eastern Sicily, Italy (this study) 
- 958 *Polycope* sp. A
 959 (Plate 3H)
 960 **Material.** One carapace.
 961 **Dimensions.** H = 289 µm; L = 278 µm.
 962 **Occurrences.** Tuvalian–Carnian, *Tropites subbulatus/*
 963 *Anatropites spinosus* zones, Monte Ganganera, Central-
 964 Eastern Sicily, Italy (this study) 
- 965 Order Halocyprida Dana, 1855
 966 Suborder Halocypridina Dana, 1853
 967 Superfamily Thaumatoxypidoidea Müller, 1906
 968 Family Thaumatoxypidae Müller, 1906
 969 Genus *Thaumatomma* Kornicker and Sohn, 1976
 970 Type species: *Thaumatomma piscifrons* Kornicker and
 971 Sohn, 1976
 972 *Thaumatomma* ? sp.A
 973 (Plate 3I)
 974 **Material.** Two carapaces.
 975 **Dimensions.** H = 525–600 µm; L = 575–600 µm.
 976 **Occurrence.** Tuvalian–Carnian, *Tropites subbulatus/*
 977 *Anatropites spinosus* zones, Monte Ganganera, Central-
 978 Eastern Sicily, Italy (this study).

4 Assemblage analysis

The assemblage is composed of 200 specimens belonging to 10 families (plus two undetermined families), 19 genera and 37 species. The 10 determined families present are: Healdiidae, Bairdiidae, Bythocyprididae, Acratiidae, Cytheruridae, Limnocytheridae, Candonidae, Cavellinidae, Polycopidae, Thaumatoxypidae. The relative abundance of the different families expressed by the numbers of genera and species is given in Figure 8.

The Bairdiidae, the most abundant family in number of species (53%) and genera (37%) (Fig. 8), are present in marine environments ranging from very shallow waters up to deep seas. The morphology of the family changes from massive thick-shelled forms in nearshore environments to elongate thin-shelled forms beyond continental slope (particularly in genus *Bairdia*). In the same way, the carapaces of Acratiidae lengthen with depth (as example: *Acratia goemeryi* Kozur, 1970 from Early-Smithian- to Late-Carnian-Triassic; see Forel et al., 2017). Here these two families present thick and ornamented shells (Plates 1E–1R and 2A–2L) which testify an open marine environment with moderate energy. The Healdiidae do also show a change of morphology with depth. The specimens with massive shells and small spines are neritic inhabitants (Plate 1A–1D) of relatively nearshore muddy conditions. In the deep sea, the specimens are thin shelled, elongate with long spines (e.g. Palaeozoic genus *Timorhealdia* Bless, 1987). In other families, some genera also show

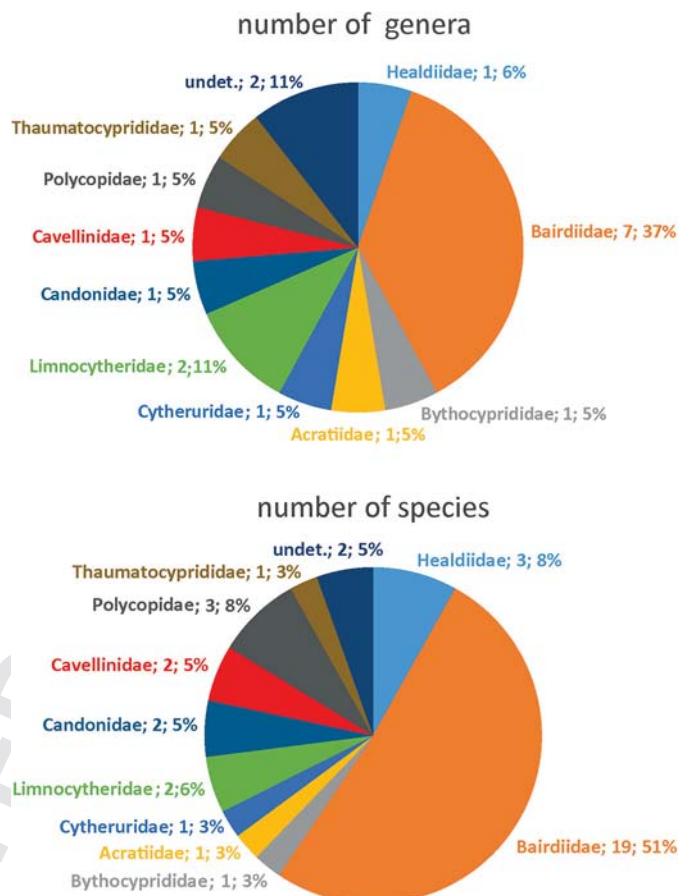


Fig. 8. Diversity of ostracod families from the *Tropites subbulatus/* *Anatropites spinosus* zones represented by number of genera (A) and species (B) in the samples of Mount Ganganera.

different morphological adaptation from neritic to deep sea environments (*Healdia*, *Microcheilinella* etc. see synthesis Tab. 1 in Crasquin and Horne). The ratios between these different morphologies have been used to characterize the depth of ate Palaeozoic and Early Mesozoic environments since quite a long time (model of Lethiers and Raymond, 1991). The present assemblage doesn't include any unequivocal deep water taxa such as those discovered recently in the Carnian of Southern Turkey for example (Forel et al., 2017) or of Sichuan, South China (Forel et al., 2019b). Although the number of specimens is very low, the diversity is quite high with 10 determined families (plus 2 undetermined), 17 genera and 37 species. This biodiversity testifies normal marine conditions and absence of environmental stress. The taxon *Simeonella brotzenorum* SOHN, 1968 which is characteristic of brackish–hypersaline conditions (Gerry et al., 1990; Monostori, 1994) is present but with only 2 carapaces. Quite all the specimens are preserved with the complete carapace. After the death of the specimens, the carapaces tend to open in a few hours (Guernet and Lethiers, 1989). This could suggest a rapid burial in the sediments due to a high sedimentation rate. Similar taphonomic characteristics were also found by Pokorny (1964) and Oertli (1971) for pelitic layer associations deposited in basins with extremely rapid distal sedimentation. We compare the results of the *Tropites subbulatus/Anatropites*

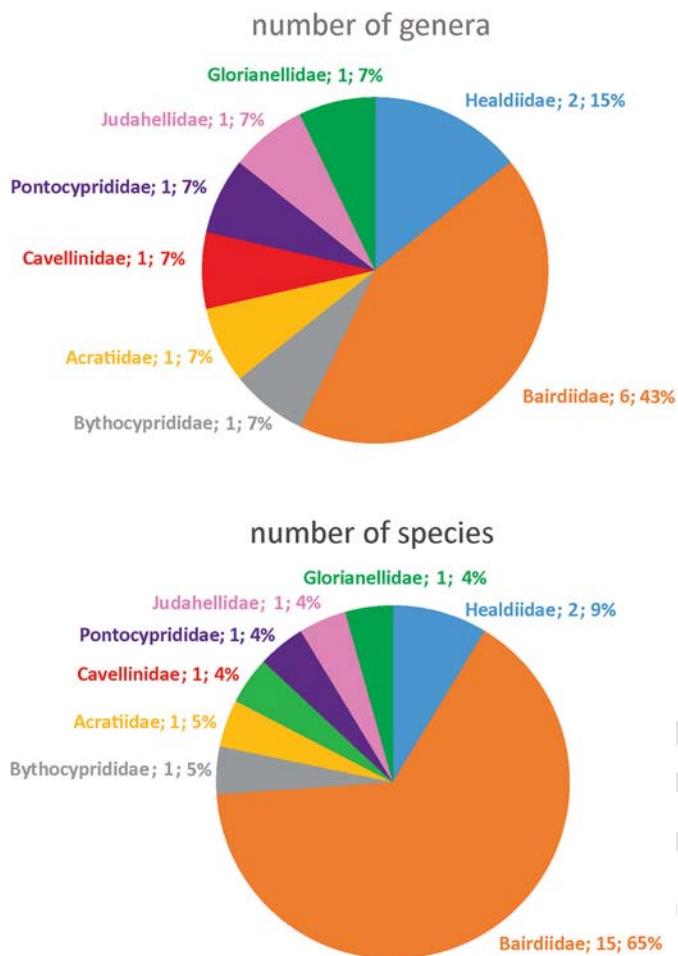


Fig. 9. Diversity of ostracod families from the *Tropites dilleri* zone represented by the number of genera (A) and species (B) in the samples of Mount Scalpello (data from Crasquin et al., 2018).

spinosus zones (this study), with the data obtained in levels just below in *Tropites dilleri* zone (Crasquin et al., 2018) (Fig. 9). Through time, the assemblage became more diversified as recorded by the increasing number of families (8 to 12), genera (14 to 18) and species (23 to 36). The percentage of Bairdiidae decreases in favour of two families being absent before, Cytheruridae and Limnocytheridae which include typical genera of nearshore environments such as *Simoenella*, *Mockella* and *Kerocythere*. We observe also the presence of the brackish – hypersaline species *Renngartenella sanctaeclusis* Kristan-Tolmann, which was suggested by Gerry et al. (1990) to be a stenohaline ostracod.

For Monostori (1994), the dominance of three genera *Kerocythere* – *Renngartenella* – *Simeonella* seems to be a signal of salinity variability. Although these genera are not dominant here, their presence testifies a shallowing of environment from the *Tropites dilleri* zone to the *Tropites subbulatus* / *Anatropites spinosus* zone. The genus *Acratia* is a typical Palaeozoic form present both in Eifelian (neritic) and Thuringian (deep) mega-assemblages (see synthesis in Crasquin and Horne, 2018). Nevertheless, this genus survived the Permian – Triassic extinction events. In 2013, Crasquin and Forel mentioned the last occurrence of neritic *Acratia* in the

Spathian and of deep marine *Acratia* in the Anisian (Crasquin-Soleau and Grădinaru, 1996). Since then, some deep marine forms were also found in the Ladinian of Balaton Highland (Monostori and Tóth, 2013), in the Carnian of Turkey (Forel et al., 2017) and Slovenia (Forel et al., 2019b). In 2013, Monostori and Tóth, described *Acratia goemeryi* from Ladinian neritic sediments of a borehole in Hungary. Three species of *Acratia* from the Carnian of Karavanke Mountains, Slovenia, are figured in Forel et al. (2019b). The occurrence of *Acratia maugerii* in the present material confirms that *Acratia* occurs in neritic environments of the Carnian.

5 Conclusion

The palaeoecological interpretation of the sedimentary facies of the Mufara Formation is extremely difficult due to the absence of intact outcrops. The original stratification and the sedimentary structures have been completely destroyed because of continuous agricultural processing of the pelitic soils and their very consistency which determines frequent drifts and landslides. In very few and limited locations parallel laminations and sandy levels were observed. The only useful palaeoecologic data are those obtained from the palaeontological analysis. The results of the ostracod fauna analysis allow the following conclusions:

- 1 The ostracod assemblage doesn't yield any evidence of deep marine taxa both at Mt. Scalpello (Crasquin et al., 2018) and at Mt. Gamberana. The Mufara Basin, therefore, can be interpreted as a shallow marine basin (Fig. 10) within the deepest and most distal part of a vast continental shelf where the carbonate platforms Panormide, Trapanese, Saccense were located. The deep marine ostracod fauna discovered recently in the Carnian of Southern Turkey (Forel et al., 2017) or in the South China (Forel et al., 2019a) suggests a deepening of the Neo-Tethys basin towards the more eastern areas.
- 2 The Mufara Basin was a site of rapid and intense sedimentation probably linked to rapid bottom currents which, sometimes, displaced and transported (also *in vivo*) microfaunas from more superficial neighbouring environments. It is pointed out here that the sediments of the Mufara Basin at Monte Gamberana do not show vortex structures which were recognized in the Mufara Basin at Monte Scapello. This suggests, that the sediment environment of the Mufara Formation outcrops at Monte Gamberana (Fig. 11) was more distal and less turbulent than that of Mt which was effected by strong bottom traction and swirling currents (Crasquin et al., 2018).
- 3 According to many authors, the Mufara basin is located in a transitional position between the bathyal Neotethys facies to the south and southeast and the carbonate platforms that surround it (Figs. 10 and 11).

Acknowledgements. The authors are grateful to the reviewers and the editors for detailed suggestions and comments to the manuscript. Thanks are due to Mr. Alfio Viola (Electronic Microscopy Laboratory, University of Catania) for SEM photos assistance. Catania Palaeoecological Research Group contribution n° 456.

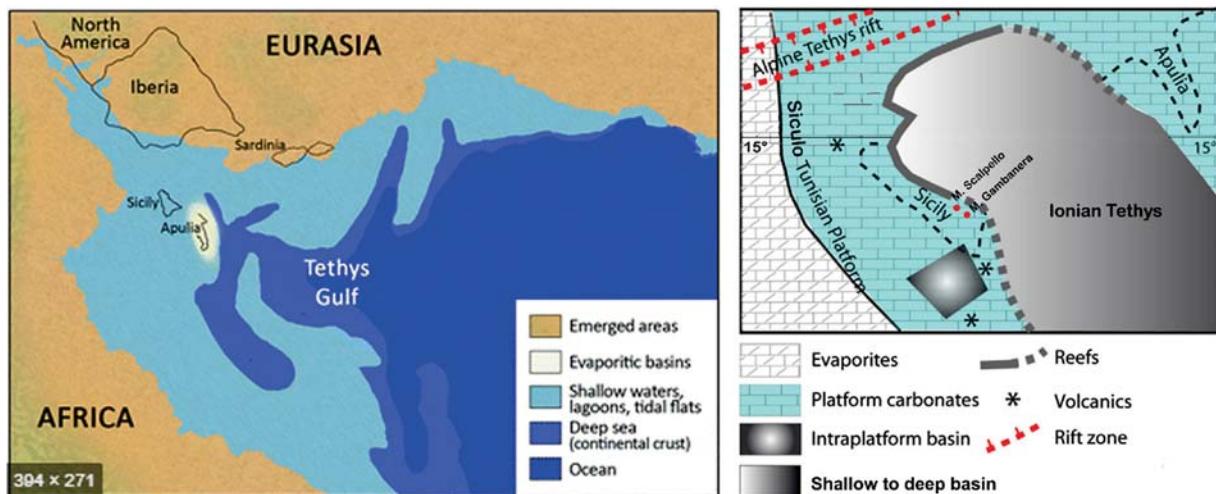


Fig. 10. Palaeogeographic reconstruction of Tethyan (left) and central Mediterranean (right) areas during Late Triassic (after Di Stefano *et al.*, 2015, modified).

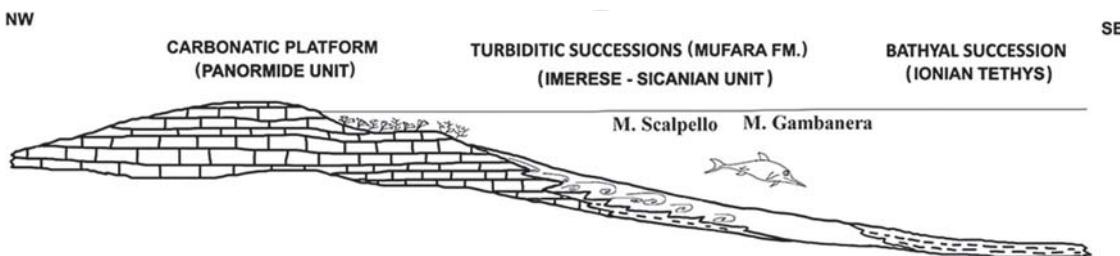


Fig. 11. Schematic palaeoenvironmental model for the late Carnian Mufara Formation basin (see also Fig. 10).

We thanks the two reviewers Emőke Tóth from Eötvös Loránd University, Budapest, Hungary and Wolfgang Mette from Innsbruck University, Austria for their fruitful comments to improve our paper.

This research was supported by the University of Catania “Piano della Ricerca 2016/2018 (code no. 227221132118)” and “PiaCeRi – Piano Incentivi per la Ricerca di Ateneo 2020-22 linea di intervento 2”.

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Cite this article as: Crasquin S, Sciuto F, Reitano A, Coco RM. 2020. Late Triassic (Tuvalian–Carnian, *Tropites subbulatus/Anatropites spinosus* zones) ostracods from Monte Gambarana (Castel di Iudica, Central-Eastern Sicily, Italy), BSGF - Earth Sciences Bulletin Vol: 190069.