THE STATUS OF *BOGIDIELLA BALEARICA* DANCAU, 1973, A STYGOBIONT AMPHIPOD FROM MALLORCA

by Jan H. STOCK (*) & Thomas M. ILIFFE (**)

Resumen

Se presenta la redescripción de *Bogidiella balearica* Dancau, 1973, un anfípodo estigobionte de las cuevas anquihalinas de Mallorca. Queda demostrado que se trata de una buena especie, clasificable dentro del subgénero *Bogidiella* s. str., y que se puede diferenciar fácilmente de *Bogidiella chappuisi* Ruffo, 1952 (con la cual se intentó sinonimizar con anterioridad), perteneciente a otro subgénero, *Medigidiella*.

Abstract

Redescription of *Bogidiella balearica* Dancau, 1973, a stygobiont amphipod from anchihaline caves in Mallorca. It proves to be a good species, to be classified with the subgenus *Bogidiella* s. str., and it is well-distinguished from *Bogidiella chappuisi* Ruffo, 1952 (with which it was tentatively synonymized in the past), belonging to a different subgenus, *Medigidiella*.

Introduction

Bogidiella balearica was described by D. Dancau (1973) after specimens from two caves in Mallorca, Coves del Drac and Cova des Pont.

The status of *B. balearica* was discussed by Karaman, 1979: 25, who regarded it as a «possible synonym» of *B. chappuisi* Ruffo, 1952. This statement was repeated by Karaman (in Ruffo, 1982: 253).

In a series of Amphipoda collected early 1986 in Mallorcan caves by the junior author, two male specimens of a *Bogidiella* were encountered, which were morphologically in good agreement with Dancau's description of *B. balearica*. Moreover, one of the specimens came from the same cave (Coves del Drac) as Dancau's type-material. On the basis of the new material, the taxonomic status of *B. balearica* is clarified; it appears to be a good species.

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Bogidiella balearica Dancau, 1973

Dancau, 1973: 114-119, figs. 1-4; Karaman, 1979: 24-25 (synonymy discussed); Stock, 1981: 354 (cited only); Karaman, in Ruffo, 1982: 253 (cited only).

Material.— 1 ♂, Mallorca 86-002, Coves del Drac (Manacor), in upper layers of 2nd lake of commercial cave; surface salinity 3 ppt, surface temperature 18.8° C; 10 Jan. 1986.

1 ♂, Mallorca 86-004, Coves dels Hams (Manacor), in upper layers; surface salinity 14 ppt, surface temperature 19.6° C; 11 Jan. 1986.

The following notes may serve to supplement Dancau's description, which is in general quite satisfactory.

Body length 2.2 and 2.4 mm. Head (fig. 1): Ocular lobe narrow, rounded; antennal sinus shallow but distinct.

First antenna (fig. 2): First peduncle segment with medioventral spine. Aethetasks on all 8 flagellum segments, each as long as corresponding segment. Accessory flagellum rather long, 3-segmented; short aesthetask on tip of segment 3.

Second antenna (fig. 3): Gland cone elongate-

triangular, rather short. Flagellum 5-segmented, aesthetasks on segments 2 and 5, subequal to lenght of corresponding segment.

Upper lip as illustrated (fig. 4).

Mandibles (figs. 5, 6): Molar seta present both left and right. Left lacinia mobilis with 5 coarse teeth, right lacinia finely toothed (9 teeth).

Lower lip (fig. 7), contrary to Dancau's description with well-developed inner lobes.

First maxilla (fig. 8): Outer lobe with 7 spines (2 pluridentate, 1 with 3 denticles, 2 with 2 denticles, 2 with 1 denticle).

Second maxilla as illustrated (fig. 9).

Maxilliped: Inner lobe (fig. 11) with bicuspidate spines on distal margin. Outer lobe (fig. 10) with 3 finely denticulated, simple spines.

First gnathopod (fig. 12): Coxal plate trapezoidal, wider than long. Posterior margin of basis with 1 short and 2 long setae. Palmar index (sensu Ruffo, 1973) 0.46. Palmar margin with 5 bifid spines, some setae, and 2 rows of fine denticles: an Angle row (A in fig. 13) and a row at the Base of the claw (B in fig. 13); the B-row is short and the A-row is implanted in a very shallow palmar angle sinus. Three setule-tipped palmar angle spines.

Second gnathopod (fig. 14): Coxal plate wider than long. Posterior margin of basis with 1 short and 1 long seta. Palmar index 0.46. Palmar margin fig. 15) with 6 bifid spines, some setae, and short rows of A- and B-spinules. Two setule-tipped palmar angle spines.

Third pereiopod (fig. 16): Basis with 4 spines on anterior margin, 3 on posterior margin. Merus 3.5 times as long as wide. Propodus with 3 setae on posterior margin.

Fourth pereiopod (fig. 17): Almost identical to P3. Coxal plate very short. Coxal gills on P4 - P6, ovate, with short peduncle.

Fifth pereiopod (fig. 18): Coxal plate vaguely equilobate. Merus 4.2 times as long as wide.

Sixth pereiopod (fig. 19) much longer than fifth. Coxal plate slightly anterolobate. Four spines on posterior margin of basis. Merus 5.1 times as long as wide. Anterior margin of propodus with 2 setules.

Seventh pereiopod (fig. 20) longer than sixth. Coxal plate hardly lobate. Posterior margin of basis with 5 spines. Merus 4 times as long as wide. Some setae on anterodistal end of carpus. Very long setae on propodus.

Lentiform organs small, rounded, slightly elleptical, smooth-edged, in basal part of basis of P3 - P7.

Epimeral plates (fig. 21) unarmed. Posteroventral corner produced into small tooth.

Pleopods 1 to 3 similar, without endopodite. Second pleopod (fig. 22) not modified in male. Two retinacula on inner side of peduncle of each pleopod, anchor-shaped, with 3 pairs of hooks (fig. 23).

First uropod (fig. 24): Peduncle with strong proximoventral spine. Margins of rami unarmed. Exopodite slightly shorter than endopodite, each ramus with 4 distal spines.

Second uropod (fig. 25): Endopodite longer than peduncle and longer than exopodite. Exopodite with 4 distal spines (3 short, 1 long). Endopodite with 4 shorter and 1 longer distal spines, non of them modified in male.

Third uropod (fig. 26): Rami slender, at least 2.5 times as long as peduncle. One of the distal spines of each ramus very long (>33 % of length of ramus).

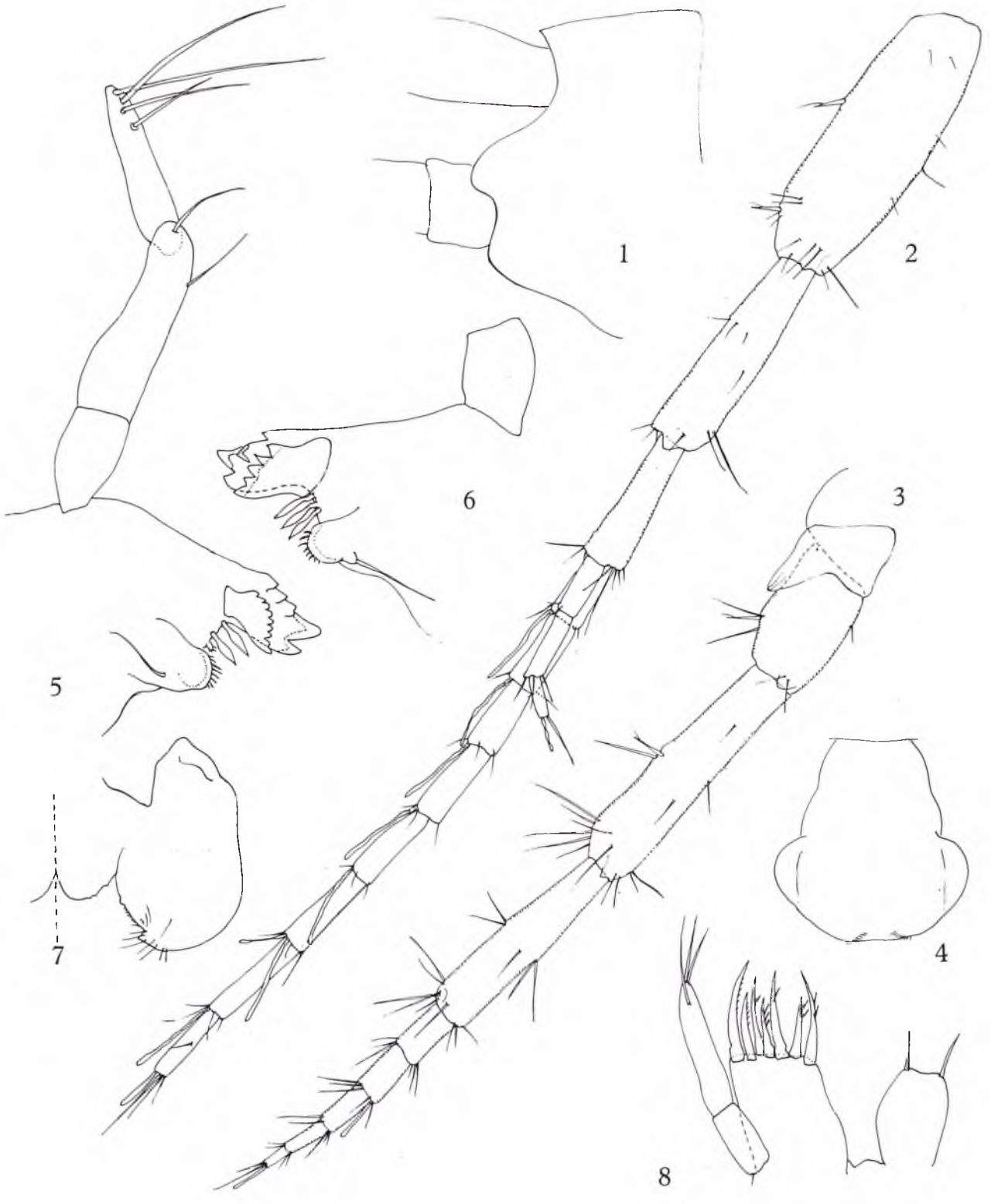
Telson (fig. 27): Rather deep, widely V-shaped distal cleft. Two plumose sensorial setae on either side. Each telson lobe with 2 long distal spines (longest spine longer than telson, shortest spine about 5/6 of length of longest spine).

Discussion

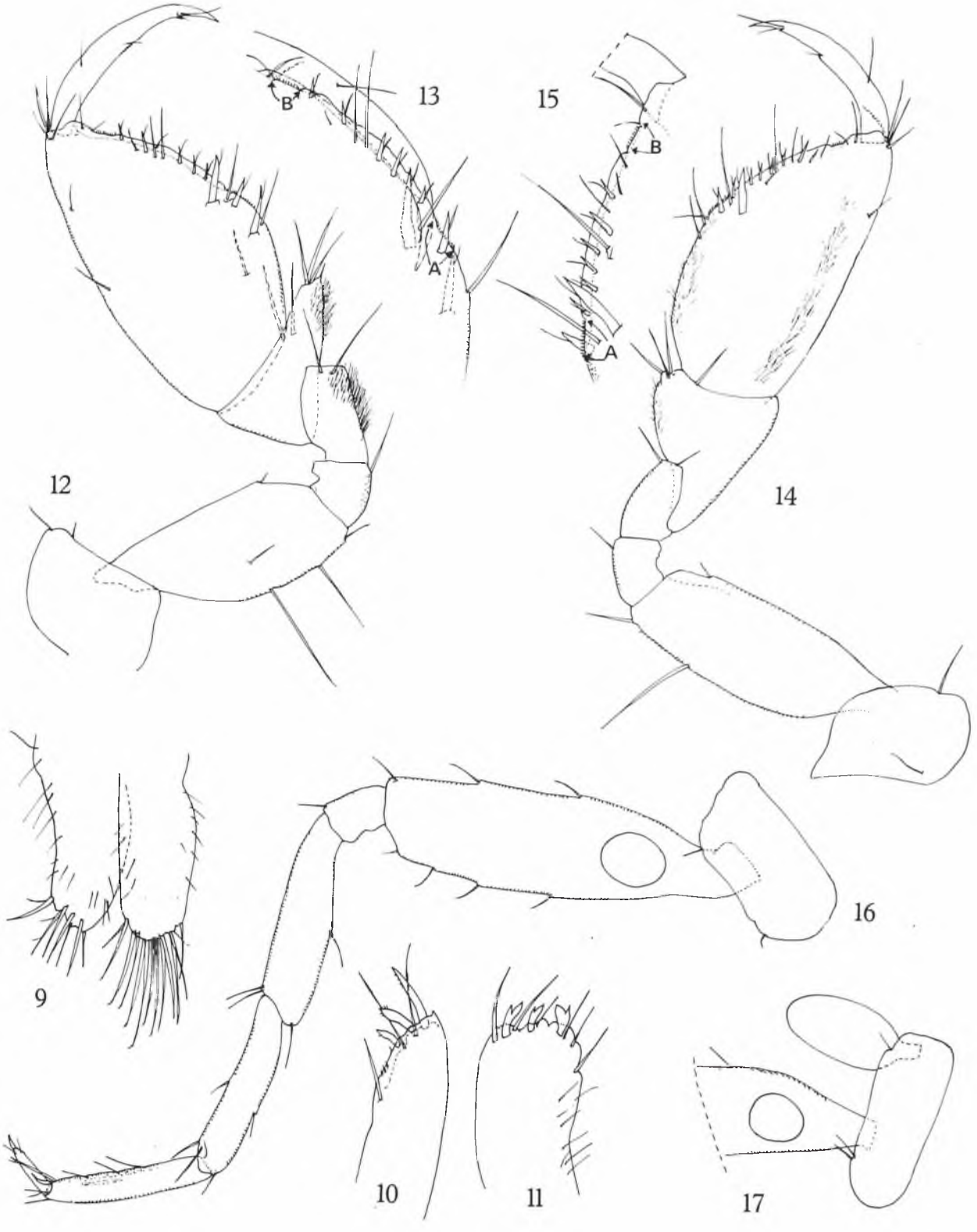
The absence of modified elements (spines, setae) on the endopodite of the second uropod and the exopodite of the second pleopod in the male of the Mallorcan taxon, show that it belongs to the subgenus *Bogidiella* s. str. (see Stock, 1981, and Karaman, 1982). Its alledged senior synonym, *B. chappuisi* Ruffo, 1952 (see Karaman, 1979) belongs to the subgenus *Medigidiella,* since it possesses modified spines, presumably serving for sperm transfer, on the second male uropod.

We have compared the Mallorcan material with a sample of *B. (M.) chappuisi* from the type area (littoral interstitial waters, Roussillon coast, France), and have observed several additional characters, allowing separation of both sexes of *balearica* and *chappuisi.* Some of these are shown in figs. 28-34 of the present paper; moreover the correct illustrations in Karaman, 1979, figs. I-IV, and in Karaman (in Ruffo), 1982, in particular fig. 171, based on topotypes, may serve very well for comparison.

The discriminating characters are: (1) The greater elongation of several appendages (peduncle of first antenna, mandible palp, pereiopods 3 through 7, third uropod) in *balearica.* For instance, the merus of P3, P5, and P6 is 2.5, 2.15, and 2.8 times as long as wide in *chappuisi,* against 3.5, 4.2, and 5.1 times, respectively, in *balearica.* (2) The presence of 3 bicuspidate spines on the inner lobe of the maxilliped (2 bicuspidate spines and an unarmed swelling in *chappuisi,* fig. 28). (3) The presence of 3 setae (2 long, 1 short) on the posterior margin of the basis of gnathopod 1 (1 long and 1 short in *chappuisi,* fig. 29). (4) Palmar margin of gnathopod 1 with ca. 6 bifid spines (0-3 in *chappuisi,* fig. 30). (5) The palmar angle sinus of gnathopod 1 is shal-



Figs. 1-8. *Bogidiella (B.) balearica* Dancau, 1973, ♂ (Manacor, Mallorca).
1, cephalosome, from the left (scale WX); 2, first antenna (WX); 3, second antenna (WX); 4, upper lip (WY); 5, right mandible (WZ); 6, left mandible, palp omitted (WZ); 7, lower lip (WZ); 8, first maxilla (WZ). Scales below fig. 19.



Figs. 9-17. *Bogidiella (B.) balearica* Dancau, 1973, ♂ (Manacor, Mallorca).
9, second maxilla (scale WZ); 10, outer lobe of maxilliped (WZ); 11, inner lobe of maxilliped (WZ); 12, first gnathopod (WX); 13, palmar margin of first gnathopod (WY) [A = angle row of spinules, implanted in angle sinus; B = row of spinules at base of claw]; 14, second gnathopod (WX); 15, palmar margin of second gnathopod (WY) [symbols as in fig. 13]; 16, third pereiopod (WX); 17, basal part of fourth pereiopod (WX). Scales below fig. 19.

low (deeper in *chappuisi,* fig. 30). (6) The B-row of spinules on the palma of gnathopod 2 is short (long in *chappuisi,* fig. 31). (7) Pereiopods 3 to 5 bear a short seta (P3, P4) or a spine (P5) in the middle of the anterior margin of the merus (absent in *chappuisi,* fig. 32). (8) The propodus of pereiopods 3 and 4 bears 3 shorts setae, that of P5 a spine (absent in *chappuisi,* fig. 32). (9) The posterior margin of the basis of P7 bears several spinules (only 1 in *chappuisi).* (10) The propodus of P7 bears longer setae and the claw is more slender in *balearica* than in *chappuisi* (fig. 33). (11) The longest telson spine is longer than the telson (shorter than the telson in *chappuisi).*

Study of a large series (>70 specimens) of *B. chappuisi* (from interstitial waters of a gravel bank at the mouth of La Baillorie, Banyuls, France, chlorinity 24696 mg/l), has revealed a broad range of variation in the expression of certain characters (number of segments in accessory flagellum of A1, length of spines on uropod 3, slenderness of pereiopods, length of telson spines, number of telson spines...) in what is presumed to be a monospecific population. Similar variations have been noticed by Karaman (1979) elsewhere in the Mediterranean belt. It remains to be seen if these populations are indeed monospecific, or whether they consist of a mixture of sibling species. At any rate, the characters 1 to 11 enumerated above, all fall outside the range of variation observed in the alledged *B. chappuisi,* and of course the apomorphic sexual dimorphism in the armature of the endopodite of uropod 2 in *chappuisi* forms already sufficient ground for placing *B. balearica* as a distinct species in a different subgenus.

Within the subgenus *Bogidiella* s. str., with which *balearica* is to be classified, the Mallorcan taxon is closely related to *aprutina* Pesce, 1980, *dalmatina* S. Karaman, 1953, *niphargoides* Ruffo & Vigna, 1977, *semidenticulata* Mestrov, 1961, and *vomeroi* Ruffo & Vigna, 1977. These species all share the combination of the following characters with *balearica:* (1) telson with II + II apical spines; (2) presence of lentiform organs on the pereiopods; (3) absence of endopodite in the pleopods.

These species can be distinguished from *balearica* as follows:

— *aprutina:* posterior margin of basis of Gn.1 with 1 long and 1 short seta; lentiform organs crenulated; spines of outer lobe of maxilla 1 with 0-3 denticles;

— *dalmatina:* basis of Gn.1 as in *aprutina;* telson cleft narrow; telson longer than wide; telson spines very unequal in length; spines on outer lobe of maxilla 1 with 1-2 denticles;

— *niphargoides:* basis of P1 with 1 short and 3 long setae; telson cleft shallower; flagellum of first antenna 18-segmented; palmar margin of Gn.1 and Gn.2 with numerous bifid spines;

— *semidenticulata:* basis of P1 as in *aprutina;* lentiform organs much larger; P3 - P6 very scantily armed; proximoventral spine of uropod 1 located in the middle of the ramus; spines of outer lobe of maxilla 1 with 1 denticle;

— *vomeroi:* basis of Gn.1 as in *aprutina;* lentiform organs located in distal part of basis of pereiopods; uropod 1 without proximoventral spine; antennae less slender; spines of outer lobe of maxilla 1 all pluridentate.

Moreover, all 5 species listed above have only 2 (instead of 3) bifid spines on the inner lobe of the maxilliped.

Other *Bogidiella* material from Mallorca

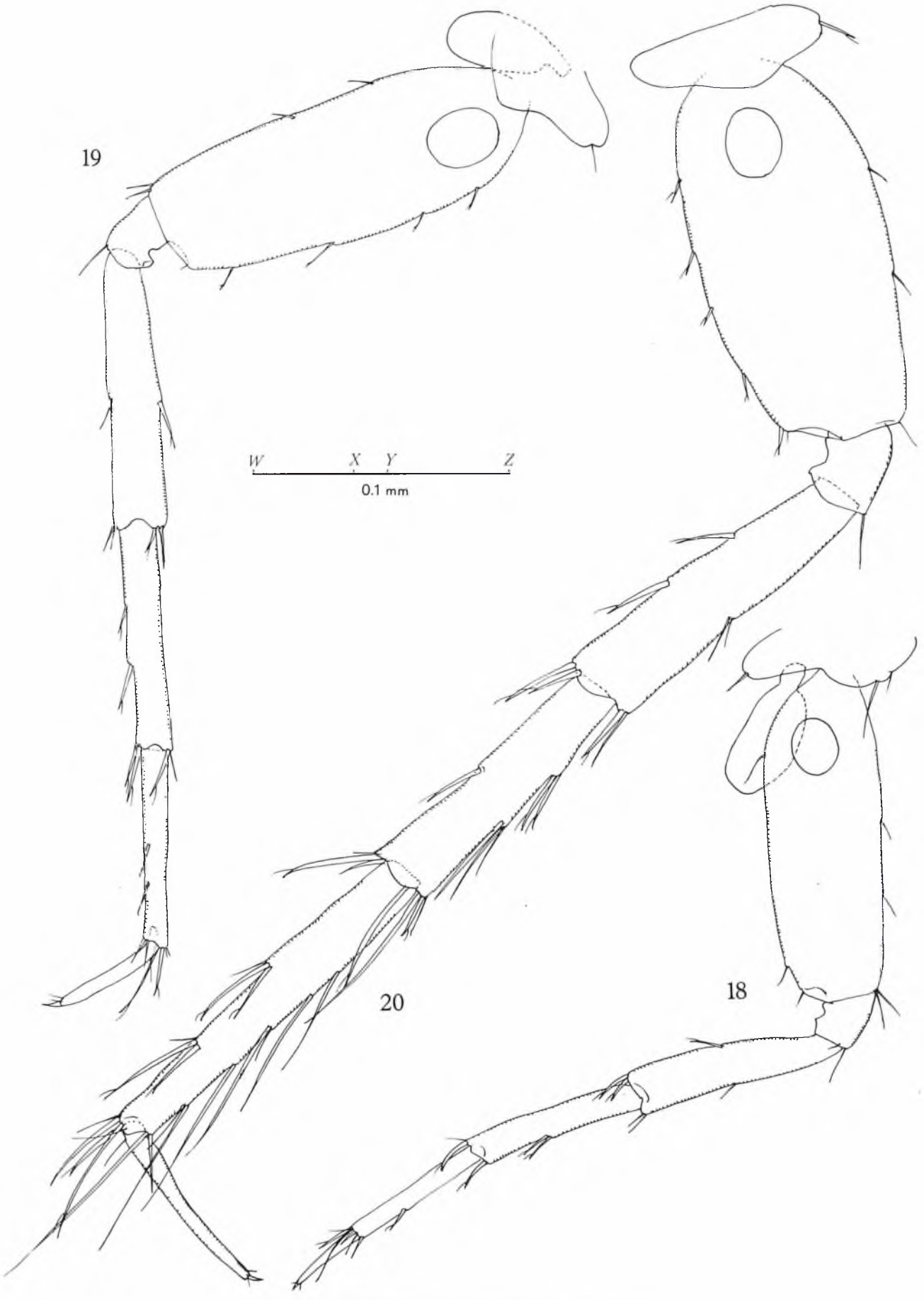
A damaged specimen of *Bogidiella,* probably a male, was collected from the underflow in the gravel bed of the Torrent de Pareis, near La Calobra (Mallorca), at ca. 1000 m from the sea, 2 Jan. 1978, chlorinity 800 mg/l (ZMA Amph. 108.099). This specimen, devoid of its P6 and P7, resembles *B. (B.) balearica* in the slenderness of the appendages, but has the distal telson armature reduced to I + I spines. Certain other characters of this specimen (armature of basis of Gn.1, armature of P3 - P5) are better in agreement with *B. (M.) chappuisi* than with *B. (B.) balearica.* This specimen was briefly mentioned by Stock, 1978: 89. Its taxonomic status must remain uncertain for the moment, awaiting more material from this locality. It appears to be rare, or at least very localized, since repeated sampling in 1983 and 1985 has failed to produce any further specimens.

Acknowledgements

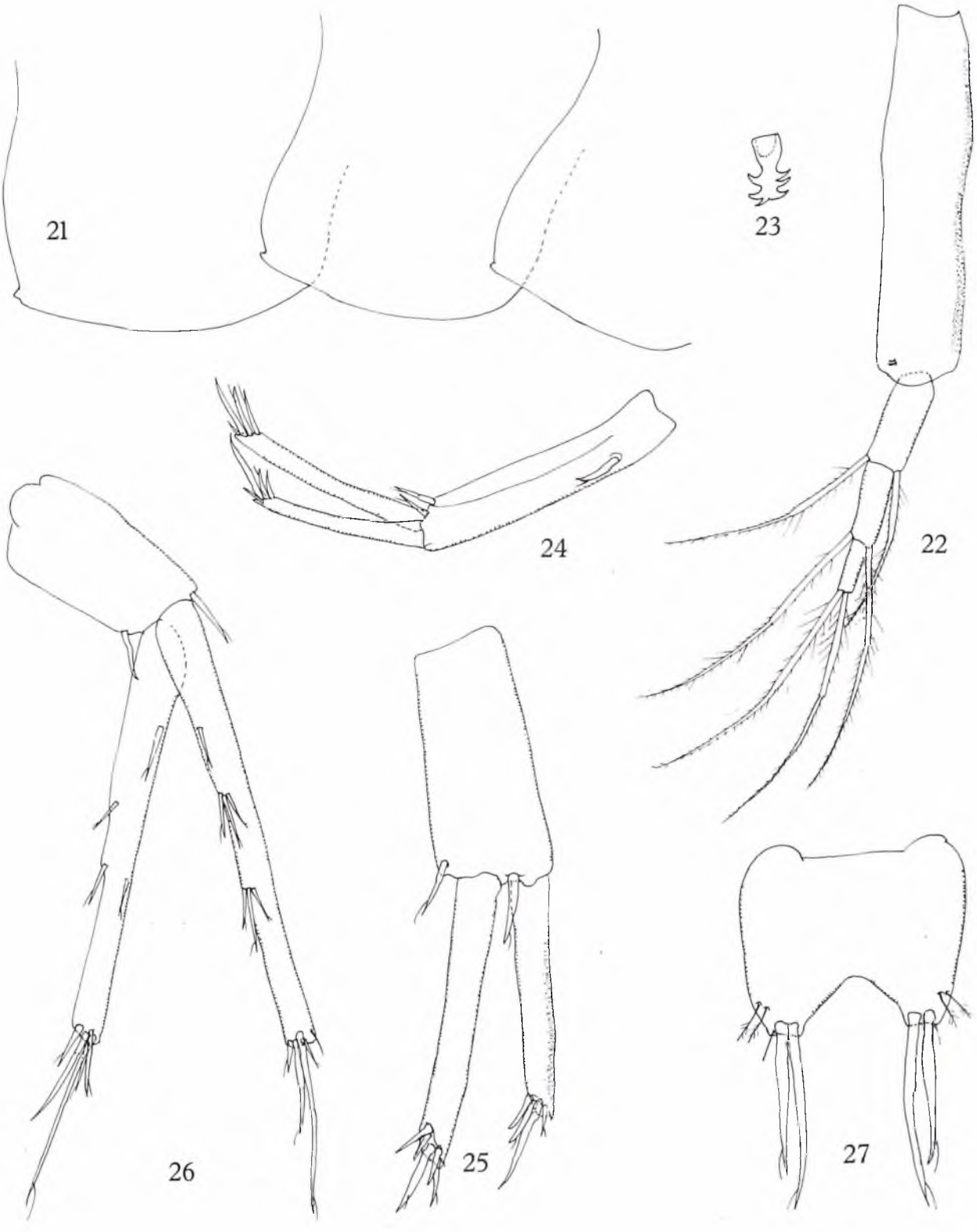
The 1985 fieldwork in Mallorca of the senior author has been supported financially by EuroUniversitas, Munich (FRG).

The 1986 collections of the junior author in Mallorca were supported by grants BSR-8215672 and BSR-8417494 from the National Science Foundation (U.S.A.). We extend our appreciation to the following individuals who assisted with logistical problems and collections and provided data on Mallorcan cave locations: Dr. Guillermo Mateu Mateu, Ana Maria Abril Duro, Joaquin Ginés, and Angel Ginés. We also thank the owners and management of Coves del Drac and Coves dels Hams for permitting us to visit and collect from these caves.

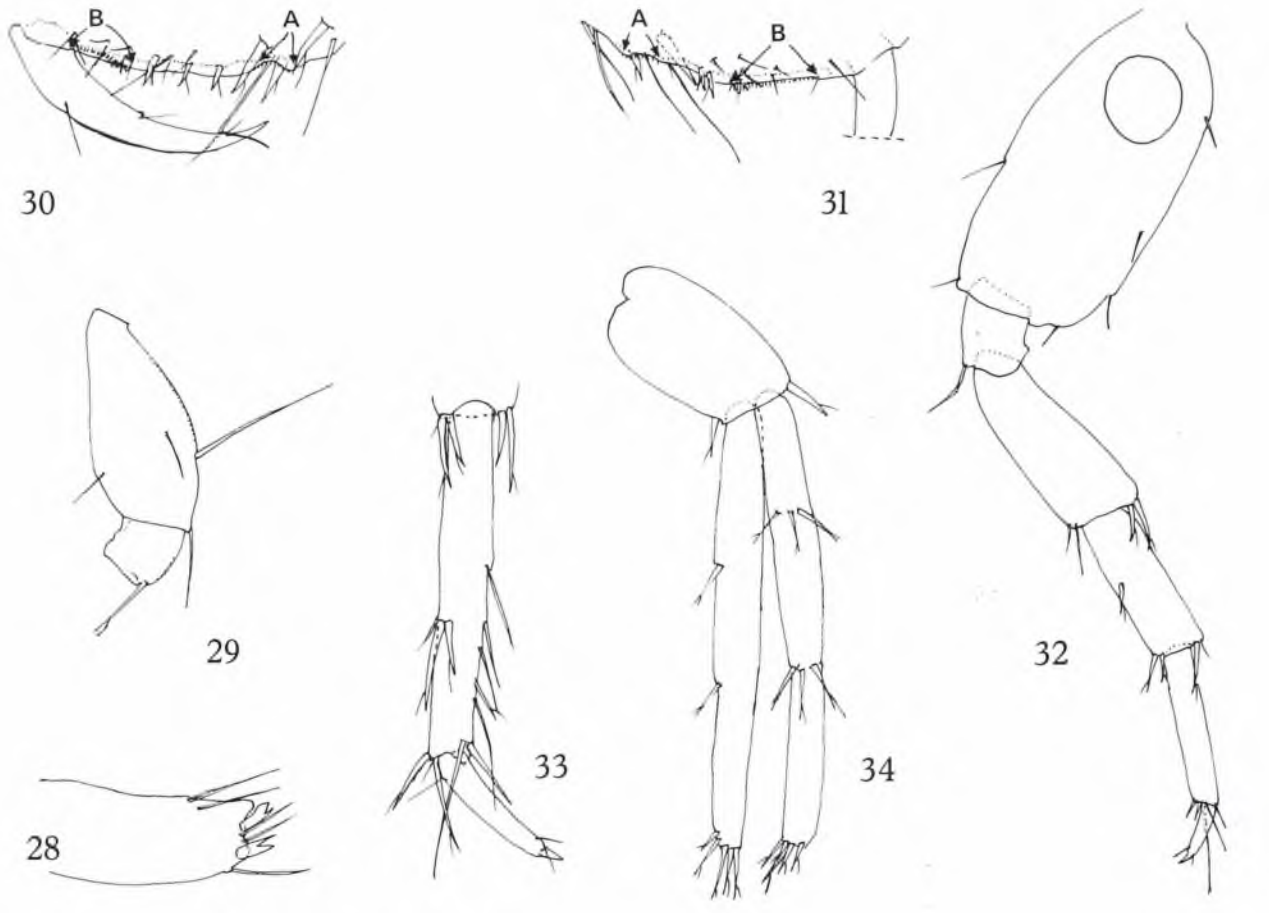
This paper is Contribution No. 1095 of the Bermuda Biological Station for Research.



Figs. 18-20. *Bogidiella (B.) balearica* Dancau, 1973, ♂ (Manacor, Mallorca).
18, fifth pereiopod (scale WX); 19, sixth pereiopod (WX); 20, seventh pereiopod (WX). All scale elements (WX, WY, WZ) correspond to 100 μm.



Figs. 21-27. *Bogidiella (B.) balearica* Dancau, 1973, ♂ (Manacor, Mallorca).
21, epimeral plates 1 to 3, from the right (scale WX); 22, second pleopod (WX); 23, retinaculum of first pleopod (free-hand sketch); 24, first uropod (WX); 25, second uropod (WY); 26, third uropod (WX); 27, telson (WZ). Scales below fig. 19.



Figs. 28-34. *Bogidiella (Medigidiella) chappuisi* Ruffo, 1952, ♀ (mouth of La Baillorie, Banyuls, France).
28, inner lobe of maxilliped (scale WZ); 29, basis of first gnathopod (WX); 30, palmar margin of first gnathopod (WY) [A = angle row of spinules, implanted in deep sinus; B = row of spinules at base of claw]; 31, palmar margin of second gnathopod (WY) [A and B as in fig. 30]; 32, fifth pereiopod (WX); 33, distal part of seventh pereiopod (WX); 34, third uropod (WX). Scales below fig. 19.

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UNIÓ GEOGRÀFICA INTERNACIONAL
Grup d'Estudi sobre l'Impacte Humà en el Carst
Actes de la reunió de 1986
Palma de Mallorca.

INTERNATIONAL GEOGRAPHICAL UNION
Study Group on Man's Impact in Karst
Proceedings of the 1986 Meeting
Palma de Mallorca.

Preàmbul

Les àrees càrstiques ofereixen un ampli camp d'investigació pel que fa a les peculiaritats de l'ocupació humana en elles. Les especials caracteristiques geomorfològiques de les zones càrstiques donen lloc a una interessant i variada incidència de l'activitat de l'home, en la seva adaptació a les condicions particulars imposades per un medi geogràfic tan especial.

Les conseqüències del desenvolupament de les activitats humanes en les zones càrstiques foren l'objecte d'una reunió del Grup d'Estudi sobre l'Impacte Humà en el Carst, que se celebrà a Palma del dia 25 al 30 d'Agost de 1986; amb aquest motiu vingueren a la nostra Illa un reduït grup de carstòlegs de diversos països, interessats en aquesta temàtica especifica. Aquesta trobada era part de les activitats de la Conferència Regional sobre els Països Mediterranis de la UNIÓ GEOGRÀFICA INTERNACIONAL, que tingué lloc a Barcelona durant el mes de Setembre d'aqueix mateix any.

En l'esmentada reunió foren presentades 12 comunicacions que s'ocupen d'una àmplia gamma d'interaccions entre l'activitat humana i el carst. Sobresurt la gran diversitat de temes tractats, abraçant tant plantejaments globals de gestió ambiental en terrenys càrstics, com previsió d'enfonsaments, problemes de deforestació, drenatge de poljes, efectes geomorfològics lligats a utilitzacions agricoles pretèrites o possibles deterioracions produïdes per la pluja àcida en els espeleotemes de certes coves. Les comunicacions ofereixen també una àmplia panoràmica des del punt de vista geogràfic ja que, endemés d'aquelles que tracten sobre el carst clàssic de Iugoslàvia i Centre-Europa, les aportacions referides als carsts de Gran Bretanya, Tasmània, Japó, Xina, Tailàndia i Àfrica del Sud, permeten contrastar les conseqüències de l'impacte de l'home sobre regions càrstiques de tot el món.

La FEDERACIÓ BALEAR D'ESPELEOLOGIA accepta l'encàrrec de la publicació de les comunicacions d'aquesta recent reunió dins un número especial d'ENDINS, el qual ara presentam. Aprofitam aquesta ocasió per agrair al Dr. Ivan GAMS, president del Grup d'Estudi, i al Professor Pere RIPOLL, del Departament de Geografia de la Universitat de les Illes Balears, el fet d'haver-nos confiat l'edició de les actes d'aquesta trobada.

Pretenem amb aquesta publicació contribuir al coneixement de la incidència de l'ocupació humana en els països càrstics, a la vegada que es dóna difusió als resultats d'un fet cientific desenvolupat en la nostra Illa. Volem des d'aqui desitjar una fructifera i continuada labor al Grup d'Estudi de la U.G.I. sobre l'Impacte Humà en el Carst.

Preamble

Karstic countries offer a wide field for investigation with regard to the peculiarities of man's occupation of these areas. Singular geomorphological characteristics of karstic zones originate a very interesting and plural incidence of man's activity in his adaptation to the particular conditions that such an especial geographical environment imposes.

The consequences of human activities development in karstic areas were the object of a meeting of the Study Group on Man's Impact in Karst, that took place in Palma de Mallorca from 25th to 30th August 1986. On that occasion, a reduced group of karstologists from different countries interested in this specific subject met in Mallorca. This event was a part of the tasks of Regional Conference on Mediterranean Countries of the INTERNATIONAL GEOGRAPHICAL UNION, celebrated in Barcelona in September 1986.

In the mentioned meeting, 12 papers dealing on a wide range of interactions between human activity and karst were presented. It stands out the great diversity of the subjects discussed covering, among other topics, global approaches on environmental planning in karstic lands as well as collapse forecast, deforestation problems, drainage and hydrological regulation of poljes, geomorphological effects related to agricultural uses in the past, or possible damages produced by acid rain on speleothems in certain caves. The papers also give a wide approach from the geographical point of view since in addition to those treating the classic karst in Yugoslavia and Central Europe, the reports on the karst in Great Britain, Tasmania, Japan, China, Thailand and South Africa allow to contrast the consequences of man's impact in karst regions all over the world.

The FEDERACIÓ BALEAR D'ESPELEOLOGIA accepted to be in charge of publishing the proceedings of this recent meeting in a special edition of ENDINS that we now present. We would like to acknowledge Dr Ivan GAMS, chairman of the Study Group, and Prof Pere RIPOLL, from the Departament de Geografia de la Universitat de les Illes Balears, for having charge us the publication of the proceedings of this meeting.

With this volume we intend to contribute to know human occupation incidence in karstic countries as well as to spread the results of a scientific event developed in our Island. We finally would like to wish a fruitful and a long life task to the I.G.U.'s Study Group on Man's Impact in Karst.

Joaquín GINÉS
FEDERACIÓ BALEAR D'ESPELEOLOGIA