Zootaxa 2096: 413–432 (2009)
www.mapress.com/zootaxa/

Article

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

Cumacea (Crustacea, Peracarida) in the deep Mediterranean, with the description of one new species*

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* *In*: Brökeland, W. & George, K.H. (eds) (2009) Deep-sea taxonomy — a contribution to our knowledge of biodiversity. *Zootaxa*, 2096, 1–488.

Abstract

Cumacean specimens were analysed from the expeditions of RV *Meteor* to the eastern Mediterranean in 1993 (Me 25/1) and 1998 (Me 40). Sampling depth ranged from 45 to 4391 m for the Me 25/1 expedition and from 1129 to 1876 m for the Me 40 expedition. In total, 29 species were identified of which one, *Campylaspis aegypta* sp. nov., is new to science. The horizontal and vertical distribution, the faunal overlap with the Atlantic and endemism of Cumacea in the Mediterranean are discussed. The age of the fauna is considered to be relatively young because of the faunal overlap with the eastern Atlantic and the paucity of endemic higher taxa.

Key words: *Campylaspis aegypta* sp. nov., deep sea, distribution, faunal overlap

Introduction

The European Mediterranean Sea is one of four intercontinental seas of the world oceans. It is divided roughly into two basins, the Western and the Eastern Mediterranean Basin. The western barrier dividing the Mediterranean and the Atlantic Ocean is the sill of Gibraltar (320 m). The maximum depth of the Western Mediterranean is 3700 m, the deep water temperature is relatively constant and close to 13°C, and the water is well oxygenated (Margalef 1985). The sill between Sicily and Tunis, which is close to 400 m deep, acts partly as a barrier between the western and eastern parts of the Mediterranean. The maximum depth of the eastern Mediterranean is more than 4000 m (Hofrichter *et al*. 2002). The water temperature in this deep-sea basin regularly exceeds 14.5°C (Klein & Roether 2002).

The Mediterranean has a long geological history and is known to be a relict of the tropical Tethys Sea. Due mainly to tectonic events during the Tertiary, the Mediterranean suffered several evaporations (Pérès 1985, Maldonaldo 1985, Tichy *et al*. 2002), the so called "Messinian Salinity Crisis". The sea level dropped, after the closure of the Gibraltar sill, which prevented water influx from the Atlantic Ocean. Consequently, due to the arid climate in this region the Mediterranean basins almost dried out. The Mediterranean was reduced to several patches that were either brackish or highly salty, marking the so called "Lago-Mare-Phase" (Schmidt *et al*. 2002).

Due to plate tectonics, climatic changes and increased sea level of the world oceans, the basins were filled up again during the late Tertiary with Atlantic water. It is doubtful whether "old" benthic organisms survived the Messinian Salinity Crisis. As there are no endemic genera or families of higher taxa in the deep-sea benthos of the Mediterranean, the fauna is most probably a "young" one (Schmidt *et al.* 2002).

After the "Gibraltar waterfall" approximately 5.3 million years ago, Atlantic taxa had the chance to invade the Mediterranean (Schmidt *et al*. 2002). For deep-sea species, however, the Gibraltar sill might have

Accepted by W. Brökeland : 11 Mar. 2009; published: 11 May 2009

presented a substantial barrier and it may still do so. The question therefore is: are there typical deep-sea cumaceans originating from the Atlantic in the Mediterranean, and how did they cross the Gibraltar sill?

The total number of north-eastern Atlantic cumacean species is 328, including those recorded for the Mediterranean. There are 88 cumacean species described for the Mediterranean to date for all depth ranges, and the number of true deep-sea species (i.e. species living below 1000 m depth) is 42.

The cumacean benthic fauna is more or less known for the western part of the Mediterranean because this region has been the subject of several faunal investigations in the past, e.g. during the "Puritan" expedition in the neighbourhood of Capri (Calman 1906), north-western Mediterranean close to Marseille (Ledoyer 1965, 1983), the Polymède expeditions (1970 and 1972) (Reyss 1972, 1974), around the Balearic Island (Cartes & Sorbe 1993), and from the work of Fage (1951). However, very little was known about the deep sea of the eastern Mediterranean before the two recent cruises with the German research vessel *Meteor* in the years 1993 and 1998 (Hieke *et al.* 1994, 1999). The cumaceans obtained during these cruises are the basis of the following study.

The expedition LEVAR (Levantine Basin Variability) with RV *Meteor* Cruise 71/2 to the eastern Mediterranean took place from 27 December 2006 to 15 January 2007. The main objective of the LEVAR programme is to elucidate the diversity of the benthic fauna of the eastern Mediterranean deep sea and its correlation with abiotic and biotic parameters, particularly with the focus on the influence of depth and/or distance to the shelf on the diversity of deep-sea benthos in oligotrophic waters. The final target is the estimation of the relative importance of pelagic production versus lateral transport for explaining diversity patterns in the extremely oligotrophic Levantine Basin (Institut für Meereskunde 2006).

The intention of the current analysis is to expand our knowledge of cumaceans in the deep eastern basins of the Mediterranean. It is also aimed to clarify the degree of faunal overlap with the north eastern Atlantic and endemism. Cumaceans, like all peracarids, are useful objects for studying biogeography as they have no pelagic larvae and therefore their active and passive range of dispersion is very low.

Material and methods

Cumacea samples from the RV *Meteor* expeditions Me25/1 (1993) and Me40 (1998) to the eastern Mediterranean were investigated. The expeditions were carried out under the scientific leadership of Dr. M. Türkay (Forschungsinstitut Senckenberg, Frankfurt). For details see Hieke *et al.* (1994, 1999). The positions of the stations are listed in Table 1. The material was sampled with box corer, epibenthic sledge and beam trawl, fixed in 4% seawater-formalin and preserved in 70% ethanol, and is deposited in the Zoological Museum, Hamburg (ZMH) and the Senckenberg Museum, Frankfurt (SMF). For synonyms and known distribution in detail see Băcescu (1988, 1992).

TABLE 1. The stations of cruises with RV *Meteor* no. 25/1 (1993) and no. 40 (1998) to the eastern Mediterranean.
1A. *Meteor* cruise no 25 in 1993

Station	Location	Longitude start	Latitude start	Longitude end	Latitude end	min. depth (m)	max. depth (m)	Date
Me25-01 KG1	Gulf of Taranto	40°09.91'N	16°46.91'E				44.5	17.05.1993
Me25-01 KG2	Gulf of Taranto	40°09.93'N	16°47.05'E				44.2	17.05.1993
Me25-02 KG	Gulf of Taranto	40°09.75'N	16°47.65'E				45.1	17.05.1993
Me25-03 KG	Gulf of Taranto	40°09.52'N	16°48.79'E				105.9	17.05.1993
Me25-04 KG1	Gulf of Taranto	40°09.65'N	16°49.65'E				154	17.05.1993
Me25-04 KG2	Gulf of Taranto	40°09.37'N	16°49.51'E				157.9	17.05.1993

.....continued

Table 1A (continued)

Station	Location	Longitude start	Latitude start	Longitude end	Latitude end	min. depth (m)	max. depth (m)	Date
Me25-05 KG	Gulf of Taranto	40°09.57'N	16°50.19'E				201	17.05.1993
Me25-06 KG	Gulf of Taranto	40°09.44'N	16°50.64'E				257	17.05.1993
Me25-07 KG	Gulf of Taranto	40°09.50'N	16°51.27'E				301	17.05.1993
Me25-08 KG	Gulf of Taranto	40°09.32'N	16°52.90'E				415	17.05.1993
Me25-09 KG	Gulf of Taranto	40°08.74'N	16°57.85'E				684	17.05.1993
Me25-10 KG1	Gulf of Taranto	40°08.23'N	17°01.86'E				998	17.05.1993
Me25-10 KG2	Gulf of Taranto	40°08.19'N	17°01.88'E				979.7	17.05.1993
Me25-10 KG3	Gulf of Taranto	40°08.25'N	17°01.82'E				1001	17.05.1993
Me25-10 Ku	Gulf of Taranto	40°09.00'N	17°05.49'E	40°08.99'N	17°03.09'E	1253	1278	18.05.1993
Me25-10 ES	Gulf of Taranto	40°09.04'N	17°04.56'E	40°08.98'N	17°05.90'E	1257	1296	18.05.1993
Me25-11 KG1	Gulf of Taranto	40°01.68'N	17°16.41'E				1529	18.05.1993
Me25-11 KG2	Gulf of Taranto	40°01.94'N	17°16.39'E				1524	18.05.1993
Me25-11 KG3	Gulf of Taranto	40°01.90'N	17°16.34'E				1523	18.05.1993
Me25-11 ES	Gulf of Taranto	40°04.37'N	´17°10.99É	40°03.38´N	17°12.07´N	1466	1477	18.05.1993
Me25-12 KG1	Gulf of Taranto	39°53.83'N	17°41.45'E				506	18.05.1993
Me25-12 KG2	Gulf of Taranto	39°53.78'N	17°41.52'E				504	18.05.1993
Me25-12 KG3	Gulf of Taranto	39°53.74'N	17°41.61'E				501	18.05.1993
Me25-12	Gulf of Taranto	39°49.69'N	17°44.48'E	39°50.01'N	17°44.31'E		0	18.05.1993
Me25-12 ES	Gulf of Taranto	39°49.50'N	17°44.73'E	39°50.39'N	17°44.02'E	503	537	18.05.1993
Me25-12 Ku	Gulf of Taranto	39°50.55'N	17°44.17'E	39°49.97'N	17°44.64'E	484	490	19.05.1993
Me25-13 Ku	Ionic Sea	39°25.53'N	18°53.55'E	39°26.33'N	18°51.37'E	851	862	19.05.1993
Me25-13 ES	Ionic Sea	39°26.14'N	18°52.08'E	39°25.75'N	18°53.38'E	838	858	19.05.1993
Me25-13 KG1	Ionic Sea	39°24.84'N	18°56.78'E				911	19.05.1993
Me25-13 KG2	Ionic Sea	39°24.79'N	18°56.87'E				912	19.05.1993
Me25-13 KG3	Ionic Sea	39°24.75'N	18°57.02'E				914	19.05.1993
Me25-14 KG1	Ionic Sea	39°09.78'N	19°26.36'E				1008	19.05.1993
Me25-16 Ku	Ionic Sea	36°35.69'N		36°37.68'N	21°30.37'E	3832	3947	22.05.1993
Me25-16 ES	Ionic Sea	36°37.13'N	21°32.29'E	36°37.89'N	21°30.96'E	3735	3855	22.05.1993
Me25-16 KG1	Ionic Sea	36°36.48'N	21°34.28'E				3848	22.05.1993
Me25-16 KG2	Ionic Sea	36°36.38'N	21°34.02'E				3848	23.05.1993
Me25-16 KG3	Ionic Sea	36°36.32'N	21°34.17'E				3849	23.05.1993
Me25-18 KG1	SE Crete	34°44.42'N	25°51.55'E				1431	25.05.1993
Me25-18 KG2	SE Crete	34°44.39'N	25°51.09'E				1383	26.05.1993
Me25-18 KG3	SE Crete	34°44.45'N	25°51.05'E				1377	26.05.1993
Me25-18 Ku	SE Crete	34°45.25'N	25°52.31'E	34°44.14'N	25°50.89'E	1386	1386	26.05.1993
Me25-18 ES	SE Crete	34°45.77'N	25°52.95'E	34°44.99'N	25°52.13'E	1412	1448	26.05.1993
Me25-19 ES	SE Crete	34°23.96'N	26°02.83'E	34°23.47'N	26°01.76'E	4204	4263	26.05.1993
Me25-19 KG1	SE Crete	34°25.04'N	26°05.75'E				4391	27.05.1993
Me25-19 KG2	SE Crete	34°24.91'N	26°05.74'E				4391	27.05.1993
Me25-19 KG3	SE Crete	34°25.33'N	26°05.94'E				4391	27.05.1993
Me25-20 KG1	Levantine Basin	34°02.59'N	27°46.73'E				2472	27.05.1993
Me25-20 KG2	Levantine Basin	34°02.74'N	27°46.73'E				2455	28.05.1993

.....continued

Table 1A (continued)

Station	Location	Longitude start	Latitude start	Longitude end	Latitude end	min. depth (m)	max. depth (m)	Date
Me25-20 KG3	Levantine Basin	34°02.74'N	27°46.80'E				2462	28.05.1993
Me25-20 ES	Levantine Basin	34°02.78'N	27°46.49'E	34°03.02'N	27°45.26'E	2452	2492	28.05.1993
Me25-20 Ku	Levantine Basin	34°03.23'N	27°44.89'E	34°03.56'N	27°42.78'E	2454	2461	28.05.1993
Me25-21 Ku	Levantine Basin	33°36.02'N	28°34.93'E	33°36.66'N	28°37.19'E	2734	3009	29.05.1993
Me25-21 ES	Levantine Basin	33°36.51'N	28°36.72'E	33°36.28'N	28°35.62'E	3030	3042	29.05.1993
Me25-21 KG1	Levantine Basin	33°36.29'N	28°34.21'E				3037	29.05.1993
Me25-21 KG2	Levantine Basin	33°36.18'N	28°34.25'E				3039	29.05.1993
Me25-21 KG3	Levantine Basin	33°36.22'N	28°34.22'E				3038	29.05.1993
Me25-21 KG4	Levantine Basin	33°36.04'N	28°34.28'E				3041	29.05.1993
Me25-22 KG1	Levantine Basin	33°14.63'N	29°27.02'E				2946	30.05.1993
Me25-22 KG2	Levantine Basin	33°14.77'N	29°27.43'E				2948	30.05.1993
Me25-22 KG3	Levantine Basin	33°14.93'N	29°26.97'E				2950	30.05.1993
Me25-22 Ku	Levantine Basin	33°15.30'N	29°27.07'E	33°17.02'N	29°22.21'E	2878	2885	30.05.1993
Me25-22 ES	Levantine Basin	33°15.37'N	29°26.01'E	33°16.00'N	29°24.27'E	2850	2859	30.05.1993
Me25-23 ES	Levantine Basin	32°42.92'N	30°30.09'E	32°42.20'N	30°31.75'E	1992	2011	31.05.1993
Me25-23 Ku	Levantine Basin	32°42.22'N	30°31.90'E	32°43.26'N	30°29.81'E	1993	2025	31.05.1993
Me25-23 KG1	Levantine Basin	32°40.97'N	30°35.61'E				1945	31.05.1993
Me25-23 KG2	Levantine Basin	32°40.91'N	30°35.81'E				1944	31.05.1993
Me25-23 KG3	Levantine Basin	32°40.83'N	30°35.73'E				1943	31.05.1993
Me25-24 KG1	Off Egypt	32°19.50'N	31°10.53'E				1007	31.05.1993
Me25-24 KG2	Off Egypt	32°19.42'N	31°10.60'E				1006	31.05.1993
Me25-24 KG3	Off Egypt	32°19.38'N	31°10.60'E				1004	31.05.1993
Me25-24 ES	Off Egypt	32°19.59'N	31°07.34'E	32°19.60'N	31°06.14'E	1019	1021	01.06.1993
Me25-24 Ku	Off Egypt	32°19.88'N	31°07.31'E	32°19.89'N	31°09.62'E	1033	1034	01.06.1993
Me25-25 Ku	Off Nile delta	32°00.54'N	31°53.70'E	32°00.55'N	31°52.61'E	196	199	01.06.1993
Me25-25 ES	Off Nile delta	32°00.43'N	31°53.64'E	32°00.45'N	31°52.85'E	191	195	01.06.1993
Me25-25 KG1	Off Nile delta	32°00.57'N	31°53.24'E				199.2	01.06.1993
Me25-25 KG2	Off Nile delta	32°00.58'N	31°53.30'E				200.6	01.06.1993
Me25-25 KG3	Off Nile delta	32°00.58'N	31°53.25'E				200.5	01.06.1993
Me25-26 KG1	Off Israel	32°59.84'N	35°02.23'E				35.8	02.06.1993
Me25-26 KG2	Off Israel	32°59.91'N	35°02.21'E				36.4	02.06.1993
Me25-27 KG	Off Israel	33°00.05'N	34°59.69'E				53.8	02.06.1993
Me25-28 KG	Off Israel	33°01.08'N	34°56.22'E				123.2	02.06.1993
Me25-29 KG	Off Israel	33°01.25´N	34°55.83É				153	02.06.1993
Me25-29 KG	Off Israel	33°01.25'N	34°55.83'E				152.6	02.06.1993
Me25-30 Ku	Off Israel	33°02.58'N	34°56.09'E	33°03.21'N	34°56.68'E	235	299	02.06.1993
Me25-30 ES	Off Israel	33°03.05'N	34°56.96'E	33°02.73'N	34°56.41'E	233	199	02.06.1993
Me25-30 KG	Off Israel	33°01.22'N	34°55.51'E				229	02.06.1993
Me25-31 KG	Off Israel	33°01.52'N	34°55.49'E				262	02.06.1993
Me25-32 KG	Off Israel	33°01.65'N	34°55.29'E				298	02.06.1993
Me25-33 KG	Off Israel	33°01.55'N	34°54.92'E				400	02.06.1993
Me25-34 KG	Off Israel	33°01.25'N	34°53.63'E				718	02.06.1993

.....continued

Table 1A (continued)

Station	Location	Longitude start	Latitude start	Longitude end	Latitude end	min. depth (m)	max. depth (m)	Date
Me25-35 KG1	Off Israel	33°01.66'N	34°50.73'E				1024	02.06.1993
Me25-35 KG2	Off Israel	33°01.65'N	34°50.71'E				1022	02.06.1993
Me25-35 Ku	Off Israel	33°04.36'N	34°48.87'E	33°02.65'N	34°47.60'E	1162	1192	02.06.1993
Me25-35 ES	Off Israel	33°02.34'N	34°46.81'E	33°03.26'N	34°37.40'E	1185	1212	03.06.1993
Me25-36 KG	Off Isreal	33°06.02'N	34°29.21'E				1522	03.06.1993
Me25-37 KG1	S of Cypres	33°19.98'N	33°24.75'E				1875	03.06.1993
Me25-37 KG2	S of Cypres	33°19.93'N	33°24.74'E				1855	03.06.1993
Me25-37 KG3	S of Cypres	33°19.97'N	33°24.75'E				1856	03.06.1993
Me25-37 ES	S of Cypres	33°24.70'N	33°26.40'E	33°23.76'N	33°26.11'E	1896	1914	03.06.1993
Me25-37 Ku	S of Cypres	33°25.02'N	33°26.47'E	33°26.99'N	33°26.98'E	1889	1942	03.06.1993
Me25-38 Ku	S of Cypres	34°27.44'N	32°27.82'E	34°27.23'N	32°30.26'E	2427	2437	04.06.1993
Me25-38 ES	S of Cypres	34°27.17'N	32°30.24'E	34°27.15'N	32°31.86'E	2427	2434	04.06.1993
Me25-38 KG1	S of Cypres	34°25.82'N	32°37.06'E				2474	04.06.1993
Me25-38 KG2	S of Cypres	34°25.96'N	32°37.28'E				2474	05.06.1993
Me25-38 KG3	S of Cypres	34°26.06'N	32°37.57'E				2474	05.06.1993
Me25-39 KG1	S of Cypres	34°01.85'N	32°04.22'E				2600	05.06.1993
Me25-39 KG2	S of Cypres	34°01.91'N	32°04.38'E				2603	05.06.1993
Me25-39 KG3	S of Cypres	34°02.11'N	32°04.26'E				2603	05.06.1993

1B: *Meteor* cruise no. 40 in 1998

Station	Location	Latitude start	Longitude start	Latitude end	Longitude end	min. depth (m)	max depth (m)	Date
Me40-03 KG1	Northern Sporaden Basin	39°14.97'N	23°42.53'E				1245	01.01.1998
Me40-03 KG3	Northern Sporaden Basin	39°14.95'N	23°42.53'E				1242	01.01.1998
Me40-03 KG4	Northern Sporaden Basin	39°14.96'N	23°42.55'E				1243	01.01.1998
Me40-03 KG2	Northern Sporaden Basin	39°15.01'N	23°42.54'E				1243	01.01.1998
Me40-04 KG1	Ierapetra-Depression, S Crete	34°26.00'N	26°03.99'E				4282	05.01.1998
Me40-04 KG2	Ierapetra-Depression, S Crete	34°26.00'N	26°04.00'E				4286	05.01.1998
Me40-04 KG3	Ierapetra-Depression, S Crete	34°26.02'N	26°04.03'E				4286	05.01.1998
Me40-04 KG4	Ierapetra-Depression, S Crete	34°26.00'N	26°04.02'E				4290	06.01.1998
Me40-05 KG1	Ierapetra-Depression, S Crete	34°25.01'N	26°04.01'E				4391	07.01.1998
Me40-05 KG2	Ierapetra-Depression, S Crete	34°25.00'N	26°04.00'E				4392	07.01.1998
Me40-05 KG3	Ierapetra-Depression, S Crete	34°25.00'N	26°04.00'E				4392	07.01.1998
Me40-05 KG4	Ierapetra-Depression, S Crete	34°25.00'N	26°04.00'E				4392	07.01.1998
Me40-06 KG1	Ierapetra-Depression, S Crete	34°24.50'N	26°04.52'E				4392	09.01.1998
Me40-06 KG2	Ierapetra-Depression, S Crete	34°24.51'N	26°04.45'E				4392	09.01.1998
Me40-06 KG3	Ierapetra-Depression, S Crete	34°24.45'N	26°04.52'E				4393	09.01.1998
Me40-06 KG4	Ierapetra-Depression, S Crete	34°24.50'N	26°04.41'E				4393	09.01.1998
Me40-04 ES	Ierapetra-Depression, S Crete	34°26.69'N	26°06.57'E	34°26.91'N	26°07.09'E	4255	4308	10.01.1998
Me40-05 ES	Ierapetra-Depression, S Crete	34°25.85'N	26°07.08'E	34°26.18'N	26°08.28'E	4382	4393	11.01.1998
Me40-06 Ku	Ierapetra-Depression, S Crete	34°24.78'N	26°05.37'E	34°27.71'N	26°09.23'E	4314	4394	11.01.1998
Me40-06 ES	Ierapetra-Depression, S Crete	34°24.84'N	26°05.78'E	34°25.19'N	26°07.14'E	4397	4398	11/ 12.01.1998

.....continued

Table 1B (continued)

Station	Location	Longitude start	Latitude start	Longitude end	Latitude end	min. depth (m)	max. depth (m)	Date
Me40-05 Ku	Ierapetra-Depression, S Crete	34°25.45'N	26°05.63'E	34°26.48'N	26°09.23'E	4342	4393	12.01.1998
Me40-07 KG	Ierapetra-Depression, S Crete	34°24.85'N	26°05.79'E				4394	14.01.1998
Me40-08 KG1	off Heraklion, N Crete	35°49.05'N	25°16.06'E				1876	15.01.1998
Me40-08 KG2	off Heraklion, N Crete	35°49.01'N	25°16.02'E				1875	15.01.1998
Me40-08 KG3	off Heraklion, N Crete	35°49.00'N	25°16.00'E				1876	15.01.1998
Me40-08 KG4	off Heraklion, N Crete	35°48.98'N	25°15.98'E				1875	15.01.1998
Me40-08 Ku	off Heraklion, N Crete	35°48.94'N	25°15.50'E	35°48.98'N	25°18.13'E	1876	1877	15.01.1998
Me40-09 Ku	off Heraklion, N Crete	35°50.47'N	25°16.24'E	35°50.42'N	25°13.58'E	1875	1876	15.01.1998
Me40-10 Ku	off Heraklion, N Crete	35°51.48'N	25°15.67'E	35°51.58'N	25°18.11'E	1876	1877	16.01.1998
Me40-09 ES	off Heraklion, N Crete	35°50.39'N	25°16.14'E	35°50.41'N	25°15.00'E		1876	16.01.1998
Me40-08 ES	off Heraklion, N Crete	35°48.96'N	25°15.78'E	35°48.91'N	25°17.17'E	1875	1877	16.01.1998
Me40-09 KG1	off Heraklion, N Crete	35°50.49'N	25°16.02'E				1876	17.01.1998
Me40-09 KG2	off Heraklion, N Crete	35°50.51'N	25°16.00'E				1876	17.01.1998
Me40-09 KG3	off Heraklion, N Crete	35°50.48'N	25°16.01'E				1876	17.01.1998
Me40-09 KG4	off Heraklion, N Crete	35°50.51'N	25°15.98'E				1876	17.01.1998
Me40-10 KG1	off Heraklion, N Crete	35°51.53'N	25°16.02'E				1877	17.01.1998
Me40-10 KG2	off Heraklion, N Crete	35°51.56'N	25°15.98'E				1877	17.01.1998
Me40-10 KG3	off Heraklion, N Crete	35°51.51'N	25°16.01'E				1877	17.01.1998
Me40-10 KG4	off Heraklion, N Crete	35°51.51'N	25°16.03'E				1877	17.01.1998
Me40-01 KG1	Northern Sporaden Basin	39°16.49'N	23°42.52'E				1272	29.12.1997
Me40-01 KG2	Northern Sporaden Basin	39°16.51'N	23°42.54'E				1272	29.12.1997
Me40-01 KG3	Northern Sporaden Basin	39°16.42'N	23°42.52'E				1267	29.12.1997
Me40-01 KG4	Northern Sporaden Basin	39°16.58'N	23°42.49'E				1269	29.12.1997
Me40-02 KG1	Northern Sporaden Basin	39°15.51'N	23°42.50'E				1248	30.12.1997
Me40-02 KG2	Northern Sporaden Basin	39°15.50'N	23°42.51'E				1249	30.12.1997
Me40-02 KG3	Northern Sporaden Basin	39°15.51'N	23°42.51'E				1250	30.12.1997
Me40-02 KG4	Northern Sporaden Basin	39°15.51'N	23°42.51'E				1250	30.12.1997
Me40-01 Ku	Northern Sporaden Basin	39°16.01'N	23°42.85'E	39°15.98'N	23°40.08'E	1240	1255	30.12.1997
Me40-02 Ku	Northern Sporaden Basin	39°15.52'N	23°45.10'E	39°15.51'N	23°42.84'E	1129	1243	30/ 31.12.1997
Me40-03 Ku	Northern Sporaden Basin	39°15.00'N	23°43.26'E	39°15.00'N	23°40.63'E	1205	1259	31.12.1997
Me40-03 ES	Northern Sporaden Basin	39°14.99'N	23°43.43'E	39°14.94'N	23°42.05'E	1208	1253	31.12.1997
Me40-02 ES	Northern Sporaden Basin	39°15.50'N	23°43.24'E	39°15.38'N	23°42.61'E	1226	1248	31.12.1997
Me40-01 ES	Northern Sporaden Basin	39°16.09'N	23°43.08'E	39°16.08'N	23°42.33'E	1252	1255	01.01.1998

Total length is measured from the tip of pseudorostrum to the tip of pleonite 6, or the tip of the telson. The article length of the appendages is measured as follows: basis along middle line; ischium to dactylus along longer margin (Mühlenhardt-Siegel 2005). The relative length of peduncle articles 1 to 3 of antenna 1 is given in % of total peduncle length (RLP). The ratio basis to rest of appendage (B/R) of maxillipeds 2 and 3 and the pereipods is given. The term "rest of appendage" means combined length of ischium to basal part of dactylus (rest = 100%). RLA: denotes the relative length of each article (ischium to basal part of dactylus) to rest of appendage.

Abbreviations: KG = box corer; ES = epibenthic sledge; Ku = beam trawl; NE = north-eastern.

Systematic part

Family Lampropidae

Hemilamprops cristatus (Sars, 1870)

Material: Me 25: 12 KG2: 1 female. ZMH: K 41836.

Remarks. The present specimen, a female, has no fold along or across the carapace as most of the *Hemilamprops* species do, but a dorsomedian serration on the distal half reaching the ocular lobe. This kind of serration is present in only five species in the genus *Hemilamprops*: *H. cristatus* (G.O. Sars, 1870) described for the Arctic and the boreal Atlantic, *H. normani* Bonnier, 1896 from the eastern Atlantic; *H. pellucidus* Zimmer, 1808 from southern Oceans; *H. serrulatus* Ledoyer, 1977 from the Kerguelen Islands; and *H. tanseianus* Gamô, 1967 from Japan. The shape of the carapace and only three pairs of lateral spine-like setae at the distal part of the telson leads to the conclusion that the Mediterranean specimen is conspecific with *H. cristatus*.

Distribution. Arctic, northern and south-western Europe, 155–4000 m depth. Newly found in the Gulf of Taranto, Ionian Sea, Mediterranean.

Platysympus typicus Băcescu, 1961

Material: Me25: 10 KG, 1 male; 11 ES (1 mm): 1 female; 19 KG 2: 1 male; 25 ES (1 mm), 1 female. ZMH: K41837. 38 ES (1 mm): 3 females, 1 of them with pleon broken off. SMF: 31271.

Distribution. Mediterranean, 453–2924 m depth.

Family Bodotriidae

Bathycuma brevirostre (Norman, 1879)

Material: Me 25: 10 ES (1 mm): 1 female, 1 manca; 10 ES (0.5 mm): 2 mancas; 11 ES (1 mm): 2 females; 16 ES (0.5 mm); 2 females, 5 mancas, all damaged. ZMH: K41383.

Me 40: 09 ES (1 mm): 1 female, SMF 31272; 09 KG 3 (1 mm): 1 female, SMF: 31273

Distribution. South-western Europe, Mediterranean, to 5000 m depth.

Cyclaspis longicaudata Sars, 1865

Material: Me 25: 11 KG 1: 1 manca; 11 ES (1 mm): 1 male, 3 juvenile; 18 KG 2: 1 female; 24 KG 1: 1 female; 35 ES (1 mm): 1 male, 4 females, 1 juvenile; 39 KG 2: 1 female, broken, ZMH: K 41839. 10 ES (1 mm): 5 mancas, SMF 31274; 13 ES (1 mm): 3 mancas, SMF 31275; 25 ES (1 mm): 1 female, SMF 31276; 35 ES (0.5 mm): 3 mancas, SMF 31277; 38 ES (1 mm): 1 female, 4 mancas, SMF 31278.

Me 40: 09 ES (1 mm): 1 manca, damaged, ZMH: K 41840.

Distribution. Northern and south-western Europe, Mediterranean, Azores, east coast of the US, off Buenos Aires Province, Ecuador (doubtful), 120–5000 m depth.

Cyclaspis sp.

Material: Me 40: 09 ES (0.5 mm): 1 specimen, damaged; 10 KG 2 (0.5 mm) 1 juvenile specimen.

Family Leuconidae

Leucon (***Crymoleucon***) ***macrorhinus*** Fage, 1951

Material: Me 25: 10 KG: 7 female, 2 male, 1 manca; 11 KG 2: 1 manca; 12 KG 1: 3 mancas; 12 KG 2: 1 female; 12 ES: 1 female; 13 KG 2: 2 female; 13 ES: 1 female;14 KG 1: 1 male; 35 KG 1: 2 females, 1 juvenile male, ZMH: K 41841. 11 ES (1 mm): 1 female, SMF 31279.

Me 40: 02 ES: 1 female, SMF 31280; 01 KG 2: 1 female, SMF 31281; 03 KG 1 (1 mm): 2 females, SMF

31282; 03 KG 2 (1 mm): 1 female, SMF 31283.

Distribution. Western Mediterranean, now found in the deep eastern Mediterranean, 200–400 m depth. Depth distribution is now extended to 1529 m.

Leucon* (*Epileucon*) *longirostris Sars, 1871

Material: Me 25:10 KG: 1 female; 10 ES (1 mm): 4 males, 10 females, 1 manca, 2 broken; ES 11 (1 mm): 2 females, 2 males, 1 manca; 11 KG 1: 4 females; 11 KG 2: 5 females; 12 KG 2: 6 females, ZMH: K 41842. 11 ES (0.5 mm): 17 mancas, SMF 31284; 13 KG 1: 5 females, SMF 31285; 13 KG 2: 4 mancas, SMF 31286; 35 KG 2: 1 male, SMF 31287; 35 ES: 1 male, 1 manca, SMF 31288.

Distribution. Arctic, northern and south-western Europe, Mediterranean, Ponto-Caspian region, Azores, east coast of the US, W Africa, SW Africa, South Africa, 200–4360 m depth.

Leucon* (*Leucon*) *affinis Fage, 1951

Material: Me 25: 08 KG: 2 females; 25 KG 2: 1 female, ZMH: K 41843. 25 KG 1: 5 females, 2 males, 2 mancas, SMF 31289.

Distribution. Western Mediterranean, 180–370 m depth. Newly found off Egypt in the eastern Mediterranean, 199 to 415 m.

***Leucon* (*Epileucon*)** sp. 1

Material: Me 25: 12 KG 2: 1 female, ZMH: K 41844.

Remarks: The present specimen resembles *Leucon affinis* Fage, 1951 in terms of habitus, shape of the carapace, serration along the dorso-median line, antennal notch, first antenna and uropods. The only difference is the presence of an obvious ventral tooth on pereionite 5, which includes the present specimen in the subgenus *Epileucon* (Watling, 1991) and is not reported for *L. affinis*.

Distribution. Gulf of Taranto, Ionian Sea, Mediterranean, 506 m depth.

Leucon* (*Leucon*)** cf. ***fulvus Sars, 1865

Material: Me 25: 35 KG 1: 1 female, ZMH: K 41845.

Remarks. The female resembles *Leucon* (*Epileucon*) sp. 1 but it has no ventral tooth on pereionite 5. In fact, Fage (1951) listed "*L. fulvus* Fage, 1940 nec G.O. Sars" in his synonymy list, indicating that both species look very similar. The present female specimen resembles *L. fulvus* in terms of the shape of the subrostral tooth, having a small extra tooth in the antennal notch, and the uropods.

Distribution. Arctic, northern Europe, East and West Canada, 9–2258 m depth. Newly found off Israel, eastern Mediterranean, 9–2258 m.

Leucon* (*Leucon*) *mediterraneus Sars, 1879

Material: Me 25: 02 KG: 5 females, 4 males; 04 KG: 14 females; 06 KG: 1 female, ZMH: K 41846. 03 KG: 3 males, 14 females, SMF 31290.

Distribution. Mediterranean, 25–3000 m depth.

Leucon* (*Macrauloleucon*) *siphonatus Calman, 1905

Material: Me 25: 04 KG: 2 females, 1 male; 10 KG: 1 male; 10 ES: 1 male (damaged); 12 KG 1: 5 females, 1 manca; 12 KG 2: 9 females, 1 juvenile male; 13 KG 1: 1 female, 3 mancas; 13 KG 2: 3 females, 2 mancas; 14 KG 1: 1 manca; 14 KG 2: 1 male; 25 KG 2: 1 female (damaged); 29 KG: 1 subadult male, ZMH: K 41847. 12 ES: 1 male, SMF 31291; 13 ES (0.5 mm): 1 male, SMF 31292; 25 KG 1: 3 females, SMF 31293; 26 ES (0.5 mm): 1 manca, SMF 31294; 30 ES: 1 female, SMF 31295; 35 KG 1: 4 females, SMF 31296; 35 KG 2: 1 manca, SMF 31297; 35 ES: 1 female, SMF 31298.

Me 40: 01 KG 2 (0.5 mm): 1 female, SMF 31299; 02 KG 1 (0.5 mm): 1 female, SMF 31300; 03 KG 1: 2 females, SMF 31301: 03 KG 2 (0.5 mm): 2 females, SMF 31302

Distribution. Central Atlantic, Mediterranean, 100–4380 m depth.

Eudorella sp.:
Material: Me 25: 11 ES (0.5 mm): 1 manca. ZMH: K 41848.

Eudorella nana Sars, 1879
Material: Me 25: 02 KG (0.5 mm): 2 males; 09 KG: 1 female. ZMH: K 41849. 04 KG (0.5 mm): 2 males, SMF 31304.

Distribution. Mediterranean, 37–300 m depth. Newly found in depths to 684 m.

Family Nannastacidae
Campylaspis alba Hansen, 1920
Material: Me 25: 25 KG 1: 1 female (damaged), 1 manca. 13 ES (1 mm): 1 female, SMF 31305; 18 ES (0.5 mm): 1 female, SMF 31306; 35 KG 1: 1 female, SMF 31307; 35 KG 2: 1 female, SMF 31308; 35 ES: 2 mancas, SMF 31309.

Me 40: 01 ES: 1 female; 1 KG 2 (1 mm): 1 female; 03 KG 2 (0.5 mm): 1 female; 09 ES: 1 male; 25 KG 1: 1 female; 25 KG 2: 1 female. ZMH: K 41850.

Distribution. Northern and south-western Europe, north-western Africa, Mediterranean, 463–3548 m depth. New depth distribution: 199–3548 m.

Campylaspis horridoides Stephensen, 1915
Material: Me 25: 35 ES (1 mm): 1 female, 1 male, 1 manca. ZMH: K 41851.

Distribution. NE Atlantic, Mediterranean, 509–2747 m depth.

Campylaspis* cf. *paeneglabra Stebbing, 1912
Material: Me 40: 02 ES: 1 female (dissected). ZMH: K 41852.
Me 25: 35 ES (0.5 mm): 4 mancas; 35 ES (1 mm): 1 manca. SMF 31010.

Remarks. The small specimens from the Senckenberg collection resemble *C. paeneglabra*. The maxilliped 3 of the female (damaged) resembles the description given by Stebbing (1912); only the serration of the inner part of the merus is not obvious.

Distribution. South-western Europe, South Africa, 805–2338 m depth.
Newly found off Israel and northern Sporades Basin, eastern Mediterranean, 805–2338 m.

Campylaspis cf. ***sulcata*** Sars, 1870
Material: Me 25: 25 KG 1: 2 females, 4 mancas; 25 KG 2: 2 females, 1 manca. ZMH K 41853

Distribution. West coast of Ireland, Norway to the western Mediterranean, now recorded for the eastern Mediterranean off Egypt, 130–650 m depth.

Campylaspis vitrea Calman, 1906
Material: Me 25: 10 ES (1 mm): 1 female; 10 ES (0.5 mm): 1 female, SMF 31311; 24 KG 1: 1 manca, SMF 31312. 11 ES (1 mm): 1 female.
Me 40: 01 KG 1 (0.5 mm): 1 female; 02 KG 1 (1 mm): 2 females; Ku 2: 1 male; ZMH: K 41854.

Distribution. South-western Europe, western Mediterranean, Brazil, eastern US, now recorded for the eastern Mediterranean off Egypt and the Gulf of Taranto, 236–2000 m depth.

Campylaspis aegypta sp. nov.
(Figs 1 & 2)
Holotype: female, 3.78 mm; ZMH K 41252; 1 June 1993; M. Türkay coll.

Type locality: eastern Mediterranean, off Nile delta, 32° 00.58' N, 31° 53.30' E, 200 m depth, RV *Meteor* cruise 25, station 25, second box corer.

Etymology. The new species is named after the type locality: off Nile delta, Egypt.

Diagnosis. Carapace with a strong sculpture forming a large and two smaller lateral depressions on each side, one of the smaller behind the antennal notch area and the other dorsal of the posterior third of the large depression.

Description. Body (Fig. 1): carapace 0.45 of total length, with carinae forming three depressed areas: upper carina starting from base of pseudorostrum and bifurcating in the dorso-posterior part. Ventral carina starting in anterior quarter of carapace from dorsal carina, directed anteroventrad, bending backwards and running parallel to ventral margin to dorsal hind end of carapace, connected with first carina in the anterior part. Lateral depression largest and deepest, open to the posterior part; dorsolateral compression second largest, with anterior border discernable from lateral but hardly visible from dorsal; third depression behind the antennal notch. Pseudorostral lobes meeting for a short distance in front of ocular lobe, the latter without lenses; siphonal tubes moderately long; ocular lobe longer than wide, no lenses; antennal notch small, acute; anterolateral tooth moderately small; anteroventral margin of carapace smooth; integument well calcified.

Five free thoracic segments visible from lateral, the first very short. Pleon 0.37 of total length; pleonite 6 a little wider than long (width to length 1.16).

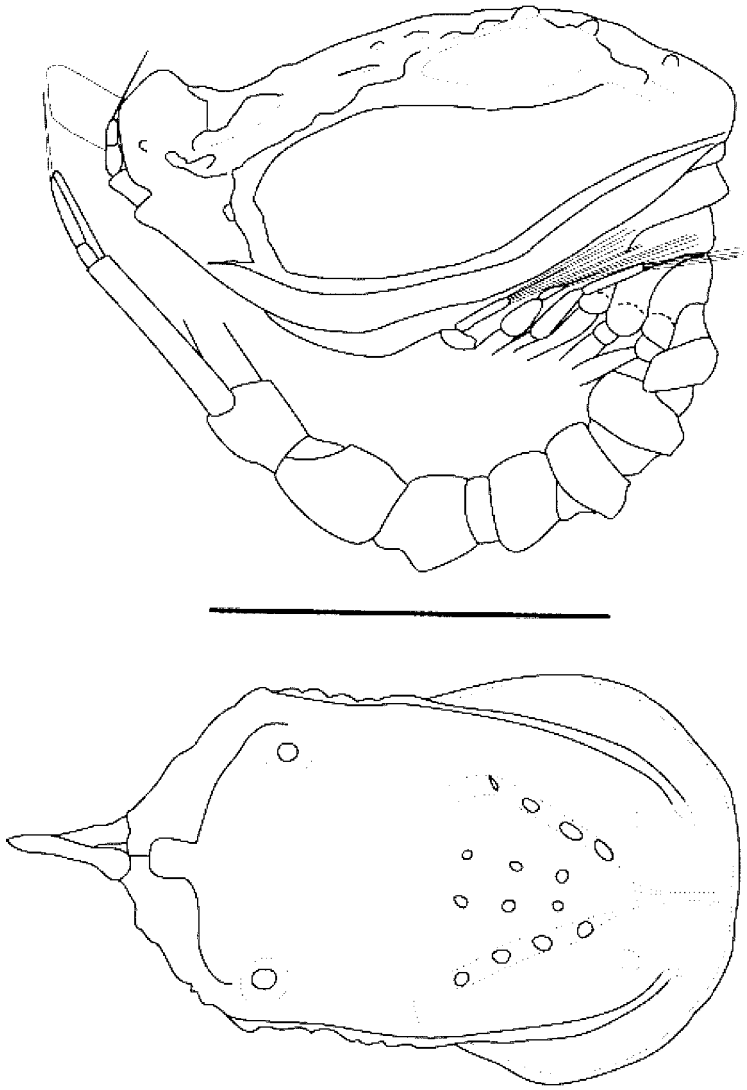

FIGURE 1. *Campylaspis aegypta* sp. nov. Habitus of the holotype. Scale bar: 1 mm.

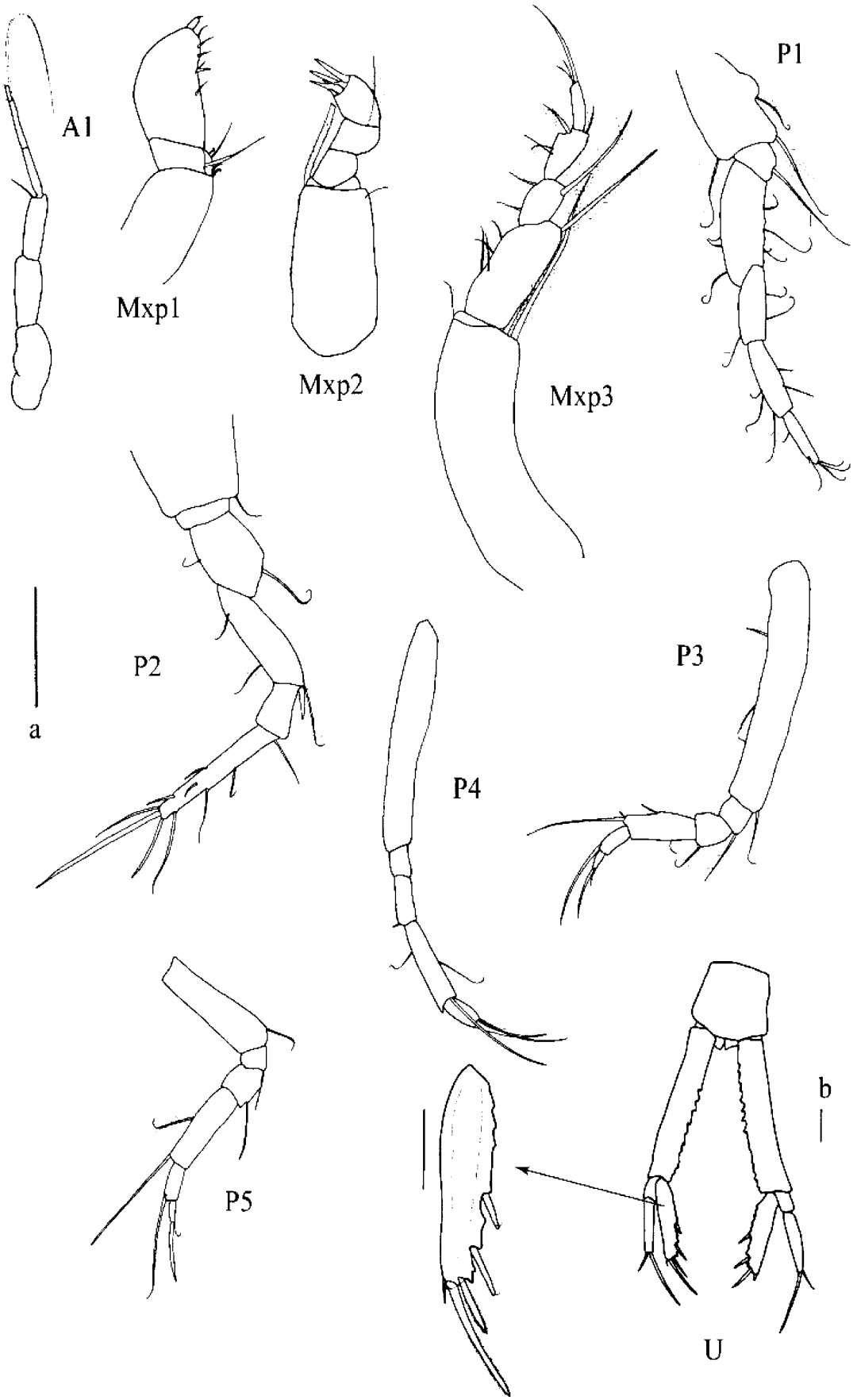

FIGURE 2. *Campylaspis aegypta* sp. nov. Appendages of the holotype. A, antenna ; Mxp, maxilliped; P, pereiopods; U, uropods and pleonite 6. Scale bars: 0.1 mm. Scale a for A1, Mxp 2 and 3, P1 to 5; scale b for U.

Antenna 1 (Fig. 2) straight, relative length of peduncle articles 1 to 3 (RLP): 40/30/29; accessory flagellum reduced; main flagellum tri-articulate.

Maxilliped 1 (Fig. 2,) terminal article minute with one tiny seta terminally.

Maxilliped 2 (Fig. 2,): B/R ratio 1, relative length of articles I to D (RLA): 7/24/21/38/10; propodus with two strong and two hair-like setae terminally; dactylus with one strong terminal seta.

Maxilliped 3 (Fig. 2): B/R ratio 1, RLA: 4/39/18/22/16; basis, merus and carpus each with one strong seta at outer distal edge; exopod present but broken off, not drawn.

Pereiopod 1 (Fig. 2): B/R ratio not given, basis broken during dissection, RLA: 10/33/20/20/16; plumose setae on basis, ischium and propodus; dactylus with three simple setae distally; exopod present but broken off, not drawn.

Pereiopod 2 (Fig. 2): B/R ratio not given, basis broken during dissection, RLA: 5/21/25/13/35, carpus with one strong seta at outer margin; dactylus cylindrical, terminal seta (unguis) longer than basal part of dactylus; exopod present but broken off, not drawn.

Pereiopod 3 (Fig. 2): B/R ratio 1.2, RLA: 14/20/38/18/10; carpus and propodus with a strong distal seta, terminal seta (unguis) longer than basal part of dactylus.

Pereiopod 4 (Fig. 2): B/R ratio 1, RLA: 14/20/40/16/9; setation similar to pereiopod 3.

Pereiopod 5 (Fig. 2): B/R ratio 0.6, RLA: 11/20/42/16/10; setation similar to pereiopod 3.

Uropod peduncle inner margin serrate; 2.1 times longer than pleonite 6, 1.9 times longer than uropod endopod. Exopod as long as endopod; endopod unsegmented, inner margin serrate, two strong setae along inner margin, one strong seta and one hair-like seta subterminally, one long seta terminally (Fig. 2).

Remarks. The specimen belongs to the *sulcata* group (Jones 1974) of the genus *Campylaspis* and resembles *C. sulcata* in terms of the dorsal outline with slight undulations. The shape of the carinae, however, differs in the present specimen: the upper carina starts from the base of the pseudorostrum and bifurcates in the dorso-posterior part. The ventral carina starts in the anterior quarter of the carapace from the dorsal carina, directing anteroventrad, bending backwards and running parallel to the ventral margin to the dorsal hind end of the carapace rather than as in *C. sulcata* with two carinae which extend obliquely from near the mid-line in the hind part of the carapace to the base of the pseudorostrum, having a fairly deep excavation between them but no bifurcation in the dorso-posterior part. In respect of the shape of the carinae or depressed areas of the carapace, the Mediterranean specimen resembles *C. rupta* Hale, 1945, an adult male from shallow waters of South Australia, which Jones (1974) put into the "spinosa" group with three other species stating: "These four species have little in common but do not fit into any other group." A second species with similar shape of carinae on the carapace is *C. pisum* Vassilenko & Tzareva, 2004 from the Sea of Japan. The position, shapes of the carinae and depressions on the carapace of *Campylaspis pisum*, *C. rupta* and *C. aegypta* sp. nov. are compared in Fig. 3.

The new species differs from these species in the number of depressions (three in *C. aegypta* sp. nov. and *C. pisum*, four in *C. rupta*), the shape of pleonite 6 (almost rectangular in *C. aegypta* sp. nov; short in *C. pisum*; triangular in *C. rupta*), the uropod peduncle and endopod (serrate in *C. aegypta* sp. nov.; peduncle slightly serrate, endopod smooth in *C. pisum*; smooth in *C. rupta*), merus, carpus and propodus of maxilliped 3 (smooth in *C. aegypta* sp. nov., serrate in *C. pisum* and *C. rupta*), and merus and carpus of pereiopod 1 (smooth in *C. aegypta*, with teeth or serrate in *C. pisum*, slightly serrate in *C. rupta*).

Nannastacus atlanticus (Băcescu & Muradian, 1972)

Material: Me 25: 25 KG 2: 1 female, ZMH: K 41855.

Remarks. Although the specimen is damaged with the pleonite and telsonic segment broken off, the bifid anterior projection of the frontal lobe is clearly visible, a character stressed by Corbera & Sorbe (1999). This is the first record of a member of the genus *Nannastacus* in Mediterranean waters of 200 m depth. There is only one *Nannastacus* species described for the Mediterranean: *N. turcicus* Băcescu, 1982 from the Aegean Sea (16–29 m).

Distribution. E Atlantic, Mauretania, 227–286 m depth. Newly found in the eastern Mediterranean.

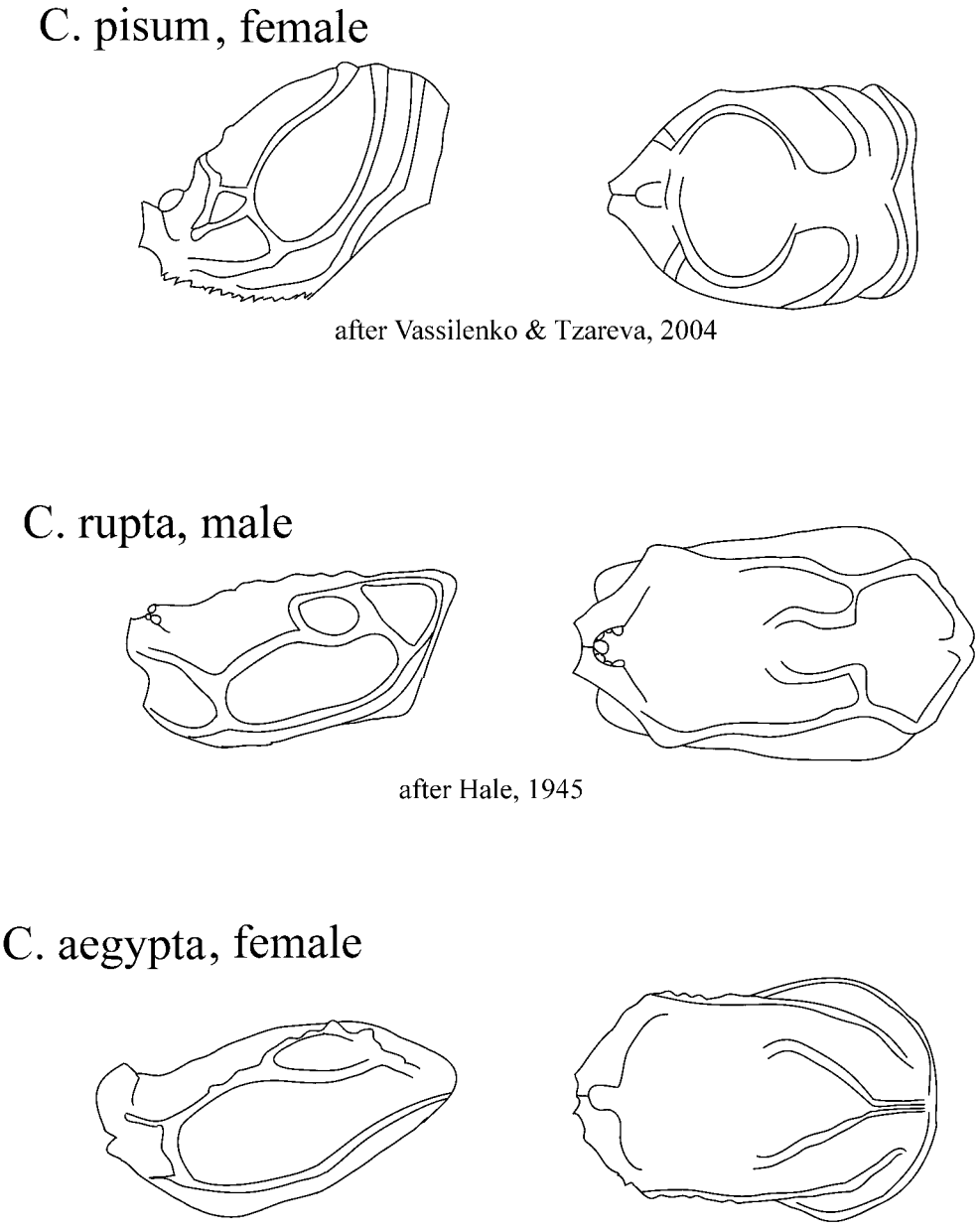

FIGURE 3. Comparison of position and direction of the carapace carinae and depressions in the *Campylaspis* species *rupta*, *pisum* and *aegyta* sp. nov., a schematic overview from lateral (left) and dorsal (right).

Procampylaspis armata Bonnier, 1896

Material: Me 25: 10 KG: 2 females, 1 manca; 10 ES (1 mm): 1 female; 18 ES (1 mm): 1 female; 18 KG 2: 1 female; 20 ES (1 mm): 1 male; 35 ES: 2 mancas; 37 KG 2: 1 male, ZMH: K 41856.

Me 40: 01 KG 1 (1 mm): 1 female, SMF 31313; 02 KG 1 (1 mm): 1 female, SMF 31314; 08 ES: 1 female, SMF 31315; 09 ES (1 mm): 1 female, SMF 31316; 10 KG 1 (1 mm): 1 female, SMF 31317.

Distribution. South-western Europe, Mediterranean, north-western Africa, western Africa, south-western Africa, Brazil, 119–4547 m depth.

Procampylaspis bonnieri Calman, 1906

Material: Me 25: 10 KG: 1 female; 11 KG 1: 3 females; 10 ES (1 mm): 17 females, 3 males; 10 ES (0.5 mm) 11 females (2 of them damaged); 11 ES (0.5 mm): 26 females, 10 male, 2 mancas; 11 KG 2: 1 male, 13 females, 4 mancas; 12 KG 1: 1 female; 12 KG 2: 1 female; 12 ES: 2 females;13 KG 1: 1 female; 12 ES: 2

mancas; 13 ES (0.5 mm): 1 female, 1 male, 3 mancas; 13 ES (1 mm): 3 females; 13 KG 2: 1 female; 24 KG 2: 1 female; 35 KG 1:1 male, 1 female; 35 KG 2: 2 females, 1 male; 35 ES: 9 males, 19 females. ZMH: K 41857. 08 KG: 1 male, SMF 31318; 11 ES (1 mm): 3 females, 2 males, SMF 31319; 35 ES (1 mm): 5 females, 1 male, 1 manca, SMF 31320.

Me 40: 01 ES: 1 male, SMF 31321; 01 KG 1 (0.5 mm): 1 female SMF 31322; 01 KG 2 (0.5 mm): 1 female; 01 KG 2 (1 mm): 1 female, SMF 31323; 02 KG 1 (0.5 mm): 1 female, SMF 31324; 02 ES: 1 male, 1 female, SMF 31325; 03 KG 1 (0.5 mm): 2 females, SMF 31326; 03 KG 2 (0.5 mm): 1 female, SMF 31327; 08 KG 1 (0.5 mm): 1 male, SMF 31328; 09 ES (1 mm): 3 males, 4 females, SMF 31329; 09 KG 3 (1 mm): 1 manca, SMF 31330; 10 KG 1 (1 mm): 1 female, SMF 31331.

Distribution. South-western Europe, Mediterranean, central Atlantic, to 2565 m depth.

Styloptocuma gracillimum (Jones, 1984)

Material: Me 25: 10 ES (1 mm): 1 male; 10 KG: 1 female; 25 KG 1: 1 female. ZMH: K 41858. 11 ES (0.5 mm): 1 female, SMF 31332; 13 ES (0.5 mm): 1 female, SMF 31333; 13 KG 2: 1 male, SMF 31334.

Remarks. The specimens from the Senckenberg collection have the long siphonal tubes, the lack of serration on the pleon somites and the very few dorso-median spines as described for the Atlantic specimens.

Distribution. Eastern and northern Atlantic, 97–5000 m depth. Newly found in the Gulf of Taranto, Mediterranean, 998–1257 m depth.

Family Diastylidae

Diastylis cornuta (Boeck, 1864)

Material: Me 25: 10 KG: 1 female; 13 KG 1: 1 female; 13 KG 2: 2 females, 1 manca. ZMH: K 41859. 10 ES (1 mm): 9 females, SMF 31335.

Distribution. Northern and south-western Europe, Mediterranean, 20–2700 m depth.

Diastylis laevis Norman, 1869

Material: Me 25: 20 ES (1 mm): 1 female. ZMH: K 41860.

Distribution. Northern and south-western Europe, Mediterranean, north-western Africa, western Africa, 100–3000 m depth.

Diastyloides carpinei Băcescu, 1969

Material: Me 25: 10 ES (1 mm): 1 male; 11 KG 1: 1 female; 12 KG 2: 1 female; 12 ES: 1 female, 1 manca. ZMH: K 41861.

Me 40: 01 KG 1 (1 mm): 1 female, 1 manca, SMF 31336; 01 KG 2 (1 mm): 1 female (damaged), SMF 31337; 02 KG 1 (1 mm): 1 female (damaged), SMF 31338; 02 ES: 3 females, SMF 31339; 03 ES: 1 female, SMF 31340; 03 KG 1 (0.5 mm): 2 females; 03 KG 1 (1 mm): 5 females, SMF 31341; 03 KG 2 (1 mm): 4 females, 1 male, SMF 31342; 09 ES (1 mm): 1 female, SMF 31343.

Distribution. Western Mediterranean, now recorded for the eastern Mediterranean, 250–2090 m depth.

Diastyloides biplicata (Sars, 1865)

Material: Me 25: 25 KG 1: 1 ovigerous female, 2 mancas. ZMH: K 41862.

Remarks. The female in the present collection has no rudimentary exopods on pereiopods 3 and 4, the character given by Fage (1940) to distinguish the species *D. biplicata* (no exopodites) and *D. bacescoi* Fage, 1940 (rudimentary exopodites present). Ledoyer (1983) reported both species from the western Mediterranean.

Distribution. Norway, British Isles, Bay of Biscay, western Mediterranean, now found in the eastern Mediterranean, 60–3000 m depth.

Leptostylis cf. ***bacescoi*** Reyss, 1972

Material: Me 25: 10 KG: 1 female; 25 KG 1: 1 female. 11 ES (0.5 mm): 8 females, SMF 31344.

Me 40: 01 KG 2 (1 mm): 1 female, ZMH: K 41863.

Distribution. Mediterranean, 2110–2665 m depth.

Leptostylis gamoi Reyss, 1972

Material: Me 25: 11 KG 1: 1 female, 1 male; 11 KG 2: 1 female; 11 ES (1 mm): 2 males (damaged); 12 KG 1: 1 female, 2 mancas, ZMH: K 41864. 20 ES (1 mm): 2 males, 1 female, SMF 31345; 24 KG 1: 1 manca, SMF 31346; 10 ES (1 mm): 3 females, SMF 31347.

Distribution. Mediterranean, 2400–2665 m depth.

Makrokylindrus (***M***.) ***spiniventris*** Hansen, 1920

Material: Me 25: 10 KG: 5 females; 14 KG 1: 1 male; 11 ES (1 mm): 2 females; 35 ES (1 mm): 1 female, ZMH: K 41865. 10 ES (1 mm): 3 females, SMF 31348.

Me 40: 02 ES: 1 female, SMF 31349.

Distribution. South-western Europe, 847–942 m depth. Newly found in the Gulf of Taranto (998 to 1257 m), Ionic Sea, and northern Sporades Basin (1226 m), Mediterranean.

Vemakylindrus cf. ***charcoti*** (Reyss, 1974)

Material: Me 25: 10 ES (1 mm): 5 females; 11 ES (1 mm): 1 female; 13 ES (1 mm): 1 female; 25 KG1: 1 manca.

Me 40: 01 KG 1 (1 mm): 1 male; 02 ES: 2 females. ZMH: K 41866. 01 KG 2 (1 mm): 2 females (1 damaged), SMF 31350; 02 KG 1 (0.5 mm): 2 mancas, SMF 31351; 02 KG 2 (0.5 mm): 1 manca; 02 KG 2 (1 mm): 1 female, SMF 31352; 03 KG 1 (1 mm): 1 female, SMF 31353; 03 KG 2 (1 mm): 1 female, SMF31354.

Distribution. Mediterranean, 453–1308 m depth.

In total, 29 species were identified. Thirteen species were newly recorded for the eastern Mediterranean, six of them were known for the Atlantic and are new for the Mediterranean, and seven species were until now only known for the western Mediterranean. One species is new to science.

Discussion

About 330 species have been described for the NE Atlantic region, including the Arctic. Out of these, 113 species (34%) occur in the Mediterranean and the Ponto-Caspian region. In total 96 species, including the species described as new for the Mediterranean in the present study, are known for the Mediterranean. From these 96 Mediterranean species 54 are Atlanto-Mediterranean, i.e., they are known to occur in the NE Atlantic as well as the Mediterranean. Of these, 4 species are widely distributed from the Atlantic to the Ponto-Caspian region; 35 species are reported from the Atlantic and both the western and eastern parts of the Mediterranean.

Four species from the present studies were known to occur in the Atlantic and are now newly reported from the eastern Mediterranean: *Leucon fulvus* (Leuconidae), *Nannastacus atlanticum*, *Campylaspis paeneglabra* (Nannastacidae) and *Makrokylindrus spiniventris* (Diastylidae). There may be representatives of these species in the western basin, but no evidence is currently available. Eleven species are known from only the Atlantic and the western Mediterranean. Surprisingly there is one species in each Mediterranean Basin known from the Pacific. *Scherocumella gurneyi* (Calman, 1927) occurs in shallow waters of the Red Sea, Suez Canal and western Indian Ocean, and is reported for the coast of Israel (Corbera & Galil 2007). *Bathycuma longicaudatum* Calman, 1912 is the second species, and was described for the deep sea of the northern Pacific (Japan and California). According to Stephensen (1915), it can also be found in the western Mediterranean.

The number of species in the Mediterranean decreases from west to east; there are 85 cumacean species living in the western and 78 species in the eastern Mediterranean (Fig. 4). These figures may be biased due to lower research effort in the eastern part during the last century. However, it could be the result of the more oligotrophic conditions in the eastern part of the Mediterranean. For the western Mediterranean we can currently list 55 Atlanto-Mediterranean, 20 endemic Mediterranean and 10 endemic western Mediterranean species. For the eastern Mediterranean we know 48 Atlanto-Mediterranean, 20 endemic Mediterranean and 10 species endemic to the eastern part of the Mediterranean.

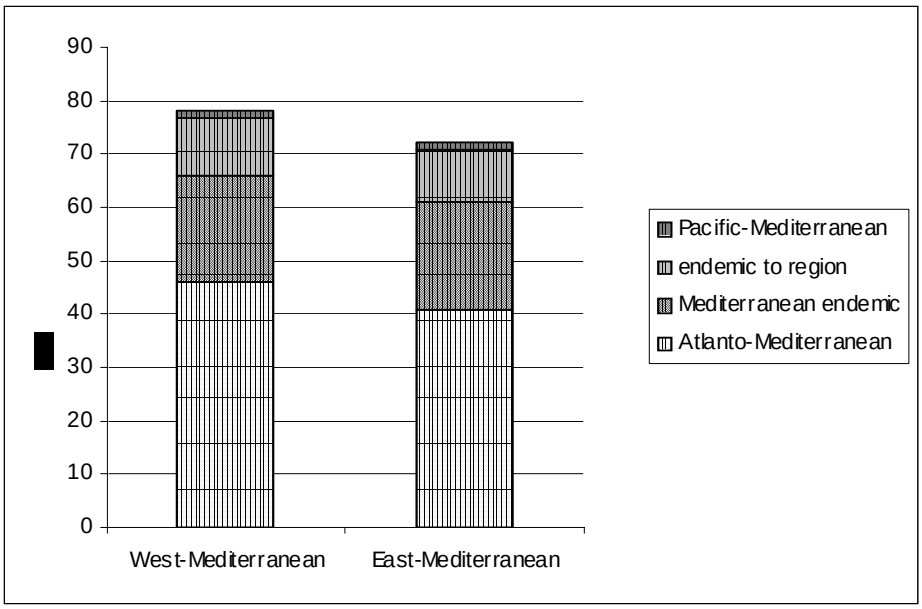

FIGURE 4. The faunal composition in both Mediterranean basins.

The cumacean faunal overlap (Table 2) between the Atlantic (excluding the Arctic regions) and the Mediterranean is 19% regarding all depths as well as just the deep sea. The faunal overlap of the endemic species between both basins of the Mediterranean is higher in the deep sea than regarding all depth ranges. Only two species (2 %) of the Mediterranean Cumacea fauna are also reported for the Pacific.

TABLE 2. Cumacean species overlap between regions. S: species number; NE: north eastern.

Regions **Atlantic/ Mediterranean**	**NE Atlantic S**	**Mediterranean S**	**total S**	**overlap S**	**% of total S**
all species, all depths	252	96	292	56	19
deep-sea species	163	43	173	33	19

Regions **Mediterranean, western to eastern Basin**	**western Basin S**	**eastern Basin S**	**total S**	**overlap S**	**% of total S**
all species, all depths	78	72	96	56	58
exclusively deep-sea species	41	34	46	33	71
endemic species, all depths	31	30	41	20	49
endemic species, deep sea	13	10	14	9	64

Similar observations were made by Bellan-Santini & Ruffo (1998) for Mediterranean benthic amphipods: 56 % of all species are common to the Mediterranean and the Atlantic, 37 % of the species are endemic to the Mediterranean, 5 % of the species are cosmopolitan and 2 % are Indo-Pacific species present in the Mediterranean due to migration or passive dispersal through the Suez-Canal.

There are 40 species endemic (42 % endemism) to the Mediterranean and Ponto-Caspian region, and 19 species endemic to the whole Mediterranean, 11 species only in the western part and 10 species only in the eastern part of the Mediterranean.

The endemism in the Ponto-Caspian Region is very high at 83%. Of the 30 species described for the Ponto-Caspian Region, four also live in the Mediterranean. Endemism is not only high at species level but also at genus level, indicating a very long period of isolation.

The faunal overlap between the Mediterranean and the Ponto-Caspian region is very low (8 %) regarding all depth ranges, due to the limited water exchange through the narrow Bosporus. Due to the anoxic condition in the Black Sea deep-sea basin, no true deep-sea Cumacea live here and therefore are not available to disperse into the Mediterranean, eurybathic species are also unknown for the Black Sea.

Most of the Mediterranean species living exclusively at depths below 1000 m are endemic to the deep Mediterranean: in the western Mediterranean these species are *Diastylis jonesi* Reyss, 1972, and *Vemakylindrus gibraltariensis* (Băcescu, 1961) (Diastylidae).

In both basins of the Mediterranean, *Procampylaspis mediterranea* Ledoyer, 1987 (Nannastacidae), *Leptostylis bacescoi*, *Leptostylis gamoi* and *Vemakylindrus vemae* (Diastylidae) are endemic to the deep-sea. The fact that these endemic deep-sea species occur in both Mediterranean basins indicates that the sill between Sicily and Tunis is obviously not an effective barrier for them.

The number of cumacean species found at different depth ranges of the Mediterranean is given in Fig. 5a for the western basin and 5b for the eastern basin. Eurybathic species are counted in several depth zones according to their depth distribution.

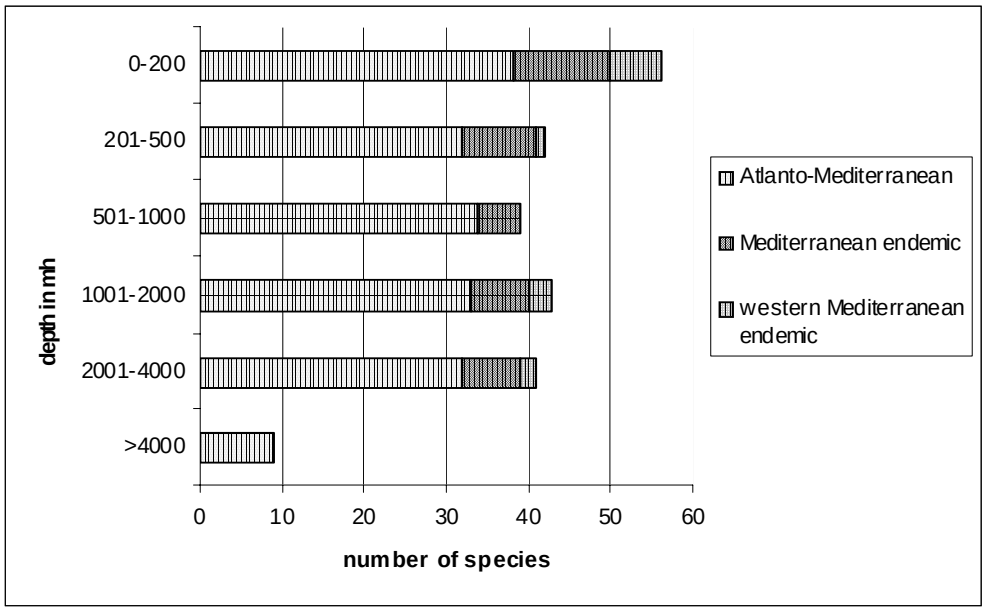

FIGURE 5. The number of cumacean species in different depth zones in the western Mediterranean. Eurybathic species are counted in several depth ranges.

In both basins the number of species is highest on the shelf. The Mediterranean endemic species occur at depths from shallow water up to a maximum of 4000 m.

One species that has been described is new to science, four species were recorded for the first time for the Mediterranean. One of these species, *Leucon fulvus*, has a wide depth distribution from the shelf to the abyssal

plain. The species *Campylaspis paeneglabra* and *Makrokylindrus spiniventris* are reported for the lower continental shelf down to the abyss. Only *Nannastacus atlanticum* lives in shallower regions of the continental slope (approximately 200 to 300 m).

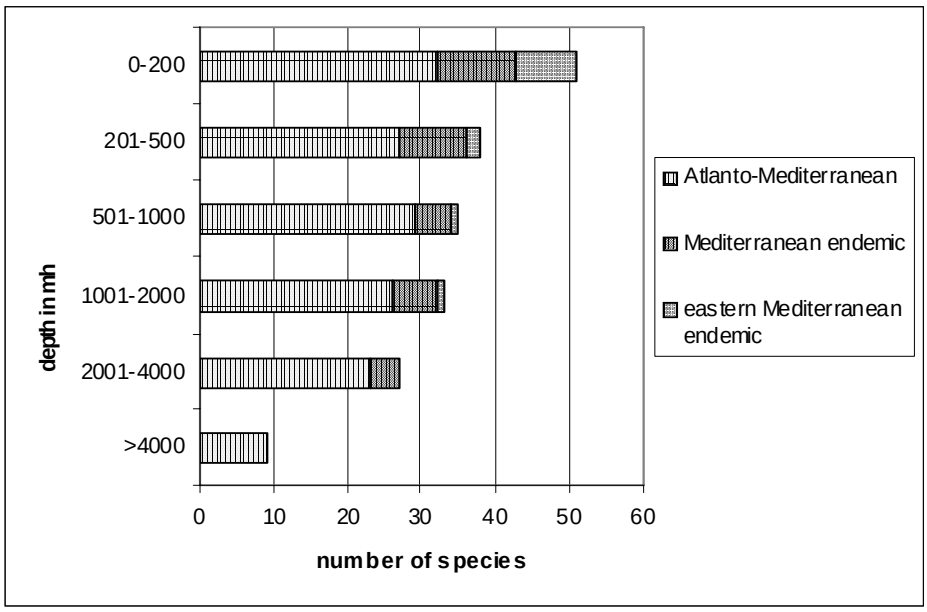

FIGURE 6. The number of cumacean species in different depth zones in the eastern Mediterranean. Eurybathic species are counted in several depth ranges.

Most cumacean species of the Mediterranean are eurybathic. Due to the warm water conditions in the deep basins, temperature is not supposed to be a limiting factor for those species adapted to the warm surface water to invade the Mediterranean deep sea. The eurybathic way of living of the deep-sea fauna and the decrease of endemism with increasing depth of the Mediterranean is also stated for gastropods (Bouchet & Taviani 1992). But in contrast to gastropods, for which the authors suggest that "the larval ecology of the species is the most important factor governing the composition of the deep Mediterranean benthos", cumacean larval development takes place in the marsupium of the females, so dispersal through free swimming larvae is impossible for Cumacea.

There are 9 species in the Mediterranean occurring exclusively at more than 1000 m depth, only two of them are supposed to have a wide distribution: *Bathycuma longicaudatum* (Bodotriidae) and *Leucon ensis* (Leuconidae), both widespread in the world oceans and in the western Mediterranean.

Madurell & Cartes (2003) reported a number of peracarid species distributed shallower in the eastern Mediterranean basin (Ionian Sea, 473–603 m) than in the western basin (Catalan Sea, 1200–1350 m). This seems not to be the case in the cumaceans.

It may be concluded that the Mediterranean cumacean fauna originated from the Atlantic across the Gibraltar sill. Therefore Cumacea are relatively young inhabitants of the very old Mediterranean Sea, invading this ocean during or after the Gibraltar waterfall period.

Bellan-Santini & Ruffo (1998) came to the same conclusion for amphipods based on a biogeographic parsimony analysis for the Gammaridea. They stated "…to a large extent its (the Mediterranean) fauna is of Atlantic origin and relatively recent (post Messinian)". But contrary to the Cumacea, the Amphipoda of the Mediterranean have endemic faunal components related to Indo-Pacific taxa, which the authors believe to be the relicts of the

Mesogeic colonization of the pre-Messinian age (Bellan-Santini & Ruffo 1998). That would indicate a higher tolerance in some gammarid amphipods to hypersalinity than in cumaceans. Only one cumacean

species *Scherocumella gurneyi* (Calman, 1927) formerly known from the Red Sea and Suez Canal was recently found in the Haifa Bay, Israel, most probably invading the Mediterranean via the Suez Canal. (Corbera & Galil 2007).

There are 13 cumacean species described for both the Atlantic Ocean and the Mediterranean Sea living in depths deeper than 320 m, which is the present depth of the Gibraltar sill. The question remains, how did these bathyal species manage to cross the shallow sill of Gibraltar without free larval stages? One possibility is that representatives of these species have a wider depth distribution than assumed but they have not yet been dicovered from shallower depths. Another possibility is that they had a wider vertical distribution range in the past and more recently become extinct in shallower depths; e.g., as the water temperature in the world oceans decreased at the end of the Tertiary, it was probably possible for Atlantic deep-sea species to invade shallower regions and cross the sill of Gibraltar. During the following ice ages with very different environmental conditions and the drop of the sea level, the shallower living representatives of these species suffered extinction.

Acknowledgements

The study was granted by the DFG (Mu 933/4). The *Meteor* cruises 25/1 and 40 were supported by the Deutsche Forschungsmeinschaft. Many thanks to: Dr. Michael Türkay (Frankfurt) for giving the cumaceans to me; Dr. Brigitte Ebbe (Bonn) for revising the English and making lots of critical and helpful remarks; Drs Daniel Roccatagliata (Buenos Aires) and Volker Siegel (Hamburg) for critical comments; The Zoological Museum, Hamburg, for providing an actual place where the work involved could be undertaken.

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