

MEDITERRANEA

SERIE DE ESTUDIOS GEOLOGICOS

Número 3

Junio 1984

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DID STROMBUS SURVIVE THE LAST INTERGLACIAL IN THE WESTERN MEDITERRANEAN SEA?

C. Zazo¹, J.L. Goy¹ and E. Aguirre²

RESUMEN

El litoral de Almería constituye el sector más rico del Mediterráneo en niveles tirrenienses, todos ellos conteniendo *Strombus bubonius*¹. Cuatro playas diferentes se observan al Este de Almería^{2, 3, 4}, la más reciente, datada en 37.720 ± 1.740 años BP (¹⁴C) y 39.000 ± 2.000 años BP (Th/U) años BP^{1, 5}, está claramente encajada en las anteriores, y a su vez se presenta relacionada con depósitos continentales de abanicos aluviales que constituyen los sistemas más recientes de la costa oriental de Almería.

Por otro lado los depósitos tirrenienses de esta región constituyen un claro ejemplo de la distinta distribución espacial de los niveles con *S. bubonius*, tanto en lo que se refiere al número, cota, o incluso disposición geométrica de los mismos que depende fundamentalmente del marco neotectónico en el que se desarrollen.

Por otra parte los autores hacen una llamada de atención sobre el empleo del término «Tirreniense» sugiriendo que se continúe utilizando a éste en el sentido de su definición original¹ «capas que contienen *S. bubonius*» sin darle un sentido cronoestratigráfico estricto. Asimismo y a la vista de los resultados sería conveniente llevar a cabo una revisión sobre la significación climato-estratigráfica de la entrada del *S. bubonius* en el Mediterráneo.

ABSTRACT

The warm gastropod *Strombus bubonius* spread into the Mediterranean Sea during the last interglacial period. Its fossil occurrence is normally used as a climatostratigraphic indicator of the Tyrrhenian transgression and linked to high sea levels of this episode^{1, 2}. However, a sequence of four successive and discordant stratigraphic units containing *S. bubonius* is observed in the Rambla Amoladeras-Rambla Sepultura compisite section, east of Almería, on the Spanish Mediterranean coast^{3, 4}. The youngest unit has been dated between 39.000 and 34.000 y BP, suggesting therefore that *S. bubonius* survived the last interglacial in the western part of the Mediterranean basin. Reconsideration of the use and meaning of the term «Tyrrhenian» and of the current somewhat confusing terminology is thus required.

The «Tyrrhenian» deposits outcropping in the Almería coastal area of Spain are unique example of several *Strombus bubonius* bearing units, which are exposed diversely according to the structural framework of each subarea. West of Almería city, three raised beaches are observed at altitudes of ca. 18 m., 14 m., 6 m., respectively; The Neogene bedrock usually outcrops in between. Two isotopic dates have been obtained on the intermediate shoreline deposits: 104.000 ± 6.000 yrs. (Th/U) and $109.000 \pm 16.000 / -12.000$ (Pa/U)⁵. East of Almería, three marine units are well exposed, in stratigraphic continuity, between El Alquian and Cabo de Gata (Fig. 1, 2)³; they correspond to the (I) Amoladeras,

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(II) Retamar and (III) Torre García episodes. Clear evidence of a fourth episode (IV-Sepultura) has been found in the occurrence, between 0 and 1 m. above present sea level, of a *S. bubonius* bearing unit, which overlies and erosional surface cut into the older units. It has been dated at 34.720 ± 1.740 BP (^{14}C) and 39.000 ± 2.000 yrs. (Th/U)⁵.

Only one single marine unit with *S. bubonius* has yet been found on the Sierra de Gata foothills. It is overlain by the El Playazo oolitic eolianite. Th/U dating of this unit yielded an age of $144.000 + 14.000/-11.000$ yrs⁵. Further north, between Cabo de Gata and Garrucha (beyond the limit of fig. 1 map), two. «tyrrhenian» units are again well preserved and exposed in stratigraphic continuity⁴.

A network of faults, bearing 120° N., $140-160^\circ$ N. and $10-20^\circ$ N., cut the three oldest tyrrhenian deposits, the youngest one (IV-Sepultura) remaining indisturbed. The best exposed marine units with *S. bubonius*

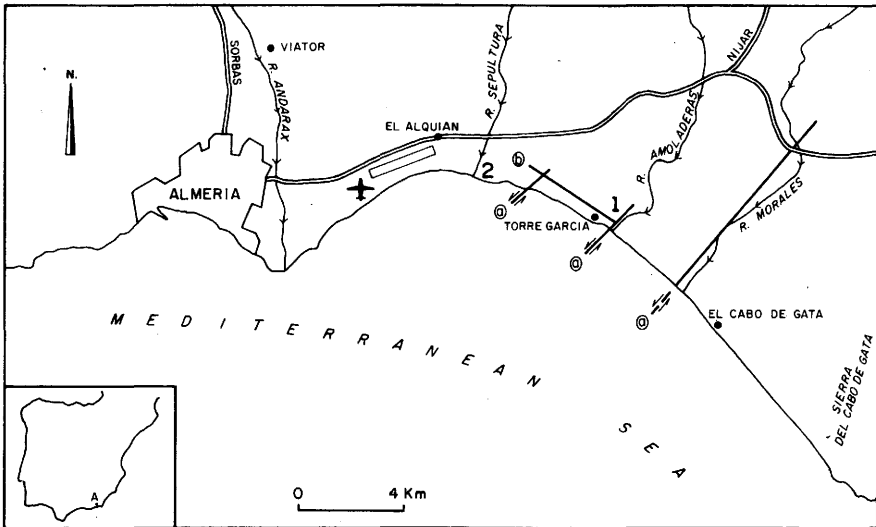


FIG. 1

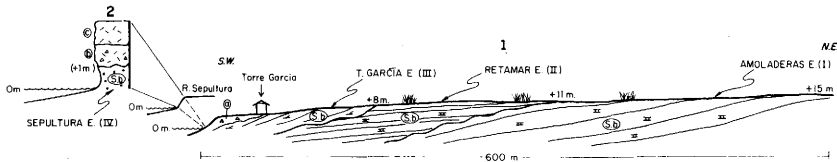


FIG. 2

Fig. 1. — Location of Amoladeras - Sepultura Tyrrhenian complex: **a** Faults bearing $40^\circ - 45^\circ$ N, **b** Faults $140^\circ - 160^\circ$ N. 1 Rambla Amoladeras section, 2 Rambla Sepultura section.

Fig. 2. — The Tyrrhenian marine units east of Almería: **S.b.** *Strombus bubonius* findings., **≠** Strongly cemented., **/** Partially cemented; **⊘** not cemented; **a b c** Continental deposits (glacis and alluvial fans); (I) (II) (III) (IV) Successive Tyrrhenian episodes.

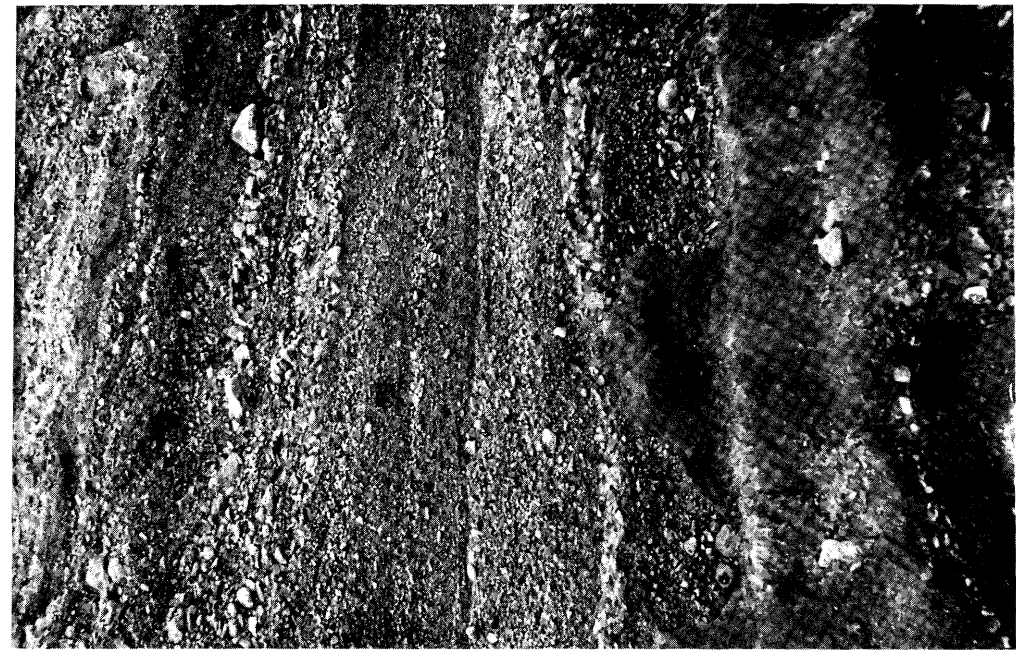


FIG. 5

←FIG. 4



Fig. 3.—(II) Rematar Episode eroding (I) Amoladeras Episode. Rambla Amoladeras.

Fig. 4.—(III) Torre García Episode deposits fillings small depressions carved into the (II) Retamar episode deposits.

Fig. 5.—*Strombus bubonius*. Bearing level IV at Rambla Sepultura (^{14}C age 34.720 ± 1.740 y BP Th/U 39.000 ± 2.000 y BP eroded by the overlaying deposits of aluvial fans.

are undoubtedly found east of the city of Almería at the Rambla Amoladeras and Rambla Sepultura sites (Fig. 1). Their stratigraphic relationship is shown on figure 2, which represents a section perpendicular to the present shoreline, from the mouth of the Rambla Amoladeras.

Each unit has distinctive sedimentological features. The oldest (I-Amoladeras) consists of interdigitate conglomerates and sands with progradational structures reflecting a lowering phase of sea level. The duration represented by the induration process is unknown. A further rise of sea level, during the Retamar episode, accounts for erosion of this layer and deposition of a second conglomerate (II-Retamar) which shows typical on-lapping structures. Strong induration of the second conglomerate is followed by deep erosion (Fig. 3). The third marine deposit (III-Torre García) consists of beach material filling small depressions carved into the former unit (Fig. 4). Its sedimentological features greatly resemble those observed in unit I, once again suggesting deposition during a lowering phase of sea level. The Torre García unit is overlain by thin (+0.5 m.) carbonate rich sandy silts of continental origin, topped by a calcareous crust. At the mouth of Rambla Sepultura 1.6 Km. to the northwest (Fig. 1, 2) the youngest *S. bubonius* bearing unit (IV-Sepultura) is observed. It consists of grey uncemented sands truncated by alluvial fan deposits which contain small calcareous concretions (Fig. 5). The stratigraphic relationships, as well as the radiometric age (ca. 35.000 BP) of this unit, clearly indicate that it is younger than units I, II and III and moreover that it was deposited after the continental sandy silts which overlie the Torre García unit (III). It is worth mentioning that west of Almería, in the Province of Málaga, a + 2 m. (asl) shoreline has been independently dated at 30.000 ± 1.200 . However, *S. bubonius* has never been reported in this site. Our observations nonetheless indicate the persistence of *S. bubonius* in the western Mediterranean basin after the attainment of the maximum sea level during the last interglacial period and its survival at least during the first cold stage of the last glaciation.

The general chronology of the Tyrrhenian episodes in the Almería area is summarized in Table I. The reported radiometric ages come from various sources. With the exception of our own samples (A, F, G)^{5, 7}, the origin of which has been well known, some ambiguity does exist on several others in as much as the authors did not notice the occurrence of several *Strombus bubonius* marine units. In most cases, the samples are attributed to an undefined «tyrrhenian» sea level^{8, 9}. Nonetheless, the chronological controls strongly support the stratigraphy we suggest. The oldest episode (I-Amoladeras), corresponds very probably to the highest sea level of the last interglacial. The Retamar (II) and Torre García (III)

episodes are certainly correlative of the relatively high sea levels recorded in several areas of the world during the oceanic isotopic stages 5a and 5c (eg. Barbados I and II)¹⁰. The more recent Sepultura (IV) episode with *Strombus bubonius* occurrence, certainly reflects the last interstadial high sea level^{11, 12, 13, 14}. However its occurrence, in the area, at or slightly above the present relative sea level does not mean that the last interstadial high sea level was at the same relative elevation elsewhere. The faults which cut the Tyrrhenian units and the elevation of the oldest one (up to 15 above present sea level) reflect strong vertical movements during the last glacial cycle in the area. The highest relative sea level of the last interglacial is usually recorded ca. 2m above the present one in other coastal areas of Spain^{3, 5}. One can reasonably consider that the Amoladeras (I) units have been tectonically uplifted ca 15m since they were deposited. Therefore the relative sea level during deposition of the recent Sepultura (IV) units could have been much lower than the present one.

In conclusion the use of the term «Tyrrhenian»¹⁴ should in the authors' opinion be restricted to its original definition: i.e. to the *Strombus bubonius* bearing marine units¹, without any chronostratigraphic implications, at least until agreement on a more formal subdivision of the Pleistocene is achieved. The figures I, II, etc., appended to the name Tyrrhenian in the current literature must be understood as having but a local value. The occurrence of four units containing *S. bubonius*, east of Almería, also suggests a revision of the climatostratigraphic significance of the *S. bubonius* incursion into the Mediterranean Sea, in as much as it apparently carried on unto the beginning of the last glaciation and possibly occurred prior to the last interglacial.

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