

# The marine and continental Upper Miocene of Crevillente (Alicante, Spain)

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Freudenthal, M., J.I. Lacomba, E. Martín Suárez & J.A. Peña. The marine and continental Upper Miocene of Crevillente (Alicante, Spain). — *Scripta Geol.*, 96: 1-8, 2 figs., Leiden, October 1991.

Two sections of Upper Miocene sediments in the area of Crevillente are described, and a correlation table of the micromammal-bearing localities in the area is given.

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## Introduction

The first fossil micromammal faunas in the area north of Crevillente (see Fig. 1) were reported by Montenat (1973) in his Doctor's thesis, which was published in 1977. The faunas were studied and described by de Bruijn, Mein, Montenat, and van de Weerd, (1975). These authors stressed the importance of the localities because the alternation of continental and marine beds permitted a correlation between continental and marine stratigraphy. Since then the fossil localities of Crevillente have been frequently cited in correlation charts and papers on faunal evolution in the European Late Miocene. We decided to review these faunas, because in the past fifteen years many new faunas of Late Miocene age were discovered all over

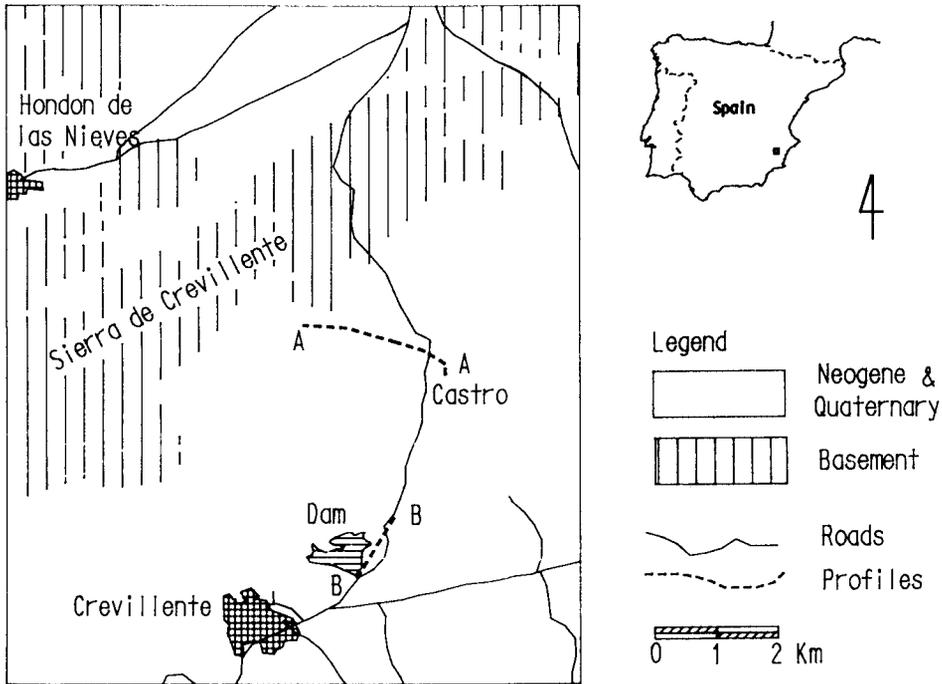


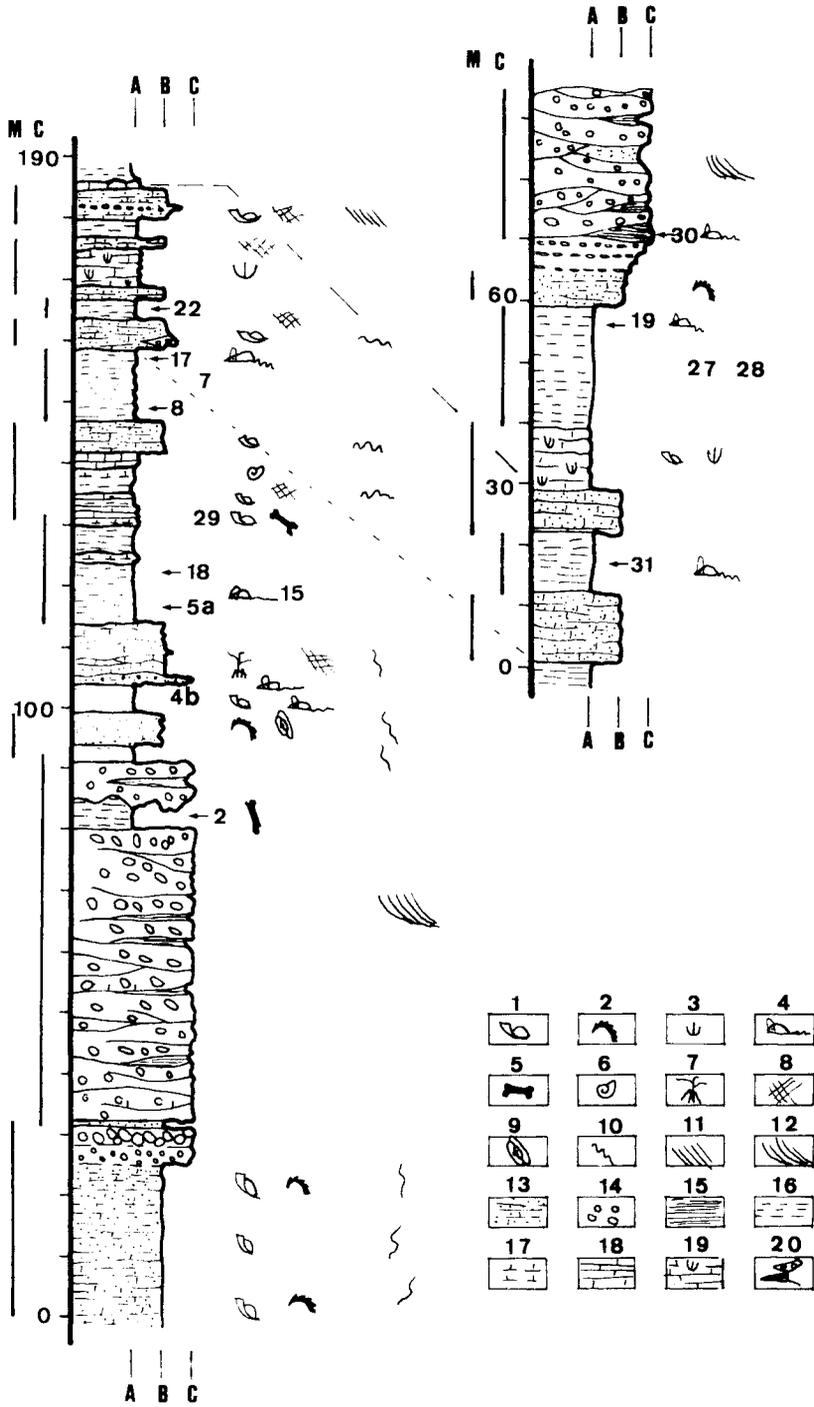
Fig. 1. Map of the Crevillente area. A-A: Castro section; B-B: dam section.

Europe, and an updating of our knowledge of the Crevillente material had become necessary.

In 1986 we started field work in the Crevillente area, that is still going on, and by now we have discovered well over 25 new fossiliferous localities, that will be the subject of several publications.

In this paper we will present a study of the sedimentary environment of the area, based on two sections, one at Castro Hill (A-A in Fig. 1; left hand column in Fig. 2), and the other one near the dam of Crevillente (B-B in Fig. 1; right hand column in Fig. 2).

Fig. 2. The lithological columns of the sections of Castro (left), and Crevillente dam (right). At the left the symbols M and C indicate marine and continental depositional environments; unmarked parts contain a mixture of continental and marine indications, or no indications at all. The left hand margin contains the scale in units of 10 m. The extension to the right within each column symbolizes grain size: A: marls, clays, and limestones; B: sands and sandstones; C: conglomerates. The dotted lines between the two columns indicate a correlation based on lateral continuity of beds. The numbers on the right hand side of each column indicate the vertebrate bearing levels; numbers with an arrow are localities in the sections, numbers without arrow are laterally correlated. Symbols: 1 = oysters; 2 = other bivalves; 3 = corals; 4 = micromammals; 5 = macrovertebrates; 6 = gasteropds; 7 = balanids; 8 = algal mats; 9 = foraminifers; 10 = marine burrows; 11 = straight cross-bedding; 12 = curved cross-bedding; 13 = sandstones; 14 = conglomerates; 15 = clays; 16 = marls; 17.= marly limestones; 18 = limestones; 19 = reef limestones; 20 = interfingering.



The Castro section was published by de Bruijn et al. (1975), and the Crevillente dam section coincides with part of the section of Matamoros, published in the same paper.

Especially our interpretation of the Castro section differs considerably from the one published before. This may partly be due to the fact that we had the luck that, a short time before we started our field work, a road was constructed to the top of the Castro, that provided us with idoneous accessibility and visibility of the strata. However, we don't have an explanation for the fact that the sediment thickness we found is considerably less than the one reported in de Bruijn et al. (1975, fig. 2).

## Lithological descriptions

### CASTRO HILL

The section of Castro Hill was taken along a W-E line, indicated in Fig. 1 as A-A. Its base is at co-ordinate point UTM 30 SXH 924405, its top at UTM 30 SXH 947397 (topographic map L-28-35, Elche).

The section begins with sandstones with a visible thickness of 30 m, overlying Mesozoic sediments that form the border and the substratum of the basin. These sandstones have a yellow colour, and are rich in oysters and other bivalves, and in worm burrows. The top is formed by two beds of solidly cemented conglomerates.

The next part (marked as continental in Fig. 2), with a gradual contact with the previous one, is formed by conglomerates with intercalated levels of red clays, that present edaphic structures. The major part of these conglomerates has a clayey matrix, although some levels don't show any matrix, and others are solidly cemented. At some spots they show cross-bedding and flat channels. Towards the top there are c. 5 m of grey and green marls and clays, that contain a mammal fauna (locality Crevillente 2), and the top is formed by conglomerates with a red matrix. These show polyhedral structures and indications of gleysation, and have a strongly erosive base with channeling.

The upper surface shows signs of a marine ingression, with worm burrows, flattened and rounded cobbles affected by lithophagous organisms, and a fauna of bivalves and foraminifers.

Next comes a suite of marls whose depositional environment – continental or marine – is not certain, with a fauna of micromammals (locality Crevillente 4B); the oysters in these marls may have slipped down from higher beds.

It is overlain by calcareous sandstones, also from uncertain depositional environment, with some indications of marine conditions (presence of acorn-shells, algal mats, and worm burrows), and at the same time brecciation and other indications of dessication. This level is very conspicuous in the topography, and forms the dip-slope west of the beginning of the private road of the Castro Hill.

Above it are marly beds containing micromammal faunas (localities Crevillente 5A and 18).

Table 1. Correlation of the Crevillente localities. Each horizontal line represents a hard bed (sandstone, conglomerate, or reef limestone), that stands out in the field and may be used for correlation. The bold-printed localities are the ones from which the cricetid fauna will be described in a separate paper in this volume.

	Elche	Castro	Dam	Crevillente
			CR 30	
Top of dam	CR 27 CR 28		<b>CR 6 ?</b> CR 19 CR 21	
Top of Castro		CR 22	CR 31	<b>CR 14</b>
	CR 25, 26 CR 24	<b>CR 17</b> <b>CR 5</b> CR 7 <b>CR 8</b>		
Dual bed		CR 29 CR 18 CR 5A	<b>CR 15</b>	
Foot of Castro		<b>CR 4B</b>		
		CR 4A		
		CR 23 CR 20		
		CR 3 <b>CR 2</b> CR 1		

Then follow marine beds rich in oysters, gastropods, algal mats, and worm burrows, with some macrovertebrate remains at the base. This suite is very useful for correlation in the direction of the village of Crevillente, because from a distance it presents itself as a pair of hard beds protruding in the topography (marked in Table 1 as 'dual bed').

It is overlain by continental marls with micromammal fauna (locality Crevillente 17), and these are followed by sandstones and reef limestones with two marly intercalations. The lower one of these contains the vertebrate locality Crevillente 22 and is of continental origin.

The top of the hill is formed by sandstones with an intercalation of fine conglomerates (stone pavement type).

### THE DAM OF CREVILLENTE

In the direction of the dam of Crevillente the thickness of the marly beds increases, as well as the grain size of the sandstones, which yield gradually to conglomerates; at the same time the indications of a marine environment, especially marine organisms, diminish.

The section near the dam was taken along a NE-SW line, indicated in Fig. 1 as B-B. Its base is at co-ordinate point UTM 30 SXH 940376, its top at UTM 30 SXH 934336 (topographic map L-28-35 Elche).

The lower part of the column of the dam is equivalent to the upper part of the column of Castro Hill. The dotted lines between the two columns represent correlations based on following certain outstanding beds in the field. In view of the limited reliability of this method, there may be some doubt on the synchronism of the correlation.

Basically, the same kind of sediments is present. The lower part of the section (below the road) will not be described in detail. At the level of the road we find a thick sequence of marls followed by calcareous sandstones. Then follows a suite of marls and thinly bedded limestones, which contains the mammal locality Crevillente 31. Next come sandstones again, that are overlain by coral reef limestones. Next follow c. 25 m of marls, that are badly exposed along the road, and covered by water NW of the dam. These marls are supposed to contain the mammal locality Crevillente 6 of de Bruijn et al. (1975). Then come red sandstones with thin conglomerate levels, that gain importance towards the top, and some limestone lenses with bird's eye structures and bivalves. The section is topped by continental conglomerates with abundant sandy and clayey matrix, forming flat channels.

The recent coastal plain sediments lie discordantly on these conglomerates.

### INTERPRETATION

The sedimentary complex shows an alternation of continental and marine beds. The continental beds are formed by alluvial fan deposits (at the base of the Castro section and at the top of the dam section), and marls and clays deposited in an environment of very calm water with occasional emersions (related to the mammal localities). The marine beds in general are witnesses of more troubled water.

We interpret the depositional environment as a delta with alluvial fans (fan delta), protected by coralline patch reefs. In this context the marls with (micro)mammals may correspond with an emerged deltaic plain, and the sandstones with a submerged plain and channels. The sediment source would be NW of the village of Crevillente, and open sea should be located towards the east (direction of Elche)

### The fossil micromammal localities

Since the study by de Bruijn et al. (1975) and Montenat (1977) the entire area has undergone tremendous changes: new roads have been constructed, and the previously waste land has been parceled out for agricultural purposes and the con-

struction of chalets. This has changed the degree of exposure of the strata considerably, partly for the better, partly for the worse. Furthermore a dam was constructed NE of the village of Crevillente.

Thanks to the help of Dr H. de Bruijn (Utrecht) and Mr P. Montoya (Novelda) we were able to locate the localities of Crevillente 1 and 2 without any difficulty. Crevillente 1 and 2 represent probably the same bed, and since Mr Montoya was at the time carrying out excavations in Crevillente 2, which permitted easy accessibility, we restricted our efforts to Crevillente 2, and paid no further attention to Crevillente 1.

We also found Crevillente 3, but gave it no further attention, since the fauna as published by de Bruijn et al. (1975) is the same as the one from Crevillente 2.

We first thought that one of our new localities Crevillente 4A or 4B corresponded to Crevillente 4 of de Bruijn et al. This turned out to be incorrect. According to Dr H. de Bruijn (pers. comm.) Crevillente 4 was not very far from Crevillente 2. In view of its topographic position Crevillente 4 must be stratigraphically lower than the calcareous sandstone bed above Crevillente 4B. However, according to fig. 2 in de Bruijn et al. (1975), it lies above this bed and corresponds to the level of Crevillente 15, 18, and 5A, or even Crevillente 17.

Neither did we find Crevillente 5. Our Crevillente 5A is certainly stratigraphically lower than the locality denominated Crevillente 5 by de Bruijn et al. (1975). It is highly probable that Crevillente 5 was located in the marl and clay beds that contain our localities Crevillente 8, 7, and 17.

Crevillente 6 is no longer accessible, since it has disappeared under the dam, that was already under construction when de Bruijn et al. (1975) collected their samples.

Mr Montoya showed us two rich new localities (Crevillente 20 and 23) slightly above Crevillente 2, and under the level of Crevillente 4A. Since there are no important faunistic differences between Crevillente 2 and Crevillente 4B we decided to postpone the study of Crevillente 20 and 23.

From the group Crevillente 5A, 18, 29, and 15 we selected Crevillente 15 for being by far the richest locality.

The localities Crevillente 8 and 17 will both be studied, as well as Crevillente 5 of de Bruijn et al. (1975). None of them is rich in cricetids, but together they seem to form a homogeneous group. Crevillente 7, in the same stratigraphic level, has not yielded any cricetid material. Its murid fauna is quite interesting. The localities Crevillente 24, 25, and 26 may belong to this group, though correlation is not certain. The material collected so far in these localities is quite limited.

Crevillente 14 is a poor locality. The main interest of this locality lies in its murid fauna. Sampling is no longer possible, since it undermines a cultivated field. The stratigraphically equivalent localities Crevillente 22 and Crevillente 31 have not yet been sampled at a large scale. We hope to do this in the near future.

As said before, Crevillente 6 is no longer accessible. Our alternative, the new locality of Crevillente 19, is too poor for exploitation. The results of Crevillente 27 and Crevillente 28 are not yet available, but these localities don't seem very promising either.

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Manuscript received 30 May 1991.