

Scaphites hippocrepis (DEKAY) IV, a new chronological subspecies from the Lower – Upper Campanian (Upper Cretaceous) boundary interval of northern Spain

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ABSTRACT:

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A fourth chronological subspecies of *Scaphites hippocrepis* (DEKAY), called *S. hippocrepis* IV, is described from the highest Lower Campanian and lower Upper Campanian of Navarra, northern Spain. It is the stratigraphically highest representative of the *hippocrepis* lineage, characterized by strong conical to massive umbilical tubercles, which number three to five in microconchs and five in macroconchs.

Key words: Ammonites, *Scaphites hippocrepis* IV, Chronological subspecies, Cretaceous, Campanian, Spain.

INTRODUCTION

Scaphites hippocrepis (DEKAY, 1827) was originally described from the east coast of the USA. COBBAN (1969) subsequently recognised three stratigraphically successive morphotypes which he regarded as chronological subspecies and designated subspecies I – III. These chronological subspecies have previously been used as zonal indices in the Lower Campanian of the Western Interior, USA. Today, however, they are also increasingly used for the dating and refined zonation of European successions and for correlation with the North American succession.

The earliest form quoted in Europe is one with characters transitional between those of *S. hippocrepis* II and III (JAGT 1989, KENNEDY & JAGT 1995, WIPPICH 1995). According to those authors, this form already occurs in the lowermost Lower

Campanian, the equivalent of the *lingual/quadrata* Zone in the zonation of SCHULZ & al. (1984), and in the French Assize P1b *sensu* ARNAUD (1878) (*compare* KENNEDY 1986).

Scaphites hippocrepis III COBBAN, 1969 is widespread in the middle to higher Lower Campanian of Europe, where it occurs in an interval from the *senonensis* Zone up to the top of the *gracilis/senior* Zone (*sensu* SCHULZ & al. 1984). It occurs commonly in northwest Westphalia in an interval between the *papillosa* and *conical/gracilis* zones (WIPPICH 1995) that is equivalent to the “Subzone of abundant *S. hippocrepis*” (= lower part of the *S. hippocrepis* III/*Menabites* spp. Assemblage Zone) in northern Spain (KÜCHLER 1998, *in press*). The *S. hippocrepis* III/*Menabites* spp. AZ correlates with the lower part of the French *Menabites* (*Delawarella*) *delawarensis* Zone *sensu* KENNEDY (1986). *S. hippocrepis* III is furthermore quoted from the

Spanish provinces of Cantabria (WIESE & *al.* 1996) and Burgos (WIEDMANN 1962, GISCHLER & *al.* 1994).

A late form of *Scaphites hippocrepis* enters in the uppermost part of the *hippocrepis* III/*Menabites* spp. AZ, still in the uppermost Lower Campanian. This late form, following the nomenclature applied

by COBBAN (1969), is called subspecies *hippocrepis* IV. It characterises the lowermost Upper Campanian *Hoplitoplacenticeras marroti* Zone of the Barranca, northern Spain (compare KÜCHLER & KUTZ 1989, KÜCHLER 1998). Details on the find locality and stratigraphic background are presented in KÜCHLER (*in press*, Text-figs 1, 3, 5).

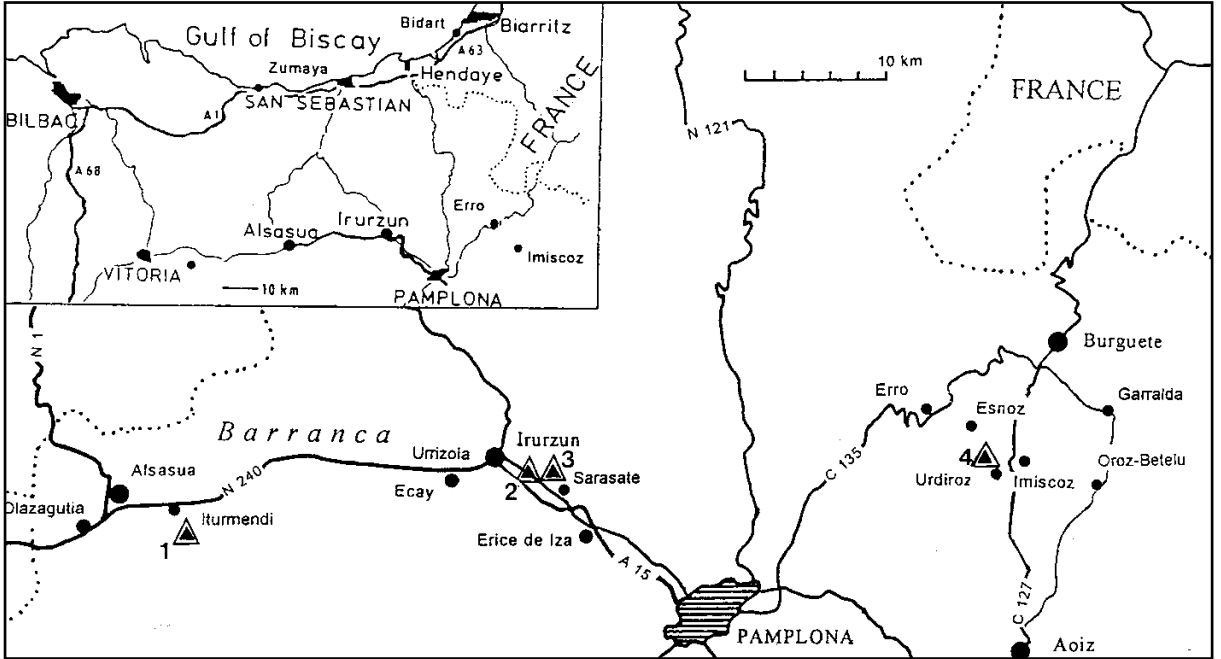


Fig. 1. Location of *Scaphites hippocrepis* IV finds in Navarra, northern Spain; 1 Iturmendi V/VI, 2 Sarasate I, 3 Sarasate IV, 4 Urdiroz-Saraguete section

		Munster Basin/Germany modified after Wipplich (1994, 1995)		Navarra/Northern Spain Küchler, this paper			
Substages		Cephalopod/echinoid assemblage zones	Ammonite Assemblages	Ammonite Zones	Local echinoid partial range zones, peak zones and ammonite/echinoid assemblage zones	Substages	
UPPER CAMPAIAN		<i>basiplana/spiniger</i>	<i>Trachyscaphites spiniger</i> <i>Hoplitoplacenticeras</i> spp. <i>Scaphites gibbus</i>	<i>Trachyscaphites spiniger</i>	<i>Echinocorys</i> ex gr. <i>conoidea</i> / <i>Echinocorys</i> ex gr. <i>conica</i>	UPPER CAMPAIAN	
		<i>conica/senior</i>	?	<i>Hoplitoplacenticeras marroti</i>	<i>Echinocorys subglobosa</i> <i>H. marroti/Offaster pilula</i>		
LOWER CAMPAIAN	uppermost	<i>gracilis/senior</i>	<i>Glyptoxoceras retrorsum</i> <i>Eupachydiscus levyi</i> <i>Scaphites hippocrepis</i> III	<i>Scaphites hippocrepis</i> III/ <i>Menabites</i> spp.	<i>Echinocorys aff. turrita/</i>	LOWER CAMPAIAN	
		<i>conica/gracilis</i>			<i>Echinocorys</i> ex gr. <i>brevis-humilis</i>		
		<i>papillosa</i>			Subzone of "abundant" <i>Scaphites hippocrepis</i>		
		<i>senonensis</i> ?	<i>Pachydiscus duelmensis</i> <i>Hauericeras pseudogardeni</i> <i>Scaphites binodosus</i> <i>Placenticeras bidorsatum</i>	<i>Scaphites hippocrepis</i> III	<i>Offaster pomelii/ M. (Isomicraster</i> sp.		
	lowermost	<i>pilula</i> ?					
	<i>lingua/quadrata</i>						
	<i>granulataquadrata</i>				hiatus		

Fig. 2. Campanian zonations; correlation between northern Spain, Navarra and Germany, Westpfalia, Munster Basin; vertical range of *Scaphites hippocrepis* IV in northern Spain

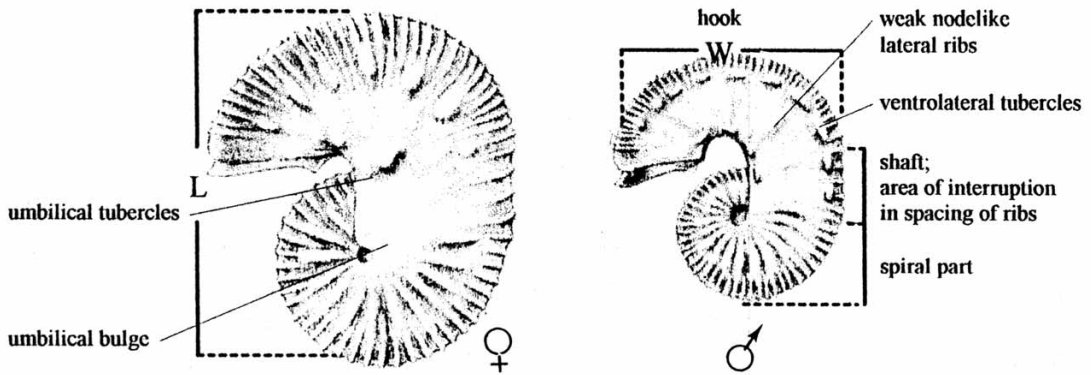


Fig. 3. Characteristic features of *Scaphites hippocrepis* (DEKAY) III; terminology after Cobban (1969, Fig. 2) and SCHMID & ERNST (1975, Fig. 1); L, length of shell; W, width of the shell as well as the width of the hook

SYSTEMATIC DESCRIPTION

Repositories: All specimens from the outcrops of the Sarasate sections/Navarra are housed in the Museo de Ciencias Naturales de Álava, Vitoria (País Vasco) and are registered with MCNA numbers. Specimens collected by author are additionally registered with (1) section symbol, (2) bed number and (3) number of the individual from this particular bed (e.g. Sarasate IV section, bed number 109b, specimen 1 = SaIV-109b/1) or are registered with the location or section symbol, find date and/or the number of the individual specimen.

Family Scaphitidae GILL, 1871
Subfamily Scaphitinae GILL, 1871
Genus *Scaphites* PARKINSON, 1811

TYPE SPECIES: *Scaphites equalis* J. SOWERBY, 1813, p. 53, pl. 18, Figs. 1-3, by subsequent designation of MEEK (1876, p. 413).

Scaphites hippocrepis (DEKAY) IV subsp. nov.
(Text-figs 4-5)

1998. *Scaphites hippocrepis* IV; T. KÜCHLER, p. 145; Pl. 15, Figs 5, 6.
1992. *Scaphites haugi* DE GROSSOUVRE; W.J. KENNEDY, M. HANSOTTE, M. BILOTTE & J. BURNETT, p. 275, Pl. 1, Figs 1, 13.
?1992. *Scaphites haugi* DE GROSSOUVRE; W.J. KENNEDY, M. HANSOTTE, M. BILOTTE & J. BURNETT, Pl. 1, Fig. 8.
?1992. *Scaphites* (*Scaphites*) *hippocrepis* (DEKAY) III;

W.A. COBBAN & W.J. KENNEDY, Figs 4.1-4.3, 4.29, 6.4.

1989. *Scaphites hippocrepis* (DEKAY) Spätformen, T. KÜCHLER & A. KUTZ, p. 200, Text-fig. 3.

TYPES: The holotype, herein designated, is specimen MCNA 9628 (= SaIV/14688) (Fig. 4a), a macroconch, from the basal Upper Campanian *Hoplitoplacenticerus marroti* Zone, bed 107 of the Sarasate IV section (Text-fig. 6), north-west of the village of Sarasate (Navarra), northern Spain.

There are 14 paratypes, mostly distorted specimens: MCNA 9629 (= SaIV-116/1) and MCNA 9630 (=SaIV-116/2) (microconchs) from bed 116; MCNA 9633 (= SaIV-Sc8458/1), MCNA 9634 (=SaIV-Sc8458/2), and MCNA 9636 (=SaIV-S2 14.6.88) from bed 114; MCNA 9639 (=SaIV-

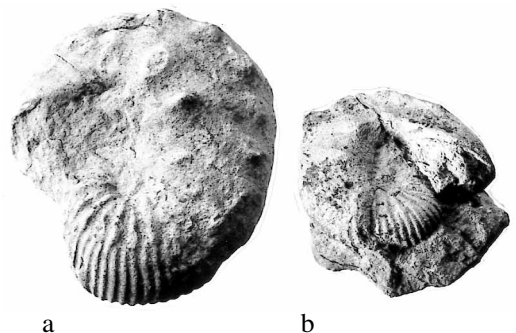


Fig. 4. *Scaphites hippocrepis* (DEKAY, 1827) IV subsp. nov.; basal Upper Campanian, *Hoplitoplacenticerus marroti* PRZ; Sarasate, Navarra, northern Spain; **a** - holotype MCNA 96 28 (= SaIV/14688), a macroconch; Sarasate IV section, bed 107; **b** - paratype MCNA 9629 (=SaIV-116/1), a microconch, local *Echinocorys subglobosa* PRZ, Sarasate IV section, bed 116; × 1

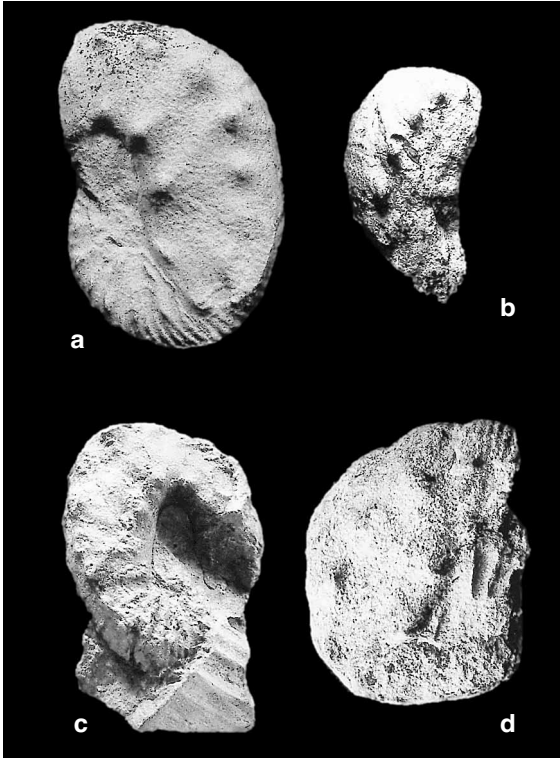


Fig. 5. *Scaphites hippocrepis* (DEKAY, 1827) IV subsp. nov.; basal Upper Campanian, *Hoplitoplacentieras marroti* PRZ; Sarasate, Navarra, northern Spain; **a** - paratype MCNA 9640, microconch, Upper Campanian *marroti* Zone around Sarasate; x 0.9; **b** - paratype MCNA 9630 (=SaIV-116/2), microconch, Sarasate IV section, bed 116; x 0.9; **c** - MCNA 9636 (=SaIV-S2 14688), microconch, Sarasate IV section, bed 114; x 0.9; **d** - MCNA 9633 (=SaIV-Se8458/1), macroconch, Sarasate IV section, bed 114; x 0.9

109d/1) and MCNA 9631 (=SaIV-109d/2) from bed 109d, MCNA 9637 (=Sa IV-109b/1) and MCNA 9638 (=Sa IV-109b/2) from bed 109b, MCNA 9632 (=SaIV-106/3) and MCNA 9635 (=SaIV-106/4) from bed 106, MCNA 9642 (=SaIV-104/1) from bed 104; MCNA 9640 a plaster cast (unregistered original in the JUDENHAGEN collection) from the Upper Campanian around Sarasate, and MCNA 9641 (=SaI-85/1) from the uppermost Lower Campanian, local *Echinocorys* aff. *turrata* Zone of Sarasate I.

Two other fragments are of microconchs: It/V-840428-7 (ex ZANDER collection) from the Upper Campanian *Globotruncana ventricosa* Zone (= *H. marroti* Zone) of the Iturmendi V section (Text-fig. 7), south of the village of Iturmendi, near Alsasua and Urdirroz-Saraguete-30983 (ex KUTZ collection)

from the Upper Campanian *marroti* Zone of Urdirroz, eastern Navarra.

DIAGNOSIS: Chronological subspecies of *Scaphites hippocrepis* characterised by strong conical to massive umbilical tubercles, three to five in microconchs and five in macroconchs. Ventrolateral tubercles on body chamber rounded to strongly clavate. Ventral ribs on phragmocone fine and distantly spaced, primaries usually bearing ventrolateral tubercles. Ventral ribs on body chamber strong, more distantly spaced than on phragmocone. Lateral ribs occur as low rib-like swellings between umbilical and ventrolateral tubercles. Whorl section subquadrate with broad rounded venter.

DESCRIPTION: The holotype, MCNA 9628 (Fig. 4a), is a slightly compressed macroconch of 39.2 mm total length (L) and 35.2 mm width of the hook (W). The phragmocone is ornamented by straight, prorsiradiate ribs that bifurcate, rarely trifurcate at low conical ventrolateral tubercles that are slightly larger than the ribs. Ribs loop across the venter. Body chamber inflated, with an umbilical bulge, an area of interruption in the spacing of the ventral ribs, and five bullate to conical umbilical tubercles. The first (adapical) and the fourth tubercle are bullate, the second is strongly conical and the third is a massive conical tubercle, while the fifth is very a weak and bullate one. Umbilical tubercles give rise to one or two very low and broad rib-like swellings on the flank which link to the 10 ventrolateral tubercles. Towards the aperture four strong rounded tubercles are succeeded by four strong, incisor-like, coarse clavi and two weak clavate tubercles on the end of the hook. As a rule, three distantly spaced ribs arise from these tubercles and loop to the tubercle on the opposite side. The whorl section is subquadrate with a broad rounded venter.

Microconchs bear bifurcate ribs and intercalatories on the spire. Rounded ventrolateral tubercles first appear immediately before the beginning of the shaft. The body chamber bears three elongated conical umbilical tubercles in paratype MCNA 9629 (=SaIV-116/1), of which the middle is the strongest one, while specimens MCNA 9641 (=SaI-85/1), MCNA 9636 (=SaIV; S2 14.6.88) and MCNA 9639 (=SaIV-109d/1) have five weak bullate to conical umbilical tubercles. Large microconchs have low, broad flank ribs. Flank ribs in small microconchs are well-marked. The ventrolateral tubercles are strong clavi, varying in number from 7 to 11. From these clavi two to three ribs arise and loop over the venter, accompanied by one or two intercalatories.

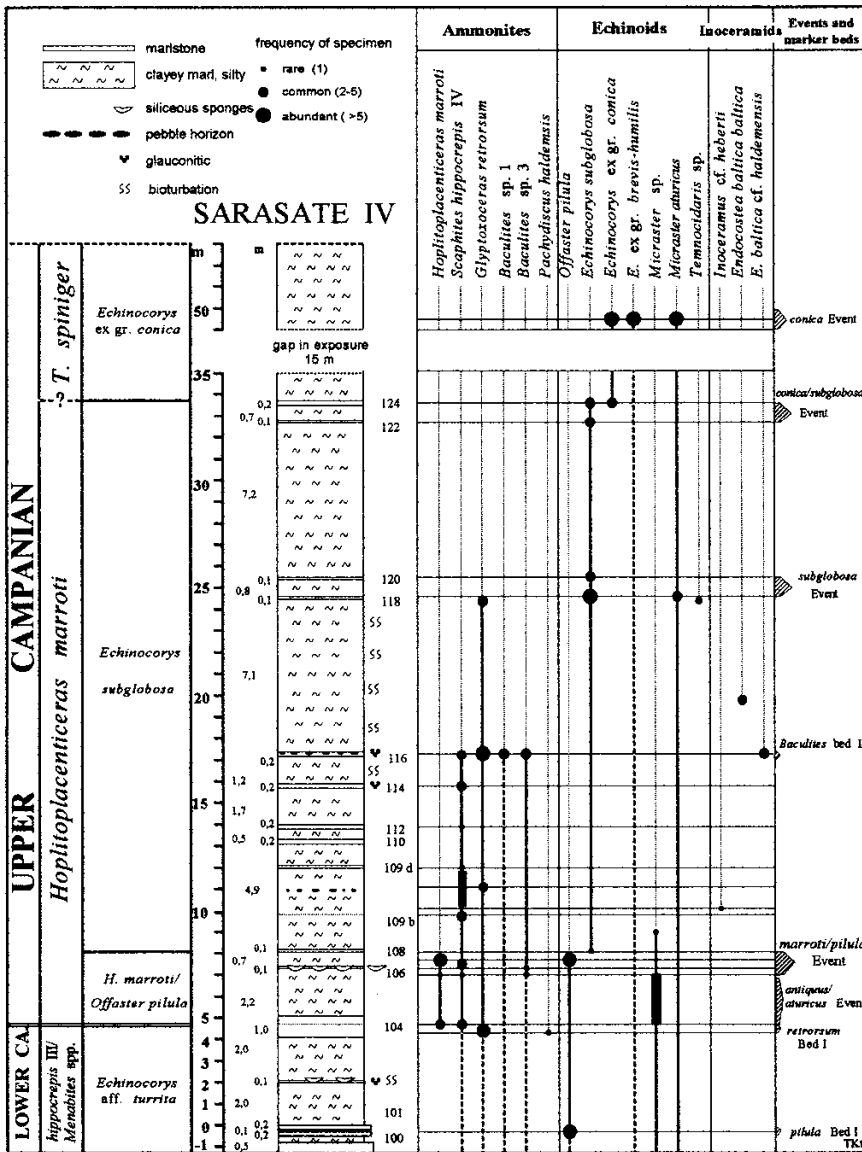
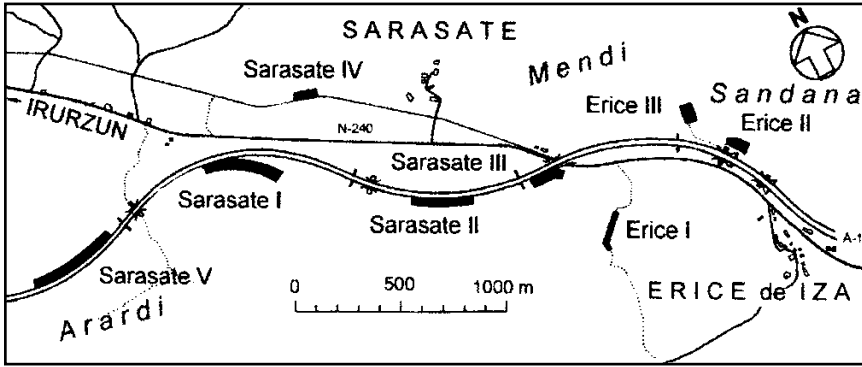


Fig. 6. Lower/Upper Campanian boundary interval of Sarasate IV section, Navarra; integrated event and macrofossil biostratigraphy; vertical distribution of *Scaphites hippocrepis* IV subsp. nov.

DISCUSSION: The late form of *Scaphites hippocrepis* recognised herein is regarded as a chronological subspecies and designated *S. hippocrepis* IV in line with the widely accepted use of Roman numerals to designate earlier chronological subspecies applied by COBBAN (1969).

Scaphites hippocrepis IV differs from *S. hippocrepis* III and transitional forms to *S. hippocrepis* IV in that it usually possesses five conical umbilical tubercles instead of 2-3, as well as coarser, more distantly spaced ventral ribs, broad low flank ribs between umbilical and ventrolateral tubercles (transitional forms are smooth) and strong ventrolateral clavi. The characters of *Scaphites hippocrepis* IV correspond to those of the three specimens from Ariège, France, referred by KENNEDY & al. (1992, Pl. 1, Figs 1 and 13) to *Scaphites haugi* DE GROSSOUVRE. *S. hippocrepis* IV, however, is not conspecific with the type specimen of *S. haugi*, which differs in the smaller number of umbilical and ventrolateral tubercles. Moreover, according to the description of the refigured holotype (KENNEDY 1986, p. 116, Pl. 21, Figs 12-14), *S. haugi* possesses

only a strong conical tubercle on the initial part of the shaft and a second, massive bulge at the beginning of the hook, as well as seven massive ventrolateral clavi on shaft and hook.

OCCURRENCE: In Navarra, northern Spain, *S. hippocrepis* IV first occurs in the uppermost Lower Campanian (uppermost part of the *Scaphites hippocrepis* III/*Menabites* spp. Zone sensu KÜCHLER 1998) and characterises the lower Upper Campanian *Hoplitoplacenticeras marroti* Zone of the Barranca. The stratigraphically highest find may come from the highest part of the *marroti* Zone or the lowermost part of the *Trachyscaphites spiniger* Zone [= *Pachydiscus haldemsi*/*Echinocorys conoidea* Zone sensu KÜCHLER & KUTZ (1989) and KUTZ (1995)] at Urdiroz/eastern Navarra. It occurs in the *Hoplitoplacenticeras marroti* Zone of Ariège, France and obviously in the higher part of the *Menabites (Delawarella) delawarensis* Zone in the Gober Chalk, NE Texas, USA (COBBAN & KENNEDY 1992) which correlates with the lower part of the European *marroti* Zone.

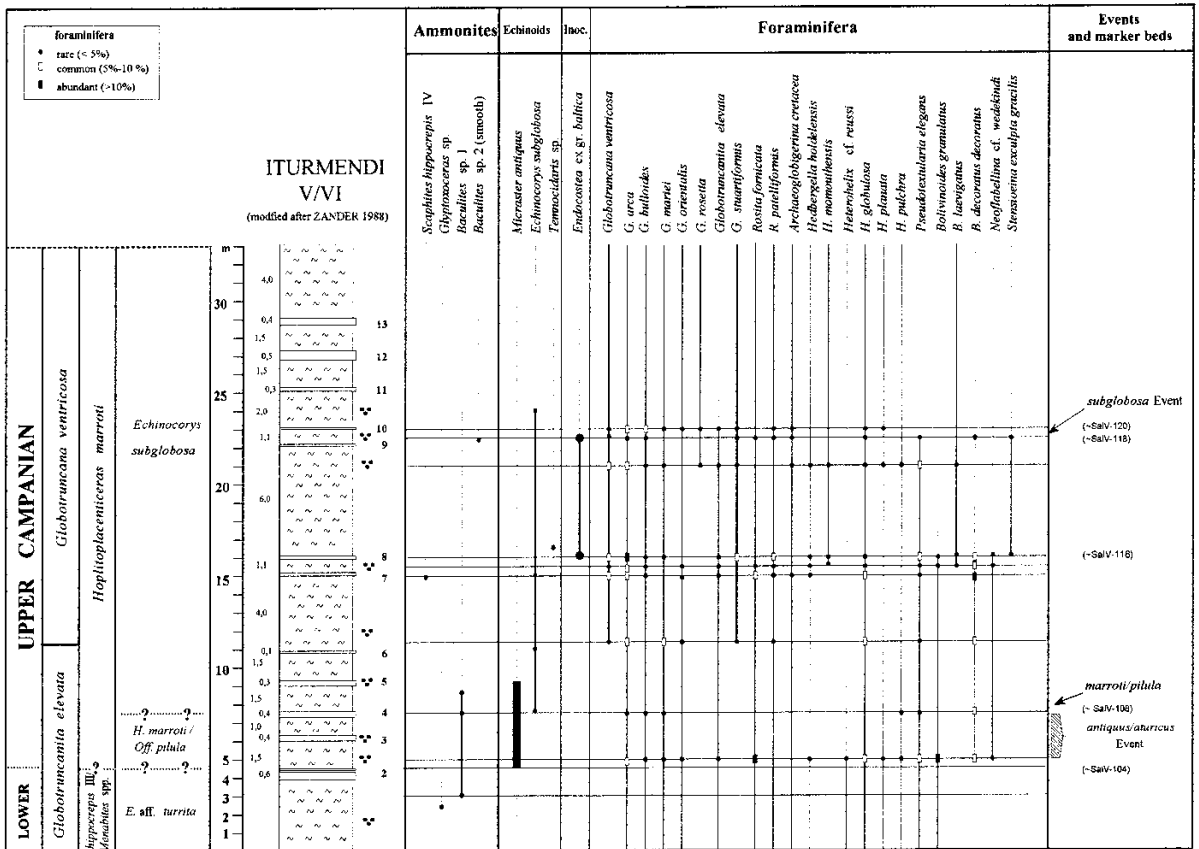


Fig. 7. Lower/Upper Campanian boundary interval of Iturmendi V/VI section; integrated microfossil and macrofossil biostratigraphy (modified after ZANDER 1988), occurrence of *Scaphites hippocrepis* IV subsp. nov.

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