Palaeontological study of Middle Oxfordian-Early Kimmeridgian (Late Jurassic) ammonites from the Rosso Ammonitico of Monte Inici (north-western Sicily, Italy)

Fabrizio CECCA
Université Pierre et Marie Curie-Paris 6,
CNRS-UMR 5143 "Paléobiodiversité et Paléoenvironnements", case 104,
4 place Jussieu, F-75252 Paris cedex 05 (France)
cecca@ccr.jussieu.fr

Bérengère SAVARY
Schlumberger Stavanger Research, Risabergveien 3,
Tananger, P.O. Box 8013, N-4068 Stavanger (Norway)
BSavary@stavanger.oilfield.slb.com

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ABSTRACT
This paper deals with the palaeontological study of ammonites collected in strata of Middle Oxfordian-Lower Kimmeridgian *pro parte* Rosso Ammonitico of two sections of Monte Inici (western Sicily, Italy), namely Monte Inici East and Castello Inici. The complete faunal list of ammonites collected in the Middle Oxfordian-Lower Kimmeridgian fossiliferous beds of Monte Inici succession is here presented for the first time. Thirty-two species have been described in the palaeontological study. As a result, the formerly published biozonation of the two successions exposed at Monte Inici has been refined. The biostratigraphical dating of the onset in the middle Oxfordian of both the radiolarite sedimentation at Castello Inici and the nodular facies of the Rosso Ammonitico at Monte Inici East is not coeval, as tentatively suggested in previous papers. On the basis of the vertical distribution of the species of the genus *Gregoryceras* Spath, 1924 the onset of cherty limestones in section Castello Inici slightly predates the onset of Rosso Ammonitico nodular facies observed in section Monte Inici East.

KEY WORDS
Ammonites,
Late Jurassic,
Rosso Ammonitico,
Tethys,
Italy,
Sicily;
biostratigraphy.

RÉSUMÉ

Étude paléontologique des ammonites du Rosso Ammonitico de l'Oxfordien moyen-Kimméridgien inférieur (Jurassique supérieur) de Monte Inici (Sicile nord-occidentale, Italie).

Ce travail présente l'étude paléontologique d'ammonites du Rosso Ammonitico, de l'intervalle Oxfordien moyen-Kimméridgien inférieur *pro parte,* dans deux localités du Monte Inici (Sicile occidentale, Italie, coupes de Monte Inici Est et Castello Inici). La liste faunique complète des ammonites récoltées dans les bancs fossilifères de l'intervalle Oxfordien moyen-Kimméridgien inférieur de Monte Inici est présentée pour la première fois. Trente-deux espèces ont fait l'objet d'une description paléontologique qui a permis d'affiner la biozonation des successions exposées dans les deux coupes du Monte Inici, présentées dans des publications précédentes. Sur la base de la distribution verticale des espèces du genre *Gregoryceras* Spath, 1924 il est possible de réfuter le synchronisme de la mise en place, à l'Oxfordien moyen, de la sédimentation radiolaritique à Castello Inici et du faciès noduleux du Rosso Ammonitico à Monte Inici Est ; le premier événement est légèrement plus ancien.

MOTS CLÉS
Ammonites,
Jurassique supérieur,
Rosso Ammonitico,
Téthys,
Italie,
Sicile,
biostratigraphie.

INTRODUCTION

Since the famous Gemmellaro's (1872-1882) monograph, the Middle and Late Jurassic ammonite species described from Rosso Ammonitico successions of western Sicily are considered "classical" of the Tethyan Mediterranean faunas. Further studies were carried out in this area by Warman & Arkell (1954), Christ (1960), Wendt (1963), De Wever *et al*. (1986), Fözy (1995) and Cecca & Pochettino (2000). The Rosso Ammonitico is the most common ammonite-rich facies in western Sicily. The abundance of fossils allows detailed biozonations in some stratigraphic intervals, although the recognition of detailed phylogenetic lineages and the precise setting of zonal boundaries are prevented by both time-averaging and discontinuous sedimentation (Marques *et al*. 1991; Olóriz *et al.* 1993, 1998).

The present work has been carried out in the framework of an extensive survey of Jurassic pelagic sediments of the western Trapanese palaeogeographic domain (Catalano & D'Argenio 1982 = Zone de Vicari of Mascle 1970) aimed at both the revision of the Gemmellaro Collection of Jurassic ammonites (Pavia & Cresta 2002) and the organisation of the Sixth International Congress on Jurassic System (Pavia 2004).

The aim of this paper is the palaeontological description of Late Jurassic ammonites collected in two sections of the Monte Inici area, namely Monte Inici East and Castello Inici (Fig. 1), whose stratigraphical and sedimentological data have already been published by Cecca *et al*. (2001) and Savary *et al*. (2003). Bed-by-bed sampling of ammonites was carried out for the first time in this area and it enabled us to identify several ammonite zones between the Middle Oxfordian Plicatilis Zone and the Upper Tithonian Transitorius Zone. The results of the present study lead to the improvement of previous zonations, although we should stress that the accuracy of the biostratigraphic interpretations depends on the quality of the fossil preservation, which is far from satisfactory in most cases. Short descriptions of both sections, with the complete bed-by-bed faunal lists, are reported

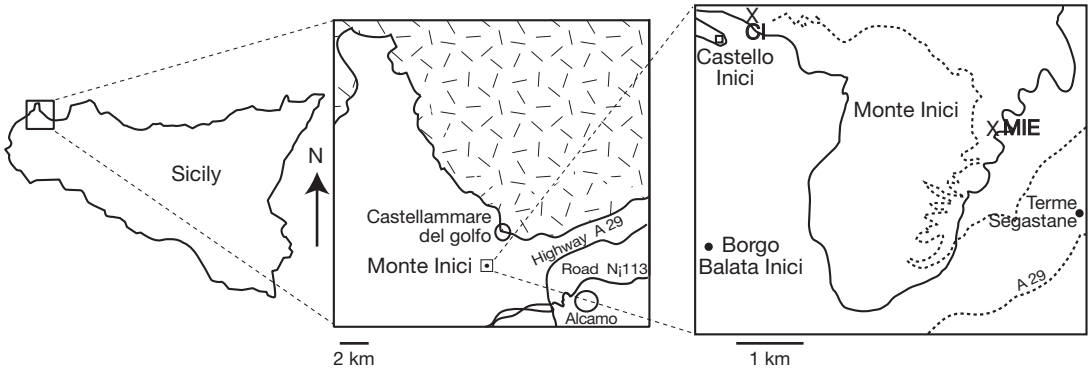


FIG. 1. — Location of the studied sections: Monte Inici East (**MIE**) and Castello Inici (**CI**).

below. The updated zonations are presented in Figures 2 and 3.

Palaeontological descriptions have been limited to ammonite taxa of the interval from the Middle Oxfordian Plicatilis Zone to the earliest Kimmeridgian Platynota Zone that have never been reported before from this area, and also to some Gemmellaro's species whose precise stratigraphical position was unknown in Sicily. Younger Kimmeridgian species have not been treated here, as they are comparable with coeval ammonites described in recent monographs (Olóriz 1978; Checa 1985; Sarti 1993). The rare Tithonian forms are not described, as further sampling is needed.

In the following discussion we refer to the zonal scheme of Cariou *et al.* (1997) with more recent changes proposed by Bert (2004) for the Oxfordian, Olóriz (1978) for the Kimmeridgian and Geyssant (1997) for the Tithonian. As far as the lower boundary of the Kimmeridgian is concerned, we have provisionally maintained in this paper the base of the Platynota Zone as the base of the Mediterranean Kimmeridgian following the recommendations of the Working Group on the Oxfordian-Kimmeridgian Boundary of the International Subcommission on Jurassic Stratigraphy (Wierzbowski 2001). Recent researches have demonstrated that this boundary does not correlate with the base of the Kimmeridgian as defined in the type areas of southern England (Schweigert & Callomon 1997; Matyja & Wierzbowski 1997; Wierzbowski *et al.* 2006).

SECTIONS STUDIED

The outcrops of Monte Inici show the Mesozoic evolution of the Trapanese palaeogeographic domain. After the drowning of a peritidal Upper Triassic-Middle Liassic carbonate platform (Inici Formation), relatively condensed pelagic limestones (Rosso Ammonitico) were deposited on a pelagic plateau. Radiolarites and/or cherty limestones can be found between an underlying Lower Rosso Ammonitico and an overlying Upper Rosso Ammonitico.

The studied sections, Monte Inici East and Castello Inici, respectively located in the eastern and southern sectors of Monte Inici, materialise two distinct stratigraphic successions. The sedimentary succession of Monte Inici East is entirely represented by Rosso Ammonitico and it is devoided of radiolarites (Fig. 1). In the southern sector of Monte Inici cherty limestones are sandwiched by Rosso Ammonitico (Warman & Arkell 1954; Christ 1960; Wendt 1963; Savary 2000). Radiolarites have also been observed in the northern (Seno di Guidaloca [Fözy 1995]) and western (Balata di Baida [Warman & Arkell 1954; Christ 1960]) sectors around Monte Inici. In the section Castello Inici we have sampled the Lower Rosso Ammonitico and the overlying cherty limestones but the Upper Rosso Ammonitico does not crop out.

The Rosso Ammonitico of the Trapanese Zone forms part of the "calcareous Ammonitico Rosso" defined by Aubouin (1964) in the Mediterranean

area (Cecca *et al*. 1992, 2001). It is worth mentioning that three subfacies have been recognized in the Rosso Ammonitico of Monte Inici (Savary 2000; Cecca *et al.* 2001) on the basis of the relative abundance of three major sedimentological components such as early diagenetic nodules (*sensu* Clari *et al*. 1984), mineralised intraclasts and matrix: 1) a nodular subfacies (Clari *et al*. 1984) matrix-supported, with early diagenetic nodules but no mineralised intraclasts; 2) a pseudo-nodular subfacies (Martire 1996) relatively matrix-poor with early diagenetic nodules and mineralised intraclasts; and 3) an intraclastic nodular subfacies (Savary 2000) matrix-supported and containing both early diagenetic nodules and mineralised intraclasts. Evidence of hydrodynamic erosion, such as erosional surfaces, truncation and reworking of ammonite internal molds, is recorded in both the intraclastic nodular and pseudo-nodular subfacies.

Section Monte Inici East

Quarrying in the northern and western sides of a natural exposure obliged us to combine observations in a single, composite, stratigraphic log (Cecca *et al.* 2001). A few normal faults affect the outcrop, but do not preclude the establishment of the vertical succession. Above the Inici Formation, a 34 m thick Rosso Ammonitico succession crops out: it has been subdivided into 59 intervals. Our sampling has been stopped at interval 60 which marks the beginning of the Lattimusa Formation.

The base of this succession has not been accurately dated as no ammonites have been recovered from intervals 1 to 5. These form a small cliff, partly inaccessible, consisting of extremely hard light coloured non-nodular micritic limestones. However we assign the very base of the pelagic succession to the Lower Callovian on the basis of data of Warman & Arkell (1954), Christ (1960) and Wendt (1963) from nearby outcrops, also confirmed by our personal observations in other outcrops of Monte Inici.

The list of the ammonites collected in Oxfordian to early Kimmeridgian fossiliferous beds is presented from bottom to top together with the number of recovered specimens. These are indicated in brackets after the name of the author of the species, which is indicated in the text only when it occurs for the first time. The vertical distribution of the identified taxa is represented in Figure 2. Note that the Transversarium Zone is here used following Bert (2004). As regards the complete distribution of Oxfordian to Berriasian ammonites in this section, we refer the reader to Cecca *et al*. (2001). The sedimentological and stratigraphical descriptions have already been presented in the latter paper and in Savary *et al.* (2003).

Middle Oxfordian, Transversarium Zone
Bed 6a: *Sowerbyceras tortisulcatum* (d'Orbigny, 1841) (4), *Gregoryceras* aff. *devauxi* Bert & Enay, 2004 (1).

Middle Oxfordian, Transversarium Zone, Schilli Subzone
Bed 6c: *Sowerbyceras tortisulcatum* (11), *Holcophylloceras* sp. (2), *Lytoceras* sp. (1), *Euaspidoceras* cf. *fontannesi* (Gemmellaro, 1878) (1), *Gregoryceras* cf. *devauxi* (1), *Passendorferia* (*P.*) sp. (1), *Sequeirosia* (*S.*) *bocconii* (Gemmellaro, 1871) (1), *Perisphinctes* (*Dichotomosphinctes*) sp. (2).
Bed 6d: *Euaspidoceras* cf. *oegir* (Oppel, 1863) (1).
Bed 6e: *Phylloceras* sp. (2), *Holcophylloceras* cf. *polyolcum* (Benecke, 1866) (1), *Sowerbyceras tortisulcatum* (8), *Lytoceras* cf. *orsinii* Gemmellaro, 1872 (1), *Lytoceras* sp. (1), *Euaspidoceras* cf. *fontannesi* (1), *E.* cf. *douvillei* (Collot, 1917 *in* Dorn, 1931) (1), *Euaspidoceras* sp. (1), *Perisphinctes* (*Dichotomosphinctes*) sp. (2).
Bed 6f: *Sowerbyceras tortisulcatum* (1), *Aspidoceras* gr. *binodum* (Oppel, 1863) (1).
Bed 8a: *Sowerbyceras* sp. (9), *Gregoryceras devauxi* (2).

Upper Oxfordian, Bimammatum Zone
Bed 8b: *Phylloceras* sp. (1), *Calliphylloceras benacense* (Catullo, 1847) (1), *Holcophylloceras* sp. (1), *Sowerbyceras tortisulcatum* (4), *Sowerbyceras* sp. (1), *Streblites frotho* (Oppel, 1863) (1).

Upper Oxfordian, Bimammatum Zone, Hauffianum Subzone(?)
Bed 8c: *Calliphylloceras* cf. *benacense* (1), *Holcophylloceras polyolcum* (1), *Taramelliceras* cf. *hauffianum*? (Oppel, 1863) (1), *Physodoceras* cf. *wolfi* (Neumayr, 1873) (1).
Bed 8d: *Holcophylloceras polyolcum* (2), *Holcophylloceras* sp. (2), *Sowerbyceras tortisulcatum* (3), *Sowerbyceras* sp. (16), *Lissoceras* (*Lissoceratoides*) cf. *erato* (d'Orbigny, 1850) (1), *Taramelliceras* sp. (1), ?"*Passendorferia*" aff. *teresiformis* Brochwicz-Lewinski, 1973 (1), *P.* (*Enayites*) aff. *gygii* Brochwicz-Lewinski & Rozak, 1976, *Passendorferia* (*P.*) sp. (1), *Euaspidoceras* cf. *radisense* (d'Orbigny, 1850) (1), *Euaspidoceras* sp. (1), ?*Pseudowaagenia* sp. (1), *Benetticeras* cf. *benettii* Checa, 1985 (1), *Physodoceras wolfi* (1), *Orthosphinctes* (*O.*) *tiziani* (Oppel, 1863) (1), *O.* (*O.*) aff. *fontannesi* (Choffat, 1893) (1), *Orthosphinctes* (*O.*) sp. A

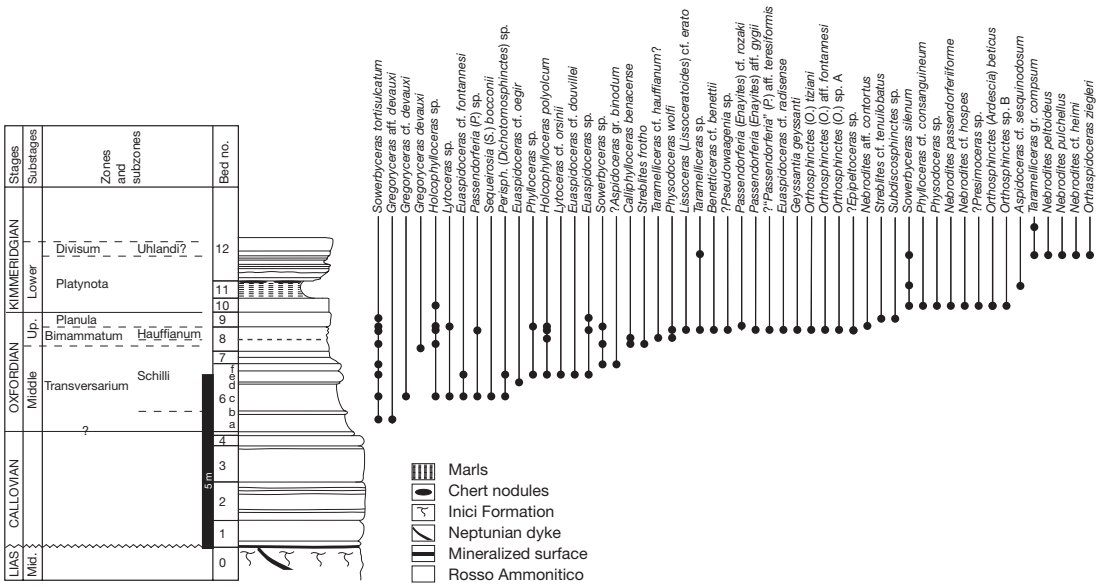


FIG. 2. — Lower part of section Monte Inici East: lithology and vertical distribution of the identified ammonite taxa.

(1), Perisphinctidae gen. and sp. indet. (1), ?*Epipeltoceras* sp. (1), *Geyssantia geyssanti* Meléndez, 1989 (1).
Bed 8d top: *Holcophylloceras polyolcum* (3), *Holcophylloceras* sp. (3), *Sowerbyceras tortisulcatum* (5), *Lytoceras* sp. (3), *Passendorferia* (*Enayites*) cf. *rozaki* Meléndez, 1989 (1), *Nebrodites* aff. *contortus* (Neumayr, 1871) (1).

Upper Oxfordian, Planula Zone
Bed 9: *Sowerbyceras* cf. *tortisulcatum* (3), *Streblites* cf. *tenuilobatus* (Oppel, 1863) (1), *Euaspidoceras* sp. (1), *Subdiscosphinctes* sp. (1).

Lower Kimmeridgian, Platynota Zone
Bed 10: *Sowerbyceras* cf. *silenum* (Fontannes, 1876) (2), *Nebrodites passendorferiiforme* Caracuel, Olóriz & Rodriguez-Tovar, 1999 (1), *N.* cf. *hospes* (Neumayr, 1873) (2), ?*Presimoceras* sp. (1), *Orthosphinctes* (*Ardescia*) *beticus* Caracuel, Olóriz & Rodriguez-Tovar, 1999 (1). Some reworked ammonites occur on the top of the bed: *Phylloceras* cf. *consanguineum* Gemmellaro, 1876 (1), *Holcophylloceras* sp. (1), *Physodoceras* sp. (1), *Orthosphinctes* sp. B (1).
Bed 11: *Sowerbyceras silenum* (1), *Aspidoceras* cf. *sesquinodosum* Fontannes, 1876 (1).

Lower Kimmeridgian, Divisum Zone (Uhlandi Sub-Zone?)
Bed 12b base: *Sowerbyceras* cf. *silenum* (1), *Taramelliceras* gr. *compsum* (Oppel, 1863) (1), *Taramelliceras* sp. (1), *Nebrodites peltoideus* (Gemmellaro, 1872) (2), *N. pulchellus* (Gemmellaro, 1876) (1), *N.* cf. *heimi* (Favre, 1877) (1), *Orthaspidoceras ziegleri* Checa, 1985 (2).

Biostratigraphic remarks
The biostratigraphic assignments of Oxfordian layers to the subzones of the Middle Oxfordian Transversarium Zone and also to the Hauffianum Subzone of the Late Oxfordian Bimammatum Zone deserve to be commented. The distributions of the species of the genus *Gregoryceras* Spath, 1924 according to Bert (2004) have been taken into account for the biostratigraphic assignment to the Schilli Subzone of beds 6c to 8a, which contain specimens identified as *G. devauxi*. The uncertain identification of the specimen found in bed 6a with the latter species only allows the dating to the Transversarium Zone. The sedimentary change observed in layer 6 from non-nodular to nodular facies occurs therefore within the Transversarium Zone *sensu* Bert (2004). The Hauffianum Subzone is recognized with doubt due to the uncertain identification of the index species in bed 8c. The faunal content of bed 8d is consistent with the Hauffianum Subzone or even the Planula Zone. However, the specimen identified as *Orthosphinctes* (*O.*) aff. *fontannesi* could suggest

the occurrence of reworked ammonites in this bed because *O. fontannesi* sensu stricto is typical of the lower part of the Bimmammatum Zone (Oloriz *et al.* 1999; Caracuel *et al.* 2000). As stressed in the palaeontological description, our specimen belong to a different taxon that only bears some morphological similarities with *O.* (*O.*) *fontannesi*.

Section Castello Inici

This section is located 3 km north-west of section Monte Inici East and exposed along the track of the southern slope of the mountain (Fig. 1). Savary *et al.* (2003) have discussed sedimentological and micropalaeontological characteristics of the succession. The contact between the Inici Formation and the Rosso Ammonitico is not well exposed and probably affected by faulting. However, Middle Callovian ammonites have been found at the top of bed 3, i.e. 1.60 m above the base of the pelagic succession. Bed 9 marks the end of the Rosso Ammonitico, which is overlain by layers 10 to 11d that correspond to cherty limestones. The total thickness of the cherty succession is unknown because the base is affected by faulting and the upper part is not exposed (Fig. 3). Noteworthy is the presence of ammonites (intervals 10 and 11a) that date the lower part of the cherty limestones to the Plicatilis Zone, Antecedens Subzone.

The complete list of ammonites collected in each bed is presented from bottom to top together with the number of recovered specimens. Their vertical distribution is represented in Figure 3.

Middle Callovian
Bed 3 top: *Reineckeia* sp. (1), *Paroxycerites* sp. (1).

Upper Callovian, Athleta Zone
Bed 4 top: *Orionoides* cf. *termieri* Gérard & Contaut, 1936 (1).

Middle Oxfordian, Plicatilis Zone, Vertebrale and Antecedens subzones
Bed 8 top: *Euaspidoceras paucituberculatum* (Arkell, 1927) (1).
Bed 9: *Sowerbyceras* cf. *tortisulcatum* (d'Orbigny, 1841) (1), *Euaspidoceras* cf. *douvillei* (Collot, 1917 *in* Dorn, 1931) (1), *E.* cf. *lytoceroide*? (Gemmellaro, 1876) (1), *Euaspidoceras* sp. (1), *Tornquistes* (*T.*) cf. *romani* (Douvillé, 1912) (1), *Gregoryceras* cf. *defayi* Bert, Marchand, Gygi, Delanoy, 2003 (1), *Gregoryceras* sp. (1), *Perisphinctes* (*Dichotomosphinctes*) gr. *antecedens*? Salfeld, 1914 (2), *Perisphinctes* (*D.*) sp. indet. (1), Perisphinctinae gen. and sp. indet. (1).

Middle Oxfordian, Plicatilis Zone, Antecedens Subzone
Interval 10 (0.45 m from the base): *Sowerbyceras* sp. (1).
Interval 10 (0.80 m from the base): *Gregoryceras* (*G.*) *riazi* (de Grossouvre, 1917) (1).

Middle Oxfordian, Plicatilis Zone, Parandieri Subzone
Interval 11a: *Sowerbyceras* sp. (4 sp.), *Gregoryceras* (*G.*) *ferchaudi* Bert, 2004 (1), *Perisphinctes* sp. (1).

Biostratigraphic remarks
The fossiliferous layer recognized at the top surface of bed 9 likely marks condensation. In fact, on the basis of the biostratigraphic distributions defined by Bert (2004) for the species of the genus *Gregoryceras* bed 9 contains ammonites of two distinct subzones of the Plicatilis Zone, namely the Vertebrale and the Antecedens subzones. The onset of cherty limestones in bed 10 occurs within the Antecedens Subzone.

On the basis of provisional ammonite identifications, and before the publication of Bert's (2004) revision of the genus *Gregoryceras*, the onset of cherty limestones was tentatively suggested (Cecca *et al.* 2001; Savary *et al.* 2003) to be coeval of the abrupt sedimentary change observed in layer 6 of the Monte Inici East section from pelagic non-nodular limestones to the nodular facies. Therefore, the beginning of the silica-rich sedimentation observed in Castello Inici section slightly predates the onset of the nodular limestones in Monte Inici East section, which seems to occur within the Transversarium Zone *sensu* Bert (2004) on the basis of the occurrence of *Gregoryceras* aff. *devauxi*.

SYSTEMATICS (BY FC)

All the material studied is housed in the Museum "G. G. Gemmellaro" of the Palermo University (MGUP). The specimens studied have been numbered in three distinct series, indicated by letters corresponding, to the sections studied: series MI4N (Monte Inici East, northern flank), series MI4W

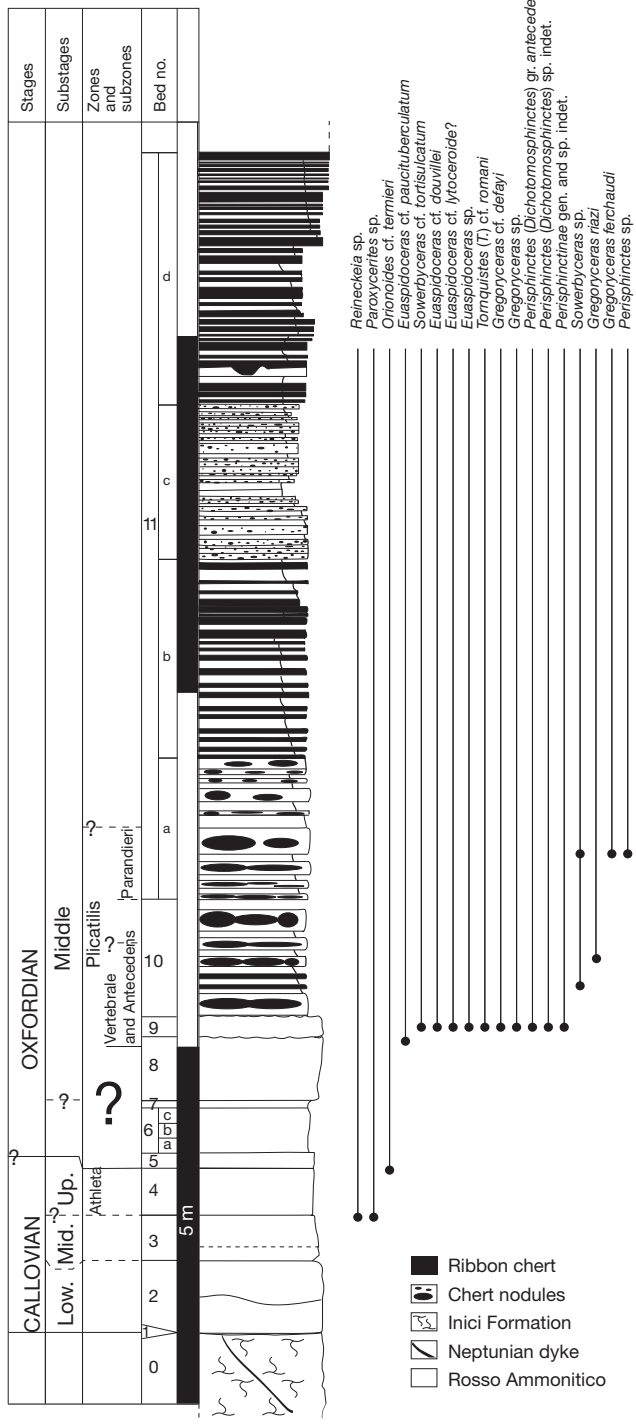


FIG. 3. — Section Castello Inici: lithology and vertical distribution of the identified ammonite taxa.

(Monte Inici East, western flank) and MI3 (Castello Inici). The bed number is indicated after the letters that designate the sections and is followed by a slash; a progressive number refers to the specimens collected in each bed. For example, specimen MI4N 8d/2 designates the second specimen collected in bed 8d of the section logged in the northern flank of Monte Inici East. It is worth noting that the bed numbering mentioned in the section "Material examined" could not correspond to the final bed numbering indicated in the logs (Figs 2; 3) and in the section "Stratigraphic distribution". As an example, specimen MI4N 8 "top"/12 has been collected in bed 8d of section Monte Inici East.

Measurement tables 1 to 25 are in the Appendix.

Order AMMONOIDEA Zittel, 1884
Suborder PHYLLOCERATINA Arkell, 1950
Superfamily PHYLLOCERATOIDEA Zittel, 1884
Family PHYLLOCERATIDAE Zittel, 1884
Subfamily CALLIPHYLLOCERATINAE Spath, 1927

Genus *Calliphylloceras* Spath, 1927

TYPE SPECIES. — *Phylloceras disputabile* Zittel, 1869.

Calliphylloceras benacense (Catullo, 1847)
(Fig. 4A)

Ammonites benacensis Catullo, 1847: 9, pl. 13, fig. 1.

Phylloceras benacense – Neumayr 1871: 336, pl. 15, fig. 3. — Gemmellaro 1878: 165, pl. 1, fig. 1, pl. 3, fig. 1; 1882: 180, pl. 15, figs 1, 2, pl. 17, fig. 1.

Calliphylloceras benacense – Joly 1977: 192, pl. 10, fig. 1, pl. 44, fig. 1, synonymy list. — Cecca 2002: 44, fig. 13.

MATERIAL EXAMINED. — MI4N 8b/2, MI4W 8b/c/2 (*C.* cf. *benacense*).

STRATIGRAPHIC DISTRIBUTION. — Beds 8b and 8c of section Monte Inici East, which have been assigned to the Late Oxfordian Bimammatum Zone. The species is commonly reported from Oxfordian-Kimmeridgian strata.

DESCRIPTION
Inner mold of an involute shell with elliptical whorl section, rounded flanks and a relatively wide and strongly convex venter. The last whorl bears five to six furrows, which are shallow and rectiradiate in the upper half of the flank, gently prorsiradiate and deeper in the lower half of the flank. No test remains are preserved. The poor preservation of the suture lines does not allow the observation of their details. Measurements: see Table 1.

DISCUSSION
The studied specimens are rather similar to those identified by Gemmellaro (1878, 1882) with *C. benacense*.

Genus *Sowerbyceras* Parona & Bonarelli, 1895

TYPE SPECIES. — *Ammonites tortisulcatus* d'Orbigny, 1841.

Sowerbyceras tortisulcatum (d'Orbigny, 1841)
(Fig. 4B)

Ammonites tortisulcatus d'Orbigny, 1841: 162, pl. 51, figs 4-6.

Non *Phylloceras tortisulcatum* – Gemmellaro 1871: 149, pl. 10, fig. 1; 1876: 49, pl. 10, fig. 1.

Sowerbyceras tortisulcatum – Joly 2000: 113, text-figs 236-242, pl. 28, figs 4-6, synonymy list.

MATERIAL EXAMINED. — MI4N 6c/1, MI4N 6e/4, MI4N 6e/5, MI4N 6e/6, MI4N 6e/7, MI4N 6f/1, MI4N 8a/1, MI4N 8a/3, MI4N 8top/1, MI4N 8a'/1, MI4W 6e/2, MI4W 8a'/1, MI4W 8c/2. Specimens determined (as *S.* cf. *tortisulcatum* due to insufficient preservation): MI3 9/6, MI4W 6e/3, MI4W 6e/4, MI4W 8c/1, MI4W 8d/2, MI4N 9/1, MI4W 9/1, MI4W 9top/1.

STRATIGRAPHIC DISTRIBUTION. — The different specimens collected come from beds ascribed to the Middle Oxfordian Plicatilis and Transversarium zones and the Late Oxfordian Bimammatum Zone.

DESCRIPTION
Phylloceratids with a relatively evolute coiling. The whorl section is rectangular with a large, slightly rounded venter and almost flat flanks, rounded ventrolateral margins and rounded umbilical edge. The inner molds collected in the studied sections show four to five deep furrows on the last whorl:

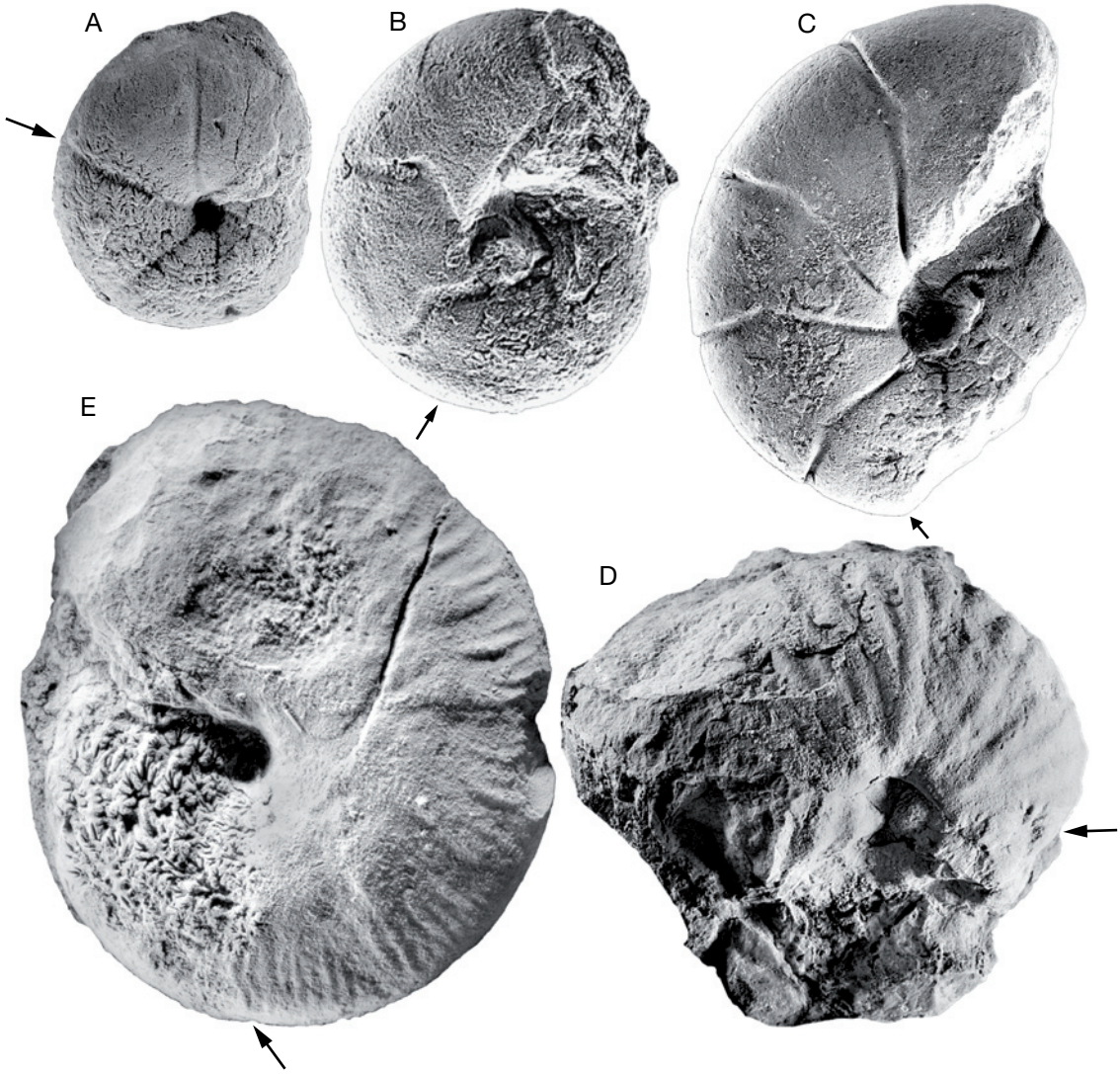


FIG. 4. — **A**, *Calliphylloceras benacense* (Catullo, 1847), specimen MI4N 8b/2 from bed 8b of section Monte Inici East; **B**, *Sowerbyceras tortisulcatum* (d'Orbigny, 1841), specimen MI4N 6c/1 from bed 6c of section Monte Inici East; **C**, *Holcophylloceras polyolcum* (Benecke, 1866), specimen MI4W 8b/c/1 from bed 8c of section Monte Inici East; **D**, *Tornquistes* (*T.*) cf. *romani* (Douvillé, 1912), specimen MI3 9/7 from bed 9 of section Castello Inici; **E**, *Streblites frotho* (Oppel, 1863), specimen MI4N 8b/1 from bed 8b of section Monte Inici East. All figures natural size. Arrows indicate the beginning of the body chamber.

these are prorsiradiate, from the umbilical edge up to mid-flank or slightly below, and from mid-flank they abruptly take a rursiradiate direction. The furrows further change their direction around the ventrolateral margin; on the venter they show a clear adoral convexity. The adoral side of the furrow is steep and its edge is very sharp, thus forming ventral ridges. Measurements: see Table 2.

DISCUSSION

This is the most common species at Monte Inici. The preservation of the numerous collected specimens

is far from satisfactory but clearly allows the identification of the d'Orbigny's species. We refer the reader to Sarti (1993) for the clear definition of the limits of *S. tortisulcatum* and the similar, younger, species *S. silenum* (Fontannes, 1876) and *S. loryi* (Munier Chalmas *in* Pillet & De Fromentel, 1875) (but see Joly 2000 for further information about the creation of the latter species) and also for the detailed information on their biostratigraphic distribution. Sarti (2002) has also shown that the specimens ascribed by Gemmellaro (1871, 1876) to *S. tortisulcatum* actually belong to *S. loryi*.

Genus *Holcophylloceras* Spath, 1927

TYPE SPECIES. — *Phylloceras mediterraneum* Neumayr, 1871.

Holcophylloceras polyolcum (Benecke, 1866)
(Fig. 4C)

Ammonites polyolcus Benecke, 1866: 182, pl. 8, figs 1, 2.

Phylloceras zignodianum – Gemmellaro 1871: 251; 1876: 47, pl. 9, figs 1, 2 (non *Phylloceras zignodianum* d'Orbigny, 1847).

Holcophylloceras polyolcum – Joly 2000: 101, text-fig. 208, pl. 25, fig. 4, synonymy list. — Pavia 2002: 57, fig. 24c, d.

MATERIAL EXAMINED. — MI4N 8d/1, MI4N 8c/2, MI4W 8b/c/1, MI4W 8top/1. Specimens determined as *H.* cf. *polyolcum* due to insufficient preservation: MI4N 6e/1, MI4N 8 "top"/4.

STRATIGRAPHIC DISTRIBUTION. — This species is rather common from bed 8c to 8d of section Monte Inici East, which have been assigned with doubt to the Hauffianum Subzone of the Late Oxfordian Bimammatum Zone. The species probably appears in a layer because a specimen identified as *H.* cf. *polyolcum* has been found in bed 6e, which has been assigned to the Transversarium Zone. This species is commonly reported from Lower Kimmeridgian to Tithonian strata (Sarti 1993). The studied material suggests for this species an earlier appearance than previously tought.

DESCRIPTION
Compressed, involute shell with elliptical whorl section. The umbilicus of this species is relatively wide when compared with the general phylloceratid morphology. Seven to nine furrows per whorl spring from the inner (dorsal) part of the umbilical margin. These furrows are radiate or prorsiradiate in the lower half of the flank but in a point roughly located slightly above the mid flank, they become shallower and larger; in the upper third of the flank the furrows are deeply excavated and rursiradiate. A ridge is developed on the adoral edge from the upper fourth of the flank and on the venter, where the furrows are adapically convex. No shell remains are preserved. Measurements: see Table 3.

DISCUSSION
The first report of this species from beds older than the basal Kimmeridgian (Cecca *et al*. 2001) can cast doubts on the identification of the studied specimens. They have been assigned to *H. polyolcum* because of their more numerous furrows, with a less sharply falcoid aspect than *H. zignodianum* (d'Orbigny, 1848) and *H. mediterraneum* (Neumayr, 1871) (the latter can be considered a synonym of the former as summarised by Pavia 2002).

Suborder AMMONITINA Hyatt, 1889
Superfamily STEPHANOCERATOIDEA
Neumayr, 1875
Family PACHYCERATIDAE Buckman, 1918

Genus *Tornquistes* Lemoine, 1910

TYPE SPECIES. — *Macrocephalites helvetiae* Tornquist, 1894.

Tornquistes (***Tornquistes***) cf. ***romani***
(Douvillé, 1912)
(Fig. 4D)

MATERIAL EXAMINED. — MI3 9/7.

STRATIGRAPHIC DISTRIBUTION. — Bed 9 of section Castello Inici, which has been assigned to the Middle Oxfordian Plicatilis Zone.

DESCRIPTION
Incomplete specimen corresponding to the body chamber of an individual that reached a diameter of about 60 mm. The shell is globular and rather

involute. The whorl section is ovate, with convex flanks converging towards the narrow venter. The umbilical edge is rounded and no umbilical wall is visible. Bundles of two strong, radiate ribs spring from radial umbilical bullae. Single ribs are intercalated between the bundles.

DISCUSSION
The poor preservation of our specimen prevents its precise identification. The morphologically closer species is *Tornquistes* (*T.*) *romani*. It is impossible to state if the specimen studied corresponds to an adult or to an immature individual but its rib density and, apparently, its umbilical width can be compared to immature specimens of similar diameter described by Thierry & Charpy (1982). The preservation does not allow observing whether the umbilical wall is really not developed or if it is simply not observable. *Tornquistes* (*T.*) *multicostatum* Thierry & Charpy, 1982 and *T.* (*T.*) *helvetiae* (Tornquist, 1896) have more evolute shells.

Superfamily HAPLOCERATOIDEA Zittel, 1884
Family HAPLOCERATIDAE Zittel, 1884

Genus *Lissoceras* Bayle, 1879

TYPE SPECIES. — *Ammonites psilodiscus* Schloenbach, 1879.

Subgenus *Lissoceratoides* Spath, 1923

TYPE SPECIES. — *Ammonites erato* d'Orbigny, 1850.

Lissoceras* (*Lissoceratoides*) cf. *erato
(d'Orbigny, 1850)

MATERIAL EXAMINED. — MI4N 8 "top"/12.

STRATIGRAPHIC DISTRIBUTION. — The specimen has been collected in bed 8d of section Monte Inici East, assigned with doubt to the Hauffianum Subzone of the Late Oxfordian Bimammatum Zone.

DESCRIPTION
Smooth, evolute and compressed shell with a high, ovate whorl section. Flanks are slightly convex and converge towards a narrow, rounded venter. Due to the poor preservation both the umbilical edge and wall cannot be observed. Measurements: see Table 4.

DISCUSSION
The absence of sculpture and the structure of the shell correspond to haploceratid or lissoceratid characters. Both whorl section and shell dimensions of the studied specimen correspond to those of the species *L.* (*L.*) *erato*, but the preservation of the umbilical area does not allow a firm specific assignement.

Family OPPELIIDAE Douvillé, 1890
Subfamily TARAMELLICERATINAE Spath, 1928

Genus *Taramelliceras* Del Campana, 1904

TYPE SPECIES. — *Ammonites trachinotus* Oppel, 1863.

***Taramelliceras* cf. *hauffianum*? (Oppel, 1863)**
(Fig. 5A, B)

MATERIAL EXAMINED. — MI4W 8b/c/3.

STRATIGRAPHIC DISTRIBUTION. — The specimen has been collected in bed 8c of section Monte Inici West. It must be stressed that the tentative identification of this specimen also makes tentative the assignment of this bed to the Hauffianum Subzone.

DESCRIPTION
The specimen is a fragment of an inner mold. It shows the venter and the upper third of the flank of a portion of the shell that corresponds to the last part of the phragmocone and the beginning of the body chamber. The venter is large and rounded; it gradually passes to the flanks due to the lack of clear ventrolateral shoulders. Rounded tubercles are visible at the transition between the venter and the flanks. One or two ribs spring from the tubercles; three to four simple ribs are intercalated between two tubercles.

Subfamily STREBLITINAE Spath, 1925

Genus *Streblites* Hyatt, 1900

TYPE SPECIES. — *Ammonites tenuilobatus* Oppel, 1862.

Streblites frotho (Oppel, 1863)
(Fig. 4E)

Ammonites tenuilobatus Oppel, 1862: 160, pl. 50, fig. 1.

Ammonites frotho Oppel, 1863: 199.

non *Oppelia frotho* – Gemmellaro 1872: 39, pl. 6, fig. 6.

Ammonites (*Oppelia*) *frotho* – Favre 1877: 28, pl. 2, figs 7, 8.

Oppelia frotho – Fontannes 1879: 24, pl. 3, fig. 7.

Oppelia frotho var. *mediogranosa* Fontannes, 1879: 24, pl. 3, fig. 8.

Streblites frotho – Wegele 1929: 106, pl. 25, fig. 10. — Christ 1960: 88, pl. 5, fig. 5.

Streblites sp. gr. *frotho* – Olóriz 1978: 50.

MATERIAL EXAMINED. — MI4N 8b/1.

OCCURRENCE. — The specimen has been collected in bed 8b of section Monte Inici East, which has been assigned to the Bimammatum Zone. The species is reported from the Bimammatum up to the Planula Zone (Olóriz 1978, 2002).

DESCRIPTION
Involute, compressed shell. The whorl section shows slightly convex sides up to mid-flank where they converge towards a fastigate ventral area whose margins correspond to sharp ventrolateral shoulders. The venter is partly preserved: it bears a high crenulated keel that is visible up to the first half of the body chamber. Due to poor preservation, the ornamentation is incompletely visible. Some small tubercles corresponding to the ventrolateral tips of secondary ribs are visible in the last portion of the phragmocone. In the body chamber, the lower side of the flank only shows weak traces of ribs that give rise to radial bullae at mid-flank. In the upper side of the flank, adorally concave ribs spring from bullae: between two of these concave ribs, finer secondary ribs of different length are visible. Some of the secondary ribs seem to spring from the lateral bullae. All ribs stop at the ventrolateral shoulders. Complex suture with E as long as half of L and S1 higher than the external saddle. Measurements: see Table 5.

DISCUSSION
The ornamentation of the phragmocone of the specimen from Monte Inici is almost invisible, thus making the comparison with the specimens figured in the literature (which are mostly phragmocones or seem to correspond to phragmocones) difficult. Our specimen has the closest morphological similarities with the one figured by Wegele (1929), which shows a weak sculpture in the last third of the last whorl and a comparable ontogenetical evolution of the ornamentation. As already observed by Christ (1960) and Olóriz (1978), it is not always easy to distinguish *S. frotho* from congeneric species like *S. tenuilobatus* (Oppel, 1863) and *S. folgariacus* (Oppel, 1863). The weakness of the ornamentation of our specimen is not entirely due to preservation failure and reflects a morphological transition towards *S. tenuilobatus*, from which it differs by the lower number of primary ribs.

Superfamily PERISPHINCTOIDEA
Steinmann, 1890
Family PERISPHINCTIDAE Steinmann, 1890
Subfamily PERISPHINCTINAE Steinmann, 1890

Genus *Perisphinctes* Waagen, 1869

TYPE SPECIES. — *Ammonites variocostatus* Buckland, 1836.

Subgenus *Dichotomosphinctes* Buckman, 1926

TYPE SPECIES. — *Perisphinctes antecedens* Salfeld, 1914.

Perisphinctes (***Dichotomosphinctes***)
gr. ***antecedens***? Salfeld, 1914
(Fig. 5C)

MATERIAL EXAMINED. — MI3 9/3, MI3 9/10.

STRATIGRAPHIC DISTRIBUTION. — Bed 9 of section Castello Inici, which has been assigned to the Middle Oxfordian Plicatilis Zone.

DESCRIPTION
The two incomplete specimens correspond to evolute shells; the largest one probably reached the

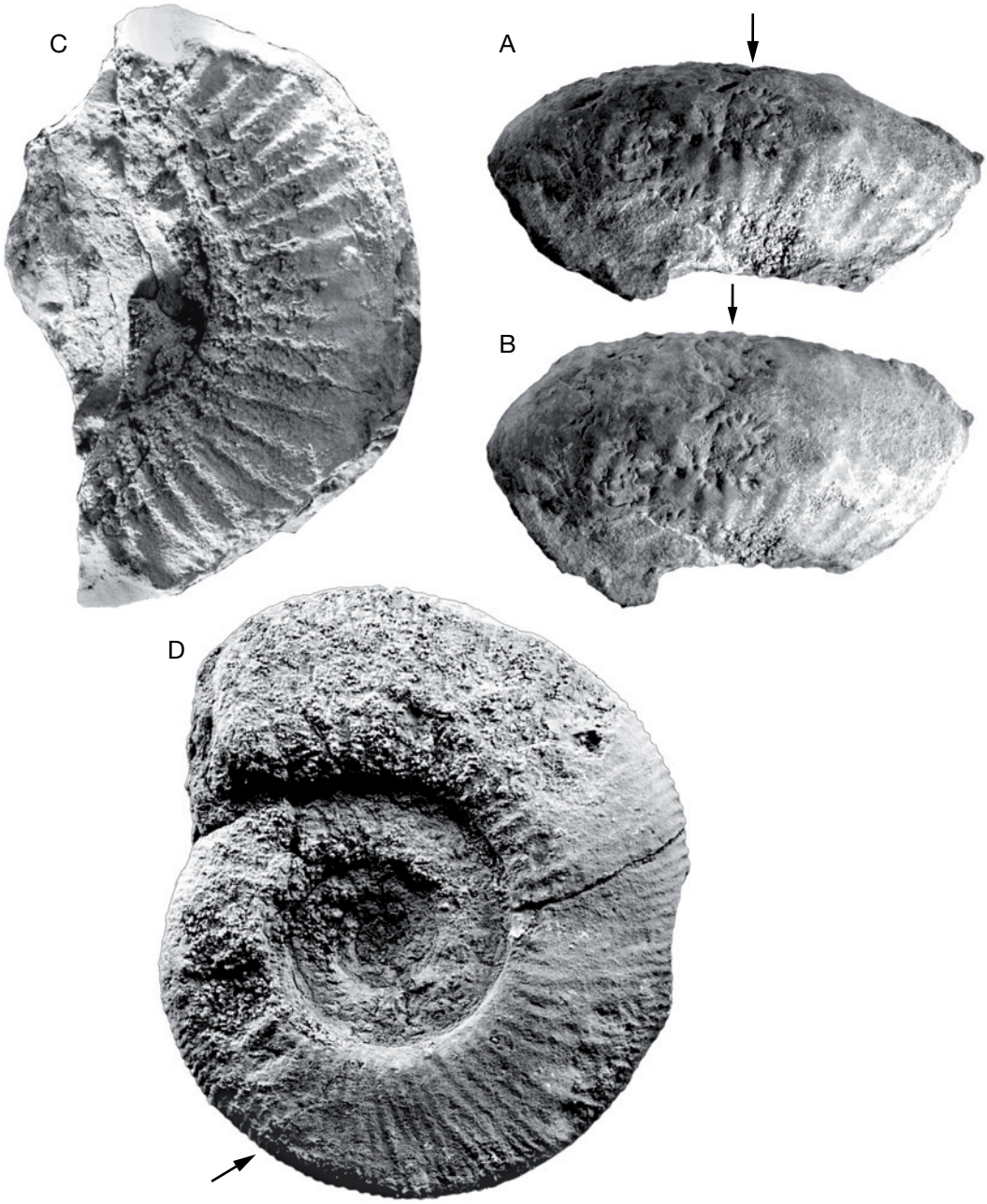


FIG. 5. — **A**, **B**, *Taramelliceras* cf. *hauffianum*? (Oppel, 1863), specimen MI4W 8b/c/3 from bed 8c of section Monte Inici East: **A**, lateral (slightly oblique) view; **B**, ventral view; **C**, *Perisphinctes* (*Dichotomosphinctes*) gr. *antecedens*? Salfeld, 1914, specimen MI3 9/10 from bed 9 of section Castello Inici; **D**, *Subdiscosphinctes* sp., specimen MI4N 9/4 from bed 9 of section Monte Inici East. All figures natural size. Arrows indicate the beginning of the body chamber.

diameter of 12 cm. The whorl section is rectangular to subtrapezoidal, characterized by a relatively large venter, flat to gently round flanks, a well developed rounded umbilical margin and a flat to oblique umbilical wall. Ribs are strong and gently prorsiradiate. The two fragments only show biplicate ribs whose point of branching is located on the upper fourth of the flank.

DISCUSSION

The preservation of the studied specimens is too poor to allow a reliable identification. The ribbing and the general features of the shell suggest affinities with the group of *P. antecedens*. The specimens from Castello Inici bear a wider whorl section than the one developed by the type specimens studied by Arkell (1937) and by specimens from the Jura Mountains and from Beauvoisin (France), respectively described by Enay (1966) and Bourseau (1977). However, Enay (1966: 473) mentions that some specimens have flanks that converge towards the venter.

Genus *Subdiscosphinctes* Malinowska, 1972

TYPE SPECIES. — *Perisphinctes kreutzi* Siemiradzki, 1891.

Subdiscosphinctes sp.
(Fig. 5D)

MATERIAL EXAMINED. — MI4N 9/4.

STRATIGRAPHICAL DISTRIBUTION. — The specimen has been collected in bed 9 of section Monte Inici East, which has been assigned to the Planula Zone. The specimens figured by Choffat (1893) were collected in layer 12 of Cabanas de Torres (Portugal), together with species of the genus *Subnebrodites*, which indicate the Planula Zone.

DESCRIPTION

Compressed, evolute shell. The whorl section is subtrapezoidal, with flat flanks converging towards a narrow, gently rounded (almost flat) venter. Due to insufficient preservation, both the umbilical edge and the umbilical wall are not clearly visible. The ornamentation consists of numerous fine, prorsiradiate ribs. These spring from the umbilical edge and bifurcate at the upper third of the flank. Some ribs remain simple. Two ribs may be united on the umbilical edge to form rib bundles, which may be composed either by two bifurcate ribs or by a simple rib together with a bifurcate rib. According to Atrops (1982), these combinations are respectively called subpolyplocoid and incomplete subpolyplocoid ribs. At least in the first third of the body chamber a narrow smooth band interrupts ribs on the venter. Measurements: see Table 6.

DISCUSSION

This specimen shows some resemblances (coiling, whorl section) with some of the specimens figured by Choffat (1893). It has been provisionally identified in Cecca *et al.* (2001) as *Perisphinctes* sp. nov. aff. *dybowskii* Siemiradzki *in* Choffat (1893: pl. 10, fig. 1), from which our specimen differs because of its denser ribbing and the development of subpolyplocoid ribs. The latter are developed in *S. castroi* (Choffat, 1893) (see Choffat 1893: pl. 10, figs 5, 6), which is clearly more involute.

Subfamily PASSENDORFERIINAE Meléndez, 1989

Genus *Sequeirosia* Meléndez, 1989

TYPE SPECIES. — *Passendorferia brochwiczi* Sequeiros, 1977.

Sequeirøosia bocconii (Gemmellaro, 1871)
(Fig. 6)

Perisphinctes bocconii Gemmellaro, 1871: 156, pl. 20, fig. 2.

?*Perisphinctes bocconii* – Gemmellaro 1874: 5, pl. 2, fig. 2.

Non *Perisphinctes bocconii* – Gemmellaro 1877: 91, pl. 4bis, fig. 15.

Sequeirosia (*Sequeirosia*) *bocconii* – D'Arpa & Meléndez 2002: 275, figs 187, 188.

MATERIAL EXAMINED. — MI4W 6c/3.

STRATIGRAPHIC DISTRIBUTION. — The specimen has been collected in bed 6c of section Monte Inici East, which has been assigned to the Middle Oxfordian Transversarium Zone. D'Arpa & Meléndez (2002) assumed that the

vertical distribution of this species could correspond to an intermediate horizon between the Antecedens and Luciaeformis subzones, most probably the base of the Transversarium Zone. However, the precise stratigraphic position of Gemmellaro's specimens remains unknown.

DESCRIPTION

Large evolute, serpenticone shell, which is represented by an incomplete whorl that seems to belong to the body chamber. The whorl section is subrectangular from a diameter of about 190 mm. The umbilical wall is not visible due to poor preservation; the venter and the umbilical margin are rounded, flanks are flat and almost parallel in the first half of the last whorl to become convergent towards its end. Primary ribs are strong, long, rounded, slightly prorsiradiate, irregularly spaced. The bifurcation of the ribs is not clearly visible because of the bad preservation. Ribs seemingly weakened on the venter and become more spaced towards the very last portion of the whorl. Measurements: see Table 7.

DISCUSSION

The lack of inner whorls makes the identification of this single specimen quite difficult. However, the general characteristics of both the shell and its sculpture strongly suggest its identification with *S. bocconii*. Similar forms already assigned by Gemmellaro to *S. bocconii* (1877: pl. 4bis, fig. 15) have been excluded from this species by Cecca *et al.* (2001) and then by D'Arpa & Meléndez (2002) who assigned them to *Passendorferia* pl. sp. indet. Our specimen resembles more the one from Ciacati Roccapalumba selected by D'Arpa & Meléndez (2002) as the lectotype of the species than the specimen collected in the locality "Chiusa e Palazzo-Adriano" figured by Gemmellaro in 1874. However, it is more evolute than the lectotype. There are also morphological resemblances with the specimen that Meléndez (1989: pl. 16, fig. 1) has figured with the name *Sequeirosia* (*S.*) n. sp. A.

Genus *Passendorferia* Brochwicz-Lewinski, 1973

TYPE SPECIES. — Nebrodites (Passendorferia) teresiformis Brochwicz-Lewinski, 1973.

Subgenus *Enayites* Brochwicz-Lewinski & Rozak, 1976

TYPE SPECIES. — *Ammonites birmensdorfensis* Moesch, 1867.

Passendorferia (*Enayites*) cf. *rozaki* Meléndez, 1989 (Fig. 7F)

MATERIAL EXAMINED. — MI4N 8c/1.

STRATIGRAPHIC DISTRIBUTION. — The specimen has been collected in bed 8d top of section Monte Inici East, which has been assigned with doubt to the Hauffianum Subzone of the Late Oxfordian Bimammatum Zone. The species has been reported from older levels of the Bimammatum Zone, namely the Hypselum Subzone or the lower part of the Bimammatum Subzone (Atrops & Benest 1986; Meléndez 1989).

DESCRIPTION

Evolute shell with rounded, subcircular whorls. Up to the last quarter of the last whorl the whorl breadth is larger than the whorl height. The ventral area is large and rounded. The ribbing is dense, radiate to slightly prorsiradiate in the second half of the last whorl. Ribs generally bifurcate at the ventrolateral margin and at the upper quarter of the flank towards the mouth; simple ribs are rare. Up to a diameter of at least 53 mm secondary ribs are almost symmetrical with respect to the primary rib from which they spring but they are clearly projected forward in the last part of last whorl. Three oblique constrictions per whorl have been observed: one of them is adorally bounded by a swollen rib and is deeper than the others. The peristome is partly preserved: the venter shows a ridge whereas a broken lappet is visible on the flank after the final constriction. Measurements: see Table 8.

DISCUSSION

The specimen from Monte Inici is rather similar to the holotype of the species but shows a higher number of primary ribs. Furthermore parabolic nodes have not been observed (because of insufficient preservation?). However, Atrops & Benest (1986) have figured two specimens of this species

Fig. 6. — *Sequeirosia bocconii* (Gemmellaro, 1871), specimen MI4W 6c/3 from bed 6c of section Monte Inici East. Scale bar: 5 cm.

devoid of parabolic nodes. Meléndez (1989) has created the species *P.* (*E.*) *rozaki* on the basis of a specimen that Brochwicz-Lewinski & Rozak (1976) originally included with doubts by in the species *P.* (*E.*) *gygii.* The latter is less evolute and more finely ribbed than *P.* (*E.*) *rozaki*. The separation between these two species may be questionable because of scarce morphological differences. *P.* (*E.*) *sanpedroi* Meléndez, 1989 has a rib density similar to that of the specimen here described but it is less evolute and its secondary ribs are not projected forward.

Passendorferia (***Enayites***) aff. ***gygii***
Brochwicz-Lewinski & Rozak, 1976
(Fig. 7E)

MATERIAL EXAMINED. — MI4N 8 "top"/6.

STRATIGRAPHIC DISTRIBUTION. — The specimen has been collected in bed 8d of section Monte Inici East, assigned with doubt to the Hauffianum Subzone of the Late Oxfordian Bimammatum Zone. *P.* (*E.*) *gygii* has been reported from older levels of the Bimam matum Zone, namely the Hypselum Subzone or the lower part of the Bimammatum Subzone (Meléndez 1989).

DESCRIPTION
Evolute shell with subcircular whorls. The flanks are flat or gently rounded, the ventral area is large and rounded. No umbilical wall is developed. Dense, radial to gently prorsiradiate ribbing which is characterized by simple and biplicate ribs. The latter bifurcate at the ventrolateral margin. Two constrictions per whorl have been observed. No parabolic nodes have been observed. Due to the lack of any traces of suture line the diameter of the beginning of the body chamber cannot be observed. Measurements: see Table 9.

DISCUSSION
The studied specimen shows some morphological affinities with *P.* (*E.*) *gygii.* However, the whorl shape, the fine, dense ribbing, the presence of parabolic nodes and also the prorsiradiate direction of the secondary ribs suggest keeping it distinct from *P.* (*E.*) *gygii* sensu stricto.

?"***Passendorferia***" aff. ***teresiformis***
Brochwicz-Lewinski, 1973
(Fig. 8E)

MATERIAL EXAMINED. — MI4N 8 "top"/5.

STRATIGRAPHICAL DISTRIBUTION. — The specimen has been collected in bed 8d of section Monte Inici East, assigned with doubt to the Hauffianum Subzone of the Late Oxfordian Bimammatum Zone. *P.* (*P.*) *teresiformis* has been reported from older horizons, namely from the Bifurcatus Zone up to lower part of the Bimammatum Zone (Meléndez 1989).

DESCRIPTION
Evolute shell with subquadrate whorls that do not develop any umbilical wall. The last third of the last whorl, which belongs to the body chamber, shows a subrectangular whorl section with distinctly flat flanks and a rounded large venter. The ornamentation consists of prorsiradiate, sharp biplicate ribs, whose point of branching coincides with the ventrolateral margin. Rib interspaces are as broad as two ribs. The point of branching is elevated and thickened but no real tubercles are developed. Simple ribs are rare. Ribs cross the venter without interruption and develop a gentle adoral convexity. A relatively deep constriction per whorl is visible, though the incomplete preservation prevents the observation of the real number of constrictions. Measurements: see Table 10.

DISCUSSION
The specimen described probably belongs to a new species and its generic position is also uncertain. It resembles to *Presimoceras teres* (Neumayr, 1873), which develops only rare biplicate ribs and bears a wider umbilicus, but our specimen is regarded here as a morphologically intermediate form between *Passendorferia* and *Trenerites* more than a form close to *Presimoceras* Sarti, 1990. It has been compared with *P.* (*P.*) *teresiformis* because of its flat-sided whorls and the sharp ribs that are raised at the ventro-lateral margin. However *P.* (*P.*) *teresiformis* sensu stricto is characterized by a wider umbilicus and less prorsiradiate ribbing. The genus *Trenerites* Sarti, 1993 includes species of the Platynota Zone (for example *T. evolutus* (Gemmellaro, 1876) and *T*. nov. sp. indet. or *T. enayi* Sarti [*in* Sarti 1993:

pl. 22, fig. 1 and fig. 2 respectively]), whose morphological characters are similar to those developed by our specimen. However, *Trenerites* is generally more evolute, characterized by narrower whorls and rare bifurcate ribs on the body chamber.

Genus *Geyssantia* Meléndez, 1989

TYPE SPECIES. — *Geyssantia geyssanti* Meléndez, 1989.

Geyssantia geyssanti Meléndez, 1989 (Fig. 7B)

Geyssantia geyssanti Meléndez, 1989: 203, pl. 19, figs 2-7, text-fig. 42.

MATERIAL EXAMINED. — MI4N 8-9/1.

STRATIGRAPHIC DISTRIBUTION. — The specimen has been collected in bed 8d of section Monte Inici East, assigned with doubt to the Hauffianum Subzone of the Late Oxfordian Bimammatum Zone. Meléndez (1989) reported this species from both the Bimammatum and the Hauffianum subzones.

DESCRIPTION

Small, compressed, evolute shell with subrectangular whorl section, rounded venter. Whorl flanks are almost flat in the last whorl and gently rounded in the internal ones. No umbilical wall is developed. Ribs are simple, sharp, distant and generally rectiradiate. There are three deep constrictions per whorl, which are adorally bounded by a prominent rib. Due to the lack of any traces of suture line the diameter of the beginning of the body chamber cannot be observed. Measurements: see Table 11.

DISCUSSION

The specimen described is easily comparable with the type specimens. However, it has been impossible to confirm the presence of biplicate ribs as the last portion of the last whorl is eroded. This species is reported for the first time from Sicily.

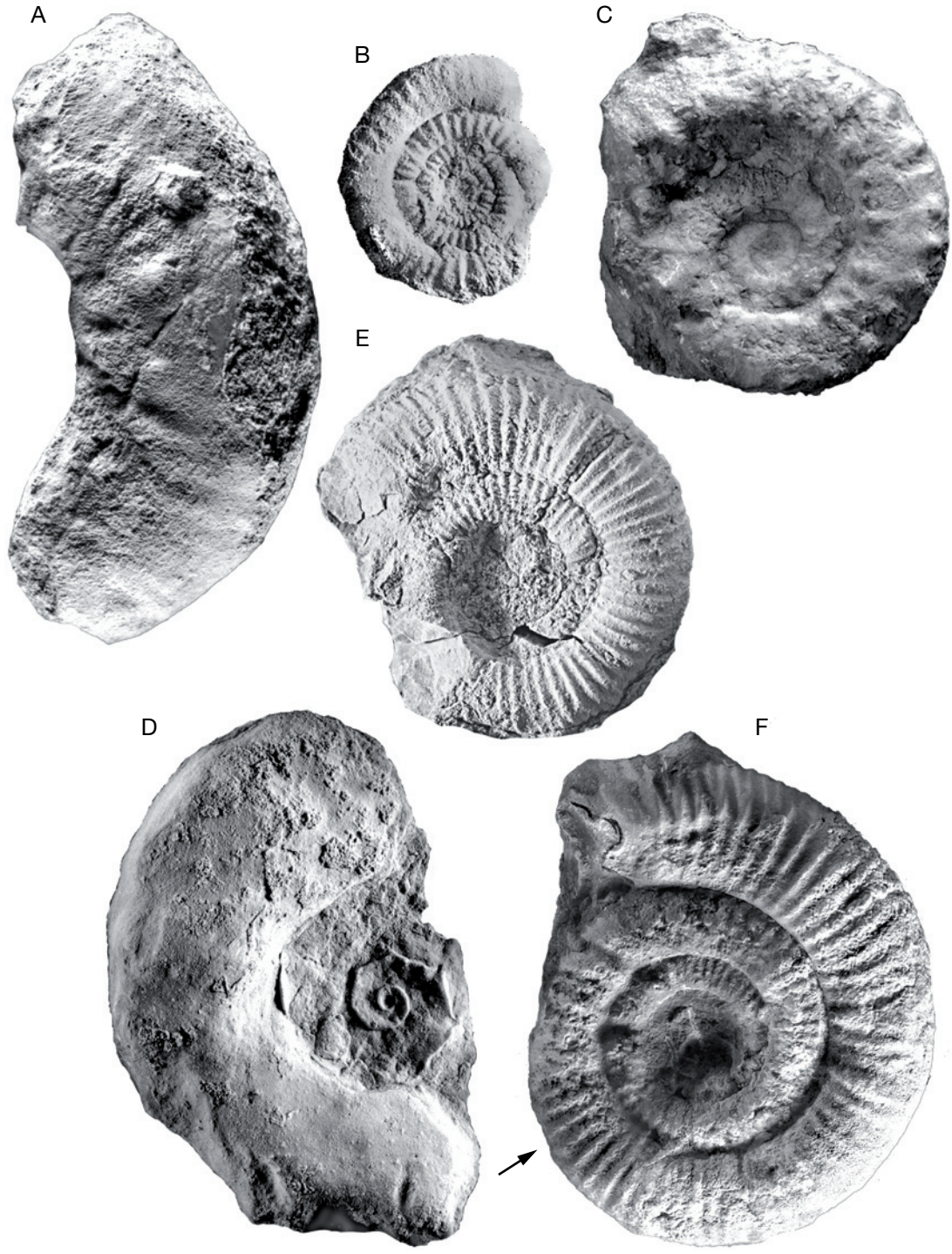
Genus *Nebrodites* Burckhardt, 1910

TYPE SPECIES. — *Simoceras agrigentinum* Gemmellaro, 1872.

REMARKS

Several authors (Brochwicz-Lewinski 1973; Meléndez 1989; Sarti 1990, 1993) have discussed the systematic position of this genus within the subfamily Idoceratinae Spath, 1924 and its relationships with the genus *Passendorferia*. Caracuel *et al*. (1999) have included *Nebrodites* within the subfamily Passendorferiinae instead of Idoceratinae. The appearance of the genus *Nebrodites* has long been dated to the Early Kimmeridgian Strombecki Zone (Olóriz 1978). Benzaggagh & Atrops (1997) and Caracuel *et al*. (1999) have recently figured earlier forms of the Platynota Zone. However, Schweigert & Callomon (1997) lowered to the Bimammatum Zone, Hauffianum Subzone, the age of the type level of the species *Nebrodites macerrimus* (Quenstedt, 1888). These authors (1997: 35) seem to question (because of the unusually early occurrence of a *Nebrodites*-like morphology?) the systematic position of the species *macerrimus* within *Nebrodites* because they used this generic name between inverted commas and consider it the microconch of the species *Presimoceras nodulatum* (Quenstedt, 1888). A *Nebrodites*-like morphology described below as *Nebrodites* aff. *contortus* (Neumayr, 1871) has been found at Monte Inici in a bed assigned with doubt to the Hauffianum Subzone. Careful investigations in the distal areas of the Mediterranean Tethys are needed to improve our knowledge of the phyletic relationships between the typical *Nebrodites* and the forms included in the subfamily Passendorferiinae, a point already stressed by Caracuel *et al*. (1999).

FIG. 7. — **A**, ?*Aspidoceras* gr. *binodum* (Oppel, 1863), specimen MI4N 6f/2 from bed 6f of section Monte Inici East; **B**, *Geyssantia geyssanti* Meléndez, 1989, specimen MI4N 8-9/1 from bed 8d of section Monte Inici East; **C**, *Euaspidoceras* cf. *oegir* (Oppel, 1863), entirely septated specimen MI4N 6d/1 from bed 6d of section Monte Inici East; **D**, *Euaspidoceras* cf. *lytoceroide*? (Gemmellaro, 1876), specimen MI3 9/9 from bed 9 of section Castello Inici; **E**, *Passendorferia* (*Enayites*) aff. *gygii* Brochwicz-Lewinski & Rozak, 1976, specimen MI4N 8 "top"/6 from bed 8d of section Monte Inici East; **F**, *Passendorferia* (*Enayites*) cf. *rozaki* Meléndez, 1989, specimen MI4N 8c/1 from bed 8d top of section Monte Inici East. All figures natural size. Arrows indicate the beginning of the body chamber.


A
B
C
E
D
F

One can ask whether the subfamilies Passendorferiinae and Idoceratinae are actually two distinct taxons or just a single lineage. Finally, Villaseñor & Olóriz (2006) have demonstrated that the Mexican forms of *Idoceras* originally described by Burckhardt (1906) do belong to the family Ataxioceratidae, making the use of the subfamily Idoceratinae unnecessary.

Nebrodites aff. *contortus* (Neumayr, 1871) (Fig. 8A, B)

MATERIAL EXAMINED. — MI4N 8d/2.

STRATIGRAPHIC DISTRIBUTION. — The specimen has been collected in bed 8d top of section Monte Inici East, which has been assigned with doubt to the Hauffianum Subzone of the Late Oxfordian Bimammatum Zone.

DESCRIPTION

Evolute, serpenticone, shell. Only the last whorl is preserved. The whorl section is elliptical, with flat to slightly rounded flanks and rounded venter. The umbilical edge is rounded and no umbilical wall is developed. The ornamentation consists of numerous radial to slightly prorsiradiate single and biplicate ribs which branch in the upper third of the flank. The ribs are attenuated on the venter. Two deep and oblique constrictions are visible in the last whorl: they are adorally bounded by strong, swollen, ribs. A third, final constriction precedes the mouth, which is marked by an abrupt lateral expansion of the whorl that acquires a subcircular section. Measurements: see Table 12.

DISCUSSION

This single specimen shows the typical characters of the genus *Nebrodites* (i.e. evolute coiling, biplicate ribs branching in the upper third of the flank, deep constrictions and attenuated ribbing on the venter), whose first appearance is generally recorded at the beginning of the Kimmeridgian. The morphological characters of this specimen are clear-cut and certainly do not allow its assignment to the genus *Passendorferia*, thus suggesting the appearance of the genus *Nebrodites* since the upper part of the Bimammatum Zone. This supports the recent reappraisal of the age of the type level of the species *Nebrodites macerrimus* by Schweigert & Callomon (1997).

Neumayr (1871: 369, pl. 21, fig. 1) described the species *Simoceras contortum*, which shows *Nebrodites* characters, from limestones of an unknown Oxfordian horizon. The specimen found at Monte Inici differs from this species because of its narrower whorls, the higher position of the point of bifurcation (upper third of the flank instead of mid flank) and, probably, the lower number of constrictions.

Nebrodites passendorferiiforme Caracuel, Olóriz & Rodriguez-Tovar, 1999 (Fig. 8C)

Nebrodites (*Nebrodites*) *macerrimus* (Quenstedt, 1888) – Geyssant 1966: 108, pl. 1, fig. 6.

Non *Ammonites macerrimus* Quenstedt, 1888.

Nebrodites passendorferiiforme Caracuel, Olóriz & Rodriguez-Tovar, 1999: 114, figs 5-14.

MATERIAL EXAMINED. — MI4W 10top/2.

STRATIGRAPHIC DISTRIBUTION. — Top of bed 10 of section Monte Inici East, which has been assigned to the Early Kimmeridgian Platynota Zone, associated with *Orthosphinctes* (*Ardescia*) *beticus* Caracuel, Olóriz & Rodriguez-Tovar, which has been reported from the middle part of the Platynota Zone whereas the type specimens of *N. passendorferiiforme* have been reported from the upper part of the Platynota Zone (Caracuel *et al*. 1999: fig. 2).

DESCRIPTION

Small, evolute shell with subcircular whorls. The ornamentation mostly consists of an alternation of simple and biplicate ribs. These are radial in the inner whorls, becoming slightly prorsiradiate in the last third of the last whorl. Bifurcate ribs branch at the upper third of the flank and are slightly projected forward. Ribs form an adoral convex trend on the venter. Two deep, oblique, constrictions and a weaker one occur on the last whorl. Due to the incomplete preservation, it is impossible to know whether other constrictions occurred or not. Measurements: see Table 13.

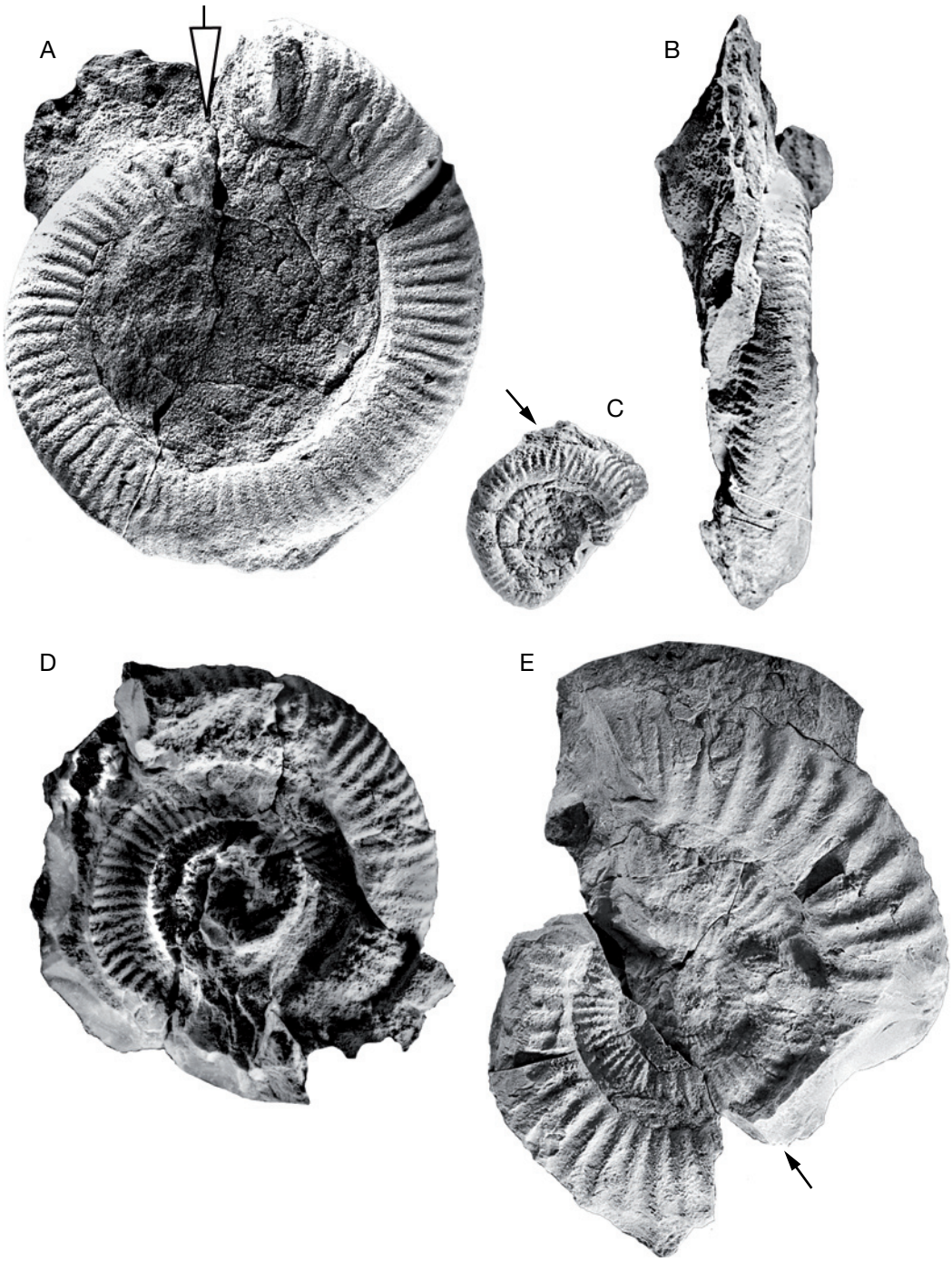


FIG. 8. — *Nebrodites* aff. *contortus* (Neumayr, 1871), specimen MI4N 8d/2 of bed 8d top of section Monte Inici East; **A**, lateral view; **B**, ventral view; **C**, *Nebrodites passendorferiiforme* Caracuel, Olóriz & Rodriguez-Tovar, 1999, specimen MI4W 10top/2 from bed 10 of section Monte Inici East; **D**, *Nebrodites* cf. *hospes* (Neumayr, 1873), specimen MI4W 10top/3 from bed 10 of section Monte Inici East; **E**, ?"*Passendorferia*" aff. *teresiformis* Brochwicz-Lewinski, 1973, specimen MI4N 8 "top"/5 from bed 8d of section Monte Inici East. All figures natural size. Arrows indicate the beginning of the body chamber.

Discussion

The described specimen bears a clear *macerrimus*-like aspect. It is almost identical to the specimen figured by Geyssant (1966: pl. 1, fig. 6). The latter has been implicitely considered different from *N. macerrimus* because Caracuel *et al.* (1999) acknowledged that it is possibly conspecific with *N. passendorferiiforme*, although they did not include it in the synonymy of the latter species. Due to Schweigert & Callomon's (1997) data about the Late Oxfordian age of the type level of *N. macerrimus*, a new appraisal of the Early Kimmeridgian specimens ascribed to this species is needed (Caracuel *et al.* 1999). The specimen from Monte Inici differs from the type specimens of *N. passendorferiiforme* for the less numerous constrictions (but note that the shell of our specimen is incompletely preserved).

Nebrodites cf. ***hospes*** (Neumayr, 1873)
(Fig. 8D)

Material examined. — MI4W 10top/3, MI4W 10top/4.

Stratigraphic distribution. — Bed 10 of section Monte Inici East, which has been assigned to the Early Kimmeridgian Platynota Zone.

Description

Evolute shell. Only the lower third of the flank of the final part of the last whorl is preserved in specimen MI4W 10top/3 on which the description is based. The whorl section is subelliptical, with gently rounded flanks and venter. The ribbing is rectiradiate to slightly prorsiradiate with an almost regular alternance of simple and bifurcate ribs. These branch at the upper third of the flank and become slightly projected on the venter, where they stop along a smoothed band. The incomplete preservation prevents the observation of the real number of constrictions: three constrictions per whorl have been observed on the preserved portions. The body chamber is not preserved, except for the final part of the last whorl. A small fragment (MI4W 10 top/4) of the body chamber of an individual, which probably reached the diameter of 90 mm, shows the same ornamental characters. Sculpture did probably not undergo significant ontogenetic changes. Measurements: see Table 14.

Discussion

The form described above bear morphologic affinities with the specimen figured by Benzaggagh & Atrops (1997: pl. 1, fig. 6) as *N. hospes suteri* Geyssant, 1966, which is a morphotype originally considered as a subspecies that groups evolute and densely ribbed specimens of *N. hospes*. Sarti (1993) has questioned the use of this subspecies which he includes within *N. hospes* sensu stricto. The preservation of our specimens is too incomplete to reach a reliable determination. Nevertheless, their finding in association with *Orthosphinctes* (*Ardescia*) *beticus* Caracuel, Olóriz & Rodriguez-Tovar, 1999 further confirms the occurrence of typical *Nebrodites* in the Platynota Zone.

Family Aspidoceratidae Zittel, 1895
Subfamily Peltoceratinae Spath, 1924

Genus *Gregoryceras* Spath, 1924

Type species. — *Ammonites transversarius* Quenstedt, 1847.

Remarks

The Sicilian specimens of the genus *Gregoryceras* originally described by Gemmellaro (1877) have been recently revised by D'Arpa & Meléndez (2002). These authors have proposed a *Gregoryceras*-based biostratigraphic scale on the basis of the Sicilian specimens and on the revision of the literature (D'Arpa & Meléndez 2004), focusing on the species *G. riazi* (de Grossouvre, 1917), *G. transversarium* (Quenstedt, 1847) and *G. fouquei* (Kilian, 1889). More recently, the systematics of the genus *Gregoryceras* has been almost entirely revised (with the exception of the *fouquei* group) by Bert (2004) on the basis of material collected in SE France. This author also proposes an accurate biostratigraphical correlation of the vertical succession of *Gregoryceras* species with the Submediterranean zonation. It is worth noting that Bert's biostratigraphical conclusions are based on the co-occurrence of *Gregoryceras*

representatives together with Submediterranean perisphinctids in SE France. This author distinguishes different chronospecies, corresponding to segments of a substantially anagenetic line within the genus *Gregoryceras*. The limits between these species are not easy to recognize and the stratophenetic succession proposed by Bert cannot be tested in the Mediterranean regions because a succession of species as complete as the one available in SE France has not been discovered yet.

The systematic and biostratigraphic conclusions of Bert (2004) are accepted in this paper and the proposed chronospecies succession from *G. iteni* Jeannet, 1951 up to *G. devauxi* is adopted. The conclusions of D'Arpa & Meléndez (2002, 2004) about the group of *G. fouquei* are also taken into account here.

Gregoryceras cf. *defayi* Bert, Marchand, Gygi & Delanoy, 2003 (Fig. 9D)

MATERIAL EXAMINED. — MI3 9/8.

STRATIGRAPHIC DISTRIBUTION. — Bed 9 of section Castello Inici, which has been assigned to the Middle Oxfordian Plicatilis Zone. According to Bert (2004), the distribution of *G. defayi* is limited to the Middle Oxfordian Plicatilis Zone and in particular to the lower part of the Vertebrale Subzone.

DESCRIPTION

The fragment collected at Castello Inici shows a large, subcircular whorl section. The flanks are rounded; the umbilical wall is large and oblique, passing to a rounded umbilical margin. No traces of sculpture are visible up to 20 mm. The preserved fragment of the last whorl shows strongly rursiradiate ribs. No sculpture is visible on the umbilical wall of the last whorl.

DISCUSSION

Despite the strongly incomplete preservation, this specimen can be compared with *G. defayi*. *G. tenuisculptum* Gygi, 1977 differs because of its shorter smooth initial stage. *Gregoryceras iteni* (Jeannet, 1951) bears ventrolateral thickenings which are not visible in our specimen.

Gregoryceras riazi (de Grossouvre, 1917) (Fig. 9E)

Peltoceras transversarium – Gemmellaro 1877: 92, pl. 4bis, fig. 17 (non *Peltoceras transversarium* Quenstedt, 1847) [fig. 16 is a different species].

Peltoceras riazi de Grossouvre, 1917: 63, pl. 9, figs 10-12, pl. 10, figs 15, 16.

Gregoryceras riazi – Bert 2004: 57, 62, pl. 7, figs 1-5, pl. 8, figs 1-4, pl. 9, figs 1-4, text-fig. 10, synonymy list.

MATERIAL EXAMINED. — MI3 10/1.

STRATIGRAPHIC DISTRIBUTION. — Interval 10 of Castello Inici section. According to Bert (2004) *G. riazi* is limited to the Middle Oxfordian Plicatilis Zone, lower part of the Antecedens Subzone.

DESCRIPTION

Deformed specimen showing an evolute shell with subtrapezoidal whorl section. Large, slightly rounded umbilical wall, which is connected to the flank through a rounded umbilical margin. Flanks are almost flat in the last whorl; venter is almost flat. Sculpture is characterized by strong ribs, springing, simple or in pairs, from primary ribs that, at their turn, originate from umbilical tubercles or bullae. From the inner third of the flank, ribs are strongly rursiradiate. Rib branching is observed at the outer third of the flank. Ribbing is already developed from a diameter of 15 mm and probably (but preservation is insufficient) starts towards 12 mm. All ribs slightly thicken at the ventrolateral margin and then cross the venter without interruption. No traces of peristome are visible. Suture lines are not visible. Measurements: see Table 15.

DISCUSSION

The preservation of this specimen is far from satisfactory but observable characters allow the assignment to *G. riazi*. The species *G. riaziformis* Bert, 2004 differs from *G. riazi* on the basis of its larger adult size, the earlier development of the sculpture (10.5 instead of 12 mm), the less rursiradiate and flexuous ribbing, and finally its slightly younger age (upper part of the Antecedens Subzone). The distinction between *G. riazi* and *G. riaziformis* is however very difficult.


A
B
C
D
E
F

Gregoryceras ferchaudi Bert, 2004
(Fig. 9C)

Gregoryceras ferchaudi Bert, 2004: 72, 76, pl. 12, figs 2-4, pl. 13, figs 1-5, pl. 14, figs 1, 2, text-fig. 14, synonymy list.

MATERIAL EXAMINED. — MI3 11a/1.

STRATIGRAPHIC DISTRIBUTION. — Interval 11 of Castello Inici section. According to Bert (2004) *G. ferchaudi* is limited to the Middle Oxfordian Plicatilis Zone, Parandieri Subzone.

DESCRIPTION

Evolute shell with subtrapezoidal whorl section, large and flat umbilical wall. Flanks are almost flat in the last whorl and slightly rounded in the internal whorls. Venter is slightly rounded. Sculpture is characterized by strong rursiradiate ribs, springing, simple or in pairs, from primary ribs which, at their turn, originate from umbilical tubercles or bullae. Ribs are already developed from a diameter of 7 mm. All ribs slightly thicken at the ventrolateral margin and then cross the venter without interruption. No traces of peristome are visible. Due to the lack of any traces of suture line the diameter of the beginning of the body chamber cannot be observed. Measurements: see Table 16.

DISCUSSION

The studied specimen is poorly preserved thus making sculpture details not accurately visible. It shows however strong morphological similarities with one of the specimens figured by Gygi (1977: pl. 2, fig. 2) as "mittlere Variante" of the species *G. riazi*.

Gregoryceras devauxi Bert & Enay, 2004
(Figs 9A, B; 10)

?*Gregoryceras fouquei* – Atrops & Benest 1984: pl. 1, fig. 3 (non *Peltoceras fouquei* Killian, 1889).

Gregoryceras cf. *fouquei* – Schairer *et al.* 2003: 209, fig. 8 (3-5) (non *Peltoceras fouquei* Killian, 1889).

"*Gregoryceras devauxi*" – Bert 2004: 89, 98, pl. 17, fig. 1, pl. 18, figs 1-3, pl. 19, fig. 2, pl. 20, figs 1-3, pl. 21, figs 1-3, pl. 22, figs 1-5, text-fig. 17, 18, synonymy list.

Gregoryceras devauxi Bert & Enay, 2004: 456, pl. 1, fig. 1, pl. 2, figs 1-3, pl. 3, figs 1, 2, pl. 4, figs 1-3, pl. 5, figs 1-3, pl. 6, figs 1-5.

MATERIAL EXAMINED. — MI4N 8a/2, MI4N 8a/3, MI4W 6c/2 (*G.* cf. *devauxi*).

STRATIGRAPHIC DISTRIBUTION. — The largest specimen has been collected from bed 6c of section Monte Inici East, whereas the smaller ones have been collected in bed 8a of the same section. According to Bert (2004), the range of *G. devauxi* coincides with the range of the Schilli Subzone that is the second Subzone of the Middle Oxfordian Tranversarium Zone.

DESCRIPTION

Evolute shell with a subtrapezoidal whorl section characterized by flat flanks and a relatively large, almost flat, venter. Strong sculpture made of rursiradiate ribs which spring, single or in pairs, from strong, prominent, umbilical tubercles and/or bullae. The latter clearly originate from the base of the umbilical wall. Ribs slightly thicken in the upper part of the flank giving rise to small, rounded ventrolateral tubercles. Simple ribs, which do not reach the umbilical margin, are intercalated between the ribs originating from the umbilical tubercles. No bifucations are observed. All ribs cross the venter without interruption forming a gentle adapical convexity, although in the last quarter of the last whorl they tend to become straight. It is impossible to know whether the studied specimens bear the body chamber or not, as no sutures are visible.

The three specimens found at Monte Inici are not morphologically identical. Specimen MI4N 8a/2 shows umbilical bullae (or thickened primary ribs), whereas MI4N 8a/3 has a steep umbilical wall, a more spaced ribbing and thicker bullae that mimic prominent tubercles.

A fragment of a larger individual (specimen MI4W 6c/2 determined as *G.* cf. *devauxi*) is still septated at a

FIG. 9. — *Gregoryceras devauxi* Bert & Enay, 2004, from bed 8a of section Monte Inici East; **A**, specimen MI4N 8a/2; **B**, specimen MI4N 8a/3; **C**, *Gregoryceras ferchaudi* Bert, 2004, specimen MI3 11a/1 from interval 11 of section Castello Inici; **D**, *Gregoryceras* cf. *defayi* Bert, Marchand, Gygi, Delanoy, 2003, specimen MI3 9/8 from bed 9 of section Castello Inici; **E**, *Gregoryceras riazi* (de Grossouvre, 1917), specimen MI3 10/1 from interval 10 of section Castello Inici; **F**, *Gregoryceras* aff. *devauxi* Bert & Enay, 2004, specimen MI4W 6a/1 from bed 6a of section Monte Inici East. All figures natural size. Arrows indicate the beginning of the body chamber.

diametre of about 100-110 mm. Ribs have lost their adapical convexity but are still gently rursiradiate and form a ventrolateral tubercle (Fig. 10).

Measurements: see Table 17.

Discussion

The described specimens correspond to three morphologies that can be ascribed to *G. devauxi*. Specimen MI4N 8a/2 (Fig. 9A) recalls, at similar diameters, some specimens already figured in the literature:
– the specimen figured by Bert (2004: pl. 22, fig. 4), which differs in the presence of bifurcate ribs from the umbilical margin;
– the specimen figured by Gygi (1990: fig. 7) with the name *G. fouquei*;
– the specimen figured by Gemmellaro (1874: pl. 1, fig. 1) with the name *G. fouquei* (identification confirmed by D'Arpa & Meléndez 2002), although at the same diameter (i.e. up to the first third of the last whorl) our specimen is more evolute.
At a comparable diameter, specimen MI4N 8a/3 (Fig. 9B), which is characterized by definitely rursiradiate ribs, strongly resembles the one figured by Bert (2004) in pl. 21, fig. 2. It also shows some morphological similarities with other specimens figured by Bert (2004: pl. 20, fig. 1; pl. 22, fig. 1) and also to the inner whorls of the holotype (Bert 2004: pl. 17, fig. 1c) but it differs because of its wider umbilicus.

Specimen MI4W 6c/2 (Fig. 10) resembles the specimen figured by Bert (2004) in pl. 17, fig. 1. It also may recall forms ascribed to *G. fouquei* or *G.* aff. *fouquei* (see D'Arpa & Meléndez 2004). However, no splitting of the ventrolateral tubercle occurs and its ribs are gently rursiradiate.

The differences between *G. devauxi* and the forms ascribed to both *G.* aff. *fouquei* and *G. fouquei* have been described by Bert (2004), to whose paper we refer the reader.

Gregoryceras aff. *devauxi* Bert & Enay, 2004 (Fig. 9F)

Material examined. — MI4W 6a/1.

Stratigraphic distribution. — The specimen has been collected in bed 6a of section Monte Inici East. According to Bert (2004) *G. tranversarium* is limited to the base of the middle Oxfordian Transversarium Zone, Luciaeformis Subzone whilst *G. devauxi* has a vertical range coinciding with that of the Schilli Subzone. The specimen described can be assigned to the middle or upper part of the Transversarium Zone.

Description

Evolute shell with a subtrapezoidal whorl section. Flanks are gently rounded in the first half of the last whorl and then almost flat in the second half; they converge towards a relatively narrow, gently rounded venter. The umbilical edge is rounded; the umbilical wall is oblique and well developed in the last whorl. The sculpture is not visible up to a diameter of almost 34 mm. Rursiradiate ribs spring, single or in pairs, from rounded umbilical tubercles. In the last quarter of the last whorl ribs spring from strong, elevated umbilical bullae and tend to become rectiradiate. Due to the poor preservation of the umbilical wall it seems that ribs originate from the umbilical margin, except the four last preserved bullae that start from the upper part of the umbilical wall. No rib branching above the inner third of the flank is observed in the last two thirds of the last whorl (the first third is insufficiently preserved). Ribs thicken on the ventrolateral margin where they tend to form extremely weak tubercles. Ribs cross the venter strengthened and without interruption; they are here gently convex adapically, although in the last quarter of the last whorl they tend to become almost straight. As weak traces of sutures are visible up to a diameter of almost 45 mm only, it is impossible to know whether this specimen bears the body chamber or not. Measurements: see Table 18.

Discussion

The ribbing of *G.* (*G.*) *transversarium* is strongly rursiradiate and often shows biplicate ribs in the outer third of the flank. The ribbing of the specimen described recalls *G.* (*G.*) *fouquei*, which differs because of its less evolute coiling and its vertical umbilical wall. *Gregoryceras devauxi*, the species that follows *G. tranversarium* in the anagenetic succession of chronospecies proposed by Bert (2004), differs because of its clearly developed tubercles on the ventrolateral margin. The described specimen likely corresponds to an immature individual of

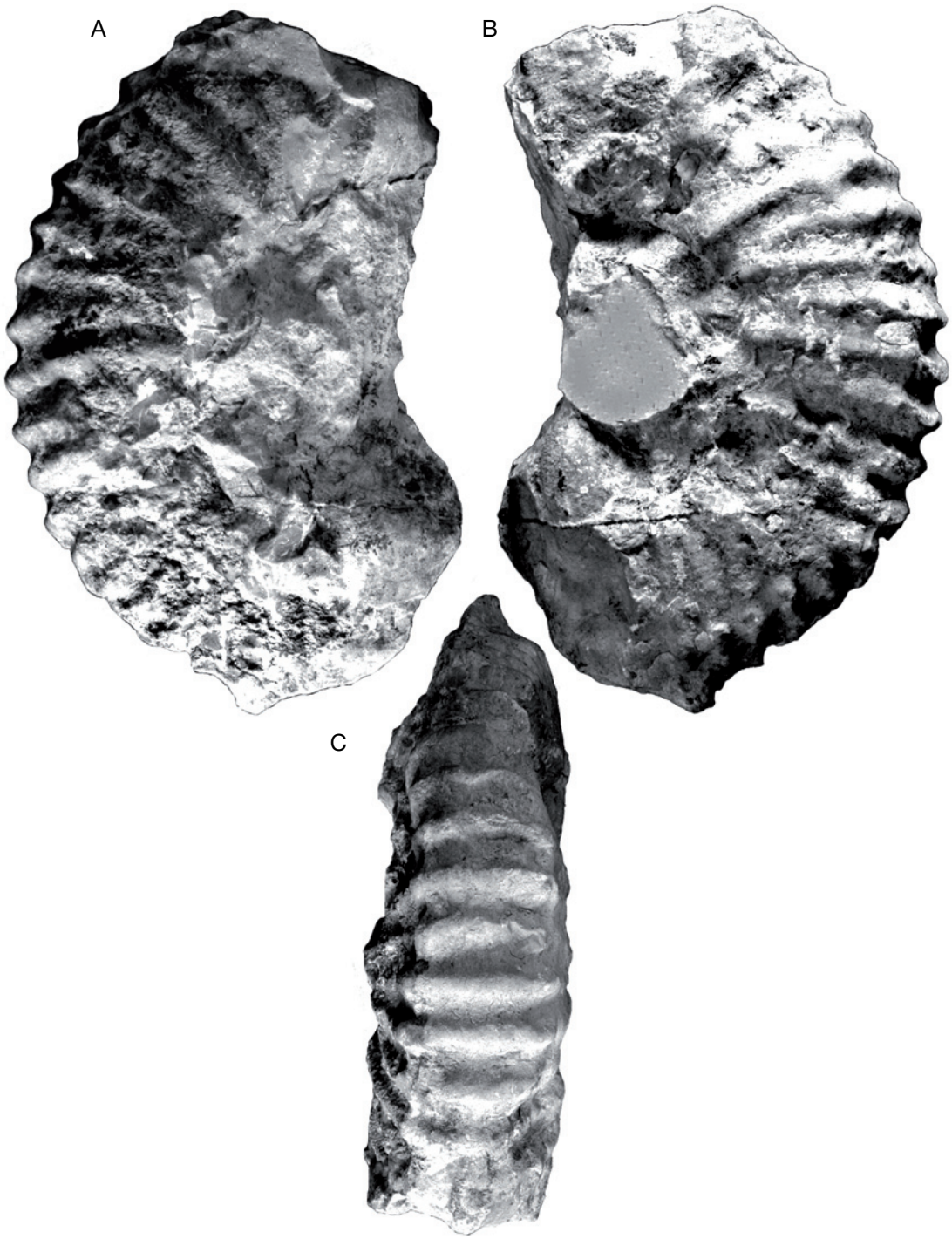


FIG. 10. — Entirely septated specimen identified as *Gregoryceras* cf. *devauxi* Bert & Enay, 2004, specimen MI4W 6c/2 from bed 6c of section Monte Inici East: **A**, **B**, lateral views; **C**, ventral view. All figures natural size.

G. devauxi as suggested by the comparison, at the same diameter, with some of the specimens figured by Bert (2004: pl. 19, figs 1, 2).

Subfamily EUASPIDOCERATINAE Spath, 1931

Genus *Euaspidoceras* Spath, 1931

TYPE SPECIES. — *Ammonites perarmatus* J. Sowerby, 1822.

Euaspidoceras cf. ***lytoceroide***?
(Gemmellaro, 1876)
(Fig. 7D)

MATERIAL EXAMINED. — MI3 9/9.

STRATIGRAPHIC DISTRIBUTION. — Bed 9 of section Castello Inici, which has been assigned to the Middle Oxfordian Plicatilis Zone.

DESCRIPTION
The specimen is an eroded internal mold of an aspidoceratid whose size is approximately 85 mm. The inner whorls are dissolved but traces of ventrolateral tubercles are visible from a diameter of 7 mm. Eight tubercles per whorl exist at a diameter of approximately 21 mm. No traces of umbilical tubercles and ribs are visible. The preserved portion of the last whorl shows traces of ventrolateral tubercles and corroded folds that likely are rib remains. Because any traces of suture lines are visible it is impossible to state whether this specimen bears the body chamber or not.

Due to the incomplete preservation, measurements cannot be taken.

DISCUSSION
The preservation of the specimen is extremely poor but the tubercles of the inner whorls and the coiling aspect suggest a tentative comparison with *E. lytoceroide*.

Euaspidoceras cf. ***oegir*** (Oppel, 1863)
(Fig. 7C)

MATERIAL EXAMINED. — MI4N 6d/1.

STRATIGRAPHIC DISTRIBUTION. — The specimen has been collected in bed 6d of section Monte Inici East, assigned to the Transversarium Zone. According to Bonnot & Gygi (2001), this species occurs within the Transversarium Zone from the top of the Antecedens Subzone up to the top of the Luciaeformis Subzone. In Bert's (2004) stratigraphic scheme this stratigraphic range corresponds to an interval spanning from the top of the Antecedens Subzone of Plicatilis Zone *sensu* Bert 2004 up to the top of the Luciaeformis Subzone of the Transversarium Zone *sensu* Bert 2004.

DESCRIPTION
The specimen is an entirely septated internal mould showing an evolute coiling. The whorl section is subquadratic, the flanks are flat. Neither the umbilical edge, nor the umbilical wall, is developed. The sculpture is made of two rows of tubercles, periumbilical and ventrolateral. The periumbilcal tubercles are rather bullae, i.e. they are shortly stretched along the height, whereas the ventrolateral tubercles have the aspect of spines. An extremely weak rib links the tubercles of the two rows. The preservation of the early whorls does not allow precise measurement of the diameter where tubercles begin. Nevertheless, the first visible ventrolateral spine occurs at a diameter of almost 16 mm, whereas the first ventrolateral bulla is visible at an approximate diameter of 18 mm. Measurements: see Table 19.

DISCUSSION
The preservation of this single specimen is far from satisfactory. However, its visible characters suggest the comparison with *E. oegir*. Our specimen shows, at the same diameter, close ornamental characters to the well preserved specimens of this species recently illustrated by Bonnot & Gygi (2001) and only differs because of its lower whorl height.

Euaspidoceras paucituberculatum (Arkell, 1927)
(Fig. 11)

Aspidoceras paucituberculatum Arkell, 1927: pl. 2, fig. 2.

Aspidoceras (*Euaspidoceras*) *paucituberculatum* – Arkell 1940: 210, pl. 45, figs 2-5, pl. 46, figs 1-4, pl. 47, figs 1, 2, text-fig. 74, synonymy list.

Euaspidoceras paucituberculatum – Bonnot & Gygi 2001: 431, pl. 1, fig. 4.

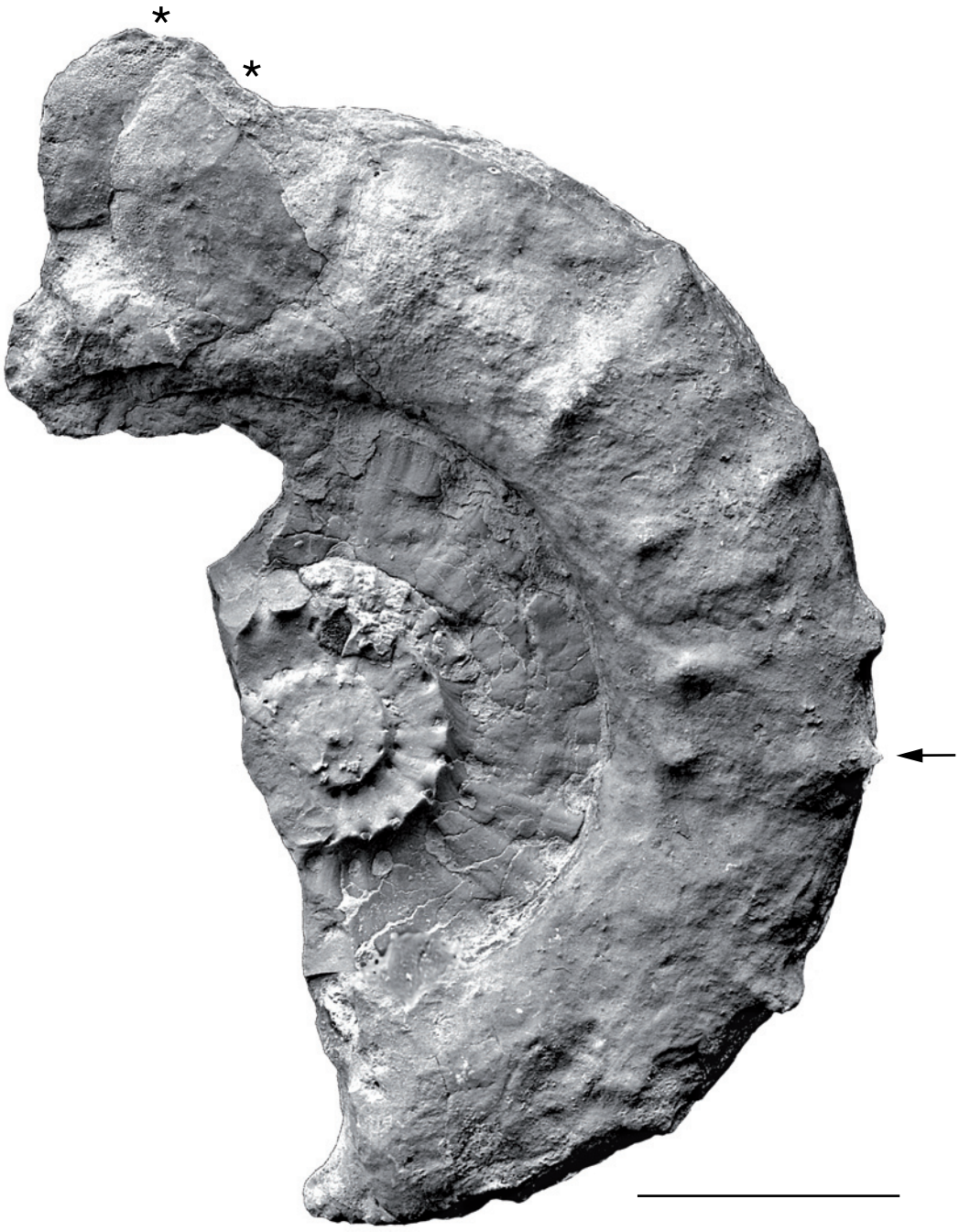


FIG. 11. — *Euaspidoceras paucituberculatum* (Arkell, 1927), specimen MI3 8 top-9/1 from the boundary between beds 8 and 9 of Castello Inici section. The two asterisks indicate two laevaptychi. The arrow indicates the beginning of the body chamber. Scale bar: 5 cm.

MATERIAL EXAMINED. — MI3 8 top-9/1.

STRATIGRAPHIC DISTRIBUTION. — The specimen has been collected at the boundary between beds 8 and 9 of Castello Inici section and possibly it belongs to the very base of bed 9. This species is reported from the Middle Oxfordian Plicatilis Zone.

DESCRIPTION

Incomplete specimen of a large individual characterized by an evolute shell whose diameter could have reached almost 210 mm. The visible inner whorls are preserved as a cast while the last whorl is an inner mould. Up to a diameter of almost 22 mm the sole sculptural elements preserved are external tubercles (these corresponded to spines almost perpendicular to the flank as demonstrated by their impression on the sediment) located on the ventrolateral edge. An umbilical row of tubercles is visible at 30 mm but probably appears around 22-24 mm. The two rows of tubercles correspond to extremities of shallow ribs. The interspaces between two ribs bear fine, radial growth-lines. Between 80 and 115 mm the sculptural characteristics are poorly visible, with the exception of growth-lines that appear to be rursi-radiate on the wide, oblique, umbilical wall. The second half of the last whorl belongs to the body chamber and is characterized by spaced ribs that bear umbilical and ventrolateral tubercles.

DISCUSSION

The preservation of the studied specimen does not allow a firm identification. The succession of ornamental stages is similar to the one described by Arkell (1940: 212, 213) but in our specimen the onset of the two rows of tubercles is recorded at lower diameters. Two laevaptychi are visible at the end of the last whorl but it is difficult to state whether they belonged to this individual or not.

Euaspidoceras cf. ***radisense*** (d'Orbigny, 1850) (Fig. 12C)

MATERIAL EXAMINED. — MI4N 8 "top"/8.

STRATIGRAPHIC DISTRIBUTION. — The specimen has been collected at the top of bed 8 of section Monte Inici East, assigned with doubt to the Hauffianum Subzone of the late Oxfordian Bimammatum Zone. The holotype of *E. radisense* comes from of the Bimammatum Zone, probably the lower part (Hantzpergue 1994).

DESCRIPTION

Evolute shell of about 92 mm of diameter. The whorl section is subrectangular, with flat flanks, rounded ventrolateral margins and a large, rounded venter. The umbilical area is badly preserved, but the umbilical margin appears to be rounded and the umbilical wall is seemingly vertical. Small, rounded tubercles are developed on the umbilical margin of the last whorl. Shallow ribs are visible in the last portion of the last whorl. Due to the lack of any traces of suture line the diameter of the beginning of the body chamber cannot be observed. Measurements: see Table 20.

DISCUSSION

Despite its insufficient preservation this specimen shows the characteristics of d'Orbigny's species. *Clambites clambus* (Oppel, 1863) shows morphological similarities, namely the shape of the whorl section and the presence of shallow ribs. However, it differs because umbilical tubercles are almost absent.

Subfamily ASPIDOCERATINAE Zittel, 1895

Genus *Aspidoceras* Zittel, 1868

TYPE SPECIES. — *Ammonites rogoznicensis* Zeuschner, 1846.

?***Aspidoceras*** gr. ***binodum*** (Oppel, 1863) (Fig. 7A)

MATERIAL EXAMINED. — MI4N 6F/2.

STRATIGRAPHIC DISTRIBUTION. — The specimen has been collected in bed 6f of section Monte Inici, which is assigned to the upper part of the Transversarium Zone, Schilli Subzone, because of the occurrence of *G. devauxi* in beds 6c and 8a. This specimen could therefore represent the oldest record of the genus *Aspidoceras*. Olóriz *et al.* (1999: 91) stress the FAD of *Aspidoceras* gr. *binodum* at the bottom of the Bimammatum Zone or even in the Hypselum Subzone. In the Subbetic Zone the genus

Aspidoceras appears in the upper part of the Bifurcatus Zone with *A. sesquinodosum* (Fontannes, 1876) whilst *A. binodum* appears at the base of the Bimammatum Zone (Olóriz *et al*. 1998). New findings of better-preserved specimens are needed to confirm this early occurrence of *Aspidoceras*.

DESCRIPTION

Fragment of the internal mold of an individual that reached a diameter of at least 100 mm. The whorl section is depressed, with rounded venter and flanks. A row of tubercles is developed right below the lower half of the flank. A periumbilical row of tubercles is also developed but poorly visible due to insufficient preservation of the umbilical edge. No sutures are visible.

DISCUSSION

The aspect of the whorl section associated to the rows of tubercles strongly recall *A. binodum*. Nevertheless, the identification of our specimen is purely tentative because of its incomplete preservation.

Subfamily PHYSODOCERATINAE Schindewolf, 1925

Genus *Physodoceras* Hyatt, 1900

TYPE SPECIES. — *Ammonites circumspinosus* Quenstedt, 1849.

Physodoceras cf. ***wolfi*** (Neumayr, 1873) (Fig. 12A)

MATERIAL EXAMINED. — MI4N 8c/3.

STRATIGRAPHIC DISTRIBUTION. — The specimen has been collected in bed 8c of section Monte Inici East, assigned with doubt to the Hauffianum Subzone of the Late Oxfordian Bimammatum Zone.

DESCRIPTION

Moderately evolute shell, with a deep umbilicus and a large whorl section. Whorl flanks are almost flat and converge towards a rounded, large venter. The umbilical wall is steep and the umbilical margin is rounded. Due to crushing, the whorl section is not correctly observable in the body chamber. The ornamentation is made of small, rounded, periumbilical tubercles. The suture line is characterized by L as deep as E and S_1 slightly higher than S_2. Measurements: see Table 21.

DISCUSSION

The preservation does not allow a firm identification of this specimen. A similar species is *P. insulanum* (Gemmellaro, 1874), which has been considered synonym of *P. wolfi* by Checa (1985). In the recent revision of the Gemmellaro species, D'Arpa & Meléndez (2002) keep the latter distinct from *P. wolfi* because of the wider whorl-breadth and the stronger tubercles. The characters visible in the phragmocone of our specimen suggest the comparison with *P. wolfi*.

Genus *Benetticeras* Checa, 1985

TYPE SPECIES. — *Benetticeras benettii* Checa, 1985.

Benetticeras cf. ***benettii*** Checa, 1985 (Fig. 12B)

MATERIAL EXAMINED. — MI4W 8c top/1.

STRATIGRAPHIC DISTRIBUTION. — The specimen has been collected in bed 8d of section Monte Inici East, assigned with doubt to the Hauffianum Subzone of the Late Oxfordian Bimammatum Zone.

DESCRIPTION

Moderately involute shell. Depressed whorl section with convex flanks, large and rounded venter. The umbilical edge is rounded and the umbilical wall is almost vertical. Periumbilical tubercles are large and tend to widen on the flank. The suture line is characterized by L as deep as E and S_1 almost as high as S_2. Measurements: see Table 22.

DISCUSSION

The preservation of this specimen does not allow a more accurate determination. Nevertheless coiling, whorl and tubercle shapes are typical of *B. bene ttii*. The species *B. vaii* Sarti, 1993 is more evolute.

Family ATAXIOCERATIDAE Buckman, 1921
Subfamily ATAXIOCERATINAE Buckman, 1921
Genus *Orthosphinctes* Schindewolf, 1925

Subgenus *Orthosphinctes* Schindewolf, 1925

TYPE SPECIES. — *Ammonites tiziani* Oppel, 1863.

Orthosphinctes* (*O.*) *tiziani (Oppel, 1863)
(Fig. 13A)

Ammonites tiziani Oppel, 1863: 246.

Perisphinctes tiziani – Choffat 1893: 32, pl. 5, fig. 8.

Perisphinctes tiziani var. *occidentalis* Choffat, 1893: 32, pl. 5, figs 5-7.

?*Perisphinctes* aff. *tiziani* – Choffat 1893: 33, pl. 7, fig. 1.

Pars *Perisphinctes tiziani* – Wegele 1929: 44, pl. 1, fig. 4a, b, *non* 5.

?*Perisphinctes* (*Orthosphinctes*) *tiziani* – Geyer 1961: 19, pl. 1, fig. 1, pl. 2, fig. 1, pl. 6, fig. 3.

Orthosphinctes (*Orthosphinctes*) *tiziani* – Matyja & Wierzbowski 1997: pl. 6, fig. 1.

MATERIAL EXAMINED. — MI4N 8 "top"/11.

STRATIGRAPHIC DISTRIBUTION. — The specimen has been collected in bed 8d of section Monte Inici East, assigned with doubt to the Hauffianum Subzone of the Late Oxfordian Bimammatum Zone. Olóriz *et al.* (1998, 1999) have reported this species from both the Bimammatum and Planula zones.

DESCRIPTION
Evolute, serpenticone shell. The whorl section is subcircular, characterized by rounded flanks and a large, rounded venter. Flanks slightly flatten in the last half of the last whorl. The umbilical margin is round, the umbilical wall is low and poorly developed. The ornamentation is made of radial, mostly biplicate ribs up to the first third of the last whorl, then, after a deep constriction ribbing becomes slightly prorsiradiate and some intercalatory ribs appear. The point of branching is very high, approximately in the upper fourth of the flank. Three constrictions are visible on the last whorl; one of them is deeper, oblique to the ribbing and adorally bounded by a swollen rib. The peristome is not preserved and the suture line is not visible. Measurements: see Table 23.

DISCUSSION
This specimen shows morphological affinities with the lectotype of *O.* (*O.*) *tiziani* selected by Wegele (1929: pl. 1, fig. 4), from which it differs because of the lower rib density.

Orthosphinctes* (*O.*)** aff. ***fontannesi
(Choffat, 1893)
(Fig. 13B)

MATERIAL EXAMINED. — MI4N 8 "top"/3.

STRATIGRAPHIC DISTRIBUTION. — The specimen has been collected in bed 8d of section Monte Inici East, which has been assigned with doubt to the Hauffianum Subzone of the late Oxfordian Bimammatum Zone. *O.* (*O.*) *fontannesi* has been reported from older layers, namely from the lower part of the Bimammatum Zone by Olóriz *et al.* (1999) and Caracuel *et al.* (2000).

DESCRIPTION
Evolute shell with an ovate, compressed whorl section. The umbilical wall is low, the umbilical edge is rounded and whorl flanks converge towards the venter. The ornamentation is poorly visible in the details and it mainly consists of biplicate and intercalatory ribs; simple ribs rarely occur. In the last quarter of the last whorl two constrictions are visible: the adapical one is deep and oblique to ribbing, the second is shallow and almost parallel to ribbing. The mouth is not preserved and no traces of suture line are visible. It is therefore impossible to recognize whether the specimen is entirely septated or not. Measurements: see Table 24.

FIG. 12. — **A**, *Physodoceras* cf. *wolfi* (Neumayr, 1873), specimen MI4N 8c/3 from bed 8c of section Monte Inici East; **B**, *Benetticeras* cf. *benettii* Checa, 1985, specimen MI4W 8c top/1 from bed 8d of section Monte Inici East; **C**, *Euaspidoceras* cf. *radisense* (d'Orbigny, 1850), specimen MI4N 8 "top"/8, from bed 8top of section Monte Inici East. All figures natural size. Arrows indicate the beginning of the body chamber.


A
B
C

Discussion

The identification of this specimen is difficult because of its insufficient preservation. It is impossible to state whether it is a microconch or an immature macroconch because any traces of the suture line are visible. From a pure morphologic point of view it shows some morphological similarities with *O.* (*O.*) *fontannesi* (Choffat 1893: 40, specimens figured in pl. 9, figs 1 and 3 only). However, with respect to our specimen, this species shows finer ribs, a wider umbilicus and a different position of the constrictions in the last whorl. At a comparable diameter *O.* (*O.*) *mogosensis* (Choffat 1893: 50, pl. 12, figs 5-8) has a narrower umbilicus and a slightly narrower ventral area.

Subgenus *Ardescia* Atrops, 1982

Type species. — *Ataxioceras desmoides* Wegele, 1929.

Orthosphinctes* (*Ardescia*) *beticus
Caracuel, Olóriz & Rodriguez-Tovar, 1999
(Fig. 13C)

Orthosphinctes (*Ardescia*) *betica* Caracuel, Olóriz & Rodriguez-Tovar, 1999: 112, figs 3, 4.

Material examined. — MI4N top10/1.

Stratigraphic distribution. — Top of bed 10 of section Monte Inici East, Platynota Zone. It has been reported from the middle part of the Platynota Zone (Caracuel *et al*. 1999: fig. 2).

Description

Evolute, planulate shell. Subelliptical whorl section with slightly rounded flanks that converge towards a rounded venter. The umbilical wall is well developed and the umbilical margin is rounded. The ornamentation is characterized by prorsiradiate ribs, which branch at the outer third of the flank. An intercalatory rib is observed between two bifurcates. At least three constrictions are visible on the last whorl; the deepest one, which is located close to the end of the last whorl, shows a slight adoral convexity. No traces of peristome and sutures are preserved. Measurements: see Table 25.

Discussion

The poor preservation of this specimen does not allow the detailed study of the ornamental characters. It shows strong morphological similarities in both the ornamentation and the shell structure with the specimen studied by Caracuel *et al.* (1999: figs 3, 4), named *O.* (*Ardescia*) *beticus*. Species of the subgenus *Ardescia* described by Atrops (1982) from South-East France show different rib characters.

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FIG. 13. — **A**, *Orthosphinctes* (*Orthosphinctes*) *tiziani* (Oppel, 1863), specimen MI4N 8 "top"/11 from bed 8d of section Monte Inici East; **B**, *Orthosphinctes* (*Orthosphinctes*) aff. *fontannesi* (Choffat, 1893), specimen MI4N 8 "top"/3, from bed 8d of section Monte Inici East; **C**, *Orthosphinctes* (*Ardescia*) *betica* Caracuel, Olóriz & Rodriguez-Tovar, 1999, specimen MI4N top10/1 from bed 10 of section Monte Inici East. All figures natural size. Arrows indicate the beginning of the body chamber.

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APPENDIX

Standard dimensions for normally coiled ammonites are given in millimetres and as percentages of the diameter. Abbreviations: **D**, maximum diameter; **N/2**, number of primary ribs per half-whorl; **S/2**, number of secondary ribs per half-whorl; **Ph**, diameter of the end of the phragmocone ("n" means that the specimen is entirely septate); **Uw**, umbilical width; **Wb**, whorl-breadth; **Wh**, whorl height; **Wb/Wh**, degree of compression of the whorl.

TABLE 1. — Measurements of *Calliphylloceras benacense* (Catullo, 1847).

Specimen	D	Wh	Wb	Uw	Wb/Wh	Ph
MI4N 8b/2	≈ 45	-	-	-	-	37
	at 42	24.5 (0.58)	14 (0.33)	2 (0.048)	0.57	
MI4W 8b/c/2	58	35.0 (0.60)	-	2 (0.030)	-	-

TABLE 2. — Measurements of *Sowerbyceras tortisulcatum* (d'Orbigny, 1841).

Specimen	D	Wh	Wb	Uw	Wb/Wh	Ph
MI4N 6e/5	90	≈ 42 (0.47)	-	≈ 18 (0.20)	-	≈ 55
	at 68	32 (0.47)	-	13 (0.19)	-	
MI4N 6f/1	≈ 73	-	-	-	-	≈ 53
	at 69	≈ 33 (0.48)	-	≈ 14 (0.20)	-	
MI4N 6c/1	55	27 (0.49)	-	≈ 11 (0.20)	-	≈ 38
	at 45	≈ 23 (0.51)	19 (0.42)	≈ 9 (0.20)	0.82	
MI4N 8a/1	66	≈ 33 (0.50)	-	≈ 13 (0.20)	-	≈ 42
MI4N 8b/3	67	33 (0.49)	-	14 (0.21)	-	≈ 43
	at 51	25.5 (0.50)	-	9.5 (0.19)	-	
MI4N 6e/6	59	≈ 30 (0.51)	-	≈ 13 (0.22)	-	≈ 38

TABLE 3. — Measurements of *Holcophylloceras polyolcum* (Benecke, 1866).

Specimen	D	Wh	Wb	Uw	Wb/Wh	Ph
MI4N 8d/1	≈ 85.5	46 (0.54)	-	14 (0.16)	-	59
	at 66	33 (0.50)	19 (0.29)	12 (0.18)	0.63	
MI4N 8c/2	≈ 97.0	-	-	-	-	62
	at 90	47.5 (0.53)	-	10 (0.11)	-	
MI4W 8b/c/1	71	35 (0.49)	≈ 20 (0.28)	13 (0.18)	0.57	≈ 46
	at 48	24.5 (0.51)	14.5 (0.30)	≈ 8 (0.17)	0.55	

TABLE 4. — Measurements of *Lissoceratoides erato* (d'Orbigny, 1850).

Specimen	D	Wh	Wb	Uw	Wb/Wh	Ph
MI4N 8b/1	≈ 70	31 (0.44)	≈ 17 (0.24)	19 (0.27)	≈ 0.55	≈ 55

TABLE 5. — Measurements of *Streblites frotho* (Oppel, 1863).

Specimen	D	Wh	Wb	Uw	Wb/Wh	Ph
MI4N 8b/1	≈ 95	-	-	-	-	≈ 55
	at 93	45 (0.48)	-	7.0 (0.075)	-	
	at 74	40 (0.54)	-	2.5 (0.034)	-	

TABLE 6. — Measurements of *Subdiscosphinctes* sp.

Specimen	D	Wh	Wb	Uw	Wb/Wh	N/2	Ph
MI4N 9/4	≈ 95	-	-	-	-	-	≈ 57
	at 82	27.5 (0.335)	-	33.5 (0.41)	-	≈ 30	
	at 76	25.0 (0.330)	18.5 (0.24)	29.5 (0.39)	0.74	-	

TABLE 7. — Measurements of *Sequeirosia bocconii* (Gemmellaro, 1871).

Specimen	D	Wh	Wb	Uw	Wb/Wh	N/2
MI4W 6c/3	≈ 258.5	≈ 65.6 (0.25)	≈ 45 (0.17)	≈ 156.4 (0.605)	≈ 0.69	19

TABLE 8. — Measurements of *Passendorferia* (*Enayites*) cf. *rozaki* Meléndez, 1989.

Specimen	D	Wh	Wb	Uw	Wb/Wh	N/2	Ph
MI4N 8c/1	79	20 (0.25)	≈ 20 (0.25)	43 (0.54)	≈ 1.000	30	?50
	at 60	16 (0.27)	18 (0.30)	32 (0.53)	≈ 1.125	28	

TABLE 9. — Measurements of *Passendorferia* (*Enayites*) aff. *gygii* Brochwicz-Lewinski & Rozak, 1976.

Specimen	D	Wh	Wb	Uw	Wb/Wh	N/2
MI4N 8 “top”/6	60	16.0 (0.27)	-	30 (0.50)	-	30
	at 48.5	14.5 (0.30)	-	24 (0.49)	-	≈ 27

TABLE 10. — Measurements of ?“*Passendorferia*” aff. *teresiformis* Brochwicz-Lewinski, 1973.

Specimen	D	Wh	Wb	Uw	Wb/Wh	Ph
MI4N 8 “top”/5	≈ 87	-	-	-	-	≈ 65
	at 78	23 (0.29)	≈ 20 (0.26)	41 (0.525)	0.87	

TABLE 11. — Measurements of *Geyssantia geyssanti* Meléndez, 1989.

Specimen	D	Wh	Wb	Uw	Wb/Wh	N/2
MI4N 8-9/1	≈ 39	-	-	-	-	22
	at 32	≈ 13.5 (0.42)	≈ 7 (0.22)	18 (0.56)	≈ 0.52	21

TABLE 12. — Measurements of *Nebrodites* aff. *contortus* (Neumayr, 1871).

Specimen	D	Wh	Wb	Uw	Wb/Wh	N/2	Ph
MI4N 8d/2	84	18.5 (0.22)	≈ 15 (0.18)	51 (0.60)	0.81	36	≈ 54
	at 68	16.0 (0.23)	≈ 13 (0.19)	39 (0.57)	0.81	35	

TABLE 13. — Measurements of *Nebrodites passendorferiiforme* Caracuel, Olóriz & Rodriguez-Tovar, 1999.

Specimen	D	Wh	Wb	Uw	Wb/Wh	N/2	Ph
MI4W 10top/2	32.5	7 (0.21)	≈ 7 (0.21)	16 (0.49)	≈ 1	≈ 27	≈ 25

TABLE 14. — Measurements of *Nebrodites* cf. *hospes* (Neumayr, 1873).

Specimen	D	Wh	Wb	Uw	Wb/Wh	N/2	Ph
MI4W 10top/3	≈ 85	-	-	-	-	-	≈ 70
	at 59	14.5 (0.245)	≈ 13 (0.22)	≈ 32 (0.54)	≈ 0.90	≈ 27	

TABLE 15. — Measurements of *Gregoryceras riazi* (de Grossouvre, 1917). All measures have been taken between the ribs.

Specimen	D	Wh	Wb	Uw	Wb/Wh	N/2	Ph
MI3 10/1	85	29 (0.34)	≈ 24.5 (0.29)	38 (0.45)	0.84		≈ 55

TABLE 16. — Measurements of *Gregoryceras ferchaudi* Bert, 2004. All measures have been taken between the ribs.

Specimen	D	Wh	Wb	Uw	Wb/Wh	N/2
MI 3 11a/1	67	23.5 (0.35)	≈ 23 (0.34)	30.5 (0.45)	≈ (0.98)	

TABLE 17. — Measurements of *Gregoryceras devauxi* Bert & Enay, 2004. All measures have been taken between the ribs.

Specimen	D	Wh	Wb	Uw	N/2
MI4N 8a/2	≈ 72	25.5 (0.35)	-	≈ 31 (0.43)	24
MI4N 8a/3	≈ 73	≈ 24.0 (0.33)	-	31 (0.42)	-

TABLE 18. — Measurements of *Gregoryceras* aff. *devauxi* Bert & Enay, 2004. All measures have been taken between the ribs.

Specimen	D	Wh	Wb	Uw	Wb/Wh	N/2
MI4W 6a/1	71	23.5 (0.33)	-	31.5 (0.440)	-	24
	at 53	19.0 (0.36)	≈ 18 (0.34)	≈ 22.0 (0.415)	≈ 0.95	-

TABLE 19. — Measurements of *Euaspidoceras* cf. *oegir* (Oppel, 1863).

Specimen	D	Wh	Wb	Uw	Ph
MI4N 8 “top”/8	≈ 59	≈ 18 (0.305)	-	28 (0.47)	n
	at 50	16 (0.320)	-	23 (0.46)	

TABLE 20. — Measurements of *Euaspidoceras* cf. *radisense* (d’Orbigny, 1850).

Specimen	D	Wh	Wb	Uw	Wb/Wh
MI4N 8 “top”/8	at ≈ 84	33 (0.390)	≈ 29 (0.345)	-	≈ (0.88)
	at 74	≈ 30 (0.405)		≈ 25.0 (0.34)	
	62	26 (0.420)		19.5 (0.31)	

TABLE 21. — Measurements of *Physodoceras* cf. *wolfi* (Neumayr, 1873).

Specimen	D	Wh	Wb	Uw	Wb/Wh	Ph
MI4N 8c/3	≈ 119	≈ 56 (0.47)	-	30.0 (0.25)	-	84
	at 84	42 (0.50)	39.5 (0.47)	18.5 (0.22)	0.94	

TABLE 22. — Measurements of *Benetticeras* cf. *benettii* Checa, 1985.

Specimen	D	Wh	Wb	Uw	Wb/Wh	Ph
MI4N 8 “top”/9	79	41 (0.52)	-	17 (0.215)	-	n

TABLE 23. — Measurements of *Orthosphinctes* (*O.*) *tiziani* (Oppel, 1863).

Specimen	D	Wh	Wb	Uw	Wb/Wh	N/2	S/2	Ph
MI4N 8 “top”/11	96	≈ 27 (0.28)	-	≈ 57 (0.59)	-	20	50	? 59
	at 77	23 (0.30)	21.5 (0.28)	≈ 40 (0.52)	0.93	≈ 25	52	

TABLE 24. — Measurements of *Orthosphinctes* (*O.*) aff. *fontannesi* (Choffat, 1893).

Specimen	D	Wh	Wb	Uw	Wb/Wh	N/2	Ph
MI4N 8 “top”/3	≈ 100	≈ 33.0 (0.33)	-	44 (0.44)	-	23	≈ 60
	at ≈ 78	23.5 (0.30)	19 (0.24)	≈ 36 (0.46)	0.81	≈ 26	

TABLE 25. — Measurements of *Orthosphinctes* (*Ardescia*) *beticus* Caracuel, Olóriz & Rodriguez-Tovar, 1999.

Specimen	D	Wh	Wb	Uw
MI4N 8 top10/1	65	20.5 (0.31)	-	29 (0.45)
	at 54	18.5 (0.34)	-	22 (0.41)