

## Upper Jurassic ammonites from Seno di Guidaloca (Western Sicily)

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(with 2 figures and Plates 20–22)

### Abstract

A sea-shore profile, in the vicinity of the west Sicilian Monte Inici, yielded a moderately rich ammonite assemblage of Kimmeridgian and Tithonian age. The bed-by-bed collected ammonites and the additional specimens coming from the loose blocks, were ranged into 25 taxa. The Upper Kimmeridgian Beckeri Zone, and the Tithonian succession of the Hybonotum, Darwini, Semiforme and Microcanthum and Durangites Zones were recognized. Although these are not new for western Sicily, some of the ammonites were documented for the first time from the region.

Key words: Upper Jurassic, Ammonoidea, Sicily, biostratigraphy

### Introduction

During the late 1980s, a joint research project was established between Università di Napoli and Eötvös University, Budapest. In the frame of this cooperation, a short field work was done in Sicily, with a special

focus on the Upper Jurassic ammonitiferous rocks. Several localities were visited, and one of them, Guidaloca, was sampled bed-by-bed.

### Locality and profile

The studied profile is situated in Western Sicily, on the seaside, between the picturesque city of Castellamare del Golfo and the remote village of Scopello (Fig. 1a). This region is the westernmost part of the Palermo Mountains, and the section is located on the foothills of Monte Inici. Paleogeographically, this region belongs to the Trapanese Pelagic Carbonate Platform (CATALANO & D'ARGENIO, 1979, 1981).

First data on the Upper Jurassic ammonite fauna of this area were given by G. G. GEMMELLARO (1872–1882) and M. GEMMELLARO (1922). Because both the Kimmeridgian and Lower Tithonian is in rubbly-weathering, nodular, light colored limestone facies, the papers above contain mixed ammonites of both stages.

More precisely obtained Jurassic cephalopod data of this region were summarized by ARKELL (1954). In this paper important sections of Rocca che Parra, Monte Bonifato, Balata and Monte Inici were figured, and ammonites were collected from several horizons, ranging from Lower Bathonian to Tithonian. Concerning Upper Jurassic, different levels of Oxfordian and Kimmeridgian,

including the well documented Beckeri Zone, as well as Lower and Upper Tithonian were recognized.

In the monograph of CHRIST (1960) many Oxfordian ammonites were figured, but there are only a very few data on the Kimmeridgian and Tithonian cephalopods.

The Santa Anna section in southwestern Sicily is the only Upper Jurassic profile where a modern, detailed and complex biostratigraphic study was made (DE WEVER et al. 1986).

The Guidaloca outcrop (Fig. 1a) can be found in a small bay, close to a camping site, where the road gets very close to the shore. Here, in the eastern part of the small bay, the light colored, nodular, well bedded limestone forms vertical cliffs. Ammonites were collected from the wall, as well as from the loose blocks. The simplified aspect of the section, and the position of the bed numbers are indicated on Fig. 1b. Although certain beds were flexuous, and small faults disturbed the profile, the main succession seemed to be clear. Each circa 1 metre of the thinly layered, very nodular limestone was regarded as a separate "bed".

Ammonites were relatively rich especially in the lower part of the profile, and in certain fallen blocks. Megafossils were very rare, or lacking in the cherty rocks below and above the numbered part of the section. The covering

white, cherty, platy limestone is of Biancone type. This Lower Cretaceous rocks form impressive cliffs at Cala Bianca, in the vicinity of the Guidaloca Bay.

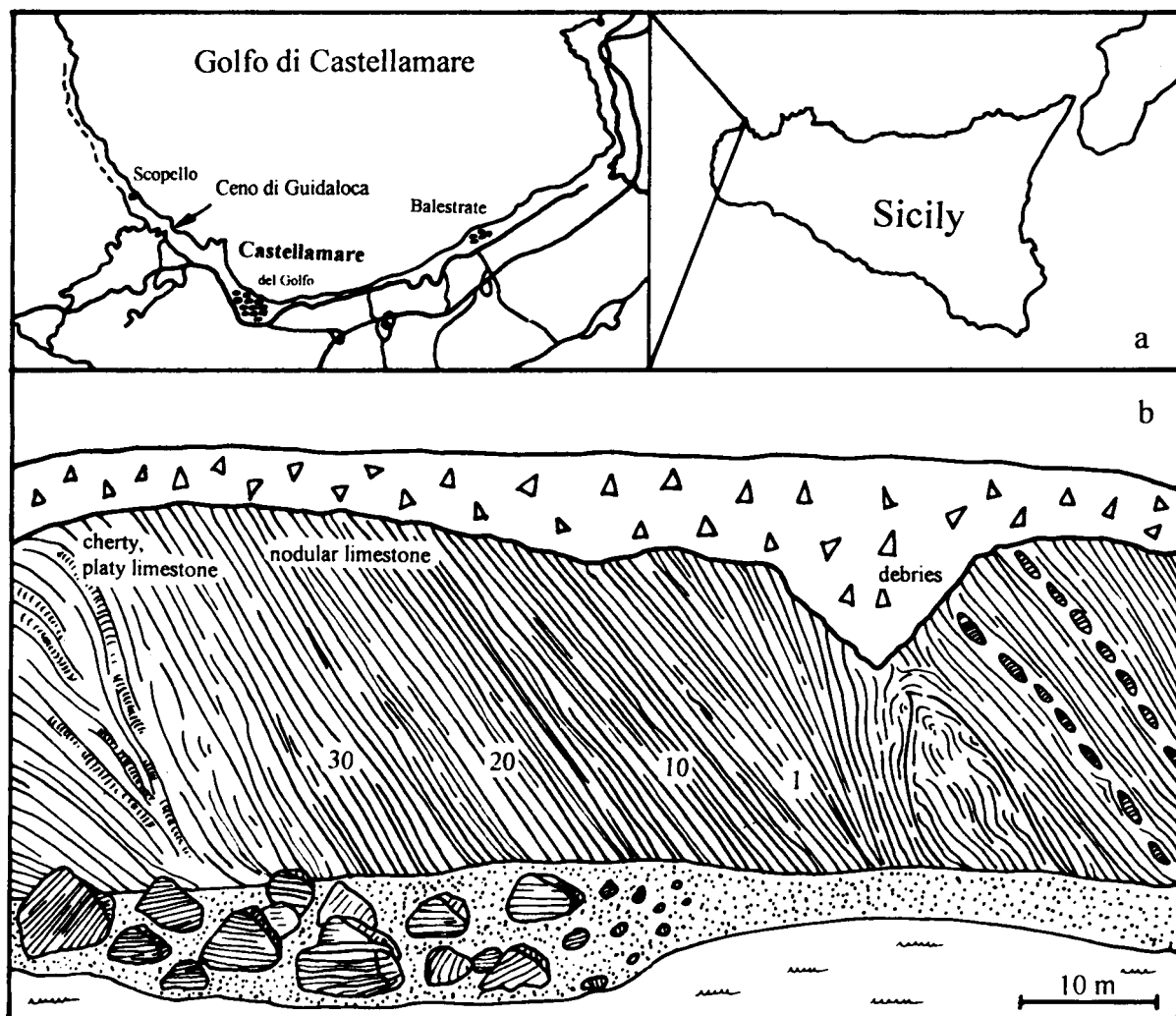


Fig. 1. a: Topographic map of Guidaloca. The section is indicated by the asterisk. b: A simplified sketch showing the Upper Jurassic rocks and the bed numbering of Guidaloca.

### Composition and age of the fauna

Ammonites were the most common megafossils. Beyond the circa 50 collected specimens, only one further pygopid-type brachiopod was found.

Ammonites were moderately well preserved internal moulds, many of them were already a fragment, before the final burial.

The most important ammonites and the biostratigraphic subdivision of the section is given in Fig. 2. The complete faunal list, including ammonites coming from the loose blocks contains the following taxa:

*Calliphyloceras kochi* (OPPEL)  
*Holcophylloceras* sp.

*Ptychophylloceras ptychoicum* (QUENSTEDT)  
*Sowerbyceras* sp.  
*Protetragonites quadrisulcatus* (D'ORBIGNY)  
*Semiformiceras ?darwini* (NEUMAYR)  
*Taramelliceras pugile* (NEUMAYR)  
*Hemihaploceras nobile* (OPPEL)  
*Haploceras elimatum* (OPPEL)  
*Haploceras carachtheis* (ZEUSCHNER)  
*Haploceras verruciferum* (ZITTEL)  
*Haploceras* sp.  
*Schaireria neoburgense* (OPPEL)  
*Aspidoceras* sp.  
*Hybonotoceras cf. hybonotum* (OPPEL)

| Number of beds | Important ammonites, collected |              |             |                |                 |                   |
|----------------|--------------------------------|--------------|-------------|----------------|-----------------|-------------------|
|                | from the beds                  |              |             | from the loose |                 |                   |
|                | H. beckeri                     | H. pressulum | A. linarezi | S. cf. darwini | H. verruciferum | Himalayitidae sp. |
|                |                                |              |             |                |                 |                   |
| 10             |                                |              |             |                |                 |                   |
| 11             |                                |              |             |                |                 |                   |
| 12             |                                |              |             |                |                 |                   |
| 13             |                                |              |             |                |                 |                   |
| 14             |                                |              |             |                |                 |                   |
| 15             |                                |              |             |                |                 |                   |
| 16             |                                |              |             |                |                 |                   |
| 17             |                                |              |             |                |                 |                   |
| 18             |                                |              |             |                |                 |                   |
| 19             |                                |              |             |                |                 |                   |
| 20             |                                |              |             |                |                 |                   |
| 21             |                                |              |             |                |                 |                   |
| 22             |                                |              |             |                |                 |                   |
| 23             |                                |              |             |                |                 |                   |
| 24             |                                |              |             |                |                 |                   |
| 25             |                                |              |             |                |                 |                   |
| 26             |                                |              |             |                |                 |                   |
| 27             |                                |              |             |                |                 |                   |
| 28             |                                |              |             |                |                 |                   |

Fig. 2. Simplified stratigraphic column and distribution of important ammonites at Guidaloca. Abbreviations: B. Z.: Beckeri Zone, H. Z.: Hybonotum Zone, D. Z.: Darwini Zone, S. Z.: Semiforme Zone, M. Z.: Microcanthum Zone, Du. Z.: Durangites Zone.

*Hybonoticer as beckeri* (NEUMAYR)  
*Hybonoticer as pressulum* (NEUMAYR)  
*Aulasimoceras* cf. *linarezi* (OLÓRIZ)  
*Micracanthoceras microcanthum* (OPPEL)  
Himalayitidae sp.  
*Orthosphictes* sp.  
*Discosphinctoides rhodaniforme* (OLÓRIZ)  
"Subdichotomoceras" sp.  
*Paraolocosphinctes* sp.  
Ataxioceratidae div. sp. indet.

Although numerous ammonites were determined on generic level only, and many of the beds yielded no megafossils, the biostratigraphic subdivision of the profile can be drawn. Zonal names refer to ENAY & GEYSSANT (1975).

In the lower part of the section *Sowerbyceras*, ataxioceratids and some taramelliceratids were found, suggesting a fossiliferous Kimmeridgian. Bed 26, yielding *Hybonoticer as beckeri* and *H. pressulum* represents the uppermost Kimmeridgian Beckeri Zone, a level, characteristic for the whole Mediterranean region, and illustrated richly by ARKELL (1954) already in western Sicily. *H. cf. hybonotum* showing the presence of the lowermost Tithonian Hybonotum Zone was found in loose blocks only. *Aulasimoceras* cf. *linarezi*, a poorly known ammonite characteristic for the Hybonotum or Darwini Zone(s) was collected from Bed 25. An oppeliid, determined as *Semiformiceras* cf. *darwini*, the index form of Darwini Zone, was collected also from Bed 25. It means that the boundary between the two Lower Tithonian zones can be drawn within the interval, called Bed 25. *Haploceras verruciferum*, an important ammonite, with a maximum frequency in the Semiforme Zone was found in Bed 24. Additional specimens of mainly or exclusively Semiforme Zone ammonites, like *Discosphinctoides rhodaniforme*, "Subdichotomoceras" sp., suggest a relatively rich assemblage of this level. Many of the strata above Bed 24 yielded no important ammonites, so the higher zones of the Lower Tithonian remained biostratigraphically undocumented.

The himalayitid found in Bed 12 represents already the uppermost Tithonian Durangites Zone, but *Micracanthoceras microcanthum*, the index form of the Microcanthum Zone was also found in loose blocks.

## Systematic palaeontology

All the ammonites described are deposited in the Paleontological Department of the Hungarian Natural History Museum, Budapest. Measured and/or illustrated specimens have inventory numbers.

Measurements are given in millimetres, according to the following order: maximal diameter of the specimen (MD), diameter (D), whorl height (H), whorl width (W), and umbilical diameter (Ud). In many specimens, due to the poor state of preservation, measurements are incomplete or missing.

Descriptions are brief, especially in the case of the well-known species. In most cases the synonym list contains the first figuration and some very important recent references only, in order to obtain basic information on the species.

Order Ammonoidea ZITTEL, 1884  
Suborder Phylloceratina ARKELL, 1950  
Superfamily Phyllocerataceae ZITTEL, 1884

Family Phylloceratidae ZITTEL, 1884

Genus *Calliphyloceras* SPATH, 1927

Type species *Phylloceras disputabile* ZITTEL, 1869

*Calliphyloceras kochi* (OPPEL, 1865)

Plate 21, fig. 4.

1865 *Ammonites kochi* – OPPEL, p. 550

1984 *Calliphyloceras kochi* (OPPEL) – SARTI, p. 485, pl. 1, figs 2a–b (cum syn.)

1994 *Calliphyloceras kochi* (OPPEL) – ZEISS et al., p. 370, pl. 1, fig. 5.

Material: One moderately well preserved specimen (M 92 696) and some additional, unregistered, strongly corroded fragments.

#### Measurements

|    |     |
|----|-----|
| MD | 98  |
| H  | 758 |
| Ud | 75  |

Description: Strongly subsolved, medium sized specimen, discoidal in shape. Coiling is very involute, with a minute umbilicus. The oval whorl section is relatively high. The umbilical wall is corroded, the flanks are highly arched with the maximal extension at the upper third part. There are about seven constrictions per whorl, which are straight at first, then moderately prorsiradiate around the venter.

Occurrence: *C. kochi* can be found throughout the whole Tithonian in the Mediterranean region. The specimen described here came from Bed 25, from the lowermost Tithonian.

Genus *Holcophylloceras* SPATH, 1927

Type species *Phylloceras mediterraneum* NEUMAYR, 1871

*Holcophylloceras* sp.

Plate 21, fig. 6.

Material: One moderately well preserved specimen (M 92 693).

#### Measurements

|    |       |
|----|-------|
| MD | 74    |
| D  | 59    |
| H  | 39 34 |
| W  | 15 18 |
| Ud | 79 78 |

Description: Incomplete, fragmentary specimen with a small piece of the body chamber. The ammonite is discoidal, very involute. Whorl section is high-oval. There are no ornamentation, only 7 constrictions per whorl on the internal mould. The constrictions are slightly prorsiradiate until the upper third part of the

flank, where, after a sharp break, they point backwards.

Occurrence: The specimen, described above, came from the debris, together with typical Kimmeridgian ammonites.

Genus *Ptychophylloceras* SPATH, 1927

Type species *Phylloceras feddeni* WAAGEN, 1875

*Ptychophylloceras ptychoicum* (QUENSTEDT 1845)

Plate 20, figs 2–3

1984 *Ptychophylloceras ptychoicum* (QUENSTEDT 1845) – VERMA & WESTERMANN, p. 29, pl. 2, fig. 1a–b (cum syn.).

Material: One numbered (M 92 709), and many unregistered specimens.

#### Measurements

|    |       |
|----|-------|
| MD | 56    |
| D  | 46    |
| H  | 31 25 |
| W  | 24 23 |
| Ud | 3 3   |

Description: Very involute, moderately inflated form. The umbilical wall, and the smooth flanks are arched. The venter is relatively broad and rounded. The whorl section is oval. The body chamber occupies about two-third of the last whorl. The sigmoid aperture is nearly entire, with a fine groove on the edge. This feature, as well as the curved, weak constrictions around the umbilical wall ("umbilical rosette") of the internal mould, suggest that the specimen is complete and adult. There are six strong, characteristic wrinkles on the venter of the body chamber.

Remarks: The species is easy to recognize because of the distinctive wrinkles on the adult body chamber. It is worth mentioning that only the relatively small (microconchiate) forms were found in Guidaloca. The two, or three times larger macroconchiate forms, abundant in many other localities, were missing in the Sicilian section.

Occurrence: The species is very common throughout the whole Tithonian. It was frequent also in Guidaloca, especially in the lower part of the section. The illustrated specimen was found in Bed 18, in the Lower Tithonian.

Genus *Sowerbyceras* (PARONA & BONARELLI, 1895)

Type species *Ammonites tortisulcatus* D'ORBIGNY, 1849

*Sowerbyceras* sp.  
Plate 20, figs 5–6

Material: Four numbered specimens (M 92 678, M 92 690, M 92 691, M 92 694) and unregistered fragments.

Measurements:

|          | MD | D  | H  | W   | Ud  |
|----------|----|----|----|-----|-----|
| M 92 678 | 62 |    | 31 | 27  |     |
| M 92 690 |    | 43 | 20 | 14  | ?12 |
| M 92 691 | 57 |    | 25 | ?21 | 13  |

Remarks: Specimens from Guidaloca are very close to those ammonites, which are described under the name *S. loryi* generally. The umbilicus is small, moderately deep, flanks are flat and subparallel. There are about four characteristic broken constrictions per whorl. The genus is typical for the Kimmeridgian, but the phyletic connection of the related species, (like *S. tortisulcatum* (D'ORB.), *S. silenus* (FONT.) *S. kobyi* (LOR.)) and their exact stratigraphic range are uncertain.

Suborder Lytoceratina HYATT, 1889  
Superfamily Lytocerataceae NEUMAYR, 1875  
Family Protetragonitidae SPATH, 1927  
Genus *Protetragonites* HYATT, 1900

Type species *Ammonites quadrisulcatus* (D'ORBIGNY, 1840)

*Protetragonites quadrisulcatus* (D'ORBIGNY, 1840)  
Plate 20, fig. 11, Plate 21, fig. 3.

Material: Two numbered (M 92 710, M 92 711) and additional unregistered specimens.

Measurements

|          | MD | D  | H  | W   | Ud |
|----------|----|----|----|-----|----|
| M 92 710 | 84 |    | 23 |     | 43 |
|          |    | 69 | 18 | ?19 | 36 |
| M 92 711 | 55 |    | 16 | 16  | 25 |
|          |    | 44 | 15 | 15  | 21 |

Remarks: Coiling is very evolute, the umbilicus is shallow and wide. Whorl section is circular. The straight to slightly curved constrictions are poorly visible on the internal moulds.

Occurrence: This Tithonian to Lower Cretaceous lytoceratid, typical for the Mediterranean region, was common also in Guidaloca. The illustrated specimens came from loose blocks.

Superfamily Haplocerataceae ZITTEL, 1884  
Family Oppeliidae DOUVILLÉ, 1890  
Genus *Semiformiceras* SPATH, 1925

Type species *Ammonites Fallauxi* OPPEL, 1865

*Semiformiceras* cf. *darwini* (NEUMAYR, 1873)  
Plate 20, fig. 13

- 1873 *Ammonites darwini* – NEUMAYR, p. 165, pl. 33, fig. 2–4.  
1982 *Semiformiceras darwini* (NEUMAYR) – ENAY, p. 118, fig. 3.  
1986 *Semiformiceras darwini* (NEUMAYR) – SANTANTONIO, p. 69, pl. 1, fig. 1.  
1993 *Semiformiceras* cf. *darwini* (NEUMAYR) – FÓZY, p. 201.

Material: One poorly preserved fragment (M 92 705).  
Measurements

|    |        |
|----|--------|
| MD | 57     |
| D  | ?33 22 |
| W  | ?12 8  |

Description: The subsolved, broken piece of internal mould is built up by a small part of the phragmocone, and by the probable mature body chamber. Very involute form, with a minute umbilicus. Flanks are, however, eroded, subparallel. At the end of the phragmocone, and at the beginning of the body chamber the venter is sharply curved with a calcite keel. The keel is fading towards the aperture, forming a flat, and relatively broad venter, with very weak tricarination in the transition. On one side of the specimen, there are weak radial, straight "ridges", altogether three on the half whorl. The species was carefully discussed by ENAY (1982).

Remarks: Related oppeliids (*Neochetoceras mucronatum*) were reported from the lowermost Tithonian (BERCKHEMER & HÖLDER 1959, ZEISS 1968) also. However, these ammonites are smooth, and do not show the characteristic radial ornamentation of the flanks, which are present in *Semiformiceras* in general.

Occurrence: *S. darwini* is the index fossil of the Lower Tithonian Darwini Zone. The Guidaloca specimen was collected from Bed 25, close to Hybonotum Zone elements, thus represents a very early form of the lineage.

Genus *Taramelliceras* DEL CAMPANA, 1904

Type species *Ammonites trachinotus* OPPEL, 1863

*Taramelliceras pugile* (NEUMAYR, 1871)  
Plate 21, fig. 2.

- 1871 *Oppelia pugilis* – NEUMAYR, p. 24.  
1873 *Oppelia pugilis* – NEUMAYR, p. 16, pl. 32, fig. 1–2.

- 1978 *Taramelliceras (Taramelliceras) pugile pugile* (NEUMAYR) – OLÓRIZ, p. 94, pl. 7, fig. 2. (cum syn.)

Material: One fragment (M 92 666).

Description: Only a part of the internal mould of a probably adult body chamber. The umbilicus can not be seen. The whorl section is compressed, highly arched. The rounded venter bears very strong clavi above the ventro-lateral shoulder. These nodules continue into faint, blunt ridges on the flank. Between the nodules, just in the median of the shell, there is a third row of tubercles.

Occurrence: This late Kimmeridgian ammonite was collected only from loose blocks at Guidaloca.

#### Genus *Hemihaploceras* SPATH, 1925

Type species *Oppelia nobilis* NEUMAYR, 1873

*Hemihaploceras nobile* (NEUMAYR, 1873)  
Plate 21, fig. 1.

- 1873 *Oppelia nobilis* – NEUMAYR, p. 167, pl. 3, fig. 4.  
1978 *Hemihaploceras nobile* (NEUMAYR) – OLÓRIZ, p. 117, pl. 7, fig. 5. (cum syn.)

Material: One specimen only (M 92 680).

Measurements

|    |     |
|----|-----|
| MD | 79  |
| H  | 732 |

Description: Medium sized fully grown specimen, with the very characteristic bullae on the ventro-lateral shoulder of the adult body chamber.

Occurrence: This late Kimmeridgian ammonite was collected only from loose blocks at Guidaloca.

#### Family Haploceratidae ZITTEL, 1884

##### Genus *Haploceras* ZITTEL, 1868

Type species *Ammonites elimatus* OPPEL, 1865

*Haploceras elimatum* (OPPEL, 1865)  
Plate 20, fig. 9

- 1865 *Ammonites elimatus* – OPPEL, p. 549.  
1986 *Haploceras (Haploceras) carachtheis* (M) (ZEUSCHNER) morphe *elimatum* – ENAY & CECCA, p. 49, pl. 4, fig. 1–5.  
1988 *Haploceras (Haploceras) elimatum* (OPP.) – FÓZY, p. 51 (cum syn.).

Material: Two registered specimens (M 92 681, M 92 673) and unregistered fragments.

#### Measurements

|          | MD | D | H  | W  | Ud  |
|----------|----|---|----|----|-----|
| M 92 681 | 44 |   | 20 | 15 | 712 |
| M 92 673 | 57 |   | 24 | 20 | 716 |

Remarks: *Haploceras* is a dimorphic group. According to ENAY & CECCA (1986) the described species is the macroconchiate form of the small and lappet-bearing *carachtheis*-group and can be specify as *Haploceras (Haploceras) carachtheis* (M) (ZEUSCHNER) morphe *elimatum*. In spite of the convincing dimorphism, giving priority to the simplicity, present paper uses the more rigid, but more conventional nomenclature.

Occurrence: The form is very frequent in the Mediterranean region, in the whole Tithonian, especially in the Semiforme - Microcathum Zones. At Guidaloca *H. elimatum* was found in the lower part of the Tithonian.

*Haploceras carachtheis* (ZEUSCHNER, 1846)  
Plate 20, fig. 12.

- 1846 *Ammonites carachtheis* – ZEUSCHNER, pl. 4, fig. 1.  
1986 *Haploceras (Haploceras) carachtheis* (m) (ZEUSCHNER) morphe *carachtheis* – ENAY & CECCA, p. 49, pl. 2, fig. 3, 4, 7, 10, pl. 3, fig. 1–2, 10, 11–16, 18–19.  
1988 *Haploceras (Haploceras) carachtheis* (ZEUSCHNER) – FÓZY, p. 59 (cum syn.)

Material: One specimen (M 92 706) only. Fragments of very close, or probably same forms were common at Guidaloca.

Description: The collected specimen is an adult body chamber fragment, with the characteristic folds on the ventral side.

Occurrence: As the microconchiate form of *H. elimatum*, *H. carachtheis* has practically the same distribution in space and time. The illustrated specimen was collected from the Upper Tithonian part of the section, from Bed 20.

*Haploceras verruciferum* (ZITTEL, 1869)  
Plate 20, figs 4, 7

- 1869 *Ammonites verruciferus* MENEGHINI – ZITTEL, p. 145  
1986 *Haploceras (Volanites) verruciferum* (ZITTEL) (m) – ENAY & CECCA, p. 48, pl. 1, fig.  
1988 *Haploceras (Hypolissoceras) verruciferum* (ZITTEL, 1869) – FÓZY, p. 63 (cum syn.).

Material: One specimen from the succession (M 92 707) and another (M 92 683) from the loose.

Measurements

|          | MD | D  | H  | W  | Ud |
|----------|----|----|----|----|----|
| M 92 707 | 57 |    | 22 | 16 | 17 |
|          |    | 49 | 13 | 11 | 13 |

**Description:** The specimen coming from Bed 24 is a fully grown, nearly entire one. Only the typical "verruca" is broken off, however, its base can be seen. The specimen collected from the loose is the end of an adult body chamber of a small specimen, with the strong ridge on the venter.

**Remarks:** Details on the priority (MENEGHINI or ZITTEL?) is given in FÓZY (1988). As it was demonstrated by ENAY & CECCA (1986) the species is a microconchiate form. The macroconch was described under the separate name *Haploceras (Haploceras) cassiferum* by FÓZY (1988, p. 57).

**Occurrence:** The species is a characteristic Lower Tithonian, (mainly Semiforme Zone) element throughout the Mediterranean region. *H. verruciferum* was chosen by OLÓRIZ (1978) as the zonal index of the Verruciferum Zone (equivalent of the Semiforme Zone of ENAY & GEYSSANT 1975). But as it was shown by ENAY & CECCA (1986), the species occurs, however rarely only, below and above the mentioned zone. Specimen from Bed 24, on the basis of size and coiling represents a typical Semiforme Zone form.

Superfamily Perisphinctaceae STEINMANN, 1890

Family Aspidoceratidae ZITTEL, 1895

Genus *Schaireria* CHECCA, 1985

Type species *Aspidoceras avellanum* ZITTEL, 1870

*Schaireria neoburgensis* (OPPEL, 1863)

Plate 20, fig. 1

1863 *Ammonites neoburgensis* – OPPEL, p. 223, pl. 58, fig. 5.

1985 *Schaireria neoburgensis* (OPPEL) – CHECCA, p. 199, pl. 4, fig. 3–5, pl. 42, fig. 1. (cum syn.)

**Material:** One specimen (M 92 675) only.

**Description:** The medium sized ?adult specimen is rather incomplete. The outer whorl is partly broken off, so the globulose inner whorls are well exposed. The umbilicus is very small and deep. Whorls are depressed, without any ornamentation.

**Remarks:** VIGH (1984, p. 72.) established the new name *Anaspidoceras* for the subgenus of *Physodoceras* HYATT, 1900. CHECCA (1985) gives careful discussion on the species.

**Occurrence:** The characteristic smooth species is common throughout the Mediterranean Realm in the Lower Tithonian (?Hybonotum – Semiforme Zone). The Guidaloca specimen was found in the debris.

Genus *Aspidoceras* ZITTEL, 1868

Type species *Ammonites rogoznicensis* ZEUSCHNER, 1846

*Aspidoceras* sp.

**Material:** One specimen (M 92 667).

**Description:** Medium sized fragment of a probably immature specimen, with a small part of the phragmocone and with the half whorl of the body chamber. The section is rounded, slightly compressed. Tubercles appear in pairs, forming two rows.

**Remark:** The subsolved fragment is insufficient for precise determination. On the other hand, there are too many names, with very poor illustrations in the literature. CHECCA's monograph (1985) on the Mediterranean aspidoceratids provides a review, containing only seven distinguished Kimmeridgian *Aspidoceras* s. str. The Guidaloca specimen is very close to *A. longispinum* (SOWERBY) sensu CHECA.

**Occurrence:** The specimen was collected from the loose blocks, together with Kimmeridgian ammonites.

Genus *Hybonotoceras* BREISTROFFER, 1947

Type species *Ammonites hybonotus* OPPEL, 1863

*Hybonotoceras* cf. *hybonotum* (OPPEL, 1863)

Plate 22, fig. 7

1863 *Ammonites hybonotus* – OPPEL, p. 254, pl. 71, fig. 1–3.

1959 *Hybonotoceras hybonotum* – BERCKHEMER & HÖLDER, p. 30, pl. 3, fig. 12, pl. 5, figs. 18, 19 (cum syn.)

**Material:** Two fragments (M 92 677, M 92 678).

**Measurements**

|          | MD | D | H  | W  | Ud |
|----------|----|---|----|----|----|
| M 92 677 |    |   | 20 | 14 |    |
| M 92 678 | 62 |   | 31 | 27 |    |

**Description:** The badly preserved phragmocone pieces show the strong rows of tubercles on the umbilical and ventro-lateral edges, connected with faint but wide ribs. The deep ventral furrow exists, but the fine serration on its edges can not be seen.

**Remarks:** The German material was carefully described by BERCKHEMER & HÖLDER (1959), while OLÓRIZ (1978) listed many new forms, too. All of the extra-European *Hybonotoceras* were discussed by VERMA & WESTERMANN (1984).

**Occurrence:** The species (and related forms, like *H. ornatum* (SPATH), *H. hildebrandti* (FUTTERER)) are known from Europe, Africa, Madagascar and India. *H. hybonotum* is the zonal index of the lowermost Tithonian Hybonotum Zone. The Guidaloca specimens were found in loose blocks.

*Hybonotoceras beckeri* (NEUMAYR, 1873)

Plate 22, figs 1, 4–5

1873 *Aspidoceras beckeri* nov. sp. – NEUMAYR, p. 202, pl. 38, fig. 3.

Material: A nearly complete but not adult specimen (M 92 669) and another fragment (M 92 688).

Measurements

|          | MD  | D  | H  | W  | Ud  |
|----------|-----|----|----|----|-----|
| M 92 669 | 110 |    | 35 | 14 | 749 |
|          |     | 91 | 29 | 12 | 40  |

Description: The shell is medium sized, evolute, the umbilicus is moderately shallow, the umbilical wall is deep. The flanks are subparallel, the ventral groove is bordered by serrated ridges. There are more periumbilical tubercles than ventro-laterals. In some cases the inner tubercles are radial, while the outer appear irregular, forming bullae. Ornamentation is typical for *H. beckeri*, ribbing is dense, irregular, ribs are flexuous, with a very low point of branching.

Occurrence: *H. beckeri* is characteristic for the uppermost Kimmeridgian Beckeri Zone. Specimens from Guidaloca were found in Bed 26 and also in the debris.

*Hybonoticeras pressulum* (NEUMAYR, 1873)  
Plate 22, figs. 6, 8

1873 *Aspidoceras pressulum* nov. sp. – NEUMAYR, p. 201, pl. 37, figs. 2, 3.

1959 *Hybonoticeras pressulum* (NEUMAYR) – BERCKHEMER & HÖLDER, p. 20, pl. 1, fig. 1, pl. 2, figs. 6, 8. (cum syn.)

Material: Two body chamber fragments (M 92 670, M 92 687).

Measurements

|          | MD | D  | H  | W   | Ud |
|----------|----|----|----|-----|----|
| M 92 670 |    |    | 23 | 9   |    |
| M 92 687 |    | 67 | 21 | 719 | 30 |

Description: The umbilical wall is vertical, the section is high oval, with maximal width around the umbilical edge. The umbilical row of tubercles contains small, numerous, slightly radial tubercles. The M 92 687 specimen has smooth flanks, like the type, but the other Guidaloca example has weak, curved ribs around the ventro-lateral edge.

Remarks: *H. pressulum*, like most *Hybonoticeras* species, shows a wide range of variability. Many of the forms were formerly described under separate species, or subspecies names. Unfortunately, until now, there are not too much data on the fine biostratigraphic appearance of the very close forms, so the present paper prefers to use not too much names.

Occurrence: The species is very common in Europe, but it was described also from India (Katchch). *H. pressulum* is typical for the uppermost Kimmeridgian Beckeri Zone. One of the specimens from Guidaloca were collected from Bed 26, while the other came from the loose.

Genus *Aulasimoceras* SPATH, 1931

Type species *Waagenia auberti* PERVINQUIÈRE, 1907

*Aulasimoceras* cf. *linaresi* (OLÓRIZ, 1978)  
Plate 22, fig. 3

1978 *Hybonoticeras* (*Hybopeltoceras*) *linaresi* – OLÓRIZ, p. 362, pl. 29, fig. 2, pl. 30, figs. 1, 2.

Material: One moderately well preserved fragment (M 92 686).

Measurements

H 26  
W 22

Description: The specimen is a small part of the phragmocone, and a piece of the body chamber. Coiling is evolute, the umbilical wall is very deep, the flanks are subparallel, the venter is broad, rounded, with wide furrow. Tubercles are distant, appearing in two rows, one above the umbilical edge, and the second on the ventro-lateral shoulder. All tubercles are very strong. The specimen, probably because of the corrosion does not show the robust ribs between the tubercles which is characteristic for the type.

Remarks: *A. linaresi* was described from the Subbetics by OLÓRIZ (1978) under the name *Hybopeltoceras*, on the basis of outer whorls only. According to GEYSSANT (in DE WEVER et al. 1986) *Hybopeltoceras* is the synonym of *Aulasimoceras*, a genus described on the basis of some inner whorls only. In this paper the opinion of GEYSSANT was accepted, although the Guidaloca material contains, again, outer whorls only.

Occurrence: The species was described from the Hybodontum Zone of the Subbeteics. The Guidaloca specimen was found in Bed 25.

Family Himalayitidae SPATH, 1925  
Genus *Micracanthoceras* SPATH, 1925

Type species *Ammonites microcanthus* OPPEL, 1865

*Micracanthoceras microcanthum* (OPPEL, 1865)  
Plate 21, fig. 7

1865 *Ammonites microcanthus* – OPPEL, p. 555.

1868 *Ammonites microcanthus* OPPEL – ZITTEL, p. 93, pl. 17, figs. 3–5 (only).

1985 *Micracanthoceras* (*M.*) *microcanthum* (OPPEL) – TAVERA, p. 169, pl. 21, figs. 1–4, pl. 22, figs. 1–6. (cum syn.).

Material: One poorly preserved, but probably nearly entire specimen (M 92 685).



## Measurements

|    |    |
|----|----|
| MD | 52 |
| H  | 14 |
| Ud | 28 |

Description: Small sized, evolute ammonite, with a shallow umbilicus. Cross section is circular, ribs are straight, biplicate, or simple. There are sporadic sharp nodules on certain ribs above the bifurcation points. The ventral side has a strong median groove, bordered by fine swellings of the ribs. The last and crowded suture lines are followed by 3/4 whorl, so the specimen is nearly complete, consequently represents a microconchiate form. The aperture is damaged.

Occurrence: *M. microcanthum* is the index species of the Upper Tithonian Microcanthum Zone (ENAY & GEYSSANT, 1975). According to TAVERA (1985) this time interval can be subdivided into the lower Simplisphinctes and to the higher Transitorius Zones. Most of the *M. (M.) microcanthum* specimens in the Subbetics were collected from the Transitorius Zone. The Guidaloca specimen came from the loose blocks.

Himalayitidae sp.  
Plate 20, fig. 8

Material: One specimen (M 92 704).

## Measurements

|   |    |
|---|----|
| H | 15 |
| W | 14 |

Description: Small parts of the minute ammonite were dislocated by micro-faults, which made the determination more difficult. The shell is moderately evolute, with a fairly deep umbilicus. Cross section is compressed, the umbilical wall is steep, flanks are subparallel, the venter is rounded, with a shallow groove. Ribbing is built up dominantly by single ribs but there are some biplicate also. Ribs are strongly prorsiradiate, especially on the inner whorls. At about 21 mm diameter the ribs are sharp, and small nodules are formed just below the overlapping next whorl. There are also fine swellings on the venter above certain ribs.

Remark: The specimen is probably related to those forms described by TAVERA (1985) under the name *Durangites*.

Occurrence: The specimen came from Bed 12.

Family Ataxioceratidae BUCKMAN, 1921  
Genus *Orthosphinctes* SCHINDEWOLF, 1925

Type species *Ammonites tiziani* OPPEL, 1863

*Orthosphinctes* sp.  
Pl. 21, fig. 5

Material: Two specimens (M92 695, M 92 684).

## Measurements

|          | MD | D | H  | W   | Ud |
|----------|----|---|----|-----|----|
| M 92 684 | 54 |   | 16 | ?20 | 24 |

Description: One of the fragments (M 92 695) is probable an anterior part of an adult body chamber. The whorl section is compressed, flanks are relatively flat. The ribbing is virgatotome, built up by bi- and trifurcating ribs. The other specimen is inner whorls only. It resembles also the Tithonian genus *Lemencia* DONZE & ENAY, 1961, but it was found together with typical Kimmeridgian ammonites.

Occurrence: Similar forms are known from the Oxfordian - Upper Kimmeridgian interval. The Guidaloca specimen came from the loose material.

Genus *Discosphinctoides* OLÓRIZ, 1978

Type species *Perisphinctes roubyanus* FONTANNES, 1879

*Discosphinctoides rhodaniforme* OLÓRIZ, 1978  
Plate 22, fig. 2

- 1978 *Discosphinctoides* (*Pseudodiscosphinctes*) *rhodaniforme* nom. nov. \*\* *Perisphinctes rhodanicus* DUMORTIER in DEL CAMPANA - OLÓRIZ, p. 494, pl. 41, fig. 2.  
1990 *Discosphinctoides* cf. *rhodaniforme* OLÓRIZ - FÖZY, p. 327, pl. IV, fig. 3.

Material: One specimen (M 92 701).

## Measurements

|   |    |
|---|----|
| H | 16 |
| W | 13 |

Description: Only a half of a whorl was found. The umbilical wall is deep, the umbilical edge is rounded, the flanks slightly curved. The ventral region is arched, the cross section is high oval. Ribbing is built up by dense, straight ribs, crossing the venter without any change. Most of them are bifurcating around the middle of the flanks, however there are also singles.

Remark: The Guidaloca fragment is close to the type, because of its relatively straight ribs. Ribbing is built up by more flexuous ribs in the Bakony specimen (FÖZY, 1990).

Occurrence: The species was described by OLÓRIZ (1978) from the Verruciferum Zone of the Lower Tithonian. It was reported also from similar level from Santa Anna section (Sicily) (DE WEVER et al., 1986), and from the Bakony Mts (FÖZY, 1990). The Guidaloca

specimen was found in debris together with Tithonian ammonites.

Genus *Subdichotomoceras* SPATH, 1925

Type species *Subdichotomoceras lamplughi* SPATH, 1925

"*Subdichotomoceras*" sp.

Pl. 20, fig. 14

Material: One specimen (M 92 703) only.

Measurements

|    |     |     |
|----|-----|-----|
| MD | 66  |     |
| D  |     | 59  |
| H  | ?17 | ?16 |
| Ud | 38  | 33  |

Description: Rather evolute shell, with a subcircular cross section. Only a small piece of the phragmocone, and the whole body chamber was preserved. Ribbing is biplicate, although singles also appear. Constrictions exist. The small lappet at the aperture is clearly visible.

Remark: *Subdichotomoceras* is a name often reported from the Kimmeridgian-Tithonian rocks of Europe, India (Katchch) and Africa. The genus was described on the basis of English ammonites, collected from the Upper Kimmeridge Clay, from a level correlative with Beckeri Zone (COPE, 1978). Later the genus was reported mainly from higher levels of the Mediterranean region. According to OLÓRIZ (1978), the genus is typical for the Lower Tithonian. In the Bakony Mts (FÓZY, 1990) it was common especially in the Semi-

forme Zone. The problem is that the Kimmeridgian forms are closely related to other biplicate ammonites, like *Katrolliceras* (VERMA & WESTERMANN, 1984), while the connection between the Kimmeridgian and Tithonian forms is unclear.

Occurrence: The Guidaloca specimens was collected from the Lower Tithonian, Bed 24.

Genus *Paraulacosphinctes* SCHINDEWOLF, 1925

Type species *Ammonites senex* OPPEL, 1865

*Paraulacosphinctes* sp.

Pl. 20, fig. 10

Material: One specimen (M 92 701).

Measurements

|   |    |
|---|----|
| H | 16 |
| W | 13 |

Description: Only a piece of the phragmocone was preserved. The umbilical wall is deep, the flanks are rather flat, the whorl section is compressed, subrectangular. Ribbing is strong and biplicate, with a weak furrow on the venter. The fragment is insufficient for precise determination.

Occurrence: The genus is typical for the uppermost Tithonian. It has a maximum frequency in the upper part of the Microcathum Zone (Transitorius Zone, according to TAVERA, 1985) and in the Durangites Zone. The Guidaloca fragment was collected from the Bed 19.

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## Plate 20

- Fig. 1. *Schaireria neoburgensis* (OPPEL, 1863), (M 92 675). Phragmocone and crushed body chamber, lateral view. Guidaloca, loose material.
- Figs. 2-3. *Ptychophylloceras ptychoicum* (QUENSTEDT 1845), (M 92 709). Adult, microconch shell. Ventral and lateral views. Guidaloca, Bed 18, Tithonian.
- Fig. 4. *Haploceras verruciferum* (ZITTEL, 1869), (M 92 683). Fragment of and adult microconch body chamber. Lateral view. Guidaloca, loose material.
- Fig. 5. *Sowerbyceras* sp., (M 92 694). Probably adult, nearly complete specimen. Lateral view. Guidaloca, Loose material, Kimmeridgian.
- Fig. 6. *Sowerbyceras* sp., (M 92 678). Probably adult, nearly complete specimen. Ventral view. Guidaloca, Bed 28, Upper Kimmeridgian.
- Fig. 7. *Haploceras verruciferum* (ZITTEL, 1869), (M 92 707). Adult, microconch, nearly entire specimen. Lateral view. Guidaloca, Bed 24, Lower Tithonian.
- Fig. 8. *Himalayitidae* sp. (M 92 704). Incomplete specimen, with a piece of the body chamber. Lateral view. Guidaloca, Bed 12, Upper Tithonian.
- Fig. 9. *Haploceras elimatum* (OPPEL, 1863), (M 92 681). Young, nearly complete macroconch specimen. Lateral view. Guidaloca, loose material.
- Fig. 10. *Paraulacosphinctes* sp., (M 92 701). Phragmocone fragment. Lateral view. Guidaloca, Bed 19, Upper Tithonian.
- Fig. 11. *Protetragonites quadrisulcatus* (D'ORBIGNY, 1840), (M 92 711). Young specimen, with the part of the body chamber. Lateral view, loose material. Tithonian.
- Fig. 12. *Haploceras carachtheis* (ZEUSCHNER 1846), (M 92 706). Fragment of a microconch body chamber. Ventral view. Guidaloca, Bed 20, Tithonian.
- Fig. 13. *Semiformiceras* cf. *darwini* (OPPEL, 1863), (M 92 705). Fragment of an adult body chamber, with a small part of the end of the phragmocone. Oblique view. Guidaloca, Bed 25, Lower Tithonian.
- Fig. 14. "*Subdichotomoceras*" sp. (M 92 703). Adult, microconch shell. Incomplete phragmocone, with a complete body chamber. Entire aperture with lappet. Guidaloca, Bed 24, Lower Tithonian.

All figures in natural size

The little bar marks the beginning of the body chamber

## Plate 21

- Fig. 1. *Hemihaploceras nobile* (NEUMAYR, 1873), (M 92 680). Adult, nearly complete specimen. Lateral view. Guidaloca, loose material, Kimmeridgian.
- Fig. 2. *Taramelliceras pugile* (NEUMAYR, 1871), (M 92 666). Fragment of a probably adult body chamber. Oblique view. Guidaloca, loose material, Kimmeridgian.
- Fig. 3. *Protetragonites quadrisulcatus* (D'ORBIGNY, 1840), (M 92 710). Not adult, but nearly complete specimen. Lateral view. Guidaloca, loose material.

- Fig. 4. *Calliphyloceras kochi* (OPPEL, 1865), (M 92 696). Immature specimen. Guidaloca, Bed 25, Lower Tithonian.
- Fig. 5. *Orthosphinctes* sp. (M 92 684). Inner whorls only. Lateral view. Guidaloca, loose material.
- Fig. 6. *Holcophylloceras* sp., (M 92 693). Young specimen, with the fragment of the body chamber. Lateral view. Guidaloca, loose material, Tithonian.
- Figs. 7. *Micracanthoceras microcanthum* (OPPEL, 1865), (M 92 685). Young, incomplete phragmocone, with the part of the body chamber. Lateral view. Guidaloca, loose material.

All figures in natural size

The little bar marks the beginning of the body chamber

## Plate 22

- Fig. 1. *Hybonoticerias beckeri* (NEUMAYR, 1873), (M 92 669). Immature, nearly complete macroconch specimen. Lateral view. Guidaloca, loose material, Upper Kimmeridgian.
- Fig. 2. *Discosphinctoides rhodaniforme* (OLÓRIZ, 1978), (M 92 701). Half whorl of a body chamber. Lateral view. Guidaloca, loose material, Tithonian.
- Fig. 3. *Aulasimoceras* cf. *linaresi* (OLÓRIZ, 1978), (M 92 686). Piece of the phragmocone, with the part of the body chamber. Lateral view. Guidaloca, Bed 25, lowermost Tithonian.
- Fig. 4. *Hybonoticerias beckeri* (NEUMAYR, 1873), (M 92 688). Body chamber fragment. Lateral view. Guidaloca, Bed 26, uppermost Kimmeridgian.
- Fig. 5. *Hybonoticerias beckeri* (NEUMAYR, 1873), (M 92 674). Fragment, lateral view. Guidaloca, Bed 26, uppermost Kimmeridgian.
- Fig. 6. *Hybonoticerias pressulum* (NEUMAYR, 1873), (M 92 670). Fragment from the loose material. Guidaloca, Upper Kimmeridgian.
- Fig. 7. *Hybonoticerias* cf. *hybonotum* (OPPEL, 1863), (M 92 677). Fragment. Oblique view. Guidaloca, loose material, lowermost Tithonian.
- Fig. 8. *Hybonoticerias pressulum* (NEUMAYR, 1873), (M 92 687). Body chamber fragment. Guidaloca, Bed 26, uppermost Kimmeridgian.

All figures in natural size

The little bar marks the beginning of the body chamber

