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REMARKS ON THE LATE VISEAN CRINOIDS FROM THE CANTABRIAN MOUNTAINS AND MENORCA (NW SPAIN AND BALEARIC ISLANDS)

Hans-Georg HERBIG

Institut für Geologie und Paläontologie,
Philipps-Universität Marburg, Hans-Meerwein-Strasse,
D-35032 Marburg, Germany.

ABSTRACT

Crinoids known from the griotte facies of the Genicera Formation (Late Tournaisian - Early Namurian), Cantabrian Mountains, are listed. The Poteriocrinitid *Balearocrinus cantabricus* Herbig (Late Visean - ?Early Namurian) is the most common species. Like its close relative *Balearocrinus breimeri* Bourrouilh & Termier from Late Visean strata of Menorca, it is typically adapted to pelagic realms. Discrimination of the morphological similar shallow-shelf dweller *Rhabdocrinus,* which is not present in Spain, is discussed, as well as relations to *Culmicrinus.*

Keywords: Crinoids, Poteriocrinitidae (*Balearocrinus, Rhabdocrinus*), Lower Carboniferous (Visean), Depositional Realm, Cantabrian Mountains, Menorca, Spain.

RESUMEN

En el presente trabajo se pasa revista a los crinoideos conocidos de las facies griotte de la Formación Genicera (Turnesiense Superior - Namuriense inferior) de la Cordillera Cantábrica. La especie más común es *Balearocrinus cantabricus* Herbig (Viseense Superior- ?Namuriense inferior). Esta especie, al igual que su especie más próxima, *Balearocrinus breimeri* Bourrouilh y Termier, del Viseense Superior de Menorca, está típicamente adaptada a ambientes pelágicos. Se discuten sus diferencias con los géneros *Rhabdocrinus,* que tiene una morfología similar, habita en plataformas poco profundas y no está presente en España, y *Culmicrinus.*

Palabras clave: Crinoideos, Poteriocrinitidae (*Balearocrinus, Rhabdocrinus*), Carbonífero Inferior (Viseense), Ambiente sedimentario, Cordillera Cantábrica, Menorca, España.

INTRODUCTION

This note was triggered by a contribution in the present journal describing a single crinoid specimen from the Carboniferous griotte limestones of the province of Palencia, NW Spain (Morris, 1992). The purpose is to contribute to the scarce knowledge of crinoids from the late Dinantian to early Namurian nodular limestones of the Cantabrian Mountains and to elucidate some facies and paleobiogeographic relations.

CRINOIDS FROM THE GRIOTTE FACIES OF THE CANTABRIAN MOUNTAINS

A single crinoid cup described as *Rhabdocrinus scotocarbonarius* (Wright, 1937) by Morris (1992) has been derived from the Villabellaco Limestones (Villabellaco Formation, Wagner & Wagner-Gentis, 1963) some 1,5 km east of Villabellaco, northern Palencia. This is a latest Tournaisian (*anchoralis*-Zone) to early Namurian (E2) series of compact, grey limestones which become nodular upwards. Wagner *et al.* (1971) showed the stratigraphic and lithological equivalence with the newly introduced Genicera Formation (Alba Formation *auct.*), which differs mostly by its predominantly red colour. Therefore, most later authors (e.g. Martínez García *et al.*, 1983, Sánchez de la Torre *et al.*, 1983, Heredia *et al.,* 1990) included the Villabellaco in the Genicera Formation. This is a conspicuous Late Tournaisian (Tn 3) to early Namurian condensed sequence all over the Cantabrian Chain. In most parts of its extent, the Formation can be subdivided into three members (Wagner *et al.,* 1971), from below: Gorgera Member (mostly nodular limestones), Lavandera Member (red shales and cherts), Canalón Member (nodular limestones).

In spite of the paucity of Carboniferous crinoids from the Cantabrian Mountains (Breimer, 1962), the very late Visean or very early Namurian specimen of *Rhabdocrinus scotocarbonarius* from Villabellaco is not the unique crinoid from the Genicera Formation (Fig.1 b). It has to be added *"Poteriocrinus minutus"* from Meré, Asturias (Barrois, 1882) and *Paradelocrinus* spec.1 from the Puerto de Tarna, NE León (Breimer, 1962; misspelled as *Pandelocrinus* sp. in Morris, 1992). Moore et al. (1978) interpreted this latter specimen as an advanced *Cyathocrinites* with eliminated anal plate. Finally, Herbig (1982) described a monotypic crinoid faunula consisting of eight specimens from Nocedo, upper Bernesga valley and erected the new species *Balearocrinus*

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cantabricus. The faunula derived from the lowermost Canalón Member (upper Genicera Formation) and was dated as Late Visean, most probably V3b.

All crinoids known thus far from the Genicera Formation belong to the order Cladida. Disarticulated crinoid remains are well-known from many outcrops of the Formation (*e.g.* Wagner *et al.*, 1971; Gandl, 1977; Eichmüller & Seibert, 1984). Seibert (1986) mentioned up to 78 cm long stem fragments from a section near Canseco, northern León.

Rhabdocrinus scotocarbonarius from Villabellaco and *Balearocrinus cantabricus* are strikingly similar and that specimen has been included in the latter taxon (see Systematic Paleontology).

DEPOSITIONAL REALM

The Genicera Formation is undoubtedly a quite uniform sequence of epicontinental pelagic, deeper water origin. This is proved by the common ammonoids, the exclusive presence of simple horn corals of the *Cyathaxonia* type (*e. g.* Kullmann, 1989), and by a trilobite fauna characterizing the cephalopod facies, respectively the culm facies (Gandl, 1977). Rodríguez *et al.* (1986) described the depositional realm in general as a large area of deep, quiet, dysphotic, dysaerobic water located far from shore. Also Mamet & Boulvain (1990) characterized outcrops in the upper Bernesga valley, close to the crinoid locality Nocedo, as open marine, deep water deposits with reduced light and oxygen content. They observed signs of mudflow deposition and scarce input of shallow water biota, like dasycladacean algae. Eichmüller & Seibert (1984) and Seibert (1986) differentiated four main depositional realms within the Genicera Formation. These are, prograding into deeper realms: (1) Aguasalio facies - a deeper subtidal shelf between normal wave base and storm wave base, (2) Genicera facies - an open-marine shelf ramp, (3) Redilluera facies - an intraplatform basin, (4) Cardaño facies - relatively steep deeper slope and transition to the fore-deep.

Only the Villabellaco crinoid has been derived from the shallowest realm, the Aguasalio facies. It is characterized by very fossiliferous bioturbated wackestones bearing a highly diverse fauna. Hardgrounds and signs of tempestites are common. The *"Poteriocrinus"* from Meré was found in the Genicera facies, which is characterized by less fossiliferous, nodular brecciated limestones and intercalated marls. Various types of gravity flow sediments are common.

Most crinoid cups from the Genicera Formation (localities Puerto de Tarna, Nocedo), as well as extraordinary long stem fragments (Canseco), have been derived from the Redilluera facies. It consists of very fine-grained mud-/wackestones, which are interpreted to represent turbitidic sediments of an intraplatform basin. Correspondingly, Eichmüller & Seibert (1984) and Seibert (1986) noted the predominance of planctic and nectic faunas. Benthic organisms are rare with the exception of relatively abundant and well-preserved crinoids. Since crinoids are rapidly disarticulated during transport, this strongly votes for an intraplatform basin habitat of specialized crinoids.

COMPARISON WITH MENORCA

In fact, *Balearocrinus,* the most common crinoid genus of the Genicera Formation, seems to be a genus typically adapted to epicontinental pelagic realms of the late Visean to Early Namurian(?). Like the occurrence in the griotte facies of the Cantabrian Mountains, the type species of the genus, *Balearocrinus breimeri* Bourrouilh & Termier, 1973, has been derived from age-wise comparable, late Visean (V3b) pelagic strata of Menorca (Bourrouilh & Termier, 1973; Bourrouilh, 1973). The Menorcan crinoid-bearing unit consists of some meters of grey pelagic limestones with numerous radiolarians and some sponge spicules and ostracodes; predominantly red shales are interbedded. The unit overlies greenish and blackish radiolarites. It is capped by an about 10 m thick greywacke package, followed again

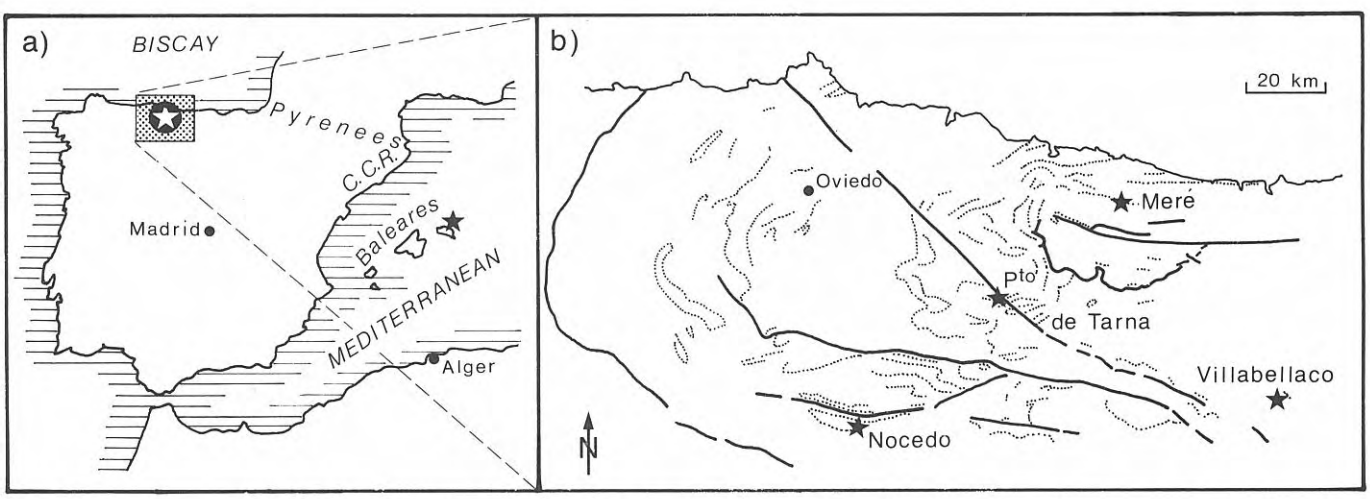

Figure 1. a. Occurrence of the genus *Balearocrinus* (asterisks) in the western Mediterranean. Discoveries in late Dinantian pelagic strata of the Catalonian Coastal Ranges (C.C.R.) and the Pyrenees are expected. b. Occurrence of crinoids (asterisks) in the Genicera Formation, Cantabrian Mountains. Outcrop belts stippled; major structural elements of the Cantabrian Zone indicated for orientation (redrawn after Seibert, 1986).

by 10-15 m of mostly red shales. Afterwards, greywacke-shale sedimentation took over entirely.

Adaption of *Balearocrinus* to the low-energy pelagic realm is indicated by its slender conical calyx and the adjoining series of compressed primibrachials, which are only slightly sloping outward and downward. Primibrachials are connected to each other and to the radials by large articular facets. This means a strongly reduced capability for arm movements (Bourrouilh & Termier, 1973), which would be required in more agitated waters, and for more effective suspension feeding as well.

Concerning this facies dependency of the genus, its occurrence in comparable late Visean to earliest Namurian pelagic sequences of the western Mediterranean Paleotethys, *e. g.* in the Catalonian Coastal Ranges and the Pyrenees is expected (Fig.1 a).

SYSTEMATIC PALEONTOLOGY

CLASS CRINOIDEA Wachsmuth & Springer, 1885
Order CLADIDA Moore & Laudon, 1943
Family **Poteriocrinitidae** Austin & Austin, 1842
Genus *Balearocrinus* Bourrouilh & Termier, 1973

Type species: *Balearocrinus breimeri* Bourrouilh & Termier, 1973.

Remarks: *Balearocrinus* is a quite unknown genus, which to the author's knowledge was only described by Bourrouilh & Termier, 1973, Bourrouilh, 1973 (redescription of the type material), and Herbig, 1982. It is not mentioned in Moore *et al.*, 1978. The genus is characterized by a slender conical calyx with unswollen,

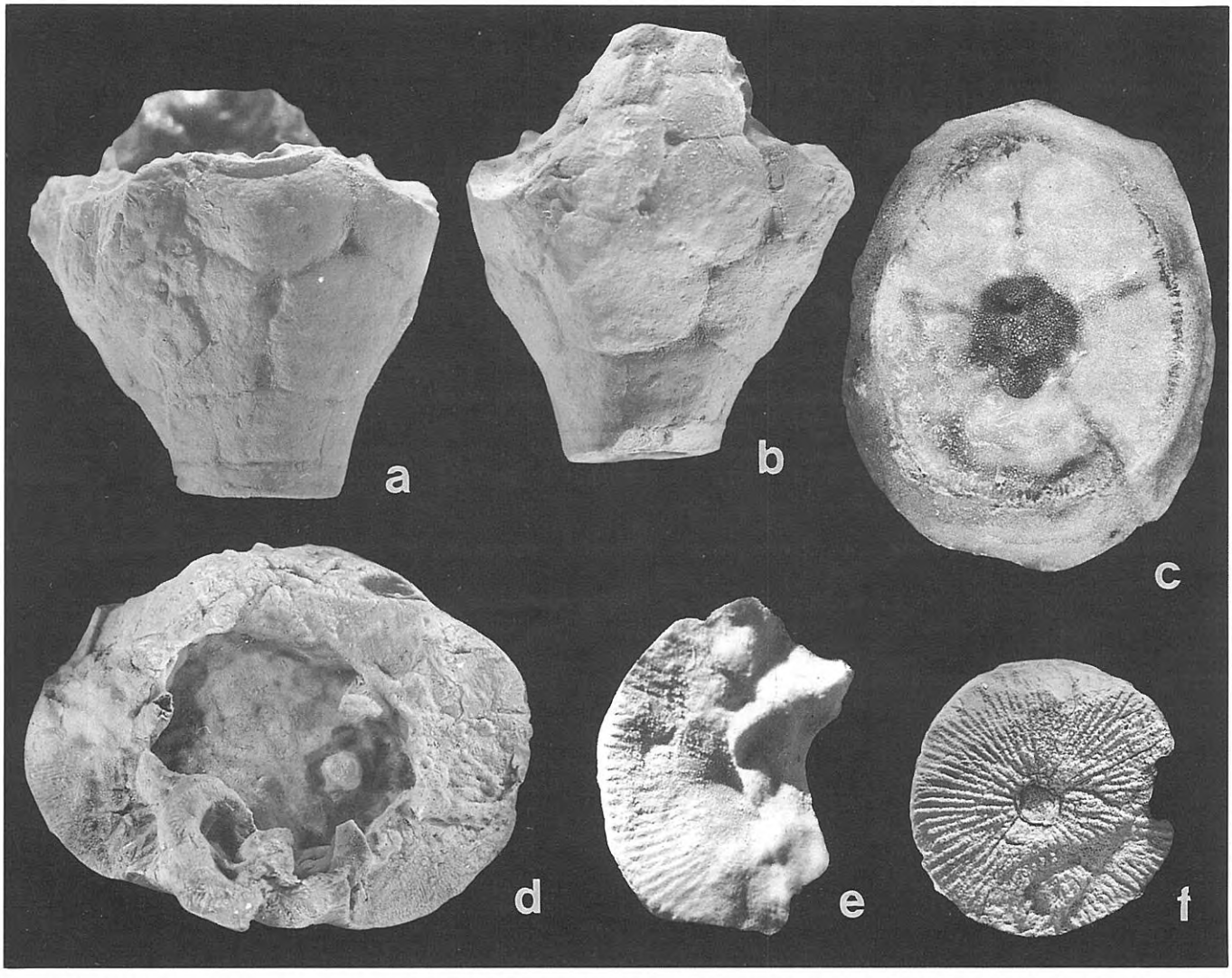

Figure 2. *Balearocrinus cantabricus* Herbig. Refigured type material. Genicera Formation (Canalón Member), Nocedo, upper Bernesga valley (Prov. León).
a-b. Holotype, SMF 34490, × 3.0. a - Anterior view of cup with well preserved first primibrachial (radius A) and uppermost columnals. b - posterior view with three anal plates and lowermost plates of anal tube. Note in both views small, localised pit-like depressions at the plate angles which might be goniopores. c. Paratype, SMF 34492, × 3.0. Aboral view of cup, showing finely radially ridged margins of the infrabasalia. d. Paratype, SMF 34493, × 3.0. Adoral view. Basal part of anal tube perserved below. Note wide articular facets of radials B and C. e. Holotype, SMF 34490, × 6.8. Wide articular facet of first primibrachial (radius A). f. Paratype, SMF 34498, × 4.2. Columnal, corresponding to the form genus *Cyclocaudex aptus* Moore & Jeffords, 1968.
Specimens are coated with ammonium chloride, except Fig. c. They are housed under their numbers in Naturmuseum Senckenberg, Frankfurt a. M.

almost flat calyx plates and infrabasals visible in lateral view. Number and arrangement of the calyx plates (including three anal plates) are typical of the Poteriocrinitidae. Radials bear large, striated articular facets, only slightly inclined outwards and downwards. Primibrachials (up to five in *B. breimeri*) are very compressed. The columnals of *Balearocrinus* correspond to the form genus *Cyclocaudex* Moore & Jeffords, 1968 (Bourrouilh & Termier, 1973). They are especially close to *Cyclocaudex aptus* Moore & Jeffords, 1968 (Fig. 2f), which is known from the Lower Mississippian of Kentucky and the Tournaisian to lower Namurian of Poland (Gluchowski, 1981a, b).

The genus *Poteriocrinites* is differentiated mostly by narrow, horseshoe-shaped radial facets; other characters are very close to *Balearocrinus.*

Rhabdocrinus is differentiated by an inflated conical calyx with swollen, convex calyx plates; marked depressions occur at the plate angles. Radial facets are strongly sloping outward-downward. The proximal primibrachials are connected by small interbrachial platelets and, thus, are included into the calyx. An anal sac is not known from *Rhabdocrinus.*

Recently, Haude & Thomas (1992) claimed synonymy of *Balearocrinus* with *Culmicrinus* (Blothrocrinidae). This was based on the very similar cups of both genera with strongly depressed primibrachials, depressed plate angles (goniopores?) in *Balearocrinus cantabricus* (Fig. 2a-b), and the discovery of isolated sac plates of *Culmicrinus* in the Menorcan stratum typicum of *B. breimeri.* Problems arise from the still mostly unknown anal tube of *Balearocrinus* and most probably different stem morphologies. A heteromorphic stem, diagnostic of *Culmicrinus*, could not be proved for *Balearocrinus* so far (Herbig 1982: p. 481 and fig. 3/6b). Moreover, columnals of *Culmicrinus* are not of the *Cyclocaudex* form type because of their very coarse crenulation (Haude & Thomas 1992: pl.5, fig. B; pl. 6, figs. H-l).

Paleoecology: *Balearocrinus* was a dweller of pelagic realms. Opposed, *Rhabdocrinus* is best documented from transgressive limestone horizons in an otherwise mostly shaly to silty near-shore facies in Scotland (Lower Limestone Group, Wright, 1950). Thus, that species apparently prefered shallow-shelf carbonate realms with stronger facies gradients and near-by land-masses (compare the detailed facies analysis of Wilson, 1989).

Balearocrinus cantabricus Herbig, 1982
(Figs. 2a-f)

*1982 *Balearocrinus cantabricus* Herbig, 479-481, Figs. 2-3.
1992 *Rhabdocrinus scotocarbonarius* (Wright); Morris, 182-183, fig. 2a-d.

Remarks: Form and dimension of the calyx as well as arrangement, shape and dimensions of the calyx plates of the single specimen of *Rhabdocrinus scotocarbonarius* described by Morris (1992) are virtually the same than of *Balearocrinus cantabricus* Herbig. This is also true for the preserved part of the anal tube, strongly compressed primibrachials, and large articular facets of radials and primibrachials. Further analogies concern the weak ornamentation of calyx plates, localised pit-like depresssions at their triple junctions, and the aboral surface of the cup, which is a shallow, truncated cone. For better comparison, part of the type material of *B. cantabricus* is refigured (Fig. 2a-f). Note, that the relatively broad appearing calyces of paratypes figured by Herbig (1982: Figs. 3/2a-b, 3/3a) are slightly crushed and compressed. Minor differences concern the somewhat stronger outward-downward inclined radial facets of Morris' specimen and the existence of up to four primibrachials - only two could be proved in the type material of *Balearocrinus cantabricus.* The existence of four primibrachials approaches *B. cantabricus* closer to the Menorcan *B. breimeri* Bourrouilh & Termier, 1973, which has five primibrachials. However, the calyx plates of *B. breimeri* are crenulated; an anal tube is not known. Since also the dimensions, as judged from Bourrouilh & Termier's figures, are comparable, a synonymy of both species might turn up. This has to be verified by further finds and restudy of the type material.

Morris (1992) listed some differences between his Cantabrian *Rhabdocrinus scotocarbonarius* and the Scottish specimens, including the holotype. Differences include those, which were used by Bourrouilh & Termier (1973) and Herbig (1982) to differentiate the genus *Balearocrinus.* This further justifies inclusion of the Villabellaco crinoid in *Balearocrinus cantabricus.*

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