Ann. Naturhist. Mus. Wien, Serie A	112	733-774	Wien, Juni 2010

Crinoids from the Barremian (Lower Cretaceous) of the Serre de Bleyton (Drôme, SE France)

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(With 2 figures and 7 plates)

Manuscript submitted on September 11th 2009,
the revised manuscript on January 11th 2010

Abstract

The Barremian of the Serre de Bleyton has yielded many disarticulated but well-preserved elements of a diverse crinoid fauna of at least six species, dominated by comatulids (three species) and isocrinids (two species). The single apiocrinitid species is rare. Except for the large and well-known comatulid *Decameros ricordeanus* d'Orbigny, 1850, with specimens similar to the subspecies or variety *vagnasensis* (de Loriol, 1888), five of the six species are new. However, only for three of them a new species name is introduced, *Isocrinus*? *bleytonensis* nov. spec., *Comatulina moosleitneri* nov. spec. and *Semiometra barremiensis* nov. spec. Two fairly rare species, *Percevalicrinus* sp. and *Apiocrinites* sp., are described in open nomenclature.

This Barremian fauna fills a stratigraphic gap from which only few crinoids had so far been described. Apart from some Hauterivian crinoids (mainly isocrinids), the stratigraphically nearest crinoid-rich (and especially comatulid-rich) horizons are the Valanginian of western Switzerland and southeastern France and especially the Aptian of southeastern France and Spain. The high percentage of new species is not surprising due to phylogenetic changes during the time span Valanginian – Aptian. Apart from these differences at species level, the crinoid fauna from the Serre de Bleyton fits well into the overall faunal composition known from Late Jurassic to Early Cretaceous sites.

Keywords: Crinoidea, Isocrinida, Comatulida, new species, Lower Cretaceous, Barremian, France, Drôme.

Zusammenfassung

Crinoiden aus dem Barremium (Unter-Kreide) der Serre de Bleyton (Drôme, Frankreich)

Aus dem Barremium der Serre de Bleyton stammen zahlreiche disartikulierte, aber gut erhaltene Skelettelemente einer diversen Crinoidenfauna. Sie besteht aus mindestens sechs Arten und wird

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dominiert von Comatuliden (drei Arten) und Isocriniden (zwei Arten). Die einzige Apiocrinitide ist selten. Mit Ausnahme der großwüchsigen und gut bekannten Comatulide *Decameros ricordeanus* D'ORBIGNY, 1850, von der Exemplare ähnlich der Subspecies oder Varietät *vagnasensis* (DE LORIOL, 1888) gefunden wurden, sind fünf der sechs Arten neu; jedoch wird nur für drei ein neuer Artname aufgestellt: *Isocrinus*? *bleytonensis* nov. spec., *Comatulina moosleitneri* nov. spec. und *Semiometra barremiensis* nov. spec. Zwei relativ seltene Arten, *Percevalicrinus* sp. und *Apiocrinites* sp., werden in offener Nomenklatur beschrieben.

Die vorliegende Fauna aus dem Barremium füllt eine stratigraphische Lücke, aus der bisher nur wenige Crinoiden beschrieben wurden. Abgesehen von einigen Crinoiden aus dem Hauterivium, hauptsächlich Isocriniden, sind die stratigraphisch nächstgelegenen crinoidenreichen (und speziell comatulidenreichen) Horizonte das Valanginium der Westschweiz und von Südostfrankreich und vor allem das Aptium von Südostfrankreich und Spanien. Aufgrund phylogenetischer Veränderungen zwischen Valanginium und Aptium überrascht der hohe Prozentsatz neuer Arten nicht. Abgesehen von diesen Unterschieden auf Art-Niveau paßt die Crinoidenfauna von der Serre de Bleyton gut zu der allgemeinen Faunenzusammensetzung bekannter Fundorte aus Ober-Jura bis Unter-Kreide.

Schlüsselworte: Crinoidea, Isocrinida, Comatulida, neue Taxa, Unter-Kreide, Barremium, Frankreich, Drôme.

Introduction

Normally, fossils can barely be isolated from the well-cemented Urgonian limestones. However, at two sites in the Serre de Bleyton (Drôme, France), each of very small size, the rock had become friable by natural weathering so that the highly diverse mesofauna can be isolated from the matrix. The crinoid fauna consists for the greatest part of disarticulated but well-preserved skeletal elements. The fauna is Barremian in age and fills the stratigraphical gap between well-known crinoid faunas from the Valanginian and Aptian which are similar in overall faunal composition but different at the species level.

Study Area and Geological Setting

The material described in this paper comes from two closely spaced sites, SdB1 and SdB2, on a slope beside a field-track at the Serre de Bleyton (Fig. 1), a low hill in front of the Serre Malivert, situated approximately 90 km northnortheast of Avignon. The nearest very small villages are Arnayon and Berlières in the east and Léoux in the south, the nearest somewhat larger villages are Villeperdrix and Rémuzat in the south. MOOSLEITNER (2007) has described the geological situation in detail. The main site, SdB1, is only 50 cm wide and 15 cm high. The fossils, usually less than 20 mm in diameter and 35 mm at maximum, are derived from a shallow marine habitat and are concentrated in the basal bioclastic limestone breccia of a turbidite which is intercalated between limestone layers deposited in deeper shelf environment. The fossils of the turbidite are Barremian, possibly late Barremian in age according to the foraminifer fauna studied by DR.

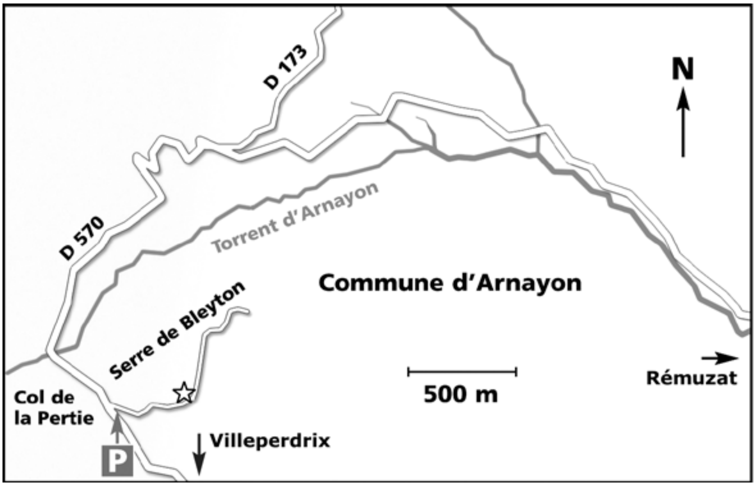

Fig. 1. Study area. The star indicates the position of the studied section from MOOSLEITNER (2007).

ANNIE ARNAUD VANNEAU, Laboratoire de Geodynamique des Chaines Alpines, Grenoble (MOOSLEITNER 2007, p. 293).

Materials and Methods

GERO MOOSLEITNER took bulk samples repeatedly, washed and sieved them, picked the fossils under a binocular microscope and treated them with Rewoquat® for cleaning, sorted them roughly into zoological groups and sent them to specialists. As is common in the great majority of fossil sites (except fossil Lagerstätten of the conservation type), the crinoids are disarticulated into isolated elements, except for pluricolumnals, comatulid cups, and comatulid cups with centrodorsal.

The author first sorted the specimens into morphologically different groups, then tried to determine the systematically most important kinds of elements (columnals in Isocrinidae and *Apiocrinites*, centrodorsals and cups in Comatulida), and later tried to combine the disarticulated brachials and part of the pinnulars and cirrals with the columnals, centrodorsals and cups, using descriptions and figures of related taxa in the literature.

All material from the Serre de Bleyton studied by the author is contained in the collections of the Natural History Museum Vienna (NHMW).

Abbreviations

Cd(d) = Centrodorsal(s); D = Diameter; Doa = oral-aboral Diameter; H = Height; L = Length; SdB1 and SdB2 = sites 1 and 2 at the Serre de Bleyton; W = Width.

Numbering of crinoid brachials:
IBr(r) = primibrachial(s), numbered from proximal to distal IBr_1, IBr_2.
IIBr(r) = secundibrachial(s), numbered similarly.
IIIBr(r) = tertibrachial(s)
IAx(x), IIAx(x), IIIAx(x) = prim-, secundi-, tertiaxil(s).

Systematic palaeontology

Order Isocrinida Sieverts-Doreck, 1952

Family Isocrinidae Gislén, 1924

Subfamily Isocrininae Roux, 1981

Genus *Isocrinus*? von Meyer in Agassiz, 1836

***Isocrinus*? *bleytonensis* nov. spec.**
(Pl. 1, Figs 1-10; Pl. 2, Figs 1-7)

pars 2007 *Nielsenicrinus lissajouxi* (de Loriol). – Moosleitner: p. 296, Pl. 9, Figs 9, 11–14, non Fig. 10.

Material: SdB1: 2 proximal pluricolumnals not included in the following figures. Numerous columnals and pluricolumnals, altogether 1579 columnals (237 large nodals, 70 small nodals, 918 large internodals, 354 small internodals), among these are 87 complete noditaxes (75 large, 12 small). 1 and 1? radials, 1 IBr_2 = IAx, 2 $IIBrr_2$, 36 brachials with muscular articulations on both facets, 10 episymmorphals, 2 hyposymmorphals, 11 II, IIIAxx.

SdB2: Numerous columnals and pluricolumnals, altogether 136 columnals (6 large nodals, 13 small nodals, 26 large internodals, 91 small internodals), among these are 2 complete noditaxes (large). 1 and 1? radials, 1 IBr_2 = IAx, 1 $IIBr_1$, 6 brachials with muscular articulations on both facets, 3 episymmorphals, 2 hyposymmorphals, 2 II, IIIAxx.

At both sites numerous cirrals and pinnulars, not counted. The cirrals, radials, brachials and pinnulars are tentatively included in the present species although it cannot be ruled out that a few of the smaller specimens might belong to *Percevalicrinus* sp. rather.

Derivatio nominis: After the site "Serre de Bleyton" in France where the crinoids were collected.

Diagnosis: Columnals commonly stellate, up to 7.2 mm in diameter, low, with a strongly developed horizontal ridge on the latera. Columnals alternate in height and width. Noditaxis of 4–8 columnals in fully-grown parts of the column. Basal circlet closed. Articulations IBr_{1-2} and $IIBr_{1-2}$ are embayed synarthries. Weak symmorphies occur in more distal positions.

Holotype: Pluricolumnal of a nodal, an infranodal, and an internodal below. Nodal diameter 5.4 mm, infra- and internodal smaller. Barremian, SdB1, Serre de Bleyton, Drôme, France, Pl. 1, Fig. 3, NHMW no. 2009z0180/0003.

Description: Description of large columnals, including nodals 3.6–7.2 mm in diameter: Columnals low and commonly stellate, less often pentalobate. As much as 11 culmina along petal. Latera with a well-developed horizontal ridge all around.

Nodals distinctly taller and wider than internodals; internodals in approximately three different size classes (Pl. 1, Figs 3 and 6–8). In fully-grown column portions, nodal height is fairly uniform, 0.8–1.4 mm. Height of the lowest internodal in a noditaxis also is fairly uniform, 0.4–0.7 mm. In many large stellate nodals the tips are slightly curved in the same direction leading to a somewhat spiral aspect (Pl. 1, Fig. 5).

Larger and smaller internodals tend to alternate: The largest internodal is situated in the middle of a noditaxis if the noditaxis has an odd number of columnals, but just above the middle if the noditaxis has an even number of columnals. The second largest internodal in noditaxes of 5 columnals is the infranodal. The two second largest internodals in noditaxes of 6 columnals are the infranodal and the supranodal, in noditaxes of 7 columnals the columnal just below the infranodal and the supranodal itself, and in noditaxes of 8 columnals the columnal just below the infranodal and the columnal just above the supranodal. Considering these relationships, the number of columnals per noditaxis may be estimated even in incompletely preserved noditaxes.

Two extraordinary pluricolumnals, both markedly stellate in outline, are from the proximal growth zone of the column, just below the cup. The smaller one (Pl. 1, Fig. 1) is only 3.0 mm in diameter and consists of 9 columnals which are, from proximal to distal, an infranodal, three low nodals, an internodal, a slightly taller nodal, an internodal, a still slightly taller nodal and an internodal. The only cryptosymplexy is on the proximal facet of the infranodal, all other articulations are symplexies. The larger pluricolumnal (Pl. 1, Fig. 2) has no cryptosymplexy at all, but only symplexies, and consists of 7 columnals, which are, from proximal to distal, two internodals, three nodals, an internodal, and a nodal, with the nodals slightly increasing in height from proximal to distal. The height of these very proximal nodals is only 0.5–0.6 mm. The extremely short noditaxes of only 1 and 2 columnals in these two proximal pluricolumnals are not considered in the tables and calculations below.

Another proximal pluricolumnal (Pl. 1, Fig. 4) consists, from proximal to distal, of a nodal and two complete noditaxes of 3 and 4 columnals, respectively. Including this specimen, 77 complete noditaxes were found (Pl. 1, Figs 4 and 6–8), see table. In average there are 5.31 columnals per noditaxis. The other pluricolumnals, shorter than a complete noditaxis, provide strong arguments that before disarticulation noditaxes of 6 and 7 columnals must have been considerably commoner than it appears from the figures in the table, but noditaxes with more than 8 columnals appear to be absent. However, calculation including all large columnals (complete noditaxes, short pluricolumnals and single columnals) averages in only 4.88 columnals per noditaxis. In 15 cases nodals and infranodals are still articulated.

Columnals per noditaxis	3	4	5	6	7	8
Number of specimens	1	15	28	26	6	1
Minimum H of pluricolumnal (mm)	2.1	2.0	2.3	2.8	4.3	4.9
Maximum H of pluricolumnal (mm)	2.1	4.2	4.5	4.6	5.7	4.9

Description of the smaller columnals, including nodals 0.7–3.5 mm in diameter: The outline may vary considerably: stellate, pentagonal, pentalobate, rarely nearly circular. Within pluricolumnals, alternation of columnal size is less pronounced, but usually detectable, than in the large ones. However, between different small specimens the height varies considerably. Typical columnals are relatively low, nodals are 0.6–0.9 mm tall. Taller small columnals and also juvenile columnals with synarthrial facets are tentatively considered to belong to *Percevalicrinus* sp. (below).

A complete noditaxis is preserved in 12 small pluricolumnals, see table. In average there are 4.92 columnals per noditaxis, a figure comparable to the large specimens. However, calculation including all small columnals (complete noditaxes, short pluricolumnals and single columnals) averages in 6.36 columnals per noditaxis, a figure which seems too large and may be explained by errors in separating between the small columnals of *Isocrinus*? *bleytonensis* and *Percevalicrinus* sp. In 6 cases nodals and infranodals are still articulated.

Columnals per noditaxis	4	5	6	7
Number of specimens	6	2	3	1
Minimum H of pluricolumnal (mm)	2.0	3.4	2.9	5.0
Maximum H of pluricolumnal (mm)	2.8	3.5	3.7	5.0

Pathological columnals: A nodal 5.5 mm in diameter from SdB1 (Pl. 1, Fig. 9) is six-rayed, with six cirrus sockets. An internodal 2.4 mm in diameter from SdB2 (Pl. 1, Fig. 10) is somewhat irregularly six-rayed. Five nodals from SdB1 have fewer than five cirrus sockets; three of these, 3.3, 4.7 and 5.7 mm in diameter, have only four; one, 5.5 mm in diameter, has only three; another one, 6.6 mm in diameter, is damaged, but may have even fewer than three cirrus sockets.

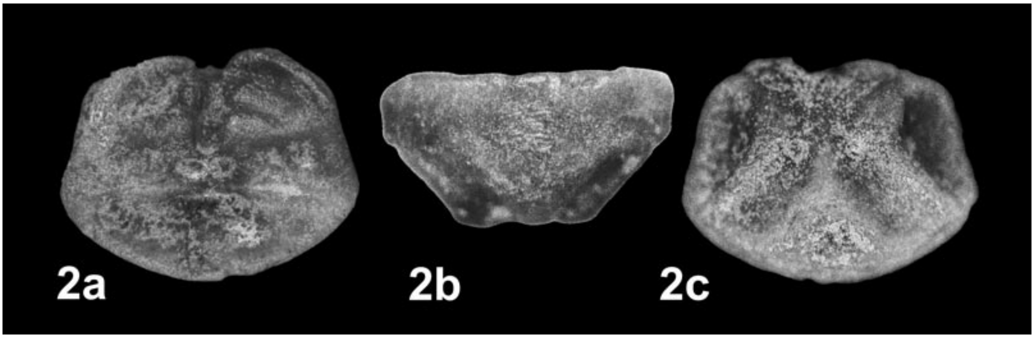

Fig. 2. Radial, probably of the family Isocrinidae, gen. et sp. indet. a: distal facet with muscular articulation; b: aboral view; c: proximal view with facets to basals. W 2.3 mm, Doa 1.8 mm, H 1.2 mm. NHMW 2009z0180/0060. Barremian, Serre de Bleyton, Drôme, France, locality SdB2.

Cirrus sockets wide elliptical, covering the whole or nearly the whole height of the nodal, but not reaching into the supranodal or infranodal. Cirrals of the usual isocrinid shape are found in large numbers, including some end claws, but are neither counted nor described here.

Two radials (Pl. 2, Figs 1–2) probably belong to the present species. The aboral surface is trapezoidal and smooth. There are two large oblique facets to the neighbouring radials which in the smaller specimen are somewhat striated near the aboral margin (Pl. 2, Fig. 1c). On the proximal side there are two small facets to the basals; they are nearly parallel to each other and to the distal side of the radial. Therefore the boundary between the basal and the radial circlets must have been nearly horizontal, and the basal circlet must have been closed. The distal facet is wide, but short in oral-aboral diameter, and the smaller specimen has two small but distinct processes near the lateral-oral margin (Pl. 2, Figs 1b–c). Such processes are only fairly indicated in the larger radial. The distal facet shows a large and deep aboral ligament fossa and a strong transverse ridge. The interarticular ligament fossae and the adoral muscle fossae are distinct, wide and short in oral-aboral diameter. The ridges between the interarticular ligament fossae and the adoral muscle fossae are nearly parallel to the transverse ridge.

Two other radials, one from SdB1 and one from SdB2 (Fig. 2), are very different and may represent a different species. In aboral view they are low triangular with two concave lower sides. Compared to the two radials described above, the ratio of the oral-aboral diameter to the width is much larger. The facets to the neighbouring radials are oblique, concave and surrounded by a ring wall. The facets to the basals are only slightly smaller. The distal facet is oval and shows a large and deep aboral ligament fossa, a strong transverse ridge, relatively weak interarticular ligament fossae, but distinct adoral muscle fossae.

	Width (mm)	Oral-aboral diameter (mm)	Height (mm)
Radials	2.7–3.7	1.2–2.1	1.7–2.2
Radials, sp. indet.	2.3–2.6	1.8–1.9	1.1–1.2
$IBrr_2$	1.8–3.7	1.2–3.0	1.1–2.3
$IIBr_1$	3.1	2.4	1.5
$IIBrr_2$	2.1–3.2	2.0–2.9	1.1–1.6
IIAxx (in part IIIAxx)	1.7–4.0	1.1–4.1	0.7–1.9

A moderate number of disarticulated brachials is thought to belong to the present species on account of size, facets and overall isocrinid morphology. On the one hand, it is possible that some of the smaller brachials may belong to *Percevalicrinus* sp. On the other, distinction between brachials of isocrinids and comatulids is fairly easy because in the comatulid brachials the morphological features of the facets are stronger.

No isocrinid brachial from the SdB has any ornament on the aboral surface except for very fine ventrical lines in a few specimens. No IBr_1 was found.

Only the larger one of the two $IBrr_2$ = IAxx is well-preserved (Pl. 2, Fig. 3). They are triangular in aboral view. The proximal facet is an embayed synarthry with week fulcral ridge, bifurcated near the aboral margin. The two facets on the distal side are oblique muscular, with their transverse ridges meeting at the aboral margin to form an approximately right angle. The aboral ligament fossa is well developed, but the interarticular ligament fossae and the adoral muscle fossae are weakly developed. The adoral grooves are deep.

The only $IIBr_1$ found (not figured) is wedgeshaped. The proximal facet is obliquely muscular. The distal facet is an embayed synarthry with well-developed fulcral ridge.

In the $IIBrr_2$ (Pl. 2, Fig. 4), the proximal facet is an embayed synarthry with weak fulcral ridge, bifurcated near the aboral margin. The distal facet is obliquely muscular with the first pinnule socket.

The brachials following the $IIBr_2$ are low, except for the axillaries. Most brachials have oblique muscular facets (Pl. 2, Fig. 5), some are episymmorphals (Pl. 2, Fig. 6), others are hyposymmorphals. The symmorphy is only weak, with two very low and blunt processes on the episymmorphal (Pl. 2, Fig. 6) corresponding to two very shallow pits on the hyposymmorphal. Between the processes the facets show numerous short and thin radial culmina near the aboral margin. One of the hyposymmorphals is extremely oblique and is presumably a $IIIBr_1$, despite its large size: 3.0 mm wide, 2.0 mm in oral-aboral diameter and 0.9 mm tall.

The IIAxx (in part IIIAxx) (Pl. 2, Fig. 7) are triangular in aboral view and subcircular on the distal side, the oral-aboral diameter equals or near-equals the width. They differ from the IAxx by a proximal oblique muscular facet and by a much smaller angle between the two transverse ridges of the distal facets. Thus, the transverse ridges do not meet, but each of them meets the aboral margin separately.

Discussion: When comparing *Isocrinus*? *bleytonensis* nov. spec. with other Early Cretaceous isocrinids (Wienberg Rasmussen 1961), it is closest to *Isocrinus*? *lissajouxi* (de Loriol, 1904) from the Berriasian to Hauterivian of France and Switzerland. However, in *Isocrinus*? *bleytonensis* the columnals are larger in diameter and comparatively lower, the difference in diameter between nodals and internodals is larger, the horizontal ridge on the latera is stronger, and the noditaxes (4–8 in fully-grown columns) are slightly shorter than in *lissajouxi* (5–9).

Compared to the large number of columnals and pluricolumnals, the number of isolated isocrinid brachials found at the SdB is too low. This may be due to separation during transport or different preservation potential.

At least the larger of the isocrinid brachials described above are thought to belong to *Isocrinus*? *bleytonensis*, because this is the only large-sized isocrinid species found at the SdB. However, no articulated specimens are preserved to prove this. In accordance with Wienberg Rasmussen (1961), isocrinid species of which only the column is known and affiliation to a genus according to brachial articulation is not certain are described as *Isocrinus*?.

On the one hand, the morphologies of the columnals of *Isocrinus*? *bleytonensis* and *I.*? *lissajouxi* (moderate to large size, stellate outline, columnals low, alternating in height and diameter, with strong horizontal ridge at the latera, noditaxes short to moderate) and of the associated radials indicating a closed basal circlet match the genus *Nielsenicrinus* Wienberg Rasmussen, 1961 in the family Cainocrinidae Simms, 1988.

On the other hand, disarticulated proximal brachials associated and believed to belong to *Isocrinus*? *bleytonensis* indicate embayed synarthries at $IBr_{1\text{-}2}$ and at $IIBr_{1\text{-}2}$ and weak symmorphies more distally. These features do not match the articulations of *Nielsenicrinus* (see Wienberg Rasmussen 1961, 1978; Hess in press): cryptosyzygy at $IBr_{1\text{-}2}$, flat synarthry at $IIBr_{1\text{-}2}$ and cryptosyzygy at $IIBr_{3\text{-}4}$. In these characters the isocrinid brachials from the SdB match those of the genus *Isocrinus* sensu stricto.

In consequence, *Isocrinus*? *bleytonensis*, in spite of its *Nielsenicrinus*-like columnals, does not belong to the genus *Nielsenicrinus*. Instead, the author believes that *Isocrinus*? *bleytonensis* may be a link between *Isocrinus* sensu stricto (family Isocrinidae, occurring already in the Jurassic) and *Nielsenicrinus* of the Cretaceous family Cainocrinidae. It seems that *Nielsenicrinus*-like columnals were developed earlier than the characteristic *Nielsencrinus*-type brachial articulations.

Subfamily Balanocrininae Roux, 1978

Genus *Percevalicrinus* Klikushin, 1977

***Percevalicrinus* sp.**
(Pl. 3, Figs 1-7)

pars 2007 *Nielsenicrinus lissajouxi* (de Loriol). – Moosleitner: p. 296, Pl. 9, Fig. 10, non Figs 9, 11–14.

Material: SdB1: Columnals and short pluricolumnals, altogether 7 nodals and 30 internodals. 35 tall juvenile columnals with synarthries are tentatively placed here.

SdB2: Columnals and short pluricolumnals, altogether 4 nodals and 27 internodals. 2 low and 5 tall juvenile columnals with synarthries are tentatively placed here.

No cirrals, radials, brachials or pinnulars are listed here, but it cannot be ruled out that some of the smaller specimens listed under *Isocrinus*? *bleytonensis* might belong to *Percevalicrinus* sp. in fact.

Description: Some juvenile internodals with smooth latera and synarthrial articulations are found. They may belong to the same species although it cannot be excluded that some of them represent juvenile Comatulida. Two are 0.5 mm in diameter each and 0.3 mm and respectively 0.4 mm tall (Pl. 3, Fig. 1). The other specimens are slender, tall and waisted, they are usually 0.2–0.6 mm in diameter and 0.6–1.6 mm tall (Pl. 3, Fig. 2). A single exceptionally large specimen is 1.1 mm in diameter and 1.9 mm tall.

Among the other small but non-synarthrial isocrinid columnals, those taller than in *Isocrinus*? *bleytonensis* are described here (Pl. 3, Figs 3–7). However, separation is not always easy. The columnals are 0.5–3.4 mm in diameter. Many, but not all, of them are characterised by straight or slightly concave latera with protruding margins of the articular facets (Pl. 3, Figs 5b and 6b), either a horizontal ridge or, more often, a horizontal line of granules instead, and interradial vertical ridges. The cirrus sockets are less elliptical than in *Isocrinus*? *bleytonensis* and lower than nodal height (Pl. 3, Figs 3b, 4a, and 7), in some specimens they are directed obliquely upwards. The longest pluricolumnal found (Pl. 3, Fig. 7) has four internodals and a nodal; it indicates that the noditaxis must have had at least six columnals.

Order Comatulida A. H. Clark, 1908

Suborder Comatulidina A. H. Clark, 1908

Superfamily Solanocrinitoidea Jaekel, 1918

Family Solanocrinitidae Jaekel, 1918

Genus *Comatulina* d’Orbigny, 1852

Comatulina moosleitneri nov. spec.
(Pl. 3, Fig. 8; Pl. 4, Figs 1-5)

pars 2007 *Comatulina* nov. spec. – Moosleitner: p. 296, Pl. 9, Figs 4–6, non 7–8.

Material: SdB1: 19 Cdd and a fragment, 14½ cups with Cdd, 6½ cups.

SdB2: 1 Cd, 2 cups with Cdd.

Numerous cirrals, brachials and pinnulars cannot be sorted into *Comatulina moosleitneri* and *Semiometra barremiensis*. They are described separately below.

Derivatio nominis: In honour of Gero Moosleitner, who discovered the sites at the Serre de Bleyton, collected, washed and forwarded the fossils to specialists.

Diagnosis: Centrodorsal in adult specimens inverse truncated conical with rounded side, bowlshaped or low and cylindrical, up to 6.7 mm in diameter. Cirrus sockets closely spaced, somewhat irregularly arranged in usually 20, less often 15–19 or 21–22 vertical columns, each with 1–4, mostly 2–3, cirrus sockets.

Cup (radial circlet) considerably taller than usual for the superfamily Solanocrinitoidea. In small to medium-sized specimens the cup is even taller than the centrodorsal.

Holotype: Cup with centrodorsal, largest diameter 5.3 mm, total height 5.0 mm, height of centrodorsal 2.8 mm, height of cup 2.5 mm. Barremian, SdB1, Serre de Bleyton, Drôme, France, Pl. 4, Figs 2a–d, NHMW no. 2009z0180/0029.

Description: Centrodorsals (Pl. 3, Fig. 8; Pl. 4, Figs 1–2 and 4–5) inverse cone-shaped in the smallest specimens (Pl. 3, Fig. 8), in larger specimens truncated inverse conical with rounded sides (Pl. 4, Figs 1b, 1c, 2b, and 2c), bowlshaped (Pl. 4, Fig. 5b) or low and cylindrical (Pl. 4, Fig. 4b). Adoral side may be somewhat concave. At SdB1, specimens of different size occur, whereas at SdB2 the 2 cups with centrodorsal are large, but the single centrodorsal is small.

Cd D (mm)	2.0–3.0	3.1–4.0	4.1–5.0	5.1–6.0	6.1–6.7
Cd H (mm)	1.0–1.5	0.9–2.0	1.7–2.7	2.4–2.8	2.9–3.0

A few very small centrodorsals, 2.0–2.6 mm in diameter (Pl. 3, Fig. 8), are convex or even pointed at the centre of the aboral side, with only a negligibly small central area free of cirrus sockets. Larger centrodorsals, however, are either plan or, more commonly, have a more or less wide and shallow concave area free of cirrus sockets (Pl. 4, Figs 1d, 2d, 4a, and 5c). In centrodorsals measuring 6.1–6.7 mm in diameter, the area free of cirrus sockets is 5.0–5.4 mm in diameter, in smaller centrodorsals it is correspondingly smaller, but very variable, in absolute diameter as well as in percentage of the diameter of the centrodorsal. Although no traces of sutures between hypothetical fused columnals are visible, breakage at such hypothetical sutures situated in different positions may explain the low and truncated shape of some centrodorsals (especially Pl. 4, Figs 4a and 4b), the variable height, the variable number of cirrus sockets and the variable width of the concave area. Within the concave area of a few well-preserved large centrodorsals, five rod-shaped elevations are present in interradial position, and in radial position a pair of short radial furrows (but no holes) may be present in each ray (Pl. 4, Figs 1d and 2d). However, in most specimens these details are not well visible. It is very doubtful if they are homologous to the dorsal star of other comatulids.

Cirrus sockets vary somewhat in size. They are closely spaced and arranged in somewhat irregular vertical columns. In many specimens, one cirrus socket in each radius situated immediately below the radial may be very small and tube-shaped, surrounded by a free space (best visible in Pl. 4, Figs 1c and 2b). Usually there are 20 vertical columns of cirrus sockets, but a few large specimens may have 21–22 and a few small specimens may have only 15–19. The columns consist of 1–4 cirrus sockets, in most cases there are 2–3. Commonly the sockets of neighbouring columns alternate in position. The adoral side of the centrodorsal has a steep, stellate, 0.8–2.0 mm wide central cavity (Pl. 4, Fig. 5a).

Cd D (mm)	2.0–3.0	3.1–4.0	4.1–5.0	5.1–6.7
Number of cirrus sockets	28–45	36–50	35–52	46–56

The cup (radial circlet; Pl. 4, Figs 1–3) is stellate. The radial facets are steeply sloping and tall in oral-aboral direction. Therefore the cup is very tall. The rod-shaped basals are well visible in cups without centrodorsal (Pl. 4, Fig. 3c), but detectable only as tiny triangles in cups with attached centrodorsal.

In small- and medium-sized specimens the cup is approximately as wide as the centrodorsal, but in large specimens the cup is up to nearly 1 mm smaller in diameter, even in interradial position.

Cup D (mm)	3.0	3.1–4.0	4.1–5.0	5.1–5.8
Cup H (mm)	1.5	1.6–2.5	2.0–2.8	2.0–3.5

The ratio: height of the cup (radial circlet) to height of the centrodorsal is very high compared to other species of the genus *Comatulina* and the superfamily Solanocrinitoidea. Small centrodorsals are usually lower than the attached cups. In medium-sized specimens (centrodorsal 4.1–5.0 mm in diameter), the centrodorsal is mostly slightly lower, less often slightly taller than the cup. However, centrodorsals 5.0–6.7 mm in diameter are usually taller than the attached cups.

There is no free aboral surface of the radial circlet, but a subradial cleft is common (Pl. 4, Figs 1c, 2b, and 2c).

The radial cavity is narrow and deep. It is normally 1.1–1.8 mm in diameter, but only 0.7 mm in the smallest cup.

The aboral ligament fossa is deep and the transverse ridge well developed. Although the interarticular ligament fossae and the adoral muscle fossae are only moderate, the ridges in-between are well developed.

Discussion: The present form differs from other species of the genus *Comatulina* (see, for example, Wienberg Rasmussen (1961) and Radwańska (2005)) and the superfamily Solanocrinitoidea by its tall cup which in small- to medium-sized specimens even exceeds the height of the centrodorsal. In this character it is similar to the stratigraphically older genus *Palaeocomaster* Gislén, 1924. However, the relatively high number of cirrus sockets and their arrangement in somewhat irregular but more or less distinct vertical columns matches the genus *Comatulina*. Thus, the new species combines a *Comatulina*-like centrodorsal and a *Palaeocomaster*-like cup.

The difference between the diameter of the centrodorsal and the smaller diameter of the cup is less pronounced than in *Semiometra barremiensis*. The star formed by the facets of the radials is thicker in the interradial areas, and the radial cavity is wider than in *Semiometra barremiensis*.

Only the centrodorsals, cups and radials of *Comatulina moosleitneri* are diagnostic of this species. The other disarticulated elements (numerous cirrals, brachials and pinnulars) are impossible to discriminate from disarticulated material of *Semiometra barremiensis*.

Family Decameridae Wienberg Rasmussen, 1978

Genus *Decameros* d'Orbigny, 1850

Decameros ricordeanus d'Orbigny, 1850

***Decameros ricordeanus* cf. *vagnasensis* (de Loriol, 1888)**
(Pl. 5, Figs 1-12; Pl. 6, Fig. 7)

pars 2007 *Decameros ricordeanus vagnasensis* (de Loriol). – Moosleitner: p. 296, Pl. 9, Figs 1–2, non 15, non 17.

Material: SdB1: 1 large Cd, 1 juvenile Cd, 2 large cups with Cdd, 253 large cirrals, 2? radials, 1 IBr_1, 66 $IBrr_{2\text{-}n}$ (22 large, 24 medium-sized, 20 small), 44 pinnulars.

SdB2: ½ medium-sized Cd, 31 large cirrals, 1 radial, 25 $IBrr_{2\text{-}n}$ (13 large, 6 medium-sized, 6 small), 2 pinnulars.

Description: Centrodorsal (Pl. 5, Figs 1–5) large, bowlshaped. Outline approximately circular but irregular due to irregular arrangement of cirrus sockets. Figures (in mm) see table.

	Cd D	Cup D	Cd H	Cup H	Total H
Juvenile Cd	5.4	—	2.0	—	—
Medium-sized Cd	9.3	—	3.0	—	—
Large cup with Cd	13.0	14.0	3.8	4.0	7.5
Large Cd	13.5	—	4.0	—	—
Large cup with Cd	14.5	16.0	4.0	5.0	8.0

Aboral side nearly flat, without cirrus sockets, dorsal star or any other ornament; diameter of flat area see table (below). Adoral side flat to slightly concave, with radially directed, but somewhat irregular coelomic furrows (Pl. 5, Figs 4b and 5a). Cirrus sockets large and closely spaced. They vary in size and outline and are arranged in very irregular vertical columns of only one or two cirrus sockets each. The total number of cirrus sockets (see table) is low and not increasing with age.

	D of flat area (mm)	Number of vertical columns	Total number of cirrus sockets
Juvenile Cd	1.5	approx. 10	17
Medium-sized Cd	7.0	—	approx. 19
Large cup with Cd	9.5	approx. 12	17
Large Cd	10.5	approx. 15	19
Large cup with Cd	11.0	approx. 13	16

Cup (Pl. 5, Figs 1–2) pentagonal, somewhat larger in diameter than centrodorsal and slightly overhanging, at least interradially. Radial cavity wide, deep, bowlshaped, pentagonal in outline, ornamented by granules, crests and pits. Radial circlet without free aboral surface. Basals hidden. Radial facets steep, trapezoidal, 8.0–9.0 mm wide in adults, muscle fossae with small projections at distal tips.

A single large isolated radial from SdB2 (Pl. 5, Fig. 8) matches the radials of the complete cups. Its facet is trapezoidal and 8.3 mm wide. The truncated triangular proximal surface (Pl. 5, Fig. 8b) represents no free surface but was formerly covered by the centrodorsal.

In contrast, the two isolated radials from SdB1 (not figured) are much smaller (width only 4.3 mm in the larger specimen) and do not match the radials of the complete cups from SdB1. Their affiliation is uncertain.

Among the isolated cirrals and brachials, those belonging to *Decameros* are easily distinguished from all other crinoids of the SdB by their large size. All cirrals are short. The proximal cirrals (Pl. 5, Fig. 6) are wide and nearly circular in outline. The distal cirrals

(Pl. 5, Fig. 7) are slender, taller than wide and elliptical in outline. Only the distal cirrals may have a ridge on the underside. No suitable large end claw was found.

The sole IBr_1 found (Pl. 5, Fig. 9) was more than 10.7 mm wide (a piece is broken off). The proximal facet is straight muscular, the distal oblique muscular with a pinnule socket (at IBr_1!).

All other brachials are non-axillary, have oblique muscular facets and a well-developed pinnule socket. They have a strong transverse ridge, a broad and distinct aboral ligament pit and a large V-shaped incision of the adoral groove. They can roughly be sorted into three groups, from proximal or adult to distal or juvenile, see table.

Brachials	Small	Medium	Large
Width (mm)	1.6–3.0	3.0–6.0	5.0–7.5
Oral-aboral diameter (mm)	1.7–3.0	3.5–6.0	5.0–7.5
Height (mm)	0.7–1.5	1.7–2.0	1.8–2.8

The largest brachials (Pl. 5, Fig. 10) are subcircular, subtrapezoidal or subpentagonal in outline, with two protruding edges at the aboral ends of the transverse ridges of both facets; here the latus is not vertical, but somewhat oblique and twisted. A crescent-shaped area is present between aboral ligament fossa and margin. At the side with the pinnule socket the latus is only slightly taller than at the opposite side, so that both facets are nearly parallel to each other.

The medium-sized brachials (Pl. 5, Fig. 11) differ from the largest ones by the fact that the latus is distinctly taller at the side with the pinnule socket than on the opposite side, and therefore there is a distinct angle between the planes of the two facets. Moreover, a strong process is present close to the aboral end of the transverse ridge of the distal facet.

In the small brachials (Pl. 5, Fig. 12) the morphological features are similar but less pronounced.

The facets of the pinnulars (Pl. 6, Fig. 7) have a µ-shaped outline (one side rounded, the other angular). They match the pinnule sockets of the brachials in outline and size.

D i s c u s s i o n : There is no doubt that the material from the SdB belongs to *Decameros ricordeanus*, a fairly variable species common in the Aptian of France, Spain and elsewhere, but hitherto unknown from the Barremian. Several subspecies or varieties have been discriminated (see WIENBERG RASMUSSEN 1961), and our material matches *vagnasensis* (DE LORIOL, 1888) relatively well, but differs from *vagnasensis* and from all other subspecies or varieties by a slightly but distinctly larger diameter of the cup compared to the centrodorsal. Moreover, our material is characterised by smooth radials, by the bowlshaped centrodorsal and by the medium number of cirrus sockets. Due to the limited number of cups and centrodorsals no new variety name is introduced here.

Assignment of the disarticulated brachials to *Decameros ricordeanus* is easy because of their large size and their special morphology and because they agree well with those of the congener *Decameros wertheimi* Peck & Watkins, 1972, of which several large articulated fragments of the crown are known. The following sentences from Peck & Watkins (1972, p. 412) about *Decameros wertheimi* perfectly match the situation in the present species: "The arms are not divided." "All brachials are joined by oblique muscular articulations." "…pinnules starting on …IBr_1…" "On a few large well-preserved specimens, from about the 6th brachial short blunt spines are present on the rounded outside slopes; these die out distally." The last sentence agrees well with the fact that processes are present mainly in the medium-sized brachials from the SdB.

In an earlier attempt to determine isolated brachials from the SdB, the author erroneously thought that axillary brachials and brachials with a syzygy might belong to the present species (see Moosleitner 2007, Pl. 9, Figs 15 and 17). However, this is not possible, because the genus *Decameros* possesses neither axillaries nor brachials connected by syzygy.

Brachials similar to those of the medium-sized brachials from the SdB had been described as "Ny-Typ Brachialia" from the upper Valanginian to lower Hauterivian of northern Germany by the author and assigned to isocrinids (Jäger 1981). However, they may rather belong to *Decameros* or to related comatulids.

Superfamily Notocrinoidea Mortensen, 1918

Family Notocrinidae Mortensen, 1918

Genus *Semiometra* Gislén, 1924

***Semiometra barremiensis* nov. spec.**
(Pl. 6, Figs 1-4)

2007 *Semiometra* nov. spec. – Moosleitner: p. 296, Pl. 9, Fig. 3.

Material: SdB1: 14 Cdd, 10 cups with Cdd; SdB2: 1 Cd, 1 cup with Cd.

Numerous cirrals, brachials and pinnulars cannot be sorted into *Comatulina moosleitneri* and *Semiometra barremiensis*. The brachials are described separately below.

Derivatio nominis: Named after the occurrence in the Barremian stage.

Diagnosis: The centrodorsal is covered by numerous very small and somewhat radially elongate cirrus sockets.

Holotype: Cup with centrodorsal, centrodorsal diameter 5.7 mm, cup diameter 5.0 mm, centrodorsal height 1.5 mm, cup height 1.7 mm, total height 2.5 mm. Barremian, SdB1, Serre de Bleyton, Drôme, France, Pl. 6, Figs 1a–c, NHMW no. 2009z0180/0045.

D e s c r i p t i o n : Centrodorsal (Pl. 6, Figs 1–4) very thin and low, saucershaped. Diameter 1.4–5.8 mm, height only 0.5–2.2 mm. Outline circular, commonly slightly irregular. The adoral side is slightly concave. Its periphery is somewhat embayed radially to support the radials and primibrachials, while interradial blunt ridges support the rod-shaped basals. The centrodorsals and the cup from SdB2 are small. The aboral side (except the central area) is covered by closely spaced, very small and radially slightly elongate cirrus sockets. They number from approximately 35 in juveniles to circa 80–100 in adults. The cirrus sockets are arranged somewhat irregularly, but commonly the sockets of one column are at the gaps between the sockets of neighbouring columns. There are approximately 20–45 (depending on the diameter of the centrodorsal) radiating columns of 1–4 cirrus sockets. At the aboral pole, a flat area 0.7–2.8 mm in diameter is free of cirrus sockets. In its centre there is a distinct dorsal star 0.5–1.4 mm in diameter composed of five narrow radiating furrows. The dorsal star corresponds to a star-shaped cavity (up to circa 2.2 mm in diameter) with somewhat larger radial furrows ("pits") in the centre of the adoral side. On the adoral side there are also 20–25 fine coelomic furrows.

The cup (Pl. 6, Figs 1–2) is markedly stellate in outline because the lower edges of the radial facets are distinctly concave, leaving a considerable portion of the centrodorsal uncovered by the radial circlet. Therefore, the low $IBrr_1$ and probably even the $IBrr_2$ must have been in contact with the centrodorsal. Even interradially the margin of the centrodorsal is protruding.

The radials have no free aboral surface. The adoral muscular fossae are tall. The ridges separating the adoral muscle fossae from the interarticular ligament fossae run parallel in the centre of the facet, but diverge laterally and adorally. Basals rod-shaped, not recognized externally due to indistinct sutures.

D i s c u s s i o n : *Semiometra* is known especially from the Upper Cretaceous, with a number of species relatively similar to each other, some of them may turn out to be synonymous. Articulated specimens are known from the Albian of Texas (PECK & WATKINS 1972). A few scattered occurrences of centrodorsals and cups are described from the Middle and Upper Jurassic. The present species fills the gap in the Lower Cretaceous. By the numerous very small and radially elongate cirrus sockets, the present species matches the Late Jurassic *S. petitclerci* (CAILLET, 1923), recently described and well illustrated by RADWAŃSKA (2007), and the Cenomanian *S. pusilla* (FRIČ, 1911) and *S. stellata* GISLÉN, 1925. However, from the Cenomanian only very few specimens are known, and therefore it is difficult to decide if their variability range matches that of the *Semiometra* species from the SdB or not. Thus the author thinks that it is better to introduce a new species for the rich material from the SdB than to try to coordinate it to an insufficiently known Cenomanian species.

Brachials belonging to *Semiometra barremiensis* or *Comatulina moosleitneri*
(Pl. 6, Figs 5-6; Pl. 7, Figs 1-8)

2007 Armglied von vermutlich / möglicherweise *Decameros ricordeanus vagnasensis* (DE LORIOL). – MOOSLEITNER: p. 296, Pl. 9, Figs 15 and 17.
2007 Armglied einer unbestimmten Crinoide. – MOOSLEITNER: p. 296, Pl. 9, Fig. 16.

M a t e r i a l : SdB1: 6 $IBrr_1$, 21 $IBrr_2$ = IAxx, 12 $IIBrr_1$, 25 $IIBrr_2$, 500 brachials with muscular articulations on both facets, 129 epi- and 150 hypozygals of the common syzygy type with few but distinct culmina, 12 epi- and 19 hypozygals of the rare cryptosyzygy type with many small culmina, many pinnulars.

SdB2: 2 $IBrr_2$ = IAxx, 2 $IIBrr_1$, 44 brachials with muscular articulations on both facets, 15 epi- and 8 hypozygals of the common syzygy type with few but distinct culmina, 2 hypozygals of the rare cryptosyzygy type with many small culmina, many pinnulars.

D e s c r i p t i o n : Brachials belonging to *Semiometra barremiensis* or *Comatulina moosleitneri* are recognised in many cases by the near-circular aboral margin, the very well-pronounced ridges, pits and fossae of their muscular, synarthrial, syzygial or cryptosyzygial facets and by their relatively large central canal. $IBrr_1$ and $IBrr_2$ = IAxx are bilateral symmetrical, whereas $IIBrr_1$ and $IIBrr_2$ are oblique. At least in the proximal brachials from $IBrr_1$ to $IIBrr_2$ the adoral portion of the facets with the adoral muscle fossae is low and elongated spatula-like. Probably IIAxx did not exist. In some brachials the pinnule socket is bordered by a strong rim. The aboral surface varies between specimens: some are smooth, others have inconspicuous granules, many have fine vertical lines.

	Width (mm)	Oral-aboral diameter (mm)	Height (mm)
$IBrr_1$	2.0–3.3	2.5–3.8	0.7–1.2
$IBrr_2$	1.8–3.8	1.0–3.8	0.8–2.1
$IIBrr_1$	1.8–2.6	2.5–3.6	0.8–1.3
$IIBrr_2$	1.5–3.0	1.5–3.6	0.8–1.5

The $IBrr_1$ (Pl. 6, Fig. 5) are very large in oral-aboral diameter and low. Usually the oral-aboral diameter is larger than the width, rarely the oral-aboral diameter and the width are equal. The outline is keyhole- or coat-of-arms-shaped, concave laterally and elongate adorally. The proximal facet is straight muscular, the distal facet is a synarthry with well-developed fulcral ridge. Width is greatest at the transverse ridge of the proximal facet.

$IBrr_2$ = IAxx (Pl. 7, Fig. 1). In large specimens the width and the oral-aboral diameter are approximately equal, in small specimens the width is larger than the oral-aboral diameter. The overall outline is rounded subtriangular, but concave laterally in the adoral portion. The aboral view is triangular to quadrangular. The proximal facet is a synarthry. The two distal facets are muscular, their transverse ridges together form a straight line without an angle in between. Width is greatest either at the transverse ridges or slightly more adorally.

In the $IIBrr_1$ (Pl. 7, Fig. 2), the oral-aboral diameter is always larger than the width. The outline is oval. The proximal facet is muscular. The distal facet is a synarthry, its well-developed fulcral ridge forms a blunt spine aborally.

In the $IIBrr_2$ (Pl. 6, Fig. 6), the oral-aboral diameter is usually larger than the width, rarely they are equal in size. The outline is oval. The proximal facet is a synarthry with a blunt spine protruding aborally. The distal facet is oblique muscular with the first pinnule socket. The distal fossa of the pinnule socket is deeply sunken into the brachial.

Beside the predominant brachials with oblique muscular articulations on both facets, a high percentage of the brachials distal of $IIBrr_2$ are epi- and hypozygals. There are two different types. In the commonest type, the syzygy (Pl. 7, Figs 5–6), the radiating culmina are few in number, very strong and long. Normally there are 9 (rarely only 7) culmina, of which the two adoral-most are bifurcated in larger specimens.

The epi- and hypozygals of the second, rarer type, the cryptosyzygy (Pl. 7, Figs 7–8), are nearly circular in aboral part of outline and wedge-shaped. The cryptosyzygial facet is flat. The culmina are very thin and low; in some specimens they are barely visible.

D i s c u s s i o n : Generally, recognition of species starts with the systematically most important elements, columnals in isocrinids and apiocrinitids and centrodorsals and cups in comatulids. Later it is tried to assign the brachials to the different groups or species. Recognition of brachials of isocrinids and *Decameros ricordeanus* is easy. Isocrinid brachials have relatively weakly developed facets, and typical isocrinid non-muscular facets such as embayed weak synarthries and very weak symmorphies occur in the SdB samples. Brachials of *Decameros ricordeanus* are recognised by their large size, their asymmetrical aboral margin and the total absence of non-muscular articulations and axillaries. After sorting out the isocrinid and *Decameros* brachials, one faces the problem that the remaining elements are similar, although they should belong to two different species of medium-sized comatulids, *Comatulina moosleitneri* and *Semiometra barremiensis* which are easily distinguished by their centrodorsals and cups. *Comatulina moosleitneri* is only slightly commoner than *Semiometra barremiensis* (ratio a little less than 5 to 3 when both localities taken together and centrodorsals and cups each counted as one unit). Thus, the brachials of these two comatulid species should be expected to occur in similar number of specimens.

However, nearly all medium-sized comatulid brachials seem to belong to a single species, characterised by their distinct facets, synarthries at $IBr_{1\text{-}2}$ and $IIBr_{1\text{-}2}$, IBr_2 = IAx, first pinnule at $IIBr_2$, the very common occurrence of syzygies distal of $IIBr_2$ and lack of IIAxx. The occurrence of only one morphological set of brachials (except the brachials connected by syzygy or, respectively, by cryptosyzygy, which belong to two different sets) seems surprising, because *Comatulina moosleitneri* and *Semiometra barremiensis* belong to two separate superfamilies, and thus their brachials are expected to be different. Paradoxically, the brachials of *Decameros ricordeanus* which belongs to the same superfamily as *Comatulina moosleitneri* are very distinct.

Moreover, the brachials found at the SdB match the brachials figured by JAGT (1999) from the Campanian to Danian when several *Semiometra* species are common but when *Comatulina* had already become extinct; this is true for the brachials of *Semiometra saskiae* JAGT, 1999 (Pl. 22) and for some syzygial brachials of indetermined comatulids (Pl. 26, especially Figs 6, 9, and 11). As a consequence, one might argue that all medium-sized comatulid brachials from the SdB should belong to *Semiometra* and none to *Comatulina*, which is, of course, virtually impossible. It seems improbable that the brachials of *Comatulina* were either more vulnerable than those of other taxa (at least the centrodorsals and cups are more robust in *Comatulina* than in *Semiometra*) and, thus, not preserved, or so small that they were overlooked while picking the samples (*Comatulina* and *Semiometra* centrodorsals and cups occur in a similar size range at the main site SdB1), or had different physical properties and were transported to sites outside the SdB localities. The relatively plain proximal facet of the $IBrr_1$ does not match well the strongly concave facet of the radials of the *Semiometra barremiensis* cups, but may match the less concave facet of the radials of the *Comatulina moosleitneri* cups a little better.

Another frustrating fact is that in the literature *Comatulina* brachials are less well known compared to those of isocrinids and the comatulids *Decameros* and *Semiometra* (see WIENBERG RASMUSSEN (1961), JAGT (1999), PECK & WATKINS (1972), and others).

Epi- and hypozygals are the only medium-sized comatulid brachials of which two morphologically different sets occur at the SdB. One set, the syzygy, is very common, the other set, the cryptosyzygy, is relatively rare, and this difference in frequency is much greater than the above mentioned 5 to 3 ratio for the centrodorsals and cups of *Comatulina moosleitneri* and *Semiometra barremiensis*. Moreover, it is not certain if the rarer, cryptosyzygial morphotype belongs to a comatulid at all, because JAGT (1999, Pl. 3, Fig. 6; Pl. 5, Fig. 8; Pl. 9, Fig. 11; Pl. 11, Fig. 10; Pl. 12, Figs 1, 8 and 9; Pl. 26, Fig. 12) considered similar cryptosyzygies to belong to several isocrinid species. However, the author considers the cryptosyzygial brachials from the SdB to belong to comatulids, because the opposite, oblique muscular facets of the epi- and hypozygals show exactly the same morphology as the other muscular comatulid brachials from the SdB, but differ from the weakly developed morphology of the isocrinid brachials.

There is an additional problem with the *Comatulina moosleitneri* brachials, because the material from the SdB contradicts the sparse data on *Comatulina* brachials reported from other localities in three points: WIENBERG RASMUSSEN (1978) did not mention non-muscular brachial articulation in *Comatulina*, and he stated that IBr_1 is axillary (see drawings of the Oxfordian *Comatulina beaugrandi* (DE LORIOL, 1889)) and that additional axillaries may occur more distally. In contrast, one should expect that one of the two sets of syzygial and cryptosyzygial brachials from the SdB should belong to *Comatulina moosleitneri*. Moreover, there is not a single IBr_1 which is axillary (such axillaries, if present, should have a straight muscular proximal facet). However, isolated radials are also much rarer than expected by the number of centrodorsals, and, therefore, lack of axillary $IBrr_1$ is not too strong an argument against the hypothesis that $IBrr_1$ of *Comatulina moosleitneri* were axillary. In addition, the axillaries found at the SdB do not hint at the fact that some of them were IIAxx.

Another possibility would be assignment of *moosleitneri* to the genus *Palaeocomaster* (see above). According to Wienberg Rasmussen (1978) at least one Middle Jurassic species of *Palaeocomaster* had synarthries, syzygies and axillaries.

Moreover, the articulated specimens described by Peck & Watkins (1972) show that in *Semiometra* the arms may be divided. However, in the disarticulated brachials from the SdB there is no kind of IIAxx which can be associated with *Semiometra barremiensis*. Therefore the author believes that this species did not possess IIAxx.

Order Millericrinida Sieverts-Doreck, 1952

Family Apiocrinitidae d'Orbigny, 1840

Genus *Apiocrinites* Miller, 1821

***Apiocrinites* sp.**
(Pl. 3, Figs 9-10)

2007 Cirren-Teilstück von vermutlich *Comatulina* sp. – Moosleitner: p. 296, Pl. 9, Figs 7–8.

Material: SdB1: 3 pluricolumnals of 16 columnals altogether.

Description: Columnals small and cylindrical, diameter 1.5–1.7 mm. A pluricolumnal of 7 columnals (Pl. 3, Fig. 10) is 6.0 mm tall, one with 5 columnals 4.7 mm and one with 4 columnals (Pl. 3, Fig. 9) 3.4 mm. Latera slightly convex, very finely striated vertically, especially near the facets. Facets circular, worn in most cases. Facets (Pl. 3, Fig. 9a) with circa 35–40 culmina, arranged in five bundles of more or less parallel culmina. The culmina are undivided, but shorter culmina are intercalated between larger ones near the periphery. In the less worn facet of 1.5 mm diameter (Pl. 3, Fig. 9a) the circular central canal is 0.4 mm in diameter.

Discussion: The pluricolumnals from the SdB are too small to allow other than genus assignment. The species of the diverse *Apiocrinites* fauna described by Wienberg Rasmussen (1961), mainly Berriasian and Valanginian in age, have at least twice a diameter, pointing to a considerable decline in size of *Apiocrinites* during the Early Cretaceous. Apart from size, the SdB specimens match *Apiocrinites oosteri* (de Loriol, 1878) from the Valanginian and Barremian of Switzerland and France and *A. valangiensis* (DE LORIOL, 1878) from the Valanginian of Switzerland and France relatively well by the lack of any special features.

Two of the three pluricolumnals are obliquely compressed and, thus, resemble cirri fragments in lateral view. This is the reason why the author (in MOOSLEITNER 2007) had erroneously considered them as cirri fragments. – Another pretended cirral, figured in MOOSLEITNER (2007 Pl. 9, Fig. 19), does not belong to a crinoid at all.

The crinoid fauna of the SdB – discussion, results and conclusions

The crinoid material from the Barremian of the SdB is relatively diverse, rich in specimens and for the greater part well preserved. It is dominated by comatulids and isocrinids and includes numerous complete noditaxes of isocrinid pluricolumnals and numerous comatulid cups, centrodorsals and cups with centrodorsal. Even though the arms of all crinoid groups are totally disarticulated, it is possible to recognise many of the brachials at the species level as defined by columnals, centrodorsals or cups. The only major problem are comatulid brachials similar to each other that seem impossible to assign to either *Comatulina moosleitneri* or *Semiometra barremiensis*. Opposite to the situation in brachials, there are two rare kinds of seemingly "supernumerary" isolated radials (possibly belonging to an isocrinid to and a comatulid) which cannot be assigned to the other elements.

At least six crinoid species (two isocrinids, three comatulids and one apiocrinitid) were found. Presumably five of these six species are new, but more or less closely related to well-known species. However, only for three of them a new species is introduced, the other two are described in open nomenclature. Except for *Apiocrinites* with only three pluricolumnals at SdB1 but none at SdB2, all other crinoid species were found at both sites.

The high percentage of new species is mainly due to the fact that the Barremian SdB fauna fills a stratigraphic gap from which only very few crinoids have so far been described. For a large part, the Barremian of Europe consists of either claystone with mainly isocrinids (if crinoids occur at all) or of well-cemented solid Urgonian limestone from which crinoids and other small fossils usually cannot be isolated. Apart from some Hauterivian crinoids (mainly isocrinids) the stratigraphically closest crinoid-rich (and especially comatulid-rich) horizons are the Valanginian of western Switzerland and southeastern France and especially the Aptian of southeastern France and Spain. Thus, the high percentage of new species is not surprising, and it may be assumed that phylogenetic changes occurred between Valanginian and Aptian. Apart from differences at the species level, the crinoid fauna from the Serre de Bleyton fits well into the overall faunal composition known from Late Jurassic to other Early Cretaceous sites: (1) within Isocrinida, a change in predominance from Isocrinidae to Cainocrinidae (see DE LORIOL (1882-1889), HESS (in press), KLIKUSHIN (1992), SIMMS (1988), WIENBERG RASMUSSEN (1961, 1978) and discussion above), (2) slow but steady increase of importance and diversity of Comatulida, (3) within Comatulida, a gradual change of predominance from Solanocrinitoidea to Notocrinoidea, (4) within Solanocrinitoidea, a change from Solanocrinitidae to Decameridae (for (2)-(4) see DE LORIOL (1877-1879, 1882-1889), HESS (in press), JAGT (1999), RADWAŃSKA (2005, 2007) and WIENBERG RASMUSSEN (1961, 1978), (5) persistence of Apiocrinitidae, although with a distinct decrease in size and importance (compare WIENBERG RASMUSSEN (1961) and discussion above).

Acknowledgements

I thank Gero MOOSLEITNER for the discovery of the fossil-rich site and for providing the material, Andreas KROH, Naturhistorisches Museum Wien, and Gero MOOSLEITNER for triggering and editing this thematic volume on invertebrates from the Serre de Bleyton, and the reviewers, Hans HESS, Naturhistorisches Museum Basel, and John W. M. JAGT, Natuurhistorisch Museum Maastricht, for their valuable comments on an earlier version which helped improve this paper considerably.

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Plate 1

Isocrinus? *bleytonensis* nov. spec.

Fig. 1. Proximal pluricolumnal of 9 columnals (5 nodals and 4 internodals); a: proximal facet with cryptosymplexy; b: lateral view. D 3.0 mm, H 2.8 mm. NHMW 2009z0180/0001.

Fig. 2. Proximal pluricolumnal of 7 columnals (4 nodals and 3 internodals); a: proximal facet with symplexy; b: lateral view. D 4.7 mm, H 2.3 mm. NHMW 2009z0180/0002.

Fig. 3. Holotype; pluricolumnal of a nodal, an infranodal, and an internodal below, all of different diameter; distal facet of the internodal with symplexy and protruding margins of infranodal and nodal. D 5.4 mm. NHMW 2009z0180/0003.

Fig. 4. Proximal pluricolumnal of a nodal and two complete noditaxes of 3 and 4 columnals; lateral view. D 3.9 mm, H 4.2 mm. NHMW 2009z0180/0004.

Fig. 5. Stellate nodal; tips curved; a: proximal facet with symplexy; b: lateral view; c: distal facet with cryptosymplexy. D 6.3 mm, H 1.0 mm. NHMW 2009z0180/0005.

Fig. 6. Pluricolumnal, complete noditaxis of 5 columnals alternating in size; lateral view. D 5.6 mm, H 3.5 mm. NHMW 2009z0180/0006.

Fig. 7. Pluricolumnal, complete noditaxis of 6 columnals alternating in size; lateral view. D 5.8 mm, H 4.2 mm. NHMW 2009z0180/0007.

Fig. 8. Pluricolumnal, complete noditaxis of 8 columnals alternating in size; lateral view. D 5.6 mm, H 4.9 mm. NHMW 2009z0180/0008.

Fig. 9. Pathological six-rayed nodal; a: proximal facet with symplexy; b: distal facet with cryptosymplexy; c: lateral view. D 5.5 mm, H 0.9 mm. NHMW 2009z0180/0009.

Fig. 10. Pathological six-rayed internodal; facet with symplexy. D 2.4 mm. NHMW 2009z0180/0010.

All specimens from the Barremian of the Serre de Bleyton, Provence, France; Figs 1-9 from locality SdB1, Fig. 10 from locality SdB2.

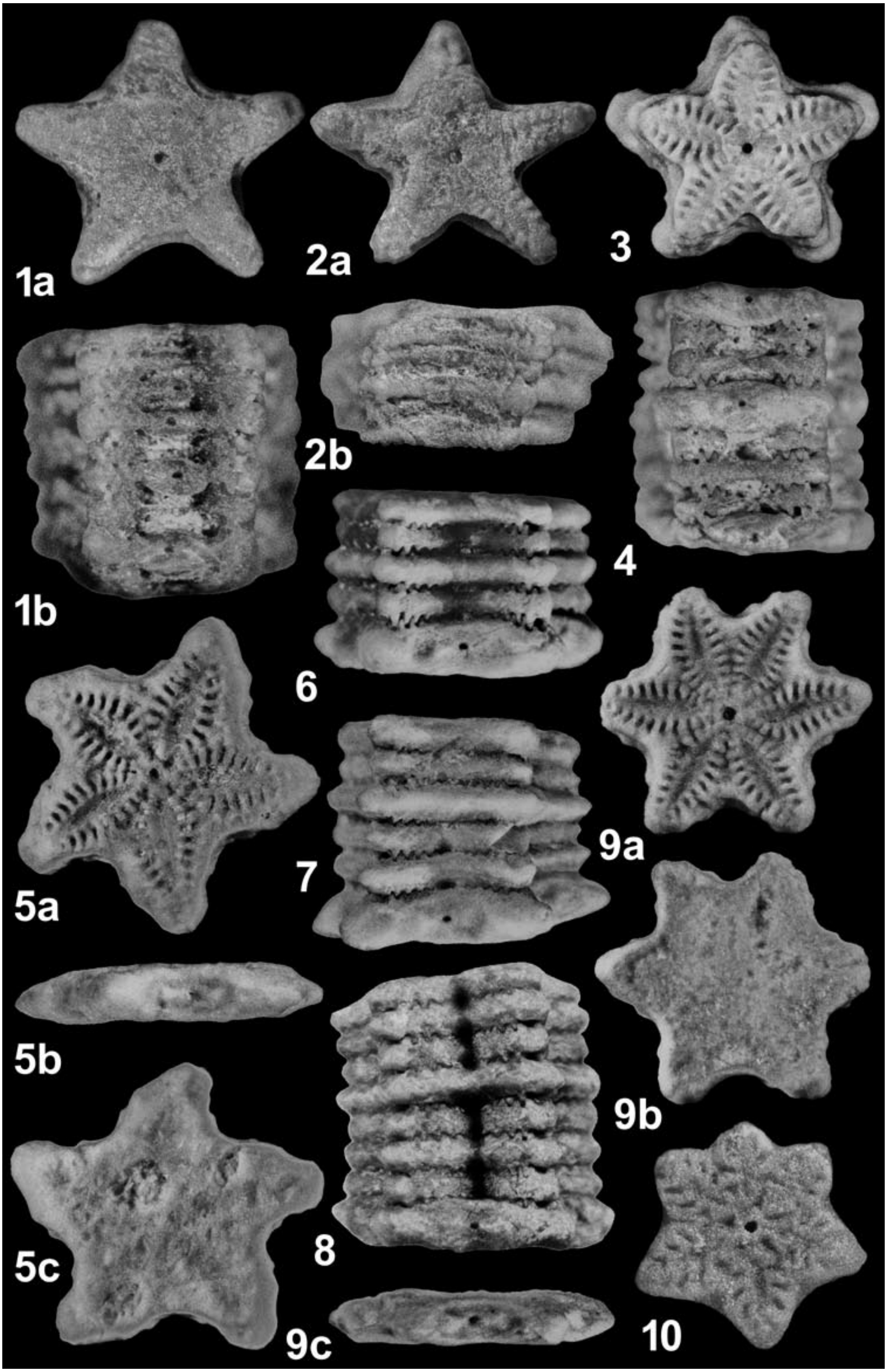
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Plate 2

Isocrinus? *bleytonensis* nov. spec.

Fig. 1. Radial; a: distal facet with muscular articulation; b: aboral view; c: adoral view; d: proximal view with facets to the basals. W 2.7 mm, Doa 1.2 mm, H 1.7 mm. NHMW 2009z0180/0011.

Fig. 2. Radial; a: distal facet with muscular articulation; b: aboral view; c: proximal view with facets to basals. W 3.7 mm, Doa 2.1 mm, H 2.2 mm. NHMW 2009z0180/0012.

Fig. 3. Primaxil, IBr_2 = IAx; a: distal facets with muscular articulations; b: aboral view; c: proximal facet with embayed synarthry. W 3.7 mm, Doa 3.0 mm, H 2.3 mm. NHMW 2009z0180/0013.

Fig. 4. Second secundibrachial, $IIBr_2$; a: distal facet with oblique muscular articulation and first pinnule socket; b: aboral view; c: proximal facet with embayed synarthry. W 3.2 mm, Doa 2.9 mm, H 1.6 mm. NHMW 2009z0180/0014.

Fig. 5. Brachial with oblique muscular articulations on both facets; distal facet with pinnule socket. W 1.9 mm, Doa 2.3 mm. NHMW 2009z0180/0015.

Fig. 6. Episymmorphal; a: proximal facet with weak symmorphy; b: aboral view, with (on lower left and right) the two low processes of the symmorphy. W 2.8 mm, Doa 3.0 mm, H 0.9 mm. NHMW 2009z0180/0016.

Fig. 7. Secundiaxil, IIAx; a: distal facets with muscular articulations; b: aboral view; c: proximal facet with oblique muscular articulation. W 4.0 mm, Doa 4.1 mm, H 1.9 mm. NHMW 2009z0180/0017.

All specimens from the Barremian of the Serre de Bleyton, Provence, France; Fig. 1 from locality SdB2; Figs 2-7 from locality SdB1.

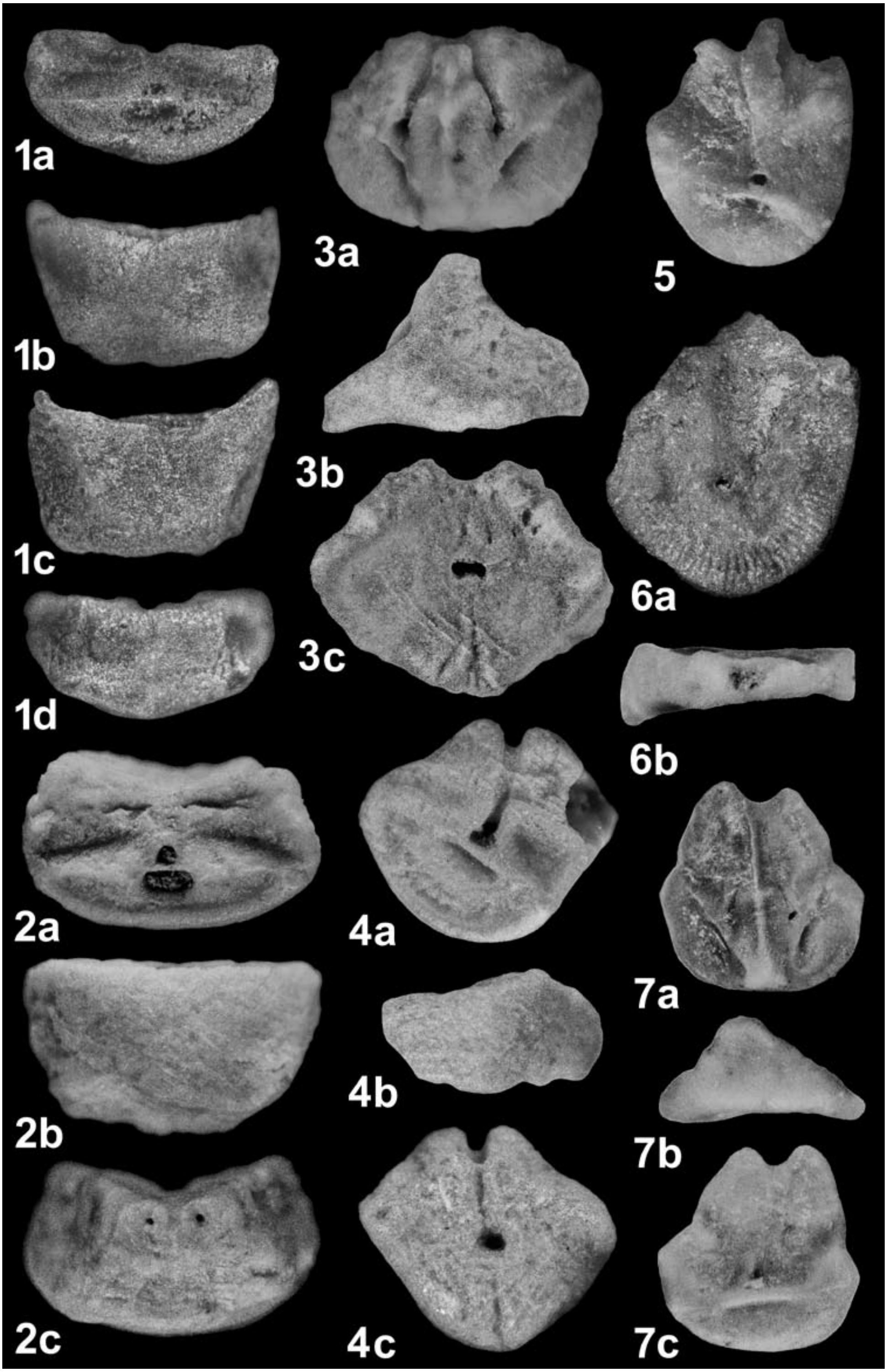
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Plate 3

Percevalicrinus sp.

Fig. 1. Low juvenile columnal; a: facet with synarthry; b: lateral view. D 0.5 mm, H 0.4 mm. NHMW 2009z0180/0018.

Fig. 2. Tall and slender juvenile columnal; a: facet with synarthry; b: lateral view. D 0.5 mm, H 1.6 mm. NHMW 2009z0180/0019.

Fig. 3. Nodal and infranodal; a: proximal facet of the nodal with symplexy; b: lateral view. D 2.3 mm, H 2.0 mm. NHMW 2009z0180/0020.

Fig. 4. Pluricolumnal of two internodals and a nodal; a: lateral view with strong ornament; b: distal facet of the nodal with cryptosymplexy. D 3.4 mm, H 2.7 mm. NHMW 2009z0180/0021.

Fig. 5. Internodal; a: facet with symplexy; b: lateral view with relatively weak ornament and strongly protruding edges of the facets. D 1.5 mm, H 1.2 mm. NHMW 2009z0180/0022.

Fig. 6. Internodal; a: facet with symplexy; b: lateral view with ornament and strongly protruding edges of the facets. D 1.7 mm, H 1.0 mm. NHMW 2009z0180/0023.

Fig. 7. Pluricolumnal of four internodals and a nodal; lateral view. D 0.9 mm, H 3.1 mm. NHMW 2009z0180/0024.

Comatulina moosleitneri nov. spec.

Fig. 8. Juvenile centrodorsal; a: adoral view; b: slightly oblique lateral view showing inverse conical, pointed shape; c: aboral view. D 2.0 mm, H 1.0 mm. NHMW 2009z0180/0025.

Apiocrinites sp.

Fig. 9. Pluricolumnal of four columnals; a: facet with five bundles of more or less parallel culmina; b: lateral view. D 1.7 mm, H 3.4 mm. NHMW 2009z0180/0026.

Fig. 10. Pluricolumnal of seven columnals; lateral view. D 1.5 mm, H 6.0 mm. NHMW 2009z0180/0027.

All specimens from the Barremian of the Serre de Bleyton, Provence, France; Figs 1-2 and 5-7 from locality SdB2, Figs 3-4 and 8-10 from locality SdB1.

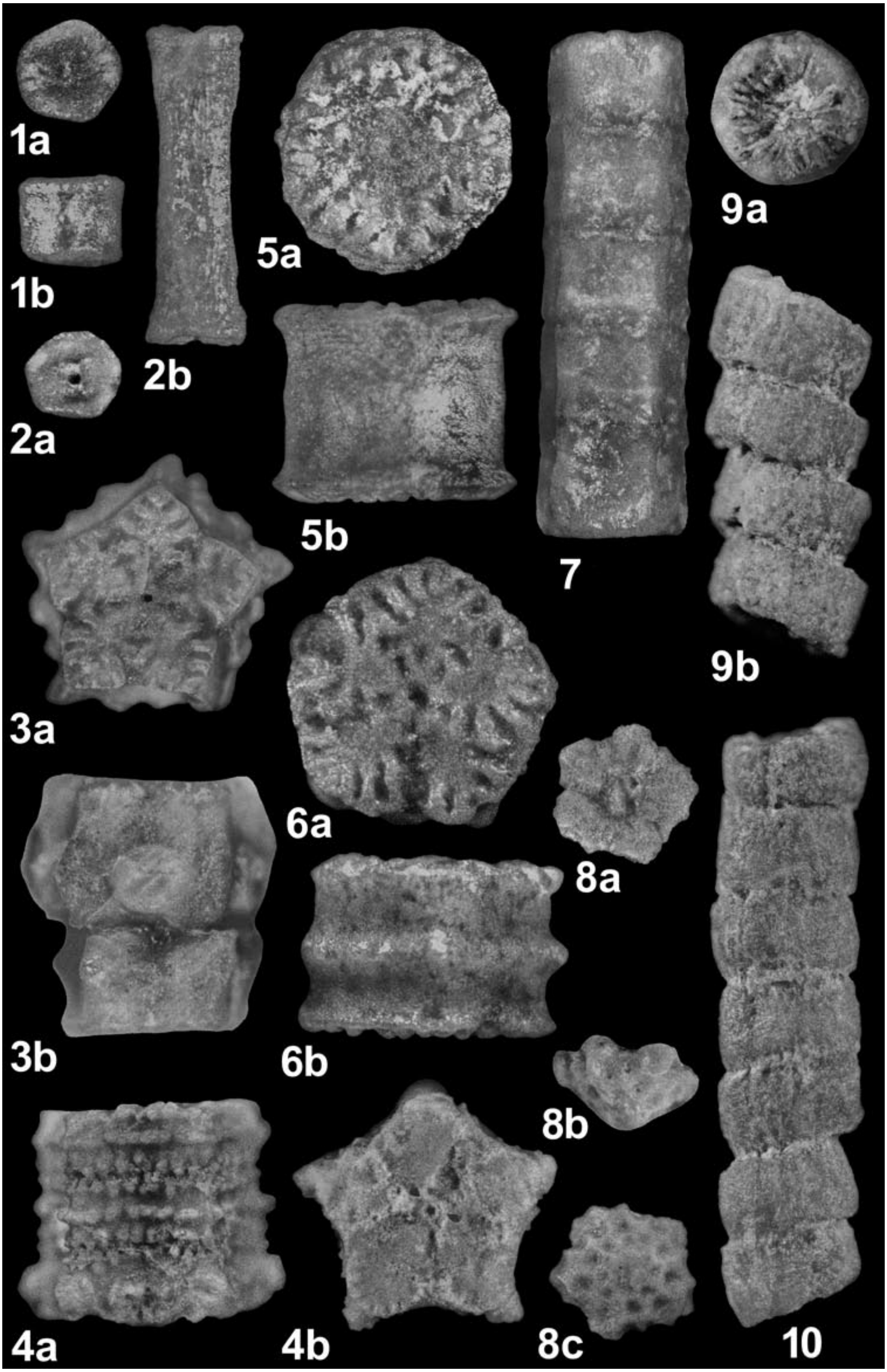
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Plate 4

Comatulina moosleitneri nov. spec.

Fig. 1. Cup with centrodorsal; a: adoral view; b-c: lateral views, centrodorsal of truncated inverse conical shape; d: aboral view. D 6.2 mm, H 4.8 mm. NHMW 2009z0180/0028.

Fig. 2. Holotype; cup with centrodorsal; a: adoral view; b-c: lateral views, centrodorsal of truncated inverse conical shape; d: aboral view. D 5.3 mm, H 5.0 mm. NHMW 2009z0180/0029.

Fig. 3. Cup; 3a: adoral view; b: lateral view; c: aboral view with rod-shaped basals. D 4.0 mm, H 2.5 mm. NHMW 2009z0180/0030.

Fig. 4. Centrodorsal; a: aboral view; b: lateral view of low and cylindrical shape. D 5.0 mm, H 2.0 mm. NHMW 2009z0180/0031.

Fig. 5. Centrodorsal; a: adoral view; b: lateral view, centrodorsal of bowl-shape; c: aboral view. D 5.3 mm, H 2.6 mm. NHMW 2009z0180/0032.

All specimens from the Barremian of the Serre de Bleyton, Provence, France; Fig. 1 from locality SdB2, figs 2–5 from locality SdB1.

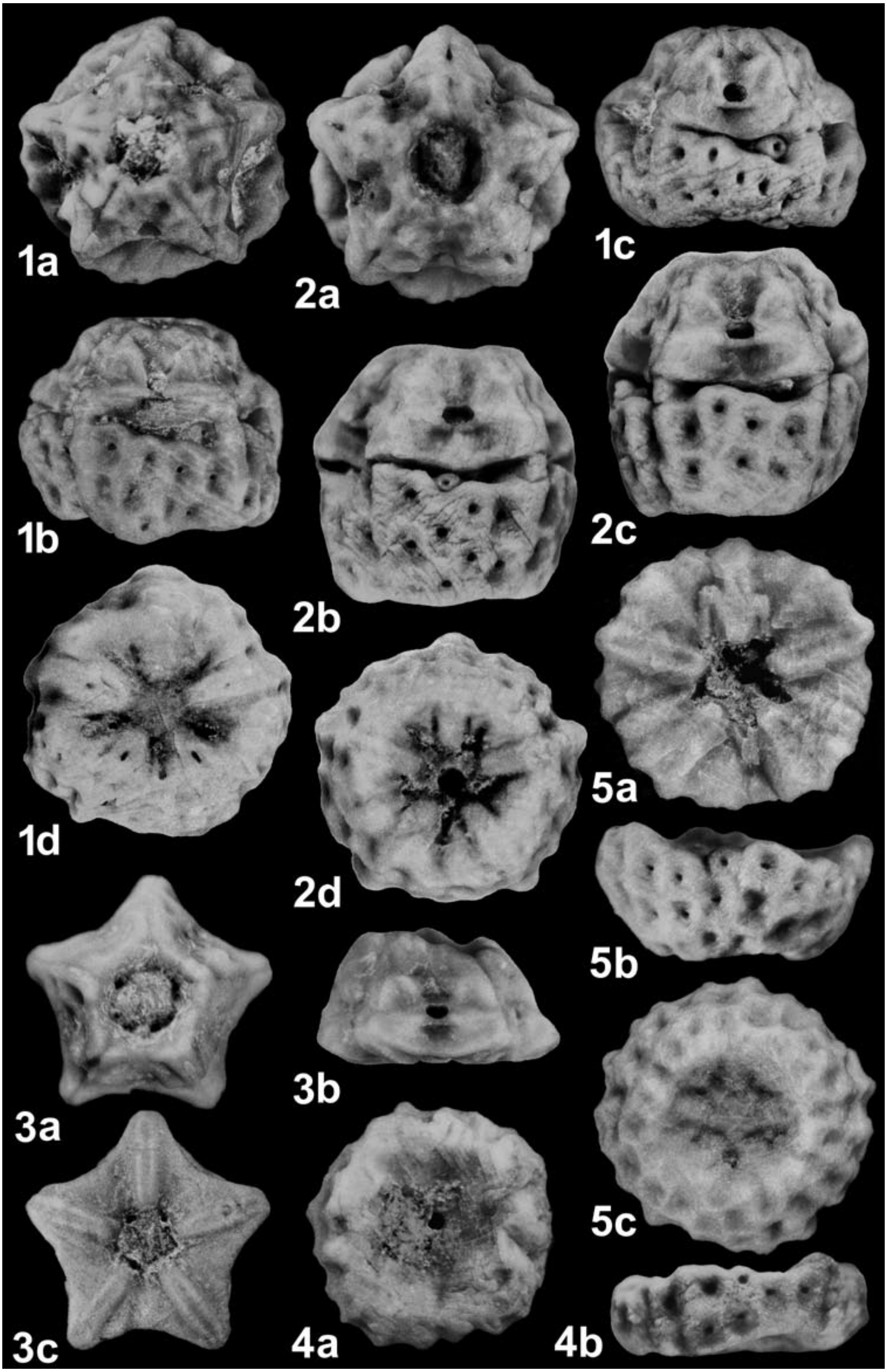
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Plate 5

Decameros ricordeanus cf. *vagnasensis* (de Loriol, 1888)

Fig. 1. Large cup with centrodorsal; a: adoral view; b-c: lateral views; d: aboral view. Cup D 14.0 mm, total H 7.5 mm. NHMW 2009z0180/0033.

Fig. 2. Large cup with centrodorsal; a: adoral view; b-c: lateral views; d: aboral view. Cup D 16.0 mm, total H 8.0 mm. NHMW 2009z0180/0034.

Fig. 3. Medium-sized, broken centrodorsal; lateral view. D 9.3 mm, H 3.0 mm. NHMW 2009z0180/0035.

Fig. 4. Juvenile centrodorsal; a: lateral view; b: adoral view with coelomic furrows; c: aboral view. D 5.4 mm, H 2.0 mm. NHMW 2009z0180/0036.

Fig. 5. Large centrodorsal; a: adoral view with coelomic furrows; b: lateral view; c: aboral view. D 13.5 mm, H 4.0 mm. NHMW 2009z0180/0037.

Fig. 6. Wide and low proximal cirral; a: oblique lateral view; b: distal facet. Horizontal D 3.5 mm, H 3.1 mm, L 2.0 mm. NHMW 2009z0180/0038.

Fig. 7. Slender and tall distal cirral; a: oblique lateral view; b: distal facet with ridge. Horizontal D 3.0 mm, H 3.8 mm, L 2.5 mm. NHMW 2009z0180/0039.

Fig. 8. Large isolated radial; a: distal facet with straight muscular articulation; b: proximal surface formerly connected to centrodorsal; c: facets to basals. W 8.3 mm, Doa 4.0 mm. NHMW 2009z0180/0040.

Fig. 9. First primibrachial, IBr_1, incompletely preserved; a: distal facet with oblique muscular articulation and first pinnule socket (on the right); a large piece on the left and a small piece on the right are broken off; b: aboral view; c: proximal facet with straight muscular articulation. W of preserved fragment 10.7 mm (was originally wider), Doa 6.0 mm, H 3.2 mm. NHMW 2009z0180/0041.

Fig. 10. Large brachial; distal facet with oblique muscular articulation and pinnule socket on the left. W 6.5 mm, Doa 6.5 mm. NHMW 2009z0180/0042.

Fig. 11. Medium-sized brachial; distal facet with oblique muscular articulation, with strong process protruding aborally and with pinnule socket on the left. W 5.3 mm, Doa 6.0 mm. NHMW 2009z0180/0043.

Fig. 12. Small brachial; distal facet with oblique muscular articulation and pinnule socket on the right. W 2.3 mm, Doa 2.7 mm. NHMW 2009z0180/0044.

All specimens from the Barremian of the Serre de Bleyton, Provence, France; Figs 1-2, 4-7, and 9-11 from locality SdB1, Figs 3 and 8 from locality SdB2.

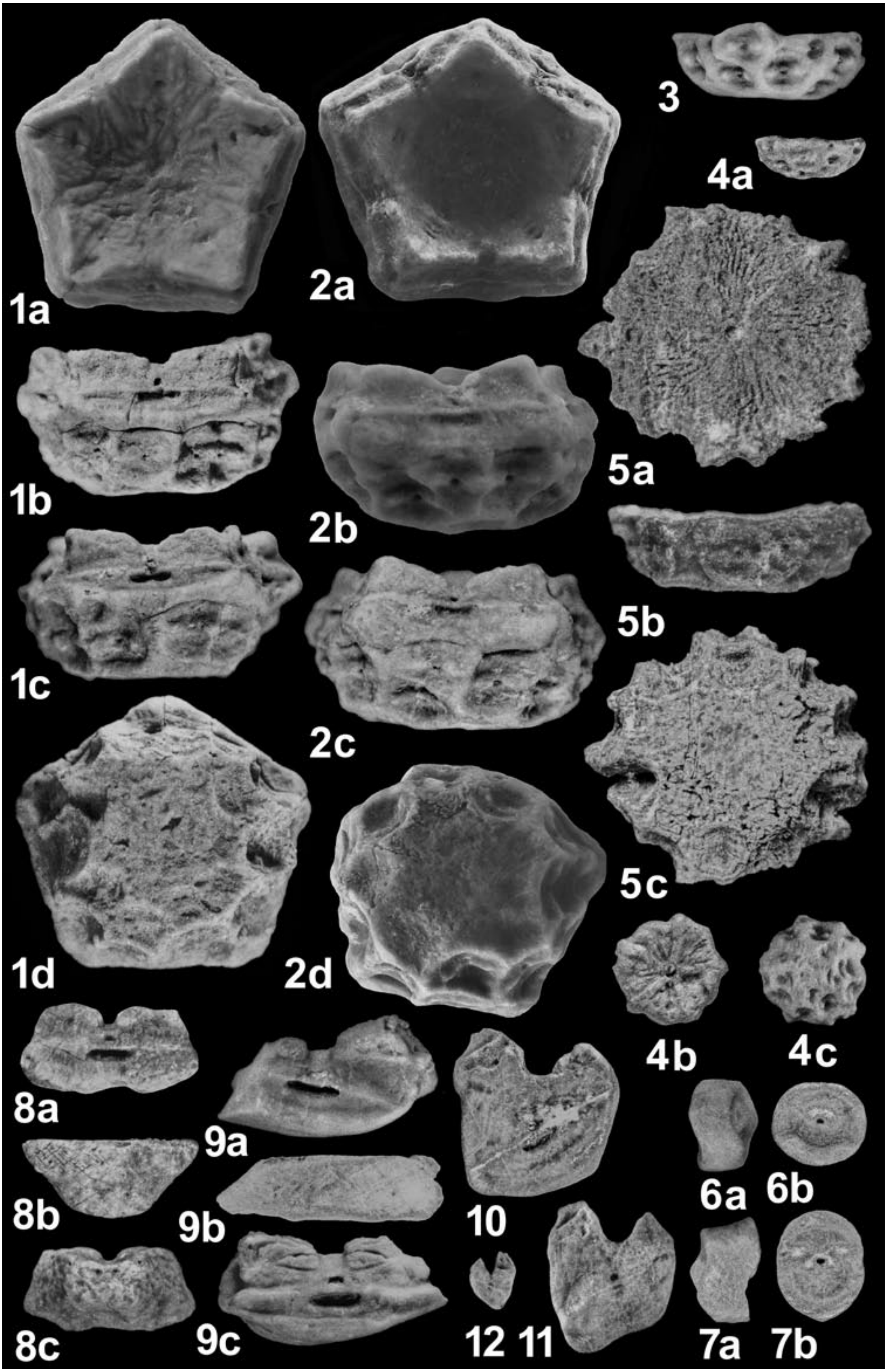
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Plate 6

Semiometra barremiensis nov. spec.

Fig. 1. Holotype; cup with centrodorsal; a: adoral view; b: lateral view; c: aboral view. Centrodorsal D 5.7 mm, cup D 5.0 mm, centrodorsal H 1.5 mm, cup H 1.7 mm, total H 2.5 mm. NHMW 2009z0180/0045.

Fig. 2. Cup with centrodorsal; a: adoral view; b: lateral view; c: aboral view. Centrodorsal D 5.3 mm, cup D 4.7 mm, centrodorsal H 1.5 mm, cup H 1.8 mm, total H 2.5 mm. NHMW 2009z0180/0046.

Fig. 3. Large centrodorsal; a: adoral view: b: lateral view; c: aboral view. D 5.8 mm, H 1.4 mm. NHMW 2009z0180/0047.

Fig. 4. Relatively small centrodorsal; a: adoral view; b: lateral view; c: aboral view. D 3.5 mm, H 0.8 mm. NHMW 2009z0180/0048.

Brachials of *Semiometra barremiensis* or *Comatulina moosleitneri*

Fig. 5. First primibrachial, IBr_1; a: distal facet with synarthry; b: aboral view; c: proximal facet with straight muscular articulation. W 3.3 mm, Doa 3.8 mm, H 1.2 mm. NHMW 2009z0180/0049.

Fig. 6. Second secundibrachial, $IIBr_2$; a: distal facet with oblique muscular articulation and first pinnule socket (on the left); b: lateral view with wedge shape and protruding process (to the lower left); c: proximal facet with synarthry. W 2.7 mm, Doa 3.6 mm, H 1.4 mm. NHMW 2009z0180/0050.

Decameros ricordeanus cf. *vagnasensis* (de Loriol, 1888)

Fig. 7. Pinnular; a: distal facet; b: aboral view; c: proximal facet. W 3.1 mm, Doa 1.7 mm, H 2.2 mm. NHMW 2009z0180/0051.

All specimens from the Barremian of the Serre de Bleyton, Provence, France. All specimens from locality SdB1.

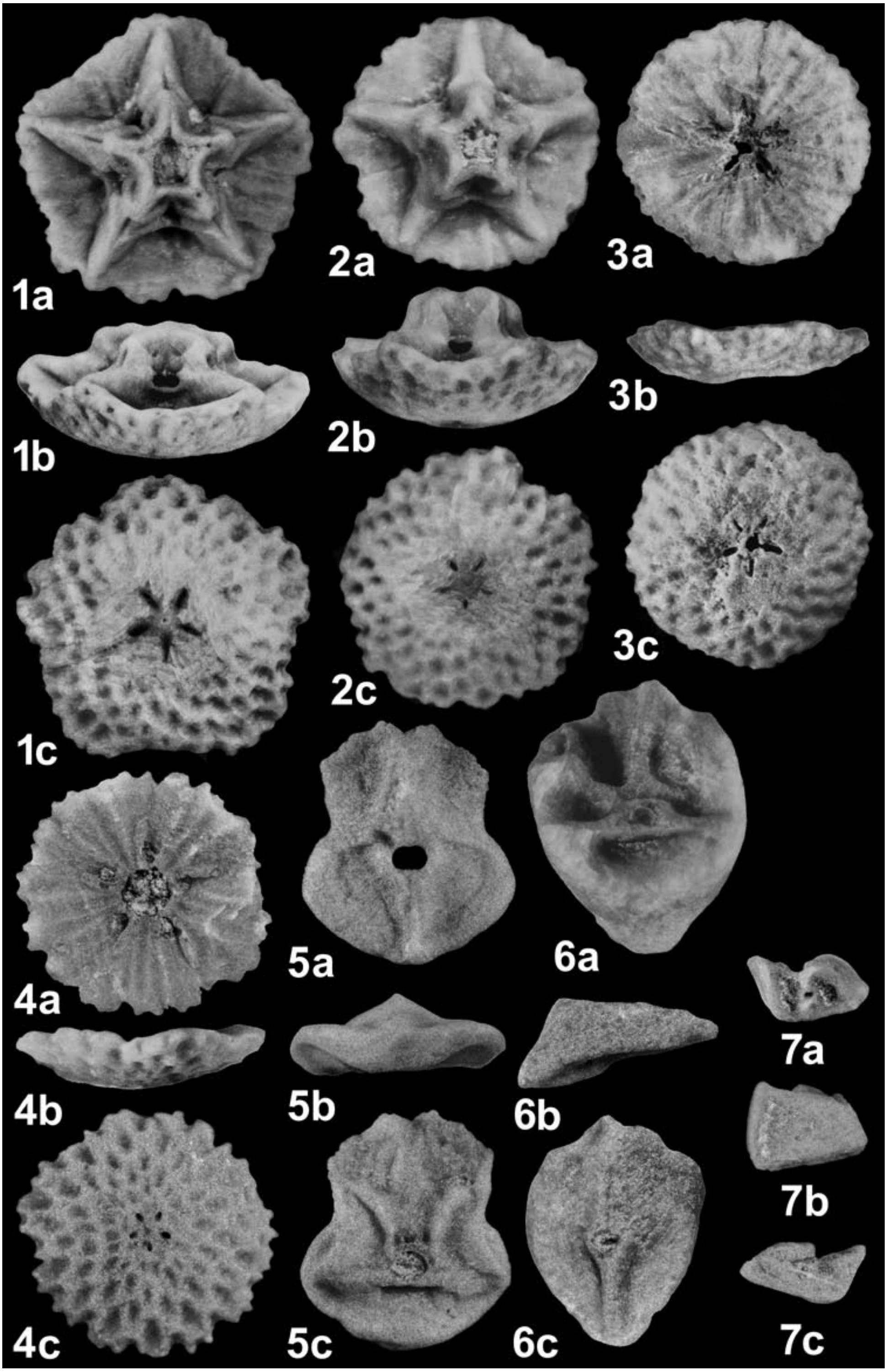
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Plate 7

Brachials of *Semiometra barremiensis* or *Comatulina moosleitneri*

Fig. 1. Primaxil, IBr_2 = IAx; a: distal facets with muscular articulations; b: aboral view; c: proximal facet with synarthry. W 3.3 mm, Doa 3.4 mm, H 1.7 mm. NHMW 2009z0180/0052.

Fig. 2. First secundibrachial, $IIBr_1$; a: distal facet with synarthry; b: aboral view; c: proximal facet with muscular articulation. W 2.6 mm, Doa 3.6 mm, H 1.3 mm. NHMW 2009z0180/0053.

Fig. 3. Small epizygal of the common type; distal facet with oblique muscular articulation and pinnule socket bordered by large rim. W 1.4 mm, Doa 1.6 mm. NHMW 2009z0180/0054.

Fig. 4. Brachial with oblique muscular articulation on both facets; distal facet with pinnule socket. W 2.5 mm, Doa 3.4 mm. NHMW 2009z0180/0055.

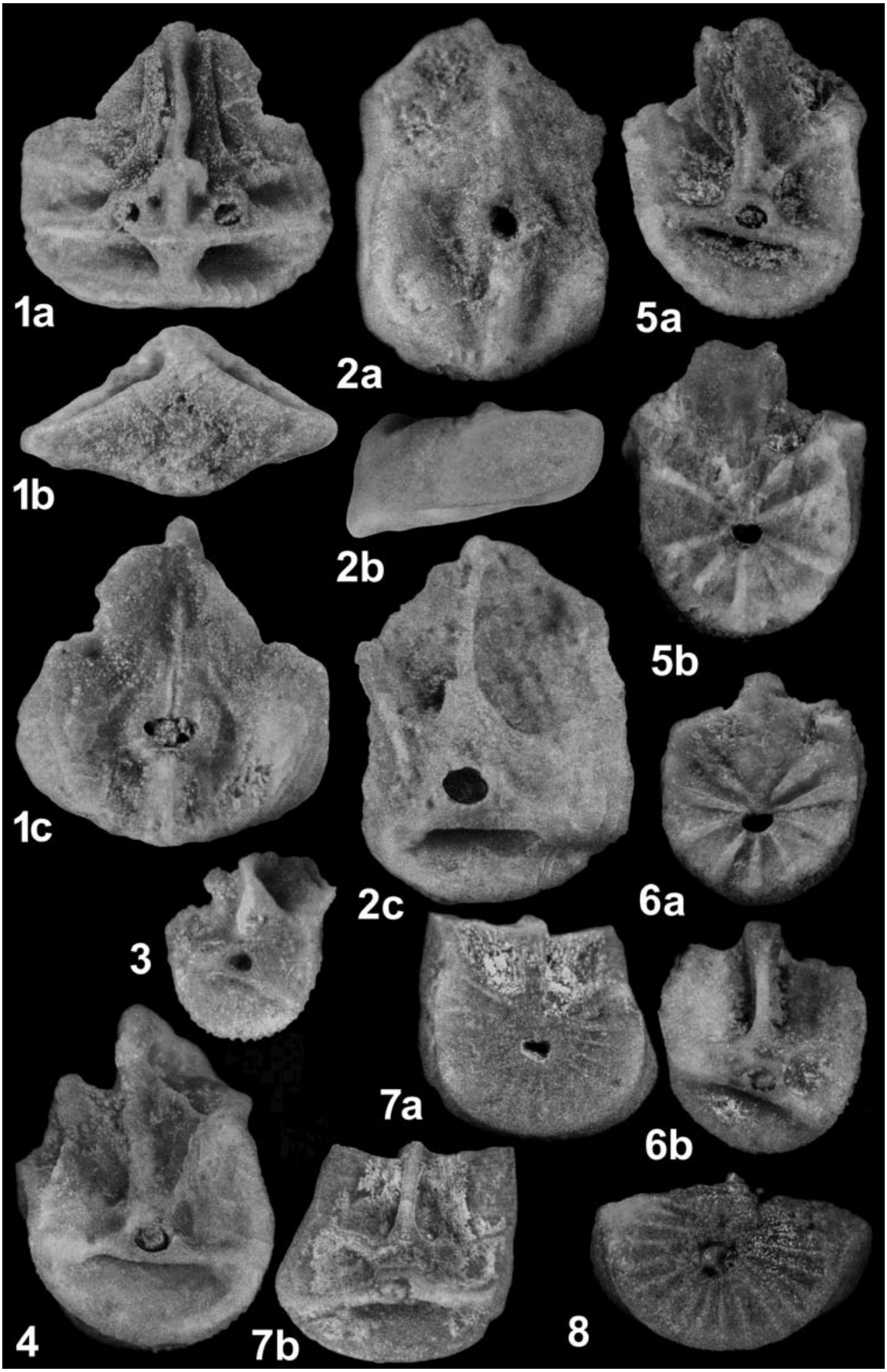
Fig. 5. Epizygal of the common type; a: distal facet with oblique muscular articulation and pinnule socket; b: proximal facet with syzygy. W 2.4 mm, Doa 2.9 mm. NHMW 2009z0180/0056.

Fig. 6. Hypozygal of the common type; a: distal facet with syzygy; b: proximal facet with oblique muscular articulation. W 2.0 mm, Doa 2.4 mm. NHMW 2009z0180/0057.

Fig. 7. Hypozygal of the rare type; a: distal facet with cryptosyzygy: b: proximal facet with oblique muscular articulation. W 2.8 mm, Doa 2.6 mm. NHMW 2009z0180/0058.

Fig. 8. Epi(?)zygal of the rare type, damaged adorally; facet with cryptosyzygy. W 2.8 mm. NHMW 2009z0180/0059.

All specimens from the Barremian of the Serre de Bleyton, Provence, France. All specimens from locality SdB1.


1a
1b
1c
2a
2b
2c
3
4
5a
5b
6a
6b
7a
7b
8

Appendix

Element	Inv. No.	Locality
***Isocrinus*? *bleytonensis* n. sp.**		
2 proximal pluricolumnals	2009z0180/0001–0002	SdB1
Numerous columnals and pluricolumnals, altogether 1579 columnals (237 large nodals, 70 small nodals, 918 large internodals, 354 small internodals), among these are 87 complete noditaxes (75 large, 12 small)	2009z0180/0003–0009, …/0061	SdB1
Numerous cirrals	2009z0180/0062	SdB1
1 radial	2009z0180/0012	SdB1
1 radial possibly belonging to a different species	2009z0180/0063	SdB1
1 IBr_2 = IAx	2009z0180/0013	SdB1
2 $IIBrr_2$	2009z0180/0014, …/0064	SdB1
36 brachials with muscular articulations on both facets	2009z0180/0015, …/0065	SdB1
10 episymmorphals	2009z0180/0016, …/0066	SdB1
2 hyposymmorphals	2009z0180/0067	SdB1
11 II, IIIAxx	2009z0180/0017, …/0068	SdB1
Numerous pinnulars	2009z0180/0069	SdB1
Numerous columnals and pluricolumnals, altogether 136 columnals (6 large nodals, 13 small nodals, 26 large internodals, 91 small internodals), among these are 2 complete noditaxes (large)	2009z0180/0010, …/0070	SdB2
Numerous cirrals	2009z0180/0071	SdB2
1 radial	2009z0180/0011	SdB2
1 radial possibly belonging to a different species	2009z0180/0060	SdB2
1 IBr_2 = IAx	2009z0180/0072	SdB2
1 $IIBr_1$	2009z0180/0073	SdB2
6 brachials with muscular articulations on both facets	2009z0180/0074	SdB2
3 episymmorphals	2009z0180/0075	SdB2
2 hyposymmorphals	2009z0180/0076	SdB2
2 II, IIIAxx	2009z0180/0077	SdB2
Numerous pinnulars	2009z0180/0078	SdB2

***Percevalicrinus* sp.**		
35 tall juvenile columnals with synarthries are tentatively placed here	2009z0180/0079	SdB1
Some columnals and short pluricolumnals, altogether 7 nodals and 30 internodals	2009z0180/0020–0021, …/0080	SdB1
2 low juvenile columnals with synarthries are tentatively placed here	2009z0180/0018, …/0081	SdB2
5 tall juvenile columnals with synarthries are tentatively placed here	2009z0180/0019, …/0082	SdB2
Some columnals and short pluricolumnals, altogether 4 nodals and 27 internodals	2009z0180/0022–0024, …/0083	SdB2
***Comatulina moosleitneri* n. sp.**		
19 centrodorsals and a fragment	2009z0180/0025, …/0031–0032, …/0084	SdB1
14½ cups with centrodorsals	2009z0180/0029, …/0085	SdB1
6½ cups	2009z0180/0030, …/0086	SdB1
1 centrodorsal	2009z0180/0087	SdB2
2 cups with centrodorsals	2009z0180/0028, …/0088	SdB2
***Decameros ricordeanus* cf. *vagnasensis* (de Loriol, 1888)**		
1 large centrodorsal	2009z0180/0037	SdB1
1 juvenile centrodorsal	2009z0180/0036	SdB1
2 large cups with centrodorsals	2009z0180/0033–0034	SdB1
253 large cirrals	2009z0180/0038–0039, …/0089	SdB1
2 radials possibly belonging to a different species	2009z0180/0090	SdB1
1 IBr_1	2009z0180/0041	SdB1
66 $IBrr_{2-n}$ (22 large, 24 medium-sized, 20 small)	2009z0180/0042–0044, …/0091	SdB1
44 pinnulars	2009z0180/0051, …/0092	SdB1
½ medium-sized centrodorsal	2009z0180/0035	SdB2
31 large cirrals	2009z0180/0093	SdB2
1 radial	2009z0180/0040	SdB2
25 $IBrr_{2-n}$ (13 large, 6 medium-sized, 6 small)	2009z0180/0094	SdB2
2 pinnulars	2009z0180/0095	SdB2

***Semiometra barremiensis* n. sp.**		
14 centrodorsals	2009z0180/0047–0048, …/0096	SdB1
10 cups with centrodorsals	2009z0180/0045–0046, …/0097	SdB1
1 centrodorsal	2009z0180/0098	SdB2
1 cup with centrodorsal	2009z0180/0099	SdB2
Brachials of *Semiometra barremiensis* n. sp. or *Comatulina moosleitneri* n. sp.		
6 $IBrr_1$	2009z0180/0049, …/0100	SdB1
21 $IBrr_2$ = IAxx	2009z0180/0052, …/0101	SdB1
12 $IIBrr_1$	2009z0180/0053, …/0102	SdB1
25 $IIBrr_2$	2009z0180/0050, …/0103	SdB1
500 brachials with muscular articulations on both facets 2009z0180/0055, …/0104	SdB1	
129 epizygals of the common syzygy type	2009z0180/0054, …/0056, …/0105	SdB1
150 hypozygals of the common syzygy type	2009z0180/0057, …/0106	SdB1
12 epizygals of the rare cryptosyzygy type	2009z0180/0059, …/0107	SdB1
19 hypozygals of the rare cryptosyzygy type	2009z0180/0058, …/0108	SdB1
Numerous pinnulars	2009z0180/0109	SdB1
2 $IBrr_2$ = IAxx	2009z0180/0110	SdB2
2 $IIBrr_1$	2009z0180/0111	SdB2
44 brachials with muscular articulations on both facets 2009z0180/0112	SdB2	
15 epizygals of the common syzygy type	2009z0180/0113	SdB2
8 hypozygals of the common syzygy type	2009z0180/0114	SdB2
2 hypozygals of the rare cryptosyzygy type	2009z0180/0115	SdB2
Numerous pinnulars	2009z0180/0116	SdB2
***Apiocrinites* sp.**		
3 pluricolumnals of 16 columnals altogether	2009z0180/0026–0027, …/0117	SdB1