Fig. 18  *Jeronia pyrenaica* Seunes, 1888, from the late Danian of Larumbe (Navarra); MGB 37382. 1, apical surface; 2, oral surface; 3, posterior profile; 4, lateral profile. All x1.5.

Family **STEGASTERIDAE** Lambert, 1917

**Diagnosis.** Test cordate, with prominent frontal groove from the ambitus to the peristome. Apical disc holasterid with four gonopores. Paired ambulacra with subpetaloid to rudimentary pore-pairs. Phyllode pore-pairs lacking from around peristome. Plastron orthosternous without rostral plate. Marginal fasciole may be present, but no other fascioles are developed.

Genus **STEGASTER** Pomel, 1883

**Diagnosis.** Thick-tested holasterid with flat base and cordate outline. Frontal groove absent adapically, deepening to ambitus with sharp keels and continuing as well-defined furrow to mouth. Petals rudimentary, flush. Plastron orthosternous. Periproct on posterior face, just supramarginal with subanal tallon. No fascioles.

**Stegaster bouillei** (Cotteau, *in de Bouillé*, 1873)

Pl. 5, figs 1–3; Figs 21, 22

1873  *Holaster Bouillei* Cotteau, *in de Bouillé*: 450.
1889  *Stegaster bouillei* Seunes: 816, pl. 26, fig. 2.
1892  *Stegaster bouillei* Nicklès: 111.

**Diagnosis.** Test elongate, up to 75 mm in length; tapering to posterior truncation. Width about 90% of length. In profile subconical with tallest point anterior; height about 50–60% of length. Anterior

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**PLATE 5**

Figs 1–3  *Stegaster bouillei* (Cotteau, *in de Bouillé*, 1873), BMNH EE6066. Maastrichtian of Sarasate, Navarra. Oral, apical and lateral views. x1.

Figs 4–6  *Stegaster palaeocenicus* sp. nov., MGB 37351 (holotype), Danian of Aristregui, Navarra. Lateral, oral and aboral views. x1.
LATE CRETAEOUS-EARLY TERTIARY ECHINOIDS
Fig. 19  Camera lucida drawings of plating in *Jeronia pyrenaica* Seunes, 1888, from the late Danian of Larumbe (Navarra); MGB 37382, a, apical surface; b, oral surface. Interambulacra shaded. Scale bar = 5 mm.

Fig. 20  Camera lucida drawing of plating in *Jeronia pyrenaica* Seunes, 1888 from the late Danian of Aristregui (Navarra); MGB 37353, apical disc. Scale bar = 5 mm.

Fig. 21  Camera lucida drawing of plating in *Stegaster bouillei* (Cotteau, in de Bouillé, 1873) from the late Maastrichtian of Bidart (Pyrénées-Atlantiques, France); BMUW 74753, apical surface (interambulacra shaded). Scale bar = 5 mm.
sulcus sharp and well developed, forming obvious narrow groove on oral surface. Ambulacral plates low and relatively wide, compared to *S. altus*, and with elongate pore-pairs en chevron. Larger primary tubercles present close to the apex and along the posterior ridge between the apex and periproct. Larger tubercles also developed just above the ambitus around the posterior part of the test. Periproct supra-ambital, but test depressed below the periproct so that the periproct opening is just visible in oral view.

**Occurrence.** Lower Maastrichtian (black shale facies), Sarasate, Navarra; upper Upper Maastrichtian, Bidart, Pyrénées-Atlantiques, France. The species was first described from the Maastrichtian of the French Pyrenees between Gar and Rébénac, and is also known from the Province of Alicante, Spain and from Turkey, Crimean peninsula, Republic of Georgia, and the North Caucasus.

**Material studied.** BMNH EE4375, EE4568, EE4566, EE6066, MGB 37286–87, 37300.

**Remarks.** Easily separated from *S. altus* by its characteristic elongate shape and vaulted upper surface with the tallest point anterior. *S. couteau* differs in having a disjunct plastron and a more ovate outline.

**Stegaster altus** Seunes, 1889

1889 *Stegaster altus* Seunes: 815, pl. 26, fig. 1.
1891 *Stegaster chalmasi* Seunes: 23, pl. 1, fig. 1.
1892 *Stegaster chalmasi* Seunes; Nicklès: 110.
1892 *Stegaster altus* Seunes; Nicklès: 111.

**Diagnosis.** Test up to 50 mm in length. Like *S. boulli*, but test almost as wide as long and very tall; height more than 70% of test length. Ambulacral plates much taller than in *S. boulli*.

**Occurrence.** Lower Maastrichtian (black shale facies), Sarasate, Navarra. Upper Upper Maastrichtian, Bidart, Pyrénées-Atlantiques, France. This species was first described from the Maastrichtian of the French Pyrenees. It also occurs in the Alicante Province of Spain and in Tunisia, Turkey, Bulgaria, Republic of Georgia and the North Caucasus.

**Material studied.** BMNH EE4396, EE4347–50, EE6176–78, MGB 37298–99, BMUW 74610, 74753, 74788, 74945, 94946, 94949, 94988, 94994.

**Remarks.** Readily distinguished from other species of *Stegaster* by its wider and much taller test.

**Stegaster couteau** Seunes, 1889

1889 *Stegaster couteau* Seunes: 813, pl. 25, fig. 3.

**Diagnosis.** Test up to 60 mm in diameter; cordiform, as wide as long or slightly wider. All material crushed, but apparently rather rounded at the ambitus when not crushed and not very tall; tallest point anterior of mid-length. Ambulacral plates rather tall with small, almost rudimentary pore-pairs. Plastron disjunct with labral plate separated from succeeding sternal plate by ambulacral plates. Tuberculization unknown.

**Occurrence.** Upper Upper Maastrichtian, Bidart, Pyrénées-Atlantiques, France.

**Material studied.** BMNH 75697, E2916, E10972, BMUW 74603, 74607, 74609a, 74772, 74789, 74791, 94946, 94948, 94985, 94986, 94989, 94991a.

**Remarks.** Most similar to *Stegaster heberti*, differing primarily in having a disjunct plastron (a feature which we can confirm is not size-related). It comes very close to *Sanchezaster habaniensis* Lambert in appearance, differing only in having double pores on ambulacral plates rather than single pores.

**Stegaster palaeocenicus** Smith & Gallemi, sp. nov.

Pl. 5, figs 4–6; Fig. 25

**Diagnosis.** *Stegaster* with disjunct plastron and posterio-lateral interambulacra.

**Description.** Test up to 55 mm in length; ovate with slight anterior invagination and small bilobed posterior projection in aboral view. Distinctly conical in profile with tallest point coincident with apical disc; rounded in front and sloping to rear. Frontal groove absent adapically, but rapidly deepening at the ambitus and continuing as a deep channel to the peristome, which is forward-facing. The interambulacral plates on either side form a distinct keel. Apical disc positioned anteriorly (about 30% test length from the anterior border); elongate and of standard holasterid structure with four gonopores. Aboral pore-pairs small and sunken; never elongate; becoming microscopic away from the apical disc. Plastron orthosternous and disjunct, with ambulacral plates separating the labrum and first sternal plate. The posterio-interambulacral are also disjunct. Periproct supra-ambient, on short posterior face and above small double protuberance. Aboral tuberculization composed of a uniform scattering of small tubercles set in a dense granulation; no enlarged tubercles differentiated. No marginal fasciole.

**Occurrence.** Late Danian of Aristegui and Larumbe, Navarra Province.

**Types.** Holotype MGB 37351, paratypes MGB37352, 37381.

**Remarks.** The deep sulcus developed from the ambitus to the peristome identifies this as a steasterid. Our species lacks the marginal fasciole and enlarged tubercles of *Guettaria* and *Rispolia*. 
and its disjunct plastron distinguishes it from all but three species of *Stegaster*, *S. cotteaui* Seunes, *S. charlesi* Lambert and *S. mairei* Lambert, all Maastrichtian in age. In none of these are the latero-posterior interambulacra interrupted as they are in our species. *S. mairei* further differs in being subglobular in shape with its periproct positioned much higher. *S. cotteaui* has a much narrower anterior sulcus, more anterior peristome (10% test length from the anterior rather than almost 30%) and is more depressed in profile. *S. charlesi* resembles our species in profile, but, according to Lambert (1931: M7), has such a reduced labral plate that only ambulacral plates surrounding the peristome. Unfortunately the only plating diagram of *S. charlesi* (Lambert 1931: M5, fig. 3) gives insufficient detail and we have not examined Lambert’s type to confirm this very unusual plate arrangement.

**Genus THOLASTER** Seunes, 1891

**DIAGNOSIS.** Test elongate with very deep frontal groove at ambitus and adorally; tapering to posterior truncation. Apical disc with four genital plates each with a gonopore. Aboral pore-pairs rudimentary, ambulacra flush. Frontal groove with sharp lateral carina; developed from apex to peristome. Oral surface flat. Plastron orthosternous. Periproct on posterior face. Very large primary tubercles prominent towards apex and along the aboral margins of the frontal groove. No fascioles.

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**PLATE 6**

**Figs 1-5** *Stegaster cotteaui* Seunes, 1889, Upper Maastrichtian of Bidart, Pyrénées-Atlantiques, France. 1–3, BMUW 74603, oral, lateral and apical views, x1. 4, 5, BMUW 94985, oral and lateral views, x1.

**Figs 6-8** *Tholaster munierti* (Seunes, 1889), BMUW 94993, Upper Maastrichtian of Bidart, Pyrénées-Atlantiques, France. Apical, oral and lateral views, x1.
Fig. 25 Camera lucida drawings of plating in *Stegaster palaecenicus* sp. nov. from the late Danian of Aristregui (Navarra); a, holotype MGB 37351, oral surface (interambulacra shaded); b, paratype MGB 37352, apical disc. Scale bars: a = 5 mm; b = 1 mm.

Fig. 26 Camera lucida drawings of plating in *Tholaster munieri* (Seunes, 1889) from the late Late Maastrichtian of Bidart (Pyrénées-Atlantiques, France); BMUW 94993, a, apical surface; b, oral surface. Interambulacra shaded. Scale bar = 5 mm.

PLATE 7
Figs 1, 2 *Hemipneustes pyrenaicus* Hebert, 1875, BMNH EE6180, Maastrichtian of Olazagutia Pass, Navarra. Apical and lateral views, ×1.
Figs 3, 4 *Hemipneustes striatoradiatus* (Leske, 1778), BMNH EE6179, Maastrichtian of Olazagutia Pass, Navarra. Apical and lateral views, ×1.
Figs 5, 6 *Echinocorys scutata* forma cotteani Lambert, 1903, BMNH EE6190, Thanetian of Casas de Oraien, Navarra. Lateral and apical views, ×1.
Figs 7–10 *Pseudoffaster caucasicus* (Dru, 1884), BMNH EE6234, Maastrichtian of Sarasate, Navarra. Apical, posterior, lateral and oral views, ×2.