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Notes on selected Cretaceous echinoids from south-central Sakhalin, Far East Russia•

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Abstract

From Albian, Santonian and Campanian strata in south-central Sakhalin, four echinoid taxa are described, illustrated and discussed. In Far East Russia, echinoids are rare constituents amongst mid- and Late Cretaceous macrofaunal assemblages in which inoceramid and non-inoceramid bivalves, plus heteromorph and non-heteromorph ammonites predominate. The sole regular species in the present lot is represented by an incomplete external mould of a primary spine of a rhabdocidarid, *Polycidaris*(?) sp., from the lower Campanian. Irregular taxa include a fragmentary, specifically indeterminate 'pygurid', *Echinopygus*(?) sp., of late Albian age, as well as two spatangoids. One of these, a toxasterid of late Campanian age, is assigned to *Niponaster* cf. *hokkaidensis* (Lambert *in* Lambert & Thiéry, 1924). The other is a new hemiasterid with a semi-ethmophract apical disc, a peripetalous fasciole with diffuse boundaries (parafasciole) and posterior petals that are near-equal in length to anterior ones, from lowermost Campanian strata. For this, the name *Palhemiaster natalyae* n. sp. is introduced. Comparisons with coeval echinoid faunas from nearby Hokkaido (northern Japan) are hampered by the generally poor preservation of the latter. However, with the exception of *Niponaster* cf. *hokkaidensis*, none of the forms recorded in the present paper appears to be represented in those Japanese assemblages.

Keywords: Cidaroida, Neognathostomata, Spatangoida, new taxon

Introduction

Macrofaunal assemblages of mid- and Late Cretaceous age from Sakhalin (Far East Russia) predominantly comprise inoceramid and non-inoceramid bivalves as well as ammonites, both heteromorph and non-heteromorph (Zonova et al., 1993; Yazykova, 2002, 2004; Sey et al., 2004; Yazykova et al., 2004; Jagt-Yazykova, 2011). Echinoids are rare, and when present, generally are poorly preserved, as demonstrated in the present note. However, we do have listings of Cretaceous echinoids from Sakhalin that suggest that there is unpublished material in various Russian institutions (e.g., VNIGRI, VSEGEI, both Sankt-Peterburg) that awaits proper assessment and scientific description. However, until now, we have been unable to trace this material, with the exception of the four specimens described below.

Here we record a single regular species from the lower Campanian (*Inoceramus nagaoi* Zone), on the basis of the external mould of a primary spine which is assigned, albeit with a query, to the rhabdocidarid *Polycidaris*. The present lot also comprises three irregular forms, namely a specifically indeterminate 'pygurid', *Echinopygus*(?) sp., of late Albian age, as well as a toxasterid and a hemiasterid spatangoid. The toxasterid, of late Campanian (*Canadoceras multicostatum* Zone) age, is assigned to *Niponaster* cf. *hokkaidensis* Lambert *in* Lambert & Thiéry, 1924, while the hemiasterid, of earliest Campanian age, is described as a new species, *Palhemiaster natalyae* n. sp. It has a diffuse peripetalous fasciole (parafasciole), a semi-ethmophract

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apical disc and posterior petals that are near-equal in length to the anterior ones. Similarities of all these forms with taxa recorded from nearby Hokkaido (northern Japan) are not readily apparent, with the exception of *Niponaster* cf. *hokkaidensis*. Detailed comparisons are hampered by the fact that echinoid assemblages from the mid- and Upper Cretaceous from northern Japan generally are incomplete, being sediment compacted, distorted to varying degrees and lacking test material (see e.g., Nisiyama, 1968; Tanaka, 1984).

To denote the repositories of material referred to in the text, the following abbreviations are used: NHMM – Natuurhistorisch Museum Maastricht, Maastricht, the Netherlands; UMUT – The University Museum, The University of Tokyo, Tokyo, Japan; VNIGRI – Vserossijskij Neftjanoj Nauchno-Isledovatel'skij Geologorazvedochnij Institut, Sankt-Peterburg, Russia; VSEGEI – Vserossijskij Nauchno-Isledovatel'skij Geologicheskij Institut imeni A.P. Karpinskogo, Sankt-Peterburg, Russia.

Localities and stratigraphy

All specimens described and illustrated below originate from Sakhalin (Fig. 1). Specific geographic and stratigraphic data (compare Jagt-Yazykova, 2011) are as follows:

- Locality 15 (leg. Ju.N. Tarasevich; collected 1965), Cape Ostryj, Tanino-Aniva Peninsula, southeastern Sakhalin; lower part of Naiba Formation (upper Albian; *Inoceramus anglicus* and *I. aiensis* inoceramid Zone, equivalent to the *Cleoniceras* sp. ammonite Zone; associated with *Sonneratia* sp. and *Pterotrigonia hokkaidoana* (Yehara, 1915);
- Locality 19 (leg. T.D. Zonova; collected 1979), valley of the River Gastello, left bank of the River Voskovaya, south-central Sakhalin; Bykov Formation, Member 10 (lower Campanian, *Inoceramus nagaoi* Zone);
- Locality 134-6 (leg. E.A. Yazykova; collected 1989), River Naiba, at the confluence with its right tributary, the Nagornaya, southern Sakhalin; Bykov Formation, Member 10 (lowermost Campanian, *Menuites* (*Neopachydiscus*) *naumanni* Zone);
- Locality 601 (leg. N.B. Salnikova; collected 1970), Kriljon Peninsula, River Garbusha, southwestern Sakhalin; Krasnoyarka Formation, Member 2 (upper Campanian, lower part of *Canadoceras multicostatum* Zone).

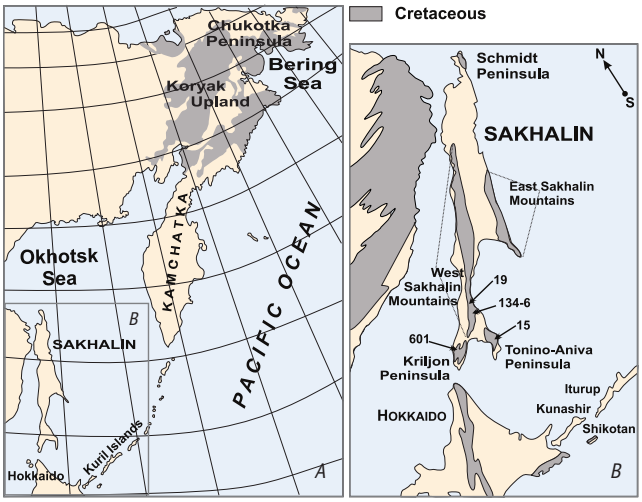

Fig. 1. Map of Sakhalin (Far East Russia), showing the localities which have yielded the echinoids described in the present paper (modified from Jagt-Yazykova 2011, fig. 1).

Systematic palaeontology

Order Cidaroida Claus, 1880
Family Rhabdocidaridae Lambert, 1900 (= Polycidaridae Vadet, 1988)
(?)Genus Polycidaris *Quenstedt, 1858*

Type species

Cidarites multiceps Quenstedt, 1858 (= *Cidaris spinosa* L. Agassiz, 1840), by monotypy.

Polycidaris*(?) sp.*

Fig. 2.

Material

A single, incomplete primary spine (NHMM 2012 074), in external mould preservation (leg. T.D. Zonova; collected 1979), from locality 19, of early Campanian age (*Inoceramus nagaoi* Zone).

Description

Spine slender, cylindrical, length (as preserved) 45 mm, greatest diameter in lower half of shaft (3.5 mm) and gradually decreasing distally to ca 3 mm. Acetabulum poorly preserved, but apparently coarsely crenulate; perforation not visible. Base smooth, height 1.8 mm; milled ring prominent, yet thin, diameter 4.2 mm; collar finely striated, height 2.3 mm, sharply demarcated from neck of shaft. Neck smooth; first thorns developing at 12 mm above collar/neck boundary. Thorns on lower half of shaft arranged in irregular rows (estimated 16-18 rows in total) of essentially two size classes; much longer and widely spaced thorns confined to median and upper portions of shaft, directed outwards and upwards (at 40-55 degrees), arranged in alternate rows, four or five in total; spine surface in between thorns very finely striated.

Discussion

In proportions of collar and neck and features of thorny ornament of varying density and strength along the shaft, this specimen closely resembles material assigned to the genus *Polycidaris* from the Lower Cretaceous (Valanginian-lower Albian) of northwest Europe (see e.g., Smith & Wright, 1989). However, NHMM 2012 074 is of early Campanian age, i.e. at

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Fig. 2. Polycidaris*(?) sp., external mould of primary spine (NHMM 2012 074) and rubber peel of the same, associated with numerous inoceramid shell prisms (leg. T.D. Zonova; collected 1979); lower Campanian (*Inoceramus nagaoi *Zone). Specimen uncoated; scale bar equals 10 mm.*

least 27 myr younger than the youngest record of the genus so far. It can be differentiated from *Polycidaris phillipsii* (Agassiz & Desor, 1847), of late Hauterivian to early Albian age (see Smith & Wright, 1989, p. 14, pl. 1, figs 1-5) and from *P. muricata* (Roemer, 1836), of Valanginian to Hauterivian date (see Smith & Wright, 1989, p. 15, pl. 1, figs 6-8), by details (arrangement in rows; thorns more curved outwardly) of the ornament along the shaft.

There are only few previous records of Late Cretaceous rhabdocidarids. Smith (1995, p. 130, text-fig. 8, pl. 1, fig. 1) described, as 'Gen. et sp. indet.', a fragment of rhabdocidarid test comprising three interambulacral plates from the early late Maastrichtian Simsima Formation in the United Arab Emirates/Oman border region; however, no spines were found associated. Subsequently, Smith & Jeffery (2000, p. 10) noted that this record probably pertained to *Polycidaris*, rather than to *Histocidaris* Mortensen, 1903 on account of the fact that only the adradial and interradial margins of the primary tubercle carried scrobicular tubercles. Jagt (1999, p. 8, pl. 1, fig. 11, as 'rhabdocidarid (?) indet.') recorded fragments of a single primary spine of Late Cretaceous (Campanian or Maastrichtian) age from the Gschliefgraben of Austria, but an early Paleocene date could not be ruled out either. That form has a more uniformly regular thorny ornament along the shaft. Of the Sakhalin taxon test plates are needed to confirm generic placement, but for the time being, it is here referred to the rhabdocidarid *Polycidaris*. Primary spines of Late Cretaceous cidarids differ markedly in having better-developed rows of thorns or of close-set granules (see e.g., Smith & Wright, 1989). Nisiyama (1966) did not record any cidaroids from correlative levels in Japan.

Stem group Neognathostomata Smith, 1981
Pygurid grade stem group ('pygurids')
(?)Genus Echinopygus *D'Orbigny, 1856*

Type species

Clypeaster *oviformis* var. 2 De Lamarck, 1816 (= *Echinoaus lampas* De la Beche, 1824), by the subsequent designation of Lambert & Thiéry (1921).

Echinopygus*(?) sp.*

Fig. 3.

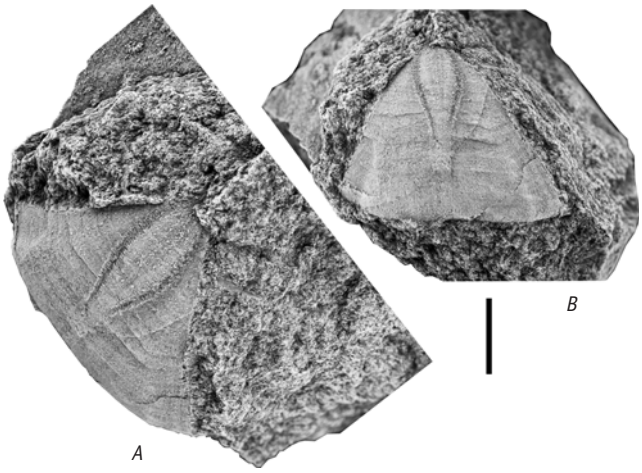

Fig. 3. Echinopygus*(?) sp., NHMM 2012 075, in apical (A) and oblique left lateral (B) views. Specimen coated with ammonium chloride prior to photography. Scale bar equals 10 mm.*

Material

A single posterior test fragment (NHMM 2012 075), in internal mould preservation (leg. Ju.N. Tarasevich, 1965), from locality 15, of late Albian age (zone of *Inoceramus anglicus* and *I. aiensis*).

Description

Fragment consisting of interambulacrum 5 and ambulacrum V, suggestive of a medium-sized test (estimated length 50 mm), test height estimated >17 mm, width >41 mm; margin angular, ambitus very low, but without posterior test prolongation; aboral surface regularly domed, lateral sides sloping. Petal lanceolate,

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broad (6 mm), ca 16.5 mm in length, strongly tapering distally, open at end and with wide interporiferous zone; pore structure and tubercles unrecognisable due to preservation.

Discussion

In the absence of important test features such as apical disc, peristome, periproct and phyllodes, the present form cannot be identified in more detail. For the time being, it is provisionally assigned to the genus *Echinopygus*, the type species of which is known from the lower Cenomanian of southern England and northwest France (Smith & Wright, 2000; Smith & Kroh, 2013). However, that species has a clearly rostrate test with a blunt posterior point, has longer posterior petals and a more concave test margin posteriorly. The much more rounded specimen from the lower Cenomanian of Wilmington, Devon (southern England) illustrated by Smith & Wright (2000, pl. 137, fig. 5) is closer to NHMM 2012 075 both in test outline and petal length and structure.

How the present form relates to Japanese 'pygurids' cannot be decided with the poorly preserved material at hand. *Pygurus asiaticus* Tokunaga, 1903 is a poorly known species from Kochi Prefecture, the age of which is unclear (compare Nisiyama, 1968, p. 6), despite the fact that Lambert & Thiéry (1921, p. 355) claimed it was of a Cenomanian date. The other form, *Pygurus complanatus* Tanaka, 1965, was originally recorded from allegedly Cretaceous levels in Nagano Prefecture. Nisiyama (1968, p. 6) noted similarities with Early Cretaceous ('Neocomian') species from Europe.

Order Spatangoida Claus, 1876
Stemgroup 'Toxasteridae' Lambert, 1920b (sensu Smith & Wright, 2008)
Genus Niponaster *Lambert, 1920a*

Type species

Niponaster hokkaidensis Lambert *in* Lambert & Thiéry, 1924, by subsequent designation.

Niponaster *cf.* hokkaidensis *Lambert* in *Lambert & Thiéry, 1924*

Figs 4, 5.

Material

A single fragmentary and abraded test (NHMM 2012 076; leg. N.B. Salnikova, 1970), from locality 601, of late Campanian age (lower part of *Canadoceras multicostatum* Zone).

Description

Test of fairly large size, though incomplete; plating thick (2.5 mm in ambulacrum III at ambitus); test length and width estimated at 75 mm and ca 70 mm, respectively; test height ca 42 mm; maximum test width apparently just posterior of apical disc; outline probably oval, anterior and lateral sides rounded; no frontal notch. Test profile domed to subconical, maximum height near apical disc. Apical disc ethmophract (see Fig. 5), but poorly preserved; genital plate 2 with numerous madreporitic pores and gonopore; genital plates 1 and 3, both with pores, partially visible; genital plate 4 incompletely preserved. Adapical ambulacra straight, non-petaloid, completely flush with test; pores transversely elongate, of near-comparable size, arranged en chevron, gradually diminishing in size towards ambitus; pores similar in all ambulacra; other details obliterated. Peristome and periproct not preserved; however, plating in plastronal and peristomial area (as preserved) suggestive of a rather small, simple peristome; plates of ambulacrals I and V and interambulacral 4 on oral surface large and elongate; labral plate not visible. Tuberculation of apical test surface visible only in patches; simple, with scattered primaries in even groundmass.

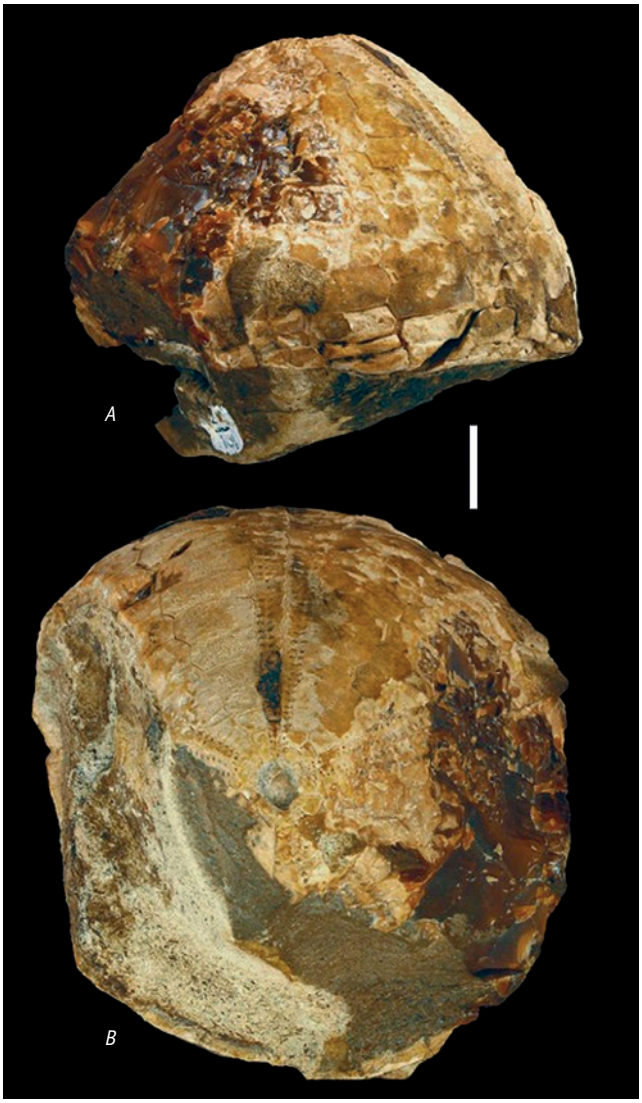

Fig. 4A, B. Niponaster *cf.* hokkaidensis *Lambert* in *Lambert & Thiéry, 1924, NHMM 2012 076, in right lateral (A) and apical (B) views. Specimen uncoated. Scale bar equals 10 mm.*

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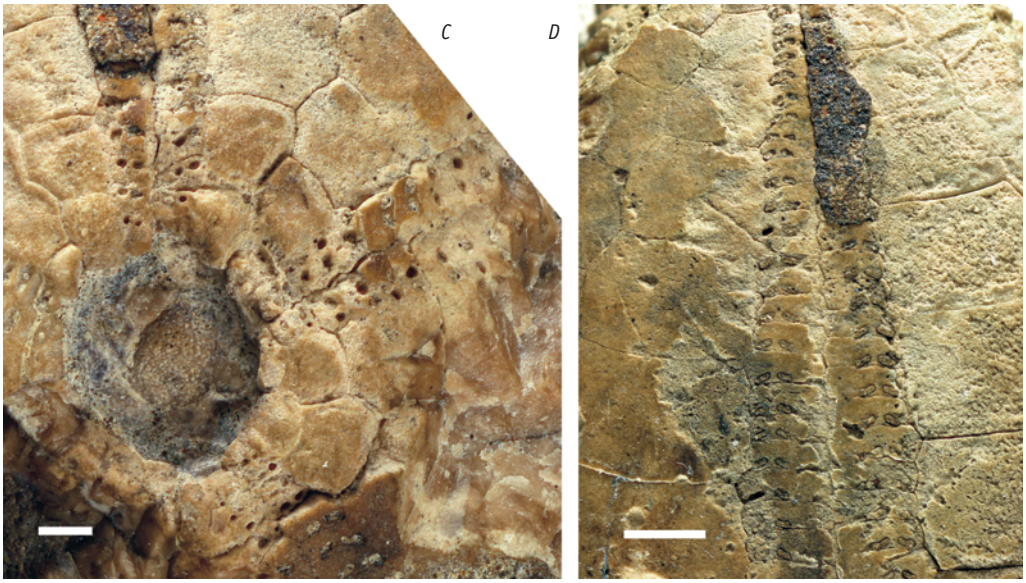

Fig. 4C, D. Niponaster *cf.* hokkaidensis *Lambert* in *Lambert & Thiéry, 1924, NHMM 2012 076, detail of apical disc (C) and structure of ambulacrum (AIII) (D) Specimen uncoated. Scale bars equal 2 mm (C) and 3.5 mm (D).*

Discussion

On account of test shape, ambulacral structure and tuberculation (as preserved), this specimen was more or less routinely assigned to the holasteroid genus *Echinocorys* Leske, 1778, when the present lot was first cursorily examined. However, preservation leaves much to be desired, only half of the test being available, and peristome and periproct either covered or lost. In addition, a sediment plug obscured the apical disc; this was subsequently removed so as to reveal a compact, ethmophract type of disc (Fig. 5), demonstrating the spatangoid nature of the specimen. However, not all details of ocular and genital plates can be assessed; the apical disc was pressed into the test, probably by sediment compaction.

On account of test proportions, ambulacral structure and general outline of the apical disc, NHMM 2012 076 is assigned to the genus *Niponaster*, representatives of which also have ovate tests, a subconical test profile and flush (to slightly depressed) aboral ambulacra and which lack a frontal sulcus. However, in the absence of periproct, peristome and sternal and labral plating, the present specimen can only be referred to the type species, *N. hokkaidensis*, with a query.

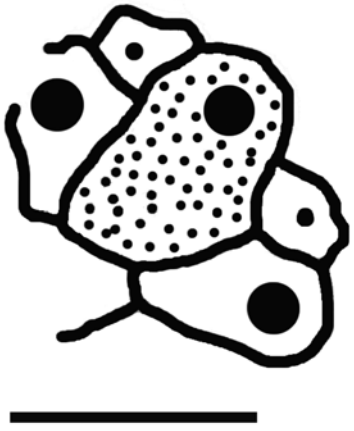

Fig. 5. Niponaster *cf.* hokkaidensis *Lambert* in *Lambert & Thiéry, 1924, line drawing of apical disc (incomplete) of NHMM 2012 076 (compare Fig. 4C). Scale bar equals 3 mm.*

Niponaster hokkaidensis (holotype: UMUT ME 07482 = '*Ananchytinarum* sp. indet.' of Jimbō, 1894, p. 45 (191), pl. 9 (25), fig. 8) probably is from the Upper Yezo Group of the Kusuri region in Hokkaido, northern Japan. Morishita (1955, pl. 15) recorded another specimen from the Minato Shale (upper part of the Izumi Group, Upper Cretaceous) of Hyogo Prefecture, which, in test outline, is close to the present specimen (Fig. 4A-B). Nisiyama (1968, p. 171) referred to another, poorly preserved specimen from Hokkaido, from an unspecified Upper Cretaceous level. The second species, *N. nakaminatoensis* Saito, 1959 (see Nisiyama, 1968, p. 173, fig. 64(39)a, b), from the upper Nakaminato Formation (Upper Cretaceous) of Ibaraki Prefecture, has comparatively wider ambulacra, a narrower labrum and sternum and an inframarginal periproct. Apart from the first-named feature, none are preserved in NHMM 2012 076.

Infraorder Hemiasterina Fischer in *Moore, 1966*
Family Hemiasteridae H.L. Clark, 1917
Genus Palhemiaster *Lambert, 1916*

Type species

Palhemiaster peroni Lambert, 1916, by original designation.

Palhemiaster natalyae *n. sp.*

Figs 6, 7.

Material

A single, well-preserved test (NHMM 2012 077; leg. E.A. Yazykova, 1989), the holotype and sole specimen known to date, from locality 134-6, of earliest Campanian (*Menuites* (*Neopachydiscus*) *naumanni* Zone) age.

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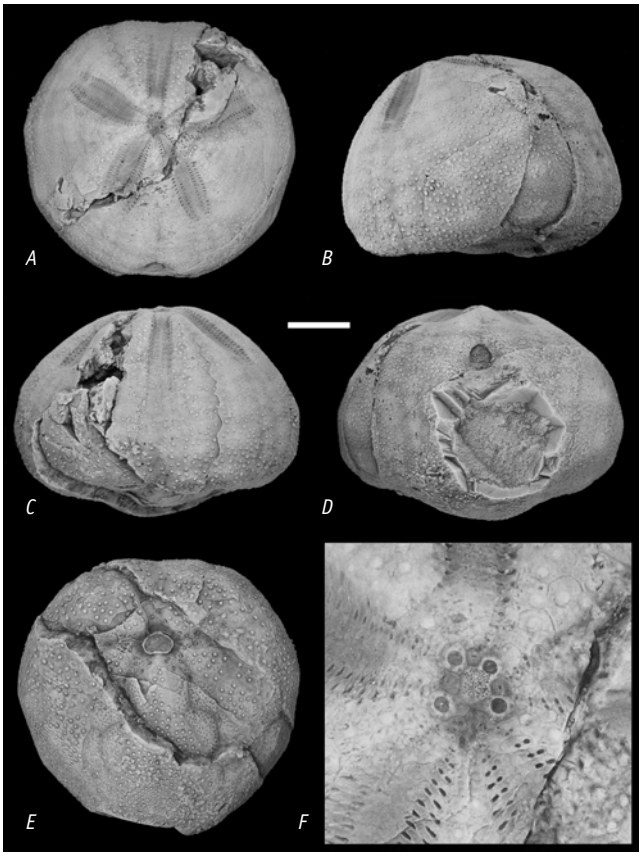

Fig. 6. Palhemiaster natalyae *n. sp., NHMM 2012 077, in apical (A), left lateral (B), anterior (C), posterior (D) and oral (E) views and detail of apical disc (F). Specimen coated with ammonium chloride prior to photography. Scale bar (for A-E) equals 10 mm.*

Derivation of name

In commemoration of Natalya Dmitrievna Zonova (1940-2007), mother of the second and younger sister of the third author.

Diagnosis

Medium-sized hemiasterid, of subangular outline, near-equal in length and width, maximum test width just posterior of apical disc, with very shallow frontal notch and sloping posterior face, interambulacrum 5 lacking median keel; apical disc subcentral, semi-ethmophract with four gonopores, genital plate 2 just separating posterior genital plates; ambulacrum III narrow and slightly sunken, shallowing towards ambitus; paired ambulacra relatively long, petaloid, moderately sunken and weakly bowed; anterior and posterior petals near equal in length; pore pairs elongate and slit like; peristome small, pentagonal and facing downwards, peristomial area deeply sunken with interambulacra 2 and 3 forming conspicuous bulges; sternal plates asymmetrical, median suture oblique; periproct ovate, situated near top of sloping posterior face; incomplete peripetalous fasciole (parafasciole), indented behind anterior petals; aboral tuberculation of widely spaced small tubercles surrounded by miliaries.

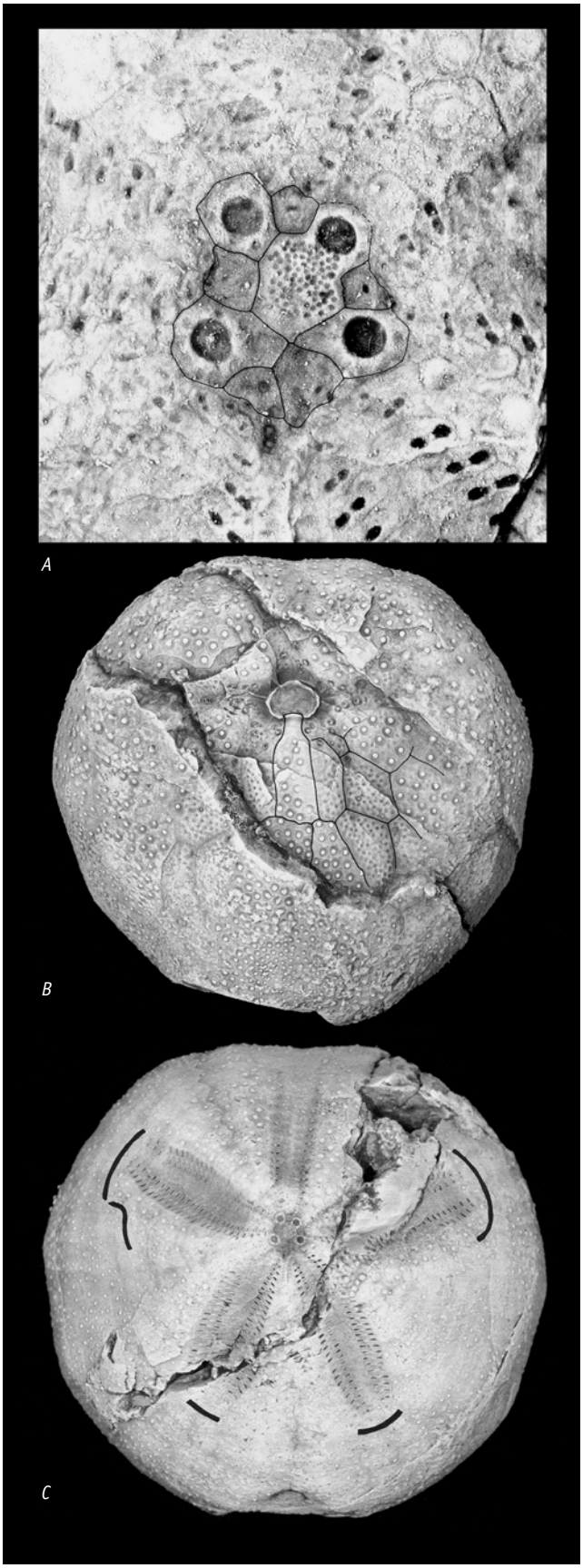

Fig. 7. Palhemiaster natalyae *n. sp., NHMM 2012 077, structure of apical disc (A), details of sternal-labral plating and course of peripetalous fasciole (parafasciole; C) inked in on photographs (see Fig. 6F, E and A, respectively).*

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Description

Test of medium size, length ca 44 mm, width 43.7 mm, height 30.8 mm (i.e., width/length ratio 99 per cent; height/length ratio 72 per cent), subcircular to subangular in outline; frontal notch inconspicuous; widest point just posterior of apical disc; test profile slightly wedge shaped with tallest point just posterior of apical disc, interambulacrum 5 lacking median keel, gradually sloping towards posterior; posterior face sloping steeply, but not vertical.

Apical disc compact, anterior of centre, ca 41 per cent away from anterior test margin; slightly depressed; semi-ethmophract with four rimmed gonopores (0.6 mm), genital plate 2 being the largest, with numerous madreporite pores; genital plate 2 just extending posteriorly between genital plates 1 and 4; genital plates 3 and 4 separated by ocular IV; five ocular pores smaller, elongate.

Frontal ambulacrum shorter than anterior and posterior petals, relatively narrow (9.4 per cent of test width); weakly but distinctly depressed adapically, shallowing distally and with relatively few pore pairs, widening only gradually towards ambitus. Pore pairs arranged obliquely in single straight rows on either side; small adapically, larger more distally, with small, yet prominent, interporal knob, adradial ones slightly larger; interporiferous zone wide (equalling up to four times width of pore pair) and with numerous secondary tubercles

Paired ambulacra petaloid adapically and moderately sunken; anterior petals 16.3 mm in length, weakly bowed and diverging at ca 125 degrees; elongate isopores, both rows tapering towards peripetalous fasciole; interporiferous zone narrower (near equalling width of pore pair) and with only military tubercles; anterior petals wider (21 per cent) than frontal groove; about 28 pore pairs per column; perradial pore slightly shorter, slit like; interporal partition low, wide, transversely elongate. Posterior petals closely similar, both in length (15.3 mm, i.e., 94 per cent of length of anterior petals) and pore structure; weakly bowed and diverging at ca 60 degrees; about 26 per column.

Interambulacra slightly inflated close to apical disc, but no median keel on interambulacrum 5; primary tubercles crenulate and perforate, small and comparatively widely spaced on upper test surface; surrounding by miliaries, but not forming dense groundmass. Primary tubercles distinctly larger and more closely spaced ambitally in all interambulacra and with distinct areoles.

Peripetalous fasciole diffuse and difficult to follow; this is, at least in part, preservation induced, of parafasciole type, with scattered tubercles amongst miliaries (compare Néraudeau et al., 1998); slight embayment between anterior and posterior petals.

Periproct high on steeply sloping posterior face; ovate in outline (length and width 4.2 and 3.1 mm, respectively).

Tubercles on oral test surface larger and more closely spaced; largest ones near anterior margin and anterior part of plastron; labral plate is long (9.5 mm; basal width 3.6 mm) and bottle shaped, projecting slightly over peristome, with near-straight distal margin and >10 large primary tubercles, extending posteriorly to start of third ambulacral plate. Sternal plates large and subequal; median suture slightly oblique, sternal plate 5.b.2 only just reaching labral plate. Ambulacra I and V forming broad periplastronal areas densely covered with small secondary and miliary tubercles.

Peristome opening ca 25 percent of test length from anterior margin; rather small (width and length 4.7 and 3.4 mm, respectively), D-shaped, surrounded by distinct rim, raised posteriorly (i.e., peristome facing obliquely forwards); area around peristome deeply sunken with interambulacra 2 and 3 forming conspicuous bulges.

Discussion

Using the key to hemiasterid genera (Smith & Kroh, 2013), the present form would appear to be closely related to *Jordaniaster* Neumann, 1999, *Palhemiaster* and *Hemiaster* L. Agassiz *in* Agassiz & Desor, 1847, while *Mecaster* Pomel, 1883 is further removed. Members of the last-named genus (range: Cenomanian to Maastrichtian) have ovate tests with distinct frontal notch, a truncate posterior face and the apical disc is ethmolytic with four gonopores, width exceeding length and with anterior and posterior gonopores on either side (see Smith & Bengtson, 1991; Smith, 1995; Smith & Jeffery, 2000; Smith & Wright, 2008). Ambulacrum III is sunken and posterior petals generally are about half to two-thirds the length of the anterior ones, while sternal plates are large and (near-) symmetrical and enlarged subanal pore pairs are present. In addition, the indented peripetalous fasciole is much better developed than in the present form.

Hemiaster has an ovate test, occasionally with a weak frontal notch and a truncate posterior face; in profile, often inflated and wedge shaped; the apical disc is ethmophract with four gonopores, and central in position. Anterior petals are around twice the length of the posterior ones, while they are subequal in the present form. The peripetalous fasciole is complete and not indented behind the anterior petals, while the aboral tuberculation is fine and dense.

In the early Cenomanian *Jordaniaster*, the test outline is much more ovate with a truncated posterior face; the frontal notch is shallow, yet distinct. The apical disc is ethmophract with four gonopores and genital plate 2 separating the posterior genital plates, but not the posterior ocular plates, as in the present form. Similar as well is the fact that the anterior and posterior petals are of comparable length, but in *Jordaniaster* the anterior ones almost reach the ambitus; in addition, the labral plate appears to extend further posteriorly, to the fourth ambulacral plate. In both genera, sternal plates are asymmetrical, with 5.b.2 larger and in broad contact with labral plate, and 5.a.2 smaller and just abutting this, and both have an indented parafasciole with occasional tubercles included.

Members of the genus *Palhemiaster*, which ranges from the upper Lower to lower Upper Cretaceous (Aptian-lower

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Cenomanian) also have rather angular test outlines, but do possess shallow, yet distinct frontal notches and the posterior faces are truncate. Apical discs are ethmophract with four gonopores, genital plate 2 separating the posterior genital plates, but not the posterior ocular plates. Ambulacrum III is wide and sunken, extending from the apical system to the peristome, while paired ambulacra are large and petaloid with petals moderately sunken and weakly bowed, nearly extending to the ambitus. The peristome is small and pentagonal and faces downwards; in the present species it is D-shaped. The sternal plates are unequal and the median suture is oblique. Members of the genus have an incomplete peripetalous fasciole which is only developed around the posterior half of the test; the reverse is seen in the present species, but this may be a matter of preservation.

In having a subangular test outline, near-equal in length and width; a very shallow frontal notch; a subcentral apical disc, semi-ethmophract with four gonopores, genital plate 2 just separating posterior genital plates; a pentagonal D-shaped peristome, facing downwards; and an incomplete peripetalous fasciole (parafasciole), indented behind the anterior petals, the new species differs from all species of *Palhemiaster* currently known (see Smith & Kroh, 2013). In addition, it is the youngest on record and the first from the Pacific rim of Far East Russia. The type species, *Palhemiaster peroni* Lambert, 1916 is from the Aptian-Albian of Algeria (North Africa), *P. ibericus* Jeannet, 1936 from coeval (Aptian) strata of the Balearic Islands (Spain) and *P. calvini* (W.B. Clark, 1915) from the Albian of Texas (United States).

Despite the generally poor preservation of Late Cretaceous hemiasterids from Far East Russia and northern Japan, none of these can be confused with the present form. The anterior and posterior petals of near-equal length, the diffuse peripetalous fasciole and semi-ethmophract apical disc suffice to differentiate it from others, including hemiasterids recorded from the Upper Cretaceous of Hokkaido by Tanaka (1984). Judging from gonopore size (Figs 6F, 7), NHMM 2012 077 would appear to be a female (compare Néraudeau, 1993).

Conclusions

In view of the fact that echinoids are rare in the mid- and Upper Cretaceous of Sakhalin and that, when present, they generally are poorly preserved, the small lot described here is of a certain interest, in documenting epifaunal generalists (cidaroids) and selective (infaunal) deposit feeders such as neognathostomates and spatangoids (compare Smith *in* Smith et al., 1988; Smith, 1995) as well as taxa that would all appear to have close links with Europe, inclusive of European Russia, Ukraine and extending into Kazakhstan. The listings of Cretaceous echinoids from Sakhalin (Fig. 8) that we have at our disposal suggest that there is unpublished material in various Russian institutions (e.g., VNIGRI, VSEGEI, both Sankt-Peterburg) awaiting proper assessment and scientific description. Unfortunately, we have not been unable to trace this material so far. *Echinocorys* and *Micraster* (entries 1-3, 19 and 20 in Fig. 8) might well be referable to those essentially European genera, although the former is also known from North America, northern Africa, Madagascar, central Asia and Western Australia (compare McNamara, 1987), while some subgenera of the latter have also been recorded from Madagascar, southern India, northern and South Africa, Crimea (Ukraine) and the Caucasus (Smith & Jeffery, 2000). Additional fieldwork in Sakhalin and screening of existing collections are called for in order to assess mid- and Late Cretaceous echinoid faunas in more detail; the present note amply demonstrates the paleobiogeographically potentially interesting character of such assemblages.

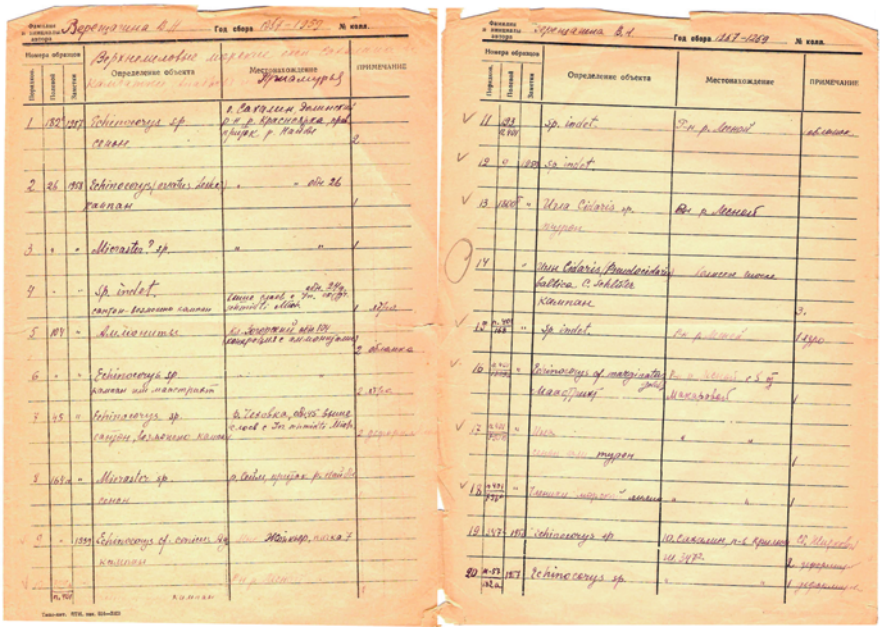

Fig. 8. Scanned pages of listings of the V.N. Vereschagin Collection (VSEGEI, Sankt-Peterburg) with lists of echinoids, identified (at least in part) by the late Olympia I. Schmidt.

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