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Second Specimen of a Rare Deep-sea Chiton, *Deshayesiella sinica* (Xu, 1990) (Polyplacophora, Lepidopleurida, Protochitonidae) from Northern Japan

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Abstract The deep-sea chiton, *Deshayesiella sinica* (Xu, 1990), was previously known only from the holotype, collected from the Okinawa Trough, East China Sea, at the depth of 1680–1950 m. A second specimen has now been collected from off Erimo-misaki, Hokkaido at a depth of 1997–2043 m, which extends the distribution range ca. 2500 km northward. Results of morphological examination support Sirenko's generic reassignment from *Hanleya* to *Deshayesiella*. Description and illustrations of the second specimen are provided.
Key words: Chiton, *Deshayesiella*, deep-sea, morphology, distribution, Japan.

Introduction

The deep-sea chiton, *Deshayesiella sinica* (Xu, 1990) was originally described as *Hanleya sinica* based on the holotype specimen collected from the Okinawa Trough, East China Sea at the depth of 1680–1950 m. Since then, no additional specimens have been reported. Sirenko (1997) assigned the present species to the genus *Deshayesiella*, however, this placement was based on the original description and no specimen was directly examined (Sirenko, personal communication).

In 2007, a single specimen of the present species was collected from off Erimo-misaki, Hokkaido at the depth of 1997–2043 m by R/V Tansei Maru of the Japan Agency for Marine-Earth Science and Technology. This paper describes and illustrates the morphology of this specimen in detail, and discusses the generic position of this species.

Materials and Methods

Methods for examination by a scanning electron microscope (SEM) follow Saito (1997). The specimen is deposited in the molluscan collection of the Department of Zoolgy, National Museum of Nature and Science.

Taxonomic account

Order Lepidopleurida Thiele, 1909

Family Protochitonidae Ashby, 1925

Deshayesiella sinica (Xu, 1990)

(Figs. 1, 2)

Material examined. NSMT-Mo 77482, 1 specimen, 16 mm in body length (curled: estimated extended length is ca. 20 mm), 10 mm in body width, Off Erimo-misaki, Hokkaido, R/V Tansei Maru KT-07-29 cruise, station E-3, 41°39.1′N, 144°07.5′E to 41°37.2′N, 144°07.6′E, 1997–2043 m, 7 November 2007; Holotype of *Hanleya sinica*, Institute of Oceanology, Academia Sinica, Qingdao, V567B-3, ca. 25 mm in body length, 16 mm in body width, Okinawa Trough, East China Sea, 26°40′N, 126°30′E, 1680–1950 m, 8 June 1978.

Description. Body (Fig. 1A) medium in size,

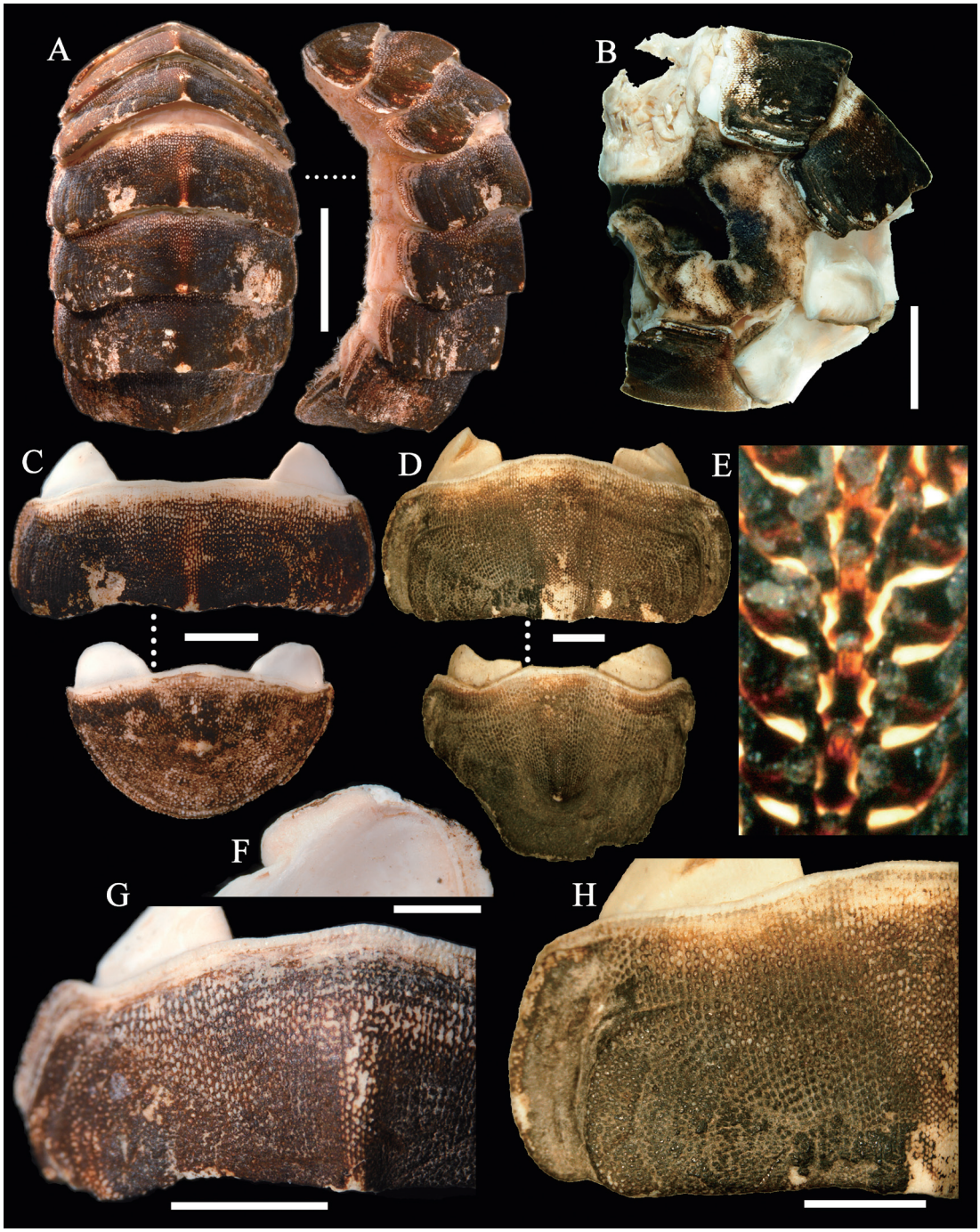

Fig. 1. *Deshayesiella sinica*. — A, C, F, G: NSMT-Mo 77482; B, D, E, H: holotype. A, B, whole animal; C, D, median and tail valves; E, central part of radula; F, lateral part of sutural lamina, ventral view, anterior to left; G, H, sculpture of the median valve. Scales, 5 mm, for A and B; 2 mm for C, D, G, H; 1 mm for F.

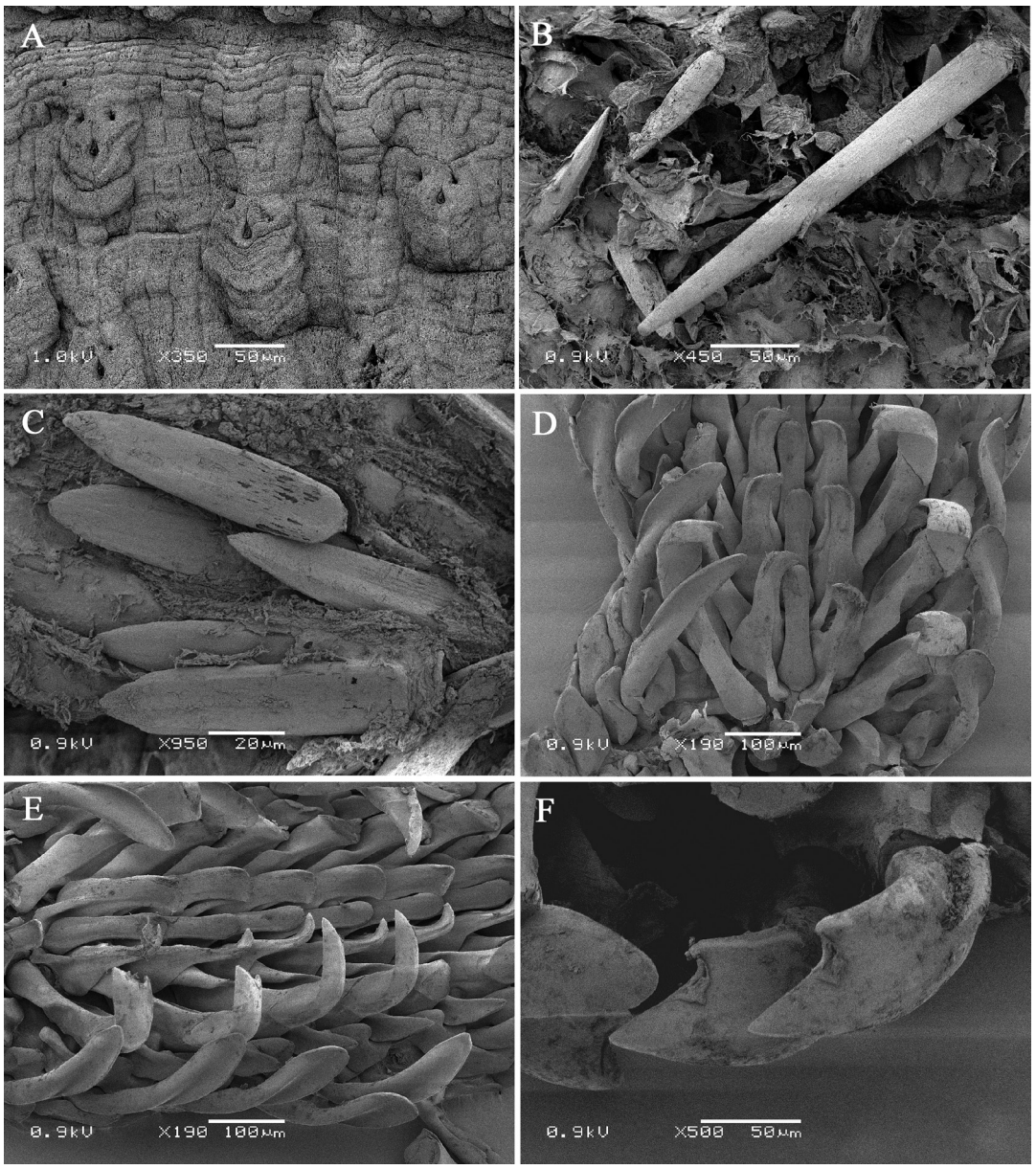

Fig. 2. *Deshayesiella sinica*, NSMT-Mo 77482, SEM images. — A, pleural area of median valve, showing aesthete pores on granule; B, spicules of perinotum; C, spicules of hyponotum; D, E, radula, anterior most row is 17th from anterior end of radula rows; F, major lateral teeth. Scales, 100 μm for D, E; 50 μm for A, B, F; 20 μm for C.

elongate oval in outline. Valves (Fig. 1C) thick, moderately elevated, carinated. Girdle narrow, scarcely encroaching at valve sutures.

Head valve crescent in outline, rounded at postero-lateral corners. Median valves wide, widest at 4th valve, carinated. Anterior margin of jugal area slightly projected in 2nd and tail valves, almost straight or slightly concave in rest of valves. Tail valve more than semicircular, narrower than head valve; mucro slightly raised, located posterior to the center; posterior slope slightly concave.

Tegmentum granulo-costate (Fig. 1C, G). Head valve, lateral areas of median valves, and posterior area of tail valve sculptured with densely packed, randomly arranged round granules, marked with concentric growth lines near margins. Pleural areas of median and tail valves sculptured with longitudinal, slightly diverging rows of elongate granules that are often fused into riblets, ca. 50 rows on each side. Jugal area with finer rows of elongate granules, but not well separated from pleural areas. Tegmentum on diagonal lines shallowly concave.

Aesthete pores (Fig. 2A) in clusters of three, located at center of each granule. Each group of pores consists of one drop-shaped pore that is largest, ca. $10 \times 6\,\mu$m, and two slightly smaller pores anterior to the larger one.

Articulamentum of head valve thickened, weakly projecting around anterior margin of transverse muscle scars. Median valves and tail valve with widely V-shaped callus. Eaves solid, nearly smooth, scattered with minute pores under the tegmentum. Tegmentum narrowly folded under on posterior margin. Sutural laminae (Fig. 1C) small, round to triangular, with slight extension at postero-lateral portion ("primordium" of insertion plate: Fig. 1F) widely separated from each other.

Girdle narrow, spiculose. Perinotum (Fig. 2B) covered with small, lanceolate, flat, smooth spicules, $80\,\mu\text{m} \times 20\,\mu$m, intermingled with long, straight, smooth needles, up to $300\,\mu\text{m} \times 30\,\mu$m. Girdle margin fringed with long needles similar to those on perinotum. Spicules on hyponotum (Fig. 2C) flat, obtusely pointed, occasionally with one broad keel, $120\,\mu\text{m} \times 25\,\mu$m.

Gills merobranchial, adanal, without interspace, 12 on left, 11 on right.

Radula (Fig. 2D–F) long, 8.5 mm in length with 51 transverse rows of mineralized teeth, at least 16 rows of immature teeth. Central tooth narrow, weakly bending at top, slightly expanded laterally near base. Centro-lateral (first lateral) teeth taller than central tooth, with wide cutting edge. Major lateral (second lateral) teeth with bicuspid head, of which the larger outer cusp is wide and pointed, and the inner cusp is very small and obtusely pointed. Inner small lateral (third lateral) teeth tall, reaching at base of major lateral's head. Major uncinus (fifth lateral) teeth rounded at top with rather wide blade. Bolster (radula cartilage) length 2.7 mm.

Remarks. Most of the morphological features of the present specimen agree well with those of the holotype (Fig. 1B, D, E, H), although there are some differences in the outline of the valves and the size of girdle spicules. These discrepancies are likely attributable to the difference of growth stage. The present specimen, ca. 20×10 mm, appears to differ merely in allometry from the larger, ca. 25×16 mm, holotype specimen. The outline of the valves in the present specimen is similar to that represented by the growthline at younger stage in the holotype. Other than the morphological differences between the two specimens, their distant localities make the identification difficult. The locality of the present specimen is ca. 2500 km northward from the type locality. The shallow water zones of these two remote areas belong to different zoogeographical provinces, namely "temperate" for the present locality and "subtropical" for the type locality by Ekman (1953), likewise "cold temperate" and "tropical" by Briggs (1974). Even in bathyal zone, the molluscan fauna of those areas are quite different from each other, but at least one buccinid gastropod, *Bathyancistrolepis trochoides* (Dall, 1907) is known from both areas, at the depth from 550–2200 m (Hasegawa, 2007). The present species appears to have a distribution pattern similar to this gastropod species. Examination of more specimens from various areas is needed to confirm the identification.

Sirenko (1997) reviewed the development of articulamentum and assigned the present species to *Deshayesiella*. Saito (2008) remarked that Sirenko's assignment may need to be reconsidered because the present species has rather vaguely regionalized tegmentum with finer sculpture, and thus is more like members of *Leptochiton* in this respect. Results of examination of the present specimen together with the

holotype mostly support Sirenko's reassignment to *Deshayesiella*. The valve features, such as the wide rectangular outline with less encroaching sutures and the scarcely demarcated jugal area, are similar to those of *Leptochiton*, but the possession of the "primordium" of the insertion plate that appears as a slight posterior extension of the sutural lamina (Fig. 1F), the morphology and composition of the girdle spicules and the radula morphology, all place this species in *Deshayesiella*.

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