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TWO NEW SPECIES OF BRITTLE-STARS (OPHIUROIDEA, PROTASTERIDAE) FROM THE UPPER ORDOVICIAN OF BOHEMIA

INTRODUCTION

Brittle-stars from the Bohdalec Formation (Upper Berounian, corresponding with Early Ashgillian) are the youngest known in the Bohemian Ordovician. At Velká Chuchle near Praha, a number of well-preserved ophiuroid specimens were discovered by the famous collector, Mr. Josef Putzker, in greenish-grey claystones representing the clayey shale facies (HAVLÍČEK, 1982, p. 125). All the original brittle-star bodies are dissoluted, and into the voids iron oxides have been precipitated. The first, and as yet the best one of all specimens donated to National Museum, Praha was incorrectly assigned by PRANTL (1948) to *Bohemura jahni.* In the present article, the latter specimen is stated as the holotype of *Taeniaster bohemicus* n. sp. *Bohemura jahni* does not occur in the Bohdalec Formation.

Further specimens of *Taeniaster bohemicus* n. sp. are deposited in collections of the Palaentological Department of the National Museum, Praha (below abbrev. as NM) and in the collections of the Geological Survey, Praha (below abbrev. as GS): coll. Chlupáč (NM), coll. Havlata (GS), coll. Putzker (NM), coll. Šimák (NM), and coll. Mikuláš (NM). Specimens of the first three collections come from claystone facies, Velká Chuchle near Praha. Rare and very poorly preserved specimens from the two latter collections have been derived from metro-excavations at Chodovská Street (Praha 4-Spořilov) where the clayey shale grades laterally into silty or sandy sediments of the so-called „*Polyteichus*" facies.

A unique slab of dark-grey micaceous silty shale, with carbonate cement and rich faunal remains, was discovered by dr. V. Havlíček in the metro-excavations at Chodovská Street (Praha 4-Spořilov) in 1970. The slab represents about the middle part of the Bohdalec Formation, particularly the „*Onniella michlensis* Community" confined to the „*Polyteichus*" facies (see HAVLÍČEK, 1982, p. 124). It

contains fragments of crinoid stems (axial canals were filled with sediment prior to dissolution of the columnals, producing steinkerns), fragments of nautiloids, and slightly pyritizated voids after bodies of protasterid brittle-stars, here named *Klarasterina klara* n. gen., n. sp. The new genus is partly related to *Taeniaster* Billings, 1858, *Drepanaster* Whidborne, 1898 and *Eugasterella* Schuchert, 1914, but it differs from them by some important particular characteristics.

The present article would never have been possible without patient work of all the collectors mentioned above. I am much indebted to dr. V. Havlíček, CSc. (Praha) for his very valuable comments on the stratigraphical position of the ophiuroids, and to dr. M. Mergl (Plzeň) for bringing to my attention all the specimens deposited in the Geological Survey, Praha. I am also much indebted to dr. W. Hammann (Universität Würzburg) for sending latex casts of the types of *Taeniaster ibericus* Hammann et Schmincke, 1986 in Praha. Finally, I would like to express my special thanks to dr. R. J. Prokop, CSc. (National Museum, Praha) for loan of the material and literature, and for all his very kind help.

DESCRIPTIVE PART

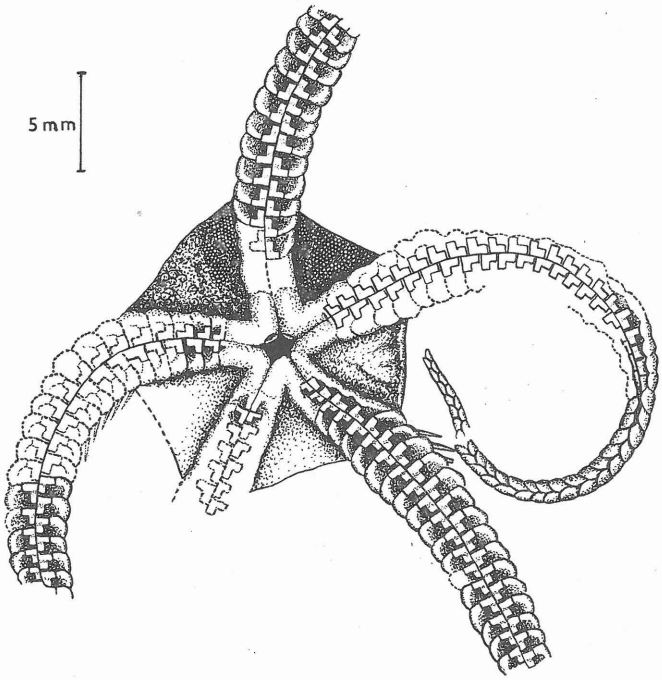
subclass *Ophiuroidea* GRAY, 1840
order *Oegophiurida* MATSUMOTO, 1915
suborder *Lysophiurina* GREGORY, 1896
family *Protasteridae* S. A. MILLER, 1889
(modified diagnosis of the family in PETR, 1989)

Taeniaster Billings, 1858

Type species: *T. spinosus* (Billings, 1857), Middle and Upper Ordovician of North America.
Diagnosis (after HOTCHKISS, 1970, HAMMANN et SCHMINCKE, 1986, modified herein):

Interradial outline of the disc straight or concave, but may be convex. Oral and aboral faces of the disc with small scales of uncertain outline, covered with granulated integument. Oral face may be covered with spines. Probably no true marginalia present. The disc margins but often thickened, especially it is visible on the aboral faces, possibly due to folding of the skin after death („pseudomarginalia" of the text-fig. 2b herein). Mouth angle plates short, their oral side may be covered with large papillae. Ambulacrals with typical boot-shaped ridge. The most important diagnostic feature of the genus is visible on oral sides of arms — the median suture between the alternate ambulacrals is straight. It is unique among protasterid ophiuroids, in which the median suture is typically characterized by sinuous appearance between the neighbouring boot-shaped ridges. Excavations for the dorsal longitudinal muscles are not very broad, the aboral outline of ambulacrals is trapezoidal to quadrate. Laterals ear-shaped, with both vertical and groove spines. The latter are but not preserved in *T. bohemicus* n. sp.
Discussion: There is no characterizations of arm tips in the diagnosis outlined above, because the arm tips in *Protasteridae* are typically whip-like, long, with ambulacrum completely closed off with laterals. This feature is very clear, e. g.. in the Bohemian Middle Ordovician species *Bohemura jahni* Jaekel, 1903 as well as in the

Upper Ordovician *Taeniaster bohemicus* n. sp. described below. The statement of HAMMANN et SCHMINCKE (1986) that „the area where the open ambulacral groove grades into the closed part does not vary within one species" seems to be exaggerated. For example, KESLING et LE VASSEUR (1971) presented their extremely rich material of *Strataster ohionensis* on many excellent photographs showing relatively high variability of this feature, to the extent of six ambulacrals even in different rays of one specimen. I have observed similar variability (to the extent of five ambulacrals) in the much more scarce material of *Bohemura jahni,* and even in the latex casts of the types of *Taeniaster ibericus* Hammann et Schmincke, 1986. Some rays of the latter species bear the ambulacral groove open between the two rows of erected laterals throughout the whole preserved portion of the arm. It is well-observable in the specimen n. 5 (HAMMANN et SCHMINCKE, 1986, fig. 7a — the arm in the lower right corner, but poorly visible on the photograph). Very probably, these observations suggest that the degree of closure of the ambulacrum in the distal part of the arm is dependent on mortal contraction and preserved in rigor mortis (suspected also by KESLING et LE VASSEUR, 1971, p. 318). However, HAMMANN et SCHMINCKE (1986, p. 57-58) believe that the closed ambulacrum in the arm tip „is neither a matter of preservation nor does it seem to be controlled by an active closure of the laterals", and they argue for presence of the long whip-like tips with permanently closed ambulacrum in living protasterids. In my opinion, the mode of preservation and



Text-fig. 1: *Taeniaster bohemicus* n. sp.
Sketch of the oral face of the holotype (NM L 25 877) drawn from the photograph on Pl. I, fig. 1.

also functional morphology of these extinct brittle-stars conflict with their theory. The „rigor mortis" theory seems to be also supported by the type of articulation between ambulacrals and laterals. The socket in the „toe" of the boot-shaped ridge of the ambulacral ossicle serving for accommodation to the so-called adambulacral nose of the lateral enabled active movement of the laterals not only in protasterids (see e. g. PETR, 1989, demonstrated on *Bohemura jahni*) but also in many other oegophiurids (see SPENCER, 1925, p. 256-257).

According to HAMMANN et SCHMINCKE (1986) the genus „*Taeniaster* is distinguished from other protasterid genera by its evenly tapering arms lacking a long whip-like tip". This is not accepted here for two reasons. In the first place, for the reason mentioned above in the „rigor mortis" theory, and secondly for the possibility that in *Taeniaster ibericus* Hammann et Schmincke, 1986 the long whip-like tips with closed ambulacrum can be simply not preserved. *Taeniaster bohemicus* n. sp., evidently closely related to the latter species, has very long whip-like tips, even with the ambulacrum closed off about three ossicles distally than in the species from Spain. Naturally, skeletal parts of ophiuroids are held together by thick skin and connective tissue and unless a brittle-star is quickly buried upon death, the tissues commonly decompose and the skeleton disarticulates. Due to the decay of the soft parts, the arm ossicles are scattered away beginning within the arm tips. Preservation of arm tips is extremely rare. In the relatively rich material of *Taeniaster bohemicus,* n. sp. all specimens are preserved with the integument in situ, skin with numerous small papillae well-preserved on the oral side of the disc and larger papillae on the jaws. However, only two specimens with remains of the long, whip-like arm tip are at disposal. None of these arms is preserved to its very tip. The largest remain is seen in the holotype (Pl. I, fig. 1; Pl. II, fig. 2; text-fig. 1).

Species and their stratigraphical and palaeogeographical distribution:

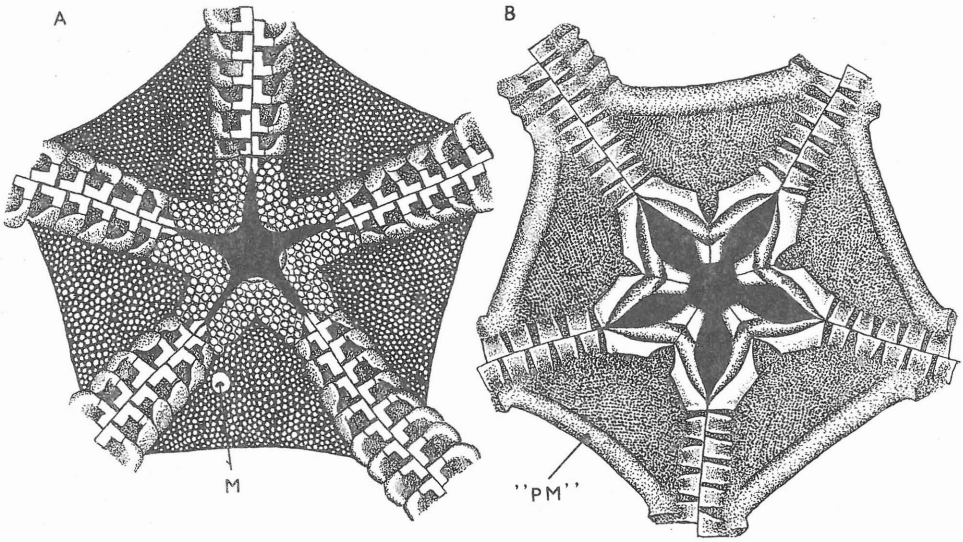
Taeniaster spinosus (Billings, 1857) — well-known from Trentonian of Quebec and New York; Edenian of Kentucky; Maysvillian of Ohio; and Richmondian of Ohio, Indiana and Ontario. (see HOTCHKISS, 1970).
Taeniaster ibericus Hammann et Schmincke, 1986 — the oldest so far known species of the genus *Taeniaster,* described from the Upper Llandeilian of Spain.
Taeniaster bohemicus n. sp. comes from the Upper Berounian of Bohemia (corresponding approximately with American Upper Edenian or Uppermost Trentonian and with British Early Ashgillian).

Taeniaster bohemicus n. sp.
(Pl. I, II — all figures; text-fig. 1, 2)

1948 *Bohemura jahni* Jaekel; PRANTL, p. 173, fig. on p. 173, non the reprint of the Jaekel's drawing of *Bohemura jahni* on p. 174).

Holotype: Specimen NM L 25 877 figured by PRANTL, 1948 on p. 173 and herein on Pl. I, fig. 1; Pl. II, fig. 2, and on the text-fig. 1.
Locus typicus: Velká Chuchle near Praha
Stratum typicum: Upper Berounian (corresp. with Early Ashgillian), claystone facies of the Bohdalec Formation.

Material: a number of well-preserved specimens in the collection of Putzker (NM), and several specimens come from other collections. The holotype — coll. Putzker (NM), paratype A — coll. Chlupáč (NM L 25 878, herein on Pl. II, fig. 1), and paratype B — coll. Havlata (GS YA 1381, herein on Pl. I, fig. 2).
Description: The disc is pentagonal, its margins straight or slightly concave. No marginal plates observed on the oral side but aboral aspect of the disc reveals distinct thickening of the margins caused possibly by folding of the skin at this place after death, forming „pseudomarginalia" (text-fig. 2b). In spite of the seemingly well-preserved nature of the brittle-stars, it is not possible to determine any detail on the surface of the integument covering the aboral sides of the disc and of the arms. The poor preservation of the aboral faces is interpreted here as having resulted from selective solution or weathering rather than from preburial abrasion because of preservation of iron oxides only in the oral faces of the fossils. The integument covering the oral side of the disc is well-observable, studded with dense, rounded, small, very numerous papillae (granules). No disc spines observed. Madreporite very problematically visible only in the holotype, near the first two right laterals (text-fig. 2a).



Text-fig. 2: *Taeniaster bohemicus* n. sp.
Reconstruction of the oral (A) and aboral (B) sides of the disc. M — presumed position of the madreporite, „PM" — „pseudomarginalia" formed possibly by folding skin at this place after death of the ophiuroid. Enlarged.

The arms are long, tapering evenly, of greatest width at the place of junction with the disc, and with very long whip-like arm tips. About five pairs of ambulacral ossicles are incorporated in the disc, and about 19 pairs of them are present in the free arm before the ambulacral groove becomes closed off with laterals. More than 21 pairs of ambulacrals are in the whip-like arm tip (21 pairs observed in the

incomplete whip-like tip of the holotype; see text-fig. 1). There are more than 45 pairs of them per arm on the whole.

Ambulacral plates of the left and right sides of the arm alternate, and the median suture (or median groove) of the ambulacrum is straight and narrow. Ambulacrals of the halves of the arm fit very closely together. Radial canal of the water vessel is enclosed within the opposite ambulacrals and as well as the inner sides of ambulacrals is not visible in any of the specimens. Oral face of each ambulacral is provided with a boot-shaped adaxial ridge which occupies slightly more than one half of the oral face of the ossicle. In some specimens, the leg of the boot is slightly longer than the sole, but typically the leg is precisely as long as the sole. The width of the leg is generally the same as that of the foot, forming about one half of the length of the ambulacral plate. The toe points bluntly, being as wide as the remaining part of the boot. At the level of the upper end of the foot there is more or less distinct, shallow groove crossing transversely the boot. This groove served probably for support of the external branch of the nerve and pseudohaemal canal. The podial basin is squarely outlined with the front of the leg and with the instep, and slightly extends onto the inner wall of the neighbouring lateral ossicle.

The aboral faces of ambulacrals are generally covered with thick integument, the surface of which is very poorly preserved as mentioned above. In some arm--portions of some specimens the insertions for the dorsal longitudinal muscles are observable, moderately broad, but in some places very broad and in many places very narrow. Therefore, the aboral outline of the ambulacrals is variably quadrate to trapezoidal. In my opinion, the character of the dorsal muscle depressions as the main diagnostic feature seems to be exaggerated, at least in the genus *Taeniaster*. The dorsal muscle depressions of *T. bohemicus* n. sp., as in other protasterids, are bordered by raised ridges.

Laterals (or adambulacrals) are about as wide as ambulacrals, ear-shaped, with short adambulacral nose. Oral ridges distinct, rounded, sometimes almost two times bent. Groove spines not observed. The oral ridges are generally slightly compressed in the proximal portion of the free arm, but distinctly erected, perpendicular to the ambulacral groove where incorporated in the disc and near the place where the laterals are gradually closed over the ambulacral groove. On the aboral side of the laterals, there is a distinct vertical ridge. Vertical spines are rarely preserved, being about as long as the length of the lateral plate, sharp and slender.

Only first ambulacrals and mouth-angle plates are preserved as components of the mouth frame. Oral side of the mouth frame is covered with papillae slightly larger than those from the oral face of the disc. (see text-fig. 2a). the mouth-angle plates are short, proximally provided with a socket for torus-attachment. Tori and teeth not preserved. Aboral side of the mouth frame invariably poorly preserved. Only the concentric grooves for the nerve and water rings are well-observable (see text-fig. 2b). Also the impressions for the musculus interradialis externus are relatively distinct.

Dimensions of the holotype (in mm.):

interradial disc radius	6
radial disc radius	7
radial arm radius	more than 50
width of arm at the place of junction with the disc	3,5

Disscusion: The closest affinities of *Taeniaster bohemicus* n. sp. appear to lie with the much older, Llandeilian species *T. ibericus* from Spain. The differences are insignificant: slightly smaller size of *T. ibericus,* and shorter ambulacrals in *T. bohemicus.* The ambulacrals are elongated in radial direction in the species from Spain (the leg is much longer than the sole) in contrast with the Bohemian species in which the leg is generally as long as the sole. Other differences are problematical: there are dense papillae on the oral side of the jaws in *T. bohemicus* while no ones are preserved in *T. ibericus.* Surprisingly, the groove spines are preserved in the latter but absent in *T. bohemicus.* Of course, the absence of groove spines in the Bohemian species should remain open to question.

In all specimens of *T. bohemicus* from Velká Chuchle (claystone facies of the Bohdalec Formation) the position of the arms suggests oriented embedding, with movement around vertical axes causing azimuthal orientation (so-called „Einsteuerung" of von KOENIGSWALD, 1930, and particularly his „Schirmlage"). The holotype (Pl. I, fig. 1 and Pl. II, fig. 2; text-fig. 1) is preserved in this position but it is not very distinct because of incompleteness of the arms. The best example is the paratype A (Pl. II, fig. 1) with all arms clearly oriented in one direction. This suggests that the brittle-stars have been moved by more or less weak current action before becoming incorporated in the soft sediment, and this mode of preservation also insinuates that in contrast with the supposed burrowing life habit of *Bohemura jahni* Jaekel (see PETR, 1988; 1989) from shallower waters, the species *Taeniaster bohemicus* n. sp., a relatively deeper-water brittle-star, led an epifaunal mode of life. This suspection is also partly supported by the familiar negative response to light of extant ophiuroids (HYMAN, 1955, p. 657).

Occurrence: Velká Chuchle near Praha in claystone facies of the Bohdalec Formation, and Praha 4-Spořilov (metro excavations at Chodovská street) in silty to sandy sediments of the „*Polyteichus*" facies of the same formation.

Klarasterina n. gen.

Type species: *Klarasterina klara* n. gen., n. sp., Upper Ordovician of Bohemia.

Diagnosis: For diagnosis and discussion see the description of the only known species below.

Klarasterina klara n. sp.

Derivatio nominis: the name is derived from the Christian name of my mother — Klara.

Holotype: the specimen GS VH 5171a showing its aboral face, figured herein on Pl. III (the specimen lower middle), on Pl. IV, and on text-fig. 3a, b.

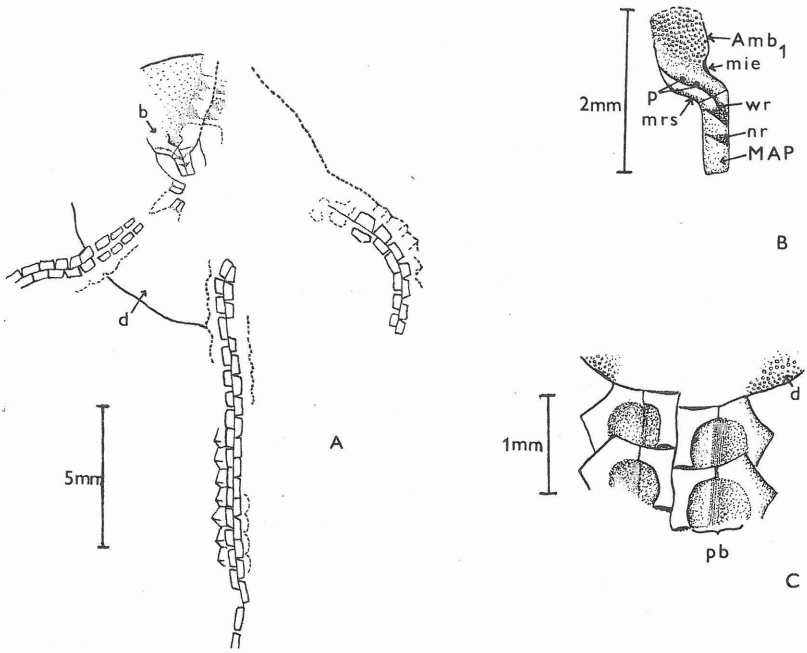
Locus typicus: metro-excavations at Chodovská Street (Praha 4-Spořilov).

Stratum typicum: Upper Berounian, middle part of the Bohdalec Formation, „*Polyteichus*" facies, so-called „*Onniella michlensis* Community" of HAVLÍČEK (1982, p. 124).

Material: Only one slab containing the holotype, paratype A — GS VH 5171b (specimen showing its oral face; herein on Pl. III upper right, and on text-fig. 3c), and several unfigured fragments of other specimens.

Description: Small protasterid ophiuroid with rounded disc. The convex margins of the disc without marginalia or „pseudomarginalia". Both oral and aboral

sides of the integument of the disc densely granulated by relatively large papillae. No disc spines observed. Madreporite not preserved. There seems to be a possibility (but it is very poorly visible on the material at the author's disposal) that on the aboral face of the disc some papillae are aggregated in small, possibly regularly arranged clusters (it is not figured herein because of absence of further supporting material).



Text-fig. 3: *Klarasterina klara* n. gen., n. sp.
A. Sketch of the aboral face of the holotype (GS VH 5171a) drawn from the photograph on Pl. III (specimen lower middle) and Pl. IV. d — disc, b — jaw figured on the text-fig. 3B.
B. dtto, detail of fused first ambulacral (Amb 1) and mouth-angle plate (MAP).
p — pores to canals leading to the podial basins of the first two tube feet.
mie — excavation for the insertion of musculus interradialis externus.
mrs — excavation for the insertion of musculus radialis superior.
wr — groove for water ring
nr — groove for nerve ring
C. Reconstruction of the oral side of the proximal part of free arm (after paratype A — GS VH 5171b) showing the boot-shaped ridges of the ambulacrals and the two times bent laterals.
d — disc, pb — podial basin
(see also Pl. III — specimen upper right).

Arms are incomplete, possibly very long, slender, tapering almost imperceptibly, being of greatest width near the place of junction with the disc. About 4 to 5 pairs of ambulacral plates are incorporated in the disc. Much more than 16 pairs of them are present in the free arm (16 pairs observed in the incomplete arm of the holotype).

Ambulacrals alternate, the median groove (or suture) between them is slightly sinuous (see text-fig. 3c). The ambulacral ossicles are elongated in radial direction and provided with a boot-shaped adaxial ridge on their oral side, bearing slender leg which is almost two times as long as the foot. Also in the aboral aspect the ambulacrals show distinct elongation, only with narrow depressions for the insertion of the dorsal longitudinal muscles (text-fig. 3a). Laterals are slightly wider than ambulacrals, ear-shaped, with oral ridges two-times bent. Also the vertical ridges are distinct. No groove or vertical spines preserved.

The preserved components of the mouth-frame are only first ambulacrals and mouth-angle plates (preserved only in the holotype, text-fig. 3b). Tori and teeth not preserved. The aboral sides of the mouth-angle plates are slender and long, three times as long as wide, with grooves for the nerve and water rings. The aboral side of the first ambulacral is provided with a distinct furrow for the water ring, with two pores to the canals to the first two podial basins. The suture between the first ambulacral and the mouth-angle plate is well-observable as well as the impression for musculus interradialis externus and musculus radialis superior.

Discussion: The new genus *Klarasterina* n. gen., represented by the only known species described herein, is partly related to *Taeniaster* Billings, 1858, *Drepanaster* Whidborne, 1898 and *Eugasterella* Schuchert, 1914. From *Taeniaster* it differs by slightly sinuous median suture between the alternate ambulacrals, and by very long mouth-angle plates. From *Drepanaster* it differs in having very narrow depressions for the insertion of the dorsal longitudinal muscles (there are extremely broad insertions in *Drepanaster* — see e. g., UBAGHS, 1942). Surprisingly, it is similar to *Eugasterella,* particularly to *Eugasterella thorni* Kesling, 1969 from the Middle Devonian of Ontario, but it is distinguished from the latter by the whole shape of laterals, and by slightly longer mouth-angle plates. However, there is an interesting similarity between the two species in the shape of the disc and of the ambulacrals.

Klarasterina klara n. gen., n. sp. led possibly an epifaunal mode of life scavenging on the remains of other dead animals of the „*Onniella michlensis* Community" (HAVLÍČEK, 1982, p. 124).

Dimensions of the holotype (in mm.):

Disc radius	5
radial arm radius	more than 17
width of arm at the place of junction with the disc	1,5 to 2

Occurrence: only the typa-locality and the type-stratum.

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VÁCLAV PETR

DVĚ NOVÉ HADICE (OPHIUROIDEA, PROTASTERIDAE) ZE SVRCHNÍHO ORDOVIKU ČECH

Z bohdaleckého souvrství (svrchní beroun) jsou známy dosud nejmladší hadice středočeského ordoviku. Byly objeveny na lokalitě Velká Chuchle u Prahy panem J. Putzkerem, a to v jílovcové facii zmíněného souvrství. Nejlepší exemplář daroval J. Putzker Národnímu muzeu v Praze a fotografie tohoto kusu byla otištěna v časopise „Chvilky v přírodě" (PRANTL, 1948). F. Prantl jej mylně zařadil do druhu *Bohemura jahni* Jaekel, 1903. Tento doposud stále nejlépe zachovaný exemplář je zde stanoven jako holotyp nového druhu, nazvaného *Taeniaster bohemicus,* n. sp., který je blízce příbuzný s druhem *T. ibericus* Hammann et Schmincke, 1986 ze svrchního llandeilu Španělska. Zbytek materiálu pana J. Putzkera přešel do vlastnictví Národního muzea až teprve ke konci roku 1987, po smrti tohoto významného sběratele. Z lokality Velká Chuchle pocházejí ještě dvě menší sbírky popisovaných hadic

(coll. Chlupáč a coll. Havlata). Špatně zachovaný materiál byl získán z písčitých sedimentů „polyteichové" facie bohdaleckého souvrství ve výkopech metra v Chodovské ulici (Praha 4-Spořilov) (coll. Šimák a coll. Mikuláš). Nový druh je zde podrobně popsán a vyobrazen a je diskutována charakteristika rodu *Taeniaster* Billings, 1858.

Druhá hadice z bohdaleckého souvrství popsaná v této práci představuje nový rod a nový druh — *Klarasterina klara,* n. gen., n. sp. Je známa podle několika exemplářů zachovaných na jediné břidlicové destičce opět z výkopů metra v Chodovské ulici (Praha 4-Spořilov). tuto destičku tmavě šedé, slídnaté břidlice s karbonátovým tmelem a slabě pyritizovanými zbytky hadic, nalezl r. 1970 dr. V. Havlíček. Pochází ze střední části bohdaleckého souvrství, „polyteichové" facie, společenstva „*Onniella michlensis*". Je částečně příbuzná rodům *Taeniaster* Billings, 1858, *Drepanaster* Whidborne, 1898 a *Eugasterella* Schuchert, 1914, ale liší se od nich některými důležitými znaky. Celkově nejvíce připomíná rod *Eugasterella,* ale má naprosto jiný tvar laterálních (adambulakrálních) desek. Od rodu *Taeniaster* ji odlišuje sinusovitá ventrální sutura mezi protilehlými ambulakrálními deskami a mnohem delší přístní rohové destičky. Od rodu *Drepanaster* se liší nesrovnatelně užšími zářezy pro úpon dorzálního podélného svalstva ramen.

EXPLANATIONS TO THE PLATES

Plate I.

Fig. 1. *Taeniaster bohemicus* n. sp., oral face of the holotype (NM L 25 877; see also text-fig. 1; for aboral face of the holotype see Pl. II, fig. 2), Bohdalec Formation, Velká Chuchle. x3

Fig. 2. *Taeniaster bohemicus* n. sp., oral face of the paratype B (GS YA 1381) with well-preserved papillae on the mouth frame, Bohdalec Formation, Velká Chuchle. x5.

Plate II.

Fig. 1. *Taeniaster bohemicus* n. sp., aboral face of the paratype A (NM L 25 878) clearly preserved in the so-called „Schirmlage", Bohdalec Formation, Velká Chuchle. x3.

Fig. 2. *Taeniaster bohemicus* n. sp., aboral face of the holotype (NM L 25 877; for oral face see also Pl. I, fig. 1 and text-fig. 1), Bohdalec Formation, Velká Chuchle. x3.

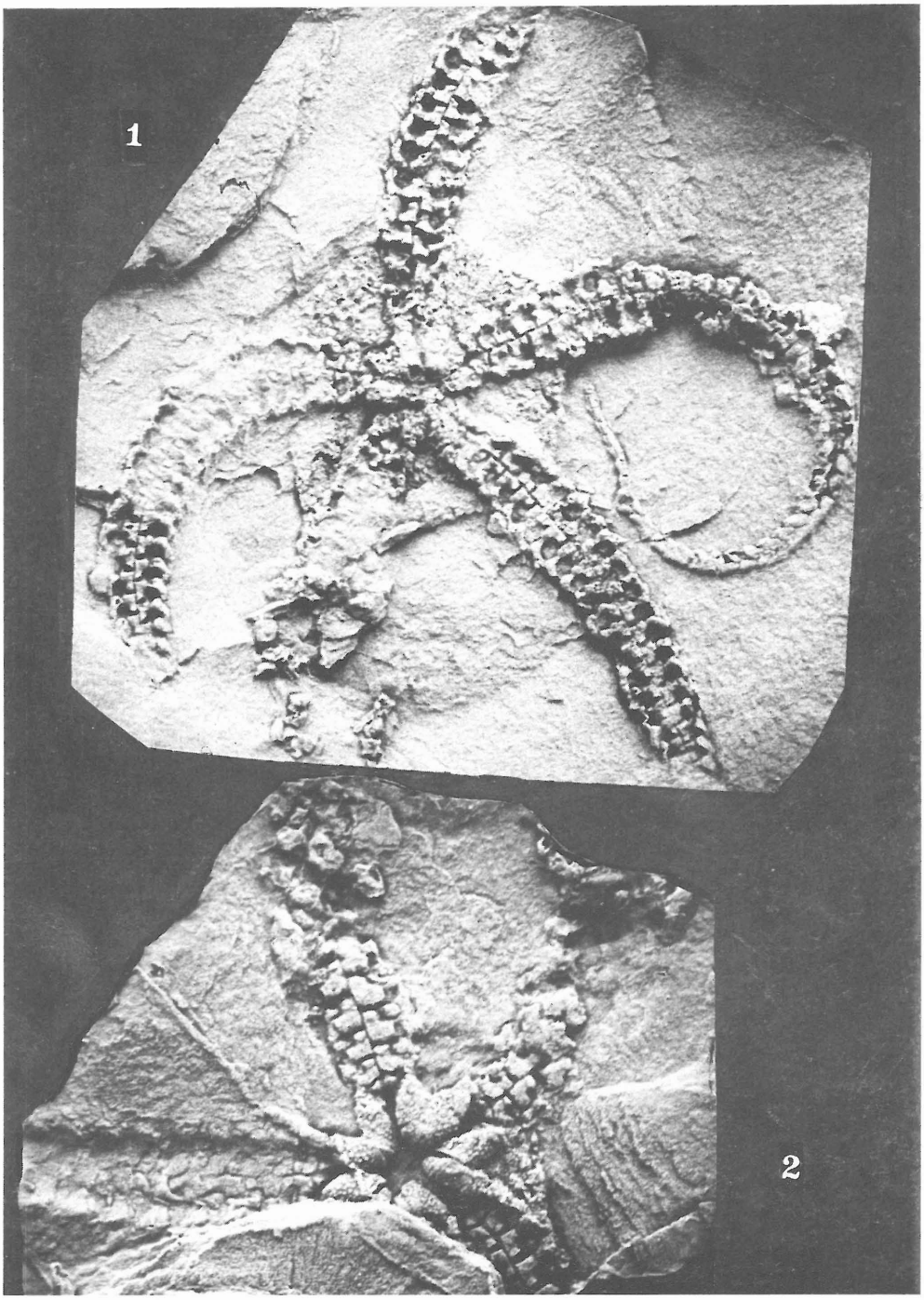
Plate III.

Klarasterina klara gen. et sp. n., part of the slab showing aboral face of the holotype (GS VH 5171a, specimen lower middle), and oral face of the paratype A (GS VH 5171b, specimen upper right), Bohdalec Formation, Praha 4-Spořilov. x3,2.

Plate IV.

Klarasterina klara gen. et sp. n., detail of the holotype (see also Pl. III, and text-fig. 3a, b), Bohdalec Formation, Praha 4-Spořilov. x4,5.

Photographs by the author, made from latex casts coated with ammonium chloride before photographing.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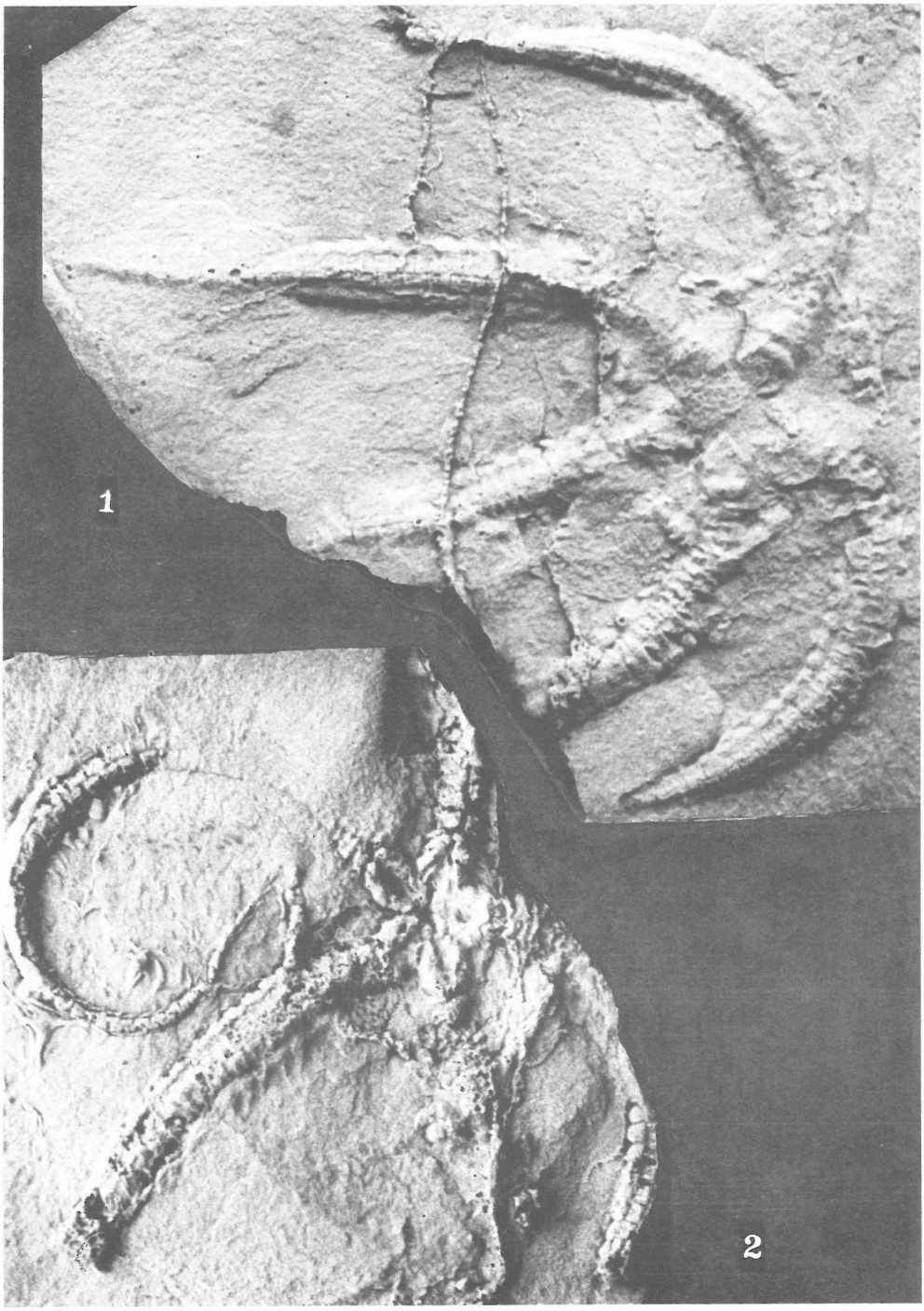
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