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Attachment scars of the brachiopod *Coenothyris vulgaris* (Schlotheim, 1820) from the Muschelkalk of Upper Silesia

ABSTRACT: Characteristic attachment scars of *Coenothyris vulgaris* (Schlotheim) occur in the Muschelkalk sequence of Upper Silesia. Their variability indicates that the pedicle could be differentiated terminally into well-defined "rootlets". The pedicle allowed the brachiopods to colonize an otherwise inhospitable, soft-bottom environment.

INTRODUCTION

The occurrence of groups of pits, forming not very extensive areas, was observed on the shells of the brachiopod *Coenothyris vulgaris* (Schlotheim) from the Muschelkalk in the vicinity of Opole Silesia. The character of these traces corresponds to the attachment scars of Cretaceous and Recent brachiopods, described recently (Bromley & Surlyk 1973) as the ichnogenus *Podichnus*.

The material investigated comes from the *Terebratula* Beds exposed in the upper part of a quarry at the town of Strzelce Opolskie. The age of this member is recognized (Zawidzka 1975) as the Middle Anisian (Pelsonian). The brachiopods collected have been assigned to the species *Coenothyris vulgaris* (Schlotheim), as determined by Assmann (1937, 1944) and Nowakowski (1972), and confirmed by the present writer's investigations. Since at Strzelce Opolskie only this brachiopod species occurs and it is represented by well-preserved specimens, all the traces from the exposure are regarded as attributable to it.

The collection under study consists of 122 well preserved attachment scars occurring on thirty five shells and comprising from one to fourteen attachment areas on particular specimens. The collection is housed at the Institute of Paleozoology, Polish Academy of Sciences, and provided with catalogue numbers *ZPAL, Bp. XXVI (1-35)*.

TAXONOMIC REMARKS

The ability of the brachiopod pedicle to etch the carbonate substrate has already been observed by Ekmann (1896, *vide* Bromley & Surlyk 1973), afterwards illustrated by Chun (1900), Muir-Wood (1959), Surlyk (1972) and recently described in detail by Bromley & Surlyk (1973). A considerable ability of the pedicle to split into "rootlets", sometimes fairly long, has also been recorded (Chun 1900, Muir-Wood 1959, Rudwick 1961, Surlyk 1972, Bromley & Surlyk 1973). Several types of pedicles of articulate brachiopods may be distinguished in regard to their length and degree of splitting (Bromley & Surlyk 1973). A characteristic, slightly etched trace, consisting of a group of pits or holes, each of which is an attachment scar of a single "rootlet", corresponds to a particular type of pedicle attached to a hard, calcareous substrate.

The comparison of the material collected with that illustrated by Bromley & Surlyk (1973) leads to the conclusion that the taxonomic division of the attachment scars of brachiopods should be based on a few characteristic features, which perhaps may be sufficient for a possible recognition of traces corresponding to at least some of the brachiopod species. There are many features typical of a brachiopod species and exerting their influence on the form of an attachment scar, such as the size of the shell and of the pedicle, the ratio of a number of the etching "rootlets" to the area of the attachment, the range of changes in the size of single processes and their ability to penetrate the substrate.

The traces described have been assigned to the ichnogenus *Podichnus* Bromley & Surlyk, 1973. Due to a certain degree of a separate character of the features of the pits under study and their unequivocal relationship with the body-fossil species *Coenothyris vulgaris* (Schlotheim), a new specific name has been erected for them: *Podichnus silesiacus* ichnosp. n.

SYSTEMATIC DESCRIPTION

Podichinus silesiacus ichnosp. n.

Holotype: the specimen presented in Pl. 1, Fig. 5.

Diagnosis. — Diameter variable, reaching a maximum of 1.8 mm. Dimensions of particular pits varying from 0.03 mm in the center to 0.1—0.18 mm on the margin. Ratio of the number of pits composing a scar to its diameter is approximately constant (Fig. 2).

Occurrence. — The surface of shells of *Coenothyris vulgaris* (Schlotheim) from the *Terebratula* Beds, Strzelce Opolskie, Middle Anisian (Pelsonian). The specific name comes from the region of occurrence, that is, Silesia.

Description. — Attachment etchings composed of a series of pits, arranged usually in compact and symmetrically formed groups (Fig. 1). Single pits are cylindrical, their size and depth gradually increasing from the center towards the margins of a group (Pl. 1, Fig. 5). The largest, peripherial pits frequently display

an eccentric, oblique shape their outline becoming elongate and oval (Pl. 1, Fig. 4). Particular pits may range in diameter from 0.03 mm in the center of scar to a maximum of 0.18 mm in the marginal zone. The most frequent diameter is about 0.10 mm. The depth of the deepest pits does not exceed 0.2 mm. The thickness of the shell of *Coenothyris vulgaris* varies between 0.2 and 0.4 mm, so that no pits piercing the valve have been observed.

The number of pits forming an attachment area is directly proportional to its diameter, and their spacing decreases with an increase in the area of attachment

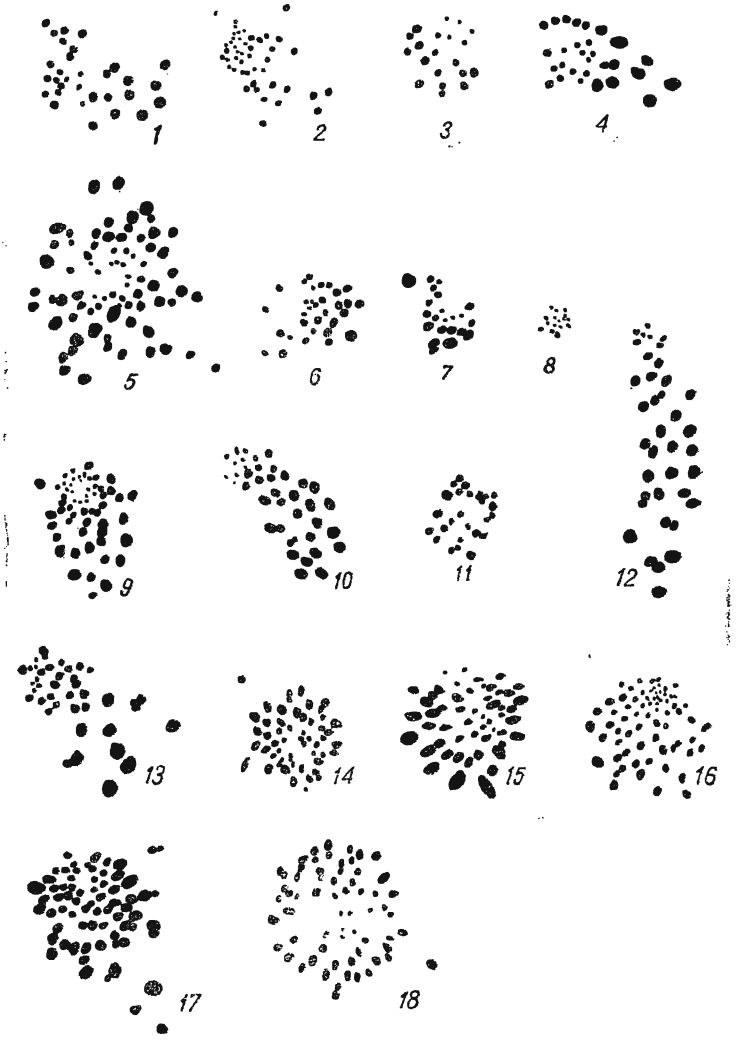

Fig. 1. Variability of *Podichnus silesiacus* ichnosp. n.; × 15

Some specimens correspond to those presented in Pls 1-2, as follows: *5* is photographed in Pl. 2, Fig. 7; *9* in Pl. 1, Fig. 5; *12* in Pl. 2, Fig. 8; *14* in Pl. 2, Fig. 1; *15* in Pl. 1, Fig. 4; *16* in Pl. 2, Fig. 3; *17* in Pl. 1, Fig. 6

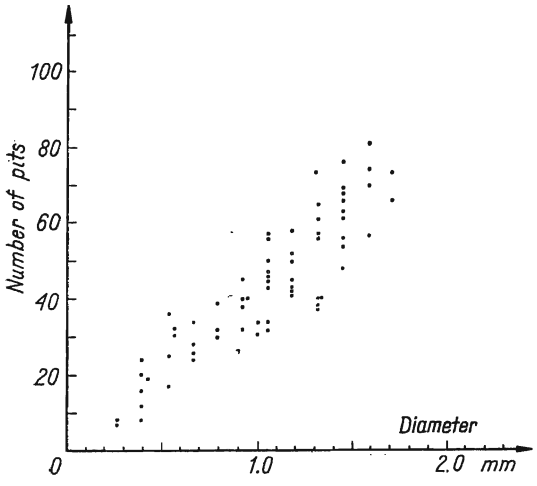

Fig. 2. Scattergram of the number of pits in a scar, *Podichnus silesiacus* ichnosp. n., and of the diameter of the scar

(Fig. 2). The most frequent are attachment scars with an area 1.0 to 1.4 mm in diameter, which directly correspond (as estimated from the size of foramen) to pedicle diameters most frequently met in the population of *Coenothyris vulgaris* under study (Fig. 3). Thus, the size of the attachment are may be considered as similar to that of the foramen, except for the most asymmetric traces. It should be assumed that traces 1.0 to 1.4 mm in diameter correspond to specimens of *Coenothyris vulgaris* 15 to 25 mm long (Fig. 4) and that these values correspond to average dimensions of adult individuals.

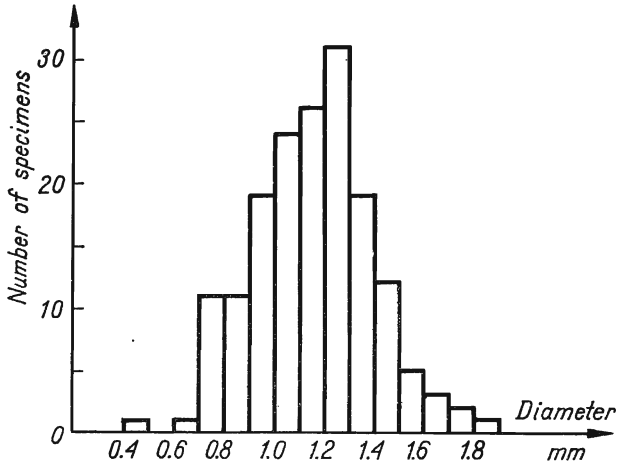

Fig. 3. Diameter frequency of the foramen in *Coenothyris vulgaris* (Schlotheim)

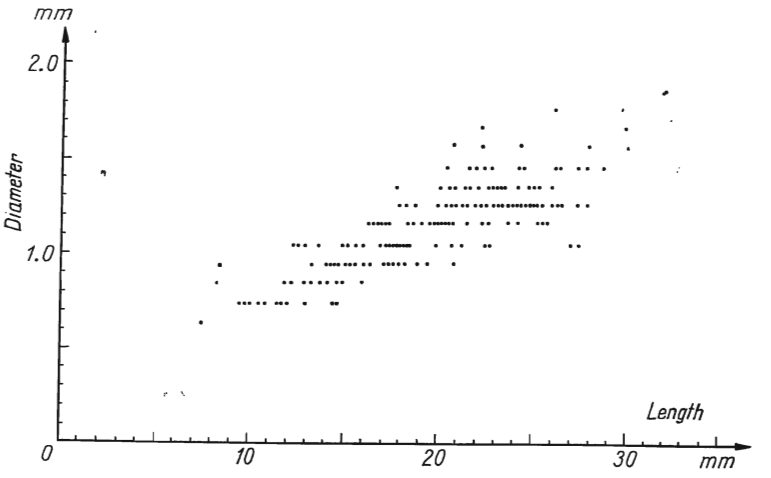

Fig. 4. Scattergram of the diameter of foramen and of the size (length) of the shell in *Coenothyris vulgaris* (Schlotheim)

Variability. — The attachment scars may be divided into several groups depending on the degree of the density of spacing and the shape of the group of pits. Consequently, we may distinguish several types of pedicles corresponding to them. This is demonstrated by a Recent species, *Terebratulina retusa* (Linnaeus), the pedicle varieties of which were described by Surlyk (1972) and Bromley & Surlyk (1973). They distinguished three characteristic groups of traces (*cf.* Bromley & Surlyk 1973, pp. 357–360). The following two of these groups have been recognized in the material under study:

(1) Compact attachment scars, in which numerous pits are so closely spaced that some of them, adjoining ones, frequently meet each other (Pl. 1, Fig. 4). They probably correspond to a pedicle not split into "rootlets", but terminating in short papillae, etching the substrate (*cf.* Bromley & Surlyk 1973, p. 357).

(2) Loosely arranged, symmetric or asymmetric attachment scars in which the distances between particular pits are from one to three times as large as their diameters (Pl. 2, Figs 1–8). This type corresponds to a rootlet-bearing pedicle (*cf.* Bromley & Surlyk 1973, p. 360).

ECOLOGY AND ENVIRONMENT

In theory, the attachment scars on the shells of scarred briachiopods should be distributed at random. However, we may observe certain areas of their more numerous distribution (Fig. 5), such as the umbonal region, on both the ventral and dorsal valve and the anterior parts of both valves. Particularly distinguished in this respect are the area below the umbo on the dorsal valve, and the region of distinct growth lines. Conspicuously unfavourable to the settlement of larvae and consequent formation of attachment scars are the convex central areas of both valves. Observations indicate that the shape of the scar is affected by its location on the host shell and by the orientation of the host shell in the sediment.

Scars situated on sloping surfaces of the valve may tend to a one-way elongation (Pl. 2, Fig. 8). The presence of a group of attachment scars may be an evidence of the position of the specimen inhabited (Fig. 6). Some properites of the distribution of scars, for example, their considerable accumulation in the umbonal part (Fig. 6*D*) allow one to suppose that the specimen inhabited was not attached itself and, therefore, the settling of new invaders took place already after its death. The occurrence of a single attachment scar on the shell of a brachiopod is not sufficient to determine its position during settling, since any two living terebratulids,

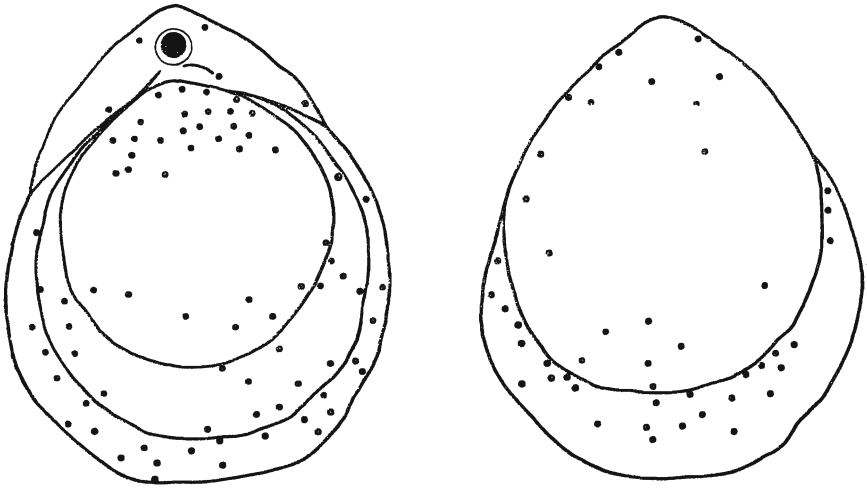

Fig. 5. All the recorded places of attachment scars, *Podichnus silesiacus* ichnosp. n. on dorsal and ventral side of the shells of *Coenothyris vulgaris* (Schlotheim)

the inhabited and the settling one, may take all possible positions. A large number of attachment scars on a specimen may be indicative either of a considerable density of the population and a tendency to a "clusterlike" associations, or of a consecutive settlement by several generations (*cf.* Fig. 6 and Pl. 1, Figs 2–3).

The view has recently been expressed that the facies in which numerous specimens of *Coenothyris vulgaris* (Schlotheim) occurred in the locality under study (*cf.* Pl. 1, Fig. 1) was unfavourable for colonization by the brachiopods due to its soft, muddy substrate (Dżułyński & Kubicz 1974, 1975). However, this difficulty could be overcome even in the soft, inhospitable areas of the bottom by utilizing shells of their own species. In the first stage of the bottom colonization, postmortem transportation

moved dead shells into the area, thus providing a favourable substrate for the subsequent settlement of larvae.

In addition, the ability of adapting the pedicle to various conditions of the substrate (*cf.* Chun 1900, Muir-Wood 1959, Rudwick 1961, Surlyk

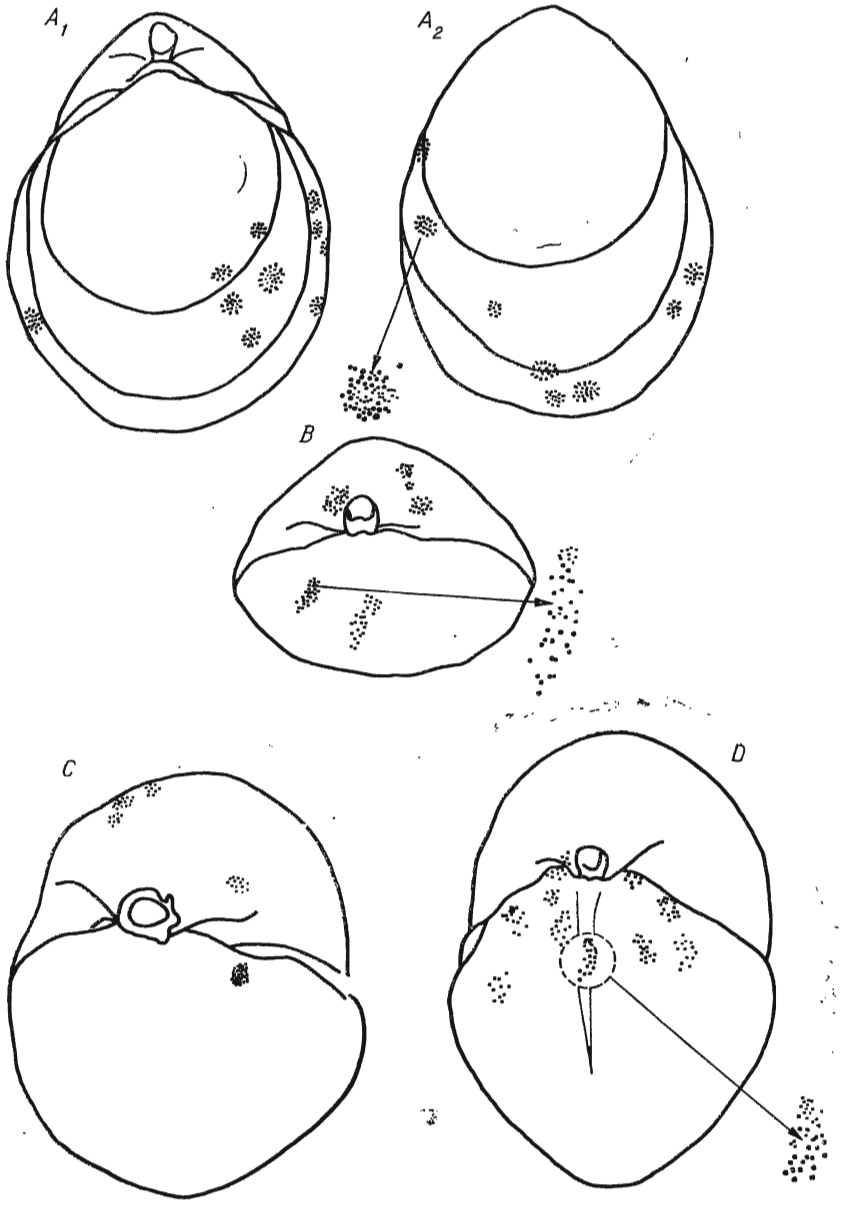

Fig. 6. Some examples of the shells of *Coenothyris vulgaris* (Schlotheim) densely scarred by *Podichnus silesiacus* ichnosp. n.

1972, Bromley & Surlyk 1973), demonstrated here by the species *Coenothyris vulgaris* (Schlotheim), allows one to conjecture that this species could settle even directly on a soft, muddy substrate, using a strongly-branched pedicle.

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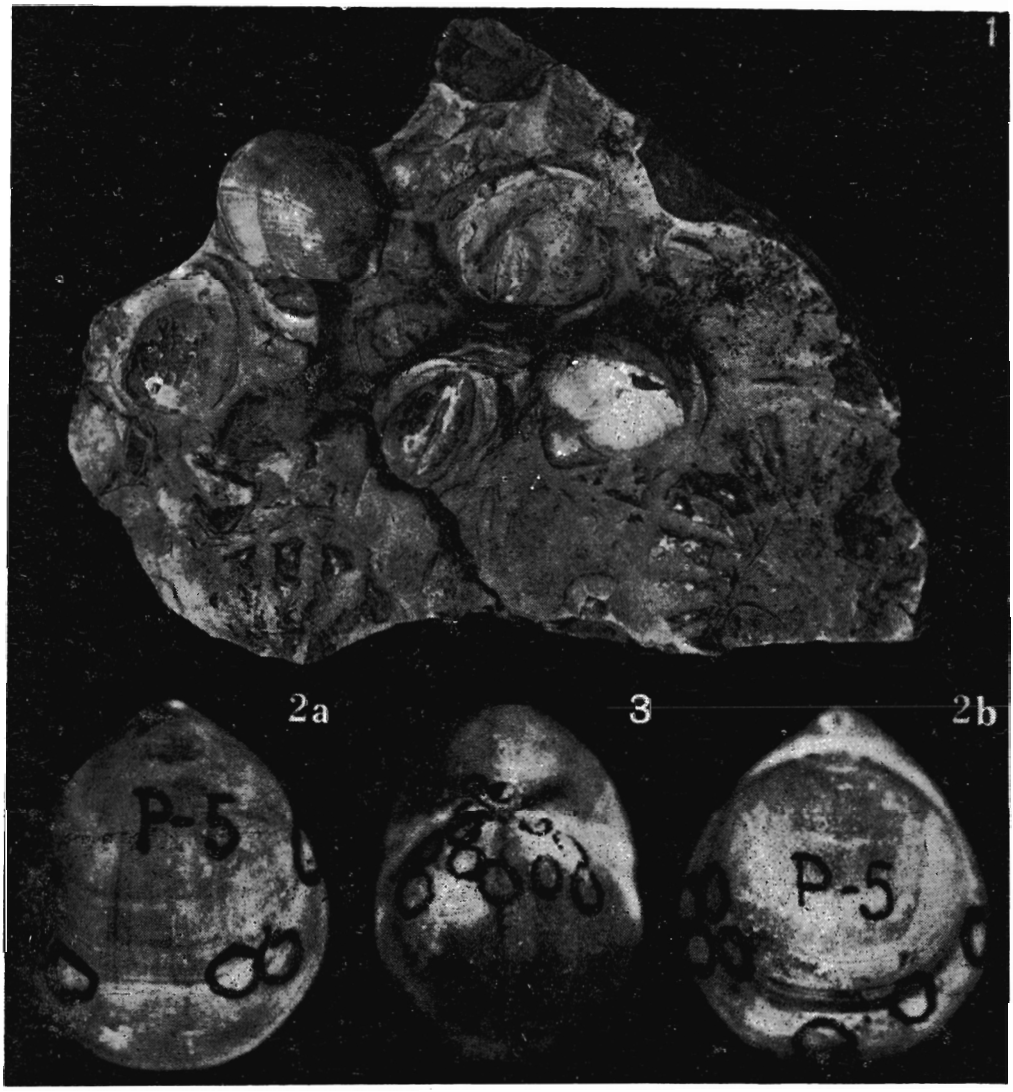
PLATE 1

1 — Fragment of the layer teemed with *Coenothyris vulgaris* (Schlotheim) from Strzelce Opolskie; nat. size.

2a, b, 3 — Two shells of *Coenothyris vulgaris* (Schlotheim) densely scarred by *Podichnus silesiacus* ichnosp. n. (in circles); × 2.

4–6 — Three examples of *Podichnus silesiacus* ichnosp. n. (5 presents the holotype) on the shells of *Coenothyris vulgaris* (Schlotheim); × 30.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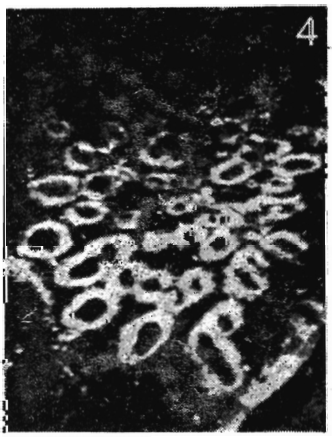
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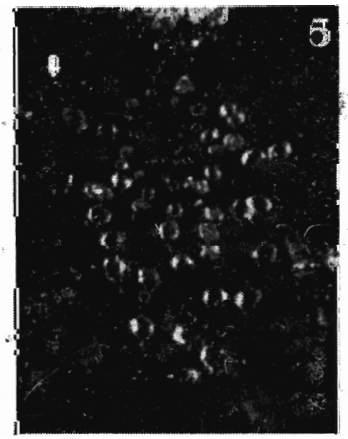
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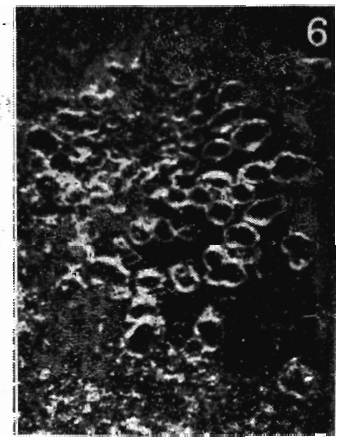
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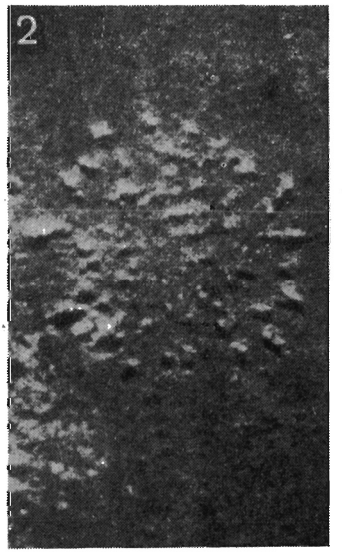
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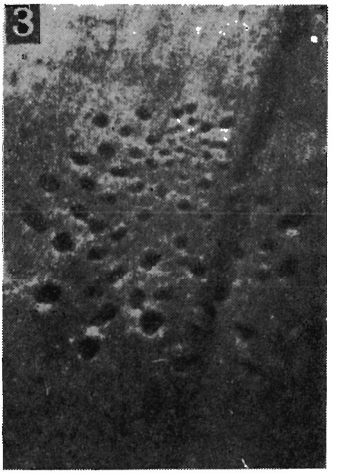
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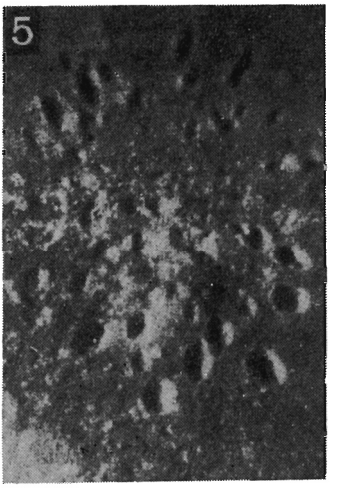
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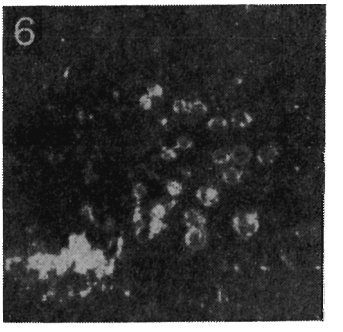
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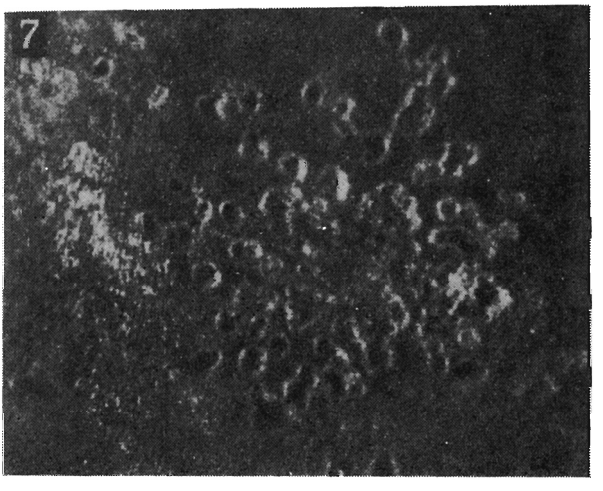
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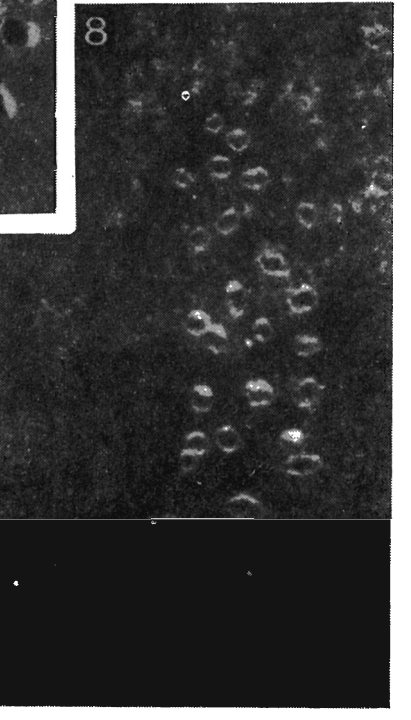
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K. MAŁKOWSKI

ŚLADY PRZYCZEPU NÓŻKI BRACHIOPODÓW *COENOTHYRIS VULGARIS* (SCHLOTHEIM) Z WAPIENIA MUSZLOWEGO GÓRNEGO ŚLĄSKA

(Streszczenie)

Przedmiotem pracy jest analiza śladów przyczepu nóżki brachiopodów *Coenothyris vulgaris* (Schlotheim) znalezionych na skorupkach tegoż gatunku w osadach wapienia muszlowego Górnego Śląska (*por.* fig. 1—6, pl. 1—2). Podano zmienność śladów i ich charakterystykę, uzasadniając utworzenie nowego ichnogatunku, *Podichnus silesiacus* ichnosp. n. Przedyskutowano także znaczenie rozważanych śladów w analizie paleoekologicznej, zwracając m.in. uwagę na ich kształt i miejsce występowania na skorupkach zasiedlanych brachiopodów.

PLATE 2

1—8 — Examples of diverse patterns of pits in *Podichnus silesiacus* ichnosp. n. occurring on the shells of *Coenothyris vulgaris* (Schlotheim) from Strzelce Opolskie; × 30.