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A new species of the cuttlefish from the Korytnica Clays (Middle Miocene; Holy Cross Mountains, Poland)

ABSTRACT: The Middle Miocene (Badenian) Korytnica Clays exposed within the Korytnica basin (southern slopes of the Holy Cross Mountains, Central Poland) yielded a rich assemblage of the sepioid cephalopods. All the collected material, composed of various fragments of the sepions, belongs to a new species, *Sepia sanctacrucensis* sp. n. The other sepioid species hitherto known from the Miocene deposits of Europe are also discussed, and the life conditions of the cuttlefish in the Korytnica basin are considered.

INTRODUCTION

In the sifting material obtained from the world-famous Middle Miocene (Badenian) Korytnica Clays exposed within the Korytnica basin on the southern slopes of the Holy Cross Mountains, Central Poland (*cf.* Bałuk & Radwański 1977), a relatively rich assemblage of the cuttlefish sepions has been recognized. The sepions are preserved in small fragments being usually a very subordinate component of the profuse, mostly gastropod-pelecypod assemblages (*cf.* Bałuk 1975, Bałuk & Radwański 1977). All the samples positive for the cuttlefish were taken in the uppermost part of the Korytnica Clays succession (*cf.* sampling places *1*—*8* in Text-fig. 1).

The cuttlefish remains have not hitherto been reported either from Korytnica, or from any other Miocene locality in Poland. Within the organic assemblage of the Korytnica Clays, these are the only representatives of the cephalopods.

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SYSTEMATIC DESCRIPTION

Class **Cephalopoda** Cuvier, 1794

Subclass **Coleoidea** Bather, 1888 [=**Dibranchiata** Owen, 1832]

Order **Sepiida** Zittel, 1895

Family **Sepiidae** Keferstein, 1866

Genus *SEPIA* Linnaeus, 1758

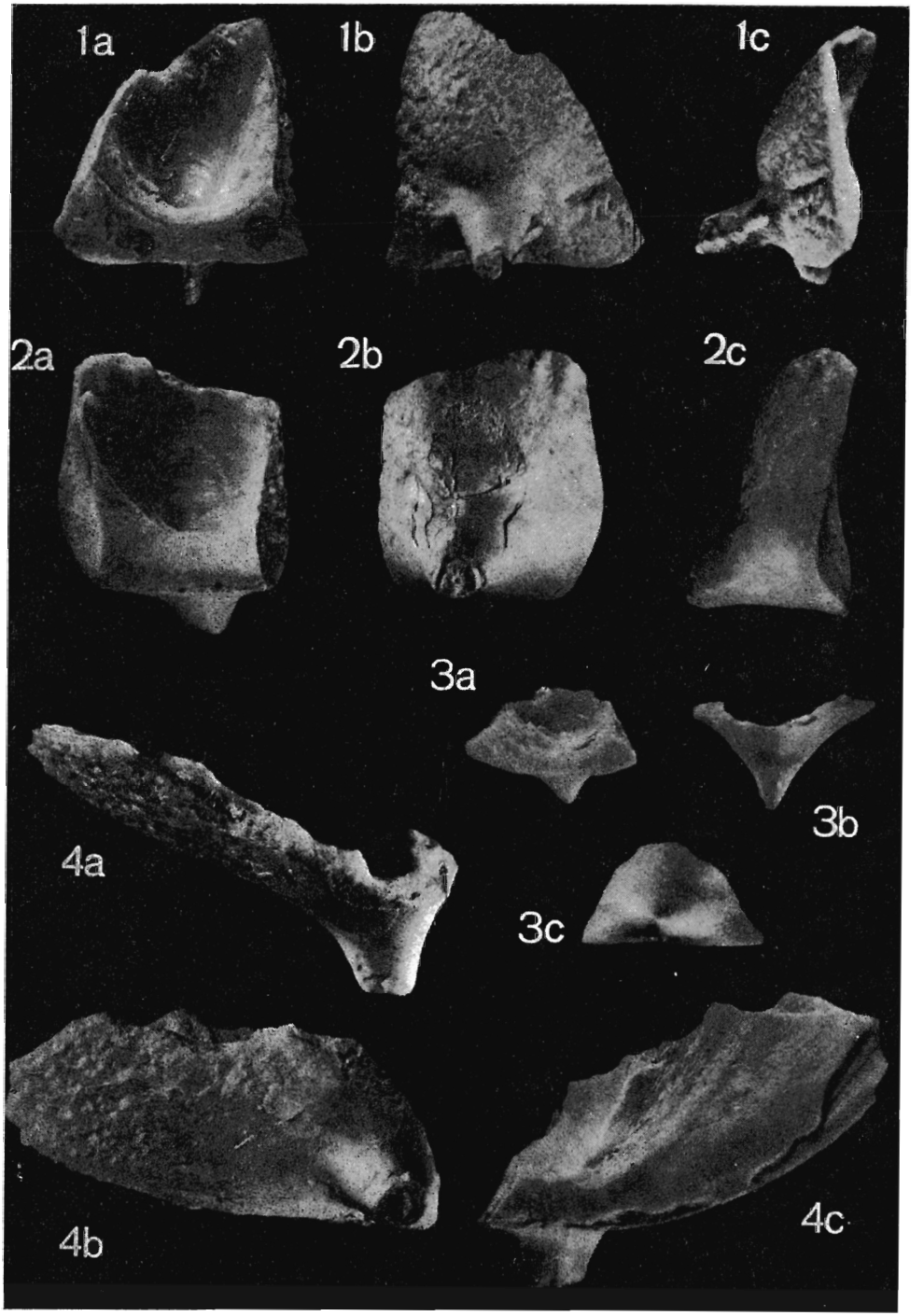
Sepia sanctacrucensis sp. n.

(Pl. 1, Figs 1—4 and Pl. 2, Figs 1—6)

Holotype: The specimen presented in Pl. 1, Fig. 1; housed in the author's collection (numbered *BkK—C0l*).
Paratypes: The specimens presented in Pl. 1, Figs 2—4 and Pl. 2, Figs 1—6.
Type locality: Korytnica, 24 km SSW of Kielce, southern slopes of the Holy Cross Mts, Central Poland.
Type horizon: Middle Miocene (Badenian).
Derivation of the name: Latin *sanctacrucensis*; after the Holy Cross Mountains region.
Diagnosis: Rostral processus almost vertical to the guardlike sheath; winglike ventral processus parallels along with the distal part of guardlike sheath; their interspace being a very narrow slit.
Material: Twenty six fragmentary sepions.
Dimensions: The largest fragment (presented in Pl. 2, Fig. 6) is 7 mm wide.

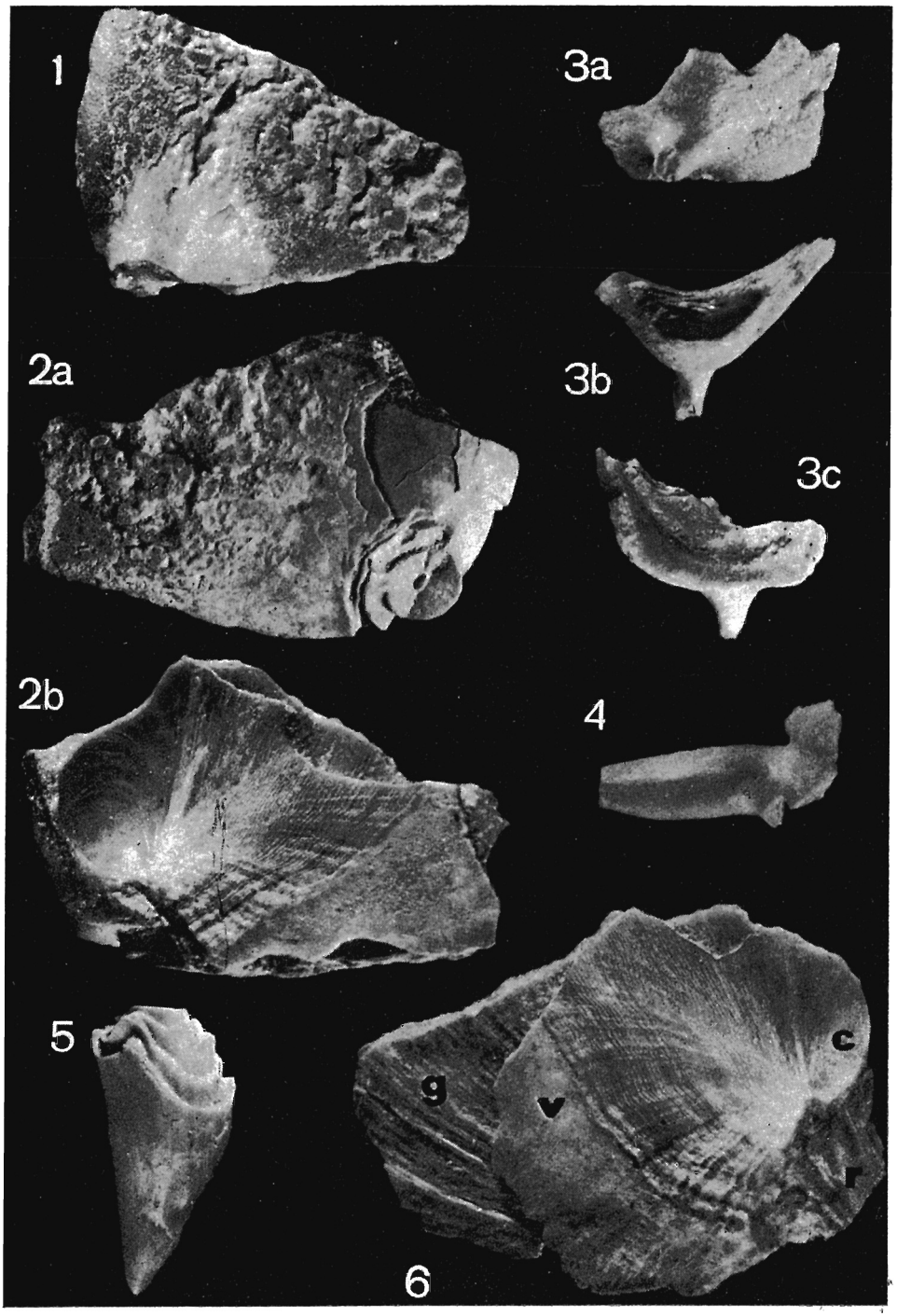
Description. — All the investigated specimens are the fragments of the apical ("rostral") part of the sepion. The guardlike sheath is considerably massive, and provided with a spinelike "rostral" processus that stretches out almost vertically. This processus is rather short and slightly arched, oval in transverse section, broad at the base, and fastly tapering backwardly. In the youngestmost specimen, if looking from the dorsal side, it is of a triangular outline (*cf.* Pl. 1, Fig. 3b). The largest specimen of the processus (*cf.* Pl. 2, Fig. 5) is *c* 4 mm long, and widest at the base (*c* 2.3 mm), its apical line being situated eccentrically, slightly backwardly. The external side of the guardlike sheath is, in its rostral part, smooth and lustrous, whilst in the remainder it is frosty and corrugated (*cf.* Pl. 1, Figs 1b and 4b), in places looking as if being etched (*cf.* Pl. 2, Figs 1 and 2a). The distal ("postrostral") part of the guardlike sheath parallels a wide, winglike ventral processus ("*Ventralfortsatz*" of Naef 1922); their interspace is very small and pronounced as a slightly discernible narrow slit. In the internal side of the guardlike sheath, the internal side of the conotheca wall is visible, and the latter displays the attachment lines of a few first septa of the phragmocone (*cf.* Pl. 1, Figs 1a, 2a, and Pl. 2, Fig. 2b). The septa themselves have not been preserved in any of the investigated specimens. In some specimens, however, preserved are fragments of the ventral wall of the phragmocone ("*Ventralwand*" of Naef 1922), made up of numerous, thin lamellae (*cf.* Pl. 2, Fig. 3b). In some other specimens, in their winglike ventral processus, visible are numerous (up to 50), densely distributed but delicate lines of the attachment of these lamellae (*cf.* Pl. 2, Figs 2b and 6).

Remarks. — The investigated specimens cannot be included into any of the hitherto known species of cuttlefish. This results both from the lack of detailed descriptions of heretofore recorded specimens, and from their diversified preservation state. The only paleontological material to which the Korytnica specimens are comparable, is that from Grund in the Vienna Basin, and described by Schaffer (1958) as *Sepia vindobonensis* Schloenbach. Within the so-determined specimens from Grund, Schaffer (1958) distinguished the forms with smaller "rostrum" and attributable to *Sepia vindobonensis*, and the forms with larger



Fragmented sepions of *Sepia sanctacrucensis* sp. n.

1 — holotype (*a* ventral, *b* rostral, *c* lateral view)
2 — paratype (orientation the same as in Fig. 1)
3 — paratype, the youngest of the investigated specimens (*a* ventral, *b* dorsal, *c* rostral view)
4 — paratype (*a* dorsal, *b* rostral, *c* ventral view)



Fragmented sepions of *Sepia sanctacrucensis* sp. n.

1 — paratype, external view of the guardlike sheath
2 — paratype; fragment with broken rostrum (*a* rostral, *b* ventral view)
3 — paratype; specimen with partly preserved ventral wall of the phragmocone (*a* rostral, *b* dorsal, *c* ventral view)
4—5 — paratypes (broken rostral processuses)
6 — paratype; the largest fragment of the sepion (ventral view) that displays the guardlike sheath *(g)*, winglike ventral processus *(v)*, conotheca wall *(c)*, and

"rostrum". The latter ones that display also a better pronounced ventral wall ("*Gabellamellenwand*" of Schaffer) remained unnamed.

Although the investigated specimens seem to be identical with these presented by Schaffer, all of them (both from Korytnica and Grund) are deviated from those described by Schloenbach (1869) from the Tegel of Baden in the Vienna Basin. If the illustrations presented by Schloenbach (1869, Pl. 7, Figs 2, 2a and 2c) are reliable, the specimens from Baden are more slender, their "rostrum" being oriented at a different angle, and their ventral processus weaker and differently oriented. The comparison is not possible however, as the Schloenbach's specimens have been lost in the collections (*fide* Schaffer 1958). For these reasons, the present writer does not include the investigated specimens into the Schloenbach's species, but introduces a separate species, *Sepia sanctacrucensis* sp. n. Concerning the diversified length of the "rostrum", the feature being pointed out by Schaffer (1958), it is also recognizable in the investigated specimens; the differences are, however, gradual, and undoubtedly caused by various age of the animals, as it is evidenced by successive stages presented in illustrations (Pl. 1, Figs 3c, 1c, 4c, and Pl. 2, Figs 2a and 5, respectively). An absence of the intermediate specimens within the six specimens from Grund (*cf.* Schaffer 1958, p. 142) is certainly accidental and results from an inadequate number of specimens. The specimen described by Roger (1947) from Saubrigues in the Aquitanian Basin in France, and determined as *Sepia* cf. *vindobonensis* has its "rostral" part not preserved, and its comparison with the Korytnica specimens is not possible.

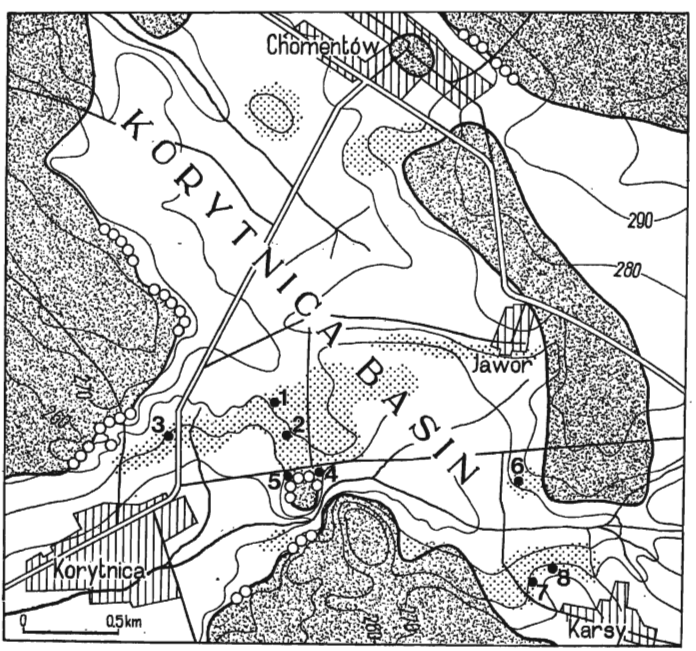


Fig. 1. Paleoenvironmental sketch of the Korytnica basin (from: Bałuk & Radwański 1977, Text-fig. 2)

Indicated are: marine area of the Korytnica basin during the Middle Miocene (Badenian) transgression *(blank)* and present-day outcrops of the Korytnica Clays *(stippled)*; preserved fragments of littoral structures *(circled)*; land or island areas along the seashore *(hachured)*

Marked are the occurrence sites 1—8 of *Sepia sanctacrucensis* sp. n.

Within the cuttlefish species that live at present in the European seas (*cf.* Naef 1923, Coen 1937, Jaeckel 1958), only *Sepia orbignyana* Férussac has its "rostrum" situated so as *S. sanctacrucensis* sp. n. In the latter, the specific alae (*Flügel* of Naef 1923) in the distal part of the sepion have not, however, been stated. Nevertheless, a relationship between these two species cannot be excluded.

LIFE CONDITION OF THE CUTTLEFISH IN THE KORYTNICA BASIN

All the investigated specimens come from the uppermost part of the Korytnica Clays, the sedimentation of which occurred at the depths ranging from over a dozen meters to almost a few (*cf.* Radwański 1969; Bałuk 1971, 1972, 1975; Bałuk & Radwański 1967, 1977). The bottom was quaggy and silty at that time, and covered either by kelp or seagrasses (*cf.* Bałuk & Jakubowski 1968, Walkiewicz 1977, Hoffman 1977, Bałuk & Radwański 1977). To this shallowmost basin the cuttlefish were certainly migrating during their breeding season by the springtime, similarly as it happens at present (*cf.* Starmühlner 1963). The cuttles then lived just at the bottom, shuffling and burrowing into the bottom sediment, or hiding themselves in the seaweed by the daytime, and hunting overnight. Their prey certainly then consisted of small fish, crabs, vagile snails or other, mostly soft-bodied animals.

In the present-day seas, the most important enemies for the cuttles are the carnivorous fish, the turtles, seals, cetaceans, and sporadically the birds (*cf.* Jaeckel 1958, Starmühlner 1963). Of these hunters, in the Korytnica basin evidently lived the fish (*cf.* Bałuk & Radwański 1977), whilst the others have not been evidenced so far. It is possible that all the investigated specimens, being the fragments of the sepions, belonged to the cuttles that had been the victims of such very predators.

CUTTLEFISH IN THE EUROPEAN MIOCENE

The findings of the cuttlefish remains in the Miocene of Europe are extremely rare, although it seems that these animals were then so frequent as they are at present. The scarcity of their findings in the European Miocene certainly results mostly from their delicate structure and from the preservation conditions. The cuttlefish skeleton may be preserved wholly, the septa including, only when being fastly buried in the sediment. It seems that the best preserved specimens are those which have been buried before the decomposition of their soft tissues. The majority of the sepions were however destroyed before their coverage by the sediment, and their damage had been caused

both by the hydromechanical and biological agents. Some of the sepions have presumably been destroyed by the predators feeding upon the cuttlefish. In consequence, only the most resistant parts of the sepions have been introduced to the sediment. On the other hand, any identification of small fragments of the sepions in the Miocene sediments is difficult, and only some of them, mostly the near-to-rostrum parts are recognizable in the sifting material.

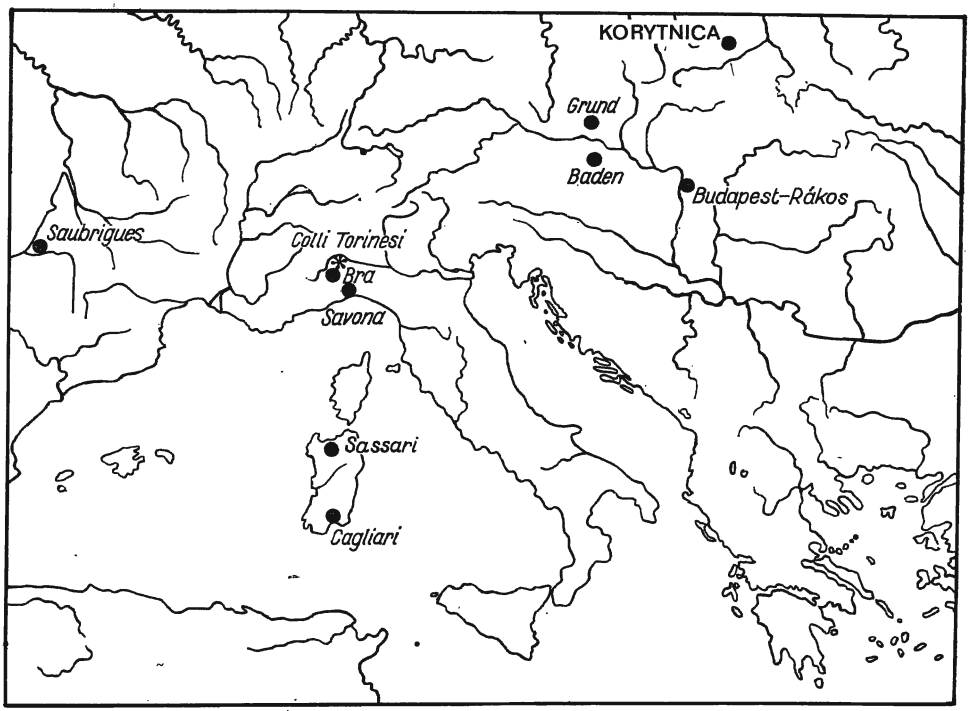


Fig. 2. Geographic distribution of the cuttlefish in the Miocene deposits of Europe
Compiled on the data presented by: Gastaldi (1868), Schloenbach (1869), Bellardi (1873), Parona (1892), Lörenthey (?1911), Roger (1947), Schaffer (1953), and Comaschi Caria (1960)
Asterisked and called as Colli Torinesi is also a group of other localities in the vicinity of Turin (Superga, Sciolze, Chieri)

Most of the specimens known in the European Miocene come from the Mediterranean (Tethys) regions, namely from Piedmont and Liguria in northern Italy, and from Sardinia (*cf.* Text-fig. 2). From the Miocene deposits of the vicinity of Turin (Colli Torinesi, Superga, Sciolze, Chieri), as well as from Bra and Savona [1], as many as ten species have been described in the last century (Gastaldi 1868, Bellardi 1873; *cf.* also Bülow-Trummer 1920), namely: *Sepia sepulta* Michelotti, *S.*

[1] The age of these cuttlefish-bearing deposits is not precisely known (*cf.* Parona 1892, Bülow-Trummer 1920), and presumably some of them are to be referred as Mio-Pliocene or Pliocene.

michelottii Gastaldi, *S. craveri* Gastaldi, *S. complanata* Bellardi, *S. gastaldii* Bellardi, *S. granosa* Bellardi, *S. isseli* Bellardi, *S. rugulosa* Bellardi, *S. verrucosa* Bellardi, and *S. stricta* Bellardi.

From Sardinia, vicinities of Cagliari and Sassari (*cf.* Text-fig. 2), four species are hitherto known, two of which were established by Parona (1892), viz. *Sepia caralitana* Parona and *S. lovisatoi* Parona, and two others identified by Comaschi Caria (1960) as *S. craveri* Gastaldi and *S. verrucosa* Bellardi.

The other Miocene regions in Europe (*cf.* Text-fig. 2) yielded only few specimens. From the Atlantic gulfs only one occurrence site is known at Saubrigues in the Aquitanian Gulf wherefrom Roger (1947) described a single and incomplete specimen of *Sepia* cf. *vindobonensis* Schloenbach. In the Paratethys basins, only the three sites have hitherto been recorded. The best preserved specimens were reported by Schloenbach (1869) who established the species *Sepia vindobonensis* when having the two, almost complete specimens from the Tegel of Baden in the Vienna Basin, Austria. From Grund in the Vienna Basin, six specimens were reported by Schaffer (1958) who assigned them, as presented above, to the same species, *S. vindobonensis* Schloenbach. From Hungary[2], one incomplete specimen is known from the bryozoan-algal limestones (*Leithakalk* facies) exposed once at Budapest-Rákos; it was reported by Lörenthey (without date; 1911 according to Kretzoi 1942) as *Sepia mediterranea* Lörenthey, the species having subsequently been reexamined by Kretzoi (1942) and called as *S. loerentheyi* Kretzoi.

As appears from the above review, the Korytnica basin is the forth region of the occurrence of Miocene cuttlefish in the Paratethys basins, and the number of the collected specimens is over twice that as in all the remaining localities. The Korytnica basin may therefore be regarded as a part of the Miocene seas very favourable for the life development of ancient cuttlefish.

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MĄTWY Z IŁÓW KORYTNICKICH

(Streszczenie)

W materiale otrzymanym po przeszlamowaniu licznych próbek iłów korytnickich znalezionych zostało 26 fragmentów szkieletów mątw (*„os sepiae"*), zwierząt nieznanych dotychczas z miocenu Polski. Wszystkie okazy (*por.* pl. 1 i 2) są fragmentaryczne i stanowią przyrostralne części szkieletu; zostały one zaliczone do nowego gatunku, *Sepia sanctacrucensis* sp. n.

Znalezione okazy pochodzą z najwyższej części iłów, która osadziła się w mioceńskim basenie Korytnicy (*por.* fig. 1, oraz Bałuk & Radwański 1977) na głębokości kilku lub kilkunastu metrów. Do takiego bardzo płytkiego zbiornika mątwy wpływały liczniej zapewne wiosną w okresie rozrodu, podobnie jak to czynią współcześni przedstawiciele tych głowonogów. Żyły one wtedy przy dnie, w ciągu dnia zagrzebując się częściowo w osadzie lub kryjąc się przed drapieżnikami w zaroślach alg bądź traw morskich, nocą zaś polując na zdobycz. Fragmentaryczny stan zachowania szkieletów nasuwa przypuszczenie, że wszystkie one są szczątkami tych osobników, które padły ofiarą drapieżników.

Szczątki mątw w osadach mioceńskich Europy należą do znacznych rzadkości (*por.* fig. 2). W basenach Paratetydy znano dotychczas zaledwie trzy stanowiska tych mięczaków (Baden, Grund i Budapeszt-Rákos); nieco liczniejsze są one natomiast w strefie śródziemnomorskiej (północne Włochy, Sardynia).