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Decapod crustaceans from the Middle Miocene (Badenian) deposits of Southern Poland

ABSTRACT: The assemblages of the decapod crustacean remains from the Middle Miocene (Badenian) of the Fore-Carpathian Depression (exclusively the Korytnica Clays) and of the Carpathians contain predominantly fragments of finger tips or chelae attributable to xanthid crabs. One species of the dorippid crabs is described new, *Dorippe? carpathica* sp. n. The occurrence of the genera *Macrophthalmus* and *Dorippe* supports closer affinities to the Recent tropical/subtropical Indo-Pacific realm.

INTRODUCTION

The intensive investigations in the Middle Miocene (Badenian) strata of the Fore-Carpathian Depression and of the Carpathians during the last years (*cf.* Bałuk & Radwański 1977) yielded numerous remains of decapods, not only in the rich assemblages from the famous Korytnica Clays (see Förster 1979) but also from the sands and the detrital bryozoan-algal limestones of the Leithakalk type, which represent the more littoral zones of the basin. The majority (199 specimens) are fragments of fingers or chelae only, like the assemblage from the Korytnica Clays. The fauna contains, however, also nine carapaces or internal moulds of carapaces (Table 1).

The preservation of the investigated material is only moderately good, permitting at most, particularly the fragments of fingers, identification to a generic or even higher taxonomic level. In spite of this inconvenience, but considering the fact, that the assemblage is the first known decapod fauna from this area, the aim of this paper is to present the material and to discuss its taxonomic, ecological and biogeographical setting as far as possible.

Acknowledgements. The author is greatly indebted to Doc. Dr. W. Bałuk and Prof. Dr. A. Radwański for the loan of the specimens. All the investigated specimens are deposited in the collection of the Institute of Geology, University of Warsaw, Poland.

SYSTEMATIC DESCRIPTION

Infraorder **Anomura** Milne-Edwards, 1832
Family **Callianassidae** Dana, 1852
Genus *CALLIANASSA* Leach, 1814
Callianassa kerepesiensis Müller, 1976
(Text-fig. 1 and Pl. 1, Fig. 5)

1975. *"Callianassa"* sp. nov.?; Müller; p. 508, Pl. 1, Figs 1—4.
1976. *"Callianassa" kerepesiensis* n. sp.; Müller; p. 149, Pl. 1, Figs 1—5.
Material: 2 right chelae and one left palma from Nawodzice.

Remarks. — Small chelae with short palma, higher than long (total length 11 mm; height of palma 7 mm, length 6 mm). Basis of fixed finger separated by a deep incision from the margin of the articulation of the movable finger. Cutting edges of the fingers smooth, without any prominent teeth. Chelae of *C. munieri* Brocchi from the Vienna and Pannonian basins show similar short

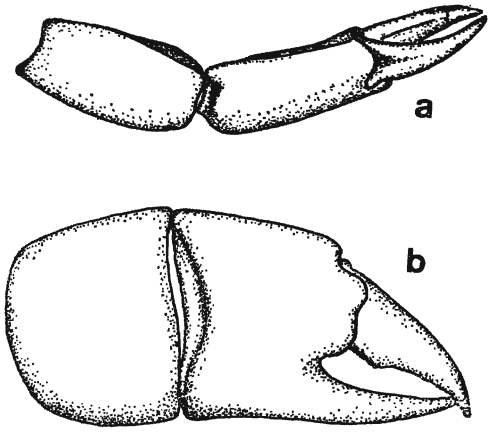


Fig. 1
Callianassa kerepesiensis Müller
Right chela and carpus; views of upper margin (*a*) and outer surface (*b*); locality Nawodzice (*cf.* Pl. 1, Fig. 5)

palmae, but lack the deep incision of the frontal margin. The classification of isolated callianassid chelae, however, turns out to be a problematic task, considering the high variability in the chelae of Recent species, demonstrated by Sakai (1969).

Family **Paguridae** Latreille, 1802
Paguridae gen. et sp. indet.
(Text-fig. 2 and Pl. 1, Fig. 4)

Material: Two dactyli of right chela from Pińczów; 4 dactyli and one fixed finger from Szczaworyż.

Remarks. — Some short, compact movable fingers correspond in shape and sculpture with the robust dactyli of Paguridae. The ornamentation of the upper/outer surface, developed as an uniform granulation of large, blunt and densely arranged tubercles, resembles *Petrochirus priscus* (Brocchi). The dactyli however are much shorter and more compact, comparable to those of the genera *Paguristes* or *Coenobita*.

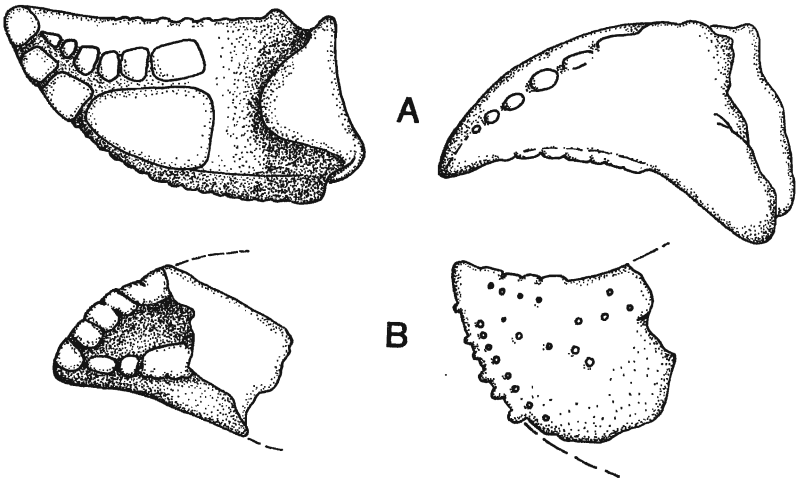


Fig. 2. Paguridae gen. et sp. indet.
Fragments of movable (*A*) and fixed finger (*B*); views of inner surfaces and cutting edges; locality Szczaworyż (*cf.* Pl. 1, Fig. 4)

Section **Oxystomata** Milne-Edwards, 1834
Family **Dorippidae** de Haan, 1841
Genus *DORIPPE* Weber, 1795
Dorippe? *carpathica* sp. n.
(Text-fig. 3 and Pl. 2, Fig. 3)

Material: A single internal mould.
Derivatio nominis: Named for its occurrence in the Polish Carpathians.
Type locality: Niskowa, 6 km west of Nowy Sącz, on the western slopes of the Nowy Sącz depression, Polish Carpathians.
Geologic horizon: Micaceous, sandy-silty layer *18* of Bałuk (1970, Text-fig. 3 and p. 111 and 153); Middle Miocene, Badenian.
Measurements: Carapace length 7 mm; width 6.6 mm.
Diagnosis: A new species of the genus *Dorippe* which differs from other species by the following features: prominent ridge on meso/metabranchial region; epibranchial and hepatic region modified by depressions and grooves, separated from mesobranchial region by a distinct groove.

Description. — The only specimen, an internal mould, lacks the frontal regions. Furthermore the mould is laterally compressed, particularly the branchial and

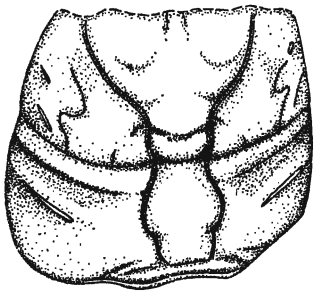


Fig. 3
Dorippe? carpathica sp. n.
Internal mould of carapace, diagenetically deformed; locality Niskowa (*cf.* Pl. 1, Fig. 3)

hepatical regions to the right, pretending an approximately subquadrangular outline of the carapace.

Carapace subquadrangular, maximum width in the posterior part of the mesobranchial region. Posterior margin bilobated. Regions of carapace well defined. Meso/protogastric region with three prominent protuberances. Wing-shaped urogastric region, pentagonal cardiac region. Epibranchial and hepatic regions modified by longitudinal grooves and depressions, separated from meso/metabranchial region by a distinct groove. A prominent ridge on meso/metabranchial region, approximately parallel to the groove.

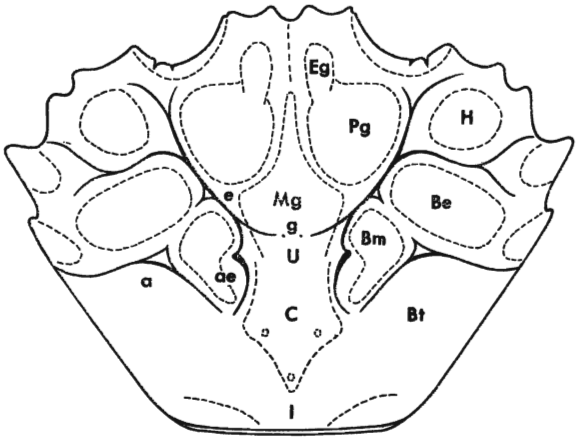
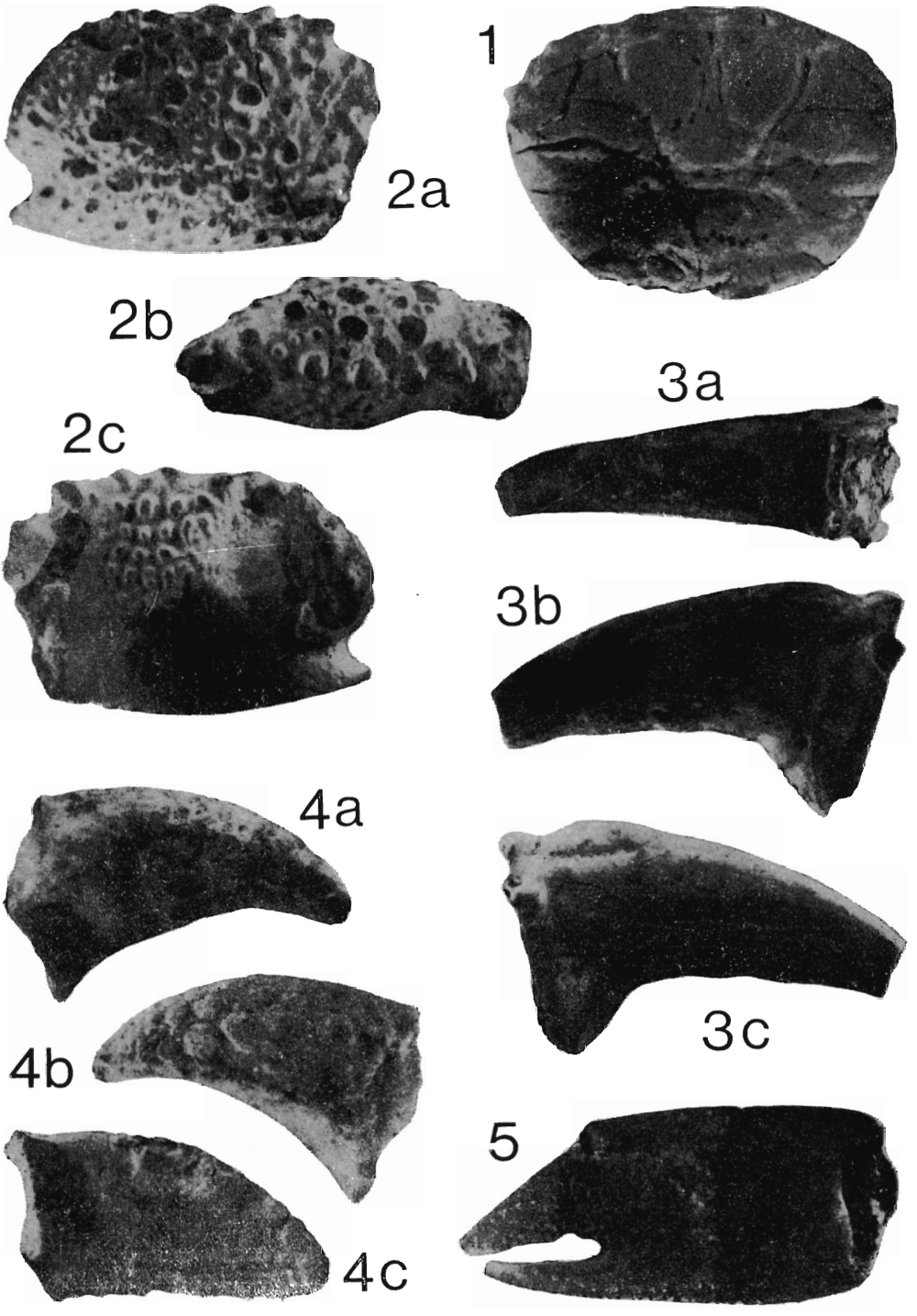


Fig. 4. Terminology of carapace regions and grooves
Eg epigastric lobe, *Pg* protogastric region, *Mg* mesogastric, *U* urogastric, *C* cardiac, *I* intestinal, *H* hepatic, *Be* epibranchial, *Bm* mesobranchial, *Bt* metabranchial region, *e* cervical groove, *a* branchiocardiac groove, *ae* attachment of attractor epimeralis muscle, *g* gastric pits

Remarks. — Though none of the known representatives of the Dorippidae show a comparable peculiar modified epibranchial and hepatic region, the general pattern of the new carapace resembles closely that of the genus *Dorippe*. Unfortunately the unique specimen is an internal mould only, which additionally is diagenetically deformed. The exact modification of regions and grooves and the sculpture of the carapace is not recognizable. It is somewhat doubtful therefore, if the specimen can be referred to the genus *Dorippe*. Only further and better preserved material will help to clarify its morphology and its generic position.

PLATE 1

1 — ?*Eriphia* sp. *D*; internal mould of carapace; detrital limestone, Grobie; × 3
2 — ?*Eriphia* sp. *C*; right palma; views of outer surface *(a)*, upper margin *(b)* and inner surface *(c)*; detrital limestone, Grobie; × 6
3 — *Cancer* sp.; dactylus, left chela; views of cutting edge *(a)*, and outer *(b)* and inner *(c)* surfaces; marly limestone, Pińczów; × 3
4 — Paguridae gen. et sp. indet.; dactylus, right chela; views of outer surface with cutting edge *(a)*, inner surface *(b)*, and total cutting edge *(c)*; marly limestone, Szczaworyż; × 6
5 — *Callianassa kerepesiensis* Müller; right chela and carpus; view of inner surface; coarse-grained sands, Nawodzice; × 4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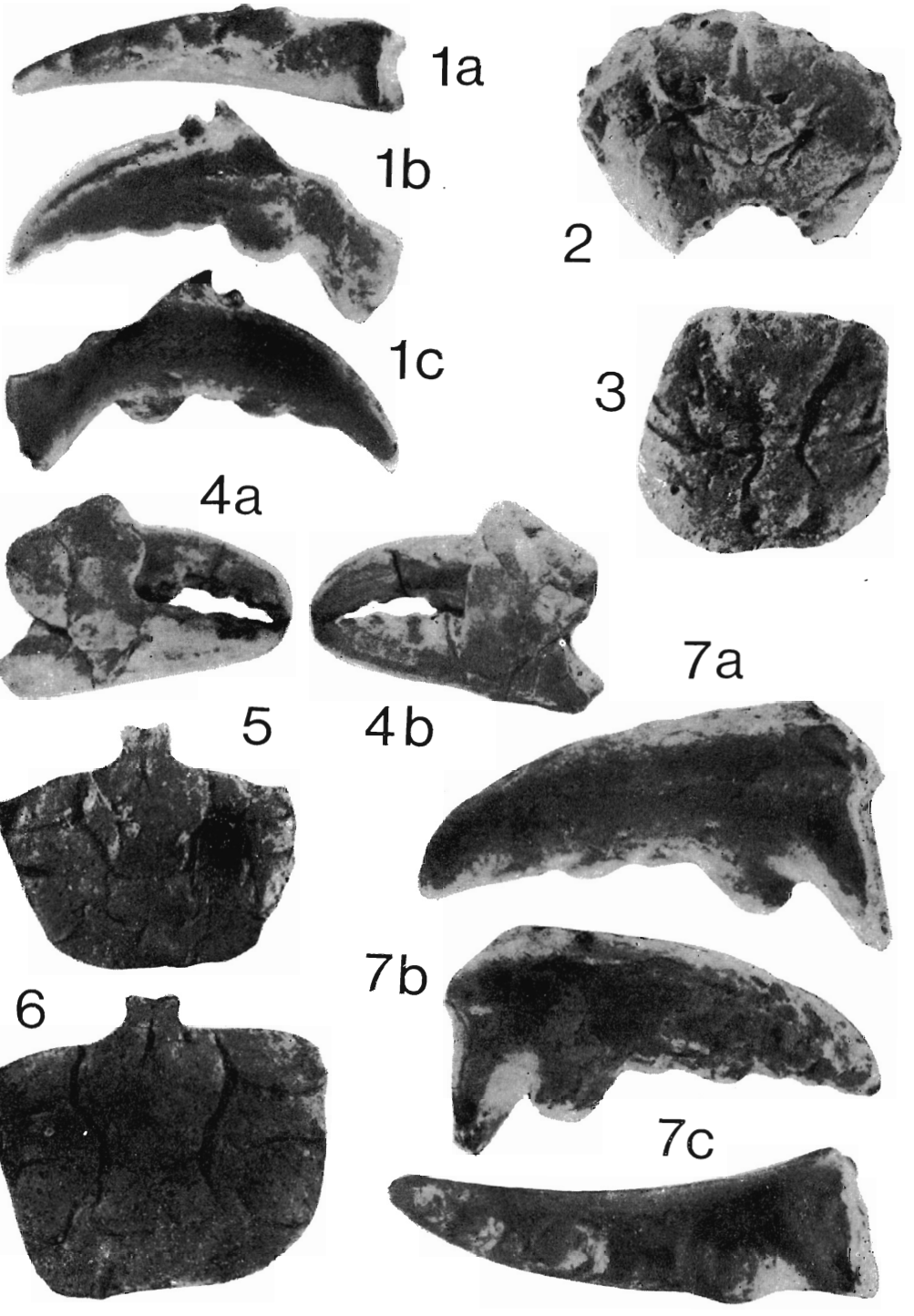

1a
1b
1c
2
3
4a
4b
5
6
7a
7b
7c

The genus *Dorippe* is known by at least three species from Miocene strata: *D. judicis* Gripp from the Lower Miocene of northern Germany (Gripp 1964); *D. frankhauseri* Studer (*in:* Bachmayer & Rutsch 1962) from the Helvetian of Switzerland; *D.* aff. *lanata* Linnaeus from the Helvetian of Portugal, and *D. margaretha* (Lörenthey & Beurlen) from the "Tortonian" of Hungary (Lörenthey & Beurlen 1929). All these representatives, however, show much closer relationships to Recent species, and in the Portuguese carapace to such an extent that Veiga Ferreira (1954) referred it to the Recent Mediterranean species.

Section **Cancridea** Latreille, 1803
Family **Cancridae** Latreille, 1803
Genus *CANCER* Linnaeus, 1758
Cancer sp.
(Text-fig. 5 and Pl. 1, Fig. 3)

Material: One dactylus, left chela from Pińczów; three dactyli, right chela, one left chela and four fixed fingers, left chela from Nawodzice.

Remarks. — Finger moderately downturned and slightly curved inward; laterally flattened, in cross-section subrectangular. Surface smooth with a fine granulation particularly on the proximal part. Outer and inner surface with two

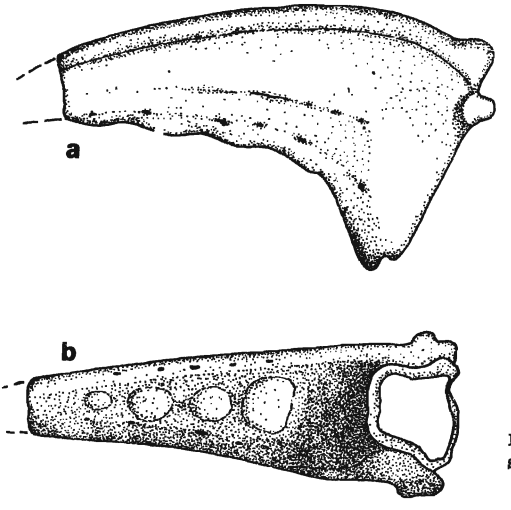


Fig. 5
Cancer sp.
Dactylus of left chela; views of outer surface (*a*) and cutting edges (*b*); locality Pińczów (*cf.* Pl. 1, Fig. 3)

PLATE 2

1 — *?Eriphia* sp. *A*; dactylus, left chela; views of cutting edge (*a*), outer (*b*) and inner (*c*) surfaces; marly limestone, Szczaworyż; × 6
2 — *Pilumnus* sp.; fragment of crushed carapace; detrital limestone, Grobie; × 6
3 — *Dorippe? carpathica* sp. n.; holotype (internal mould of carapace); fine-grained sandstone, Niskowa; × 6
4 — *?Eriphia* sp. *B*; fragment of right chela; views of outer (*a*) and inner (*b*) surfaces; marly limestone, Busko; × 2
5—6 — *Macrophthalmus vindobonensis* Glaessner; internal moulds of carapaces; fine-grained sandstone, Niskowa; × 5
7 — *?Eriphia* sp. *A*; dactylus, right chela, crusher claw; views of inner (*a*) and outer (*b*) surfaces, and cutting edge (*c*); marly limestone, Szczaworyż; × 3

weak grooves; upper groove of inner surface fading out rapidly. Single deep pits joining the base of the teeth; teeth little accentuated, blunt and shallow.

The genus *Cancer* has been reported repeatedly (Lörenthey & Beurlen 1929, Glaessner 1933, Comaschi Caria 1951, Janssen 1972) from the Middle Miocene of the Paratethys basins, though mostly by isolated chelae or fingers only.

Section **Brachyrhyncha** Borradaile, 1907
Superfamily **Portunoidea** Rafinesque, 1815
Family **Portunidae** Rafinesque, 1815
Genus *PORTUNUS* Weber, 1795
Portunus granulatus (Milne-Edwards, 1860)

Older synonymy: *see* Glaessner 1929, p. 267 *(Neptunus granulatus).*

1929. *Neptunus granulatus;* Lörenthey & Beurlen; p. 188, Pl. 13, Figs 3—4; Pl. 14, Figs 1, 4.
1932. *Neptunus granulatus;* Via; p. 137, Pl. 5, Figs 2, 5 and Pl. 6, Fig. 2.
1933. *Neptunus granulatus;* Glaessner; p. 5.
1939. *Neptunus granulatus;* Beurlen; p. 136.
1941. *Neptunus granulatus;* Via; p. 16, Pl. 1, Figs 7—9 and Pl. 2, Figs 10—17.
1948. *Neptunus granulatus;* Via; p. 145, Pl. 1, Figs 2—3.
1949. *Neptunus granulatus;* Schouppé; p. 140, Fig. 2.
1951. *Lupa hastata;* Comaschi Caria; p. 149, Pl. 1.
1952. *Neptunus granulatus;* Via; p. 75, Fig. 10.
1954. *Neptunus granulatus;* Veiga Ferreirra; p. 63, Pl. 1, Figs 1, 4, 7, Pl. 2, Figs 8—14, Pl. 3, Figs 18, 23, Pl. 4, Figs 31—32, Pl. 6, Figs 42, 44.
1956. *Neptunus granulatus;* Comaschi Caria; p. 284, Pl. 1, Figs 1—7, Pl. 2, Figs 1—6, Pl. 3, Figs 1—2.
1958. *Neptunus granulatus;* Moret; p. 39, Pl. 1, Figs 1—2, 4—6.
1959. *Neptunus granulatus;* Galopim; p. 80, Pl. 1, and Pl. 2, Figs 1—3.
1962. *Neptunus granulatus;* Zbyszewski & Veiga Ferreira; p. 286, Pl. 1, Fig. 6.
1965. *Neptunus granulatus;* Veiga Ferreira; p. 150.
1968. *Neptunus* aff. *granulatus;* Stancu & Andreescu; p. 466, Pl. 7, Fig. 85.

Material: One fragment of the medial regions of a large (>5 cm) carapace from Busko (*coll.* Dr. R. Wrona; reported by Radwański 1969, p. 49); 1 carapace and one abdomen and two chelae from Niskowa.

Remarks. — This well known and in the Miocene of the Mediterranean widely spread species (from the Azores and Portugal to Sinai Peninsula) is represented by fragments only, but characteristic for the species.

Portunidae gen. et sp. indet.
(Text-fig. 6 and Pl. 3, Fig. 4)

Remarks. — A small left movable finger from Pińczów resembles closely the dactyli from the Korytnica Clay (Förster 1979) in its five distinct ridges, and in the development of the teeth. According to its bigger size the ornamentation of

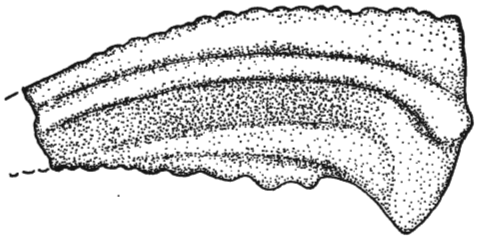


Fig. 6
Portunidae gen. et sp. indet.
Dactylus of left chela; outer surface; locality Pińczów (*cf.* Pl. 3, Fig. 4)

the surface is coarser, particularly on the upper margin. All these dactyli show close relationships to fingers of the genus *Macropipus*, a common crab in the Badenian of the Paratethys basins.

Superfamily **Xanthoidea** Dana, 1851
Family **Xanthidae** Dana, 1851
Genus *PILUMNUS* Leach, 1815
Pilumnus sp.
(Text-fig. 7 and Pl. 2, Fig. 2)

Material: Two fragments of carapaces from Grobie.

Discussion. — The two remains, being the internal moulds, show the anterior parts of the carapace only. Carapace transversely oval, nearly 1.3 as wide as long. Front bilobated with median fissure. Five sharp teeth on antero-lateral margin. Distinc epigastric lobes; mesogastric and wing-shaped urogastric regions well defined, other regions less well marked. Cervical groove median deep, fading antero-laterally.

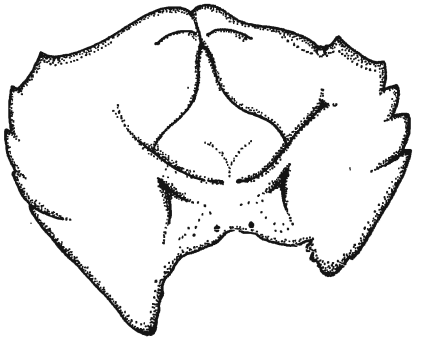


Fig. 7

Pilumnus sp.

Fragment of crushed and deformed carapace, internal mould; locality Grobie (*cf.* Pl. 2, Fig. 2)

The genus *Pilumnus* is known by at least two species from the Middle Miocene. Remains have been recorded repeatedly from the Paratethys basins (Glaessner 1928, p. 190; Lörenthey & Beurlen 1929, pp. 191 and 225; Bachmayer 1953, p. 253; Müller 1974, 1975, 1976). The two investigated fragments differ by their deep grooves and better marked regions, a fact, common in internal moulds of *Pilumnus* as stated already by Bachmayer (1953, 253). A significant difference, however, is the occurrence of 5 teeth on the antero-lateral margin. The species *P. mediterraneus* (Lörenthey) has only three, and *P. telegdii* Müller four teeth, but Lörenthey & Beurlen (1929, Pl. 12, Fig. 14) figured another carapace with 5 teeth.

The numerous remains of stout, short chelae, usually fragments of the smooth palmae only, in the same detritic limestones, in which the carapaces occur, may be probably chelae of *Pilumnus*.

Genus *ERIPHIA* Latreille, 1817
?*Eriphia* sp.
(Text-figs 8—11 and Pl. 2, Figs 1 and 7, and Pl. 3, Fig. 5)

Material: 20 fragments of the fixed and 21 of the movable finger of the right chela from Nawodzice (*cf.* Text-figs 8—9; one fixed finger, right chela from Niskowa; two fixed and 4 movable fingers, right, and one movable finger, left chela from Szczaworyż (*cf.* Text-figs 10—11).

Description. — Fragments of remarkable large fingers (movable finger about 34 mm, that means a total length of the chela of about 70 mm) show close relationships to fingers of the Recent species *E. spinifrons* (Herbst). Usually the cutting edge of the robust right chela, the crusher claw, is preserved only.

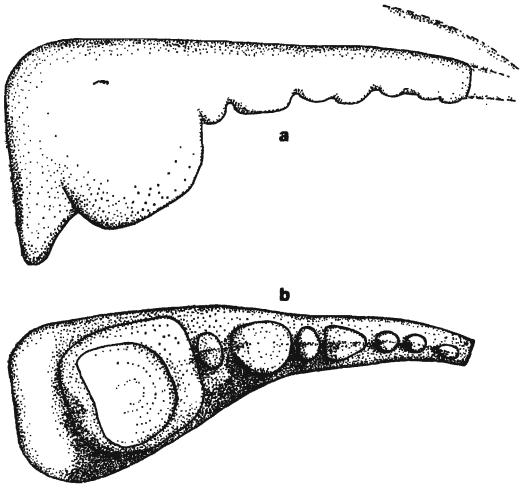


Fig. 8
?Eriphia sp. *A*
Fragment of a right dactylus; views of outer surface (*a*) and cutting edge (*b*); locality Nawodzice

Dactylus curved slightly inward. Surface smooth, tubercles only on the proximal part of the upper margin. Inner surface proximal with two grooves, separating a medial ridge; upper groove fading out rapidly. Outer surface with two rows of elongated pits. Further pits joining the base of the teeth on both sides. Teeth unequal, diminishing gradually in size toward tip (**1112134**). Proximal tooth large, broadened and raised, subsquare in outline and directed backward.

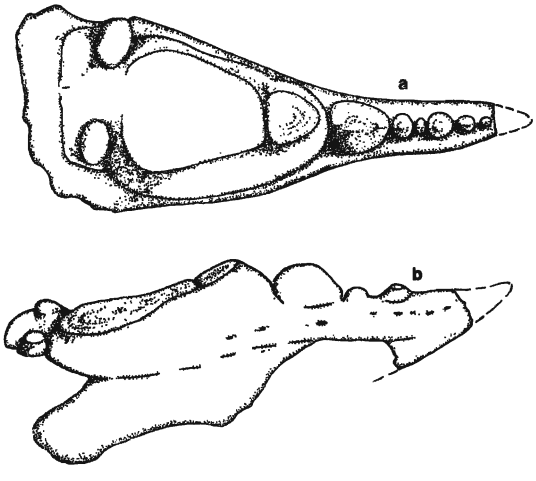


Fig. 9
?Eriphia sp. *A*
Fragment of fixed finger, right chela; views of cutting edge (*a*) and outer surface (*b*); locality Nawodzice (*cf.* Pl. 3, Fig. 5)

The fixed finger is short and robust; inner surface with two rows, outer surface with one medial row of pits. Cutting edge proximal of third (or fourth) tooth broadened to a large subtriangular platform, original formed by three teeth (one at the inner, two at the outer edge). Proximal of this usually strongly worn-out platform two small, laterally placed teeth.

There are, however, some similarities to the fingers of the genera *Menippe* and *Pilumnus*. But both lack the extraordinary enlargement of the proximal tooth of the fixed finger as well as the movable finger.

Some fragments from the same localities may belong to the smaller nipper claw of *Eriphia*. Dactylus moderately downward and inward curved. Surface

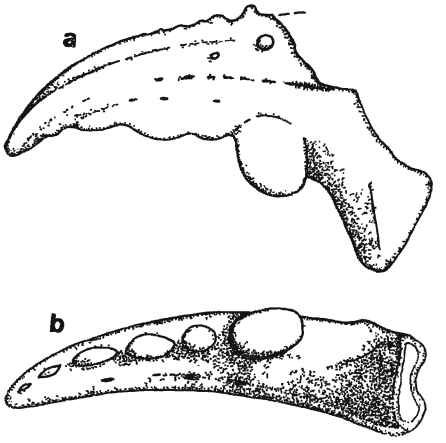


Fig. 10
?*Eriphia* sp. *A*
Fragment of a left dactylus; views of outer surface (*a*) and cutting edge (*b*); locality Szczaworyż (*cf.* Pl. 2, Fig. 1)

smooth with one deep medial groove on the inner and two on the outer surface, forming a rounded ridge on it. Teeth of the cutting edge diminishing gradually in size toward the tip.

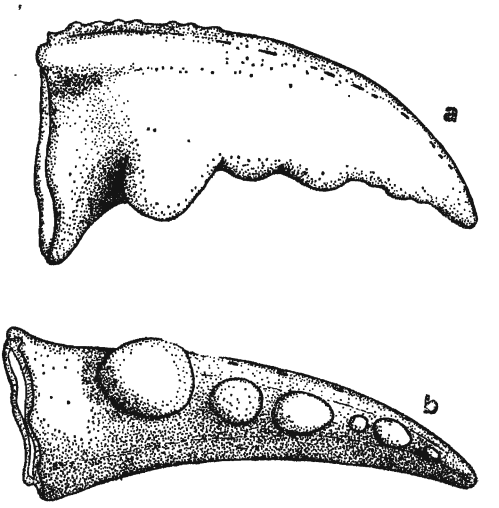


Fig. 11
?*Eriphia* sp. *A*
Dactylus of right chela; views of outer surface (*a*) and cutting edge (*b*); locality Szczaworyż (*cf.* Pl. 2, Fig. 7)

Index much shorter and increasing rapidly in height. Inner surface with one prominent medial ridge, outer surface with two ridges, converging toward tip and enclosing a triangular depression.

?*Eriphia* sp. *B*
(Pl. 2, Fig. 4)

Material: Three fragments of right chelae from Busko.

Remarks. — The three fragments (length 36, width 28, thickness 16 mm) resemble the chelae of *Eriphia sp.*, figured by Glaessner (1933, p. 3 and Pl. 1, Fig. 2) from the Miocene of Malta in their robust shape. They differ in the existence of a row of small tubercles at the upper margin of the inner surface, a feature common in Recent species. The chelae lack the proximal broadening of the cutting edge, characteristic for the crusher claw, but absent in the nipper claws of *Eriphia.*

?*Eriphia* sp. *C*
(Text-fig. 12 and Pl. 1, Fig. 2)

Material: Three right palmae from Grobie.

Remarks. — The small right palmae (length 7.5; width 5.7; thickness 3.7 mm) resemble in shape and sculpture the chelae of *Eriphia,* though the fingers are not preserved. Upper margin and outer surface spinose, inner surface flattened, smooth

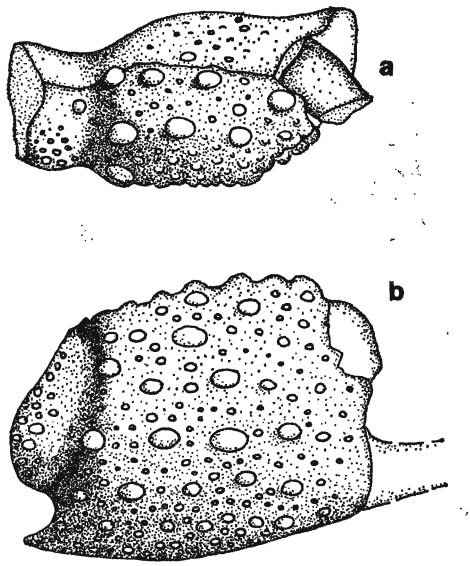


Fig. 12
?*Eriphia* sp. *C*
Right palma; views of upper margin (*a*) and outer surface (*b*); locality Grobie (*cf.* Pl. 1, Fig. 2)

and in the dorsal region with tubercles only. Carpus with the same subtriangular cross-section and dorsal flattened margin as in Recent species. Chelae of *Actaea* show usually a more uniform ornamentation with larger and blunt tubercles.

?*Eriphia* sp. *D*
(Text-fig. 13 and Pl. 1, Fig. 1)

Material: One internal mould of a carapace from Grobie.

Description. — Carapace wider than long (length 13.1; width 18.5 mm; w/l 1.41). Frontal margin bilobated with a medial fissure. Distance between orbita

relatively narrow, thereby antero-lateral margin wide, semicircular, with 4 teeth. Grooves and regions extraordinary well defined. Distinct epigastric lobes, subtriangular hepatic region, smooth and uniform arched, with an oblique, straight against third antero-lateral tooth tending ridge-like anterolateral margin. Epibranchial region arched, separated by a distinct groove from mesobranchial region, which in turn is separated by another sinuous groove from metabranchial region. A further short but distinct groove on postero-lateral metabranchial region. Nar-

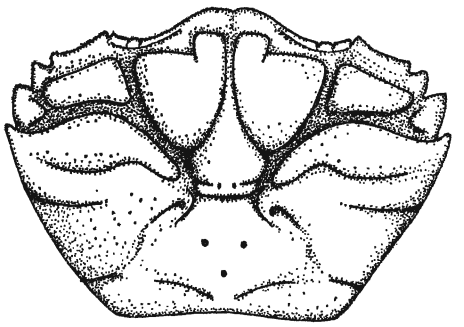


Fig. 13
?Eriphia sp. *D*
Internal mould of carapace; locality Grobie
(*cf.* Pl. 1, Fig. 1)

row, wing-shaped urogastric, pentagonal cardiac region with three protuberances. Well marked intestinal region, parallel to posterior margin, medial divided by depression.

Remarks. — The peculiar modification of the branchial regions and the ridge--like antero-lateral margin of the hepatic region, unique in all compared Recent and fossil carapaces, pretend a special taxonomic position. Internal moulds of *Eriphia,* however, particularly of the Carribean *E. gonagra* Fabricius, show a comparable pattern of grooves and regions. Divergent phenomenons, and strange not only for the genus *Eriphia,* are the extraordinary deep posterolateral groove of the metagastric region, the straight, ridge-like antero-lateral margin of the hepatic region, and the narrow position of the orbita. A similar outline of the carapace with narrow placed orbita and a wide semicircular antero-lateral margin show the genera *Menippe, Chlorodiella* or *Panopeus,* among which *Panopeus* shows the closest affinities. The genus *Panopeus* differs in a well marked branchiocardiac groove, extending from the lateral gastrocardiac markings of the attractor epimeralis muscle to the fourth (last) tooth of the anterolateral margin of the carapace and in a vague urogastric region, which is joined with the mesogastric region.

Among fossil crabs the investigated specimen resembles the genera *Laevicarcinus* and *Titanocarcinus.* The dubious genus *Laevicarcinus* lacks the teeth on the merely arcuate antero-lateral margin and the groove of the metabranchial region. The genus *Titanocarcinus* shows a well delimited triangular mesobranchial region and a well defined brachiocardiac groove, posterior to epi/mesobranchial regions. The species *"T." vulgaris* Glaessner, a common crab in the Middle Miocene of the Paratethys basins, differs obviously in its modified epi/mesobranchial regions, splitted into four distinct regions. It must be refered better to the genus *Xantho.* Only new and better preserved specimens may help to clarify the generic position of this unique remain.

Genus *XANTHO* Leach, 1804
Xantho cf. *vulgaris* (Glaessner, 1928)
(Text-figs 14—15 and Pl. 3, Figs 1—3 and Pl. 4, Figs 1—4)

Material:
crusher claw right: 36 dactyli, 11 fixed fingers from Łychów
crusher claw left: 12 dactyli, 2 fixed fingers from Łychów
nipper claw left: 24 dactyli, 9 fixed fingers from Łychów
nipper claw right: 3 dactyli, 4 fixed fingers from Łychów
crusher claw right: 1 dactylus from Skotniki
crusher claw right: 1 dactylus from Pińczów

Description and remarks. — The abundant fingers (total 101 specimens) from Łychów can be refered to two types of chelae; most of them belong to the robust crusher claw (61), the remainder to the more slender nipper claw of a crab closely related to the Recent *Xantho floridus* (Mont.). As in *Xantho floridus* the right chela is usually the major (crusher) claw, the left chela the nipper claw. The material from Łychów show however a reverse development too. The principal difference between the fossil fingers and those of the Recent species is the existence of a strong tooth at the base of the dactylus.

Fingers moderately downturned and slightly curved inward; laterally flattened, in cross-section rounded rectangular. Surface smooth with a fine granulation. Dorsal margin joined by a row of pits (inside and outside). Cutting edge flanked

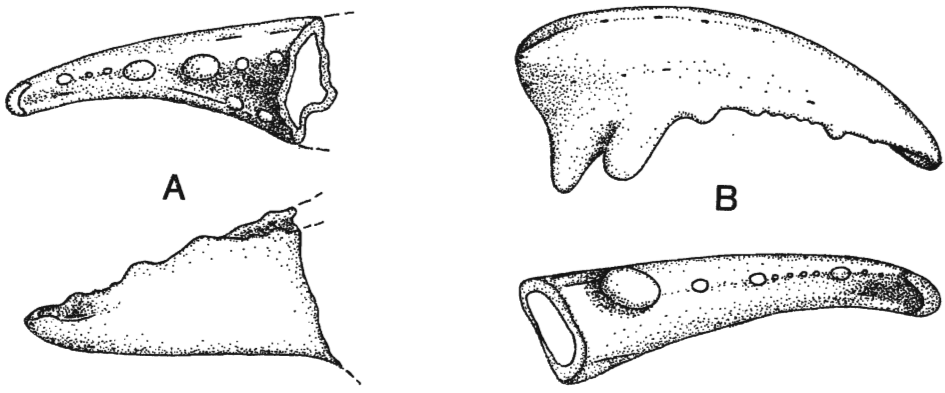
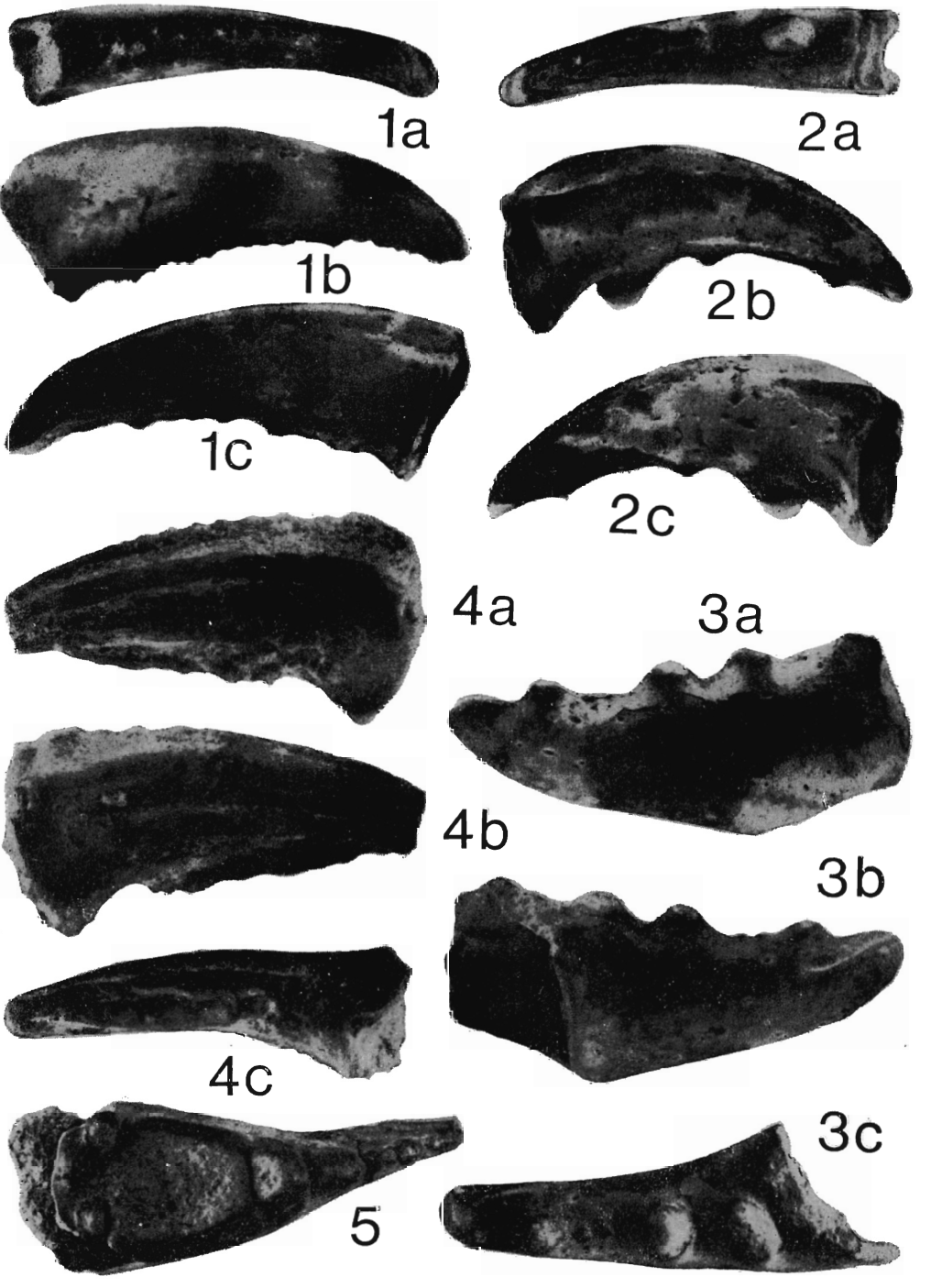
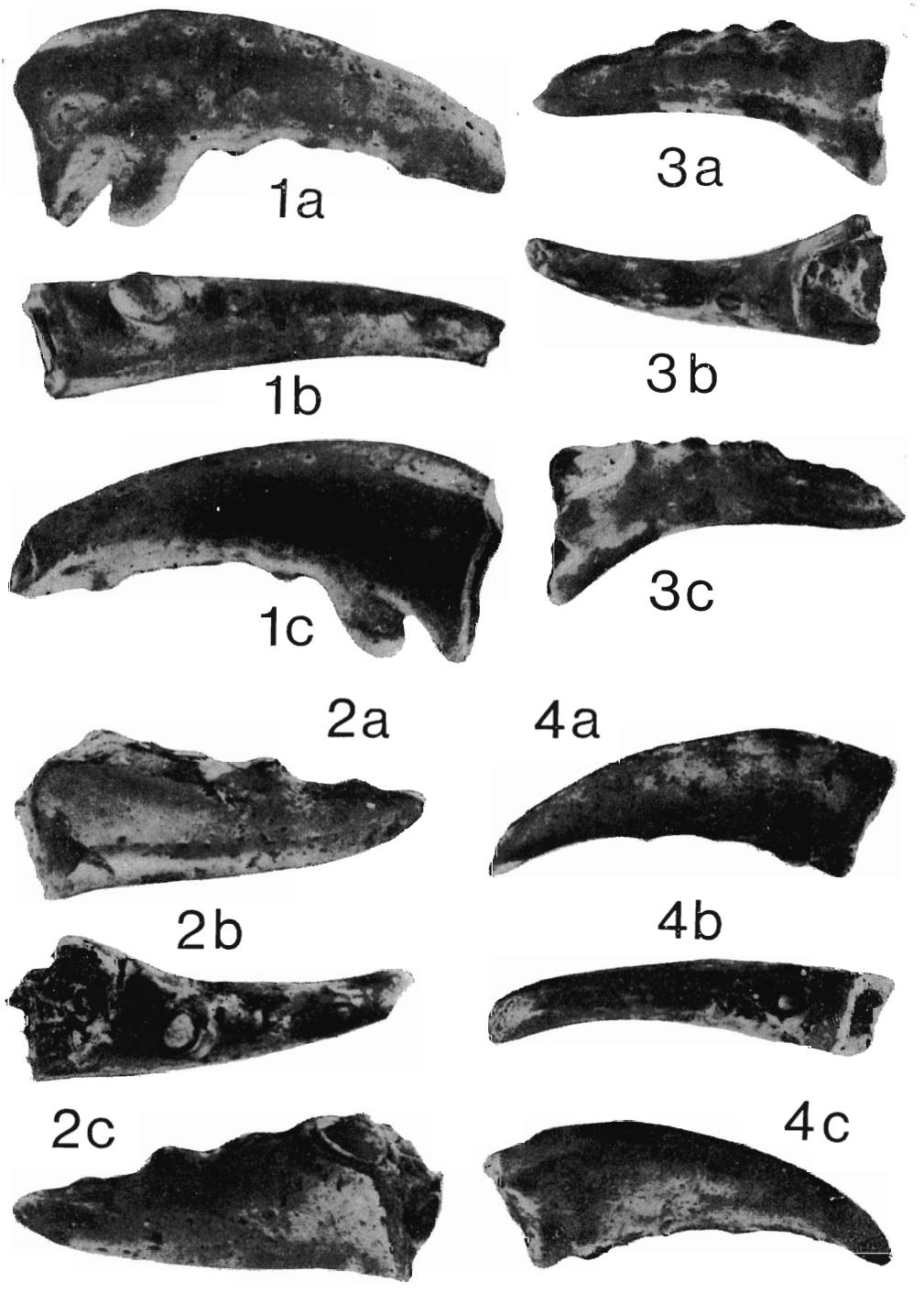


Fig. 14. *Xantho* cf. *vulgaris* (Glaessner)
Crusher claw, right chela; *A* fixed finger, views of cutting edge and inner surface; *B* dactylus, views of outer surface and cutting edge; locality Łychów (*cf.* Pl. 4, Figs 1—2)

PLATE 3

1—3 *Xantho* cf. *vulgaris* (Glaessner) from gastropod coquina at Łychów × 4; *1* dactylus of right chela (nipper claw); views of cutting edge *(a)*, outer *(b)* and inner surface *(c)*; *2* dactylus of left chela (crusher claw); views of cutting edge *(a)*, inner *(b)* and outer *(c)* surfaces; *3* fixed finger of left chela (crushed claw); views of outer *(a)* and inner *(b)* surfaces, and cutting edge *(c)*
4 — Portunidae gen. et sp. indet.; dactylus, left chela; views of outer *(a)* and inner *(b)* surfaces, and cutting edge *(c)*; marly limestone, Pińczów; × 6
5 — ?*Eriphia* sp. *A*; fixed finger of right chela; view of cutting edge; coarse-grained sands; Nawodzice; × 2


1a
2a
1b
2b
1c
2c
4a
3a
4b
3b
4c
5
3c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by a second row of pits, on the outer surface only weak or sometimes absent; on the inner surface more distinct on the distal part and ending in a deep elongated pit of the spoonshaped cavity behind the tip. Cutting edges at the external margin.

Dactylus of the crusher claw with unequal teeth, irregularly diminishing in size toward the tip (**11311234**). Usually a prominent tooth just above the pit of the cavity. Last (proximal) tooth enlarged and high grown, directed backwards/ /outwards, a feature rare in Recent representatives of the genus *Xantho*, but common in *Eriphia* or *Pilumnus*. The laterally compressed, subrectangular cross-section, however, the spoon-shaped tip and even the dentation, particularly that of the nipper claw resemble much more the fingers of *Xantho* than *Eriphia*, *Pilumnus* or *Titanocarcinus*.

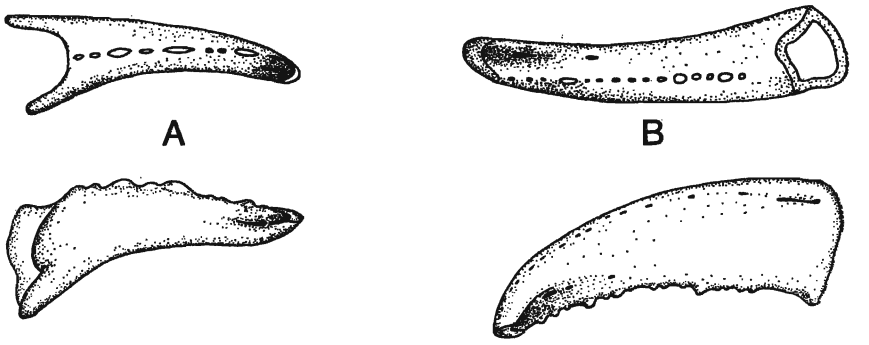

Fig. 15. *Xantho* cf. *vulgaris* (Glaessner)
Nipper claw; views of cutting edge and inner surface; *A* fixed finger of left chela; *B* dactylus of right chela; locality Łychów (*cf.* Pl. 3, Fig. 1 and Pl. 4, Fig. 3)

Fixed finger of crusher claw: tip spoon-shaped and slightly curved inward. Teeth irregular, with a prominent tooth behind the spoonshaped cutting edge of the tip. Proximal (basic) part broadened over the total width of the finger, with two stronger teeth at the outer margin and a or two smaller teeth inside.

Both fingers of the nipper claw are much more slender, but with the same spoon-shaped and slightly inward curved tip, and the prominent pit in the cavity behind the tip. Cutting edges near outer margin, acute and gradual tapering. Dactylus with fine irregularly spaced teeth, diminishing gradually in size toward tip. Fixed finger with acute prehensile edge over total length; acute elongated teeth, irregularly alternating with smaller teeth.

A comparative examination with fingers of *Xantho vulgaris* (Glaessner) yielded no significant differences without regard to the larger size of the Łychów specimens (Förster 1979).

PLATE 4

1—4 — *Xantho* cf. *vulgaris* (Glaessner) from gastropod coquina at Łychów; views of outer surface *(a)*, cutting edge *(b)*, and inner surface *(c)*; × 4

1 dactylus rgiht chela (crusher claw); *2* fixed finger of right chela (crusher claw); *3* fixed finger of left chela (nipper claw); *4* dactylus of left chela (nipper claw)

Superfamily **Ocypodoidea** Rafinesque, 1815
Family **Ocypodidae** Rafinesque, 1815
Subfamily **Macrophthalminae** Dana, 1852
Genus *MACROPHTHALMUS* Desmarest, 1823
Macrophthalmus vindobonensis Glaessner, 1924
(Text-fig. 16 and Pl. 2, Figs 5—6)

1924. ***Macrophthalmus vindobonensis*** **n.sp.; Glaessner; p. 109, Fig. 1 ab.**
1928. ***Macrophthalmus vindobonensis*** **m.; Glaessner; p. 196.**
Material: 3 internal moulds from Niskowa.

Measurements (mm):

carapace (without rostrum) length	width	width/length
8.9	15.5 (deformed)	1.74
7.9	10.6	1.34
6.1	8.3	1.36

Description. — Carapace subrectangular, flat, wider than long; maximum width at extraorbital spine; a second, smaller lateral spine behind first transversal groove. Rostrum wing-shaped, bilobated and slightly down turned; anterior margin sinuous. Regions well defined by deeply impressed grooves. Meso/protogastric region anteriorly divided by a medial depression — the continuation of the rostral groove, which separates slightly elevated epigastric lobes. Well defined hepatic, epi- meso- and metabranchial regions, distinct pentagonal urogastric/ /cardiac region. Intestinal region separated by a deep longitudinal depression from metabranchial region. Surface smooth with weak granulation.

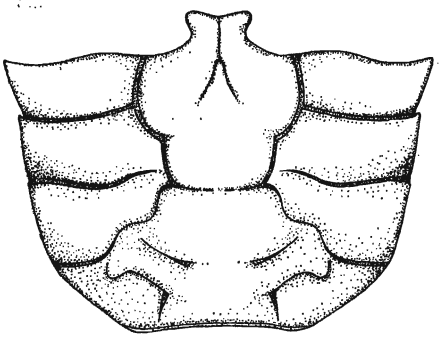

Fig. 16
Macrophthalmus vindobonensis
Glaessner
Internal mould of carapace; locality Niskowa (*cf.* Pl. 2, Fig. 6)

Remarks. — The three specimens from Niskowa are internal moulds, differing from the older ("Helvetian") specimens of Glaessner only by their smaller size. The differences in the length/width ratio in the three Niskowa specimens and between the Carpathian and Vienna material may be caused by compaction effect in the deposits at Niskowa.

Nearly the same ratio (1.4) can be observed in the second Miocene species, *M. aquensis* Milne-Edwards & Brocchi from the Upper Vindobonian of Aix-en--Provence, SE-France. According to the schematic figures of Remy (1952, p. 29, Fig. 1), the only figures of the species, it is closely related to *M. vindobonensis*. Compared with Recent species of the genus *Macrophthalmus* the two Miocene species differ obviously in their sub-rectangular carapaces, which are not yet so much transversally broadened as in the Recent species, and in a better delimitated urogastric and intestinal region.

Table 1

Decapod crustacean material from the Middle Miocene (Badenian) deposits of Southern Poland

Locality \ Material	Fingers Abbreviations: P – palma, D – dactylus, I – fixed finger, Ch – chela		Carapaces	
FORE-CARPATHIAN DEPRESSION				
SOUTHERN SLOPES OF THE HOLY CROSS MTS:				
PIŃCZÓW	Paguridae	2 D		
	Portunidae	1 D		
	Xantho sp.	1 D		
	Cancer sp.	1 D		
SKOTNIKI	*Xantho* sp.	1 D		
BUSKO	*?Eriphia* sp. *B*	3 P	*Portunus granulatus*	1
	Xanthoidea	1 D		
SZCZAWORYŻ	Paguridae	6 D		
	Xantho sp.	1 D		
	?Eriphia sp. *A*	6 D, I		
GROBIE	*?Eriphia* sp. *C*	3 P	*?Eriphia* sp. *D*	1
	Pilumnus sp.	7 P	*Pilumnus* sp.	2
NAWODZICE	*Callianassa kerepesiensis*	3 P		
	?Eriphia sp. *A*	41 D, I		
	Cancer sp.	8 D, I		
LUBLIN UPLAND:				
ŁYCHÓW	*Xantho* cf. *vulgaris*	101 I, D		
CARPATHIANS				
NISKOWA	Paguridae	1 D		
	Portunus granulatus	2 Ch	*Portunus granulatus*	1
	Portunidae	1 D	*Macrophthalmus vindobonensis*	3
	Xantho sp.	6 D		
	?Eriphia sp. *A*	1 D	*Dorippe? carpathica*	1

References to the localities

PIŃCZÓW: detrital (bryozoan-redalgal) limestones of the *Leithakalk* type; general comment on facies development and organic communities presented by Radwański (1969, p. 53), faunistic data and lists of fossils by Kowalewski (1930, pp. 54—55), some additional data on fossil content by Radwański (1977a);

SKOTNIKI: similar limestones of the *Leithakalk* type overlying littoral conglomerates (*see* Radwański 1969, p. 45);

BUSKO: marly limestones and marls with redalgal detritus and large foraminifers (*see* Radwański 1969, pp. 49—51 and Text-fig. 21);

SZCZAWORYŻ: limestones of the *Leithakalk* with marly intercalations (*see* Kowalewski 1930, pp. 54—55);

GROBIE: similar limestones with coral patches of *Tarbellastraea reussiana* (Milne-Edwards & Haime) amongst colonies of which the decapod remains occur (*see* Wrona 1970);

NAWODZICE: coarse-grained sands with a rich faunal assemblage (unit *2* in the section) of diverse fossils buried either *in situ* or redeposited; the decapod remains belong to that latter group (*see* item *8* in Bałuk & Radwański 1968, Text-fig. 3; item *h* in Radwański 1970, Text-fig. 3; general remarks also in Radwański 1973, pp. 396—399);

ŁYCHÓW: coquinas composed of shells of herbivorous gastropods; ecological analysis of the community presented by Hoffman & *al.* (1978); some additional data on fossil content by Radwański (1977a);

NISKOWA: fine-grained sandstones and siltstones of layer *18* in the section analysed by Bałuk (1970, Text-fig. 3 and pp. 111, 127 and 153—154).

ECOLOGICAL AND BIOGEOGRAPHICAL REMARKS

In comparison to the decapod assemblage of the Korytnica basin (see Förster 1979), the composition of the discussed fauna shows some significant differences: the occurrence of genera indicative of littoral and nearshore environments. Remains of crabs from the upper beach zone are absent in the fauna, though burrows attributable to the ghost crab *Ocypode* are common in the marly sands at Chomentów (Radwański 1977a,b). The record of the genus *Ocypode* represented by the body fossils, however, is narrow and the genus has been traced back into Pleistocene times only (Rathbun 1935, Secretan 1958, Via 1976), caused by the unfavourable conditions of preservation in the upper beach environment.

The sandflats of the littoral zone and the lagoonal mudflats are represented by *Callianassa* and *Macrophthalmus,* and, to a certain extent, by Paguridae, *Eriphia,* and *Xantho.* The remaining genera, always compared to their Recent representatives, are inhabitants of shallow to deeper water, though generally not exceeding a depth of more than 100 meters.

The fragmentary preservation, insufficient for identification to a specific level in most of the remains, and the small number of species altogether, make a biogeographic analysis problematical. Nevertheless, the occurrence of the genus *Macrophthalmus* with a distribution in the subtropical/tropical Indo-Pacific exclusively, indicates closer affinities to the Recent decapod fauna of this realm. This Indo-Pacific affinity is supported by the occurrence of *Dorippe,* a genus with a prevailing distribution in the Indo-Pacific nowadays. The decapod fauna confirm thus the relationships already stated by the analysis of the other organic assemblages (*see* Bałuk & Radwański 1977, pp. 116—117).

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