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A new littoral locality within the Middle Miocene (Badenian) Korytnica Basin (Holy Cross Mountains, Central Poland)

ABSTRACT: The first littoral locality connected with the sediments overlying the Korytnica Clays in the southern part of the Korytnica Basin (Middle Miocene, Badenian; Holy Cross Mts, Central Poland) is described. Sedimentological and ecological premisses show that the discussed littoral structures originated in an environment of energy higher than those associated with the Korytnica Clays. It is also suggested that the present-day extent of the Badenian deposits is of erosional nature and cannot be directly used as a base for paleogeographical reconstruction.

INTRODUCTION

During fieldwork carried out in summer 1981, the authors found a new locality with littoral structures of Middle Miocene (Badenian) age. It is situated on a hill between the villages Karsy and Korytnica, and called the locality *VI* (see Text-fig. 1), being a part of the Karsy-Staniewice Ridge which bordered the Middle Miocene (Badenian) Korytnica Basin from the south (RADWAŃSKI 1969, BAŁUK & RADWAŃSKI 1977).

Littoral structures, *i.e.* abrasion surfaces and littoral rubbles are very common along the shores of the Korytnica Bay developed during the Badenian transgression onto the southern slopes of the Holy Cross Mountains. A detailed study has led to paleogeographical reconstruction of the Badenian shoreline of the Bay as well as of the whole coast of the Cracow and Miechów Uplands and of the Holy Cross Mountains (RADWAŃSKI 1968, 1969, 1973). The aim of this paper is to revise the paleogeographical reconstruction of a part of the Korytnica Bay in the light of a discovery of marine sediments on the area treated previously as an island (RADWAŃSKI 1969), and to show some aspects of rock-borer communities succession caused by environmental factors.

RECONSTRUCTION OF SEDIMENTARY ENVIRONMENT

Many littoral pebbles or cobbles bored by rock-borers occur over the fields near Karsy. Material which builds littoral rubbles originated from a local substrate, *i.e.* pelitic and coquinal limestones of Lower Kimmeridgian age (*cf.* MACHALSKI 1983). Moreover, blocks of organodetrital limestone have been found. They are composed of red-algal and bryozoan detritus, foraminifers and calcite-skeletal remains of polychaetes, echinoderms, and bivalves (*see* Pl. 2, Fig. 3). Original aragonitic shells have been dissolved and they appear in a form of moulds and/or imprints. Many pebbles and cobbles infected by rock-borers are stuck within this limestone, and usually encrusted by corallines; they often constitute nuclei of rhodoids [1] (Pl. 2, Figs 1—2).

The discussed locality should be correlated with marly sands overlying the Korytnica Clays in the central part of the Basin (*see* Text-figs 2—3 *in* GUTOWSKI 1984), whereas all the previously known littoral localities in the Korytnica Zone were connected with clay sedimentation (*cf.* RADWAŃSKI 1969).

The recognized deposits are only an erosional residuum of sediment cover that was originally greater. It is evidenced by a finding of a single block of an oolitic Kimmeridgian limestone bored by Badenian rock-borers on the SE slope of the Mt. Grodzisko (*see* Text-fig. 1), near the discussed area.

The rock-borer community (lithophocoenosis *sensu* RADWAŃSKI 1964, 1965, 1969) from locality *VI* consists of [2]: *Jouannetia semicaudata* (des MOULINS), *Lithophaga* sp., *Aspidopholas* sp., *Cliona vastifica* HANCOCK, *Potamilla reniformis* (O. F. MÜLLER), *Polydora ciliata* (JOHNSTON), *Cliona celata* GRANT, *Gastrochaena* sp., and *Botula* sp. Most of the bivalve borings are empty or filled with red-algal limestone. Only in few borings the moulds of their producers, *Jouannetia semicaudata* (des MOULINS) and *Botula* sp., were found. The genus *Botula* MÖRCH, 1853, of the family *Mytilidae* is represented by one specimen (Pl. 1, Fig. 1a-1d); it is recognized for the first time in the Badenian littoral structures of Poland. This specimen is similar to *"Lithodomus (Botula) subcordata* (d'ORBIGNY)" from the Miocene of the Aquitanian Basin (COSSMANN & PEYROT 1914), but the investigated material makes specific assignation impossible.

The lithophocoenosis from the locality *VI* differs from those previously known from the Korytnica zone, *e.g. I, II* lying nearest to VI (*see* RADWAŃSKI 1969 and Text-fig. 1), by an almost complete absence of *Gastrochaena* sp. This is probably

[1] The term rhodoid is accepted according to classification given recently by PERYT (1983).

[2] The composition is given according to the frequency of particular borings.

caused by ecological factors. According to RADWAŃSKI (1970), *Gastrochaena* densely bored preferably in quiet waters and was confined to terminal parts of bays or tresholds in marginal zones of bays. Similar pattern of distribution is observed in the recent reefs of Bermuda (BROMLEY 1978).

The development of abrasion and sedimentation in the discussed part of the Karsy-Staniewice Ridge is interpreted (Text-fig. 2) as follows.

Relatively quiet conditions during the Korytnica Clays deposition (stage *A* in Text-fig. 2) were reflected in the taxonomic composition and the state of preservation of lithophocoenosis connected with the Clays (*see* RADWAŃSKI 1969, BAŁUK & RADWAŃSKI 1977). The bivalve *Gastrochaena* played in all these communities a very important role.

Sedimentary environment of marly sands overlying the Korytnica Clays (stage *B* in Text-fig. 2) was characterized by high hydrodynamic activity among which storms were the most significant (GUTOWSKI 1984). Heavy storms also led to the increasing abrasion of the Karsy-Staniewice Ridge. Abrasion surfaces and littoral rubbles were occupied by lithophocoenosis in which only single individuals of *Gastrochaena* occurred.

The corallines probably encrusted abrasion surfaces and/or parts of rocky slopes not covered by earlier sediments. Parts of such crusts were broken off and colonized by corallines to form laminar rhodoids typical of high energy environment (*cf.* BOSENCE 1983). Usually, they are abraded and reach a size of about to 3 cm. Greater rhodoids have large nuclei being the Jurassic pebbles. Corallines constitute here a thin crust around the pebbles and are represented by a few lamines only (Pl. 2, Fig. 1).

Littoral pebbles and cobbles have been rolled down into deeper parts of the Basin. Single pebbles and cobbles occur within marly sands at Korytnica and red-algal detrital limestones at Chomentów (RADWAŃSKI 1969, 1977; GUTOWSKI 1984). Lately, Quaternary erosion of loose sandy deposits may have led to accumulation of littoral pebbles and cobbles in the form of residuum exposed over a cropland (locality *V* of RADWAŃSKI 1969; *see* Text-fig. 1, and stage *C* in Text-fig. 2).

REMARKS ON PALEOGEOGRAPHY

The most significant fact concluded directly from the discovery of littoral structures near Karsy is a submersion of this part of the Karsy-Staniewice Ridge during the Badenian transgression. However, the ridge constitued undoubtedly a positive element of the submarine morphology and thus the Korytnica Basin could have been separated from the open sea to the south (*cf.* RADWAŃSKI 1969, BAŁUK & RADWAŃSKI 1977). It may also be supposed that similar deposits are covered by Quaternary deposits somewhere else along the Karsy-Staniewice and the Chomentów Ridge.

The red-algal limestone facies connected with littoral rubbles and abrasion surfaces was probably developed over a greater area than it can be indicated by its present-day lateral extent. These deposits were strongly eroded during the next period of the history of the Basin. Red-

-algal detritus is the main component of the "detrital Sarmatian" gravels deposited on the foreland of the Korytnica Bay and of the whole Holy Cross shores as a result of a eustatic uplift of this area, its strong erosion and redeposition of detrital material to the south (RADWAŃSKI 1973, RUTKOWSKI 1976). Red-algal limestones were also destroyed during the Pleistocene glaciations. Abundant red-algal detritus was found within the moraines near Strawczyn (30 km N from Korytnica), produced during invasion of a lobe of Scandinavian icesheet from the south (LINDNER 1977).

For a paleogeographical reconstruction it must be considered that the post-Badenian inversive block movements gave the present shape to the Basin, modifying particularly its western part, near Niziny (SZYMANKO & WÓJCIK 1982). It is also impossible to conclude directly about the Badenian paleogeography using only a present-day morphology of Mesozoic substrate.

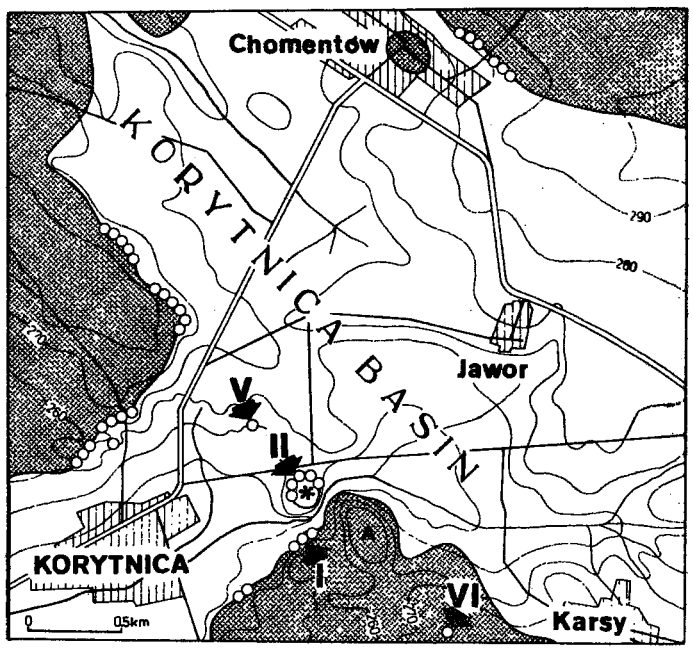

Fig. 1. Geological sketch of the Korytnica Basin

Indicated are: present-day outcrops of the Middle Miocene (Badenian) and Quaternary sediments *(blank)*; preserved fragments of littoral structures *(circles)*; ridges of the substrate, composed of the Jurassic limestones *(hachured)*

Asterisked is the summit of Mt. Łysa; marked with black triangle is the summit of Mt. Grodzisko

I, II, V, VI — littoral structures discussed in the text (*I, II, V* assigned the same as by RADWAŃSKI, 1969)

Taking into account these facts, it is assumed that the present-day extent of Badenian sediments as well as of littoral structures is of erosional nature. The Badenian sea extended probably somewhat further to

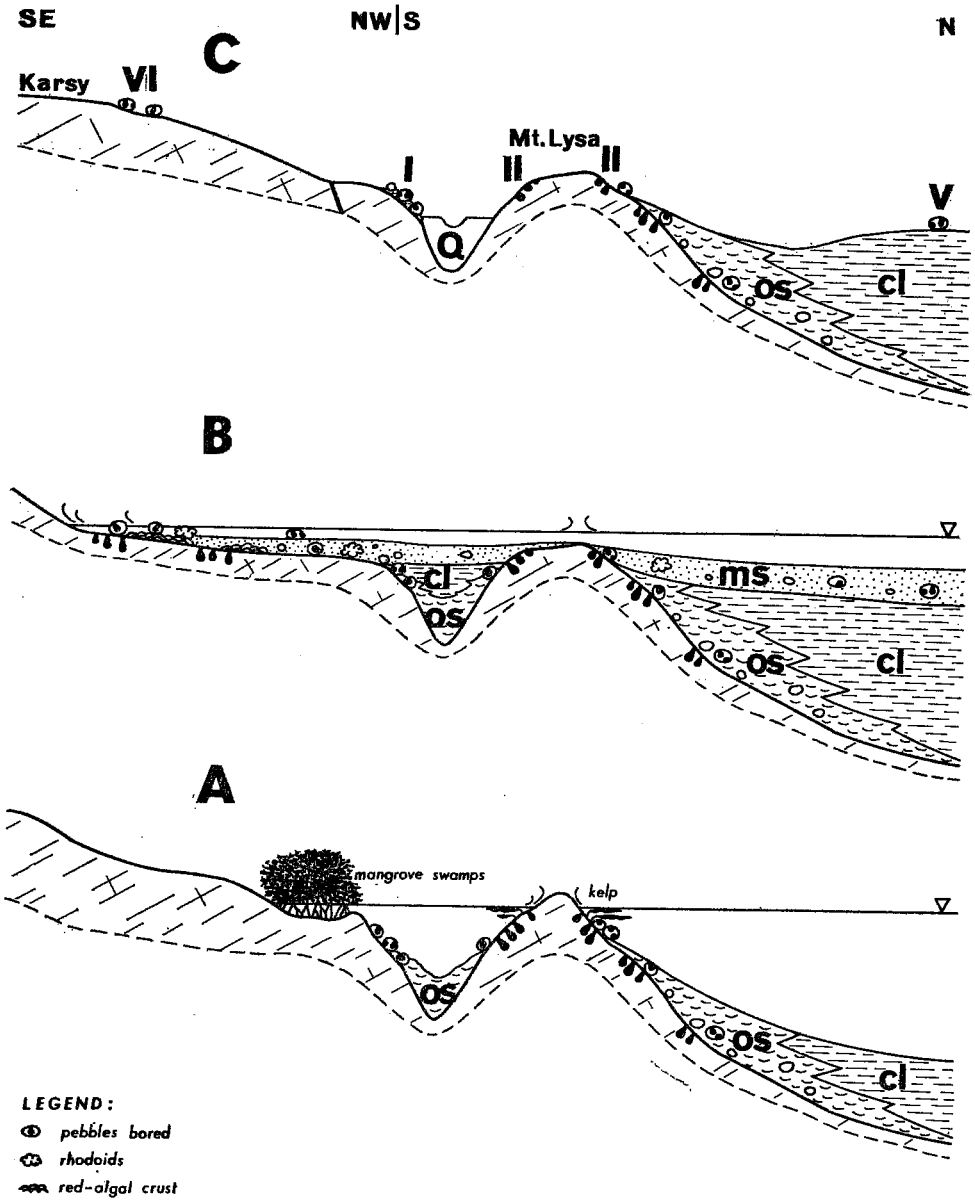

Fig. 2. Idealized sections through the Karsy-Staniewice Ridge, to show the successive developmental stages (*A*, *B*, *C*) of this part of the Korytnica Basin (stage *A* after BAŁUK & RADWAŃSKI 1977, Text-fig. 5)

Middle Miocene (Badenian) sediments: *cl* — Korytnica Clays, *os* — oyster shellbed, *ms* — marly sands; **I, II, V, VI** — littoral structures (*cf.* Text-fig. 1), **Q** — Quaternary; further explanations in the text

the NW than it has been marked by RADWAŃSKI (1969). The presence of an isolated exposure of Badenian marine deposits at Wierzbica, corresponding to the Korytnica Clays (KOWALEWSKI 1930; RADWAŃSKI 1967, 1969), can be well explained in the light of this interpretation.

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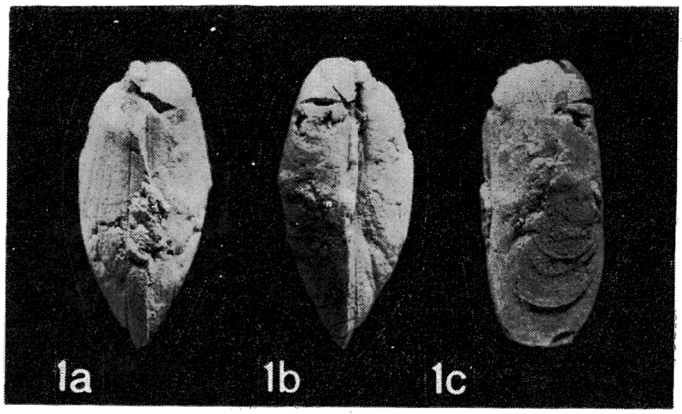
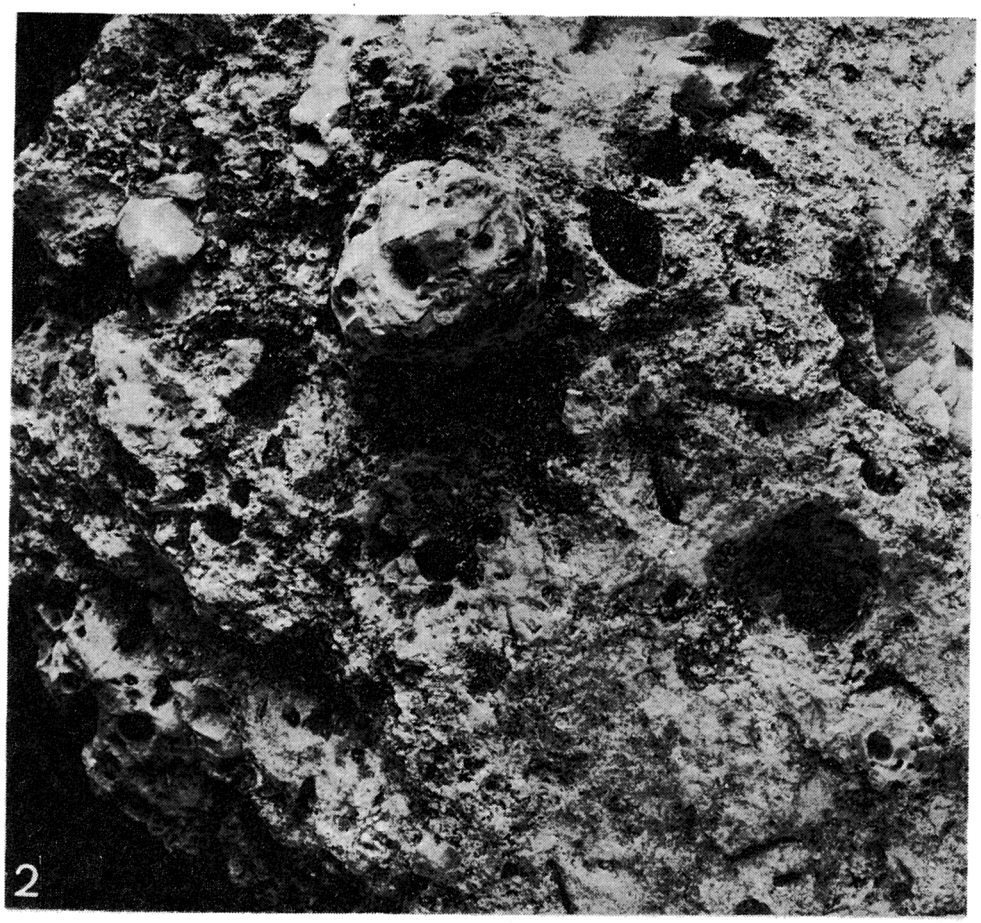
NOWE STANOWISKO UTWORÓW LITORALNYCH W BASENIE KORYTNICY

(Streszczenie)

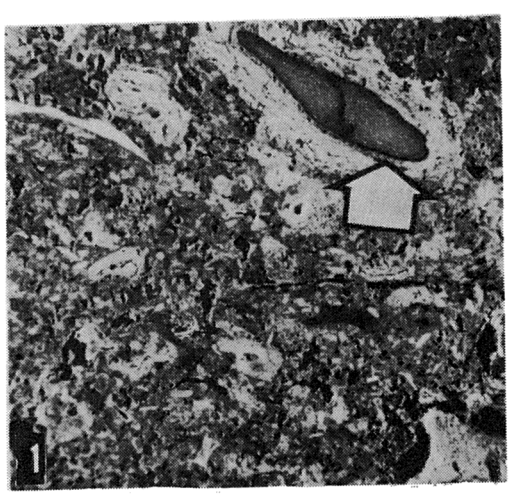
W pracy opisano nowe stanowisko litoralne związane z utworami pokrywającymi iły korytnickie w południowej części basenu Korytnicy (fig. 1). Na podstawie przesłanek ekologicznych i sedymentologicznych (*patrz* pl. 1—2) wykazano, że rozważane struktury litoralne tworzyły się w środowisku o wyższej energii niż analogiczne formy związane z iłami korytnickimi (fig. 2). Wyrażono pogląd, że dzisiejszy zasięg osadów badenu posiada na obszarze całej Zatoki Korytnickiej charakter erozyjny.

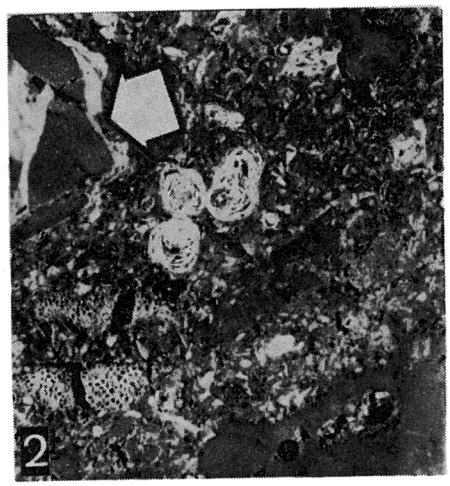


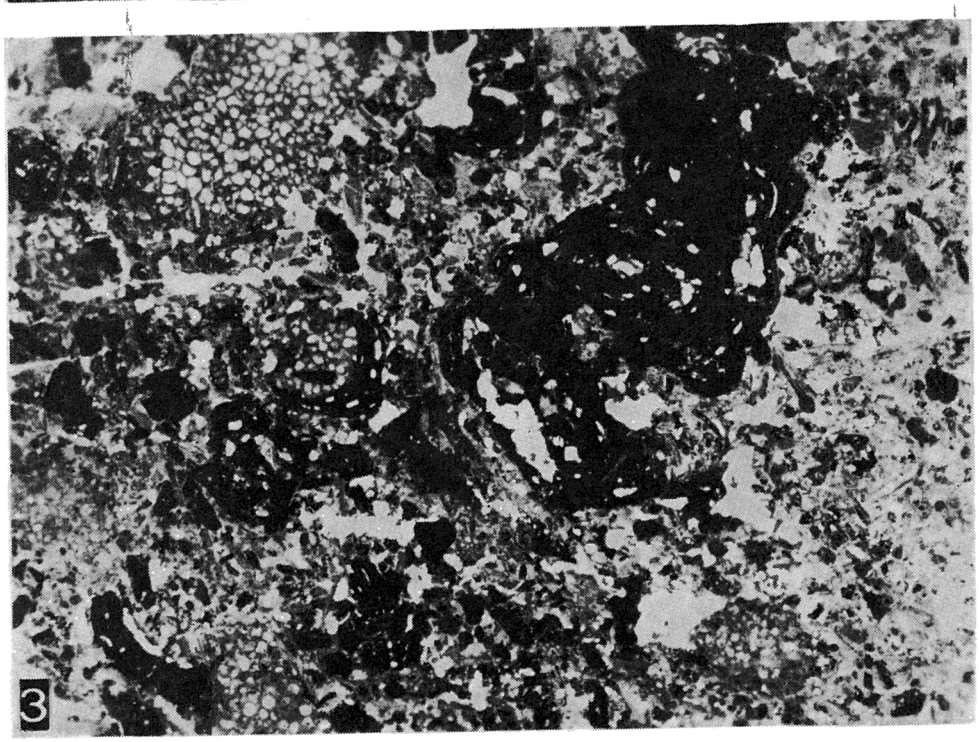


1 — *Botula* sp.: 1a — ventral, 1b — dorsal, 1c — left lateral views of the internal mould, 1d — boring containing an imprint of the left valve of the same specimen; × 2

2 — Detrital red-algal limestone containing Kimmeridgian pebbles bored by the Middle Miocene (Badenian) rock-borers; × 2







Middle Miocene (Badenian) detrital red-algal limestone

1 — Rhodoid with a Kimmeridgian pebble as its nucleus *(arrowed)*; × 2

2 — Thin red-algal crust around a Kimmeridgian pebble *(arrowed)*, and small rhodoids nearby; × 2

3 — Red-algal and bryozoan detritus; × 3