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## Elasmobranch teeth from the mid-Cretaceous sequence of the Mangyshlak Mountains, Western Kazakhstan

**ABSTRACT:** A relatively small assemblage of the elasmobranch teeth collected in the mid-Cretaceous (Upper Albian through Coniacian) sequence of the Mangyshlak Mountains, Western Kazakhstan (*see* MARCINOWSKI & *al.* 1996; *this volume*) is dominated by the hybodontoids of the genus *Ptychodus* AGASSIZ, 1838, associated with few proper sharks. Within the *Ptychodus* assemblage that comprises the common AGASSIZ' species *mammillaris*, *rugosus*, *polygyrus*, and the rare *latissimus*, indicated is the presence of *P. rugosus* DIXON, 1850, the species only occasionally recorded in Europe. The whole assemblage is, however, identical with that known from the Albian and the Upper Cretaceous sequences of Europe, and this supports an assignment of the Mangyshlak area to the European Zoogeographic Realm during the mid-Cretaceous.

### THE PROVENANCE OF THE MATERIAL STUDIED

The teeth, the only remains of the elasmobranch fish that have been met when studying the mid-Cretaceous (Upper Albian through Coniacian sequences of the Mangyshlak Mountains, Western Kazakhstan), appeared to be rare faunistic elements of many, quite widespread and much fossiliferous strata, detailly described in a separate paper (MARCINOWSKI & *al.* 1996). They are confined primarily to the condensed sequences, developed as the Phosphatic Horizons, especially numbered *IVb* and *V*, that ranged Middle – Upper Cenomanian and Upper Turonian – Coniacian respectively (*see* MARCINOWSKI & *al.* 1996). A regional phosphatization process, responsible for the preservation of the faunal elements is interpreted by MARCINOWSKI & *al.* (1996) as progressing during relatively high stands, whereas the formation of the Phosphatic Horizons (*I - V*), featured by residual lags of phosphatic nodules and condensation and/or reworking of fauna, proceeded at the regressive pulses of the sea stands.

The number of the collected teeth of elasmobranchs is very low indeed, as compared to all other fossils (*see* MARCINOWSKI & *al.* 1996). A paucity of the fish remains is thus a remarkable feature of all the studied mid-Cretaceous sequences of Mangyshlak. Nevertheless, the recognized assemblage seems to be worthy of description, to complete the former brief accounts of the ammonites, belemnites, inoceramid bivalves, and echinoderms, particularly the irregular echinoids, as given by MARCINOWSKI & *al.* (1996).

#### THE ELASMOBRANCH ASSEMBLAGE

The studied assemblage of the elasmobranch remains from the mid-Cretaceous sequences of Mangyshlak consists mostly of teeth of the hybodontoid sharks of the genus *Ptychodus* AGASSIZ, 1838, associated with a lesser number of those of proper sharks (*see* Pls 1 - 2).

The whole studied material is poorly preserved, and the teeth are mechanically damaged to a variable extent. The proper sharks are represented mostly by fragments of the crowns, and only a few bear fragments of the root. The same concerns the *Ptychodus* teeth, some of which are, moreover, not extractable from hard phosphatic matrix.

All the species recognized within the studied assemblage are well known in the literature. If the proper sharks are represented by quite common species, the hybodontoid sharks exhibit a few forms rarely noted in the recognized reports.

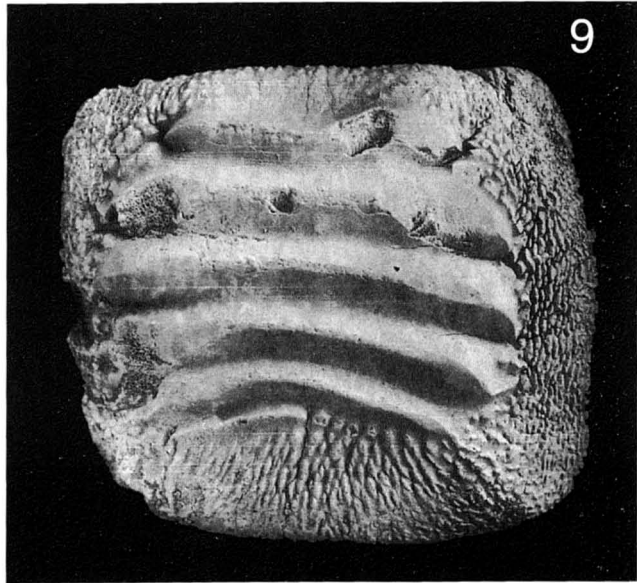
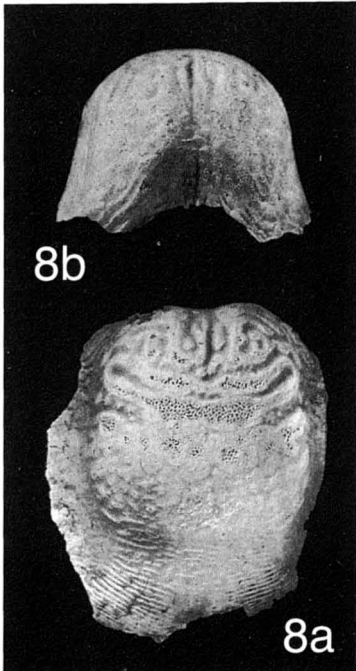
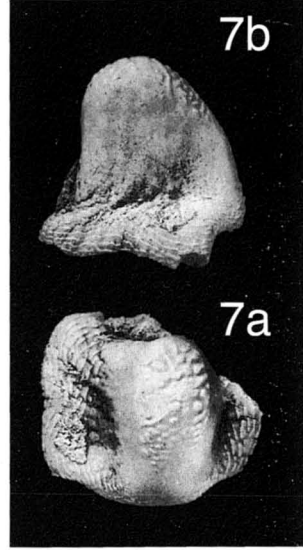
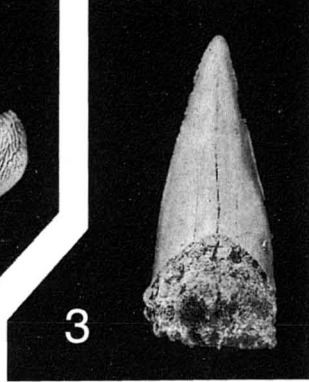
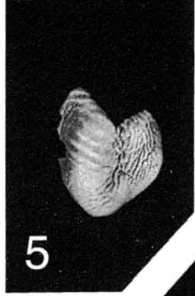
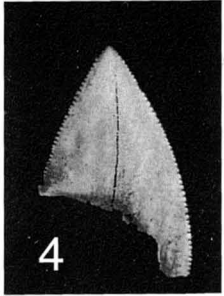
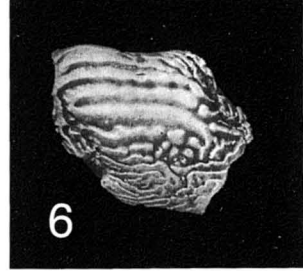
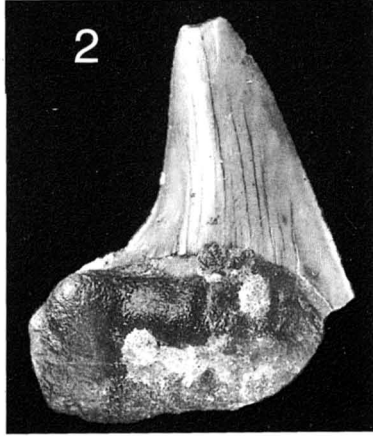
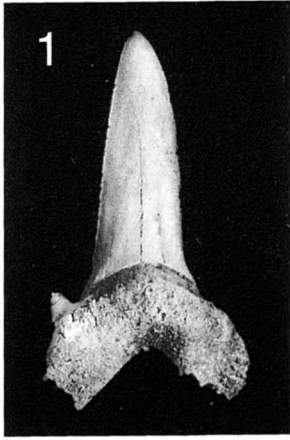
#### PLATE 1

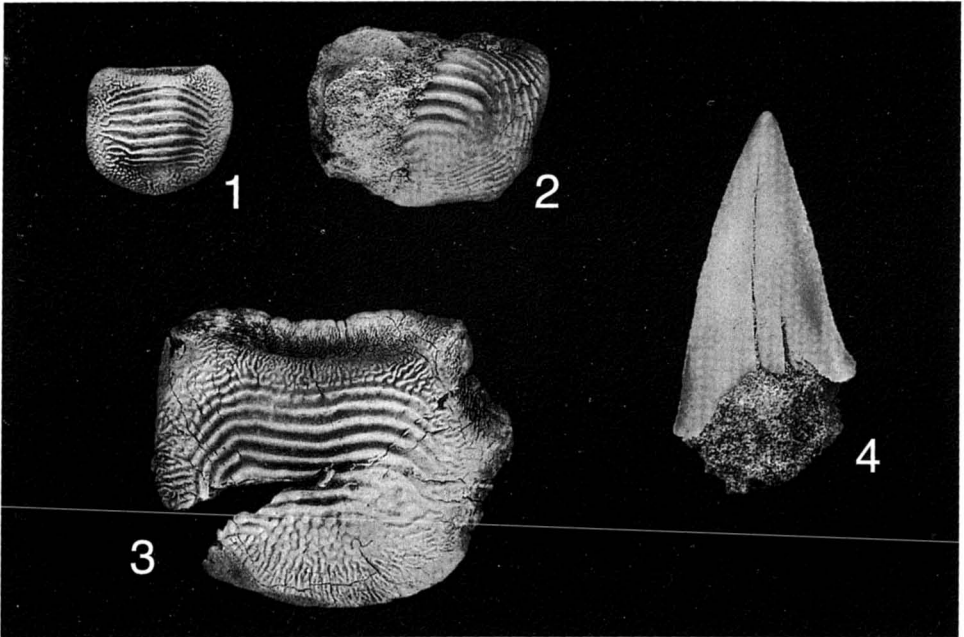
##### Elasmobranch teeth from the mid-Cretaceous Besakty section in the Mangyshlak Mountains, Western Kazakhstan

All specimens come from Bed 42A (Posphatic Horizon Vb) — Upper Turonian – Coniacian (*see* MARCINOWSKI & *al.* 1996, pp. 32-33)

- 1 — *Lamna* (?*Plicatolamna*) sp.
- 2 — *Oxyrhina mantelli* AGASSIZ, 1843
- 3 — ? *Oxyrhina* sp.
- 4 — *Squalicorax falcatus* (AGASSIZ, 1843) : broken crown of a lateral tooth
- 5 — *Ptychodus mammillaris* AGASSIZ, 1839 : tooth of the adsymphyial file of the upper jaw
- 6 — *Ptychodus polygyrus* AGASSIZ, 1839
- 7a - 7b — *Ptychodus rugosus* DIXON, 1850 : 7a – upper, 7b – lateral view
- 8a - 8b — *Ptychodus rugosus* DIXON, 1850, symphyial tooth of the lower jaw: 8a – upper, 8b – lateral view
- 9 — *Ptychodus latissimus* AGASSIZ, 1843

All photos taken x 2

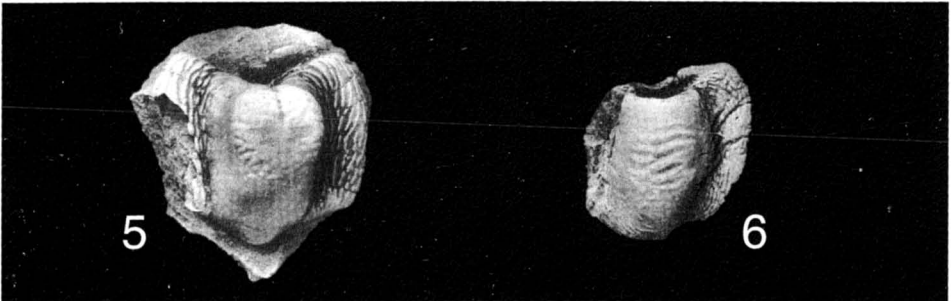




Elasmobranch teeth from other mid-Cretaceous sequences of the Mangyshlak Mountains, Western Kazakhstan

- 1 — *Ptychodus decurrens* AGASSIZ, 1839; 2 — *Ptychodus mammillaris* AGASSIZ, 1839; both from Shyrkala - Airakty section, Bed 20 (Phosphatic Horizon IVb) — Upper Cenomanian (see MARCINOWSKI & al. 1996, p. 15).
- 3 — *Ptychodus decurrens* AGASSIZ, 1839; Kush section, Bed 15 (Phosphatic Horizon IVb) — Middle - Upper Cenomanian (see MARCINOWSKI & al. 1996, p.19).
- 4 — *Cretolamna appendiculata* (AGASSIZ, 1843); Shakh-Bogota section, Bed 11 (Phosphatic Horizon V) — Upper Turonian (see MARCINOWSKI & al. 1996, p. 7)

All photos taken x 2



Comparative material of *Ptychodus rugosus* DIXON, 1850 from the mid-Cretaceous of Europe

- 5 — Specimen from the "Odra" quarry at Opole, Lower Silesia, Poland; uppermost part of the Middle Turonian (see WALASZCZYK 1992, pp. 96 and 109)
- 6 — Specimen from the Arnager Greensand, Isle of Bornholm, Denmark; Lower Albian - Middle Cenomanian (see CHRISTENSEN 1984, pp. 320-321; cf. also MARCINOWSKI & RADWAŃSKI 1983, pp. 75-76)

Both photos taken x 2

In particular sections of the mid-Cretaceous sequence of Mangyshlak, the elasmobranch teeth are more frequent only in one layer (Bed 42A) of the Besakty section, and their collection is presented herein almost fully (Pl. 1, Figs 1-9). The other sections yielded very scarce material that is herein illustrated (Pl. 2, Figs 1-4) to show some better preserved specimens, especially those of the genus *Ptychodus*, represented locally by the species other than in the Besakty section.

#### SOME REMARKS ON THE RECOGNIZED SPECIES

The proper sharks are relatively common elements of the mid-Cretaceous sequences of Mangyshlak. Within the collected specimens, mostly numerous fragments of small teeth, only few are taxonomically identifiable (*see* Pl. 1, Figs 1-4 and Pl. 2, Fig. 4).

Of the reported species, a fragment of the lateral tooth of *Squalicorax falcatus* (AGASSIZ, 1843) may be commented: its size, slightly larger than average for the species, and stronger serration (*see* Pl. 1, Fig. 4) indicate possibly its being close to the forms transitional (*see* HERMAN 1977) to the evolutionary younger species, *S. kaupi* (AGASSIZ, 1835).

The hybodontoid sharks to which the genus *Ptychodus* AGASSIZ, 1838, has recently been assigned (*see* CAPPETTA 1987), are represented by five species, whose occurrence is to be commented as follows.

### *Ptychodus mammillaris* AGASSIZ, 1839

These relatively small-sized teeth (*see* Pl. 1, Fig. 5 and Pl. 2, Fig. 2) are concordant with those reported in the referenced literature. A highly asymmetric tooth (Pl. 1, Fig. 5) is interpreted herein as of the adsymphyseal file of the upper jaw (*compare* WOODWARD 1912, Pl. 47, Fig. 19).

The species has often been recorded from Poland (*i.a.* ROEMER 1870, KSIĄZKIEWICZ 1927, MAŁECKI 1980) as ranging Cenomanian through Santonian. The Authors reported it from the Cenomanian (RADWAŃSKI 1969, MARCINOWSKI & RADWAŃSKI 1983) and Turonian (MARCINOWSKI 1974). It is also known from the Turonian of the Ukraine (SHAKH & KARPENCHUK 1964).

### *Ptychodus rugosus* DIXON, 1850

The collected specimens, solely in the Besakty section (*see* Pl. 1, Figs 7-8), are rather large as for this species (*see* WOODWARD 1912). The larger tooth (Pl. 1, Fig. 8a-8b) is interpreted herein as of the symphyseal file of the lower jaw.

The species is known from isolated teeth, rarely noted in the literature (*see* WOODWARD 1912, HERMAN 1977), what justifies to illustrate herein the two comparative specimens from Poland and Denmark (Pl. 2, Figs 5-6). From Poland, from the Cracow Upland, one specimen was formerly noted by KSIĄZKIEWICZ (1927), and another one by MAŁECKI (1980).

## *Ptychodus polygyrus* AGASSIZ, 1839

The collected specimen (*see* Pl. 1, Fig. 6), of a smaller size as for the species (*see* WOODWARD 1912), and highly asymmetric is probably from the lateral file of the lower jaw.

The species is known to range Turonian through Lower Campanian, being especially common in the Turonian (*see* WOODWARD 1912, HANTKE 1958, HERMAN 1977). In Poland, reported only from the Turonian and Santonian of the Cracow Upland (KSIĄŻKIEWICZ 1927, MAŁECKI 1980, MARCINOWSKI & RADWAŃSKI 1983). In the Ukraine, it is not rare in the Coniacian (SHAKH & KARPENCHUK 1964).

## *Ptychodus latissimus* AGASSIZ, 1843

The only collected specimen, extremely well preserved (*see* Pl. 1, Fig. 9), coincides with those presented in the literature (*see* WOODWARD 1912, HERMAN 1977).

This relatively rare species was noted from Poland only by one credible specimen from the Opole Cretaceous, by ROEMER (1870, Pl. 36, Fig. 7), and by some obscure specimens hardly recognizable in their photos presented by KSIĄŻKIEWICZ (1927). In the Ukraine, it occurs in the Turonian (SHAKH & KARPENCHUK 1964).

## *Ptychodus decurrens* AGASSIZ, 1839

The collected specimens (*see* Pl. 2, Figs 1 and 3) coincide well with those presented in the literature (*see* WOODWARD 1912, HERMAN 1977). From Poland the species is credibly reported only from the Cenomanian (KSIĄŻKIEWICZ 1927, MARCINOWSKI 1974, MARCINOWSKI & RADWAŃSKI 1983).

The studied assemblage of the *Ptychodus* species is identical with that known from various European regions (*see* WOODWARD 1912, HERMAN 1977, CAPPETTA 1987). As it may be ascertained from the recognized reports, the most common in Europe are the species *P. mammillaris* and *P. decurrens*, the both occurring primarily in the Cenomanian. It may be noted that these two species are also known from the North American mid-Cretaceous (*see* references *in*: WILLIAMSON & *al.* 1993), where they associated to some other (?endemic) species (*see* CAPPETTA 1987, WILLIAMSON & *al.* 1993). It is thus nothing particular that these two species, although rare, are more often found than the others in the mid-Cretaceous sequences of the Mangyshlak Mountains in Western Kazakhstan.

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1-8 — *Trochoceramus morgani* (SORNAY); Aimaki section, Daghestan; L. Maastrichtian; nat. size; 1 — Specimen No. A 408-5, 2 — A 398-1, 3 — A 408-6, 4 — A 401, 5 — A 408-8, 6 — A 408-2, 7 — A 382, 8 — A 410  
 9 — *Trochoceramus tenuiplicatus* (TZANKOV); Specimen No. K12, Nida Trough, south-central Poland; L. Maastrichtian;  $\times 0.9$

## REFERENCES

- CAPPETTA, H. 1987. Chondrichthyes II: Mesozoic and Cenozoic Elasmobranchii. *Handbook of Paleichthyology*, **3B**, 1-193. Gustav Fischer Verlag; Stuttgart – New York.
- CHRISTENSEN, W.K. 1984. The Albian to Maastrichtian of Southern Sweden and Bornholm, Denmark: a Review. *Cret. Res.*, **5**, 313-327. London.
- HANTKE, R. 1958. *Ptychodus*-Zähne aus dem Seewerkalk von Grabs (Kt. St. Gallen). *Ecl. Geol. Helv.*, **51** (1), 61-64. Basel.
- HERMAN, J. 1977. Les Sélaciens des terrains néocrétacés & paléocènes de Belgique & contrées limitrophes. Eléments d'une biostratigraphie intercontinentale. *Mém. Expl. Cart. Géol. Min. Belgique*, **15**, 1-450. Bruxelles.
- KSIĄŻKIEWICZ, M. 1927. Les poissons fossiles du crétacé supérieur des environs de Cracovie. *Bull. Acad. Polon. Sci. Lett., Cl. Sci. Math.-Nath., sér. B*, 979-1006. Cracovie.
- MAŁECKI, J. 1980. Teeth of fishes of the genus *Ptychodus* from Cretaceous Chalk sediments in the vicinity of Cracow. *Bull. Acad. Polon. Sci., Sér. Sci. Terre*, **28** (1), 51-57. Warszawa.
- MARCINOWSKI, R. 1974. The transgressive Cretaceous (Upper Albian through Turonian) deposits of the Polish Jura Chain. *Acta Geol. Polon.*, **24** (1), 117-217. Warszawa.
- & RADWAŃSKI, A. 1983. The mid-Cretaceous transgression onto the Central Polish Uplands (marginal part of the Central European Basin). *Zitteliana*, **10**, 65-79. München.
- , WALASZCZYK, I. & OLSZEWSKA-NEJBERT, D. 1996. Stratigraphy and regional development of the mid-Cretaceous (Upper Albian through Coniacian) of the Mangyshlak Mountains, Western Kazakhstan. *Acta Geol. Polon.*, **46** (1/2) [*this issue*], pp. 1-60. Warszawa.
- RADWAŃSKI, A. 1969. In: HAKENBERG, M., Albian and Cenomanian between Małogoszcz and Staniewice, SW margin of the Holy Cross Mountains. *Studia Geol. Polon.*, **26**, pp. 39, 42 and 109. Warszawa.
- ROEMER, F. 1870. Geologie von Oberschlesien. Breslau.
- SHAKH, L.M. & KARPENCHUK, J.R. 1964. Predstavniki rodu *Ptychodus* z kreydovikh vidkladiv Podillya. *Akad. Nauk URSR, Nauk.-Prirodovnav. Muz.*, pp. 79-83. *Ízd. Naukova Dumka. Kiiiv.*
- WALASZCZYK, I. 1992. Turonian through Santonian deposits of the Central Polish Uplands; their facies development, inoceramid paleontology and stratigraphy. *Acta Geol. Polon.*, **42** (1/2), 1-122. Warszawa.
- WILLIAMSON, T.E., KIRKLAND, J.I. & LUCAS, S.G. 1993. Selachians from the Greenhorn Cyclothem ("Middle" Cretaceous: Cenomanian – Turonian), Black Mesa, Arizona, and the paleogeographic distribution of Late Cretaceous selachians. *J. Paleont.*, **67** (3), 447-474. Tulsa.
- WOODWARD, A.S. 1912. The fossil fishes of the English Chalk. *Palaeontogr. Soc. (Monogr.)*, Part 7, 225-264. London.