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Pygopid brachiopods and Late Jurassic palaeorelief in the Gerecse Mts., Hungary

Pygopid brachiopodák és a késő-jura domborzat a Gerecsében

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(Figures 3)

Abstract

Late Jurassic/Early Cretaceous pygopid brachiopods are sensitive indicators of palaeorelief within the bathyal realm. *Pygope catulloi* and *Pygope diphya* – both bearing a small, umbonal perforation – were adapted to live in a deeper environment which would have been poor in nutrients; while *Pygope janitor* and *Pygites diphyoides* – with large, central perforations – inhabited a less deep environment. The distribution of 144 pygopid specimens in 7 Tithonian sections outlines the horst-and-graben structure of the Gerecse Mts. in the Late Jurassic period. The western and eastern parts were deeper, while the central Gorba High known as the site of lacunose sedimentation was a shallower environment within the bathyal, aphotic zone.

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Összefoglalás

A felső-jura/alsó-kréta Pygopidae brachiopodák érzékeny jelzői a batiális régió vízmélység-különbségeinek. A *Pygope catulloi* és a *Pygope diphya* – mindkettőnek kicsi, búbközeli perforációja van – a mélyebb, táplálékban szegényebb vízmélységekhez alkalmazkodott. A *Pygope janitor* és a *Pygites diphyoides* – nagyméretű, központi helyzetű perforációval – kevésbé mély vizek lakója volt. Hét gerecsei szelvényben 144 Pygopidae példányt vizsgáltam meg. A Nyugati- és a Keleti-Gerecsében egyaránt a mélyebb vízi fajok találhatók, míg középen, az erősen hézagos rétegsorairól ismert Gorba-háton a sekélyebb batiális övre jellemző fajok fordulnak elő.

Introduction

The most spectacular brachiopods of the Mesozoic era belong to the family Pygopidae (MUIR-WOOD 1965). There are two genera, containing four species, and all of these bear perforations on the valves. Members of the group *Pygope janitor* + *Pygites diphyoides* bear large, central perforations, while those of the *Pygope catulloi* + *Pygope diphya* group bear minor perforations displaced towards the umbo (JARRE 1962) (*Fig. 1*).

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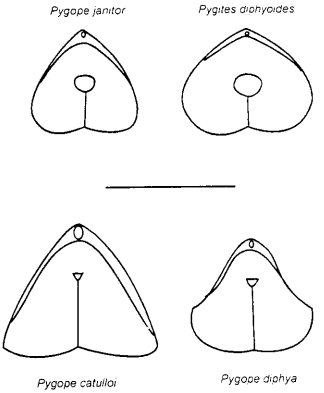

Fig. 1 Valves of the *Pygope janitor* + *Pygites diphyoides* brachiopod group bear large, central perforations, while those of the *Pygope catulloi* + *Pygope diphya* group bear minor perforations displaced towards the umbo

1. ábra. A *Pygope janitor* és a *Pygites diphyoides* brachiopoda nagyméretű, központi helyzetű perforációt, míg a *Pygope catulloi* és a *Pygope diphya* kicsi, búbközeli perforációt visel.

AGER (1967) recognised that Pygopidae were the most typical Tethyan forms among Mesozoic brachiopods. VÖRÖS (in SANDY 1988) provided an interpretation: *diphya* occupied the southern, Apulian margin of Tethys (i.e. the Mediterranean microcontinent), while *janitor*, originating from there, was dispersed on the northern margin. Reviewing published material from 62 localities ranging from the Subalpine chains in Switzerland as far as the Balkans, KÁZMÉR (1990, 1993) extended VÖRÖS' ideas to the *diphya* + *catulloi* and *janitor* + *diphyoides* species groups, and offered a palaeoecological explanation for their apparently separate (mostly mutually exclusive) distribution.

Members of the *catulloi* + *diphya* group developed the umbonal perforation at a young stage of their ontogeny. It made it possible for these species to inhabit hostile environments (great depth, scarce food), not suitable for other species. They flourished there with virtually no competitors. The *janitor* + *diphyoides* group had a central perforation, developed later during ontogeny. These could not live under so harsh conditions as the previous group, but lived in a less deep environment which provided more food, successfully competing with other organisms. The *catulloi* + *diphya* pair, successful in deep water, were unable to compete in the shallow bathyal environment (KÁZMÉR 1990, 1993).

This understanding of pygopid palaeoecology is here tested on the horst-and-graben structure of the Gerecse Mountains, Hungary (VÖRÖS & GALÁCZ 1998; CSÁSZÁR et al. 1998; FODOR & LANTOS 1998). A N–S trending topographic high outlined by discontinuous Jurassic sedimentation has been recognised and recently named Gorba High (CSÁSZÁR 1995). Pygopid fauna from seven Tithonian profiles arranged perpendicularly to the Gorba High (*Fig.* 2) have been studied and their composition is presented here.

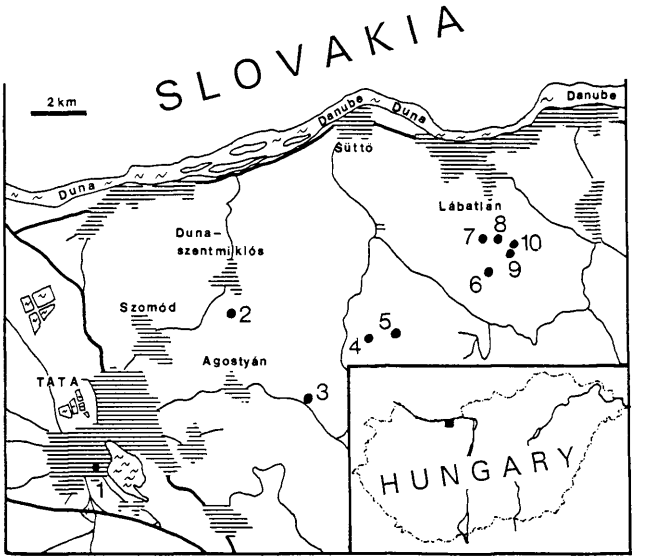

Fig. 2 Locations of pygopid-bearing successions in the Upper Jurassic of the Gerecse Mountains (modified after SZENTE, this volume). Localities: 1. Kálvária Hill, Tata; 2. Szomód; 3. Agostyán; 4. Szél-hegy shaft; 5. Pap-rét; 6. Törökbükk; 7. Ördöggát; 8. Tölgyhát; 9. Dogger-bánya; 10. Martonkút

2. ábra. A Pygopidae faunákat szolgáltató lelőhelyek a gerecsei felső-jurában (SZENTE, 1998 után, módosítva). 1. Tata, Kálvária-domb; 2. Szomód; 3. Agostyán; 4. Szél-hegyi akna; 5. Pap-rét; 6. Törökbükk; 7. Ördöggát; 8. Tölgyhát; 9. Dogger-bánya; 10. Martonkút

Material

One hundred and forty-four Tithonian brachiopods of the Pygopidae family (MUIR-WOOD 1965) have been identified. Most of them are from museum collections made by the late Gyula and Gusztáv VIGH, and they were kindly offered to the author for study by István FŐZY, Head of the Department of Education, Hungarian Natural History Museum, together with specimens collected by himself.

Although pygopids are "jewels" of many palaeontological collections due to their large size and uncommon shape, our faunas are not spectacular. Most of

the specimens have been fragmented before being embedded in the sediment, indicating particularly high-energy conditions (see FŐZY et al. 1994 for details).

The number of *Triangope triangulus* (VALENCIENNES 1819) specimens is listed for each locality to show that the distribution of these pygopid forms does not show any particular pattern on the species level.

Detailed descriptions of the respective localities (except Tata, Agostyán, Tardos–Szászvég, Dogger-bánya, and Marton-kút) can be found in the monographic study of FŐZY (1993).

Kálvária Hill, Tata

Here there is purple and light-grey cephalopod limestone of undistinguished Tithonian–Berriasian age (FÜLÖP 1976:70). VIGH in FÜLÖP (1976:73) listed fifty *T. triangulus* and five *P. diphya* specimens. A large, additional specimen is a fragment of the *catulloi* group.

Agostyán

Here can be found dark red, clayey limestone with rich, poorly preserved crinoid and echinoid fauna. VIGH (1961) mentions the occurrence of *P. diphya*, but does not give the number of specimens.

Tűzkő Hill (= Lőtér), Szomód

This locality comprises crinoid limestone of Tithonian–Berriasian age (FŐZY 1993; CSÁSZÁR et al., this volume). There are eight specimens of *T. triangulus* in a dark limestone containing frequent crinoid ossicles.

Szászvég, Tardos

Nothing has been published about this locality. Gyula and Gusztáv VIGH collected a small fauna in 1941 one *T. triangulus* and one fragment of the *janitor* group.

Szél-hegy shaft, Tardos

In this locality can be found a rich Lower Tithonian fauna of ammonites, bivalves and brachiopods in sparitic crinoid limestone (FŐZY 1993; FŐZY et al. 1994). The locality has yielded forty-three *T. triangulus* and sixteen *P. janitor* specimens.

Paprét-árok, Tardos

This locality is composed of pink, purple, very hard limestone. The Tithonian is only 0.36 to 1 m thick. Ammonites from a few beds bear trace fossils: borings, worm tubes and grazing traces (FŐZY 1993). It has yielded four *T. triangulus* specimens and three fragments of the *janitor* group.

Törökbükk

One *T. triangulus* specimen from a thin, condensed biancone-like limestone (FŐZY 1993) has been found here.

Ördöggát

This locality has yielded one *T. triangulus* specimen from the Lower Tithonian limestone (FŐZY 1993).

Tölgyhát quarry, Lábatlan

This represents the most famous, complete Jurassic sequence in the Gerecse Mountains. The Lower Tithonian, pink limestone beds (CECCA et al. 1993; FŐZY 1993) have yielded four *T. triangulus* specimens and one fragment of the *catulloi* group.

Dogger-bánya, Lábatlan

There is an unpublished profile about this disused quarry. It has yielded three *T. triangulus* specimens.

Marton-kút, Lábatlan

Nothing has been published about this locality. It has yielded one *P. catulloi* specimen and one unidentified one (of the *janitor* group?) from Bed 16/a.

Palaeorelief

A broad reconstruction of palaeorelief in the Transdanubian Range has been published for the Early Jurassic (KÁZMÉR 1987; FODOR & LANTOS 1998) and for the Early Cretaceous periods (KÁZMÉR 1988). The detailed study of CSÁSZÁR (1995) and CSÁSZÁR et al. (in press) for the Gerecse and Vértes region outlined a Late Jurassic elevation in the Gerecse. This Gorba High runs north–south between the Danube and Tatabánya. Remarks concerning discontinuous Jurassic sedimentation in the centre of the Gerecse and more complete sequences in the east and west have already been made by VIGH (1935). GALÁCZ and VÖRÖS (1972), GALÁCZ et al. (1985) and recently VÖRÖS & GALÁCZ (1998) have provided a key, interpreting similar sequences in the Bakony as local basins and elevated blocks, respectively.

FŐZY (1993) subdivided the Upper Jurassic ammonite-bearing successions into basins (Margit-hegy, Tölgyhát, Törökbükk, Ördöggát, Szomód) and elevated blocks (Pap-rét, Szél-hegy quarry). He recognised the Asszony-hegy and Szél-hegy shaft successions as gravity slides deposited on a slope. FŐZY's observation on the unusual presence of trace fossils (borings, worm tubes and grazing traces) on ammonites in the Pap-rét profile suggests a low sedimentation rate, which may be an indication of exposure the forces of erosion.

CSÁSZÁR (1995) was the first to make a sketch map and cross-sections of the Gorba High (his Fig. 10, and Figs. 11–12, respectively). Following his ideas a sketch cross-section is offered, indicating the suggested position of pygopid-bearing successions in the Gerecse Mountains (*Fig. 3*). This is the first attempt to estimate the relative altitude of the Gorba High. Its relief was

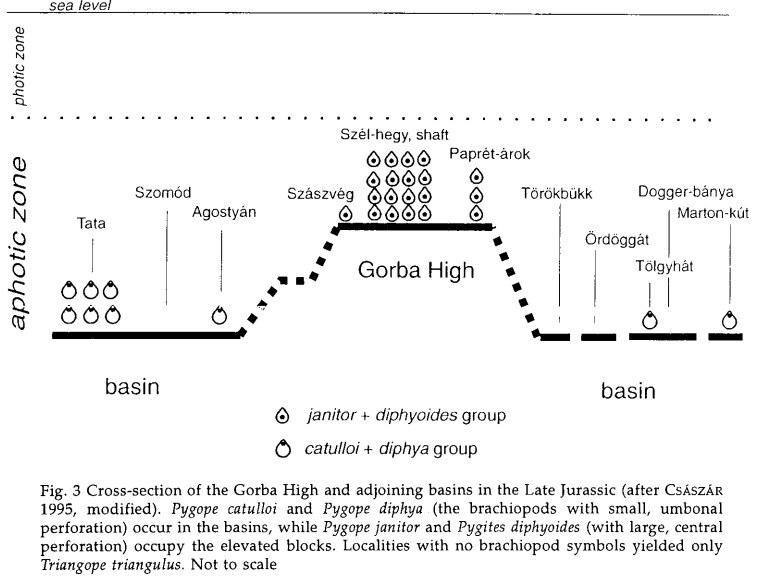

Fig. 3 Cross-section of the Gorba High and adjoining basins in the Late Jurassic (after CSÁSZÁR 1995, modified). *Pygope catulloi* and *Pygope diphya* (the brachiopods with small, umbonal perforation) occur in the basins, while *Pygope janitor* and *Pygites diphyoides* (with large, central perforation) occupy the elevated blocks. Localities with no brachiopod symbols yielded only *Triangope triangulus*. Not to scale

3. ábra. A Gorba-hát és a szomszédos medencék metszete a késő-jura idején (CSÁSZÁR 1995 után módosítva). A *Pygope catulloi* és a *Pygope diphya* brachiopoda-faj (mindkettő kicsi, búbközeli perforációt visel) a medencékben fordul elő, míg a *Pygope janitor* és a *Pygites diphyoides* (nagy, központi helyzetű perforációval) a kiemelt blokkokra korlátozódik. A brachiopoda-jelek nélküli lelőhelyek csak *Triangope triangulust* szolgáltattak. Nem méretarányos ábra

certainly much higher above the neighbouring basin landscape than is indicated by the thickness differences between incomplete and complete successions only. Completeness of the successions is rather a matter of chance. Of course, sites exposed to currents on top of elevations have offered less possibility to preserve sediments than localities in better protected basins. I suggest, that the elevation of the top of the Gorba High compared to the deepest nearby basin was in the range of a few hundred metres at least. This accentuated relief has developed in the aphotic zone.

Three independent observations support the existence of the Gorba High, the most pronounced of local elevations in the Gerecse Mountains: (1) incomplete Jurassic successions of reduced thickness (FŐZY 1993; CSÁSZÁR 1995) and (2) shallow bathyal pygopid species on the high compared to deeper water species in the adjacent basins (this paper), and (3) low sedimentation rate as

indicated by trace fossils on ammonite shells in the Paprét profile (FŐZY 1993). Poorly documented sedimentary features suggesting slope sedimentation (FŐZY 1993) corroborate the existence of significant differences in relief during Late Jurassic age.

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