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New data to the stratigraphy of the Pelsonian Substage at Köveskál (Middle Triassic, Balaton Highland, Hungary)

by
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Abstract — New excavation and fossil collection at the classical Middle Triassic locality of Horog-hegy (Köveskál, Balaton Highland, Hungary) revealed that a nearly 40 m thick sequence of the Felsőörs Limestone Formation represents the Pelsonian and Illyrian Substages. Within the Balatonicus Zone, the Balatonicus Subzone, the Zoldianus Subzone and a third, unnamed subzone are proved by detailed collections; the Trinodosus and Pseudohungaricum Subzones of the Trinodosus Zone have been inferred from ammonoids found in loose blocks. Brachiopod limestone ("Recoaro" limestones, or Horoghegy Member) appears in two distinct horizons: in the Balatonicus Subzone and at the top of the Zoldianus Subzone. These two horizons were correlated with "Recoaro" beds at other, well-dated sections of the Balaton Highland (Aszófő, Felsőörs). The synchronous and repeated appearance of brachiopod shell beds in the basinal sequences is interpreted as reflecting local tectonic episodes related to the fragmentation of the Anisian platforms. The first phase may correspond to the first differentiation episode of the formerly uniform Megyehegy platform or ramp, i.e. the birth of the isolated platforms (e.g. Tagyon platform) in the Balatonicus SubChron. The second phase may be connected to the progressive fragmentation and demise of the platforms at the Balaton Highland at the end of the Zoldianus SubChron.

Key words: lithostratigraphy, biostratigraphy, ammonoids, brachiopods, Middle Triassic, Balaton Highland, Hungary.

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Introduction

The village of Köveskál has a well-established name in the Triassic literature. It was first mentioned in the early report by ZEPHAROVICH (1856) and it lent its name to the brachiopod species "*Spiriferina*" *koeveskalyensis* (STUR, 1865), and subsequently the genus *Koeveskallina* DAGIS (see SIBLIK, 1970, 1972). All these records refer to a small hill called Horog-hegy (or Mezőmál in the earlier literature), two kilometres east of the village, where Middle Triassic limestones were quarried in small pits.

BÖCKH (1873) described the fundamental geological features of the locality. In the northward dipping sequence, he distinguished a basal, platy limestone overlain by a dolomite that forms the hill top, followed by brachiopod limestone ("Recoaro" limestone) and bituminous, platy limestone, and, finally, the grey "Reifling" limestone. BÖCKH (1873) listed a rich brachiopod fauna from the "Recoaro" limestone and observed that "*Ammonites balatonicus*" occurred both in the brachiopod limestone and in the bituminous, platy limestone; whereas the "Reifling" limestone was characterised by "*Arcestes Studeri*" and "*Ceratites binodosus*".

DIENER (1899, 1900) and ARTHABER (1903) provided additional data about the ammonoid fauna and emphasized that the upper ammonoid level corresponded to the *trinodosus* horizon. LÓCZY (1913, 1916) drew a sketchy but informative geological profile of the Horog-hegy. The recent stratigraphical reviews (e.g. BALOGH et al. 1983, CROS & SZABÓ 1984) merely summarised the results of previous authors.

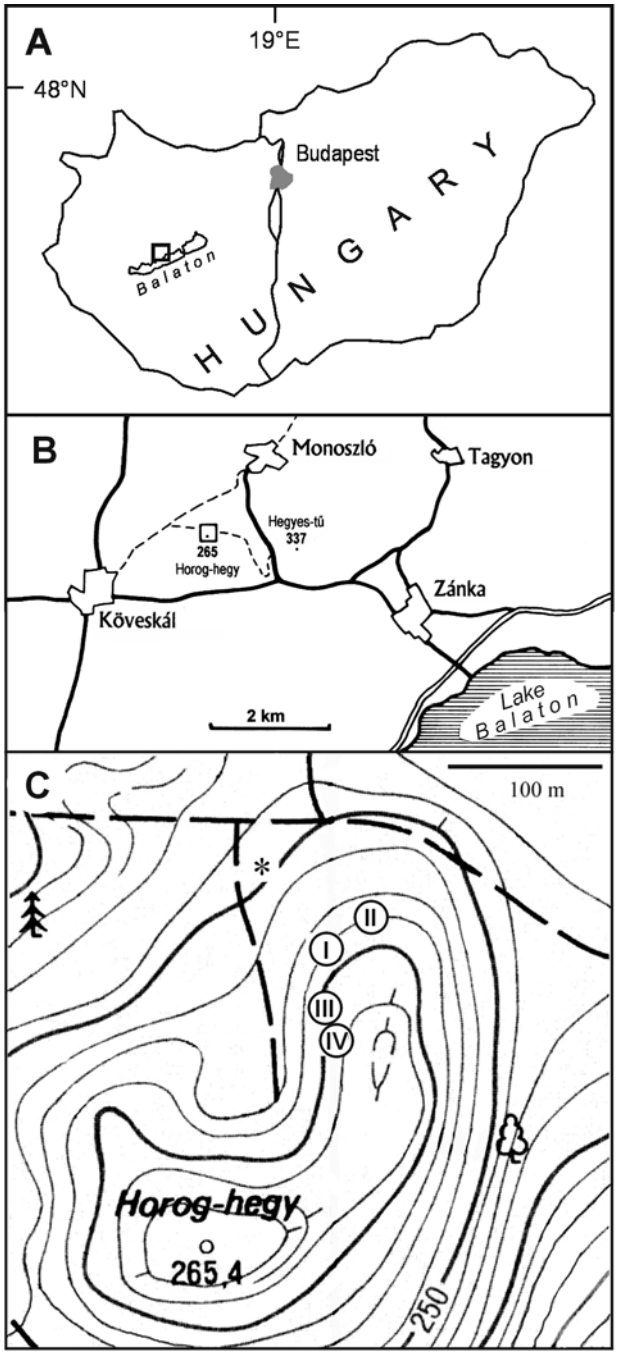
As part of a detailed study of the Anisian brachiopods from the Balaton Highland, PÁLFY (1986, 1991) made new collections at the locality. He recognised that two different types of "Recoaro" limestone occurred: a reddish-brown and another, grey, bituminous, siliceous, organodetrital limestone, but their stratigraphical relationship remained unclear.

The present study on the stratigraphy of the Horog-hegy at Köveskál is part of an ongoing research project aimed at the definition of the Pelsonian Substage at the Balaton Highland.

The figured specimens are deposited in the Geological and Palaeontological Department of the Hungarian Natural History Museum.

Locality and outcrops

The Horog-hegy (265 m) lies 2 km ENE of the village of Köveskál, 4 km N of the northern shore of Lake Balaton. The bulk of the hill is formed by Megyehegy Dolomite (Lower Pelsonian?), overlain by gently dipping beds of Felsõörs Limestone (Pelsonian to Illyrian), about 40 m in thickness. The fossiliferous localities occur on the forested northern slope of Horog-hegy, between the hilltop and an E–W running forest track (Figure 1). During a short visit in 1995, T. BUDAI, L. DOSZTÁLY, I. SZABÓ and A. VÖRÖS collected ammonites from loose blocks in the area, which indicated the presence of both the middle Anisian Balatonicus Zone and the uppermost Anisian "*Lardaroceras* beds".



In 2001, J. PÁLFY, I. SZENTE and A. VÖRÖS made a more detailed field survey on the northern slope of the Horog-hegy and excavated a few small artificial exposures; this involved the removal of the thin (10–20 cm) soil above the bedrock and bed-by-bed collecting of fossils (brachiopods, ammonoids, bivalves) at four points (Horog-hegy I., II., III. and IV.; Fig. 1).

Horog-hegy I. This is the largest outcrop with a 4 m horizontal and 1 m vertical extent, cut into the rather steep slope. The lowermost unit is a more than 50 cm thick, light grey, slightly siliceous, unfossiliferous limestone (mudstone). This is overlain, with a sharp contact, by a 40 cm thick, light-brown, coarse-grained bioclastic limestone with brachiopods of rock-forming amount ("Upper Recoaro"); this rock-type is very widespread on the hillside and provided the brachiopod fauna of the previous collections). On the irregular top of the brachiopod limestone, a thin (5–10 cm) layer of ochre-yellow, fine-grained crinoidal limestone follows which yielded a moderately rich, poorly preserved ammonoid fauna (*Beyrichites, Schreyerites* ?, *Judicarites*).

Horog-hegy II. A smaller, 2 m wide outcrop around 50 m eastwards from the previous one, along the strike of the beds. The exposed sequence is almost the same as in Horog-hegy I., but here the lowermost mudstone is well-bedded, slightly bituminous and yielded a poorly preserved *Bulogites*, and the brachiopod limestone ("Upper Recoaro") attains only 20 cm thickness.

Horog-hegy III. Nearer to the hilltop, 40 m southwards from Horog-hegy I, a small pit exposes a few thin beds of monotonous, dark grey, bituminous limestones which provided some ammonoids (*Balatonites, Norites*). The measured dip is 20° to the NNW (320º).

Horog-hegy IV. Another small pit 10 m southwards from the previous one. A thin (10–15 cm) layer of brachiopod-rich, light grey bioclastic limestone ("Lower Recoaro"), intercalated between dark grey, bituminous limestones is exposed here. About 20 cm below, a yellowish-grey, mottled, pebbly mudstone layer appears. The measured dip is 18° to the NNW (330º). Apart from brachiopods and bivalves, this brachiopod bed also yielded, a few ammonoids (*Balatonites, Norites*).

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Figure 1 — Location of the study area. A — Index map of Hungary; **B** — Köveskál and its vicinity in the west-central part of Balaton Highland; **C** — Location of outcrops, **I**: Horog-hegy I., **II**: Horog-hegy II., **III**: Horog-hegy III., **IV**: Horog-hegy IV., ***** : loose blocks with ammonoids of Trinodosus Zone.

Fauna

The localities described above yielded altogether a few specimens of gastropods, 50 bivalves, 80 ammonoids and more than one thousand brachiopods. The determined taxa are listed below, according to localities (specimen numbers in parentheses).

1. Loose blocks near the forest track (from siliceous limestone, Plate I: 10)
Marmolatella ? sp.
Paraceratites cf. *trinodosus (*MOJSISOVICS, 1882) (Plate I: 8)
Megaceratites ? cf. *subnodosus* (MOJSISOVICS, 1882)
Lardaroceras div. sp. (Plate I: 9)
Flexoptychites sp.
Age: This fauna suggests the presence of the Trinodosus and Pseudohungaricum Subzones of the Trinodosus Zone (Illyrian).

2. Horog-hegy I + II, Bed 1
Judicarites cf. *euryomphalus* (Benecke, 1866) (Plate I: 5a-b)
Beyrichites cf. *beneckei* (MOJSISOVICS, 1881) (Plate I: 6)
Schreyerites ? cf. *binodosus* (HAUER, 1851) (Plate I: 7)
Ptychites ? sp. indet.
Age: "unnamed subzone", Balatonicus Zone (Pelsonian).

3. Horog-hegy I + II, Bed 2 ("Upper Recoaro")
Discinisca cf. *discoides* (SCHLOTHEIM, 1820)
Decurtella decurtata (GIRARD, 1843)
Volirhynchia vivida (BITTNER, 1890)
Volirhynchia tommasii (BITTNER, 1890)
Costirhynchopsis mentzeli (BUCH, 1843)
Caucasorhynchia altaplecta (BÖCKH, 1872)
Piarorhynchella trinodosi (BITTNER, 1890)
Sinucosta pectinata (BITTNER, 1890)
Costispiriferina manca (BITTNER, 1890)
Dinarispira cf. *dinarica* (BITTNER, 1890)
Dinarispira avarica (BITTNER, 1890)
*Punctospirella fragilis (*SCHLOTHEIM, 1814)
Mentzelia mentzeli (DUNKER, 1851)
Koeveskallina koeveskalyensis (STUR, 1865)
Thecocyrtella sp.
Tetractinella trigonella (SCHLOTHEIM, 1820)
Schwagerispira schwageri (BITTNER, 1890)
Schwagerispira mojsisovicsi (BÖCKH, 1872)
Coenothyris vulgaris (SCHLOTHEIM, 1822)
Angustothyris ? *angustaeformis* (BÖCKH, 1872)
Age: Ammonoids were not found, therefore this bed is only tentatively assigned to the top of the Zoldianus Subzone of Balatonicus Zone (Pelsonian).

4. Horog-hegy I + II, Bed 3
Bulogites ? sp.
Koeveskallina sp.
Age: Zoldianus Subzone, Balatonicus Zone (Pelsonian).

5. Horog-hegy III
Entolium sp.
Solemya abbreviata (FRECH, 1904)
Norites cf. *gondola* (MOJSISOVICS, 1869)
Balatonites balatonicus (MOJSISOVICS, 1872) (Plate I: 3, 4)
Age: Balatonicus Subzone, Balatonicus Zone (Pelsonian).

6. Horog-hegy IV, brachiopod bed ("Lower Recoaro")
Palaeonucula ? sp.
Unionites subrectus (BITTNER, 1901)
Mysidioptera sp.
Leptochondria sp.
Hoernesia sp.
Cassianella ? sp.
Bakevellia sp.
Myoconcha ? sp.
Schafhaeutlia ? sp.
Norites cf. *gondola* (MOJSISOVICS, 1869) (Plate I: 2a-b)
Balatonites balatonicus (MOJSISOVICS, 1872) (Plate I: 1a-c)
Decurtella cf. *decurtata* (GIRARD, 1843)
Volirhynchia tommasii (BITTNER, 1890)
Volirhynchia cf. *projectifrons* (BITTNER, 1890)
Costirhynchopsis mentzeli (BUCH, 1843)
Caucasorhynchia cf. *altaplecta* (BÖCKH, 1872)
Piarorhynchella trinodosi (BITTNER, 1890)
Homoeorhynchia ? sp.
Costispiriferina manca (BITTNER, 1890)
Dinarispira cf. *dinarica* (BITTNER, 1890)
Punctospirella fragilis (SCHLOTHEIM, 1814)
Mentzelia mentzeli (DUNKER, 1851)
Koeveskallina koeveskalyensis (STUR, 1865)
Thecocyrtella ? sp.
Tetractinella trigonella (SCHLOTHEIM, 1820)
Schwagerispira schwageri (BITTNER, 1890)
Schwagerispira cf. *mojsisovicsi* (BÖCKH, 1872)
Coenothyris vulgaris (SCHLOTHEIM, 1822)
Sulcatinella incrassata (BITTNER, 1890)
Angustothyris ? *angustaeformis* (BÖCKH, 1872)
"Pexidella" aff. *sturi* (BÖCKH, 1872)
Age: Balatonicus Subzone, Balatonicus Zone (Pelsonian).

Stratigraphy

The scattered outcrops allowed us to construct a lithological column of the Middle to Upper Anisian sequence at the northern slope of Horog-hegy (Figure 2). The eight metres thick, measured part of the section (between Horog-hegy I. and IV.) was complemented by observations on the distribution of loose rock fragments. Altogether, considering an average dip of 15°, the thickness of the Felsõörs Limestone Formation (as "FLF" below) seems to exceed 35 m.

Lithostratigraphy. From a lithological point of view, the lowermost 10 m of the section shows the general features of the lowermost part of the FLF observed in

other basinal facies of the Balaton Highland. Above the Megyehegy Dolomite it starts with a dolomitised "transitional unit", and higher up it contains a level with mud pebbles embedded in a yellow-mottled matrix, which is interpreted as an intra-basinal debris flow. The next, 10 cm-thick brachiopod limestone layer ("Lower Recoaro") corresponds, by definition, to the "Horoghegy Member"of the FLF and is interpreted as accumulation of biodetritus

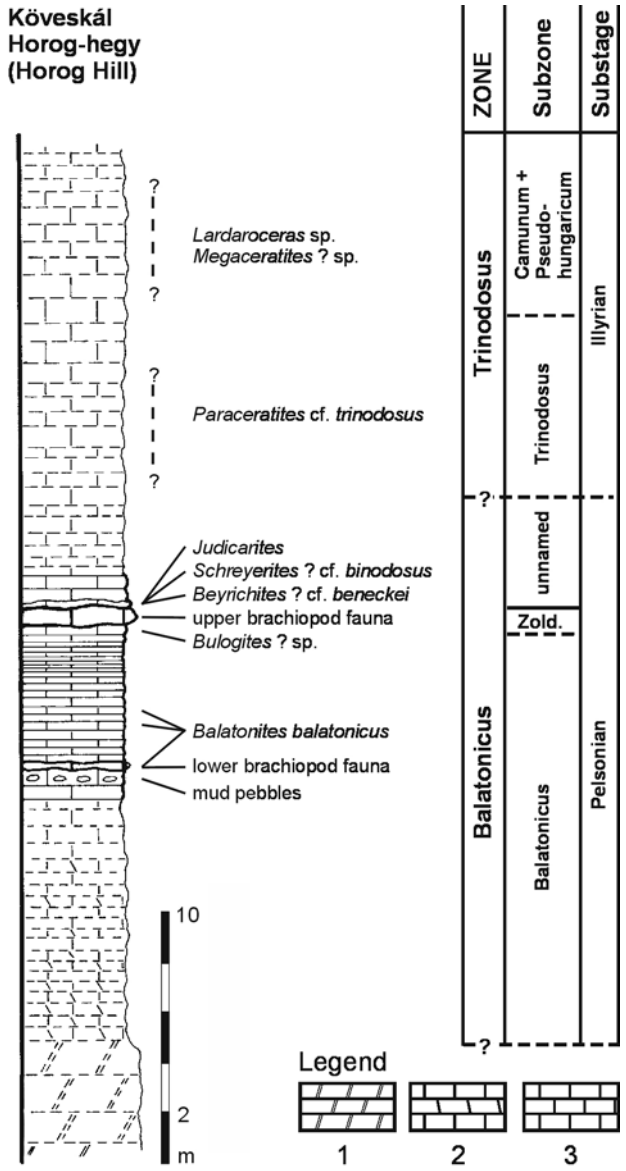

Figure 2 — Stratigraphic section of the northern slope of Horog-hegy (Köveskál), showing the bio- and chronostratigraphic subdivision based on the occurrences of age-diagnostic ammonoid taxa. — Zold. = Zoldianus, **1** = Megyehegy Dolomite, **2** = dolomitised limestones of the "transitional unit", **3** = limestones of the Felsőörs Formation (dashed symbols denote estimated parts of the sequence).

redeposited from thick, well-bedded, bituminous limestone unit represents the "Bocsár Member" of the FLF. In its upper one-third, it contains a finely bedded, laminated interval which is also characteristic to the correlative horizons of other basinal sections of FLF (e.g. at Aszófő). The unique feature of this section is that the "Horoghegy Member" appears again, in a higher, separate level: this few dm thick, brownish brachiopod limestone bed ("Upper Recoaro") is the source of the classic brachiopod fauna. The next, ochre-yellow, fine-grained crinoidal limestone layer with many poorly preserved ammonoids has no known counterpart in other Anisian sections. It probably forms a transition to the overlying mudstone layers of the FLF which become more and more siliceous and cherty higher up and commonly contain silicified ammonoid remains ("Forráshegy Member"). Their thickness is estimated as attaining 20 m.

Biostratigraphy. The biostratigraphical subdivision of the section is based on the scattered occurrences of diagnostic ammonoids. The zonal/subzonal scheme developed by VÖRÖS (1987, 1998) was applied, with a modified, informal use of an unnamed subzone which replaces the Binodosus Subzone (Figure 2, 3). The lowermost ammonoid-bearing bed is "Recoaro II" at locality Horoghegy IV, where *Balatonites balatonicus* and *Norites gondola* clearly prove the Balatonicus Subzone of Balatonicus Zone (Pelsonian). A little higher, a few layers of the well-bedded, bituminous Bocsár Member yielded the same fauna, therefore they also belong to the Balatonicus Subzone. After an unfossiliferous part, the bed immediately below "Recoaro I" yielded *Bulogites* ? sp., suggesting the Zoldianus Subzone of the Balatonicus Zone. The position of the boundary between these two subzones remains uncertain. No determinable ammonoids were recovered from the upper brachiopod bed ("Recoaro I"). The next higher layer yielded several specimens of *Beyrichites* cf. *beneckei, Schreyerites* ? cf. *binodosus* and a fragment of *Judicarites* cf. *euryomphalus*. This association may represent the formerly used "Binodosus Subzone" (sensu VÖRÖS 1987), but the content and position of this subzone became controversial recently (see discussion). From the higher part of the section, ammonoids were collected only from loose blocks, but the presence of *Paraceratites* cf. *trinodosus, Megaceratites* ? cf. *subnodosus* and different species of *Lardaroceras* clearly shows the successive presence of the Trinodosus, (Camunum ?) and Pseudohungaricum Subzones of the Trinodosus Zone (Illyrian).

Discussion

1. The unnamed (= formerly Binodosus) subzone

Despite the lucid summary of the "centennial contradictions" surrounding the Binodosus Zone or Subzone (ASSERETO 1971), the interpretation (content and position) of this unit now seems more confused than ever. For the Tethyan ammonoid zonal scheme, ASSERETO (1974) proposed to use the name Balatonicus Zone instead of Binodosus Zone for the interval covering the Pelsonian Substage, and this was

accepted by the Subcommission of Triassic Stratigraphy (ZAPFE 1983).

At the subzonal level, the Binodosus Subzone was applied again by VÖRÖS (1987) but it was based on a single occurrence of the index species. Moreover, the attempt to define the Binodosus Subzone as the lowermost part of the Trinodosus Zone was not satisfactory and was not followed by others (e.g. TATZREITER & VÖRÖS 1991, BALINI 1993, MIETTO & MANFRIN 1995). BALINI (1993) and TATZREITER & BALINI (1993) avoided using the name "Binodosus" as zonal/subzonal index. More recently, MIETTO & MANFRIN (1995) suggested a completely new zonal/subzonal scheme for the Anisian (and also for the higher Triassic). There the Binodosus Subzone appeared as the uppermost part of the Pelsonian, more or less corresponding to the Zoldianus Subzone of VÖRÖS (1987).

The index species seems to be contradictory in terms of its taxonomic interpretation and stratigraphic position. TATZREITER & BALINI (1993), when erecting the new genus *Schreyerites*, intentionally excluded the species *Ceratites binodosus* (HAUER, 1851) and BALINI (pers. comm. 2002) still holds this opinion. On the other hand, MIETTO & MANFRIN (1995) found the suture of their "*C.*" *binodosus* as a proper basis for assigning this species to *Schreyerites*. A more crucial problem lies in the contradictory data on the stratigraphic occurrence of "*C.*" *binodosus* in the very important Anisian reference section of Dont. BALINI (1993) found it in the level β [corresponding to the upper part of Niveau 3 of ASSERETO (1971), and to the Binodosus Subzone of VÖRÖS (1987)], and this record is confirmed (MUTTONI et al. 1998, BALINI, pers. comm. 2002). On the other hand, MIETTO & MANFRIN (1995, and pers. comm. 2002) collected their "*C.*" *binodosus* from the lower level R [corresponding to the lower part of Niveau 3 of ASSERETO (1971), and to Zoldianus Subzone of VÖRÖS (1987)], and this was the reason why they suggested a "Binodosus Subzone" of deeper position. The arguments of both groups of authors are reasonable, but the proper documentation (monographic descriptions or at least detailed logs with range charts) is still lacking in both cases.

These unsolved contradictions force us to abandon the use "Binodosus" as a subzonal name. We maintain the Zoldianus Subzone as defined by VÖRÖS (1987) and correlated by TATZREITER & VÖRÖS (1991). The subsequent biostratigraphic interval is characterised by the occurrence of the species "*C. binodosus*" (*sensu* ASSERETO 1971, BALINI 1993 and VÖRÖS 1987) accompanied by *Judicarites* and *Longobardites,* but in this study we keep this unit provisionally unnamed. We assign this unnamed subzone to the top of the Pelsonian, with its theoretical upper boundary drawn at the first appearance of *Paraceratites* (i.e., base of Trinodosus Zone, Illyrian). The Giudicarie sections (e.g. Stabol Fresco, BALINI et al. 1993) are best suited for drawing this boundary, whereas, due to their scanty fossil record in this interval, neither the Balaton Highland, nor the Dont sections are useful in this respect.

2. The two levels of brachiopod ("Recoaro") limestones

An unusual feature of the Horog-hegy section is that the brachiopod limestone ("Recoaro" Limestone, or "Horoghegy Member") appears in two distinct, biostratigraphically well-dated levels in the Balatonicus Subzone and at the top of the Zoldianus Subzone. In other sections of the Balaton Highland, where this member of the FLF is known, it occurs at only one level. It was dated by ammonoids in the Aszófõ section where it belongs to the Balatonicus Subzone (PÁLFY 1986, TATZREITER & VÖRÖS 1991). In the Felsõörs section the crinoidal-brachiopodal limestone beds were assigned to the Binodosus Subzone (VÖRÖS 1998), whereas earlier records suggest that they may also represent the highest part of the Zoldianus Subzone (SZABÓ et al. 1980). Thus the "Recoaro" beds at Aszófõ and Felsõörs show remarkable correlation with the two levels of the Horog-hegy section (Figure 3). It must be noted, however, that in contrast to the less than one metre thick "Recoaro" levels at Köveskál, the crinoidal-brachiopodal limestones form several metres thick intervals both at Aszófõ and Felsõörs.

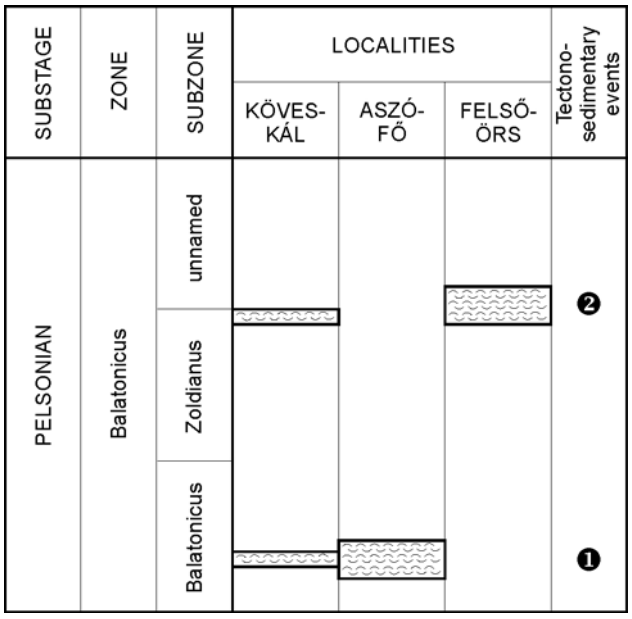

Figure 3 — Correlation chart of the two levels of "Recoaro" limestone in well-dated sections of the Balaton Highland with a possible interpretation of the events. — 1: Isolation of surviving Tagyon-type carbonate platforms; **2:** Fragmentation and demise of carbonate platforms.

The two levels of brachiopod ("Recoaro") limestones of the Horog-hegy section show subtle differences. At each level, twenty species were identified, of which 16 occur at both horizons. By far the most abundant species are *Tetractinella trigonella* and *Mentzelia mentzeli* in both the lower and the upper brachiopod bed. The designation of a *Mentzelia mentzeli–Tetractinella trigonella* association, first observed in the material collected

mostly from the upper bed (PÁLFY 1991), is thus applicable to both horizons. The lower bed yielded several rare species, which were previously only known from Aszófő in the Balaton Highland area. These include *Volirhynchia* cf. *projectifrons*, *Homoeorhynchia* ? sp., *Sulcatinella incrassata,* and "*Pexidella*" aff. *sturi*. A lithological similarity between the lower brachiopod limestone of Köveskál and that of Aszófő was also noted, and the preservation of brachiopods from these two localities is comparable. The most striking preservational difference between the two brachiopod beds at Köveskál is that *T. trigonella* occurs as mostly articulated valves at the lower level, whereas at the upper level the majority of specimens are disarticulated valves.

Despite the slight differences, the fauna of the two levels has largely similar composition what points to a common source. The relevant paleogeographic models (BUDAI & VÖRÖS 1992, VÖRÖS et al. 1997) identify the source area of the shell debris redeposited to the basin as the western margin/slope of the Tagyon Platform. This margin was envisaged for the Pelsonian time as running along a NW–SE trend, at 1 km distance from the present-day Horog-hegy; it was downfaulted in the Illyrian (VÖRÖS et al. 1997, figs 3, 4). The rocky escarpments and slopes of the Tagyon Platform/Plateau could serve as biotopes of brachiopods, crinoids and other sessile benthic organisms. After death, their shells and skeletons were carried down to the neighbouring basin from time to time and were deposited as shell-beds intercalated with the basinal limestones.

The marked phases of increased redeposition might be caused by sudden sea-level falls, which might be resulted in downslope removal of shelly material from the shallow areas. This model is not fully applicable in our case, because there is no consistent corelation with the regressive sequence boundaries recognised for the Balaton Highland (HAAS & BUDAI 1999). Although the "Upper Recoaro" level (Zoldianus/Binodosus Subzone) may correspond to the regressive top surface of Sequence A3 (HAAS & BUDAI 1999), the "Lower Recoaro" level (Balatonicus Subzone) coincides with a marked maximum flooding interval (BUDAI & HAAS 1997).

Here we prefer an alternative model which is a modified version of that developed for the Jurassic brachiopod distribution and basin evolution of the Bakony Mts. by VÖRÖS (1986, 1993). There, the repeated mass accumulations of brachiopods were interpreted to be related to repeated tectonic movements along the fault-bound escarpments of submarine elevations. If we apply this interpretation to the Anisian of the Balaton Highland, the synchronous appearance of "Recoaro" limestones in different sections would reflect regional tectonic episodes. Consequently, the repeated appearance of "Recoaro" limestone in the basinal sequences marks two major phases of the fragmentation of the Anisian platforms: one in the Balatonicus Subchron, another at the end of the Zoldianus Subchron. The first phase may correspond to the first fragmentation episode of the formerly uniform Megyehegy platform or ramp, i.e. the birth of the isolated platforms such as the Tagyon platform (BUDAI & VÖRÖS 1992, HAAS & BUDAI 1999). The second tectonic phase may also be reflected in the progressive fragmentation and eventual demise of the platforms at the Balaton Highland (e.g. Tagyon and Szentkirályszabadja; BUDAI et al. 1993, VÖRÖS et al. 1997).

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Explanation to Plate I

1a–c ***Balatonites balatonicus*** **(Mojsisovics, 1873), (M.2002.474), × 1.— a, c**: lateral views, **b**: ventral view — Köveskál, Horog-hegy IV, Anisian, Balatonicus Zone (Balatonicus Subzone),

2a–b ***Norites*** **cf.** ***gondola*** **(Mojsisovics, 1869) (M.2002.475), × 1.** — **a**: lateral view, **b**: ventral view — Köveskál, Horog-hegy IV, Anisian, Balatonicus Zone (Balatonicus Subzone).

3 ***Balatonites balatonicus*** **(Mojsisovics, 1872) (M.200130), × 1. —** Köveskál, Horog-hegy III, Anisian, Balatonicus Zone (Balatonicus Subzone).

4 ***Balatonites balatonicus*** **(Mojsisovics, 1872) (M.2001.31), × 1. —** Köveskál, Horog-hegy III, Anisian, Balatonicus Zone (Balatonicus Subzone).

5a–b ***Judicarites*** **cf.** ***euryomphalus*** **(Benecke, 1866) (M.2001.34), × 1. — a**: lateral view, **b**: ventral view — Köveskál, Horog-hegy I, Anisian, Balatonicus Zone (unnamed Subzone).

6 ***Beyrichites*** **cf.** ***beneckei*** **(Mojsisovics, 1881) (M.2001.32), × 1.** — Köveskál, Horog-hegy I, Anisian, Balatonicus Zone (unnamed Subzone).

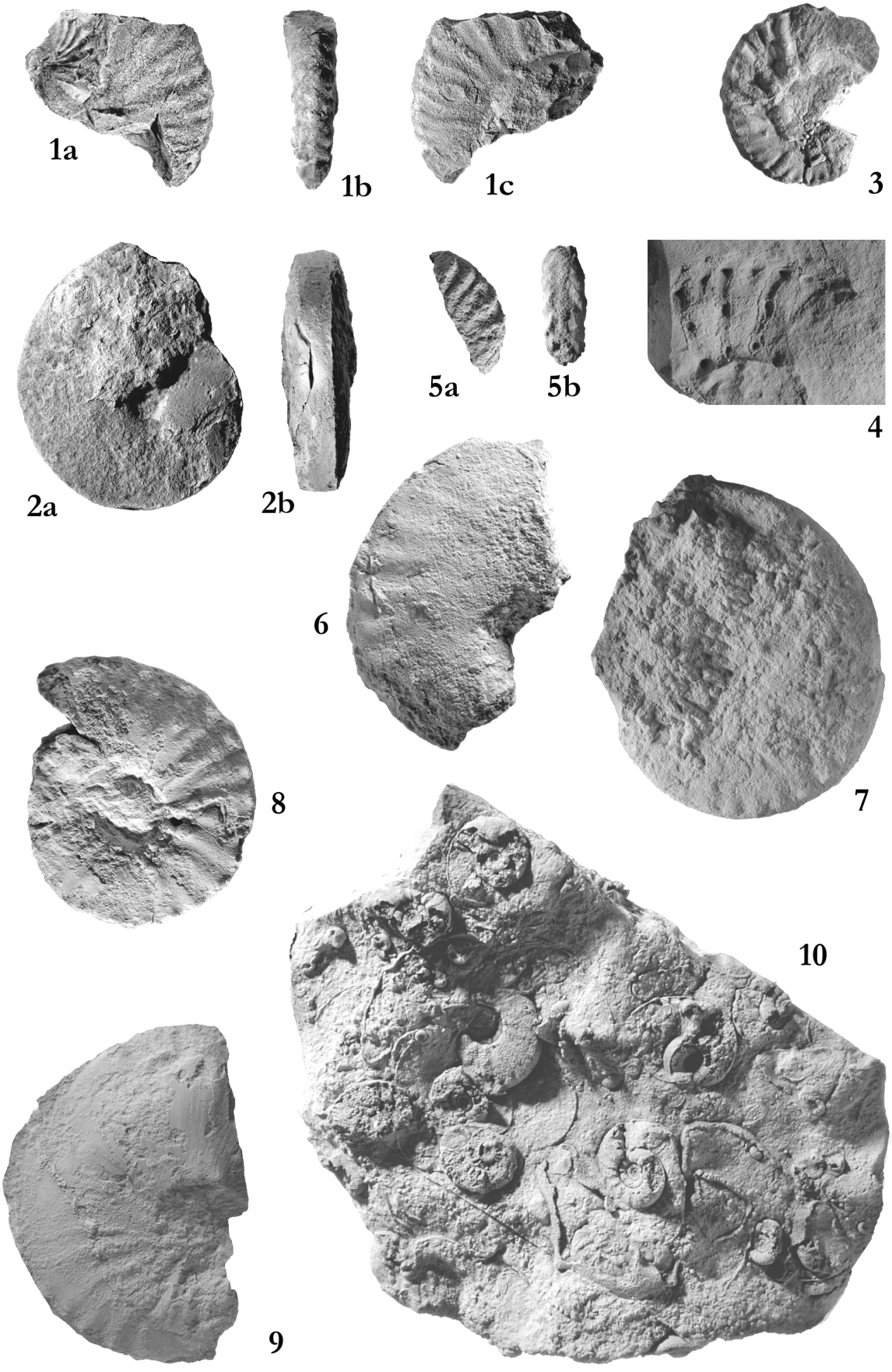
7 ***Schreyerites*** **? cf.** ***binodosus*** **(Hauer, 1851) (M.2001.33), × 1.** — Köveskál, Horog-hegy I, Anisian, Balatonicus Zone (unnamed Subzone).

8 ***Paraceratites*** **cf.** ***trinodosus*** **(Mojsisovics, 1882) (M.2001.35), × 1.** — Köveskál, Horog-hegy, Anisian, Trinodosus Zone (loose block).

9 ***Lardaroceras*** **sp. (M.2001.36) , × 1.** — Köveskál, Horog-hegy, Anisian, Trinodosus Zone (loose block).

10 **Limestone slab with silicified shells of ceratitids and ptychitids, × 1. —** Köveskál, Horog-hegy Anisian, Trinodosus Zone (loose block).

Plate I



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