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# MIDDLE TRIASSIC PLATFORM AND BASIN EVOLUTION OF THE SOUTHERN BAKONY MOUNTAINS (TRANSDANUBIAN RANGE, HUNGARY)

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*Key words*: Middle Triassic, synsedimentary tectonics, eustatic sea-level changes, platform and basin evolution, Balaton Highland, Veszprém plateau.

*Abstract*. Middle Triassic history of the Southern Bakony Mts. is outlined on the base of horizontal and vertical facies changes of the formations.

During the Pelsonian (Balatonicus Chron) the evolution of the basins and platforms was determined basically by synsedimentary tectonics. The Felsöörs basin of the Balaton Highland opened due to the block-faulting of the Bithynian carbonate ramp (Megyehegy Dolomite). Above the drowning blocks "halfgraben" basins were formed (Felsöörs Formation), while isolated platforms developed on the uplifted ones in the middle part of the Balaton Highland and on the Veszprém plateau (Tagyon Formation). Due to the relative sea-level fall in the early Illyrian, the platforms became subaerially exposed and karstified.

As a consequence of the late Illyrian tectonic subsidence (manifested by neptunian dykes) the central platform of the Balaton Highland has been drowned (Camunum Subchron). On the contrary, the Anisian platform of the Veszprém plateau was totally flooded only during the latest Illyrian (Reitzi Subchron) due to eustatic sea-level rise. It was followed by a short highstand period (Secedensis Chron), characterised by the first progradation of the Budaörs platform on the Veszprém plateau and highstand shedding in the basins and on the submarine high (Vászoly Limestone) in the centre of the Balaton Highland basin. Due to the following rapid sea-level rise, carbonate sedimentation continued in eupelagic basin from the Fassanian (Buchenstein Formation). At the beginning of the late Longobardian highstand period (Regoledanus Chron) the Budaörs platform intensively prograded from the Veszprém plateau to the southwest, causing highstand shedding in the Balaton Highland basin (Füred Limestone).

*Riassunto*. Viene delineata la storia del Triassico Medio nelle montagne meridionali del Balaton, sulla base dei cambi laterali e verticali di facies delle unità rocciose.

Durante il Pelsonico (Chron Balatonicus) l'evoluzione dei bacini e delle piattaforme fu controllata essenzialmente dalla tettonica sinsedimentaria. Il bacino di Felsöörs delle Balaton Highland si aprì in seguito alla frammentazione in blocchi della rampa carbonatica di età bitinica (Dolomia di Megyehegy). Sui blocchi in sprofondamento si formarono dei bacini di tipo "halfgraben" (Formazione di Felsöörs), mentre piattaforme isolate si sviluppavano sulle porzioni rialzate nella parte centrale delle Balaton Highland e sul plateau di Veszprém (Formazione di Tagyon). In conseguenza della caduta relativa del livello del mare nell'Illirico inferiore, le piattorme emersero e furono carsificate.

Per la subsidenza tettonica verificatasi nell'Illirico superiore (suggerita dai dicchi nettuniani) la piattaforma centrale delle Balaton Highland sprofondò (Subchron Camunum). Invece la piattaforma anisica del plateau di Veszprém fu totalmente sommersa solo durante l'Illirico terminale (Subchron Reitzi), a causa dell'innalzamento eustatico. Questo fu seguito da un breve periodo di stazionamento alto (Chron Secedensis), caratterizzato dalla prima progradazione della piattaforma di Budaörs platform sul plateau di Veszprém e dall'ammantamento di depositi bacinali nei bacini e sugli alti sottomarini (Calcare di Vászoly), al centro del più vasto bacino delle Balaton Highland. In seguito al successivo rapido innalzamento del livello marino, la sedimentazione carbonatica continuò nel bacino pelagico dal Fassanico (Formazione di Buchenstein) sino al Longobardico. All'inizio del Longobardico sommitale (Chron Regoledanus) la piattaforma di Budaörs progradò significativamente dal plateau di Veszprém verso SE, formando una copertura omogenea sul bacino delle Balaton Highland (Calcare di Füred).

## Introduction

The primary goal of the authors is to give a reconstruction of the Middle Triassic basin and platform evolution on the Balaton Highland and the Veszprém plateau (Southern Bakony Mts., Transdanubian Range) based on the facies patterns and connections of platform and basin successions (Budai & Haas 1997; Vörös et al. 1997; Haas & Budai 1999; Budai et al. 2001). New biostratigraphic data have raised the opportunity to establish a more detailed chronostratigraphic subdivision for

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| Stage | Substg. | Ammonite Zone/Chron | Ammonite Subzone/Subchron |
|---|---|---|---|
| Carnian | Julian | Aon | |
| Ladinian | Longobardian | Regoledanus | |
| | | Archelaus | |
| | Fassan. | Gredleri | |
| | | Curionii | |
| Anisian | Illyrian | Secedensis | |
| | | Reitzi | Avisianum |
| | | | Reitzi |
| | | | Liepoldti |
| | | | Felsoeoersensis |
| | | Trinodosus | Pseudohungaricum |
| | | | Camunum |
| | | | Trinodosus |
| | Pelson. | Balatonicus | Binodosus |
| | | | Zoldianus |
| | | | Cadoricus |
| | | | Balatonicus |

Tab. 1 - Middle Triassic bio/chronostratigraphic chart used in the present paper (based on Vörös 1998, Vörös et al. 2003a).

the middle Anisian to lowermost Carnian sequence (Vörös 1998; Vörös et al. 2003a, b) and to insert the main phases of the Middle Triassic history into a more precise geochronological frame than before.

The investigated area of the Balaton Highland and the Veszprém plateau is characterized by poorly exposed denudation surface where good outcrops are rare and to follow the geometry of the direct contact between the Middle Triassic platform and basin successions is almost impossible. Because of the close stratigraphic relationship between the Middle Triassic formations of the Bakony Mts and the Southern Alps (Budai 1992; Budai & Haas 1997; Haas & Budai 1999) the best solution to eliminate this handicap is to correlate our profiles with the classical area of the Dolomites where several studies were published about the geometry of the platforms and their slopes, based on large-scale physical stratigraphy (Bosellini & Rossi 1974; Bosellini 1984, 1991; Bosellini & Stefani 1991; Bosellini et al. 1996a, b; Brandner et al. 1991) and sequence stratigraphy (De Zanche et al. 1993, 1995; Rüffer & Zühlke 1995; Gianolla et al. 1998; Maurer 2000). Detailed facies analysis (Gaetani et al. 1981; Gaetani & Gorza 1989; Senowbari-Daryan et al. 1993; Rüffer & Zamparelli 1997; Emmerich et al. 2005) and biostratigraphic and cyclostratigraphic contributions (Brack & Rieber 1993; Eggenhoff et al. 1999; Mundil et al. 2003) were taken into account, as well.

The official chronostratigraphic chart of the Middle Triassic has been changed recently. Here we apply the decision of the Subcommission on Triassic Stratigraphy i.e. to draw the base of the Ladinian at the base of the Curionii Zone as suggested by Brack et al. (2003). The Middle Triassic bio/chronostratigraphic units used in this paper are shown in Tab. 1.

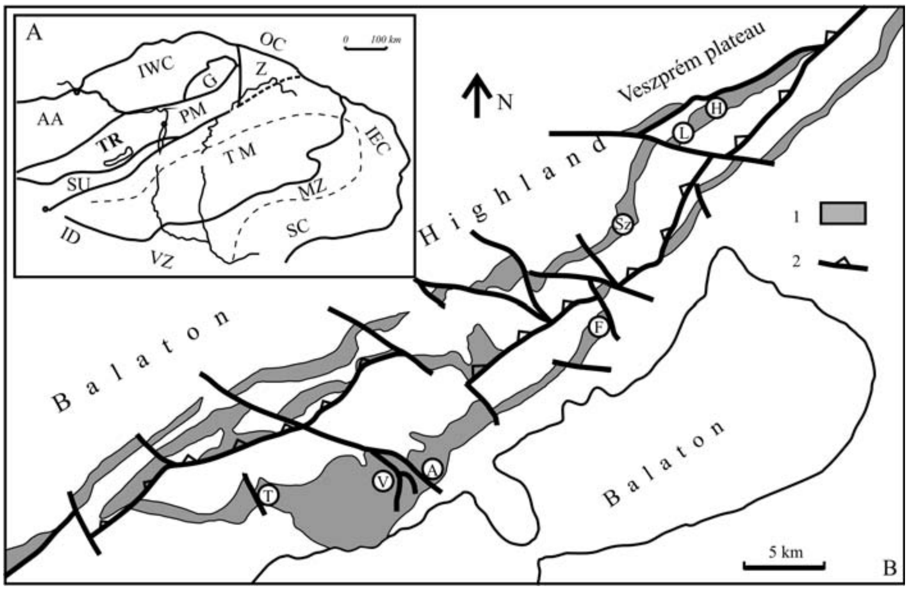


Fig. 1 - A) Megatectonic setting of the Transdanubian Range (after Haas et al. 1995). Abbreviations: AA - Austroalpine Units, G - Gemer, ID - Inner Dinarides, IEC - Inner East Carpathians, IWC - Inner West Carpathians, MZ - Mures Zone, OC - Outer Carpathians, PM - Pelso Megaunit, SC - South Carpathians, SU - Sava Unit, TM - Tisza Megaunit, TR - Transdanubian Range, VZ - Vardar Zone, Z - Zemplén.
B) Simplified geological map of the study area with the location of the investigated sections. Legend: 1. Middle Anisian to lowermost Carnian formations on the surface, 2. Litér overthrust. Abbreviations: A - Aszófö (Fig. 4/B), F - Felsöörs (Fig. 4/A), H - Hajmáskér (Fig. 7), L - Litér (Fig. 6), Sz - Szentkirályszabadja (Fig. 3), T - Tagyon, V - Vászoly (Fig. 5).

#### Geological setting

Hungary lies in the central part of the Carpathian Basin, surrounded by the Alps, the Carpathians and the Dinarides. According to the sedimentary evolution and facies patterns of pre-Tertiary formations, the territory of Hungary can be divided into two main tectono-sedimentary terranes, the Pelso and Tisza Megaunits (Fig. 1/A) (Kovács et al. 2000). The Transdanubian Range belongs to the Pelso Megaunit, characterized by an elongated syncline structure striking SW-NE direction. Middle Triassic formations crop out along the southern flank of the syncline structure of the range, on the Balaton Highland and the Veszprém plateau

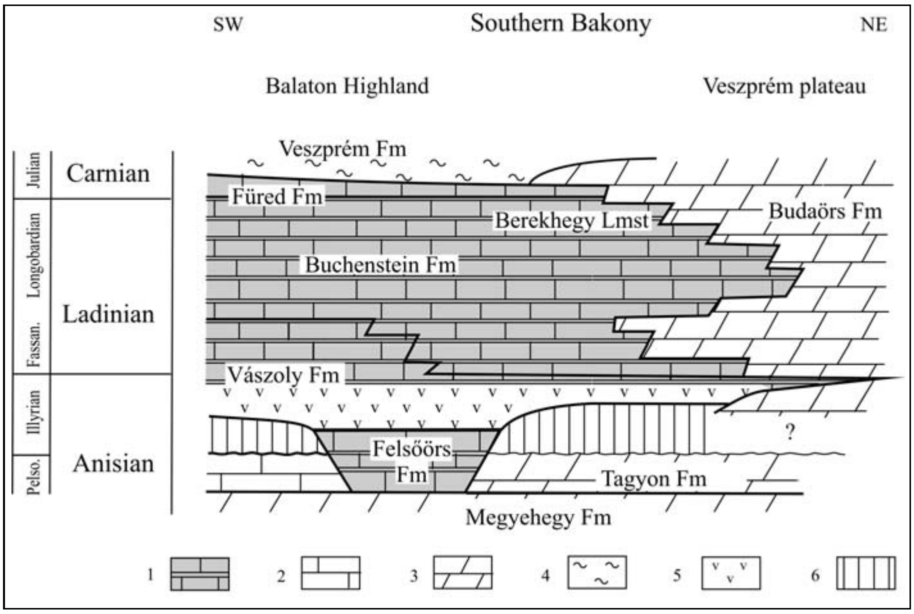


Fig. 2 - Middle Triassic lithostratigraphic units of the Bakony Mts. (modified after Haas & Budai 1999). Legend: 1. pelagic limestones (basin facies); 2. shallow marine limestones (platform facies); 3. shallow marine dolomites (platform facies); 4. pelagic marls (basin facies); 5. volcanites; 6. gap.

(Southern Bakony Mts). The most decisive structural element of the region is a significant south vergent overthrust of NE-SW strike (Litér Line) that resulted in repetition of the Permian-Triassic succession (Fig. 1/B).

Present-day lithostratigraphic subdivision of the Middle Triassic succession of the Balaton Highland and the Veszprém plateau (Fig. 2) has been worked out on the basis of the last regional geological mapping project (Budai et al. 1999a, b) and several other projects sponsored by the Hungarian Research Found (Budai 1992; Vörös et al. 1997; Budai et al. 2001).

**Middle to Upper Anisian platform and basin facies of the Southern Bakony Mts.**

Anisian formations show characteristic lateral facies distribution along the Balaton Highland and the Veszprém Plateau above the uniform Lower Anisian carbonate ramp built up of the Aszófö Dolomite, the Iszkahegy Limestone and of the Megyehegy Dolomite (Budai & Vörös 1992; Haas & Budai 1995; Vörös et al. 2003b). The Pelsonian platform carbonate succession of the Tagyon Formation is built up by cyclic alternation of shallow subtidal bedded fossiliferous limestones (or dolomites) and thin stratified calcite-spotted limestones (or dolomites) of intertidal facies, moreover, supratidal lithofacies were also detected. The formation is very rich in calcareous algae (*Physoporella pauciforata pauciforata*, *Ph. pauciforata undulata*, *Ph. pauciforata sulcata*, *Ph. pauciforata gemerica, Teutloporella peniculiformis, Anisoporella anisica, Poncetella hexaster*) and forams (Oravecz-Scheffer 1987; Budai et al. 1999b; Vörös et al. 2003b), while ammonoids (*Balatonites balatonicus*) were found only at Szentkirályszabadja (Budai & Haas 1997; Vörös 1998). The Lofer cyclic Tagyon Formation develops gradually from the carbonate ramp facies of the Megyehegy Dolomite, while its upper boundary with the overlying upper Illyrian crinoidal, ammonitic limestone (Vászoly Formation) is sharp (Fig. 3). The areal extension of the formation is restricted to the middle part of the Balaton Highland while it is widespread on the Veszprém plateau.

Upper Anisian platform carbonates (e.g. like the Contrin Formation in the Dolomites) are unknown, or at least biostratigraphically are not documented in the Southern Bakony Mts.

The Pelsonian to lower Illyrian basin succession of the Balaton Highland is represented by the Felsöörs Formation (Fig. 4/A) which is built up by nodular (often cherty) limestones, bituminous laminites (Fig. 4/B), marly limestones and marls with tuffite intercalations in the upper part. In the surroundings of the Pelsonian platforms biodetrital limestone intercalations also occur, containing crinoids and brachiopods (Pálfy 1991, 1994; Vörös & Pálfy 2002; Vörös et al. 2003b) together with redeposited lithoclasts from the slope of the adjacent platform and/or submarine high (Budai & Haas 1997). Stratigraphic extension of the Felsöörs Limestone persists from the base of the Balatonicus Zone up to the Pseudohungaricum Subzone of the Trinodosus Zone (Márton et al. 1997; Vörös et al. 1996, 2003a,b). The formation reaches its greatest thickness (about 150 m) close to the Pelsonian platform in the centre of the Balaton Highland (Aszófö). From here to the northeast its thickness decreases gradually and it pinches out on the Veszprém plateau (Szentkirályszabadja).

Lithology of the upper Illyrian basin succession shows characteristic differences on the former basin and platform areas. On the basin area of the Balaton Highland, the Vászoly Formation is built up mainly by tuffs and tuffites with siliceous limestone nodules and lenses

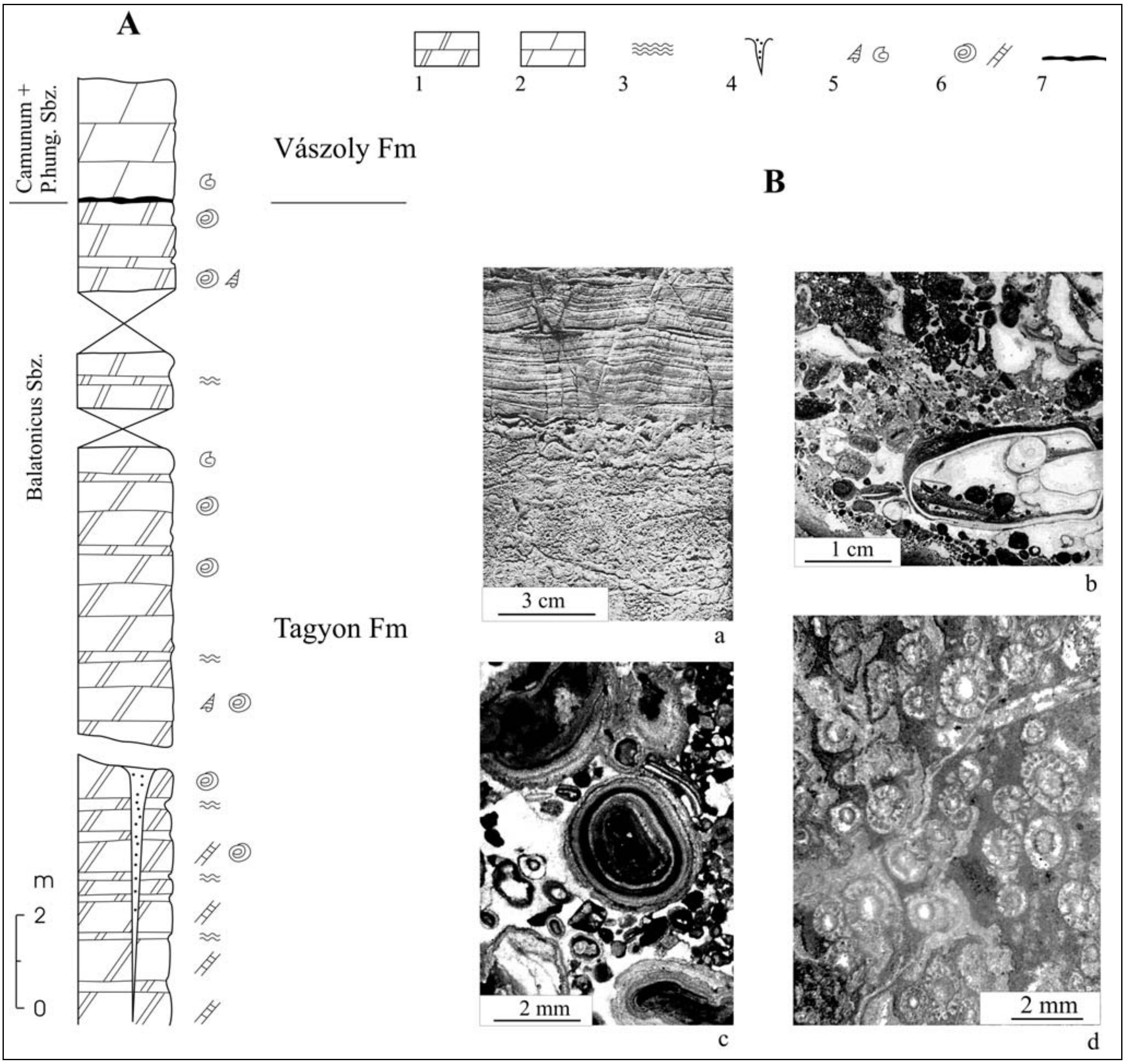


Fig. 3 - A) Lithologic column of the Tagyon Formation and the overlying Vászoly Formation in the quarry of Szentkirályszabadja (modified after Budai et al. 2001). Legend: 1. Lofer-cyclic dolomite of platform facies; 2. dolomitized limestone of basin facies; 3. stromatolite; 4. neptunian dyke; 5. gastropods, ammonoids; 6. oncoids, dasyclads; 7. paleosol.
B) Characteristic facies-types of the Tagyon Formation: a. stromatolite with teepee structure (above) and oncoidal facies (below); b. ammonite shell in oncosparite; c. vadose pisoids in fine grained microoncoidal matrix; d. dasyclads *(Physoporella pauciforata pauciforata).*

(Fig. 4), showing continuous transition from the underlying Felsöörs Formation and to the overlying Buchenstein Formation, as well. In contrast to the basin areas, the basal beds of the Vászoly Formation sharply overlie the Pelsonian platform carbonates on the Veszprém plateau (Fig. 3) and in the central part of the Balaton Highland (Fig. 5/A). These crinoidal limestones (or dolomites) and the overlying tuffitic strata contain rich ammonite associations from the Camunum Subzone up to the Secedensis Zone (Vörös et al. 1996; Márton et al. 1997; Vörös 1998;. Budai et al. 1999b, 2001). The tuffs and tuffites are covered by light grey, thick-bedded nodular limestone (Vászoly Limestone Mb) of early Ladinian age (Curionii Zone) which is restricted to the territory of the Pelsonian platforms (Fig. 5/B).

### Ladinian to Lower Carnian basin and platform facies of the Southern Bakony Mts.

Ladinian basin succession of the Southern Bakony Mts. is built up by bedded nodular, siliceous, cherty limestones with marl and tuff or siliceous tuffite inter-

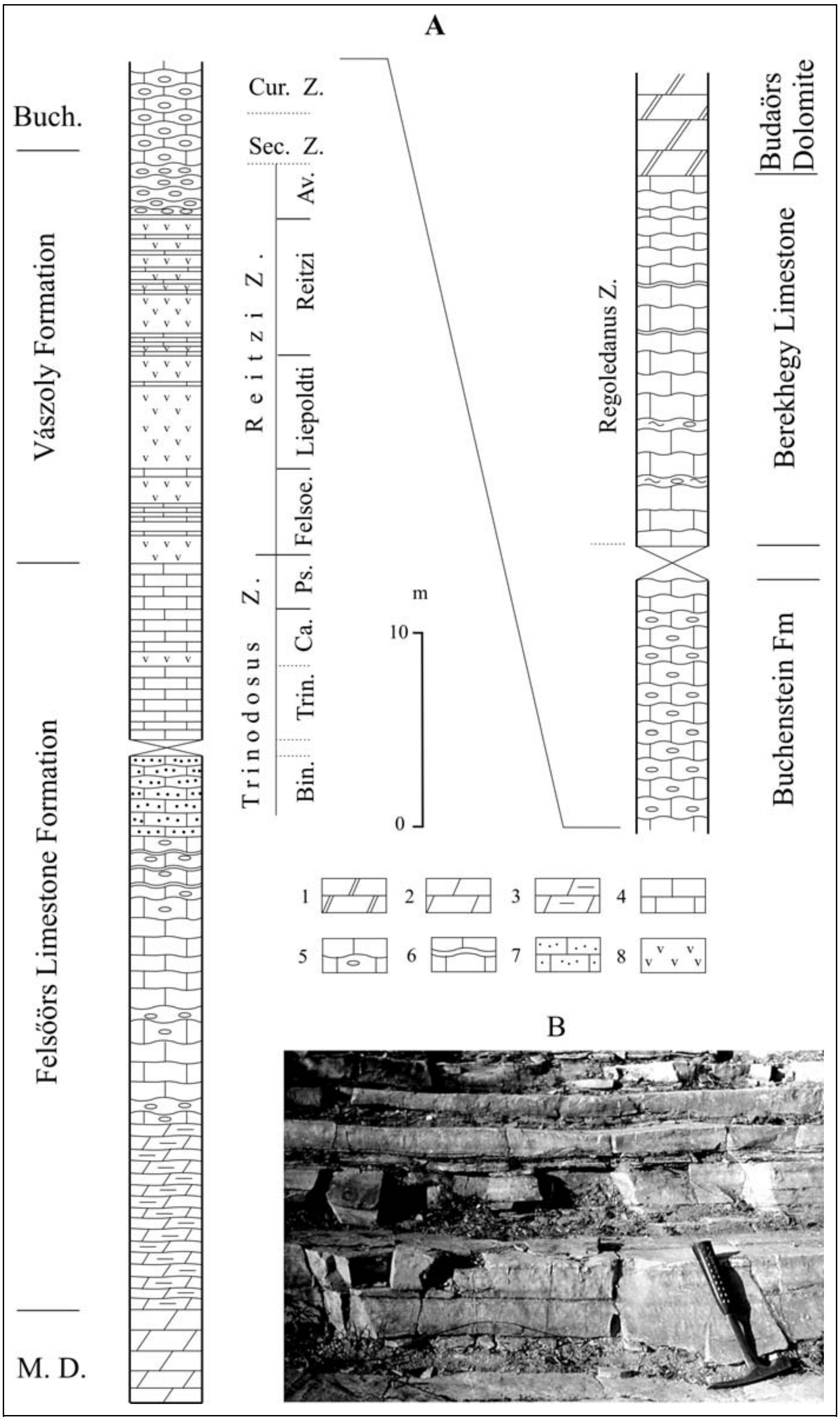


Fig. 4 - A) Lithologic column of the Felsöörs key section representing the middle Anisian to Upper Ladinian basin sequence of the Balaton Highland, overlain by lower Carnian platform carbonate (modified after Vörös et al. 2003a). Legend: 1. dolomites of platform facies; 2. dolomites of carbonate ramp facies; 3. bituminous dolomites; 4. bedded, laminated limestones; 5. bedded nodular limestones with chert; 6. flaser-bedded limestones with marl intercalations; 7. crinoidal-brachiopodal limestones; 8. tuff, tuffite. Abbreviations: M. D. - Megyehegy Dolomite; Buch. - Buchenstein Formation; Bin. - Binodosus, Trin. - Trinodosus, Ca. - Camunum, Ps. - Pseudohungaricum (Subzones of Trinodosus Zone); Felsoe. - Felsoeoersensis, Av. - Avisianum (Subzones of Reitzi Zone); Sec. Z. - Secedensis Zone; Cur. Z. - Curionii Zone.
B) Bituminous laminite of the Felsöörs Formation in the Aszófö section (Balatonicus Zone).

calations. The eupelagic basin facies of the Buchenstein Formation develops gradually from the underlying Vászoly Formation on the basin area of the Balaton Highland (Fig. 4/A), while above the Pelsonian platform siliceous laminites cover abruptly the Vászoly Limestone (Fig. 5/A). On the Pelsonian platform area of the Veszprém plateau the Ladinian basin succession shows lateral transition to the heteropic platform carbonate of the Budaörs Formation. The lowermost dolomite intercalation lies between the Vászoly and the Buchenstein Formation (Fig. 6/A). Based on the ammonite data of Sóly (Vörös 1998) and Litér sections (Budai et al. 2001) its position can be fitted between the Avisianum Subzone of the Reitzi Zone (below) and the Gredleri Zone (above).

The uppermost Ladinian to lower Carnian basin succession of the Southern Bakony Mts. shows a special trend in facies and age according to the distance from

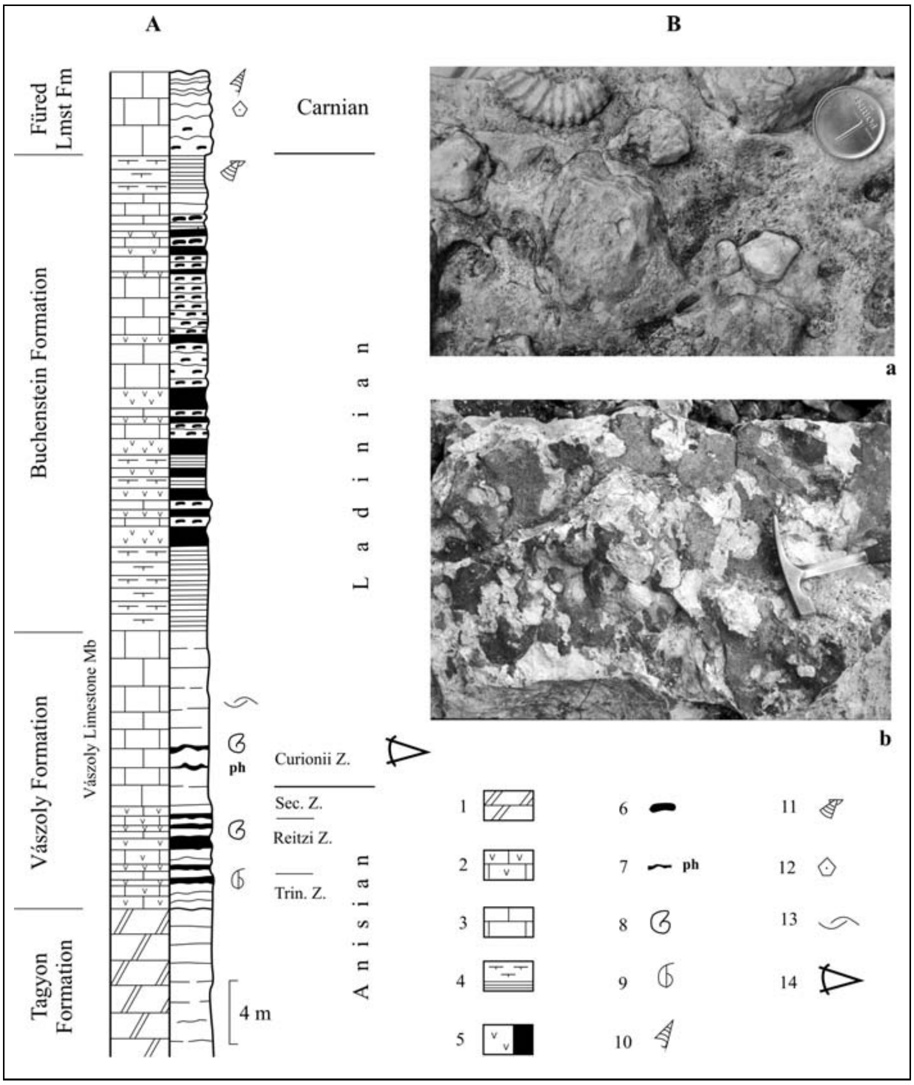


Fig. 5 - A) Lithologic column of the upper Anisian to lower Carnian basin succession above the Pelsonian "Tagyon platform" in the middle part of the Balaton Highland (modified after Budai et al. 1999b). Legend: 1. dolomites of platform facies; 2. tuffitic limestones of basin facies; 3. bedded (nodular) limestones of basin facies; 4. siliceous, laminated limestones and tuffites; 5. tuffs, altered clayey tuffites; 6. chert; 7. phosphoritic hard-ground; 8. ammonoids; 9. brachiopods; 10. gastropods; 11. bivalves; 12. crinoids; 13. filaments; 14. viewpoint of bedding planes shown on Fig. B. B) a - *Eoprotrachyceras curionii* in the Vászoly Limestone Mb (diameter of the coin is 1,5 cm); b - phosphoritic hard-ground on the bedding plane of the Vászoly Limestone Mb.

the coeval platform. On the area of the Balaton Highland basin, the Füred Limestone develops gradually from the underlying Buchenstein Formation with the decrease of the volcanites. The well bedded tabular limestone succession is built up by cyclic alternation of nodular light grey limestone beds and marl layers. Parallel with the thickening of the marl intercalations, the facies of the limestone succession shows a shallowing upward trend. The Füred Limestone is overlain by the Veszprém Marl on the basin area of the Balaton Highland. Based on ammonite data and microbiostratigraphic evaluation, the age of the Füred Limestone is early Carnian in the central part of the Balaton Highland (Budai & Dosztály 1990). From the Balaton Highland basin to the north-eastern platform of the Veszprém plateau the distal facies of the Füred Limestone is substituted by the more proximal Berekhegy Limestone above the Buchenstein Formation (Fig. 7/A). The thin limestone beds show graded stratification with coarse bioclastic calcarenites on the base (Fig. 7/B). Allodapic clasts contain coated grains of platform origin. Forams (*Agglutisolenia* sp., *Austrocolomia cordevolica*, *A. marschalli*, *Gaudryinella* sp., *Kriptoseptida klebelsbergi*, *Meandrospirella planispira*, *Ophthalmidium plectospirus*, *O. carintum*, *O. exiguum*, *Paralingulina ploechingeri*, *Pilaminella gemerica*, *Reophax rudis*, *Schmidita inflata*, *Triadodiscus eomesozoicus*, *Turriglomina magna*, *T. carnica)* and microproblematica in the redeposited sediments (*Koivaella permiensis*, *Ladinella porata*, *Messopotamella angulata*, *Panormidella aggregata*, *Tubiphytes carinthiacus*, *T. obscurus* and *Bacinella* forms) may indicate platform-rim where carbonate sediments probably could have been binded by encrusting algae (Haas et al. 2000). With increasing number of dolomite intercalations thickening upwards, the Berekhegy Limestone passes gradually to the platform carbonate of the Budaörs Dolomite (Fig. 7). Based on ammonite record (*Celtites epolensis*) and microbiostratigraphic data, the Berekhegy Limestone represents the uppermost part of Ladinian stage (Regoledanus Zone) and probably the lowermost Carnian, as well.

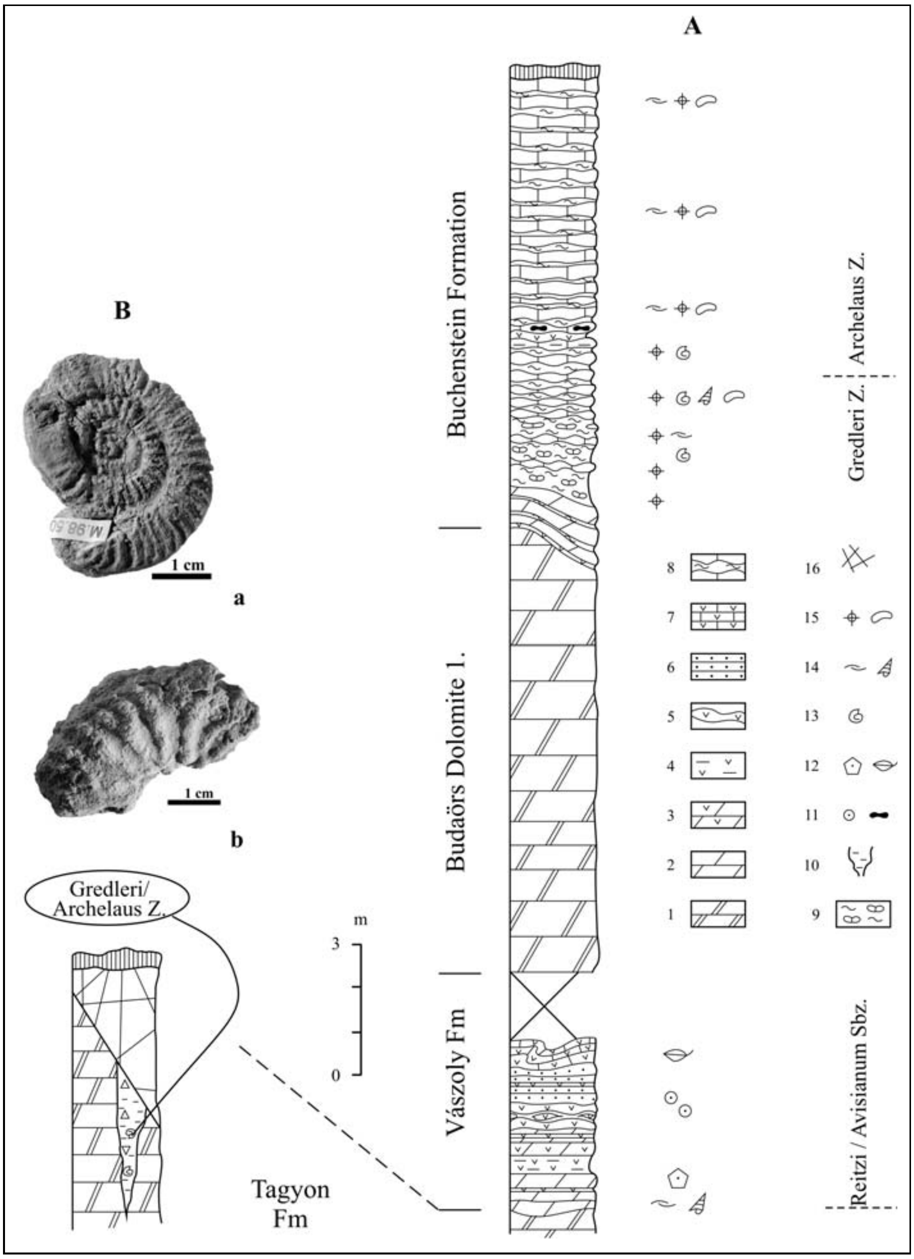


Fig. 6 - A) Lithologic column of the upper Anisian to Ladinian sequence of the Litér quarry (modified after Budai et al. 2001). Legend: 1. platform dolomite; 2. dolomitized limestone of basin facies; 3. tuffitic dolomite; 4. weathered tuff; 5. flaser-bedded tuff; 6. calcareous tuff-sandstone; 7. tuffitic limestone; 8. nodular, siliceous limestone with marl intercalations; 9. marl with limestone nodules; 10. neptunian dyke; 11. pisoids, chert nodules; 12. crinoids, brachiopods; 13. ammonoids; 14. filaments; gastropods; 15. radiolarians, ostracods; 16. heavily tectonized part of the section.
B) Ammonites collected in the neptunian dyke: a - *Arpadites* cf. *arpadis*, b - *Protrachyceras gredleri.*

**The main stages of the Middle Triassic platform-basin evolution in the Southern Bakony Mts. (discussion)**

Based on the study of facies patterns and the horizontal and vertical connections of the Middle Triassic platform carbonates and basin facies on the Balaton Highland and the Veszprém plateau in a detailed biostratigraphic frame, the middle Anisan to early Carnian history of the Southern Bakony Mts. can be summarized as follows (Figs. 8 and 9).

During the Pelsonian the formation and evolution of the basins and platforms was determined basically by synsedimentary tectonics (Budai & Vörös 1992; Haas & Budai 1995). The Balaton Highland basin opened at the beginning of the Pelsonian (Balatonicus Chron) due to the block-faulting of the Bithynian carbonate ramp (Megyehegy Dolomite) along faults of NW-SE direction (Budai & Vörös 1993). Above the drowning blocks "halfgraben" basins were formed (Felsöörs Formation), while isolated platforms (Tagyon Formation) developed on the uplifted ones in the middle part of the Balaton Highland and on the Veszprém plateau (Fig. 9/a). Two distinct tectonic episodes can be recognized during the Pelsonian (in the Balatonicus and Zoldianus Subchron) based on the biostratigraphic evaluation of the allodapic sediments redeposited along the tectonically controlled escarpments (Vörös & Pálfy 2002). The Pelsonian tectonic phase is in obvious connection with the rifting process of the Neotethys ocean branch (Haas et al. 1995) represented by strike-slip movements of extensional geodynamic regime (Doglioni & Neri 1988). However, according to the appearance of Teth-

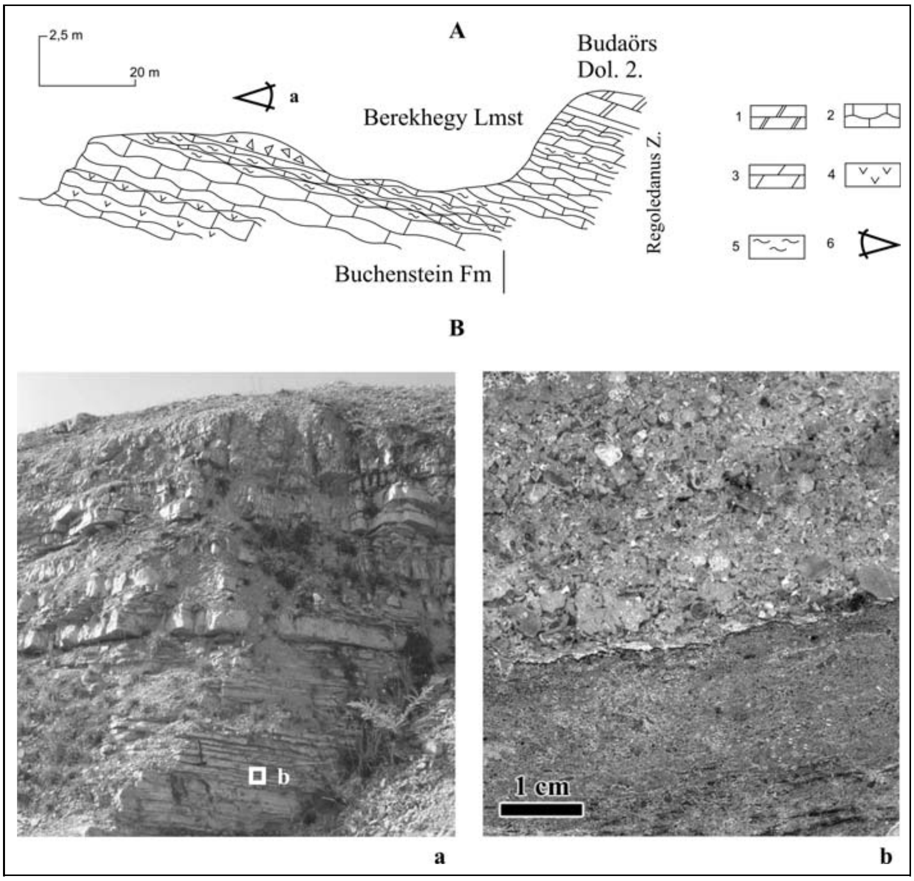


Fig. 7 - A) Profile across the Berekhegy quarry at Hajmáskér showing transition from the upper Ladinian basin succession (Buchenstein Fm.) through the toe-of-slope facies of Berekhegy Limestone to the lower Carnian platform (Budaörs Dolomite) of the Veszprém plateau (modified after Budai et al. 2001). Legend: 1. dolomites of platform facies; 2. nodular limestones of basin facies; 3. dolomitized limestones; 4. tuff, tuffite; 5. marl intercalations; 6. view point of the quarry.
B) a - graded layers of the Berekhegy Limestone overlain by the Lower Carnian prograding succession of the Budaörs Dolomite; b - graded layers of the Berekhegy Limestone with allodapic carbonate clasts derived from the coeval Budaörs platform.

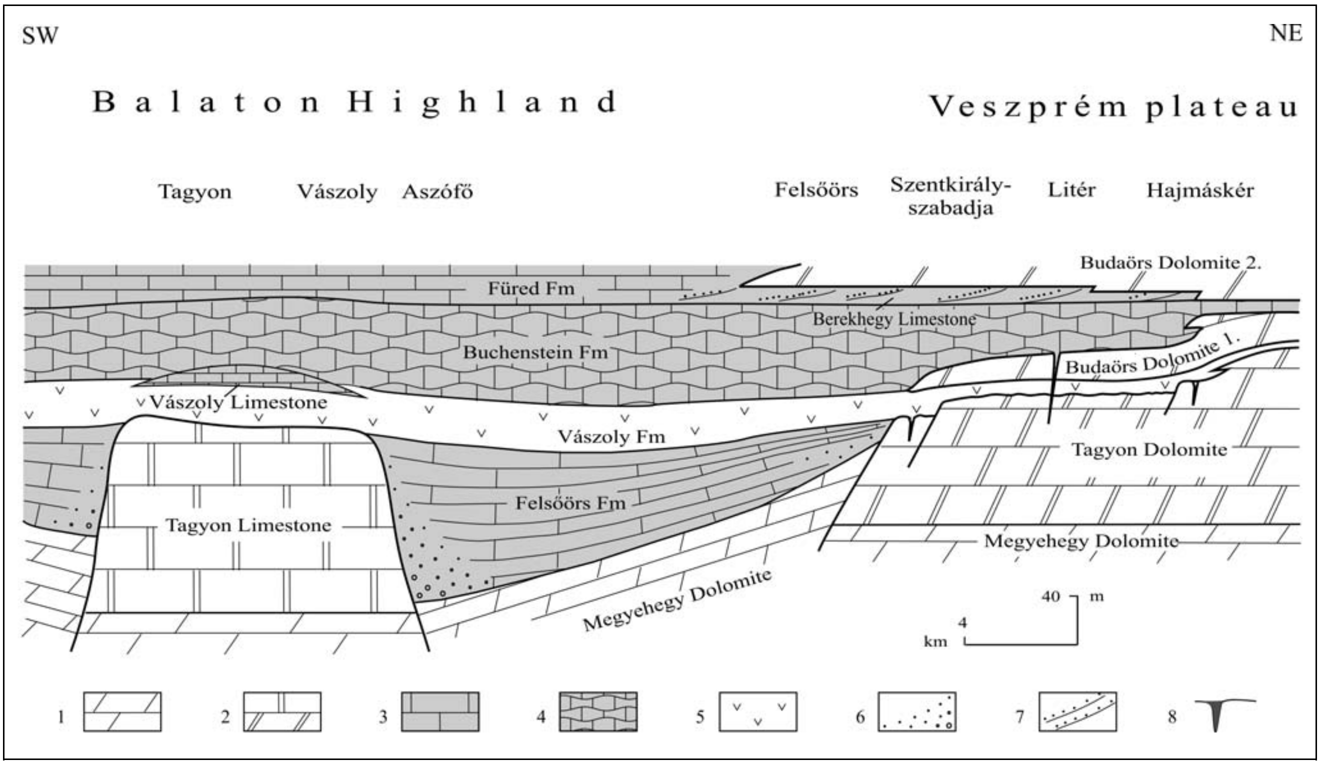


Fig. 8 - Relationship between Middle Triassic platform carbonates and basin facies on the Balaton Highland and the Veszprém plateau. Legend: 1. dolomites of ramp facies; 2. limestones and/or dolomites of platform facies; 3. limestones of hemipelagic basin facies; 4. limestones of eupelagic basin facies; 5. volcanites; 6. allodapic sediments of tectonically controlled platform slope, 7. graded allodapic sediments of prograding platform slope; 8. neptunian dykes.

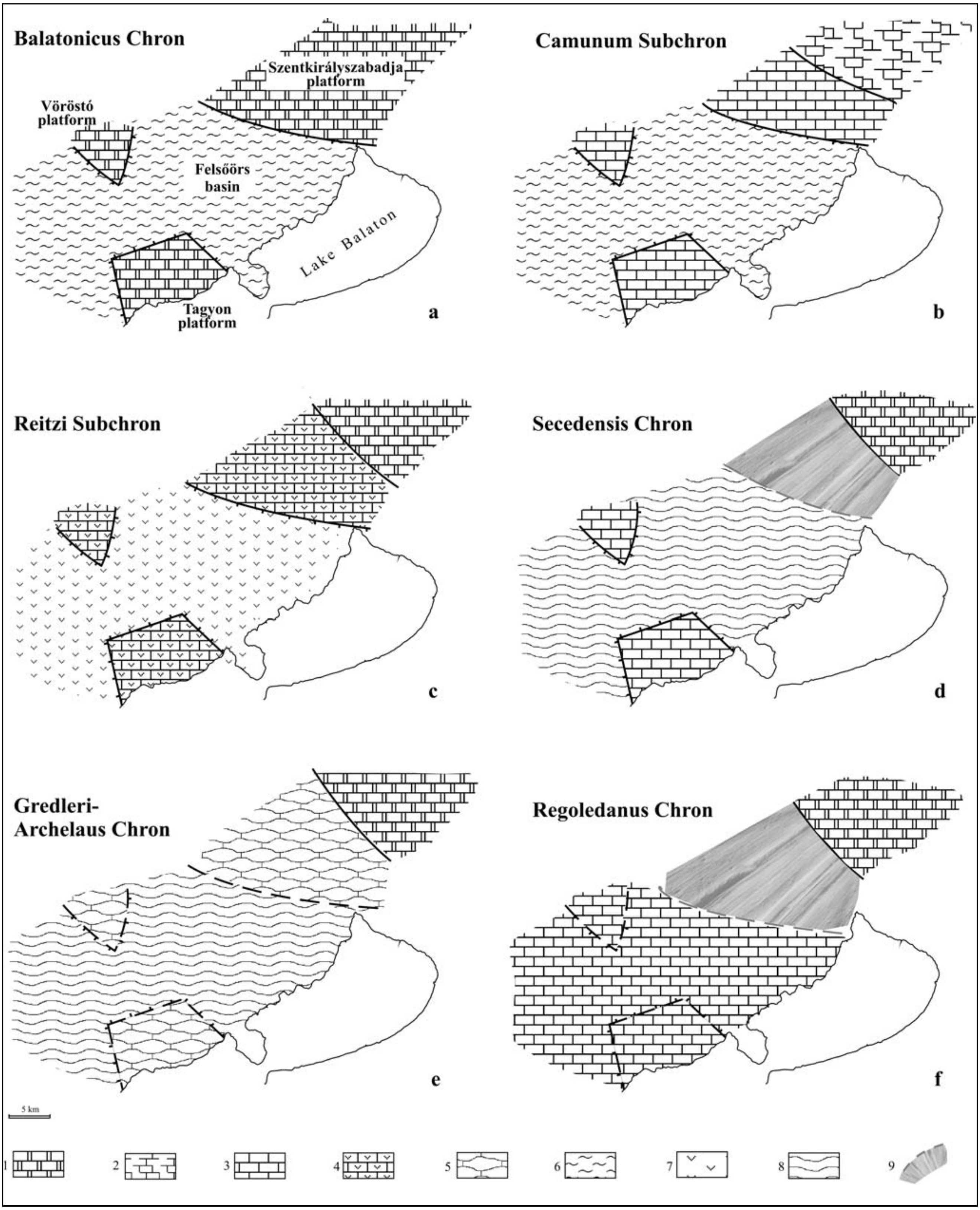


Fig. 9 - Paleogeographic map series of the Southern Bakony Mts. showing the position of platforms and basins in selected time intervals of the middle Anisian to late Ladinian period. Legend: 1. carbonate platform; 2. subaerially exposed platform; 3. shallow subtidal submarine high; 4. subtidal submarine high; 5. shallow bathyal submarine high; 6. hemipelagic basin; 7. pelagic basin with volcanites; 8. eupelagic basin; 9. prograding platform slope.

yan fauna in the Lower Muschelkalk of the German Basin (Aigner & Bachmann 1992) it can't be excluded that accommodation space of the Felsoörs basin was influenced also by eustatic sea level rise during the Pelsonian (Budai & Haas 1997). Anyhow, the evolution of the Pelsonian platforms and basins in the Bakony Mts. has to be controlled by tectonics much more than in the Dolomites, because the Tagyon platform does not show progradation in contrast to the Upper Serla platform (Gianolla et al. 1998).

Due to the early Illyrian relative sea-level fall, the Pelsonian platforms became subaerially exposed and karstified (Budai & Haas 1997). This emersion and the subsequent erosion (documented by the Richthofen Conglomerate in the Southern Alps) can be in connection with transpressive strike-slip tectonics identified in several parts of the Dolomites (Doglioni 1984, 1987, 1988) and recently in the Bükk Mountains, as well (Velledits 2004). It is worth mentioning that the scale of the erosion during this period was much smaller in the Bakony area than in the Dolomites. Duration of the gap can be estimated as much as 2 Ma on the base of biostratigraphic data (see Fig. 3). The lack of coarse grained clasts and spectacular karst phenomena on the truncated surface of the Tagyon platform indicates that the paleogeographic position of the Bakony Mts. can be assumed in arid zone during the Early Illyrian where the emersion was not so dynamic as in the Dolomites.

Indicated by neptunian dyke at Szentkirályszabadja, the next downfaulting block tectonic event can be dated to the late Illyrian (Camunum Subchron, Fig. 9/b) along the edge of the Veszprém plateau, probably in connection with the collapse phase of the previous updoming period. As a consequence of this tectonic subsidence, the central platform of the Balaton Highland has been drowned. The subaerial exposure and the following rapid drowning can be the reason for the lack of an Illyrian carbonate buildup in the Southern Bakony Mts. corresponding to the Contrin platform of the Dolomites.

The main phase of the late Anisian explosive volcanism can be dated to the Reitzi Chron. The geochemical character of the potassium rich alkaline to calcalkaline volcanites of the Bakony Mts. may also be connected to rifting (Harangi et al. 1996) rather than to a subduction related process (Castellarin et al. 1988).

The Anisian platform of the Veszprém plateau was totally flooded only during the latest Illyrian (Reitzi Subchron, Fig. 9/c) due to eustatic sea-level rise (Budai et al. 2001). This transgressive phase is widespread in the Northern Calcareous Alps (Rüffer & Zühlke 1995; Rüffer & Zamparelli 1997), in Lombardy (Gaetani et al. 1998) and in the Julian Alps (Jadoul et al. 2002). It was followed by a highstand period at the end of the Anisian (Secedensis Chron, Fig. 9/d), characterised by the first progradation of the Budaörs platform on the Veszprém plateau and highstand shedding in the basins and on the submarine high in the centre of the Balaton Highland (Vászoly Limestone) (Budai & Haas 1997; Haas & Budai 1999). The first progradation of the Budaörs platform can be correlated with the Sciliar 1 in the Dolomites (De Zanche et al. 1993; Gianolla et al. 1998) and in the Julian Alps (Jadoul et al. 2002). It is worth mentioning that there are no evidence for progradation of the Catinaccio platform during this period (Bosellini & Stefani 1991), continuous aggradation went on through the Reitzi, Secedensis and Curionii Chrons (Maurer 2000).

Due to the following sea-level rise, carbonate sedimentation continued in eupelagic (more or less starved) basin of the Southern Bakony from the Fassanian till the late Longobardian (Buchenstein Formation, Fig. 9/e), where Wengen-type volcanoclastics are missing (Budai 1992). The phosphoritic hard-ground (Fig. 5) within the Vászoly Limestone (Curionii Zone) can be interpreted as a transgressive surface on the central submarine high of the Balaton Highland. Based on the paleogeographical analysis of ammonoids (Vörös 1996, 2002) and ostracod assemblage of the Litér quarry section (Fig. 6/A) dominated by psychrosphaeric forms (*Acanthoscapha veghae, Acratia goemoeryi, A. triassica, Healdia (Healdia) felsooersensis, Monoceratina sp.?, Nagyella longispinosa, Polycope hungarica, P. ladinica, P. levis*) it can be supposed that the Buchenstein basin was more than 500 m deep and was bordered by aggrading platforms (Budai et al. 2001). Neptunian dyke, filled with ammonite bearing tuffs and tuffites (Archelaus/ Gredleri Zone) in the Litér quarry (Fig. 6/B), proves that extensional tectonic activity increased again during the middle Longobardian, coevally with volcanic eruptions, as in the Dolomites (Blendinger 1985; Doglioni 1987; Bosellini 1991). It should be noted that there are no evidence for significant progradation of the Budaörs platform during the Gredleri and Archelaus Chron, in contrast to several platforms of the Dolomites, where rapid progradation has been observed (Maurer 2000), or several different progradations (Sciliar 2 and Sciliar 3) have been distinguished in this period (De Zanche et al. 1993; Gianolla et al. 1998). This difference may be explained by volcanotectonic activity which was intense in the Dolomites (Bosellini 1991; Bosellini & Stefani 1991) and could provoke relative sea-level fall by domal uplift (Doglioni 1987). Such influence is not manifested in the Southern Bakony Mts. where the basin was deepening from the Curionii to the Regoledanus Chron. It can be concluded that, in comparison with the Dolomites, the paleogeographic position of the Bakony Mts. was more distant (probably to the NNE) from the Middle Triassic volcanic centres.

At the beginning of the following highstand period (Regoledanus Chron, Fig. 9/f) the Budaörs platform intensively prograded from the Veszprém plateau to the southwest causing highstand shedding in the Balaton Highland basin (Füred Limestone). Platform progradation is common during this time interval in the Western Tethys, e.g. in Lombardy (Jadoul et al. 1992), in the Dolomites (De Zanche et al. 1993; Gianolla et al. 1998), in the Julian Alps (Jadoul et al. 2002), in northwestern Croatia (Gorican et al. 2005) and in the Northern Calcareous Alps (Brandner 1984; Rüffer & Zamparelli 1997) as well.

## Conclusions

Analysing the main features of the Middle Triassic platform and basin evolution of the Southern Bakony Mts. it can be outlined that the control of eustatic sea level changes was overprinted by local or regional synsedimentary tectonic events from time to time. This can be the explanation for the main differences between the evolution of the Southern Bakony and the Dolomites, related to the distinct paleogeographic position of the two territory.

In the area of the Bakony basins, accomodation space was primarily controlled by extensional block faulting movements during the Pelsonian; however, eustatic sea level rise can't be excluded either. Relative sea-level fall in the early Illyrian, causing subaerial karstification of the Pelsonian platforms, may be connected to transpressive strike-slip tectonics. Tectonically controlled subsidence of the platforms during the late Illyrian (Camunum Subchron) can be proved by neptunian dykes. Late Illyrian rise of the relative sea level (Reitzi Subchron) and the following highstand period (Secedensis Chron), however, might have been under eustatic control. Further deepening of the Balaton Highland basin during the Ladinian was basically generated by eustatic rise of sea level, however, the role of middle Longobardian tectonic movements, manifested by neptunian dykes, has to be considered, as well. In contrast to the Dolomites, repeated volcanotectonic activity did not affect the relative sea level. The following highstand during the latest Ladinian and the earliest Carnian gave the opportunity for the platforms to prograde and shed carbonate mud into the adjacent basins not only in the Southern Bakony but in many parts of the Western Tethys.

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