

STRATIGRAPHIC PROBLEMS OF THE BOUNDARIES AND SUBDIVISION  
OF THE MIDDLE TRIASSIC ANISIAN STAGE IN THE ALPINE AND  
HUNGARIAN FACIES REGIONS

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Abstract

The denomination "Anisian" (Anisus) was given by WAAGEN and DIENER in 1895, who thus denoted the upper stage of the Dinarian Series, in contrast with the lower one called Hydasopian.

The Hydasopian Stage is named after the river Ihelum in Pakistan, called in hellenistic times Hydaspes. In modern terms, the authors designed the "Upper Ceratitic Limestone" on the eastern bank of the river, belonging to the Salt Range, as stratotype.

The name "Anisian" is connected with the Grossreifling occurrences along the river Enns (In Latin: Fluvius Anisus).

WAAGEN and DIENER (l. c.) have not subdivided the Hydasopian, while the Anisian they cut into two substage, the lower being called Balatonian and the upper one Bosnian.

As the index species of the Balatonian Substage they designated the ammonoid species Ceratites binodosus, with its type area in the Balaton Highland. The respective index species of the Bosnian Substage should have been Ceratites trinodosus, with its type occurrences (more correctly, type faunas) at Reutte-Schreyer-Alm Prezzo and Han Bulog.

PIA (1930) promoted the Anisian to a substage, comprising as a lower stage the Hydasopian, and the Pelsonian and Illyrian stages as its upper part. He designed the type regions of all these three stages in the Southern

Alps, thus completely disregarding the original definitions given by WAAGEN and DIENER in 1895.

In later literature, PIA's subdivision has become rather common and was adopted by the majority of the authors.

In the Alpine facies region the problem of the Scythian/Anisian biostratigraphic boundary has not been settled yet, due to the poorly fossiliferous nature of the transitional formations, and particularly to the complete lack of ammonoids in them (e. g. the Guttenstein Limestone),

For a long time, the problem of the Binodosus and Trinodosus Zones was a crucial point in Anisian biostratigraphy. There have been divergent opinions on the possibility of their distinction from each other. It is a fact that these two species have not been found together in any Alpine profile.

ASSERETO (1971) revised the Ammonoidea faunas of both the South and the North Alpine (Grossreifling) classical localities.

The Anisian stratotype at Grossreifling was designated by ZAPFE (1971) just on the basis of ASSERETO's studies. In fact, this is a complex stratotype comprising three sections as follows (from bottom to top):

1. Rahnbauerkogel: the lowermost fauna horizon represented by Balatonites species
2. Tiefengraben: with an Ammonoidea fauna characteristic of the Binodosus horizon.
3. Kapelle bei Salzbrücke: with the typical fauna of the Trinodosus horizon.

ASSERETO (1971) succeeded in correlating the Ammonoidea faunas of Grossreifling with those of the classical localities in the Southern Alps.

Neither ASSERETO (1971) nor ZAPFE (1971) touched the problem of the biostratigraphic boundaries of Anisian. No boundary stratotypes have been designated so far.

In connection with the Hydaspien substage of WAAGEN and DIENER (1895), SPATH (1934) pointed out that the Anasibirites bearing fauna of the "Upper Ceratite Limestone" is older than the Alpine Upper Scythian (Campilian). From the Alpine "Hydaspien" (sensu PIA 1930) no Ammonoidea are known. It is rather uncertainly defined biostratigraphically and the "Hydaspien" denomination is by no means justified.

A new light is shed on Alpine Lower Anisian biostratigraphy by the works of SUMMESBERGER and WAGNER (1969), ASSERETO (1971) and ZAPFE (1971). ASSERETO (1971) correlated one part of the Guttenstein Limestone series in the Scheibling Graben (Grossreifling area), from which SUMMESBERGER and WAGNER described the occurrence of Dadocrinus gracilis, with the Balatonites bearing beds of Rahnbauerkogel.

In the literature on Alpine Lower Anisian biostratigraphy since PIA (1930) the name "Pelsonian" has been widely used in chronostratigraphic sense. It would comprise the Middle Anisian *Paraceratites binodosus* Ammonoidea Zone and the *Decurtella decurtata* brachiopod Biozone, respectively.

The denomination is of Latin origin: *Lacus Pelso*, i. e. Lake Balaton - At first, it was used as "Balatonisch" for the lower part of the bipartite Anisian, by WAAGEN and DIENER (1895, p. 1293): "Der *Binodosus* Zone entspricht die Balatonische, der *Trinodosus*-Zone die Bosnische Unterstufe. Die erstere Benennung spielt auf die Umgebung des Platten-Sees an, wo die reiche Gliederung des unteren Muschelkalkes durch die vervienstvollen Arbeiten von J. Boeckh ueber die Trias des Bakony-Waldes nachgewiesen wurde."

LÓCZY (1916), relying on the study by ARTHABER (1903) denied the existence of the *Binodosus* Zone (originally, in J. BOECKH's work, "Arcestes

studereri horizon"), referring the respective beds into the Trinodosus Zone, making no mention whatsoever of C. binodosus in the Anisian of the Balaton Highland.

PIA (1930) added to the confusion by designating the characteristic formations and faunas of the Pelsonian, just as in the case of the Hydaspien, in the Southern Alps.

With regard to priority, the stratotype of Pelsonian is to be designated in the area originally mentioned by WAAGEN and DIENER, viz. in the Balaton Highland. The most appropriate profile is provided by the Malomvölgy Forrás-hegy at Felsőörs village, exposing a continuous sedimentary sequence from Lower Anisian to Upper Ladinian. The exposure is actually rather poor, could be, however, much improved by some earthwork. This choice is supported also by the fact that this is the best-studied Middle Triassic profile in the region.

Balatonites balatinicus (MOJSISOVICS) could serve as index species of the Pelsonian Substage, which seems to indicate the lowermost Ammonoidea horizon in the Balaton Highland as well as at the Grossreifling localities.

The boundaries of the Balatonites balatinicus Biozone in the Balaton Highland are rather uncertain. The lower and upper boundaries have not been established at the type locality of the species (Mencshely village) and in its other occurrences, either (Köveskál, Hidegkut). State of exposition and continuity of these sequences, however, are much less favourable, than for the Felsőörs profile.

However, in the Felsőörs section not a single specimen of Balatonites balatinicus has been found. The Trinodosus beds described by ARTHABER (1903) and by LÓCZY (1916) are underlain by brachiopod and crinoid bearing beds characterized by the species Caucasorhynchia altaplecta (BOECKH) and "Rhynchonella" atitina BITTNER. Crinoidal stem fragments seem to belong to the Dadocrinus gracilis group.

From the very similar brachiopod bearing beds at Kövekál Balatonites balatonicus specimens are known. Poorly preserved specimens collected from brachiopod bearing beds at Felsőörs may belong to this species, or to another species of the zone. It is not unlikely that further search will lead to the discovery of good specimens of Balatonites balatonicus as well.

As for the type localities of the Bosnian Substage as defined by WAGEN and DIENER (1895), it turned out that these contain condensed faunas (SILBERLING and TOZER 1968, GAETANI 1969, ZAPFE 1971).

Accordingly, the author proposes the following subdivision of the Anisian.

#### I. Pelsonian Substage

Proposed holostratotype: Hungary, Balaton Highland, Forráshegy section of Malomvölgy valley at Felsőörs village.

Index species: Balatonites balatonicus (MOJSISOVICS), Caucasorhynchia altaplecta (BOECKH), "Rhynchonella" attilina BITTNER.

Known occurrences: Balaton Highland, Northern and Southern Alps and Slovakia (?).

The proposal is supported by priority and by the fact that this profile has been much better studied than the Rahnbauerkogel lowermost portion of the Anisian stratotype. There is no prescription which would make obligatory to designate the stratotype of a defined substage within the stratotype of the stage itself.

#### II. Tiefengrabenian Substage

Proposed holostratotype: Austria, Steiermark, Grossreifling, Tiefengraben section.

Index species: Paraceratites binodosus (HAUER).

Known occurrences: Northern and Southern Alps, Balaton Highland (?), Mecsek Mts.



### III, Salzabrückian Substage

Proposed holostratotype: Austria, Steiermark, Grossreifling section, Salzabrück.

Index species: Paraceratites trinodosus (MOJSISOVICS),

Known occurrences: Northern Alps, Southern Alps, Balaton Highland.

It would be possible to unite the Tiefengrabenian and Salzabrückian into a single substage (?) Reiflingian, including the biozones Paraceratites binodosus and P. trinodosus.

In the Alpine facies province, it is impossible to draw the Scythian Anisian boundary on the basis of Ammonoidea. It is very likely that the bivalvian species Costatoria costata (ZENKER) is the key of the problem indicating the uppermost beds of the Scythian. This assumption must be, however, verified by means of a thorough revision of this species.

The lower boundary of the Dadocrinus gracilis (BUCH) Biozone falls beyond doubt within the Anisian, the upper boundary of this Biozone is, however, rather uncertain, just like the upper biostratigraphic boundary of the Anisian, for which no boundary stratotype has been designated.

ASSERETO (1969) considers the Avisianus Zone as characteristic of the Anisian/Ladinian boundary (where it occurs).

The first undoubtedly Ladinian biozone is that of Protrachyceras reitzi (BOECKH).

Consequently, the Felsőörs section is very suitable for being chosen as the Anisian/Ladinian boundary stratotype, because in it the boundaries of the P. reitzi Biozone are precisely established, in contrast to most of the Alpine localities.

Taking into account the newest achievements of Alpine biostratigraphy, based on the revision of Ammonoidea ranges and classical Ammonoidea

faunas, the necessity of revision of the "classical" Anisian brachiopod (Decurtella decurtata, Piarorhynchia trinodosi) biozones as well as those of Dasycladacea defined by PIA is evident. Their correlation with the Ammonoidea zonation is very difficult. Additional aid is hoped from the advances in Conodonts and Holothurioidea studies, which are of growing, but all the same of secondary and auxiliary role.

#### Review of the Anisian sequences in South and North Hungary

In the Mecsek and Villány Mts. (South Hungary) the Scythian/Anisian boundary can be drawn at the top of the Costatoria costata (ZENK.) bearing carbonate beds. These are overlain in both mountains by a thick carbonate sequence yielding a poor molluscan fauna and some remnants of Dadocrinus gracilis (BUCH). This sequence can be assigned to the Pelsonian (auct.) Substage. Higher up there is a thin member with abundant brachiopod fauna: from its lowermost beds one single specimen of Paraceratites binodosus has been found in the Mecsek Mts. The predominant brachiopod species of this member is Coenothyris vulgaris (SCHLOTHEIM), Tetractinella trigonella (SCHLOTHEIM) being common in the lower part, while the upper part yields almost exclusively C. vulgaris. This brachiopod fauna denotes the Binodosus-Trinodosus Zone level. In both mountains it is overlain by carbonate beds devoid of any fauna: the next fossiliferous ones suggest already the Ladinian (Trigonodus bearing group in the Mecsek, Lingula christomani SKUPHOS bearing beds in the Villány Mts). The latter can be correlated with the Partnach Beds in the Northern Alsp.

In the Gömör and Bükk facies regions of North Hungary the upper boundary of the Scythian is indicated by the disappearance of C. costata as well, the Lower Anisian being represented by the poorly fossiliferous "Guttenstein" Beds. In the Gömör facies region these are overlain by algal and brachiopod bearing "Wetterstein" Beds. The studies done so far on the latter do not allow the subdivision and the drawing of the upper boundary of the Anisian. The brachiopod fauna is rather similar to that of the Mecsek

and Villány Mts, with slightly higher number of taxa and less marked predominance of Coenothyris vulgaris.

In the Bükk facies region according to K. BALOGH (1964) the middle part of the Anisian is represented by igneous rocks, overlain by a thick limestone series, paleontologically barren. Accordingly, the biostratigraphic subdivision as well as the drawing of the upper boundary of the Anisian is impossible here:



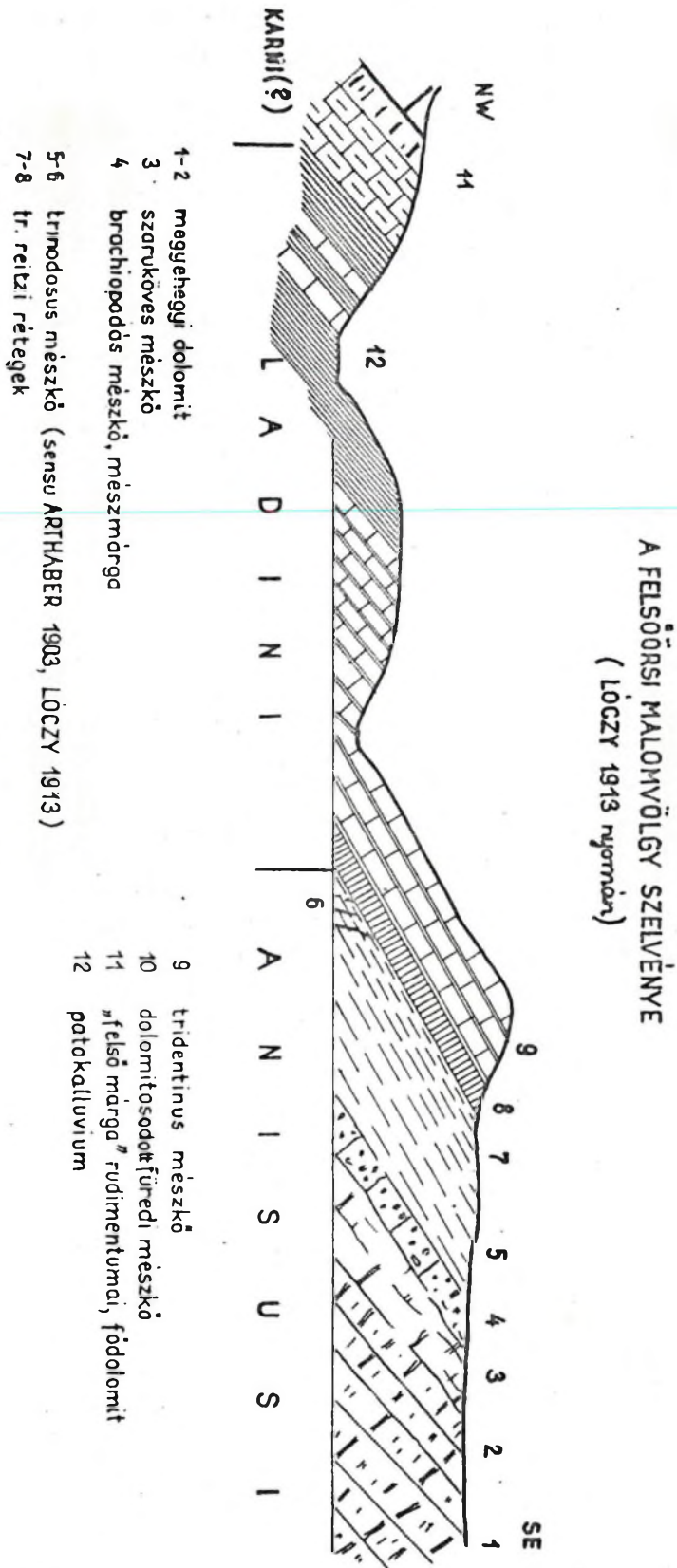
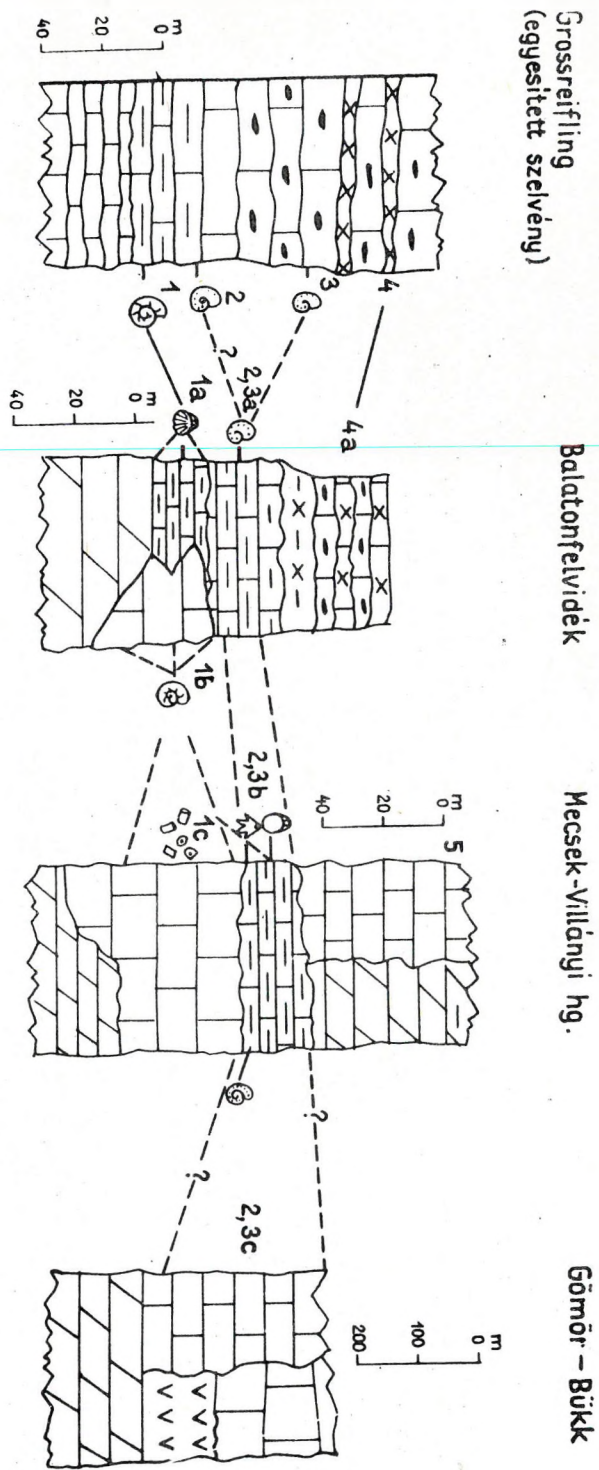


Fig. 1. The profile of the Malomvölgy at Felsőörs

<b>Emelet :</b> <b>Stage :</b>	<b>A N I S U S I</b>  <b>A N I S I A N</b>	
<b>Alemelet :</b> <b>Substage :</b>	<b>REIFLINGI</b> <b>REIFLINGIAN</b>	<b>PELSOI</b> <b>PELSONIC</b>
<b>Sztratotípus :</b> <b>Stratotype :</b>	<b>KAPELLEI</b> <b>KAPELLE</b>  Ausztria , Stájerország Ausztria, Styria Grossreifling, Kapelle bei Salzabücke	<b>TIEFENGRABEN</b> <b>TIEFENGRABEN</b>  Ausztria, Stájerország Ausztria, Styria Grossreifling, Tiefengraben
<b>Ammonoidea biozóna :</b> <b>Ammonoidea biozóna :</b>	Paraceratites trinodosus (MORSISOVICS)	Paraceratites binodosus (HAUER)
		Magyarország, Balatonfelvidék Hungary, Balaton Highland Felsőörs, Malomvölgy, Forráshegy
		Balatonites balatonicus (MORSISOVICS)

2. ábra: Javasolt modell az anisusi emelet alemelet felosztásához.

Fig. 2.: A proposed scheme for the substages of the Anisian Stage



3. ábra: Az anisusi sztratotípus és a magyarországi anisusi rétegsorok korrelációja.

Fig. 3.: Correlation of the Anisian stratotype and the Anisian sequences of Hungary

3. ábra magyarázat:

- 1: Rahnbauerkogel-i Balatonites balatonicus fauna.  
 1a: Balatonfelvidéki Brachiopoda-fauna, Caucasorhynchia alaplecta, "Rhynchonella" artilina. (Felsőörs, Köveskál, Nagyvázsony.)  
 1b: Balatonfelvidéki Balatonites balatonicus fauna. (Mencshely, Csicsó, Köveskál, Hidegkut.)  
 1c: Mecsek és Villányi hegységi Dadocrinus gracilis-es rétegek.  
 2: Tiengrabeni Ammonoidea fauna (Paraceratites binodosus)  
 3: Kapelle bei Salzbrücke-i fauna (P. trinodosus)  
 2, 3a: Balatonfelvidéki Binodosus(?) -Trinodosus fauna (Felsőörs, Köveskál, stb.)  
 2, 3b: Mecsek és Villányi hegységi Brachiopoda fauna. (Alsó részén: P. binodosus, Tetractinella trigonella, felső részén csaknem Coenothyris vulgaris monospecifikus fauna).  
 2, 3c: Gömöri algás, brachiopodás "Wettersteini" mészkőösszlet.  
 4: Grossreiflingi faunaszegény "Buchensteini" rétegek.  
 4a: Balatonfelvidéki Reitzi-s rétegek.  
 5: Mecseki trigonodusos mészkő és villányi Lingula christomani-s dolomit, dolomitmárga összlet.

Fig. 3. Correlation of the Anisian stratotype and the Anisian sequences of Hungary

Legend:

- 1 = Balatonites balatonicus fauna of Rahnbauerkogel  
 1a = Brachiopod fauna of the Balaton Highland, Caucasorhynchia alaplecta, "Rhynchonella" artilina (Felsőörs, Köveskál, Nagyvázsony)  
 1b = Balatonites balatonicus fauna of the Balaton Highland (Mencshely, Csicsó, Köveskál, Hidegkut)  
 1c = Dadocrinus gracilis-bearing beds of the Mecsek and Villány Mts.  
 2 = The Ammonoidea fauna of Tiengraben (Paraceratites binodosus)  
 3 = Kapelle bei Salzbrücke fauna (P. trinodosus)  
 2, 3a = Binodosus(?) - trinodosus fauna of the Balaton Highland (Felsőörs, Köveskál, etc.)  
 2, 3b = The brachiopod fauna of the Mecsek, and Villány Mts (P. binodosus, Tetractinella trigonella in its lower part, a nearly monospecific Coenothyris vulgaris fauna in its upper part)  
 2, 3c = Algal and brachiopodal "Wetterstein" limestone sequence of Gömör  
 4 = Poorly, fossiliferous "Buchenstein" beds of Grossreifling  
 4a = Reitz beds of the Balaton Highland  
 5 = Trigonodus limestone of the Mecsek and the complex of Lingula christomani-bearing dolomite and dolomitic marl of the Villány Mts.