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Chitinozoans of the Cellon Section (Upper Ordovician - Lower Devonian).- A Preliminary Report

with 1 figure

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Introduction

The investigations of the chitinozoans from the Cellon-section were part of a project with the goal of examining the geographic and stratigraphic distribution of the palynomorphs within the different facies of the upper Ordovician to lower Devonian strata in the Carnic Alps.

These are: the shallow water facies with mainly calcareous deposits, the siliciclastic basin facies and the transitional facies mediating between them.

In none of these facies *spores* could be observed. The *acritarchs* showed to be strongly influenced by the local environments. Their only remarkable occurrence was in the lower Silurian of the Cellon-section which belongs to the calcareous facies (PRIEWALDER, 1987). The *chitinozoans* however proved to be the geographically and stratigraphically widest distributed group of the palynomorphs.

Concerning the chitinozoans 79 samples from the siliciclastic and transitional facies have been examined so far only by spot checks: 60% of them proved to be fossiliferous.

From the upper Ordovician to lower Devonian sequence of the Cellon-section 92 samples have been studied. 48 (= 52%) yielded chitinozoans.

As the chitinozoans were opaque to transmitting light the investigations had to be done mainly under SEM. About 4.300 micropalaeontological objects (chitinozoans as well as chitinozoan-like and/or problematic particles) have been examined in this way. Approximately 12.600 SEM-photos have been taken.

It has to be pointed out that the names of the chitinozoans in this report are provisional because they are based only on gross determinations of the fossils. Detailed studies have yet to be carried out and will result in more diverse chitinozoan associations at many horizons of the section.

In the Cellon-section the chitinozoans are restricted to four sequences (fig.1):

- to the Plöcken Formation (upper Ashgill);
- to the lower part of the Kok Formation (upper Llandovery);

- to the sequence from the uppermost Kok Formation to the top of the Cardiola Formation (upper Ludlow);
- to the sequence from the upper part of the Alticola Limestone to the lowermost Rauchkofel Limestone (Ludlowi/Pridolian boundary - lowermost Lochkov).

Chitinozoans of the upper Ordovician

In the Uggwa Shales and Uggwa Limestones no chitinozoans were found. Instead black and glossy particles with chitinozoan-like contours (probably consisting of graphite) were frequently present. In the light-microscope they could be confused with badly preserved chitinozoans.

Stratigraphically the chitinozoans occur for the first time at the base of the Plöcken Formation (sample ***126***) with a few representatives of *Conochitina* EISENACK 1931 and probably also *Tanuchitina* JANSONIUS 1964. Further numerous melanosklerits with a strong resemblance to chitinozoans were observed , as well as the chitinozoan-like graphitic particles.

In the uppermost part of the Plöcken Formation a few samples (***128*** , ***129*** , ***45***) contain taxa which are diagnostic for the upper Ashgillian: *Armoricochitina nigerica* (BOUCHE 1965) and *Tanuchitina elongata* (BOUCHE 1965). Furthermore *Desmochitina minor* EISENACK 1931 (which is limited to strata of Ordovician age) and representatives of *Conochitina*, *Rhabdochitina* (?) EISENACK 1931, *Spinachitina* SCHALLREUTER 1963 and the first specimen of the *Ancyrochitininae* with broken processes were extracted.

The Ashgillian samples yielded only very few chitinozoans in a rather bad state of preservation: most specimens are preserved threedimensionally, but broken.

Chitinozoans of the upper Llandovery

Sample ***46A*** at the very base of the Kok Formation (= upper Llandoverian), which after a long hiatus follows the Plöcken Formation in a conformable position, yielded a completely different chitinozoan fauna with a great number of individuals: numerous representatives of the *Lagenochitinidae* and *Ancyrochitininae*, which cannot be determined absolutely ; *Ancyrochitina cf.diabolo* (EISENACK 1937), *A.gr.ancyrea* (EISENACK 1931), *Cyathochitina caputoi* DA COSTA 1971 and *Eisenackitina sp.A* which is very characteristic of this sample.

Samples ***47*** , ***130*** , ***131*** and ***49*** contain many specimens of *Bursachitina* TAUGOURDEAU 1966 and *Conochitina* (e.g. *C.cf.emmastensis* NESTOR 1982), further *Eisenackitina sp.A*, *Angochitina aff.longicollis* EISENACK 1959, as well as *A.cf.nigerica* and *Laufeldochitina ? sp.*, which are reworked and of upper Ordovician age.

In the upper part of the Llandoverian layers of the Kok Formation (samples ***50, 132***) chitinozoans appear which are very similar to *Conochitina proboscifera* EISENACK 1937, a typical species of the upper Telychian/lower Sheinwoodian; *Conochitina spp.*(e.g.*C.cf.armillata* TAUGOURDEAU & JEKHOWSKI 1960), *Eisenackitina sp.* and *Lagenochitina sp.* occur at minor amounts.

The uppermost Llandoverian sample (***133***) yielded only badly preserved individuals resembling *Angochitina longicollis* (= typical of the upper Telychian/lower Sheinwoodian), as well as *Conochitina sp.*, *Cyathochitina sp.*, *Eisenackitina sp.* and *Sphaerochitina sp.*.

The chitinozoans from this part of the section are entirely or partly flattened and frequently folded. In cases of intense folding or variable flattening of the vesicles (e.g. thinner-walled necks are more, thicker-walled body chambers less strongly deformed) their contours may be altered to an extent that the original taxon is difficult to recognize.

Throughout the Wenlock and lower Ludlow associations of determinable chitinozoans are missing; only sporadic and badly preserved fossils are present: sample ***135***: one fragment of *Belonechitina sp.*; sample ***54***: the internal moulds of *Conochitinidae indet.*; sample ***136***: fragments of *Conochitinidae indet.* and *Lagenochitinidae indet.*, sample ***56***: *Bursachitina sp.*, *Lagenochitinidae indet.*, *Conochitinidae indet.*.

Chitinozoans of the upper Ludlow

From the uppermost layer of the Kok Formation (sample ***63***) to the top of the Cardiola Formation (sample ***145***) a great variety of chitinozoans occurs.

At the base of this sequence (sample ***63***, ***141***) abundant and diverse *Angochitina* EISENACK 1931, *Sphaerochitina* EISENACK 1955 (e.g. similar to *S.impia* LAUFELD 1974), *Conochitina* and a few *Bursachitina sp.* and *Eisenackitina sp.*, as well as some *Ancyrochitina sp.* appear.

Above it a fragment of *Linochitina* (sample ***142***) was found. Some *Cingulochitina cf.convexa* (LAUFELD 1974), *Sphaerochitina spp.* and *Angochitina spp.* (like in samples ***63*** , ***141***) and a few *Ancyrochitininae indet.*could be extracted from sample ***64***.

The middle part is dominated by numerous *Conochitina. C.aff.tuba* EISENACK 1932 occurs in sample ***143***. Sample ***66*** yielded *C.aff.latifrons* EISENACK 1964 and rare *Sphaerochitina sp.*.

Finally in the last sample of this sequence (***145***) a few *Cingulochitina sp.* and *Ancyrochitininae indet.* are present.

Here an other - unusual - state of preservation could be observed: the vesicles of thin-walled taxa from limestones collapsed threedimensionally similar to a deflated rubber ball. This feature probably developed at an early stage of diagenesis when the internal cavities of the chitinozoans became dehydrated before mineral fillings could

grow (these fillings are common in fossils from limestones and responsible for their threedimensional preservation).

From the lower part of the Alticola Limestone up to the end of the Ludlowian no chitinozoans were found.

Chitinozoans of the Pridoli and lower Lochkov

A rich development of chitinozoans is documented by sample ***73*** from the Ludlow/ Pridoli boundary area and persists throughout the Pridolian to the end of the section in the lower Lochkov (sample ***89***). It comprises the upper part of the Alticola Limestone, the Megaerella Limestone and the lowermost part of the Rauchkofel Limestone.

Three samples (***73***, ***74***, ***75***) at the base of this succession contain *Eisenackitina barrandei* PARIS & KRIZ 1984 and *Urnochitina* group *urna* (EISENACK 1934).

The two taxa occur together within a very short interval also at the Ludlow/Pridoli boundary of some sections in the Bohemian type area of the Pridoli series (KRIZ et al., 1986).

There *E.barrandei* is characteristic of upper Ludlow strata but in a few cases it extends some cm into the basal Pridoli before it becomes extinct.

*U.*gr.*urna* appears directly at the boundary or a few cm above it. It develops quickly to the dominant and diagnostic taxon (= *U.urna*) of the Pridoli.

In the Cellon-section the situation is a little different. As the upper Ludlow strata above the Cardiola Formation did not yield any chitinozoans (except sample ***73*** from the topmost Ludlow layer) samples ***73***, ***74*** and ***75*** are the only horizons where *E.barrandei* is present. It seems that this important taxon ranges higher into the Pridol than it is the case in Bohemia.

Further taxa in the above samples are: some *Bursachitina* sp. (sample ***73***); numerous *Eisenackitina granulata* (CRAMER 1964) and *E.interme-*

dia ? (EISENACK 1955), a few *Sphaerochitina cf.sphaerocephala* (EISENACK 1932), *Angochitina sp.*, *Gotlandochitina sp.* and *Ancyrochitina gr.ancyrea* (EISENACK 1931) (samples ***74*** , ***75***).

Sample ***149*** shows a very low fossil content: only some *Eisenackitina sp.*, *Angochitina sp.* and *Ancyrochitina ? sp.*.

The development of the typical *Urnochitina urna* (= a worldwide occurring diagnostic fossil of the Pridoli) starts suddenly and with a great number of individuals in sample ***76***. As already described in the literature the fauna here too is almost monospecific, only rare *Desmochitinidae indet.*occur in addition.

Also the next sample (***149A***) shows a special feature: *U.urna* becomes numerically unimportant, whereas large quantities of *Bursachitina krizi* (PARIS & LAUFELD 1980) are present (the residue consisted almost entirely of representatives of this taxon).

Sample ***150*** again is dominated by *U.urna*, while only very few individuals of *B.krizi* and *Desmochitinidae indet.* occur.

The next three samples (***151***, ***152***, ***153***) yielded insignificant associations with various *Lagenochitinidae indet.*, a fragment of *B.krizi* (?), some *Angochitina aff.chlupaci* (PARIS & LAUFELD 1980) and *Sphaerochitina sp.*.

In the following sample ***78*** the only taxon is *E.granulata* with a few well preserved individuals. It is still present in sample ***154***, but there accompanied by rare *B.krizi*, *Linochitina klonkensis* PARIS & LAUFELD 1980 and *Ancyrochitina sp.*.

The chitinozoan fauna now starts to rearrange: *U.urna* occurs with more and more decreasing numbers of individuals, while *Angochitina* EISENACK 1931, *Cingulochitina* PARIS 1981, *Gotlandochitina* LAUFELD 1974, *Linochitina* EISENACK 1968, *Sphaerochitina* EISENACK 1955 and especially *Ancyrochitina* EISENACK 1955 become frequent.

The most frequent taxon in sample ***81***, from which large quantities of chitinozoans could be extracted, is *Ancyrochitina sp.A* (simple processes with very broad basis).Other taxa are *L.klonkensis*, *Calpichitina corinnae* JAGLIN 1986, *Sphaerochitina cf.sphaerocephala* (EISENACK 1932), *Gotlandochitina ? sp.* and *U.urna* with very few specimens.

Samples ***82*** and ***83*** contain poor associations: very few *U.urna*, *Ancyrochitina sp.A* and *S.cf.sphaerocephala*.

Sample ***84*** from the lowermost Lochkovian layer yielded a rich fauna: comparatively numerous *U.urna* (the last documented occurrence in the section), many well preserved and diverse *Angochitina*, *Gotlandochitina*, *Sphaerochitina* (e.g. *S.sphaerocephala*) and a few *Ancyrochitina* with unusual processes.

The fossil content of sample ***85*** (the number of individuals is rather low) is dominated by *Eisenackitina bohemica* (EISENACK 1934) which is an index-fossil typical of the Lochkov. Accompanying taxa are a few *Angochitina aff.chlupaci*, *Cingulochitina sp.*, *Desmochitinidae indet.* and *Lagenochitinidae indet.*.

In sample ***156*** *A.chlupaci* is now present with several unequivocal individuals together with a few *Angochitina sp.* and *Desmochitinidae indet.*.

The remaining samples in the section (***157*** , ***87*** , ***88*** , ***158*** and ***89*** with a large quantity of chitinozoans) are dominated by numerous *Ancyrochitina* (at least 5 species). Moreover they yielded numerous diverse *Angochitina*, *Sphaerochitina*, *Gotlandochitina*, *Linochitina* and *Cingulochitina* [e.g.*C.ervensis* (PARIS 1979)] .

The chitinozoans of the Pridoli/Lochkov sequence are usually preserved threedimensionally (especially thicker-walled taxa), thinner-walled individuals are often more or less strongly collapsed.

Conclusions

In contrast to the acritarchs which are mainly restricted to the upper Llandovery to lower Wenlock strata the chitinozoans are present in almost all series of the upper Ordovician to lower Devonian succession of the Cellon-section.

In several samples (*46A*, *141*, *74*, *76*, *149A*, *150*, *81*, *84*, *89*) they occur with large numbers of individuals and usually great diversity.

Environmental conditions obviously were more favourable for the chitinozoans in the upper part of the section. Starting with the topmost layer of the Kok Formation (upper Ludlow) up to the lower Lochkov they show greater diversities and larger numbers of individuals and also better preservation than in the lower part.

The chitinozoan associations of the upper Ashgill and upper Llandovery strata which after a gap of two stages follow in a conformable position are easily to distinguish.

The boundaries between the Llandovery and Wenlock and the Wenlock and Ludlow, respectively, are hardly to determine by the aid of chitinozoans as these fossils are missing throughout the Wenlock and also in the lower Ludlow. The bases of the Pridoli and the Lochkov, however, are well documented by diagnostic chitinozoan associations.

The chitinozoans of the Cellon section show close relationships to those from Bohemian deposits of the same age which is especially pronounced in the upper Ludlow to lower Lochkov sequence (DUFKA, 1992; KRIZ, 1992; KRIZ et al. 1986; PARIS & KRIZ, 1984; PARIS et al., 1981).

On the other hand in the Cellon-section samples from the base of the Wenlock to the lower Ludlow yielded no chitinozoans whereas in Bohemia diverse faunas could be obtained from sediments of this period (KRIZ, 1992; KRIZ et al., 1993). This phenomenon might be caused by unfavorable conditions for preservation (e.g. oxidation) in the depositional environment of the Cellon section.

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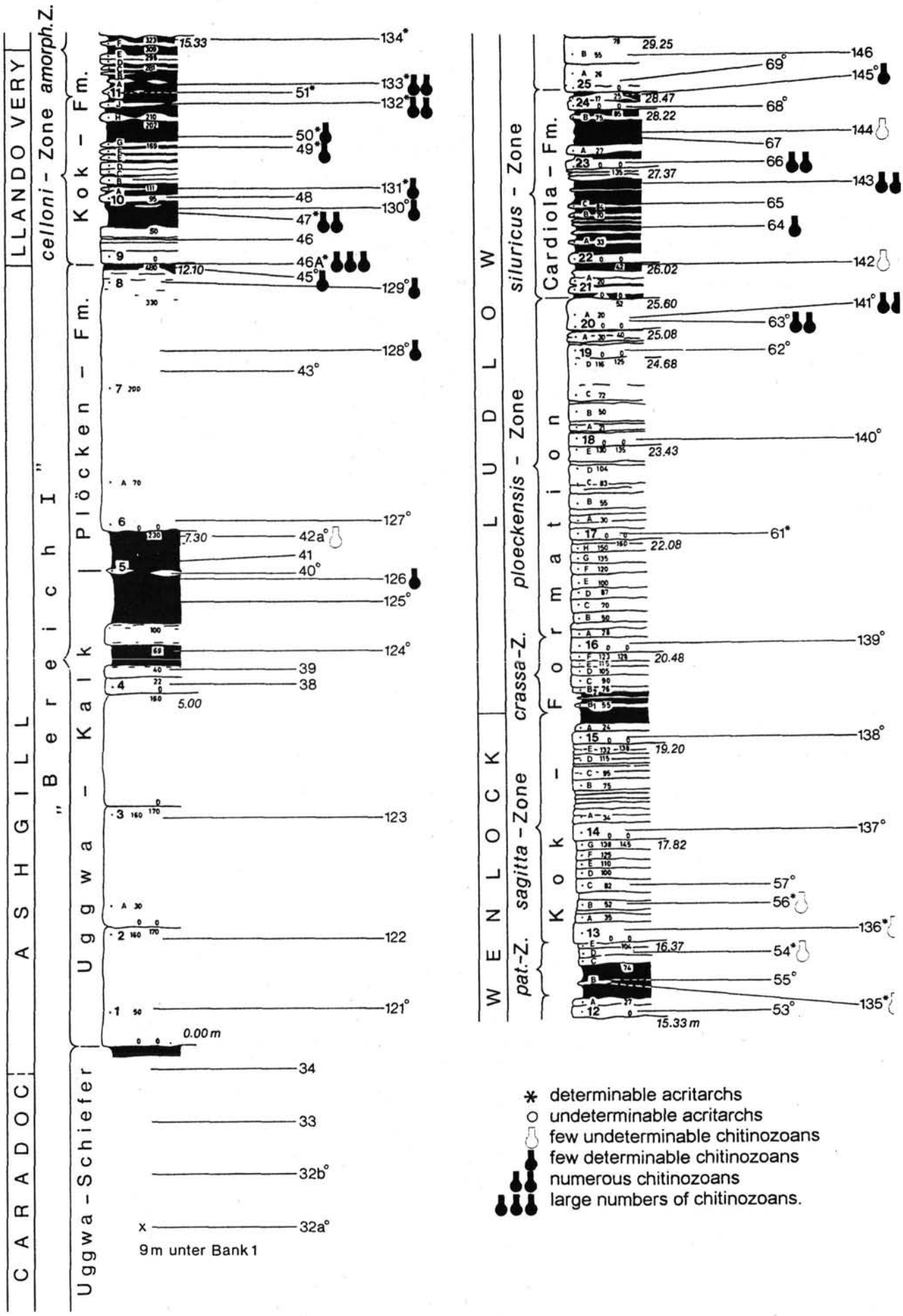

Fig.1: The location of the samples in the Cellon-section (drawing of the section after SCHÖNLAUB 1985).