THE DEVONIAN-CARBONIFEROUS BOUNDARY
AT GRÜNE SCHNEID SECTION (CARNIC ALPS)
A REVIEW

by

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(2 figures)

At the Grüne Schneid section of the central Carnic Alps of southern Austria the Devonian-Carboniferous boundary is well defined. Based on rich occurrences of conodonts, ammonoids and trilobites the boundary is drawn 26.5 cm above the base of the 32 cm thick limestone bed no. 6, between subbed nos. 6 C and 6 D (Fig. 1). Our data suggest continuous sedimentation of cephalopod limestones in a pelagic setting at the passage from the Devonian to the Carboniferous.

In successive order conodonts assigned to the Lower, Middle and Upper praesulcata, the sulcata, and the Lower duplicata-Zones were recognized (Fig. 2). However, the transition from Siphonodella praesulcata to S. sulcata has not been recorded. The first occurrence of the name-bearer of the sulcata-Zone, however, coincides with the appearance of index goniatites for the base of the Carboniferous.

In addition to conodonts the Grüne Schneid section provided a rich collection of more than 200 ammonoid specimens. They were grouped into four ammonoid horizons. These are the Lower and Upper paradoxa-Zones of the Wocklumeria Stage, the prorsum-Zone of the following Acutmitoceras fauna of the latest Devonian, and the acutum-Zone of the Gattendorfia Stage of the Lower Carboniferous (Fig. 1).

Of particular interest is the 11 cm thick subbed no. 6 B. It can be subdivided into a lower 4 cm thick, more argillaceous, ammonoid-free horizon (6 B1), which presumably corresponds to the Hangenberg Shale, and a 7 cm thick upper horizon (6 B2) which is characterized by small goniatites. They belong to the genus Acutmitoceras. In contrast with the underlying subbed no. 6 A from this level no clymeniids are recorded. The assemblage clearly indicates a time-equivalent of the Acutmitoceras fauna of Stockum.

Subbed no. 6 D coincides with the lowermost Carboniferous Gattendorfia Stage which is defined by the entry of Gattendorfia subinvoluta and Acutmitoceras acutum.

From the Grüne Schneid section more than 120 trilobite remains have been collected. They belong to three associations. The late Upper Devonian part of the section is characterized by both blind forms and those with reduced eyes of the Helioprontus-Chaunoprotus association, followed in subbeds 6 B2 and 6 C by the abruptirhachis association with normally oculated trilobites; such forms appeared immediately after the "Hangenberg Event" and shortly below the D/C boundary. The oldest Carboniferous trilobite association consists of Liobolina and Macrobole which exhibit moderately sized eyes in oculated specimens.

In conclusion, the vertical change of the trilobite fauna suggests a change of the environment from the aphytic zone in the late Wocklumeria Stage to a slightly shallower environment inhabited by trilobites with well developed eyes during the latest Devonian subbed nos. 6 B and 6 C. It may reflect the end-Devonian regression which lasted through the succeeding sulcata-Zone. At the base of the duplicata-Zone the appearance of trilobites with reduced and also normal eyes suggest a deepening and, hence a transgression.

Fig. 1A, B - Grüne Schneid section. Fig. 1A shows the upper part of the section with bed nos. 8 to 1. Fig. 1B, 32 cm thick bed no. 6 and its subdivision into 4 (5) subbeds numbered from base to top 6 A, 6 B, 6 C, 6 D. D/C boundary between subbed nos. 6 C and 6 D. Note uniform lithology throughout the boundary bed.
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<table>
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<tr>
<th>Nm</th>
<th>K1</th>
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Ammonoidea

Baviera sp.
Eolaquiceras wockelmannae
Paraowackelmannia paraoda
Wockelmannia sphenoides
Camelacymella strata
Linguocymella similis
Acutilimoceras carnatum
Acutilimoceras kleinera
Acutilimoceras intermediate
Acutilimoceras cf. intermedium
Acutilimoceras sublimicratum
Acutilimoceras accludum
Acutilimoceras cf. prosum
Acutilimoceras crevices
Acutilimoceras spheroidale
Acutilimoceras sp.
Mimobiloceras cretacea
Mimobiloceras ? sp.
Gallantinella subholovita
Gallantinella reticulatum
Gallantinella evoluta
Escaletus planus
Escaletes cf. spinatissimus

Trilobita

Heleopeltus cf. eberestuniensis
Heleopeltus canavensis
Heleopeltus subcanavensis
Typhloplectus (G.) conni
Tyrphloplectus (S.) sp. 1
Chonopeltus (Ch.) carnatus
Chonopeltus (Ch.) cf. parvos
Hassla cf. antedapum
Planaris (Pr.) granulatus
Belgipale abdulghafirin
Semipeltus (M.) cf. fuhrimya
Liobolus crestaevendensis
Liobolus subincurvatus
? Globulus sp.
Semipeltus (M.) fuhrimya alpinus
Semipeltus (M.) dreverensis
Semipeltus (M.) sp. aff. dreverensis
Cyrtogapetus (C.) bix
Archebalus (Ph.) planus
Semipeltus (M.) bixus
Philobolus macrurus
Diacypride schoenlaubi

Conodonta

Bispathodus a. aculeatus
Bispathodus c. castatus
Bispathodus c. ultimus
Bispathodus stabilis
Bispathodus ziegleri
Brachimella suprema
Palmatolepis gr. expansa
Palmatolepis guenoclymeniae
Palmatolepis gr. gracilis
Palmatolepis gr. sigmoideal
Polygnathus n.sp. A
Polygnathus n.sp. B
Polygnathus n.sp. C
Polygnathus n.sp. D
Polygnathus n.sp. E
Polygnathus n.sp. F
Polygnathus n.sp. G
Polygnathus n.sp. H
Polygnathus n.sp. I
Polygnathus n.sp. J
Polygnathus n.sp. K
Polygnathus n.sp. L
Polygnathus n.sp. M
Polygnathus n.sp. N
Polygnathus n.sp. O
Polygnathus n.sp. P
Polygnathus n.sp. Q
Polygnathus n.sp. R
Polygnathus n.sp. S
Polygnathus n.sp. T
Polygnathus n.sp. U
Polygnathus n.sp. V
Polygnathus n.sp. W
Polygnathus n.sp. X
Polygnathus n.sp. Y
Polygnathus n.sp. Z

Lithities laterals
The extensive geochemical analysis of the boundary beds include common and trace element abundances, the content of Ir in selected samples, and the distribution of carbon and oxygen isotopes. The comprehensive set of data provides no evidence for an extraterrestrial component in the boundary sediment nor is there any argument for a severe and major extinction event occurring on Earth some 350 million years ago.

Although the imprints of the internationally recognizable “Hangenberg Event” are well preserved in the Carnic Alps our results suggest an event of rather moderate amplitude. In the pelagic realm it is manifested as a regressive event shortly before the end of the Devonian, followed by a transgression at the base of the duplicata-Zone of the early Tournaisian.