

AN EQUIVALENT OF THE *KARSTENICERAS* LEVEL WITHIN THE VIENNA WOODS (SPARBACH SECTION, LUNZ NAPPE, NORTHERN CALCAREOUS ALPS, LOWER AUSTRIA)

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Detailed palaeontological and lithological studies of Lower Cretaceous sediments from the Northern Calcareous Alps in Lower Austria uncovered spectra of Lower Barremian macrofaunal elements (e.g. ammonoids) and within the section an equivalent of the former described *Karsteniceras* Level, which shows, 150 km away in the Ternberg Nappe, abundance of *Karsteniceras ternbergense* LUKENEDER. Striking similarities between these two laterally correlated occurrences in faunal spectra, lithology and geochemistry are reported.

The new detected ammonoid mass-occurrence (Sparbach section) dominated by *Karsteniceras ternbergense* is of Early Barremian age (*Coronites darsi* Zone). About 250 specimens of *K. ternbergense* between 7 and 29 mm in diameter were investigated. The geochemical results indicate that the *Karsteniceras* mass-occurrence within the described Lower Cretaceous succession was deposited under intermittent oxygen-depleted conditions. Due to the additional finding of the *Karsteniceras* Level at Sparbach the former described *Karsteniceras* Level (KB1-B section, Upper Austria) currently has got the status of a more widespread lateral biostratigraphic significant 'horizon', at least for the Northern Calcareous Alps. Its potential status as a stratigraphic horizon and its potential for correlation is manifested due to its extension to a wider geographical area. The cephalopod fauna at the outcrop belongs exclusively to the Mediterranean Province.

The discovery of a Lower Cretaceous cephalopod mass-occurrence in the Losenstein Syncline (KB1-B section, Ternberg Nappe, Northern Calcareous Alps, Upper Austria), of Early Barremian age, was recently published by LUKENEDER (2003). A *Karsteniceras* mass-occurrence in two beds only 150 mm thick was reported in the latter paper. An invasion of an opportunistic (r-strategist) *Karsteniceras* biocoenosis during unfavourable conditions over the sea-bed during the Early Barremian was proposed for the KB1-B section. As noted by LUKENEDER (2003), the deposition of the limestones in this interval occurred in an unstable environment and was controlled by short- and long-term fluctuations in oxygen levels. The author therefore assumed that *Karsteniceras* inhabited areas of stagnant water with low dissolved oxygen.

Such 'ammonoid beds' are the result of bio-events, which are often manifested by the abundance or mass-occurrence of ammonoids. The *Karsteniceras* Level described herein is observable some 150 km west in the Ternberg Nappe, what hints to the fact that both mass-occurrences were formed by the same bio-event and the former is therefore an equivalent of the Upper Austrian occurrence. The presented paper is a further step for lateral correlation of such ammonoid mass-occurrences and establishment of ammonoid abundance zones for stratigraphic correlation within the Northern Calcareous Alps.

Sparbach versus KB1-B: differences and affinities

Remarkable similarities between the Sparbach (Lower Austria) and the KB1-B section (Upper Austria) are observable in age, fabric, lithology, thin sections and faunal spectra. Number and thickness of abundance beds can be correlated precisely over the distance of more than 150 kilometers.

One of the few apparently differences can be seen in the obtained geochemical results. The sulphur and TOC contents within beds of the *Karsteniceras* Level at Sparbach are remarkable lower than in corresponding beds of the equivalent at the KB1-B section (see list below), what affects brighter colors of the sediments at the Sparbach locality.

Sparbach**Age:** Early Barremian, *Coronites darsi* Zone**Thickness:** 2 beds a 0.15 m**Colour:** light grey**Fabric:** indistinct laminated**Lithology:** marly limestones**Geochemistry:**CaCO₃ vary between 73 and 83%.

TOC vary between 0.03 and 0.52%.

SULPHUR ARE FROM 0.27 TO 0.57 MG/G**Environment:** (less) dysoxic**Dipping:** 320/40°**Cephalopod fauna:** *Eulytoceas* sp., *Barremites* (*Barremites*) *difficilis*, *Pulchellia* sp., *Holcodiscus* sp., *Anahamulina subsincta*, *Karsteniceras ternbergense*.**Specimens of *Karsteniceras*:** n = 250
(7-29 mm)**Benthic forms:** *Propeamusium***Thin section:** Laminated radiolarian wackestone calcified radiolarians, sponge spicules, aptychi, ostracods, roveacrinids, rhyncholite fragments, *Colomisphaera heliosphaera* (VOGLER), *Spirillina* sp.**KB1-B****Age:** Early Barremian, *Coronites darsi* Zone**Thickness:** 2 beds a 0.15m**Colour:** dark grey to black**Fabric:** indistinct laminated**Lithology:** marly limestones**Geochemistry:**CaCO₃ vary between 66 and 80%

TOC vary between 1.6 and 4.6%.

SULPHUR 0.33 TO 1.4%**Environment:** dysoxic**Dipping:** 080/70°**Cephalopod fauna:** *Phylloceras* sp., *Eulytoceras* cf. *phestum*, *Holcodiscus* sp., (*Barremites*) cf. *difficilis*, *Pseudohaploceras* sp., *Pulchellia* sp., *Moutoniceras moutonianum*, *Karsteniceras ternbergense*, aptychi (*in situ* in *Karsteniceras*) and *Rhynchoteuthis* sp.**Specimens of *Karsteniceras*:** n = 326
(5-37 mm)**Benthic forms:** *Inoceramus***Thin section:** Laminated radiolarian wackestone, calcified radiolarians, sponge spicules, aptychi, ostracods, crinoids**Results and conclusions**

The macrofauna of the Lower Cretaceous beds in the Sparbach succession (Flössel Syncline) is represented especially by ammonoids, aptychi and bivalves. The frequency of the ammonoids and the richness of the fauna make this section especially suited for an accurate study of the vertical ammonoids distribution. In the whole section 270 ammonoids have been found. About 250 specimens of *Karsteniceras ternbergense* between 7 and 29 mm in diameter were investigated. Juveniles and adults could be separated. The limonitic ammonoid moulds are restricted to the distinct laminated-beds. Due to the bad preservation (limonitic steinkerns) of the ammonoids and the lithologic character of the Schrambach Formation they are difficult to collect. Nevertheless one ammonoid zone defined by HOEDEMAEKER et al. (2003) can be recognized. The stratigraphic investigation of the ammonoid fauna revealed that the Sparbach section comprises Lower Barremian sediments. Whether the Valanginian to Hauterivian are represented at the Sparbach section remains unclear due to the bad outcrop-situation at the rest of the sequence and are correlated moreover under the appliance of the lithology. The Early Cretaceous of the Flössel Syncline is considered to range from the Late Valanginian to the Early Barremian. The stratigraphy within this paper follows the compiled reference stratigraphy papers by HOEDEMAEKER & RAWSON (2000) but basically HOEDEMAEKER et al. (2003). Only ammonoid species of Mediterranean character were observed at the Sparbach section.

Due to the additional finding of the *Karsteniceras* Level at Sparbach the proposed *Karsteniceras* Level (KB1-B section, Upper Austria) by LUKENEDER (2003) currently has got the status of a more

widespread lateral biostratigraphic significant 'horizon', at least for the Northern Calcareous Alps. Its potential status as a stratigraphic 'horizon' and its potential for correlation is manifested due to its extension to a wider geographical area (approx. 150 km).

The geochemical results indicate that the assemblage was deposited under conditions of intermittent oxygen-depletion associated with stable water masses. A highly dynamic environment, controlled by short- and long-term fluctuations in oxygen levels, and poor circulation of bottom-water currents within an isolated, basin-like region led to the accumulation of the *Karsteniceras* Level. The brighter color of the sediment and the lower content of TOC and sulphur at the Sparbach section refer to a less dysoxic environment than this was assumed for the KB1-B sequence.

It is assumed that, based on the described features from Sparbach section, the KB1-A and literature data, *Karsteniceras* most probably had an opportunistic (r-strategist) mode of life and was adapted to dysaerobic seawater. *Karsteniceras* probably inhabited areas of water stagnation with low dissolved oxygen, showing abundance peaks during times of oxygen depletion, which hindered other invertebrates from colonising such environments.

The evidence for an oxygen-depleted formation of the *Karsteniceras* mass-occurrence needs to be supplemented by additional analysis of the micropalaeontological record (e.g. benthic foraminifera, nannofossils) and further investigations on the organic carbon material (e.g. type and producers).

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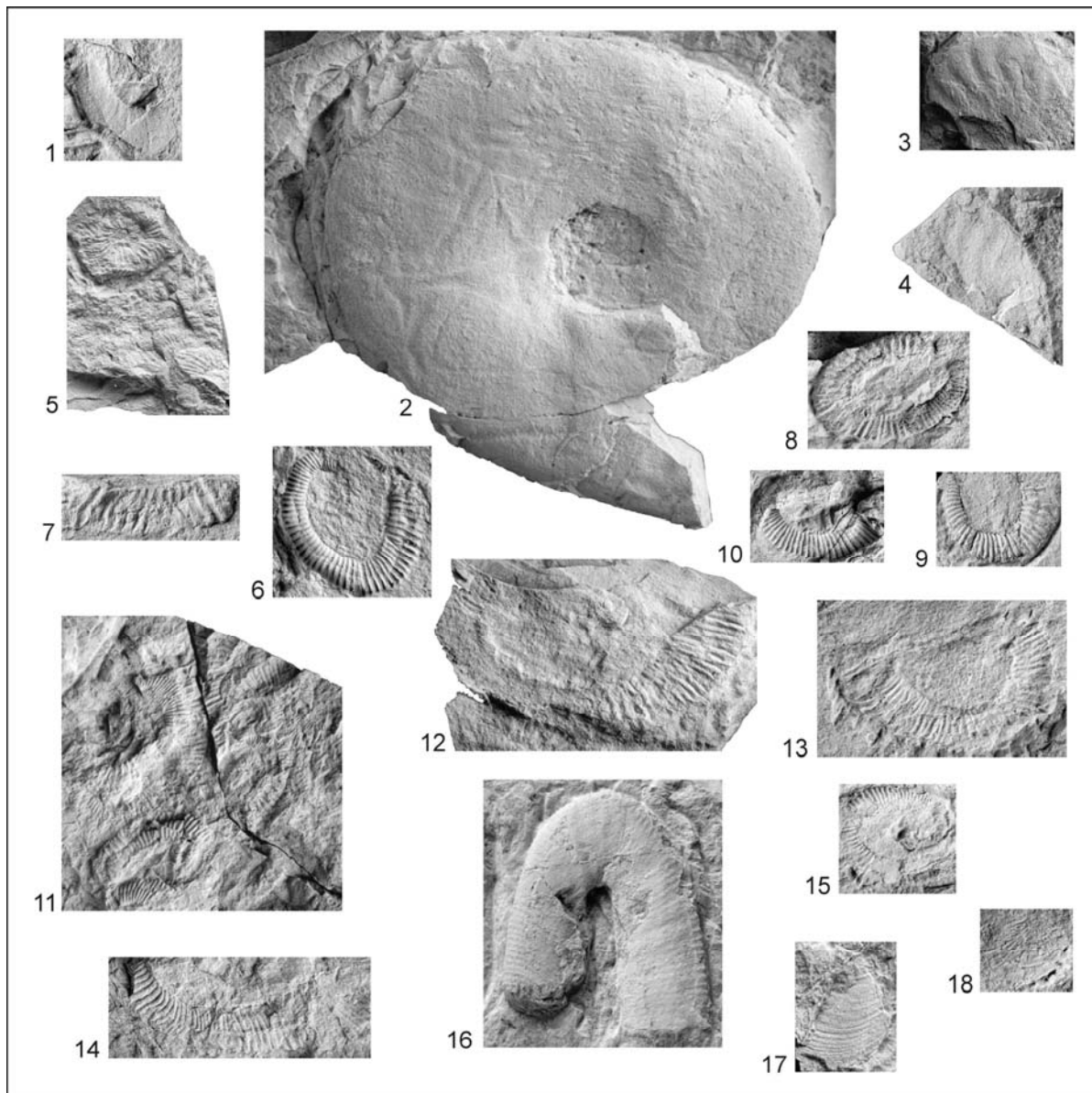


Fig. 1. Early Barremian Lytoceratina, Ancyloceratina, aptychi and bivalves from the Flössel Syncline (Schrambach Formaion). Typical representatives of the Sparbach assemblage.

1 – *Eulytoceras phestum* (MATHERON 1878); 2004z00/0001, x1. 2 – *Barremites (Barremites) cf. difficilis* (D'ORBIGNY 1841), 2004z00/0002, x1. 3-4 – *Pulchellia* sp., 2004z00/0003-04, x1. 5-15 – *Karsteniceras ternbergense* LUKENEDER 2002, 2004z0045/0005-15, x1. 16 – *Anahamulina subcincta* (UHLIG 1883), 2004z00/0016, x1. 17 – *Lamellaptychus* sp., 2004z00/0017, x4. 18 – *Prepeamusium* sp. (bivalve), 2004z00/0018, x1.

All specimens were collected at the Sparbach section, coated with ammonium chloride before photographing and are stored at the Museum of Natural History Vienna (Burgring 7, A-1014, Vienna).