



Cretaceous ammonite mass-occurrences – causes and explanations

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Mass occurrences in the palaeontological record can act as proxy for the environmental activities and biotic crisis through time. It has to be noted that the ultimate causes are often unknown and not well understood and are under comprehensive discussion. Environmental changes as displayed by the sea-level and climate will become more obvious and the 'motor' behind such occurrences or mass mortalities better understood.

Case study 1: Karsteniceras mass-occurrence (FWF Project P13641-GEO)

The mass-occurrence (Northern Calcareous Alps, Upper Austria) dominated by *Karsteniceras ternbergense* is of Early Barremian age (Moutoniceras moutonianum Zone). The *Karsteniceras* mass-occurrence comprises 8 different genera, each apparently represented by a single species. About 300 specimens of *K. ternbergense* between 5 and 37 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 associated with stable, salinity-stratified water masses. *Karsteniceras* inhabited areas of stagnant water with low dissolved oxygen and shows abundance peaks during times of oxygen depletion. Based on lithological and geochemical analysis combined with investigations of trace fossils, microfossils and macrofossils, an invasion of an opportunistic (r-strategist) *Karsteniceras* biocoenosis during unfavourable conditions over the sea bed during the Early Barremian is proposed.

Case study 2: Olcostephanus mass-occurrence (FWF Project P 16100-N06)

A Lower Cretaceous mass-occurrence of ammonites in the Ternberg Nappe of the Northern Calcareous Alps (Upper Austria) is described. The occurrence (KB1-A) with dominating *Olcostephanus (O.) guebardi* is from the Saynoceras verrucosum Zone (Upper Valanginian). The mass-occurrence over an interval of almost 3 metres is interpreted as a long-term, 'normal' accumulation from the water column during a favourable time interval of the Upper Valanginian. About 200 specimens between 1 cm and 15 cm diameter were investigated. The ammonite fauna of the Olcostephanus-Level comprises 9 different genera with 10 species. The *Olcostephanus* mass-occurrence is most probably a widespread phenomenon, but it appears most common at oceanographically significant places on the sea-floor during a transgressive sea-level phase.

Case study 3: Lower Cretaceous ammonite abundance peaks (FWF Project P 20018-N10)

The Lower Cretaceous (Hauterivian-Barremian) ammonite assemblage from the Dolomites (North Italy) clearly indicates a Mediterranean character. Ammonite abundances are strongly correlated to single intervals of the section. Ammonite-rich beds were detected within the *Crioceratites krenkeli* Zone, the *Toxancyloceras vandenheckii* Zone and the topmost *Gerhardtia sartousiana* Zone. Ammonite abundance peaks occur in bed 66 ($n > 60$) *C. krenkeli* Zone and the *G. sartousiana* Zone in beds 197 ($n > 120$) or bed 199 ($n > 200$). The Hauterivian is dominated by *Pseuthormannia*-*Crioceratites*-*Plesiospitidiscus*, the Barremian by *Kotetishvilia*-*Melchorites*-*Silesites*. Ammonite abundances are clearly linked to sea-level changes from Late Hauterivian to mid Late Barremian times. Abundance and diversity peaks occur during phases of high sea-level pulses and the corresponding maximum flooding surfaces (*P. mortilleti*/*P. picteti* and *G. sartousiana* Zone).