

Petrologic and isotopic characteristics of metacarbonate rocks of the Austroalpine Basement east of the Tauern Window (Eastern Alps)

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Metacarbonate rocks from the Koralpe - Wölz nappe system were investigated regarding their petrological and isotopic characteristics. The aims of the study were to get some information about the evolution of this rock type during the pre-Alpine and Alpine metamorphic events and to distinguish between different lithostratigraphic units by means of mineral assemblages, stable isotope characteristics and sedimentation ages.

The Koralpe-Wölz nappe system represents an eo-Alpine high-pressure metamorphic part of the Austroalpine Basement (Eastern Alps). It is interpreted as a metamorphic extrusion wedge with an inverted metamorphic field gradient in the tectonic lower part and an upright field gradient in the upper part.

From bottom to top the Koralpe-Wölz nappe system comprises the following complexes: the Wölz Complex, the Greim Complex (both with greenschist to greenschist-amphibolite transitional facies), the Rappold Complex (amphibolite facies), the Koralpe-Saualpe-, Millstatt- and Sieggraben Complexes (all up to eclogite facies), the Plankogel Complex and at the uppermost position the Radenthein Complex (both with greenschist-amphibolite transitional facies).

The eo-Alpine metamorphic field gradient in the area E of the Tauern Window clearly documented by metabasites from low greenschist facies in the N to eclogite facies in the S is confirmed also by siliceous dolomitic marbles (CMSCH-system): within the northernmost part in the Sölk valley (Wölz Complex), the mineral assemblage Dol+Cc+Qtz is present. T-estimates were obtained with Cc-Dol-solvus thermometry which yields a T-range between 437 to 465°C. Within the Greim Complex about 20 km southwards the first occurrence of Tre is recognized. Cc-Dol thermometry yields 540 to 562 °C. Within the overlying Rappold Complex temperatures increase to 660-691°C and lead to the first occurrence of Di which is the dominant index mineral further south in the Millstatt, Koralpe-Saualpe (680-740 °C) and Pohorje Complexes. Fo is rare which reflects the high P/T-gradient, and is probably stabilized by high water activity. Fo is restricted to the southern Koralpe area where it is accompanied by Di+Ti-Chu and to the Sieggraben and related complexes with Chl+Ti-Chu or Spl (CMASCH-system). In the Sieggraben Complex Fo is stabilized by the highest temperatures recorded so far for the eo-Alpine event (ca. 760 °C).

Clear indications of polymetamorphism by either mineral relics or mineral chemical zonations and reaction textures are usually absent with the only exceptions in the Rappold- and Millstatt Complexes where rare Di-inclusions within Tre most probably represent pre-Alpine (Permian?) relics. Calcitic marbles were investigated regarding their ⁸⁷Sr/

⁸⁶Sr-, ¹⁸O/¹⁶O- and ¹³C/¹²C- ratios. The study of the ⁸⁷Sr/⁸⁶Sr -ratios of the different units allows to distinguish two groups, a lower one with values minor than 0.70847 in a very narrow range (Rappold, Plankogel and Koralpe-Saualpe Complexes) and a higher one with more scattering values above 0.70855 (Wölz, Pohorje, Millstatt, Radenthein Complexes). The complexes showing lower Sr-values are characterized by highly variable δ¹⁸O-values from 19.3 up to 31 and δ¹³C from -1 up to 4.8, whereas the group with the higher Sr-values shows δ¹⁸O-values between 17.7 and 25.8 and δ¹³C in a very narrow range (-0.1 to 2.9). The δ¹⁸O and δ¹³C patterns of the individual complexes often plot in overlapping fields but at least some of the complexes can be separated from the others, e.g., the Rappold Complex with the highest values in δ¹⁸O plot in a very narrow range compared to the others. These isotopic patterns most probably reflect primary trends of the carbonate rocks.

Age constraints were derived by comparing the Sr-ratios with the Sr-seawater curve (McARTHUR et al. 2001). The group of marbles with low Sr-ratios occurring in the Rappold, Plankogel and in the northern part of the Koralpe-Saualpe Complex forms a specific type of basement in the eastern part of the Austroalpine unit. According to the Sr-seawater curve three age intervals in the Lower Paleozoic (370-384, 398-407 or 426-444 Ma) are possible deposition ages for these marbles.

For the very thick and pure marbles of the Millstatt Complex a different deposition age in the range of 409-423 Ma (Silurian-Devonian border) is likely.

McARTHUR, J.M., HOWARD, R.J. & BAILEY, T.R. (2001): Strontium isotopic stratigraphy: LOWESS-Version3. Best-fit line to the Sr-isotope curve for 0 to 509 Ma and accompanying look up table Version 4: 08/03 for delivering numerical age. - Journal of Geology, **109**: 155-169.

Matrixalter der Hallstatt Mélange der Saalachzone (Nördliche Kalkalpen; Österreich)

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Die Saalachzone ist seit langem eine umstrittene Zone aufgrund ihrer Zugehörigkeit. Zur Neudefinition dieser Zone sowie zu einem kurzen geschichtlichen Abriss vgl. MISSONI & GAWLICK (dieser Band).

Im Bereich von Unken grenzt die Hallstatt Mélange auf die Beckenfüllung der im späten Jura entstandenen Tauglboden Mélange. Dieses Becken (Tauglboden Becken) beinhaltet ebenso wie die Matrix der Hallstatt Mélange Radiolarienfaunen aus einem sich überschneidenden Altersbereich (Oxfordium). Deshalb werden beide ra-

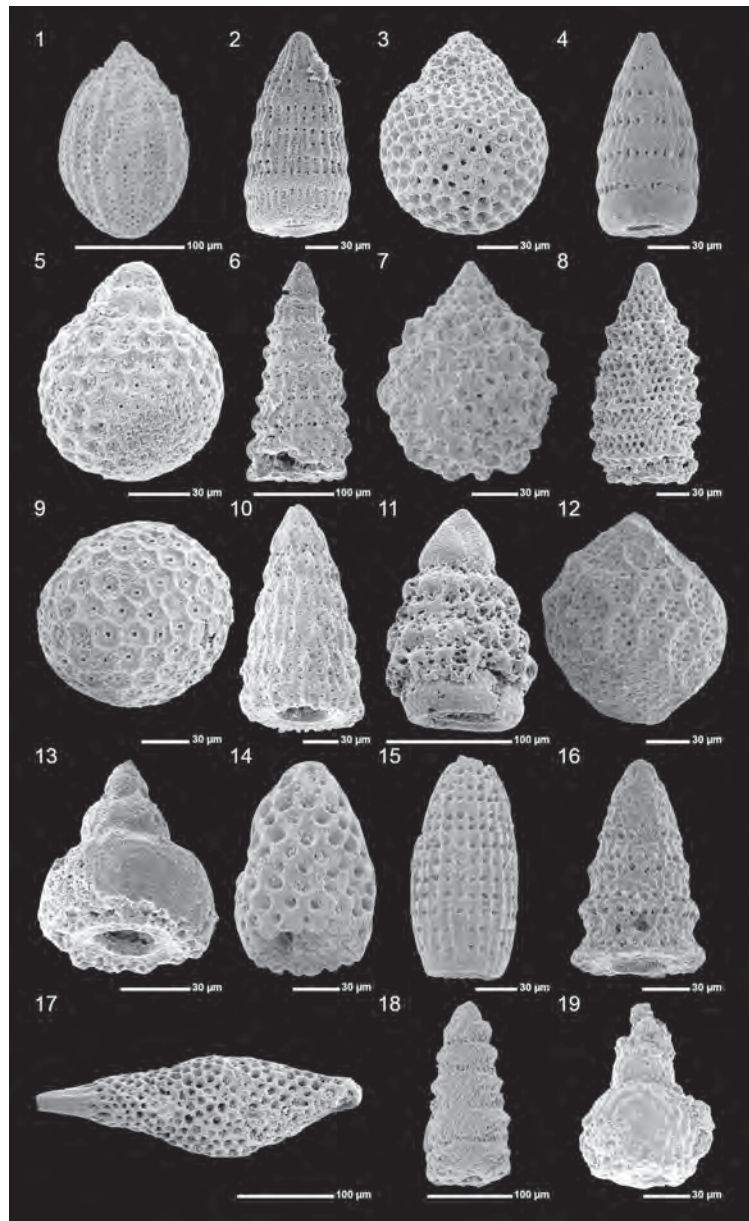


Abb. 1: Radiolarien der Probe GS 16a - *Zhamoidellum ovum*-Zone, insbesondere *Protunuma lanosus*-, *Williriedellum carpathicum*- oder *Williriedellum dierschei*-Subzone: 1. *Protunuma multicostatus* (HEITZER). 2. *Archaeodictyomitra minoensis* (MIZUTANI). 3. *Zhamoidellum ovum* DUMITRICA. 4. *Loopus doliolum* DUMITRICA. 5. *Williriedellum* cf. *dierschei* SUZUKI & GAWLICK. 6. *Hsuum brevicostatum* (OZVOLDOVA). 7. *Tricolocapsa undulata* (HEITZER). 8. *Triversus hungaricus* (KOZUR). 9. *Gonglyothorax* cf. *favosus* DUMITRICA. 10. *Hsuum maxwelli* PESSAGNO. 11. *Stichomitra annibill* KOCHER. 12. *Williriedellum crystallinum* DUMITRICA. 13. *Eucyrtidiellum unumaense* (YAO). 14. *Droltus galerus* SUZUKI. 15. *Archaeodictyomitra rigida* PESSAGNO. 16. *Dictyomitrella kamoensis* MIZUTANI & KIDO. 17. *Pseudoeucyrtis reticularis* MATSUOKA & YAO. 18. *Cinguloturris primorica* KEMKIN & TAKETANI. 19. *Eucyrtidiellum nodosum* WAKITA.

diolaritischen Abfolgen fälschlicherweise oft zusammengefasst. Das Tauglboden Becken, dem auch die Unkener Mulde zugerechnet wird, enthält aber im Gegensatz zur Hallstatt Mélangé Komponenten und Gleitschollen aus dem lagunären Dachsteinkalkfaziesraum.

Das Matrixalter der Hallstätter Mélangé kann anhand der auftretenden Radiolarienfaunen datiert werden. Die Radiolarien-Proben entstammen der Hallstatt Mélangé (Struberg-Formation) südlich von Unken und sind zurzeit in detaillierter Bearbeitung. Von entscheidender stratigraphischer Bedeutung hat sich die Probe GS 16a herausgestellt, die im Folgenden dargestellt ist. Diese Probe enthält *Eucyrtidiellum unumaense* und *Zhamoidellum ovum*, so dass sie in die *Zhamoidellum ovum*-Zone, insbesondere der *Protunuma lanosus*-, *Williriedellum carpathicum*- oder *Williriedellum dierschei*-Subzone gestellt wird. *Pseudoeucyrtis reticularis*, eine Art, die ebenfalls in der Probe auftritt, ist bisher in den Nördlichen Kalkalpen aus der *Podocapsa amphitrepta*-Zone bekannt. Daher ist diese

Probe sehr ungewöhnlich, und stratigraphisch kann sie deshalb nur in die höhere Subzone (*Williriedellum dierschei*-Subzone) eingestuft werden. Die wichtigsten Arten sind in der Abbildung dargestellt. Aufgrund dieser Radiolarien wird diese Hallstatt Mélangé ins Oxfordium (*Williriedellum dierschei*-Subzone) datiert.

Die genaue Abtrennung der Hallstatt Mélangé, d. h. der Saalach Zone von der Tauglboden-Formation der Unkener Mulde erfordert weitere detaillierte stratigraphische und fazielle Untersuchungen des Gebietes, besonders Komponentenbestandsuntersuchungen in den verschiedenen auftretenden Brekzienkörpern. Die Datierung der Matrix der Hallstatt Mélangé ist dabei ebenfalls von entscheidender Bedeutung.