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Multidisciplinary approach for the identification of Middle Devonian biotic crisis in the Carnic Alps: results of the Project FWF P23775-B17

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The FWF (The Austrian Science Fund) Project P23775-B17 focuses on the Middle Devonian climate perturbation and their effects on the tropical coral communities. In order to identify intervals related to climate change, sections of three different paleoenvironmental settings (shallow water platform, distal slope and pelagic) in the Carnic Alps (Austria-Italy) were investigated in detail. Methods used include microfacies analysis, conodont biostratigraphy and the application of geochemistry (carbon and oxygen isotopes, TOC and sulfur content, major and trace elements) and geophysics (magnetic susceptibility and gamma-ray spectrometry).

The shallow water facies of the Kellergrat Reef Limestone (Givetian - ?Frasnian) exposed between Forcella Monumenz and Val di Collina (abandoned quarry) which is located at trail #149 to the Rifugio Marinelli (Italy) is characterized by the massive limestone composed of the fore-reef breccia. Within the Kellergrat Reef Limestone of the abandoned quarry abundant reef organisms are found. The Hoher Trieb Formation (Eifelian - Frasnian) of Zuc di Malaseit Basso section (Mt. Zermula, Lanza, Italy) consists of gray to dark gray platy limestone beds with the intercalation of black shale and chert, which are accumulated at the distal slope. The Valentin Limestone (Eifelian - Givetian) in the Wolayer Glacier section (Central Carnic Alps, Austria) is characterized by highly condensed but rhythmically deposited sediments, which show pelagic facies. Except for one thin layer (70a middle) below the Eifelian - Givetian boundary, which shows fine grained peloidal packstone with rare tentaculites, the dominant facies is composed of tentaculitid wackestone.

Within the *kockelianus* – *hemiansatus* conodont zones of the Hoher Trieb Formation, three remarkable depressions of $\delta^{13}\text{C}_{\text{carb}}$, which correspond with increasing values of TOC and sulfur are observed. The second depression of $\delta^{13}\text{C}_{\text{carb}}$ between the beds ZMB23 to ZMB20 starts with the largest negative shift of carbon isotope values in the section, ranging from 2.2 to 0.1 ‰. Within these beds, a positive spike of MS value is observed just after a minor negative shift. Such a minor negative shift is also found in the Th/U values (GRS) of the same interval. We considered that the shifts observed in the carbon isotope, TOC and sulfur content, MS and GRS in beds ZMB23 to ZMB20 are related to paleoenvironmental changes which were associated with the late Eifelian Kačák Event.

In the Valentin Limestone, a pronounced negative excursion of MS from 43.39 to 27.71 ($10^{-9} [\text{m}^3 \cdot \text{kg}^{-1}]$) is observed between beds 70a base and 70 top across the layer 70a middle. TOC and sulfur content show increased values within the bed 70a. Although $\delta^{13}\text{C}_{\text{carb}}$ values show only a slight negative shift across the layer 70a middle, it is suggested that the layer 70a middle is associated with the Kačák Event.

The corals found in the Hoher Trieb Formation and the Valentin Limestone are assigned to the re-deposited materials derived from the Eifelian or Givetian shallow water limestone. In the Carnic Alps, the Eifelian and Givetian shallow water deposits are known in the Spinotti Limestone, *Amphipora* Limestone and the Kellergrat Limestone. The succession from the Spinotti Limestone to the Kellergrat Limestone shows the change in sediments which was deposited in peritidal setting that was followed by dark bituminous limestone rich in *Amphipora* and later succeeded by a well-developed reef communities. The Spinotti and Kellergrat limestones yields diverse frame building organisms like tabulate, rugose corals and stromatoporoids, whereas the *Amphipora* Limestone yields rugose corals predominately of *Dendrostella*. The change in the sediments and in the coral community might link to the changing environmental conditions which were resulted from the Middle Devonian climate perturbations.

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