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## Middle Devonian rugose corals of the Carnic Alps and their relation to the Late Eifelian Kačák Event

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The Early to Middle Devonian is known as an interval dominated by global greenhouse conditions with an acme in diversity, size and latitudinal distribution of reefs during the Eifelian to Givetian. Nonetheless, also the Middle Devonian climax witnessed several climate perturbations that resulted in more or less severe biotic events. One of these events is the Late Eifelian Kačák Event (HOUSE 1985), which is represented by a black shale and chert interval documented in sedimentary sequences globally. The polyphase dysoxic/anoxic event-interval is constrained to the *kockelianus-ensensis* conodont biozones (HOUSE 1985). The event is characterized by significant extinctions among benthic invertebrate groups such as trilobites (e.g., CHLUPÁČ 1994) and distinctive faunal changes as observed in planktonic dactyloconarid tentaculites (e.g., an appearance of index species *Nowakia* (*Nowakia*) ex. gr. *otomari* BOUČEK & PRANTL (e.g., WALLISER 1985 and 1996). In addition, effects on other marine organisms such as algae, ammonoids, brachiopods, corals and conodonts were reported in the Barrandian of Czech Republic, the type area of the Kačák Event (BUDIL 1995, WALLISER *et al.* 1995).

Since its recognition, the Kačák Event is known from one lacustrine and at least ten marine areas within the Panthalassic, Rheic and Paleotethys oceans (e.g., MARSHALL *et al.* 2007, ELLWOOD *et al.* 2010). As far as documented, biotic response related to the event has been observed mainly from benthic organisms of pelagic deposits. However, the coral community, which is observed in neritic deposits of the Barrandian also shows a faunal change after the Kačák Event (GALLE & HLADIL 1991). For a better understanding of the processes behind the event we realized that it is necessary to focus especially on changes in neritic tropical coral-communities which are observed before and after the event as these are regarded as the first ones that suffer changing environmental conditions.

Middle Devonian strata of the Carnic Alps are distinguished into ten different units representing a neritic to pelagic succession within an area of approx. 240 km<sup>2</sup> across Austrian-Italian border. According to SCHÖNLAUB *et al.* (2004), a horizon with dark-stained (phosphoritic?) lithoclasts of an interval known as "unit 3" within the pelagic succession at Mt. Freikofel (= Mt. Cuelat) could be related to the Kačák Event or the Eifelian/Givetian boundary. A more distally deposited lateral unit of this succession is the Hoher Trieb Formation (Eifelian to Frasnian). In general it is assigned to the distal slope facies and characterized by flaser and platy limestone with clay and chert layers (KREUTZER 1992). Either of above mentioned unit yield corals in breccia-levels. From the breccia level of the Hoher Trieb Fm. exposed at Mt. Findenig (= Mt. Lodin) silicified corals composed of eight species in seven genera have been reported (see Fig. 1). According to the FLÜGEL & HUBMANN (1994), the age of these silicified corals is not clear. Latter author referred to "?Givetian" age. Our preliminary study revealed that the conodonts collected from the breccia levels bearing the silicified corals within the Hoher Trieb Fm. cropping out at Lanza area (Italy) indicate not exclusively Givetian but also Eifelian age (*kockelianus* to Lower *varcus* conodont zones). This indicates that the silicified corals were accumulated as redeposited material derived from either Eifelian or Givetian reefal limestone of the neritic carbonate platform. Eifelian to Givetian neritic deposits are observed in the Spinotti Limestone and the overlying Kellergrat Reef Limestone. Although abundant and well preserved corals are known from "unit A" at the base of the Spinotti Lst. (Eifelian; SCHÖNLAUB *et al.* 2004), exposed at the Sentiero Spinotti (Italy), they have not been studied in detail yet. From Givetian to Frasnian deposits of the Kellergrat Reef Lst. at Hohe Warte, Kellerwände and Kollinkofel (Austrian-Italian border) ten rugosan

species belonging to nine genera are reported (Fig. 1; OEKENTORP-KÜNSTER & OEKENTORP 1992). Of them, one species, *Dendrostella trigemme*, also occurred in the massive reefal limestone unit at Mt. Zermula (Italy). Following FLÜGEL & HUBMANN (1994) the massive limestones at Mt. Zermula possibly represent equivalent strata to the Kellergrat Reef Lst. Totally 12 rugosan species in 9 genera have been described from this unit (FERRARI 1968). They are considered to be ?Givetian in age, except for *Tabulophyllum delicatum* which ranges from ?Givetian to Frasnian age (FLÜGEL & HUBMANN 1994). Apart from the rugose corals that occur in the Hoher Trieb Fm. at Mt. Findenig, as well as in the Kellergrat Reef Lst. and in the reefal limestone at Mt. Zermula, 29 rugosan species belonging to 18 genera have been found in the Givetian or ?Givetian deposits of the Carnic Alps (e.g., FRECH 1887 and VINASSA DE REGNY 1918).

Kellergrat Reef Limestone	Massive reefal limestone in Mt. Zermula	Hoher Trieb Formation
<i>Dendrostella trigemme</i>	<i>Dendrostella trigemme</i>	<i>Cystiphyllum? geyeri</i>
<i>Battersbyia</i> sp.	<i>Palaeophyllum vurgaris</i>	<i>Grewingkia? carnica</i>
<i>Acanthophyllum concavum</i>	<i>Pseudamplexus</i> sp. aff. <i>P. frechi</i>	<i>Barrandeophyllum carnicum</i>
<i>Acanthophyllum</i> sp.	<i>Tabulophyllum delicatum</i>	<i>Entelophyllum articulatum</i>
<i>Grypophyllum</i> sp.	<i>Tabulophyllum heckeri giveticum</i>	<i>Entelophyllum? alpinum</i>
<i>Stringophyllum</i> sp.	<i>Battersbyia devonica</i>	<i>Pycnactis mitratum</i>
<i>Cyathophyllum? bathycalyx</i>	<i>Stringophyllum schwelmense</i>	<i>Sociophyllum torosum</i>
<i>Columnaria</i> sp.	<i>Neospongophyllum primordiale</i>	<i>Cyathophyllum? taramelli</i>
<i>Alaiophyllum jarushevskiyi</i>	<i>Cyathophyllum dianthus</i>	
<i>Temnophyllum</i> sp. cf. <i>T. latum</i>	<i>Cyathophyllum coespitosum</i>	
	<i>Cyathophyllum</i> sp. cf. <i>C. volaicum</i>	
	<i>Disphyllum? recessum</i>	

Fig. 1: List of the corals from the Kellergrat Reef Limestone (central Carnic Alps), massive reefal limestone at Mt. Zermula and the Hoher Trieb Formation at Mt. Findenig, based on VINASSA DE REGNY (1918), FERRARI (1968) and FLÜGEL & HUBMANN (1994).

An important step was achieved just recently during field work in Lanza area where we found out that in deeper marine deposits the coral bearing breccia-levels commonly are succeeding an interval of black shale with chert nodules. This black shale interval, dated by conodonts in the Oberbuchach II section (SCHÖNLAUB *et al.* 2004), represents the Kačák Event and is traceable throughout the entire deeper marine sequence of the Carnic Alps, whereas no black shale was found on the platform where the corals derived from. In order to identify this event also within the shallow marine sequence, we aim to reveal an overview of middle Devonian rugose coral assemblages of the proto-alpine realm, to see if there were any distinctive changes at species-level, which are linked with the Kačák Event.

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