

Ber. Inst. Erdwiss. K.-F.-Univ. Graz	ISSN 1608-8166	Band 14	Graz 2009
<i>Paleozoic Seas Symposium</i>	Graz, 14-18 th September 2009		

Exceptional microbial carbonates in the Silurian of Gotland in the aftermath of the Ireviken extinction event: Indication of an anachronistic facies?

OSWALD, I.¹ & MUNNECKE, A.¹

(1) Geozentrum Nordbayern, Fachgruppe Paläoumwelt, Loewenichstr. 28, D-91054 Erlangen; Rinox2@web.de; axel.munnecke@gzn.uni-erlangen.de

The Silurian is characterised by several positive stable carbon and oxygen isotope excursions, and these excursions show common geochemical, sedimentological, and palaeontological signatures indicating common steering mechanisms (MUNNECKE *et al.* 2003). One of the sedimentological features is the high abundance of microbial carbonates on shallow platforms during the isotope excursions. As the onset of the isotope excursions are connected to extinction events for different groups of organisms (e.g., conodonts, graptolites, trilobites), the high abundance of microbial carbonates has been interpreted in the recent literature as anachronistic facies in the aftermath of the extinctions (CALNER 2005). For the present study an abandoned quarry in the northernmost part of Gotland (Tofta Formation) was investigated which shows spectacular stromatolites in the upper part of a large patch reef (Fig. 1). In total, 56 thin sections have been prepared and investigated for their microfacies. In contrast to “normal” stromatolites, the microbial carbonates investigated here show a high abundance of metazoans, e.g., encrusting tabulate corals (e.g. *Thecia swinderniana*) and bryozoans (*Fistulipora*), gastropods, echinoderms, trilobites, stromatoporoids, and boring bivalves. *Rotpletzella* (probably a cyanobacteria), *Wetheredella* (microproblematicum) and solenoporacean algae are abundant, *Hedstroemia* (probably a cyanobacteria) is rare, and up to now no *Girvanella* has been observed. In total, 8 microfacies types have been classified and described.



Fig. 1: Vertical to overhanging cauliflower-like stromatolite (coin for scale)

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The high abundance of intergrowing microbial carbonates and metazoans and especially grazing organisms like gastropods argue against an anachronistic facies. In addition, an extremely high palaeosalinity appears unlikely as well because of the stenohaline character of the organisms. In contrast to other bioconstructors cyanobacteria secrete calcite extracellularly, and therefore react directly to changes in sea-water chemistry. Such changes might result from changing CO₂ concentration in the atmosphere which is directly related to sea-water pH. We therefore assume as working hypothesis that changes in sea-water chemistry might have been responsible for the high abundance of microbial carbonates during the isotope excursions. This, however, has to be confirmed by future investigations.

References

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Zeitschrift/Journal: [Berichte des Institutes für Geologie und Paläontologie der Karl-Franzens-Universität Graz](#)

Jahr/Year: 2009

Band/Volume: [14](#)

Autor(en)/Author(s): Oswald [Sturm] Isabella, Munnecke Axel

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