Diagenetic history of the Korallenoolith (Malm) of Northwestern Germany: Implications from *in-situ* trace element and isotopic studies

F. Bruhn[1], J. Veizer[2,3], D. Buhl[2] and J. Meijer[4]

[1]*National Isotope Centre, Institute of Geological and Nuclear Sciences, PO Box 31 312, Lower Hutt, New Zealand*
[2]*Institut für Geologie, Mineralogie und Geophysik, Ruhr-Universität Bochum, D-44780 Bochum, Germany*
[3]*Department of Earth Sciences, University of Ottawa 140 Louis Pasteur, Ottawa, Canada K1N 6N5*
[4]*Institut für Physik mit Ionenstrahlen, Ruhr-Universität Bochum, D-44780 Bochum, Germany*

We have collected rock samples from the abandoned Konrad iron ore mine near Salzgitter/Germany, to elucidate the diagenetic history of the Korallenoolith formation in Northwestern Germany.

Petrographic and cathodeluminescence investigations showed that the rocks contain a wide range of different particles, from primary biogenic material to various generations of interparticle cements to cement in fissures and fractures.

The diagenetic environment of cement precipitation has been reconstructed using *in-situ* trace element microanalyses with PIXE, using the Bochum proton microprobe. Furthermore, the different components were analysed for their radiogenic ($^{87}Sr/^{86}Sr$) and stable ($\delta^{13}C$, $\delta^{18}O$, $\delta^{34}S$) isotope signatures.

"Rim cements" around echinoid fragments display different stages of cement precipitation. Early cement generations show high Sr concentrations and low $^{87}Sr/^{86}Sr$ values. In contrast, later generations of the rim cements reveal relatively low Sr values of around 300 ppm and iron concentrations of up to 3 %. Fissure cements represent an even later stage of diagenetic history. They consist of calcite, anhydrite and celestite and are characterised by significantly increased $^{87}Sr/^{86}Sr$ values. The results of stable isotope measurements are corroborative of these observations.

The results of combined trace element and isotopic measurements indicate that the biogenic material was deposited in a shallow marine environment with normal salinity and a relatively high primary availability of iron. Early generations of diagenetic cements reveal the same marine signature and were therefore precipitated in a closed system, where the trace element and isotopic signatures were inherited from dissolved predecessor phases. In contrast, later generations of rim cements and particularly the fissure cements show completely different chemical signatures. They were precipitated in an open system from formation waters of fundamentally different origins.