Ber. Inst. Erdwiss. K.-F.-Univ. Graz	ISSN 1608-8166	Band 21	Graz 2015
STRATI 2015	Graz, 19 – 23 July 2015		

Lanthanides and microbes influence the deposition of Late Triassic Hallstatt pelagics, Northern Calcareous Alps

MISSONI, S.[1], GAWLICK, H. J.[1], ONOUE, T.[2], PROCHASKA, W.[1]

[1] University of Leoben, Department of Applied Geosciences and Geophysics, Austria (s.missoni@daad-alumni.de)
[2] University of Kumamoto, Department of Earth & Environmental Sciences, Japan

New biostratigraphic, sedimentological, and geochemical data and a thorough review of existing literature modify existing knowledge on the sedimentology, palaeogeography and ocean acidification of the Late Triassic Hallstatt margin from the Northern Calcareous Alps. Criteria are drawn from examples on the variegated Hallstatt facies of the Kälberstein quarry, Germany and the Bad Dürrnberg church section, Austria. Siliceous, deep-water limestones of the Pötschenhöhe quarry, Austria represent the oceanward sedimentation on the Triassic passive continental margin.
In Early Norian hemipelagic settings, distant to large carbonate platforms, shedding of carbonate mud during sea-level highstand has still major control on sediment accumulation rates. In the Lacian 2, the Massiger Hellkalk is formed in high sedimentation rates by low energetic, biturbated biomicrites of deep-water biota. Seismic shocks induced by an initial stage of ?strike-slip tectonic or ?an extensional pulse, favour in monomict breccia horizons mixing advection of seawater through the sediment, coupled with a Na-Cl-anomaly and singular negative shifts of O-isotopes. Shallow-burial fluid flow and acidic formation fluids of surface-near temperatures drive rapidly the accumulation in the homogenized sediment and thus favour sulphate reduction and an anaerobic methanotroph archaea, which is suggested by a biodegraded microfabric, altered apatite structures on conodonts, and the SO_4, F, and J-ionisation. At the base of the Lacian 3, biogenic hydrate water releases in the Hallstatt limestones are coupled with another Cl-anomaly. At the top of Lacian 3 first hardgrounds were established as a consequence of reduced sedimentation rates.
In the Alaunian 1, strong tectonic pulses triggered by strike-slip motions destabilize the geometry on the Hallstatt margin. Variations in the morphology, climatic cooling with reduced stable O- and C-isotopes, and eustatic pulses are coupled with a change in ocean circulation. Erosion of an uplifted deeper continental crust-fragment in the hinterland resulted in remobilized transition and LREE metals. In the rapidly accumulating hemipelagic biomicrites of the Hangend Rotkalk and the Pötschen Limestones, the organic matter becomes extracted by an anaerobic metanotrophic archaea under the presence of metal chelates. This higher biological availability of LREE and some similarities of lanthanides (III) with calcium (II) process these bacteria to replace Ca into Ce in the biomolecules of (some) deeper water biota. The shallow-burial diagenesis in the deep water becomes identified by the altered litho- and microfacies, strongly altered apatite crystallinity on conodonts, intense fluctuations in the Ca-ionisation of the palaeo-seawater, and matrix-selective dolomitization of the bioturbated wackstones and marls.
The Alaunian/Sevatian boundary in the Hallstatt margin is characterized by an abrupt change in deposition. Formation of pull-apart basins perpendicular to the margin is evidenced by polymictic breccia formation. An increased availability of transition metals and lanthanides catalysed the metal chelate and microbial activity in the hemipelagic sediment. Hence, any hydrothermal fluid flow can be excluded on the Late Triassic Hallstatt margin.

Acknowledgement:
This study is founded by FWF Hertha-Firnberg project T533-N21 of the Austrian Science Fund. Preliminary examinations by FWF project P14131-TEC.