Geophysical Research Abstracts
Vol. 12, EGU2010-2394-5, 2010
EGU General Assembly 2010


# Climatic changes in the aftermath of the end-Permian mass extinction - evidence from palynological records of Pakistan

Elke Hermann (1), Peter A. Hochuli (1), Hugo Bucher (1), Thomas Brühwiler (1), David Ware (1), Michael Hautmann (1), Helmut Weissert (2), Stefano M. Bernasconi (2), Ghazala Roohi (3), and the PMNH (3) Team

(1) Institute and Museum of Palaeontology, University of Zurich, Karl Schmid-Str. 4, 8006 Zurich;(ehermann@pim.uzh.ch), (2) Department of Earth Sciences, ETH Zürich, Switzerland, (3) Pakistan Museum of Natural History, Garden Avenue, Islamabad 44000, Pakistan

Early Triassic fossil records feature the varied responses of the biosphere to the greatest mass extinction in the Phanerozoic. Few marine clades recovered relatively quickly (e.g. ammonoids, Brayard et al., 2009 and conodonts, Orchard, 2007) whereas benthic organisms showed a comparatively slow recovery (Hautmann et al., 2008). Environmental perturbations such as climatic changes are thought to be the cause for the delayed recovery of some clades (Galfetti et al., 2007). A climatic framework of this interval can be inferred from the palynological data of the sedimentary archives of the thermally unaltered Salt Range and Surghar Range sections in Pakistan.

Spore-pollen records from four sections provide new evidence for climatic perturbations in the aftermath of the end-Permian mass extinction. The palynological record encompasses isolated assemblages from the Permian and the Griesbachian and a continuous from the middle Dienerian up to the Anisian. Concomitant organic carbon isotope data allow for correlation with other Early Triassic sections. Age control is provided by ammonoids and conodonts.

Two markedly different assemblages have been recovered from the Chhidru Formation:

One assemblage is dominated by typical Permian floral elements such as conifer and pteridosperm pollen indicating dry climates in the late Permian. The second is dominated by lycopod spores (up to 60%). In comparison with other records this assemblage can be assigned to the Griesbachian indicating more humid climates and the diachrony of the boundary between Chhidru Formation and Mianwali Formation.

Middle to late Dienerian palynological assemblages are characterised by the dominance of spores indicating humid climates. Lower Smithian assemblages show a continuous increase pollen abundance indicating a trend towards dryer climates. This trend is reversed in the middle Smithian, with increasing dominance of spores towards the upper Smithian. A distinct and abrupt change from spore-dominated to pollen-dominated assemblages marks the onset of dryer climates in the Spathian and Anisian. This change coincides with the Anasibirites/Wasatchites beds and the onset of a global positive shift in the organic and inorganic carbon isotopes. It can be correlated with a similar climatic change in the Boreal realm (Galfetti et al., 2007).

Values of bulk organic C-isotopes from the samples with Permian affinity range around -26‰. Whereas $\delta^{13}C_{org}$ values of samples with Griesbachian affinity display values around -29‰ indicating a stratigraphic level near the negative carbon isotope minimum that marks PT boundary sections worldwide.

Middle Dienerian $\delta^{13}C_{org}$ values around -28‰ are followed by an increase across the Dienerian-Smithian boundary with peak values of -24‰ during the middle Smithian. The following steady decrease to values around -32‰ reached at the level of the Anasibirites/Wasatchites beds is followed by a pronounced positive shift at the Smithian-Spathian boundary. Stable Spathian values (around -28‰) are followed by another positive shift at the Spathian-Anisian boundary (-25‰).

The three positive shifts (Dienerian-Smithian, Smithian-Spathian, and Spathian Anisian) coincide with or seem to be closely related to changes in the spore/pollen - ratio implying a close relationship between environmental changes and ecological responses. C-isotope perturbations in the Early Triassic are thought to be caused by recurring $CO_2$ releases probably by late protracted pulses of the Siberian Trap emplacement (Payne & Kump, 2007).The close relationship between positive C-isotope excursions, extinctions of ammonoids, and climatic changes proposed by Galfetti et al. (2007) for the Smithian/Spathian boundary and can be confirmed for the most pronounced shifts of the Early Triassic.

References

Brayard, A., Escarguel, G., Bucher, H., Monnet, C., Brühwiler, T., Goudemand, N., Galfetti, T., Guex, J. (2009). Good Genes and Good Luck: Ammonoid Diversity and the End-Permian Mass Extinction. Science 325: 1118-1121.

Galfetti, T., Hochuli, P. A., Brayard, A., Bucher, H., Weissert, H., Vigran, J. O. (2007) Smithian/Spathian boundary event: Evidence for global climatic change in the wake of the end-Permian biotic crisis: Geology 35: 291-294.

Hautmann, M., Bucher, H., Nützel, A., Brühwiler, T., Goudemand, N., Brayard, A. (2008) Recovery of Benthos versus Nekton after the End-Permian Mass Extinction Event - A Preliminary Comparison, GSA annual meeting: Houston, Tx, p. no. 285-14.

Orchard, M.J. (2007) Conodont diversity and evolution through the latest Permian and Early Triassic upheavals: Palaeogeography, Palaeoclimatology, Palaeoecology, 252: 93-117.

Payne, J.L., Kump, L. R. (2007) Evidence for recurrent Early Triassic massive volcanism from quantitative interpretation of carbon isotope fluctuations: Earth and Planetary Science Letters 256: 264-277.