P108-MO

SECULAR VARIATIONS OF PHYTOPLANCTONIC BIOMARKERS AT THE HIRNANTIAN MASS-EXTINCTION EVENT (ORDOVICIAN)

Petra EMPT and Lorenz SCHWARK

Institute of Geology and Mineralogy, University of Cologne, Zuelpicher Str. 49a, 50676 Cologne, Germany

The Hirnantian Event is the first of the "Big Five" Phanerozoic mass extinctions (Bambach et al., 2004) with an estimated generic loss of more than 50% both of benthic and planctonic species. However, the fossil record, on which those data are based on, is incomplete since many classes of phytoplankton produce no preservable hard parts. Molecular fossils or biomarkers add complementary information to the fossil palynomorph record since all important Paleozoic phytoplankton groups – with the exception of Acritarchs – produce distinct biomarkers, of which the most important are hopanes (cyanophytes), tricyclic triterpenoids (tasmanites algae), C_{27}-steranes (red algae), C_{28}- and C_{29}-steranes (modern and primitive green algae). Thus, changes in the relative proportions of hopanes, tricyclic triterpenoids and steranes reflect changes in the phytoplanktonic assemblage.

Two sections from different paleogeographic settings and different paleoclimate regimes from Anticosti Island, Canada (Copper et al., 2001) and the Siljan district, Sweden (Ahlberg et al., 1998) were investigated for sterane and hopane compositions, reflecting the regional phytoplanktonic paleo-assemblage. Thus, shifts in biomarker distribution associated with extinction events could be analysed. Since the sites are located in different climate zones, the onset and impact of the Hirnantian cooling was determined by carbonate isotope values. For all investigated extinction pulses a notable but short-lived rise in the C_{28}-sterane content occurs, implying a reversible change in the green algae assemblage from more primitive, mainly C_{29}-sterane-producing algae, to C_{28}-sterane-producing algae. The latter most likely derive from the prasinophyte algal class, known to proliferate upon deterioration of environment quality (Tappan, 1980) and to produce high abundances of C_{28}-steranes in modern prasinophytes (Volkmann et al., 1994).

The relation between steranes (algae) and hopanes (cyanophytes) also undergoes a drastic and short-lived, but contradictory change: On Anticosti Island, modern green algae are least affected by the mass extinction, while in the Siljan District, the cyanophytes benefit from this extinction event. The effect of the global mass extinction shows distinct local differences. This development differs from the younger Paleozoic mass extinctions, that all show equal pattern in the phytoplankton development, favouring the modern green algae above primitive green algae and cyanophytes (Empt, 2004; Schwark and Empt, 2006).

Differences in the phytoplanktonic biomarker content on the Ordovician shelf in contrary to homologues trends at other Paleozoic Events might indicate independent faunal provinces that could react individually to environmental changes. The resulting lower evolutionary stress might have led to the survival of the various Ordovician “Lazarus Taxa”.

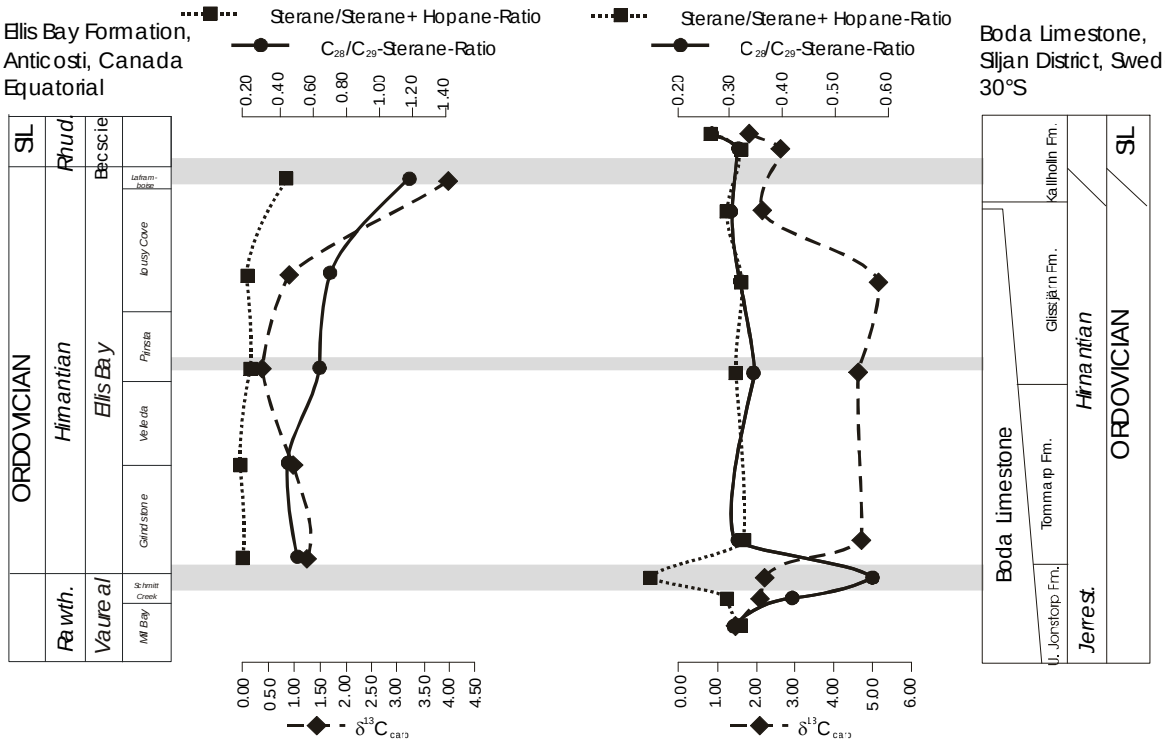

Figure 1. C_{28}/C_{29}-sterane ratios and sterane/hopane ratios during the multistaged Hirnantian Event (gray shading indicates extinction pulses). Both ratios show short-time, reversible aberrations for extinction pulses. The onset and impact of cooling is shown by carbonate isotope values.

REFERENCES

AHLBERG, P. 1989: Agnostid trilobites from the Upper Ordovician of Sweden and Bornholm, Denmark. – *Bulletin of the Geological Society of Denmark* 37, pp. 213-226

BAMBACH, R.K., KNOLL, A.H., WANG, S.C. 2004 Origination, extinction, and mass depletions of marine diversity. Palaeobiology 30, pp. 522-542

COPPER, P. 2001: Reefs during the multiple crisis towards the Ordovician-Silurian boundary; Anticosti Island, eastern Canada, and worldwide. – *Canadian Journal of Earth Siences* 38, pp. 153-171

EMPT, P. 2004: Ph.D. Thesis accessible at: http://kups.ub.uni-koeln.de/volltexte/2004/1264/

SCHWARK, L., EMPT, P. 2006: Sterane biomarkers as indicators of Palaeozoic algal evolution and extinction events. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 240, 225-236

TAPPAN, H., 1980: Palaeobiology of Plant Protists. Freeman, San Francisco. 1028 pp.

VOLKMAN, J.K., BARRETT, S.M., DUNSTAN, G.A., 1994: Sterol biomarkers for microalgae from the green algal class Prasinophyceae. Organic Geochemistry 21, 1211–1218.