BIOMARKERS INDICATION OF MARINE MICROBIAL COMMUNITY CHANGES DURING THE END-ORDOVICIAN MASS EXTINCTION EVENT

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The Late Ordovician – Early Silurian time interval was a remarkable period of climate and sea level changes documented by faunal turnover and conspicuous geochemical signatures. The end-Ordovician (Hirnantian) crisis is the first globally distinct extinction during the Phanerozoic, belongs to so called “big five” mass extinctions. Biomarkers (molecular fossils) are one of tools which can confirm that mass extinctions were caused by diverse environmental forces, and moreover, indicate any changes of marine microbial communities. An elevated hopane/sterane ratio is attributed to high bacterial vs. algal productivity and in some cases is associated with significant environmental perturbations (e.g., Wang, 2007). Here we present the geochemical data provide insight into the microbial community changes across the Ordovician/Silurian boundary in the SW margin of the Holy Cross Mountains (Zbrza section), Poland. Recently, Rohrssen et al. (2012) showed significant differences in the hopane/sterane ratio values between the Hirnantian, Katian and Rhuddanian of Anticosti Island (Canada), the Cincinati Arch (midwestern USA) and the Vivini Formation (Nevada, USA). In the Zbrza section we have also observed elevated hopane/sterane values during the Hirnantian (Fig. 1), but the differences compared to the Katian and Rhuddanian are not as high as for an epeiric sea (Rohrssen et al., 2012). Reduction of algal productivity is explained by denitrification in oxygen minimum zones (LaPorte et al., 2009), but taking into account the much lower TOC values in the Hirnantian mudstones of the Zbrza section associated with water column and seafloor oxidation, bacterial reworking during deposition must also be taken into account. Nevertheless, changes in the relationship between steranes and hopanes correlates well with climate change caused by the Hirnantian glaciation. Interestingly, the distribution of C_{27}-C_{29} steranes also changed significantly during the Late Ordovician ice age. Generally, the sterane distribution from the Early Paleozoic marine deposits is characterized by a predominance of the C_{29} steranes (e.g., Schwark and Empt, 2006), derived from photosynthetic algal cell membranes (Rohrssen et al., 2012). However, during the Hirnantian we observe a reversal of the sterane distribution with a dominance of the C_{27} isomers (Smolarek et al., 2017; Fig. 1). Similar changes were also noted in the early Katian during the so called Gutenberg Carbon Isotope Excursion (Pancost et al., 2013), and were interpreted as nutrient status diversification. In the case of the Zbrza section, such a phytoplankton community shift was undoubtedly triggered by the Hirnantian Gondwana glaciation and a decrease in the Rheic Ocean temperature. A preponderance of C_{27} steranes during the Hirnantian was not reported by Rohrssen et al. (2012) and can be explained by the variable geographic position of sections investigated of North American profiles and shallow water conditions. Undoubtedly, more research on other basins is needed to fully understand this dynamic phenomenon.

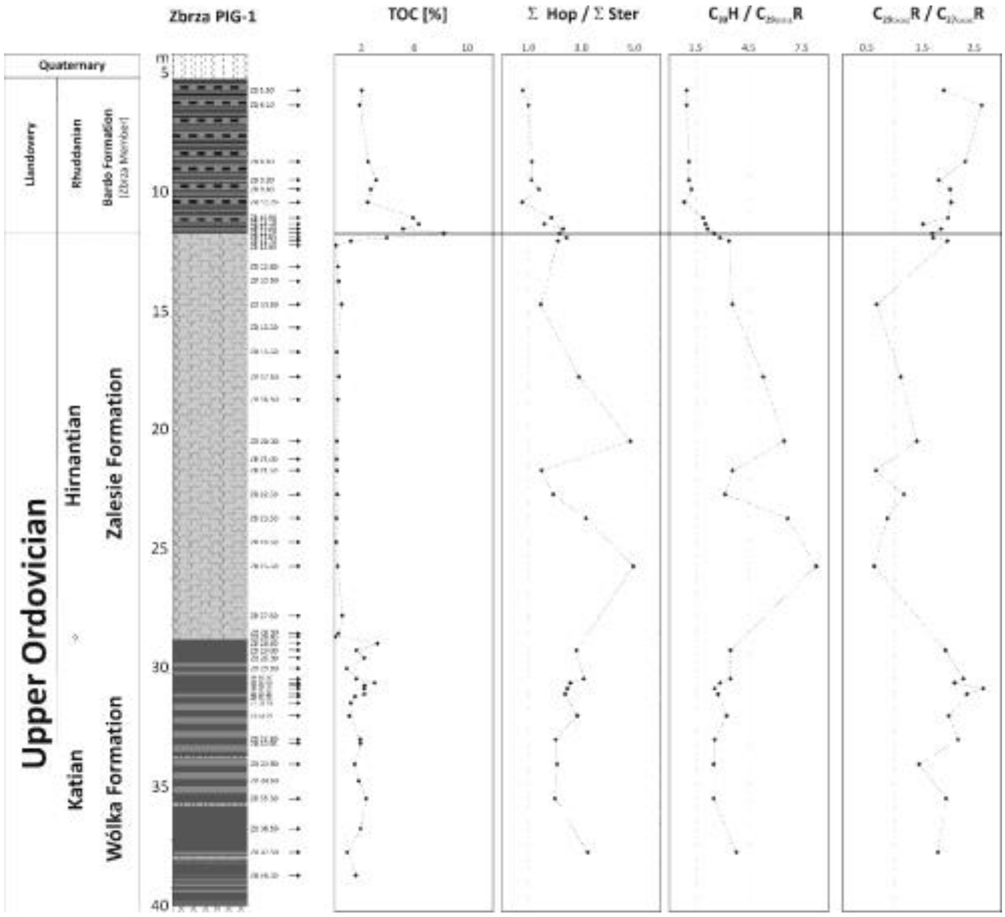

***Figure 1** Stratigraphic distribution of TOC and biomarker ratios across the Zbrza PIG-1 borehole.*

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