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A comparison of the organic carbon isotope composition of whole rock with that of isolated palynomorph groups (chitinozoans and scolecodonts) from the early Silurian of Gotland

T. R. A. Vandenbroucke (1,2), A. Munnecke (3), M. J. Leng (4), T. Bickert (5), O. Hints (6), G. Maier (3), and T. Servais (1)

(1) Université Lille 1, UMR 8217 du CNRS: Géosystèmes, Avenue Paul Langevin – bât. SN5, 59655 Villeneuve d'Ascq cedex, France, (2) Research Unit Palaeontology, Department of Geology, WE13-S8, Ghent University, 9000 Ghent, Belgium, (3) Universität Erlangen-Nürnberg, GeoZentrum Nordbayern, Fachgruppe Paläoumwelt, Loewenichstr. 28, D – 91054, Erlangen, Germany, (4) NERC Isotope Geosciences Laboratory, British Geological Survey, Nottingham NG12 5GG, UK, (5) Marum, Center for Marine Environmental Sciences, Universität Bremen, D-28359 Bremen, Germany, (6) Institute of Geology, Tallinn University of Technology, Ehitajate tee 5, 19086 Tallinn, Estonia

In the Early Palaeozoic, the carbon isotope composition of marine carbonates ($\delta^{13}C_{carb}$) are variable and at times much higher (exceeding +7‰) than values through the rest of the geological column. Organic matter associated with the carbonates have a variable carbon isotope composition ($\delta^{13}C_{org}$). However, the interpretation of $\delta^{13}C$ from bulk organic carbon is complex because of a whole number of poorly known factors that influence the signal. Despite these difficulties, Early Palaeozoic global $\delta^{13}C_{org}$ events are widely used and interpreted in terms of global climate variation.

Here, we focus on one of these poorly understood influences on the signal, i.e. the variety of sources that could constitute the bulk organic carbon that is measured for $\delta^{13}C$ in rocks. We compared the carbon isotope composition of bulk rock with that of two palynomorph groups, scolecodonts (jaws of benthic annelid polychaetes) and chitinozoans (marine mixed-layer epipelagic zooplankton). The samples were taken from the Llandovery-Wenlock strata of the Lusklint 1 section on Gotland (E Sweden), which spans the typical rhythmic limestone-marl alternations of the Upper and Lower Visby formations, and incorporates the lower half of the famous Ireviken extinction Event and its associated oxygen and carbon isotope excursion.

$\delta^{13}C$ of the palynomorphs are consistently lower than bulk $\delta^{13}C$, and the $\delta^{13}C$ of the benthic scolecodonts are lower than of the planktonic chitinozoans. While the difference between bulk and palynomorphs data may be in part a function of trophic state, the difference between the scolecodonts and chitinozoans in the well-mixed water column may imply an infaunal mode of life for the scolecodonts. Even more negative values for the scolecodonts in the middle of the section may represent variations in primary marine productivity, oxidation of organic matter in the bottom waters, or genera effects. In general however, trends between the three datasets are parallel indicating similarities in the low frequency, environmentally forced controls.