



Palynomorph Darkness Index: a case from Upper Ordovician deposits of Estonia.

Amalia Spina (1), Andrea Sorci (2), Olle Hints (3), Geoff Clayton (4), Robbie Goodhue (5), Simonetta Cirilli (6), Sveva Corrado (7), Andrea Schito (8), and Rosalba Padula (9)

(1) University of Perugia, Department of Physics and Geology, Italy (amalia.spina@unipg.it), (2) University of Perugia, Department of Physics and Geology, Italy (andrea.sorci89@gmail.com), (3) Department of Geology, Tallinn University of Technology, Tallinn, Estonia (olle.hints@ttu.ee), (4) Department of Animal and Plant Sciences, University of Sheffield, Sheffield, UK (GCLAYTON@tcd.ie), (5) Trinity College Dublin, Dublin, Ireland (GOODHUER@tcd.ie), (6) University of Perugia, Department of Physics and Geology, Italy (simonetta.cirilli@unipg.it), (7) University of Roma Tre, Department of Sciences, Roma, Italy (sveva.corrado@uniroma3.it), (8) University of Roma Tre, Department of Sciences, Roma, Italy (andrea.schito@uniroma3.it), (9) Center "Climate Change and Biodiversity in Lakes and Wetlands" of Arpa Umbria, Perugia, Italy (r.padula@arpa.umbria.it)

This study focuses on assessment of the thermal maturity of Upper Ordovician deposits from southern Estonia, using optical and geochemical analyses of palynomorphs. The investigated Valga-10 drill core section comprises the Pirgu and Porkuni Baltic regional stages of latest Katian and Hirnantian age. These strata yielded a very diverse and well-preserved palynological assemblage, including acritarchs, chitinozoans, and cryptospores. The age of the deposits is well constrained by means of biostratigraphy (acritarchs, chitinozoans, conodonts) as well as sequence stratigraphic and chemostratigraphic correlations. In the present study, the efficacy of the inexpensive and simple Palynomorph Darkness Index (PDI) method to define the thermal maturity of organic matter was assessed. PDI is derived from the measurement of the red, green and blue (RGB) intensities of light transmitted through palynomorphs, using a standard optical microscope and digital camera. Investigation of PDI from acritarchs and cryptospores reveals low thermal maturity (about 20%) for these Upper Ordovician deposits. The same maturity grade was obtained by other quantitative geochemical and optical methods such as micro-Raman spectroscopic analysis, Chitinozoan Reflectance and fluorescence colour changes of acritarchs. The positive calibration established confirms that PDI is a robust quantitative method for estimating the thermal maturity of sections containing organic matter that is unsuitable for Rock-Eval pyrolysis, or are lacking vitrinite, for example most Lower Palaeozoic rocks and some distal marine sediments.