

Electron Paramagnetic Resonance Study of a Photosynthetic Microbial Mat and Comparison with Archean Cherts

M. Bourbin · S. Derenne · D. Gourier · J.-N. Rouzaud · P. Gautret · F. Westall

Received: 2 February 2012 / Accepted: 7 November 2012 /

Published online: 20 December 2012

© Springer Science+Business Media Dordrecht 2012

Abstract Organic radicals in artificially carbonized biomass dominated by oxygenic and non-oxygenic photosynthetic bacteria, *Microcoleus chthonoplastes*-like and *Chloroflexus*-like bacteria respectively, were studied by Electron Paramagnetic Resonance (EPR) spectroscopy. The two bacteria species were sampled in mats from a hypersaline lake. They underwent accelerated ageing by cumulative thermal treatments to induce progressive carbonization of the biological material, mimicking the natural maturation of carbonaceous material of Archean age. For thermal treatments at temperatures higher than 620 °C, a drastic increase in the EPR linewidth is observed in the carbonaceous matter from oxygenic photosynthetic bacteria and not anoxygenic photosynthetic bacteria. This selective EPR linewidth broadening reflects the presence of a catalytic element inducing formation of radical aggregates, without affecting the molecular structure or the microstructure of the organic matter, as shown by Raman spectroscopy and Transmission Electron Microscopy. For comparison, we carried out an EPR study of organic radicals in silicified carbonaceous rocks (cherts) from various localities, of different ages (0.42 to 3.5 Gyr) and having undergone various degrees of metamorphism, i.e. various degrees of natural carbonization.

M. Bourbin · S. Derenne (✉)

Biogéochimie et Ecologie des Milieux Continentaux, UMR CNRS 7618, Université Pierre et Marie Curie, 4 place Jussieu, 75252 Paris Cedex 05, France
e-mail: sylvie.derenne@upmc.fr

D. Gourier

Chimie-ParisTech, Laboratoire de Chimie de la Matière Condensée de Paris, UMR CNRS 7574, 11 rue Pierre et Marie Curie, 75005 Paris, France

J.-N. Rouzaud

Laboratoire de Géologie de l'Ecole Normale Supérieure, UMR CNRS 8538, 24 rue Lhomond, 75231 Paris Cedex 05, France

P. Gautret

Université d'Orléans, ISTO, UMR CNRS 7327, 45071 Orléans, France

F. Westall

Centre de Biophysique Moléculaire, UPR CNRS 4301, rue Charles Sadron, 45071 Orléans Cedex 02, France