A confocal Raman proxy for affinities and fossilization mode of Silurian acritarchs

B. KREMER1*, J. KAZMIERCZAK1, M. BAUER2 AND R.W. STARK2

1Institute of Paleobiology, Polish Academy of Sciences, Twarda 51/55, 00-818 Warsaw, Poland (*correspondence: kremer@twarda.pan.pl)
2Department of Earth and Environmental Sciences, Ludwig Maximilian University of Munich, Theresienstr. 41, 88333 Munich, Germany

The application of Raman spectroscopy to paleontology has opened a new era in microfossil analyses at the sub-micrometer scale. Confocal Raman spectroscopy permits investigation of fossil organic micro-objects in three dimensions without the need to extract the specimen from the surrounding rock matrix.

We applied Raman to study in situ Early Silurian organic-walled enigmatic microfossils, classified traditionally to an informal taxonomic group the Acritarcha. Based on the detection of internal spore-like bodies, acritarchs have been re-interpreted as vegetative cells of unicellular green algae (Chlorococcales) [1]. To verify the identity of the internal bodies as spores we used confocal Raman microscopy to examine their chemical and mineral content. Chemical maps of the spore-like bodies showed kerogen carbon mixed with ferrous-oxide (hematite) on the surfaces and quartz that fills the interiors. The presence of kerogen at the surface of the internal bodies underscores their biological origin, rather than as an artifact of the fossilization process.

The Raman spectroscopy results elucidate the complex fossilization history of the studied acritarchs. Early diagenetic mineral (ferrous-oxide and silica) precipitation played a key role in the preservation of their fragile spore-like reproductive structures.