Molecular characterisation of acritarchs: applying infrared spectroscopy to better infer biological affinities with other organic-walled microfossils.

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Acritarchs are an informal, polyphyletic, and morphologically heterogenous group of organic-walled microfossils of unknown biological affinity. Some acritarchs share morphological similarities with certain microplankton resting stages (from e.g., dinoflagellates, prasinophycean-, chlorophycean-, and zygnematophycean green algae), others with miospores, egg cases of zooplankton, or even skeletal fragments of higher organisms. For most extant organism groups able to produce organic-walled microremains, the structural, fozzilisable molecular compounds are relatively well-known. These are dinosporin in dinoflagellate cysts, algaenan and cellulose in green algae, sporopollenin in spores and pollen, proteinaceous polysaccharides in zooplankton eggs, chitin in higher animals, and cellulose/lignin/cutin in higher plants. While considering the taphonomy of such compounds, molecular parallels can be drawn between acritarchs and microfossils with known biological affinities which, together with possible morphological parallels, provide a stronger argumentation for inferring biological assignments.

Here, attenuated total reflection micro-Fourier transform infrared spectroscopy was used to collect a large dataset from a wide range of Quaternary to Palaeozoic microremains, including many acritarch species. These data reveal a - sometimes large - molecular variability in samples with taxonomically and morphologically heterogenous assemblages. This shows that chemo-specific signatures can survive diagenesis and can sometimes be used to better infer the biological affinity of acritarchs.