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Influences of silica and embedding on thermal alteration of aliphatic hydrocarbons in cyanobacteria as evaluated by FTIR

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To study influences of the presence of silica and embedding on thermal changes of aliphatic hydrocarbons in prokaryotic cells, cyanobacteria Synechocystis sp. PCC6803 were isothermally heated at 250-400 ℃ and the changes in IR signals were monitored by micro-Fourier transform infrared (FTIR) spectroscopy. The absorbance of aliphatic C-H decreased with heating time, indicating the degradation of aliphatic hydrocarbons. Both the presence of silica and embedding delayed the degradation of the aliphatic C-H. The absorbance ratios of 2960 cm-1 band (aliphatic CH3) to 2925 cm-1 band (aliphatic CH2) (R3/2 values) increased or changed little by the heating. Raman spectral features showed that some experimental products had a structural ordering similar to the Proterozoic microfossils, indicating that they were carbonized to a degree similar to the microfossils. These results reveal that the presence of silica and embedding affect the thermal degradation rate of aliphatic C-H in cyanobacteria but do not lead to the decrease in R3/2 values. The low R3/2 values of Proterozoic prokaryotic fossils from Bitter Springs and Gunflint Formations are not considered to be due to thermal degradation upon fossilization during diagenesis. Although other possibility cannot be ruled out, the results suggest that precursor lipids, having low R3/2 values, were selectively preserved in microfossils.

Keywords: micro-FTIR, cyanobacteria, silica, thermal alteration, aliphatic hydrocarbon