Possible existence of lipid-like aliphatic hydrocarbons in Neoproterozoic bacterial cells on the basis of micro FT-IR spectroscopy

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A series of heating experiments of cyanobacterial cells and their constituents have been conducted by using micro FT-IR with a heating stage in order to examine the origin of functional characteristics retained in ˜850 Ma Neoproterozoic Bitter Springs bacterial fossils. The membrane fraction, soluble fraction, and lipid fraction were isolated from modern cyanobacteria (Synechocystis, sp. PCC6803) by centrifugation, sonication, distilled water and organic solvent extraction. The fraction samples on CaF_2 disks were measured at room temperature by micro FT-IR, then were heated at 250-350 ^{o}C under both atmospheric and low-oxygen conditions. Thermally degradated samples were measured at room temperature after the heating experiments.

The bands at 2960 cm^{-1} (aliphatic CH_3), 2925 cm^{-1} (aliphatic CH_2), 1650 cm^{-1} (C=O: amide I), and 1540 cm^{-1} (CNH: amide II) are typically observed in the whole cell, membrane fraction, and soluble fraction, and those at 2960 cm^{-1} (aliphatic CH_3), 2925 cm^{-1} (aliphatic CH_2) are typically observed in lipid fraction. The CH_3/CH_2 and CNH/CH_2 absorbance ratios reveal that the whole cell represents a mixture of the amide-contained substances (soluble fraction) and the lipids (lipid fraction) before and after heating experiments. These ratios of Bitter Springs bacterial fossils are similar to those of lipids. These results indicate that on the basis of the aliphatic CH moieties, Neoproterozoic bacterial cells might have already possessed lipid-like membrane mainly composed of long-chain aliphatic hydrocarbons.