

Fatty acid analysis of a layered community of cyanobacteria developing in a hypersaline gypsum crust

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With 4 figures and 1 table in the text

Abstract: We have analyzed the fatty acid composition of a cyanobacteria-dominated endoevaporitic microbial community that developed within a benthic gypsum crust in a hypersaline saltern evaporation pond in Eilat, Israel. The upper 0.5–2 cm of the crust, found below brine containing 190–240 g.l⁻¹ salts, is densely populated by orange-brown unicellular *Halothece*-type cyanobacteria. Below, a layer of green-colored *Phormidium*-type filamentous cyanobacteria is found. Underneath are a layer of purple sulfur bacteria and finally a black layer in which sulfate reduction occurs. We have analyzed the fatty acid composition of the lipids extracted from the two cyanobacterial layers. The community in the upper brown layer contained significant amounts of polyunsaturated fatty acids (16:2 cis 7,10 and 18:2 cis 9,12), in addition to monounsaturated (mainly 16:1 cis 9) and saturated fatty acids (mainly 16:0). The *Phormidium* layer was virtually devoid of polyunsaturated fatty acids, and the monounsaturated fatty acids 16:1 cis 7 and 18:1 cis 9 were found in high concentrations. The positions of the double bonds suggest that the biosynthesis of these unsaturated fatty acids may proceed by an oxygen-independent pathway in which an intermediate β -hydroxyalkanoyl-ACP is dehydrated. Microelectrode studies showed that the cyanobacteria in the green layer are found in anoxic conditions during the night and also during part of the day, and are exposed to sulfide diffusing from the lower layers. The apparent use of an anaerobic pathway of monounsaturated fatty acids biosynthesis and the lack of polyunsaturated fatty acids may be an adaptation to a partially anaerobic existence. The cyanobacteria in the green layer are capable of anoxygenic CO₂ photoassimilation in the presence of sulfide, showing further adaptation of the community to life under anaerobic conditions.

Key words: Cyanophyceae/Cyanobacteria, fatty acids, hypersaline, halophilic, salterns, gypsum.

Abbreviations: ACP, acyl carrier protein; FAME, fatty acid methyl esters; DCMU, 3(3,4-dichlorophenyl)-1,1-dimethylurea.