Antarctic cyanobacteria sources of biosignatures

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Abstract

The high UV intensities and extreme seasonality make some of Antarctic habitats interesting to the study life adaptive strategies in extreme conditions, and the biosignatures that can be preserved. In Antarctica, most of the surface, lacustrine and endolithic photosynthetic niches are occupied by cyanobacteria, which are well equipped to survive cold, desiccation or UV exposure. To provide a better understanding of the cyanobacteria survival strategies to extreme conditions, we used transmitted light and TEM microscopy as well as high-throughput sequencing technologies on the Antarctic lineage *Phormidesmis priestleyi*. We observed and characterized the production of a gloeocapsin-like UV-screening pigment and compared it to the pigment produced by *Gloeocapsa alpina*. Cyanobacteria are considered to be the inventors of oxygenic photosynthesis and therefore played a pivotal role in early Life and Earth evolution during the Precambrian. However, to perform photosynthesis in the UV exposure of the Early Earth unprotected by an ozone layer, their ancestors must have developed multiple molecular strategies. The presence of a gloeocapsin-like pigment in different cyanobacterial lineages may suggest its early production by their common ancestor, potentially present before the oxidation of the atmosphere.

In Polar regions, low temperatures lead to the success of particular organisms featuring adaptations to molecular and cellular disturbances such as rigidity of membranes, reduction of enzyme-catalyzed reactions, and solute transport. Our results underline the importance of functional categories of genes involved in the production of key molecules for the survival of polar *P. priestleyi* (e.g. exopolysaccharides, chaperone proteins, fatty acids and phospholipids).

The study of Antarctic cyanobacteria is promising to find new analog biosignatures for Life in rocky habitable planets. This project is supported by the mini-ARC PUMA (ULiège, Belgium).

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