

TITLE: BIOSIGNATURES OF KERALA RED RAIN CELLS: IMPLICATIONS IN UNDERSTANDING THEIR ORIGIN

Author(s): Rajkumar Gangappa, Malcolm Thomas and Stuart Hogg
Department of Science and Sport, University of Glamorgan, UK

ABSTRACT

The red rain that fell over Kerala, southern India (2001-2012) was characterised by the red pigmented particles. Earlier proposal claiming that these are known algal bloom blown from trees (Sampath et al, 2001; DiGregorio, 2007) has been studied by us and disproved. Also, further investigation reporting their extraordinary properties including a suggestion that they lack DNA (Louis and Kumar 2003; 2006; 2008) has been invalidated (Gangappa and Hogg, 2013). However, their claim regarding the growth and replication of these cells at 300°C needs more investigation if it is to gain acceptance.

Current study provide evidences regarding the biological properties of Kerala red rain cells to gain insights into environmental conditions from which they may have originated. Combined with various research strategies and high resolution instruments, we have demonstrated the following interesting properties of Kerala red rain cells: (1) unusually thick external envelope enclosing the central core; (2) stability of red pigment at temperatures about 100°C and pH variations; (3) absence of eukaryotic ultrastructures; (4) possible replication at 121°C with nanostructures (possible daughter cells) having similar morphological features inside the large mother cells at such high temperature. They contain high percentage of carbon, iron, silicon and aluminum and often enclosed in a silicon rich biofilms. Further investigation shows that the positive detection of DNA in these cells was possible only after the complete removal of red pigment, thereby providing an explanation for the negative outcome of earlier studies in this regard. Moreover, evidences are shown to support that these cells contain high amounts of UV absorbing compounds, porphyrin complexes and possible scytonemin.

Kerala red rain cells may prove to be polyextremophiles belonging to prokaryotes and may have possibly originated from the environment containing above mentioned chemical elements, high energy UV exposure and possible high temperatures. This may be of high interest and red rain cells can be viewed as a possible candidate in future Astrobiological investigations.

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