ABSTRACT
SPELEO BRAZIL 2001
Brasília DF, 15-22 de julho de 2001

13th International Congress of Speleology
4th Speleological Congress of Latin América and Caribbean
26th Brazilian Congress of Speleology

Calcite Biomineralisation in the Caves of Nullarbor Plains, Australia

Annalisa CONTOS 1**, Julia JAMES** 1**, Andrew HOLMES** 2**, Brigid HEYWOOD** 3**,**
Michael GILLINGS 2**, Peter ROGERS** 4**, David STONE** 5
1 - School of Chemistry University of Sydney, NSW 2006 Australia
2 - School of Biological Sciences, Macquaire University
3 - School of Chemistry, Keele University
4 - Monash Medial Centre
5 - ANSTO Research Facility

In caves under the Nullarbor Plain, divers report extensive mantles of a biological material. The mantles are gelatinous and transparent and only can be seen because of the microcrystalline calcite associated with them. They cover the roof and walls of the partially and totally water filled passages to the limits of exploration.
The nature of these mantles was investigated using electron microscopy and DNA analysis. The microcrystalline calcite was examined using electron microscope techniques, X-ray diffraction, Fourier transform infrared spectroscopy, Raman spectroscopy and thermogravimetric analysis. The cave water was analysed for major ions and trace metals and modelled using geochemical modelling software.
Water analysis revealed high levels of sulfate and nitrate together with significant nitrite. The community structure showed a high proportion of novel phylotypes as well a high abundance of Nitrospira relatives. The unusual community, the nitrite in the water, and the apparent absence of aquatic macrofauna, means these microbial structures may represent biochemically novel, chemoautotrophic communities dependent on nitrite oxidation.
The waters were slightly saturated with respect to calcite, suggesting the microbial mantles play a role in calcite nucleation and crystal growth. The calcite crystals were predominately spindle shaped with curved {hk.0} faces lying parallel to the c-axis. Calcite precipitated under conditions designed to mimic the inorganic solution chemistry of the cave revealed a different morphology to that observed in the cave samples. These differences suggest that the formation and growth of the microcrystalline cave calcite is influenced by the microbial mantles.