BIOGEOLOGICAL RAMAN SPECTROSCOPIC STUDIES OF ANTARCTIC LACUSTRINE SEDIMENTS

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Abstract: This contribution reports on the applications of Raman spectroscopy to the analysis of lacustrine sediments, looking at both organic and inorganic matter. The similarities to palaeolakes on Mars are considered.

The analysis of lacustrine sediments is an accepted method for deciphering the palaeoenvironment of the lake's catchment area. Each strata of the sediment gives information about the rock type it was eroded from and also the state of the lake, i.e. oxic or anoxic.

As Antarctica has long been accepted as a putative analogue for Mars, analysis of Antarctic material may give results that can be compared to sediments on Mars. The Viking Orbiter has detected evidence for 179 palaeolakes in impact craters on Mars [1].

The sediments used in this study are taken from Lake Hoare in the Dry Valleys region of Antarctica and Lake Nella, which is a seasonally open lake situated in the Larsemann Hills in eastern Antarctica [2]. The Lake Hoare samples are from two different boreholes, one in an oxic area and the other from an anoxic region of the lake, at depths of 15 m and 30 m respectively [3]. The Lake Nella core was taken at a water depth of 9.6 m and the results have been used for a depth comparison of organic matter (see Figure 1).

Raman spectroscopy has been selected as a suitable method of analysis as it does not destroy the sample, can be used *in situ* and does not require any (or very little) sample preparation. It is a suitable method for analyzing both inorganic and organic matter.

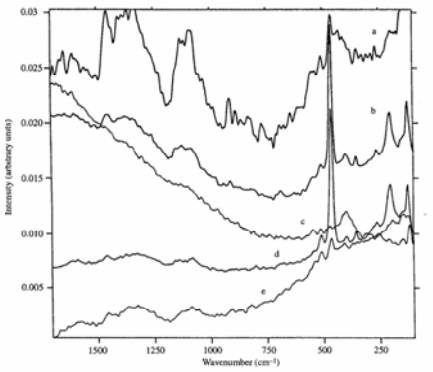

Figure 1: spectra of several different layers from within the Lake Nella core [2]. They increase in depth from a to e.

Several spectrometers and laser wavelengths have been employed in this investigation: a Bruker IFS66 FT operating at 1064 nm; a Renishaw multi-laser instrument with wavelengths of 488, 514.5, 633 and 785 nm; and a portable Renishaw spectrometer with a fibre-optic probe at 785 nm.

The results from the portable spectrometer are compared with the laboratory-based instrument to assess the suitability of the miniature version for use on location, specifically in the Antarctic and possibly on future Mars missions.

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