

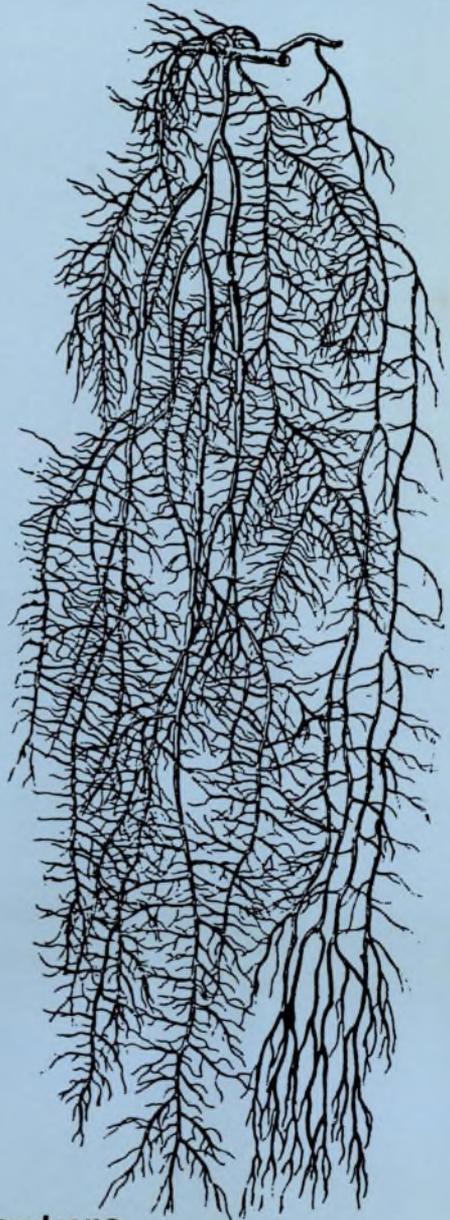
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PYRENOCARPS ON LST.

**Edited by O.L.Gilbert,
Dept. of Landscape Architecture,
The University, Sheffield S10 2TN**



Lichens of the Antarctic cold deserts

It is not generally known that the Antarctic contains a number of dry intensely cold areas which remain largely free of snow and ice. South Victoria Land is an example of an Antarctic cold desert where any snow mostly sublimates without melting or is blown away; others occur near McMurdo Sound. These areas contain very few visible signs of plant or animal life; even the soil is sterile. The principal habitat for life in these areas is actually under the surface of rocks where lichens known as cryptoendoliths occupy pore spaces often to a considerable depth. Only semitranslucent coarsely grained rocks such as weathered sandstones and granite are suitable. The rocks must be broken open in order to see the lichens.

These lichens were first discovered just ten years ago by an American microbiologist, Wolf Vishniac, who designed biological experiments for the Mars Viking landers. Specifically he was in Antarctica to study soil microbiology but also collected rock samples for Imre Friedmann, a specialist in endolithic algae in desert rocks. These samples came from a high elevation Beacon Sandstone formation which had never been visited by biologists. Vishniac unfortunately died in an accident shortly afterwards but the rock samples were retrieved and sent back to the U.S. Friedmann examined the samples and quickly realized that they contained lichens growing entirely under the rock surface. He coined the term cryptoendoliths and started a programme of Antarctic exploration in 1976 which continues to this day. Lichenologists who have participated include Y. Garty, L. Kappen and myself.

A typical cryptoendolithic lichen has an upper black zone c. 1mm thick, then a 2-4mm white zone and below this a conspicuous green zone. All zones are produced by fungal hyphae and unicellular green algae (often Trebouxia) in symbiotic association. Unidentified colourless bacteria are also regularly present. The zoning suggests the thallus is organised; haustoria and adpressoria are present at the fungal/algal contacts and lichen acids such as norstictic and gyrophoric are produced. The hyphae, which normally form a white woolly web amongst the rock crystals can

become coloured by iron compounds, probably haematite. This may be a result of local solubilizing of cementing substances in the rock. Medullary hyphae can penetrate to 20mm depth.

The life history of these lichens is affected by exfoliation of the rock surface which is partly a result of weathering and partly due to the activity of the organism in the rock. Lichens exposed by exfoliation usually dry out and crumble away. In favoured environments however, such as sheltered ledges, the cryptoendolithic lichens continue to grow on the surface of the rock changing to an epilithic growth form. Morphology changes to an areolate, plectenchymatous thallus and apothecia may develop. Buellia (B.pallida), Lecidea (L.capsulata, L. cf. auriculata), and Acarospora spp. have been identified. Cryptoendoliths may just be growth forms of well-known epilithic species or permanently adapted forms unknown elsewhere.

There is some evidence that the lichens are kept under the rock surface not by aridity or low temperatures but by rapid temperature fluctuations across the 0°C level caused by gusting winds. In one series of observations lasting 42 min. rock surface temperature moved across 0°C fourteen times with an amplitude of 7.7°C. Temperatures under the surface of the rock in the lichen zone remained above 0°C during the same period. The lichens therefore appear to survive in an inhospitable environment without actually experiencing its extremes.

The ecosystem of the dry valley deserts is simple. Blue-green algae and phycobionts are the primary producers, mycobionts may be regarded as consumers, and colourless bacteria as decomposers.



An Antarctic cold desert: Linnaeus Terrace,
Wright Valley, Asgard Mountains.

Secondary consumers and predators are absent. The unique adaptive achievement of the cryptoendolithic lichens is the ability of the mycobiont to change its growth form from plectenchy-matous (a thick dense tissue) to filamentous while still maintaining thallus organisation and to revert back when conditions so permit. Since 1970 the Antarctic dry valleys have been considered the closest terrestrial equivalent of the Martian environment and hypotheses about the possibility of life on Mars were based on this comparison. Working in the Antarctic setting is like looking back in time 600 million years when all ecosystems functioned without higher forms of life.

The Antarctic cryptoendoliths are baffling, complex organisms and trying to study them in the field can be an exasperating experience. There are so many unanswered questions on their structure, mode of dispersal, metabolism and evolution that it will take many more years of study to understand them. (Note: For further information consult an article in Science 215:1045-1053, 1982 by E.I. Friedmann.)

MASON E. HALE

Report on the New Year meetings, 6-7 January 1984

The conversazione on the Friday evening, attended by 33 people, was a successful venture which we hope to repeat next year. Pleasant surroundings, an excellent buffet, together with a plentiful supply of alcohol, set the stage for the Book Auction. This highlight of the evening was skilfully masterminded by Mark Seaward and Frank Brightman who had no difficulty in persuading members to vie with each other for, amongst other treasures, early issues of the Lichenologist. Prices realised ranged from 20p to £15 or more and a grand total of over £300 was raised for the Society.

Forty-six people attended the A.G.M. After years of stability in the officers ranks there was, for us, quite a shuffling round of responsibilities. Joy Walker took over the mantle of Secretary; Dougal Swinscow filled the vacant post of Auditor; Frank Dobson is gradually taking over the job of Assistant Treasurer and