but their prevalance in the fossil record was drastically reduced during the lower Paleozoic (Awramik 1981). Their decline is thought to be due to the evolution and diversification of eucaryotes and metazoans (Garrett 1970). Modern stromatolites are restricted to extreme environments that preclude organisms that either compete with or destroy algal mats and their resultant sedimentary structures. Recognition of their presence in antarctic lakes constitutes the first observation of polar stromatolites (Parker, Simmons, Wharton, and Seaburg in press). Because these lakes exhibit a paucity of metazoans and turbulence and low light intensities, they may represent reasonable analogs of Precambrian ecosystems.

Our investigations show that *Phormidium frigidum* is the dominant species in all of these mats. Therefore, the various stromatolitic morphologies in these lakes reflect adaptation to various combinations of ecological properties (i.e., light, temperature, and water chemistry) and/or variations in the components of mat communities. Observations this past year revealed types of mat growth that strongly resemble fossil stromatolites that became extinct at the end of the Precambrian (Raaben 1969). Lake Fryxell contains mat that is precipitating columnar calcite casts. This is apparently the result of the high water hardness of this lake. This year also marked the first time a vibracorer was used beneath the ice in Antarctica (figure). A vibracorer is specially designed to collect soft sediments with a minimum of distortion. Penetration was made to till in two lakes.

Antarctic lakes are valuable natural laboratories. Because they lack higher invertebrates and vertebrates, they resemble in many ways ecosystems that occurred more than 600 million years ago. The result is that we have the opportunity to study analogs of ancient ecosystems and, by manipulating these communities under controlled, artificial laboratory conditions, we can gain insight into the effects of different environmental conditions in the past on stromatolite morphology.

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Vibracore operation on Lake Hoare. The vibracorer consists of a Wyco electric vibrator connected to a 20-foot section of aluminum pipe. The vibrator is powered by a high-cycle generator.

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Endolithic microorganisms in the dry valleys of Antarctica

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From 8 December 1980 to 7 January 1981, my associates and I continued the survey of microorganisms and the study of microclimate in the mountainous regions of the dry valleys.

Over 100 samples of cryptoendolithic lichens were collected from different localities. On the basis of their infrequent sexual stages, three genera (*Buellia*, *Lecidea*, and *Acarospora*) could be identified. These genera are unrelated and belong to different families. Yet, their cryptoendolithic stages, which are sterile, are morphologically similar and distinguishable only on the basis of chemical characteristics. It remains to be investigated whether cryptoendolithic lichens are growth forms of epilithic species or exist only as cryptoendoliths, having been permanently adapted to their environment.

Microclimatological parameters (rock temperature at different depths, light, and relative humidity inside rocks and of the air) were continuously recorded on Linnaeus Terrace (77°36'S 161°5'E) (Asgard Range), near the site of the automatic weather station. There is indication that the principal reason for the absence of life forms on the rock surface is the rapid rate of alternate freezing and thawing. Thus, on 25 December, during a period of 42 minutes (starting at 8:30), temperature on the rock surface moved across 0°C no less than 14 times. At the same time, temperature in the lichen zone (3 millimeters below the surface) was more stable and always above freezing point. The rapid alternation of freezing and thawing is a physiological stress with which most organisms are unable to cope. The cryptoendolithic way of life (inside porous rocks) presupposes a specific morphogenetic adaptation that enables organisms to penetrate the rock substrate, thus evading the extreme and stressful conditions on the surface and take refuge in a protected niche. Some results were presented in a paper at the Symposium on Subantarctic Terrestrial Ecosystems, organized by the Comité National Français des Recherches Antarctiques at the University of Rennes, France, (Friedmann, Friedmann, and McKay in press).

Aseptic samples of rocks and of adjacent soils were used to culture algae, fungi, and bacteria. Cultures of bacteria were sent to P. Hirsch, University of Kiel, Germany, and yeast cultures to H. Vichniac, Department of Microbiology, University of Oklahoma, Stillwater, for further study.

Members of the field party were: Mason E. Hale (lichencology), Eliezer Kashi (geology), Christopher P. McKay (micrometeorology), Roseli O. Friedmann (microbiology), and E. I. Friedmann.

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Adaptative potential of terrestrial invertebrates: Maritime Antarctica

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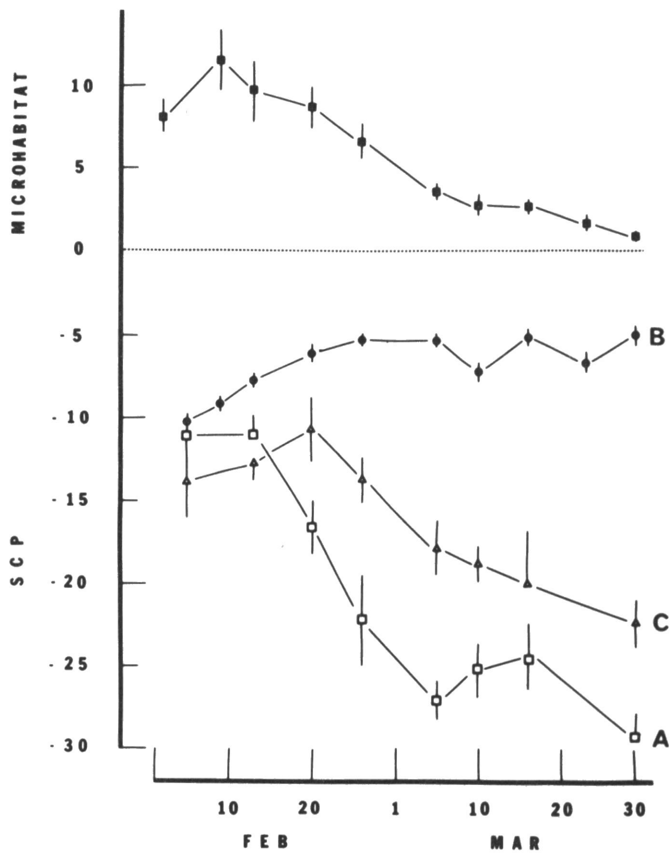

Figure 1. Seasonal changes in microhabitat temperatures recorded 1 centimeter below the surface and supercooling points (SCP) of three dominant terrestrial arthropods of the Palmer Station area. B = *Belgica antarctica*; C = *Cryptopygus antarcticus*; A = *Alaskozytes antarcticus*.

Terrestrial invertebrates of the maritime antarctic (Palmer Station, 64°46'S 64°03'W) endure prolonged freezing and near-constant low temperatures (Baust 1980, 1981). Typical microhabitats do not afford ample periods of elevated temperatures that might permit completion of a life cycle. At best, a few days of relatively warm temperatures (5°–10°C) during the austral summer may provide an opportunity for adult emergence, egg laying, and hatching (Edwards and Baust 1981). The immature stages must, however, maintain life processes at or below freezing for 90 percent of the year.

Two groups of free-living terrestrial arthropods dominate in this region. Insects are represented by a holometabolous dipteran, *Belgica antarctica*, and a few collembolan species, of which *Cryptopygus antarcticus* is most abundant. Mites represent a second major group. As illustrated in figure 1, these groups use two distinct hardening strategies. *Belgica* is freezing-tolerant and elevates supercooling points (SCP) to approximately −5.4°C with the onset of "winter." This SCP elevation suggests a recruitment of endogenous ice nucleators (Baust and Zachariassen in press) as found in other polar insects. The diminution of supercooling capacity is adaptive in that it ensures early freezing during occasional exposures below