c5.1

VIABLE BACTERIA, METHANE AND HIGH ICE CONTENT IN ANTARCTIC PERMAFROST: RELEVANCE TO MARS.

E. I. Friedmann,[1] A. D. Gilichinsky,[2] G. S. Wilson,[3] V. Ostroumov,[2]
E. A. Vorobyova,[4] V. S. Soina,[4] V. A. Shcherbakova,[2] T. A. Vishnivetskaya,[2]
J. P. Chanton,[5] R. O.Friedmann,[6] C. P. McKay[7], E. Rivkina[1,2]

[1]Florida State Univ., Tallahassee, FL 32306-2043, USA, FAX: 1-904-644-9829, e-mail: friedm@bio.fsu.edu; [2]Lab. Soil Cryol., Russian Acad. Sci., Puschino, Moscow Region 142292, RUSSIA, FAX: 7-096-779-0532, e-mail: gilichin@issp.sherpukov.su; [3]Byrd Polar Res. Ctr., Ohio State Univ., Columbus, OH 43210-1002, USA, FAX: 1-614-292-4697, e-mail: wilsongs@geology.ohio-state.edu, [4]Dept. Soil Biol., Moscow State Univ., 119899 Moscow, RUSSIA, e-mail: rott@soina.msk.ru; [5]Dept. Oceanogr., Florida State University, Tallahassee, FL 32306-3015, USA, FAX: 1-904-644-2581, e-mail: jchanton@mailer.fsu.edu; [6]Department of Biology, Florida A. and M. Univ., Tallahassee, FL 32307, USA, FAX: 1-904-561-2996, e-mail: friedm@bio.fsu.edu; [7]NASA-Ames Res. Ctr., Mail Stop 245-3, Moffett Field, CA 93035, USA, FAX: 1-415-604-6776, e-mail: mckay@galileo.arc.nasa.gov.

Exploratory drillings in Antarctic permafrost were performed in Taylor Valley (eolian and fluvial sediments, up to 150,000 years old), in Miers Valley (lacustrine sediment, age undetermined), and on Mt. Feather (ancient soil, Sirius formation, at least 2 million and possibly over 15 million years old). The depth and temperature of the drilling cores were 17 m (-18°C), 4 m (-21°C) and 2-3 m (-25 to -27°C) respectively. At all sites, the permafrost is covered by a 10 - 20 cm thick layer of powdery dry soil on the surface. To reduce the possibility of contamination, a gasoline-powered drill was used without a drilling fluid and cores were treated aseptically. Each core contained viable bacteria, including anaerobes, their number varying up to 10^2-10^3 g^{-1} by plate counts and to 10^5 g^{-1} by fluorescence. Most samples contained methane in quantities up to 670 μl kg^{-1} of biological origin (presumably by bacteria), shown by its isotopic composition ($\Delta^{13}C$ = 54.8‰). Enzyme (invertase) activity was present in most samples. The ice content of all samples was unexpectedly high, at least 25% and up to over 50%. Our findings revise earlier ideas about the "dry" Antarctic permafrost.

These results provide strong support to the idea that Martian permafrost may contain ground ice and that ancient permafrost on Mars may contain samples--possibly viable--of life forms from an earlier, wetter period. Also, ice may be nearer to the surface of Mars than previously thought.

This research was supported by grants of the Office of Polar Programs, National Science Foundation.