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2.11 Preliminary Report on Radiocarbon Dating of Cryptoendolithic Microorganisms

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Zusammenfassung: Vorläufige Messungen mittels der Beschleuniger-Massen-Spektrometrie (AMS) zeigen, daß mikrobielle Gemeinschaften aus der Ross Desert ein Alter in der Größenordnung von 10^3 Jahren haben.

The existence of microbial communities living inside desert rocks has been reported by FRIEDMANN et al. (1967, 1976), first in rocks collected from the hot and dry Negev desert and later in rocks in the frigid Ross Desert of Southern Victoria Land, Antarctica. The extremely inhospitable climatic conditions in both places has led to the suggestion that these organisms have very low rates of metabolism and may, in addition, be very old (FRIEDMANN 1982).

We would like to report our first preliminary results of an attempt to measure the radiocarbon age of these microbial systems by using the technique of accelerator mass spectrometry (AMS). Usually the radiocarbon dating method is applied to dead material, assuming that the living organism exchanges carbon rapidly during its lifetime, so that the ^{14}C isotope composition is in equilibrium with the atmospheric amount and that this exchange is interrupted completely after its demise (close system hypothesis). Recently it has been shown by MCKAY et al. (1987) that it is also possible to obtain information on the age of living organisms, e. g. open system, by using the same method provided the exchange of carbon with the atmosphere occurs on time scales comparable to, or longer, that the decay rate of ^{14}C (T1/2 = 5730 y). However, only a lower limit for the true age of an open system can be deduced from a radiocarbon age measurement, as long as this mixing time constant is not known.

Radiocarbon dating by accelerator mass spectrometry is a well established technique by now (WOELFLI 1987). This method allows to determine quasi-simultaneously $^{14}C/^{12}C$ as well as $^{13}C/^{12}C$ ratios from solid carbon samples with an accuracy comparable to that of the conventional Beta-counting method, but in contrast to the latter, on samples as small as a few tenth of milligram. Details of the applied technique are described elsewhere (SUTER et al. 1984). To obtain well defined datable material, lipids were extracted from colonized rocks collected in the Ross Desert (McMurdo Dry Valleys) by organic solvents. Using a method similar to that described by GIGER et al. (1984) the organic solvent was evaporated and the remanent lipid dried, mixed with Ag-powder, distributed onto copper holders and introduced into the ion source (caesium sputter beam).

Our preliminary measurements showed a ^{14}C deficiency indicating a carbon age in the order of magnitude of 10^3 years.

As mentioned above, the conventional radiocarbon age gives only a lower limit for the true age of living organisms, until the mixing time constant is determined in an independent experiment. However, these preliminary results indicate that the microbial communities on the Ross Desert may belong to the oldes living organisms in existence on Earth.

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