Exob. 8-8
10/24/60

COMMENTS [redacted] AND PROPOSALS FOR THE MARS 1964 EXPERIMENT

1. A lander should be attempted. Physical and chemical measurements should take priority within the limited capacity of the instruments and telemetry channel. These should aim at characterizing the surface environment and would greatly enhance the precision of later flights.

2. These measurements should include:

a) composition of the atmosphere, especially O_2 and H_2O

b) diurnal temperature cycle at ground level (a high middle latitude might offer the most promising site for moderate temperatures)

c) If more prolonged measurements, the seasonal temperature cycle at ground level

d) ground moisture (electric conductivity?)

e) pH and concentration of soluble electrolytes (electrical conductivity) of soil samples suspended in water

f) detection of pyrolyzable organic matter in soil sample - if weight permitted, even better to have gas chromatogram and mass spectra

g) the solar spectrum at ground level

3. Multivator. If weight permits, and with higher priority, if there is any doubt as to the effectiveness of sterilization controls, a simple multiple chamber culture device can be constructed. About 20 chambers containing 1 ml of culture fluid each can be flown sealed, opened for inoculation, resealed and scanned once daily for several weeks by nephelometer and mhometer. This experiment should be possible within 10, perhaps 2-5 pounds, and need take only a few dozen bits per day. The same design could also be used for the detection of gross enzymatic activity in soil samples collected by the inhalation of atmospheric dust.

The detailed composition of the culture media has not yet been thought out. Some general possibilities can be indicated in the light of the limited available information on the habitat. The mechanism of carbon fixation is likely to be less predictable than the oxidation of reduced carbon; some organisms should be found working the latter part of the cycle and these are stressed in the indicated tests.

a) Electron acceptors - these might be furnished either in solution or in a coherent pellet

$Fe_2O_3 \longrightarrow FeO, Fe$

$S \longrightarrow S^{=}$

$NO_3^{-} \longrightarrow N_2$

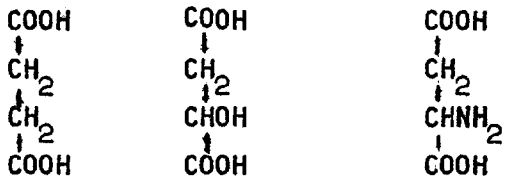
$N_2 \longrightarrow NH_3$

$SO_4^{=} \longrightarrow S^{=}$

$O + H$ (as might be furnished by slow electrolysis) $\longrightarrow H_2O$

b) Sources of reduced carbon

CH_2O	CH_3CHO	$CH_3COCOOH$
CH_3OH	C_2H_5OH	D- and L- CH_3CHNH_2COOH
CH_3NH_2	$C_2H_5NH_2$	$CHNH_2COOH$
HCOOH	CH_3COOH	$CH_2OHCOCH_2OH$
CO	CH_2NH_2COOH	$CH_2OHCHOHCH_2OH$
C	CHOCOOH	
	COOHCOOH	



D- and L-

D- and L-: glucose; deoxyribose; ribose; amino acid mix $\geq$ than C_5; purines and pyrimidines.

c) The fermentation (internal redox dismutation) of the organic compounds in middle oxidation states can be tested without specifying the oxidant.

d) Open questions: pH, ionic strength, phosphate, trace metals and growth factors, residual oxygen

e) We are planning to look into the question of overt enzymatic activity of crude soils. This approach would be more plausible if we could plan to fractionate the organic particles by flotation for making an enzymatic test - e.g. for diaphorase or ATPase.

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