RAMPART CRATERS: MECHANISM FOR EXCAVATION OF A MARTIAN BIOTA OF HALOTHERMOPHILIC ARCHAEA-BACTERIA. Steven W. Mitchell, Department of Physics and Geology, California State University, Bakersfield, CA 93311 (smitchell@csubak.edu)

Introduction: Investigations of bacterial phylogeny using nucleic acid sequencing suggest that the first life forms to evolve on Earth were hyperthermophilic archaea and bacteria [1]. This biota probably persued microbial chemosynthesis based on the anaerobic metabolization of sulfur aand/or the aerobic oxidation of hydrogen sulphide, hydrogen, methane or Fe(II) to Fe(III) [2,3]. Such a biota would have evolved and spread rapidly, perhaps within 30 Myr beginning near the end of the early bombardment (approx. 3.8 Bya) [2,4].

A Martian Biota: Conditions similar to those which led to the origin of life on the Earth do seem to have existed on Mars during the late Noachian [5,6]. If life did evolve on Mars, an archaea-bacteria biota may have had the opportunity to diversity and spread, but its biomass would have been been relatively much smaller [7]. Potential late Noachian-Hesperian aqueous, endolithic, and subsurface niches would have been present in lacustrine/ocean, fluvial, permafrost, and hydrothermal settings in the context of a probable alkaline hydrosphere [8-12]. Present surface conditions, however, seem to exclude the possibility of even relict exposed or endolithic niches [13,14]. Consequently, subsurface hydrothermal environments have been considered mostly likely to provide niches for a surviving Martian biota [15,16]. By the late Amazonian, a significant decline in volcanism had restricted both the size and extent of potential hydrothermal sources so that the discovery/study of any associated ecosystem may be very difficult [16].

Rampart Craters: Martian rampart craters form when ejecta surges loose fluidizing vapors and the transported material is deposited [17]. Subsurface volatiles in the form of groundice and permafrost extend to a depth of perhaps several kms [18]. If a subsurface viable spore-stage archaea-bacteria biota was present in the groundice, it would be incorporated in the volatized ejecta (and subsurface plume). A reanimation of the spore assemblage would result in a microbial bloom. Following complete cooling of the impact ejecta/subsurface plume a new spore assemblage would be formed. Halophilic bacteria spores can remain vaible for at least 250 Myr [19]. Given the apparent Martian cratering rate [20], the long-term survival of a biota based on intermittent hydrothermal and impact-generated events might be possible.

Exobiology Exploration: Rampart craters may provide the most likely locations for the preservation of viable Martian life forms. At shallow depths they may preserve concentrations of halothermophilic archaea-bacteria spores. Rampart craters formed in areas of late Amazonian volcanism would be the most promising locations for the search for spore concentrations.

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