A ~3.5By record of water-limited, acidic weathering on Mars

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The secondary mineral budget on Earth is dominated by clay minerals, Al-hydroxides, and Fe-oxides, which are formed under the moderate pH, high water-to-rock ratio conditions typical of Earth's near-surface environment. Recent orbital data (Mars Express, MRO) indicates that conditions favoring the production of clay-mineral dominated alteration assemblages may have prevailed in isolated localities on the ancient Noachian surface of Mars. In contrast, the chemical and mineralogical composition of rocks and soils from the sites where landed missions (Viking, Pathfinder, MER) have operated on Mars indicate a secondary mineralogy that is dominated not by clay minerals, but by Mg-, Fe-, Ca-sulfates, Fe-oxides, and amorphous silica.

This discrepancy can be explained as resulting from differences in the chemical weathering environment of Earth and Mars. We suggest that chemical weathering processes on Mars are dominated by: (1) a low-pH, sulfuric acid-rich environment in which the stoichiometric dissolution of labile mineral phases such as olivine and apatite (±Fe-Ti oxides) is promoted; and (2) relatively low water-to-rock ratio, such that other silicate phases with slower dissolution rates (e.g., plagioclase, pyroxene) do not contribute substantially to the secondary mineral budget at the Martian surface. Under these conditions, Al-mobilization is limited, and the formation of significant Al-bearing secondary phases (e.g., clays, Al-hydroxides, Al-sulfates) is inhibited. Recent experimental and modeling results indicate that in this weathering regime, acid conditions can be generated by the dissolution of pre-existing sulfate minerals. Dissolution-acidification processes relieve the requirement for widespread, volcanically-produced "acid fogs" as a driver for soil and rock surface alteration processes.

The geological age of rocks and soils analyzed at landed mission sites on Mars is likely late Noachian (<~4.0 Ga) and younger. Thus, the antiquity of samples analyzed *in situ* on Mars suggest that water-limited, acidic weathering conditions have more than likely been the defining characteristic of the Martian aqueous environment for billions of years.

Bacteria, fungi and archaea on silicate minerals – A case for selective colonization

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Understanding of mineralogical influences on surface and subsurface microbial community structure and diversity has been enhanced greatly by the use of culture-independent molecular techniques, both *in situ* and in laboratory experiments. It is still unclear how mineral surfaces influence the distribution and activity of the microbial communities they harbour. Experiments were designed to evaluate specific/random colonization of silicate minerals. DNA-based techniques were combined with multivariate statistics to investigate the influence of mineral types on fungal and bacterial diversity and microbial community structure developed on three minerals (muscovite, feldspar and quartz) sampled at a 10 metre scale from a pegmatitic granite outcrop. Archaeal DNA was also extracted, amplified and cloned, and analyses were performed to identify species associated with the 3 minerals. In other experiments, biofilms formed on sterile 1-2 mm mineral grains were used to assess the microbial colonization pattern on silicate minerals (albite, biotite, muscotive, quartz and microcline) submerged within perforated plastic tubes the upper unpolluted reaches of the River Liffey, Ireland during a 8 and 12 week period. Our results suggest a strong mineralogical influence on the structure and composition of the associated community, with distinct bacterial and fungal ribotypes selected by each mineral type. For the first time, Archaeal species associated with silicate minerals were described.