WIND-ERODED SILICATE AS A SOURCE OF HYDROGEN PEROXIDE ON MARS. E.N. Bak[1], J.P. Merrison[2], S. K. Jensen[3], P. Nørnberg[4] and K. Finster[1,2], [1-4]Aarhus University, Denmark. [1]Department of Bioscience, [2]Department of Physics and Astronomy, [3]Department of Chemistry, [4]Department of Geoscience.

Introduction: Investigations of Mars as a potential habitat for past or present life depend on understanding the chemistry of the Martian soil as it affects the preservation of organic compounds and thus the risk of forward contamination as well as the suitability of organic compounds as biomarkers. The classical Gas Exchange Experiment and the Labeled Release Experiment conducted by the Viking Landers demonstrated that the Martian surface soil is oxidizing [1, 2]. However, the cause of the soil's oxidizing properties is uncertain [3]. The Martian surface material mainly consists of silicates [4] that due to wind erosion has a very fine grained texture. Based on the composition of the surface material and investigations showing that crushing of silicates can give rise to reactive oxygen species [5], we hypothesized that wind erosion of silicates can explain the reactivity of Martian soil.

Methods: We simulated wind-erosion of silicates by tumbling quartz sand in sealed quartz ampoules with defined atmospheres. The eroded sand was suspended in water and the hydrogen peroxide concentration was followed using a scopoletin/horseradish peroxidase assay.

Results: The simulated wind-erosion effectively eroded the sand over weeks of tumbling and we saw a clear correlation between an increase in surface area and the release of hydrogen peroxide. The production of hydrogen peroxide depended on the presence of atmospheric oxygen and was inhibited by atmospheric carbon dioxide. Nevertheless, taking into account the high surface area of Martian soil and the atmospheric oxygen and carbon dioxide content, wind-eroded silicate could result in the formation of at least 7 to 31 nmol hydrogen peroxide per cm^3 soil, which could explain the amount of $^{14}CO_2$ released in the Labelled Release Experiments [6]. Further, the heat-stability of eroded silicate as a source for hydrogen peroxide matches to the results obtained by the Viking Landers.

Discussion: Wind-eroded silicate as a potential source of hydrogen peroxide does not contradict previously proposed hypothesis for the cause of the reactivity of Martian soil. Wind-erosion of silicate could thus be one of several causes of the soil's reactivity.

As our experiments show, the globally distributed wind eroded silicate dust can lead to the production of hydrogen peroxide which might explain the reactivity of the Martian soil. The reactivity of eroded silicate could further affect the degradation of organic compounds on Mars, be a stress factor for past and present life as well as pose a danger to future Mars explorers.

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