

Wind mediated oxidation of pyrite: a putative mechanism for sulfate production on Mars. S. Knak Jensen¹, H. P. Gunnlaugsson¹, J. M. Merrison¹, P. Nørnberg¹. ¹Mars Simulation Laboratory, Aarhus University, DK-8000 Aarhus C, Denmark. e-mail: kemskj@chem.au.dk, hpg@phys.au.dk, merrison@phys.au.dk, geopn@phys.au.dk

Introduction: Recently, sulfate-rich layered deposits have been identified on the surface of Mars [1], [2], [3]. The observations are consistent with sulfate formation from oxidation of pyrite in an aqueous environment [4], [5]. Here we report a reaction for sulfate formation from pyrite under conditions similar to the present martian environment, i.e., the absence of water.

Experimental: A sample of pyrite is placed in a sealed reaction chamber with gases like oxygen, carbon dioxide or argon – but no water. The reaction chamber is exposed to gentle mechanical agitation as described elsewhere [6]. This motion is expected to mimic the mutual rubbing of mineral grains by the wind. After several days of agitation, the sample was analyzed by Mössbauer spectroscopy and X-ray diffraction.

Results: Representative Mössbauer spectra are shown in Fig. 1

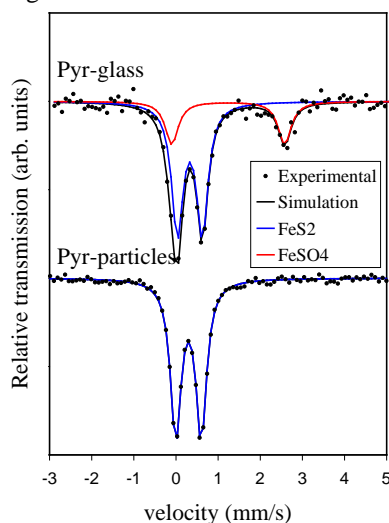


Fig. 1: Mössbauer spectra obtained from an agitated sample (Pyr-glass) compared to the Mössbauer spectrum of the original sample (Pyr-Particles).

Both Mössbauer- and X-ray spectra show spectral lines that are not present in the sample before agitation. These lines can be identified as ferrous sulfate.

References:

- [1] Gedrin A. et al., (2005) *Science* 307,1587-1591.
- [2] Langevin Y. et al., (2005) *Science* 307,1584-1586.
- [3] Bibring J. P. et al., (2005) *Science* 307,1576-1581.

- [4] Bishop J. L. et al (2004) *Int. J. Astrobiology* 3, 275-285.
- [5] Zolotov M. Y. And Shock E. L. (2005) *Geophys. Res. Lett.* 32, 21203.1-21203.5.
- [6] Merrison J. M. et al., *Icarus* (2010). *In print*. <http://dx.doi.org/10.1016/j.icarus.2009.09.004>.