The Significance and Chemistry of the Martian Peroxide and Perchlorate Oxidants

*Sushil K Atreya[1], Eric H Wilson[1], Thérèse Encrenaz[2], Ralf I Kaiser[3], Paul R Mahaffy[4]

1. University of Michigan Ann Arbor, USA, 2. Observatoire de Paris, Meudon, France , 3. University of Hawaii, Honolulu, USA, 4. NASA Goddard Space Flight Center, USA

Oxidants play a crucial role in the habitability of Mars. Two oxidants –peroxide and perchlorate –are particularly important in this context. Hydrogen peroxide was proposed for the lack of detection of surface organics on Mars by Viking [1]. Three decades later it was detected in the Martian atmosphere [2,3]. Although no instruments have ever flown to test its presence in the surface, diffusion from atmosphere into the regolith is expected, where hydrogen peroxide can have a relatively long residence time. Unlike hydrogen peroxide, perchlorates have been detected in the Martian surface, first by Phoenix in 2008 in the north polar region [4], and then again in the equatorial region by the Curiosity rover [5,6]. Homogeneous gas phase chemistry appears inadequate to explain the seasonal trend in hydrogen peroxide [7]. Heterogeneous processes involving airborne dust may play a role [7,8]. Likewise, perchlorate formation on Mars is poorly understood. The same atmospheric process that explains the terrestrial perchlorate abundances fails to produce the observed perchlorate abundance at Mars by several orders of magnitude. An alternative proposal to perchlorate formation in an ancient aqueous environment or by the solar UV is an initiation throughout the history of Mars in the surface by cosmic ray radiolysis to source gaseous ClO_2 to the atmosphere with subsequent further oxidation [9]. This talk will discuss the current status of the processes of peroxide and perchlorate formation and destruction and their significance on Mars in the above context. References: [1] Oyama, V.I., et al. (1977) *Nature* 265, 110–114. [2] Encrenaz, T., et al. (2004) Icarus 170, 424. [3] Clancy, R.T., et al. (2004) Icarus 168, 116. [4] Hecht, M.H., et al. (2009) Science, 325(5936), 64, doi:10.1126/science.1172466. [5] Glavin, D.P., et al. (2013) JGR Planets 118, 1955, doi:10.1002/jgre.20144. [6] Ming, D.W., et al. (2014) Science, 343(6169), doi:10.1126/science.1245267. [7] Encrenaz, T., et al. (2015) A&A. 578, A127 (12pp), DOI: 10.1051/0004-6361/201425448. [8] Atreya, S.K., et al. (2006) Astrobiology 6 (no. 3), 439. [9] Wilson, E.H. et al., (2016) JGR Planets, doi: 10.1002/2016JE005078, 2016.

Keywords: Mars, Habitability, Oxidants, Perchlorate, Hydrogen peroxide, Radiolysis

