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Coupled Surface-Atmosphere Chemistry of the Martian Peroxide and Perchlorate Oxidants

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Oxidants play a significant role in planetary habitability. On Mars, while they can be a source of nutrients, they can also destroy surface organics. They may also impact the atmospheric trace gas chemistry. Hydrogen peroxide was first detected in the martian atmosphere in 2003 [1,2], and perchlorates were detected in the surface in 2008 in the polar region [3] and 2012 in the equatorial region [4,5]. Global and seasonal maps of hydrogen peroxide have been generated from regular observations since 2003 [6], while all indications are that perchlorates are ubiquitous on Mars. Homogeneous gas phase chemistry can generally explain the observed atmospheric hydrogen peroxide, but the magnitude of seasonal variation poses a challenge. Heterogeneous chemistry involving airborne dust lifted from the surface and triboelectric processes [6,7] may play a role. Perchlorate formation on Mars is poorly understood, but one thing is clear that the same atmospheric process that works reasonably well for terrestrial perchlorates fails at Mars. An alternative proposal to perchlorate formation in an ancient aqueous environment is an initiation throughout the history of Mars in the surface by radiolysis to source gaseous ClO_2 to the atmosphere with subsequent further oxidation [8]. This talk will discuss the current status of oxidant chemistry on Mars in the above context and provide directions for future laboratory and modeling studies.
References: [1] Encrenaz, T., et al. (2004) Icarus 170, 424. [2] Clancy, R.T., et al. (2004) Icarus 168, 116. [3] Hecht, M.H., et al. (2009) Science, 325(5936), 64, doi:10.1126/science.1172466. [4] Glavin, D.P., et al. (2013) JGR Planets 118, 1955, doi:10.1002/jgre.20144. [5] Ming, D.W., et al. (2014) Science, 343(6169), doi:10.1126/science.1245267. [6] Encrenaz, T., et al. (2015) A&A. 578, A127 (12pp), DOI: 10.1051/0004-6361/201425448. [7] Atreya, S.K., et al. (2006) Astrobiology 6 (no. 3), 439. [8] Wilson, E.H. et al., (2016) JGR Planets, doi: 10.1002/2016JE005078, 2016.