Formation of akaganeite on Mars

T.S. PERETYAZHKO[1], D.W. MING[2], E.B. RAMPE[2], R.V. MORRIS[2], D.G. AGRESTI[3]

[1]Jacobs, NASA JSC, Houston TX, 77058 (tanya.peretyazhko@nasa.gov), [2]NASA JSC, Houston TX, 77058, [3]University of Alabama at Birmingham, Birmingham, AL, 35294

Akaganeite (β-FeO(OH,Cl) a chloride-containing Fe(III) (hydr)oxide) has been detected on the surface of Mars by the Mars Science Laboratory Curiosity rover in Gale Crater, Mars [1] and from orbit by the Mars Reconnaissance Orbiter in Robert Sharp crater and Antoniadi basin [2]. Formation mechanisms of akaganeite on Mars are still unclear. Comparison of martian observations with experimental data on akaganeite formation at different values of pH and dissolved Cl^- concentrations reveals that akaganeite in Yellowknife Bay, Gale crater likely formed from basaltic sediments under moderately saline, acidic to alkaline conditions, whereas akaganeite in Robert Sharp crater may have formed from iron(II) sulfides and/or basalts under saline acidic conditions [3]. Experimental studies were designed to verify these formation mechanisms. We have investigated formation of akaganeite from natural Fe(II) sulfide mineral pyrrhotite. Pyrrhotite was incubated in HCl solution (pH ~1.3) under ambient conditions. At the end of the reaction, the liquid containing dissolved Fe(II) was separated from the solids and Fe(II) was oxidized to Fe(III) by H_2O_2. The solution pH was then increased to pH 2 and 4 and incubated at 80 °C overnight. X-ray diffraction analysis of the precipitates revealed formation of akaganeite under acidic pH 2 conditions; hematite, ferrihydrite or schwertmannite formed at moderately acidic pH 4. The results indicate that formation of akaganeite from Fe(II) sulfides is plausible in acidic environments and could occur in Robert Sharp crater on Mars. Experiments will be also performed to investigate formation of akaganeite from Mars-analogue basalts.

[1] Vaniman et al. (2014) *Science*, vol. 343; [2] Carter et al (2015) *Icarus* 296-310; [3] Peretyazhko et al (2018) *JGR Planets*, vol 123.