

THE INVESTIGATION OF CHLORATE AND PERCHLORATE/SAPONITE MIXTURES AS A POSSIBLE SOURCE OF OXYGEN AND CHLORINE DETECTED BY THE SAMPLE ANALYSIS AT MARS (SAM) INSTRUMENT IN GALE CRATER, MARS. J. Clark^{1,2}, B. Sutter^{1,2}, D.W. Ming², P. Mahaffy³.
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The Sample Analysis at Mars (SAM) instrument on board the Curiosity Rover has detected O₂ and HCl gas releases from all analyzed Gale Crater sediments, which are attributed to the presence of perchlorates and/or chlorates in martian sediment. Previous SAM analog laboratory analyses found that most pure perchlorates and chlorates release O₂ and HCl at different temperatures than those observed in the SAM data. Subsequent studies examined the effects of perchlorate and chlorate mixtures with Gale Crater analog iron phases, which are known to catalyze oxychlorine decomposition. Several mixtures produced O₂ releases at similar temperatures as Gale Crater materials, but most of these mixtures did not produce significant HCl releases comparable to those detected by the SAM instrument. In order to better explain the Gale Crater HCl releases, perchlorates and chlorates were mixed with Gale Crater analog saponite, which is found at abundances from 8 to 20 wt % in the John Klein and Cumberland drill samples. Mixtures of chlorates or perchlorates with calcium-saponite or ferrian-saponite were heated to 1000 °C in a Labsys EVO differential scanning calorimeter/mass spectrometer configured to operate similarly to the SAM oven/quadrupole mass spectrometer system. Our results demonstrate that all chlorate and perchlorate mixtures produce significant HCl releases below 1000 °C as well as depressed oxygen peak release temperatures when mixed with saponite. The type of saponite (calcium or ferrian saponite) did not affect the evolved gas results significantly. Saponite/Mg-perchlorate mixtures produced two HCl releases similar to the Cumberland drilled sample. Mg-chlorate mixed with saponite produced HCl releases similar to the Big Sky drilled sample in an eolian sandstone. A mixture of Ca-perchlorate and saponite produced HCl and oxygen releases similar to the Buckskin mudstone drilled sample and the Gobabeb 2 eolian dune material. Ca-chlorate mixed with saponite produced both HCl and oxygen releases within the same range as the Rocknest windblown deposit, the Greenhorn eolian sandstone, and the John Klein drilled mudstone. Overall, mixtures of perchlorates or chlorates with saponite provide the first explanation for the high temperature HCl releases in addition to the oxygen releases observed in Gale Crater materials.