



CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

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Project Title Mars Likes It Hot: The Effect of Temperature and Dust Storms on the Clay-Bicarbonate Reaction	
<p style="text-align: center;">Abstract</p> <p>Objectives Methane in the Martian atmosphere was first detected by a team at NASA's Goddard Space Flight Center in 2003. In 2014, the Mars Express Orbiter reported that concentration levels varied with the seasons, peaking during the summer. Proposed sources for its mysterious origin include geological (Fischer Tropsch type reactions and magma outgassing), cosmological (UV irradiation of meteoritic organics, and cosmic dust), and biological ones (present-day microbial activity). Recently, a new anoxic chemical reaction involving sodium bicarbonate (NaHCO₃) and clays such as nontronite, both of which abundant on the Martian surface, has been found to produce methane. The objective of this project is to test if this reaction could account for the Martian methane and its seasonal variation and be postulated as another plausible source for it.</p> <p>Methods To test whether this clay-sodium bicarbonate reaction could be a plausible source, the reaction was replicated in 25 mL rubber-sealed anoxic flasks (simulating the Martian atmosphere) using Nontronite and wustite-containing basalt, and the gaseous products measured using a GC-FID (Gas Chromatograph with Flame Ionization Detector). Furthermore, the effect of increased temperature and agitation on the reaction were measured by applying them each one hour before sampling.</p> <p>Results Results on a limited number of trials indicate an overall increase in methane production on samples that were heated and stirred. However, there was no statistical significance because of the limited number of trials and the variance among samples.</p> <p>Conclusions Further steps will be taken in the form of substantially more trials at simulated Martian temperatures. The further investigation and characterization of the clay-bicarbonate reaction could not only help researchers further understand Martian methane but could also shed light into methane-producing In-Situ Resource Utilization (ISRU) technologies.</p>	
Summary Statement Tested whether a new geochemical methane-producing reaction could be another plausible source for the mysterious Martian methane and its seasonal variation.	
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