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Determination of the Sources of Chlorinated Hydrocarbons Detected During MSL Missions

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Sample Analysis at Mars (SAM) is one of the instruments of the MSL mission. Three analytical instruments composed SAM: the Tunable Laser Spectrometer (TLS), the Gas Chromatography (GC) and the Mass Spectrometer (QMS). It includes a sample preparation and gas processing system implemented with a pyrolysis system, wet chemistry (MTBSTFA and TMAH) and the hydrocarbon trap (silica beads, Tenax® TA and Carbosieve G), employed to concentrate volatiles released from the sample prior to GC-MS analysis [1].
This study investigates several propositions for chlorinated hydrocarbon formation, detected by SAM. Here we report on the detection of chlorohydrocarbon compounds and their potential origin.
To date, SAM has detected a range of diverse chlorinated hydrocarbons from GCMS analysis of samples collected at the several locations explored by Curiosity (Rocknest, John Klein, Cumberland and Confidence Hill). Some of these chlorohydrocarbons are produced during pyrolysis by the reaction of Martian oxychlorine compounds in the samples with terrestrial carbon from a derivatization agent (MTBSTFA) present in SAM [2, 3]. Chlorobenzene cannot be formed by the reaction of MTBSTFA and perchlorates (2) and two other reaction pathways were therefore proposed : (i) reactions between the volatile thermal degradation products of perchlorates (e.g. O_2, Cl2 and HCl) and Tenax® and (ii) the interaction of perchlorates (T > 200 °C) with OM from Martian soil such as benzenecarboxylates [4, 5].
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