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The Sample Analysis at Mars experiment of the NASA/MSL 2009 mission: search for organic molecules and traces of a (pre)biotic activity at the surface of Mars

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In past times, life might have emerged under Martian environmental conditions milder than the present ones. This life could have left some traces of its existence at the surface of Mars up today. Even if this did not happen, prebiotic molecules may have been preserved that might be similar to the ones that prevailed on the Earth surface some 3.5 to 4 billion years ago. NASA's MSL09 rover will arrive at Mars in 2010 to explore its surface and subsurface. Aboard this rover the analytical laboratory, named Sample Analysis at Mars (SAM) and under the responsibility of the NASA/GSFC, will analyze samples both collected in the atmosphere and in the soil. One among the SAM goals is to determine molecular abundances and isotopic ratios of organic molecules collected in the atmosphere and in the soil. SAM will also examine atmospheric noble gases linked to the history of the planet, and structural gases that may be released by pyrolyzed soil samples. The search for prebiotic information will be performed by analyzing gases either directly sampled from the atmosphere, or obtained from soil processing physical heating or chemical reactions. With this aim, SAM will use the three analytical subsystems it includes, i.e. a gas chromatograph (GC), a quadrupole mass spectrometer (QMS), and a laser spectroscope (TLS), or combinations of them. We present here this analytical laboratory, with a particular focus on the Gas Chromato-

graph instrument which is a French contribution to SAM. The GC is a stand-alone instrument especially dedicated to the study of organic molecules and we describe here its capabilities for the detection of organic complex molecules either in Mars atmosphere or in its soil. The first calibration data obtained with the flight model of the GC will be presented to demonstrate its good analytical performance. Moreover, a few words will be given on the possibility for the experiment to characterize minerals which could result from a biological activity, such as carbonates, using their property to release structural gases when heated at high temperature.