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Sample Analysis at Mars: the SAM experiment

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SAM (Sample Analysis at Mars) is an experiment dedicated to atmospheric, ground and underground in-situ chemical and isotopic analysis, in the frame of an US/French collaboration, which has been accepted to be onboard MSL09. This experiment will be devoted, in particular, to the search for traces of prebiotic chemistry, or of past or present biological activity. Consequently we will focus, here, on two aims: detection of organic molecules, detection of inorganic molecules linked to biological activity. Volatile organics are extracted from the sample by simple heating, whereas refractory molecules are made analyzable (i.e. volatile), using fragmentation by pyrolysis (as in the ACP experiment onboard Huygens probe) or new techniques –which allows to analyse the most refractory molecules-. Gaseous mixtures thus obtained are analyzed by Gas Chromatography associated to Mass Spectrometry, these techniques allow to identify organic molecules, up to amino or benzene-carboxylic acids. Isotopic measurements will be performed and specific columns will be used to analyse the chirality of organic complex molecules. Coupled with these pyrolysis techniques, SAM may also use a TLS device for isotopic and organic analysis. Concerning inorganics, carbonates and other salts are associated to the dense and moist atmosphere necessary to the development of life, heating the samples allows the analysis of structural gases of these minerals (CO_2 from carbonates etc.), enabling to identify them. Inorganic compounds formed by or in presence of living organisms (carbonates etc. from shells, corals, stromatolites, microbialites) show a thermal behavior, due to their slightly different crystalline structure, which may help to assert the presence of extinct life, even in the absence of organic molecules.