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In-situ measurements of total carbon

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Quantitative assessment of the equilibration of biotic and pre-biotic materials and of the mechanisms leading to their presence in a planetary context requires knowledge of the relative concentrations of the organic species within a sample. The measurement of these relative concentrations is not practical for many remote sensing and in-situ techniques because of the large number of potential compounds having high variance in (for example) volatility, spectral response and/or molecular weight. One approach is to compare the concentration of identified materials to the total carbon and total organic carbon in a sample. The traditional two-stage approach for this measurement is acidification to convert "inorganic" carbon to CO_2 and pyrolysis to convert the remaining "organic" carbon and carbon-based compounds the CO_2. Measurement of the evolved CO_2 provides a measure of organic and total carbon in the sample. These measurements are relatively successful in a laboratory context, but are difficult to implement robotically, particularly in challenging environments. A variety of alternative approaches for achieving total carbon measurements with acceptable accuracy are examined for feasibility of use in a field or robotic environment, with particular emphasis on soils on Mars.