A next generation life detector

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The detection of life in the solar system using organic compounds is a major objective of astrobiology. Powerful techniques are available to recognise the fingerprint of life but require good preservation of life’s organic remains. Heat, pressure and oxidation all degrade the obvious characteristics of life in organic structures. The detection of life in ancient, heated or degraded organic mixtures will be especially important as samples are returned from Mars to Earth laboratories. Techniques such as the measurement of stable carbon isotope ratios allow the recognition of life when organic structures have become difficult to interpret.

Stable isotope ratio measurements now extend to the level of individual compounds, termed compound specific isotopic analysis (CSIA) providing greater diagnostic capabilities. A next generation method is now available, but currently unapplied. At Imperial College London, stable carbon isotope ratio techniques have now progressed from individual compounds (CSIA) to individual carbon atoms, to give position specific isotope analysis (PSIA). There are multitude of potential arrangements of carbon isotopes in hydrocarbons with five carbon atoms or less. These arrangements can be used as unique geochemical signatures to identify the sources of organic compounds. The PSIA method is a system recently developed in
the Organic Geochemistry Laboratories. Few of these systems exist globally and the
application of this system to astrobiology and planetary science is an exciting step.

![PSIA system at Imperial College London](image)

**Figure 1.** The PSIA system at Imperial College London (left panel) and the increased
resolution provided by compound specific isotope analysis, or “CSIA” and the
ultimate resolution provided by position specific isotope analysis, or “PSIA” (right
panel).

The research will use equipment in the
Imperial College Organic Geochemistry Laboratories
(right). Full training will be provided. The project
would suit a candidate with enthusiasm for Planetary
Science or Astrobiology and a background in Earth
Science, Chemistry or a subject that develops
similar skills.

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