PTAL Report Summary

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Periodic Reporting for period 1 - PTAL (Planetary Terrestrial Analogues Library)

Reporting period: 2016-01-01 to 2016-12-31

Summary of the context and overall objectives of the project

A new and exciting era of planetary space exploration started in 2000 with a plethora of in-situ and orbital missions in operation at terrestrial planets and small Solar System bodies. The characterisation of the surface of these planetary objects is one of the major goals of space exploration. In order to support these operations, reduction and analyses of the space mission data, the PTAL (Planetary Terrestrial Analogues Library) project aims to build and exploit a multi-instrument spectral data base and joint spectral interpretation tools. We will determine mineral alteration pathways for natural and artificial terrestrial analogue materials under well-defined and controlled experimental conditions. The impact of varying environmental conditions (e.g. gas pressure, temperature, pH-value) will be tested to better constrain the geochemical aspect of habitable conditions on Mars, the prime target of this project. All natural and artificial rock samples and their alteration products will be characterised for the spectral library with commercial and dedicated spacecraft instrumentation (XRD, NIR, RAMAN, LIBS) under laboratory conditions, and where possible on in situ field campaigns.

Both the understanding of alteration pathways and coordinated analyses of the surface of Mars from orbital and landed platforms with new and well-characterised spectral data will allow unprecedented interpretations of the climatic and environmental evolution for materials detected at new landing sites using our well-defined experimental parameter space for deriving conditions and evolution of environment and climate at Mars. Defining and characterising the ingredients for habitability at yet another planet will broaden our conception on the origin and evolution of life on our own planet, and prepare future investigations of forthcoming space missions in which several project members are highly involved.

Work performed from the beginning of the project to the end of the period covered by the report and main results achieved so far

The Planetary Terrestrial Analogues Library (PTAL) project is implemented in five work packages: WP1 – Laboratory Experiments, Field Analogue Site Studies, WP2 – Spectral characterisation of laboratory samples, WP3 – Spectral characterisation of planetary surfaces from orbital and landed data, WP4 – Spectral Library of NIR, Raman and LIBS, and WP5 – Management and Dissemination.

The main objective of the Planetary Terrestrial Analogues Library (PTAL) project is to build and exploit the spectral library for the characterisation of the mineralogical and geological evolution of terrestrial planets and small Solar System bodies.
This aim will be achieved by conducting the following four tasks:

1. Performing laboratory experiments under controlled conditions and documenting rock alteration of field-collected planetary (often Martian) analogue materials, so that the impact of varying of environmental conditions (e.g. gas pressure, temperature, pH-value) can be quantified. We want to characterise and define the geochemical aspect of habitable conditions on Mars, which is the prime target of this investigation.
   In the previous period, we have collected rocks and started experiments to achieve this objective as reported under work package one (WP1).

2. Characterising of rocks and their alteration/weathering products as input for the spectral library with standard commercial and dedicated spacecraft instrumentation (NIR, RAMAN, LIBS, XRD) under laboratory conditions and where possible on in-situ field campaigns at Earth analogue sites.
   In the previous period, we started characterising rocks and their natural and experimental alteration products with the above mentioned methods, as reported under work packages one and two (WP1, WP2).

3. Performing coordinated analyses of the Martian surface from both orbital and landed platforms with new spectral data. The documentation of these analyses will result in scientific publications.
   These tasks are scheduled for a later period (WP 3).

4. Developing a data base, which will allow users to jointly interpret laboratory results and newly gathered in-situ or remote sensing data using the instruments (LIBS, NIR, RAMAN) on board of current and future space missions (e.g. Hayabusa-2, Curiosity, ExoMars, Mars2020).
   In the previous period, we started to lay out the data base concept and input characteristic were defined, as reported under work package four (WP 4).

Our project has been presented at several outreach events, for example, at the 11th European Researchers' Night Event, or the Oslo Science Fair 2016.

**Progress beyond the state of the art and expected potential impact (including the socio-economic impact and the wider societal implications of the project so far)**

The Planetary Terrestrial Analogues Library (PTAL) project is to experimentally describe alteration processes in defined and controlled environmental conditions. Such an approach for space material is novel and has found in the recent month many followers. Our goal is to provide by the end of the project an openly accessible library with these well-characterised materials.

Defining and characterising the ingredients for climate variability and habitability at yet another planet will broaden our conception on the origin and evolution of life on our own planet, and prepare future investigations of forthcoming space missions in which several project members are highly involved.

**Related information**