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Project Co-ordinator: Prof Nigel Mason, University of Kent

1. **Nature:** R = Report, P = Prototype, D = Demonstrator, O = Other

2. **Dissemination level:**

PU	PP	RE	CO
Public	Restricted to other programme participants (including the Commission Service)	Restricted to a group specified by the consortium (including the Commission Services)	Confidential, only for members of the consortium (excluding the Commission Services)

Executive Summary / Abstract:

The first TA call was rapidly and successfully implemented and offered 24 TA simulation-analytical facilities. The call was opened on 25th Feb 2020 and closed May 5th 2020. The peer review and normalisation of the evaluations of the sub-panels was completed on June 16th, discussed and approved by the PMC and published 30th June. Despite the rapid implementation of the TA call there were 80 applications (for the TA 1 & 2 facilities combined), of which 41 were funded. COVID-19 has had a huge impact on the implementation of TA visits. Numerous visits were planned for the summer-autumn of 2020 but were cancelled. A protocol for remote access has been established and two TA visits were completed and a third started in 2020. Further remote access visits are planned for early 2021.

A strategic collaboration has been established with Korea Basic Science Institute (KBSI) to add a further 11 analytical facilities to TA 2. Call 2 was opened in November 2020 and closed on Jan 6th 2021. Perhaps due to a longer period of advertising, TA applications received for Call 2 were higher than in Call 1, underlining the demand from the community for TA access, even during the time of COVID restrictions. 101 applications were received in Call 2 for both TA1 & TA2. The implementation period of TA visits approved under Call 1 has been extended to the end of 2021.

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Deliverable

1. Explanation of work & Overview of progress

The Distributed Planetary Laboratory Facility (DPLF), TA2, provides access to 13 internationally renowned research centres and 24 facilities for the simulation or characterisation of planetary conditions and materials. In addition to these we have recently added a further 11 facilities based in South Korea. There is urgent need for access to these facilities because Europe is operating, preparing and planning a fleet of spacecraft to investigate the surface and atmospheric environments and compositions of Mercury, Venus, Mars, Jupiter, Titan, Europa, Uranus, Neptune, comets, asteroids and the Moon. These disparate bodies host remarkably diverse environments, many incomparable to terrestrial conditions. DPLF will provide support for key mission goals by enabling: validation of instrument design and performance; laboratory measurements to interpret surface and atmosphere observations from planetary bodies (e.g. composition, temperature, texture, etc.); a better understanding of the physical and geological processes that formed specific planetary environments, evaluation of the biogeochemical processes that control the likelihood that life could evolve or survive.

The state-of-the-art TA facilities offer sophisticated infrastructure and extensive academic and technical support. DPLFs are led by scientific staff of worldwide standing, several of who have been awarded major grants and awards, e.g. ERC starting, consolidator, advanced and synergy grants. The teams have produced >100 publications in the highest ranked journals (Nature-Science family, PNAS) in the last 5 years and are involved in missions involving international space agencies (e.g. ESA-JAXA HERACLES and NASA's Mars 2020). The combined infrastructure represents an investment of well over €50 M (excluding buildings). Two new clean laboratories will be completed at TA facilities during the duration of EPN-2024-RI (VUA & CRPG) representing a further investment of > €5M. The team includes coordinators of a Distributed System of Scientific Collections (DiSSCO; SYNTHESIS+), and members of other current or proposed research infrastructures (e.g., IPERION CH). 6 of the facilities are based in Under Represented States (URS) and 3 are managed by a commercial company.

The management of the overall TA programme (including both TA1 & TA2) is coordinated by the TA Sub-Committee (VUA, NHM, DLR, AU and UNIBO) and supported by the TA office at the VUA that also provides the secretarial support. In collaboration with WP11 NA1, a TA application workshop was held on 3rd December to aid people to write applications to the second TA call. The focus of the workshop was to provide practical advice to applicants. Publicity of the workshop concentrated on attracting participants from underrepresented states.

1.1 Objectives

As explained above, the aim of TA2 is to provide the international community access to 24 world-leading simulation and analytical facilities in Europe relevant to the planning, implementation and scientific exploitation phases of current and forthcoming missions to Mercury, Mars, asteroids, comets and the icy moons of Jupiter.

Europlanet aims to expand the facilities available for the TA program through strategic international collaborations. During 2020 a reciprocal agreement has been established with Korea Basic Science Institute (KBSI) that adds a further 11 facilities to TA 2. Call 2 was opened in November 2020 and closed on Jan 6th 2021 and applications of European researchers to visit Korean TA facilities and vice versa is included. Discussions are on-going to establish a similar reciprocal arrangement with TA facilities (TA 1 & 2) with the Chinese Academy of Science.

1.2 Explanation of the work carried in WP

The first TA call was rapidly and successfully implemented and offered access to all 24 TA2 facilities. The call was opened on 25th Feb 2020 and closed May 5th 2020. Applications are anonymous and peer reviewed by experts independent from the EPN-2024-RI, a process managed by ESF. The peer review and normalisation of the evaluations of the sub-panels was completed on June 16th, discussed and approved by the PMC and published 30th June 2020. Despite the rapid implementation of TA call there were 80 applications (for TA1 and TA2 facilities combined), of which 41 were funded. One application was excluded due to lack of anonymity and six were found to be technically unfeasible. COVID-19 has had a huge impact on the implementation of TA visits. Numerous visits were planned for the summer-autumn of 2020 but were cancelled. A protocol for remote access was established and two TA visits completed and a third started in 2020. Further remote access visits are planned for 2021. The implementation period of TA visits approved under Call 1 has been extended to the end of 2021.

A strategic collaboration has been established with Korea Basic Science Institute (KBSI) to add a further 11 facilities to TA 2. Call 2 was opened in November 2020 and closed on Jan 6th 2021. Despite COVID-19, 101 TA applications were submitted in Call 2, an increase of 25% from Call 1, underlining the demand from the community for TA access, even during the time of COVID restrictions. The implementation period of TA visits approved under Call 1 has been extended to the end of 2021.

In collaboration with WP11 NA1, a TA application workshop was held on 3rd December to aid applications to the second TA call. The focus of the workshop was to provide practical advice to applicants. The workshop was attended by 57 participants, of which about half were early career scientists, and 16 (28%) were from under-represented states.

The scientific report for only one project has been completed.

Application 20-EPN-042 was fully completed and the scientific report finalised. The project, “Reflectance spectroscopy of ammonium-bearing minerals: a tool to improve the knowledge of the surface of icy planetary bodies”, was conducted by Maximiliano Fastelli of the University of Perugia at the Cold Surfaces Spectroscopy at IPAG (Facility 2.8).

Reflectance VIS-NIR spectra were collected at ten different temperatures: 270-245-220-180-160-140-120-100-90-270K. For the samples characterized by a low temperature phase transitions (mascagnite (NH₄)₂SO₄, sal-ammoniac NH₄Cl, ammonium phosphate (NH₄)H₂PO₄, tschermigite (NH₄)Al(SO₄)₂·12(H₂O) and ammonium nitrate NH₄NO₃), the number of measurement steps were increased in the proximity of the expected temperature of mineral transformation. Cooling and heating experiments, using the same cooling/heating rate, were performed to break the phase transition T. In particular, mascagnite, sal-amoniac and ammonium phosphate monobasic samples showed clear spectral bands variations during cooling, indicating that a phase transition occurred. Spectra were collected with three different grain sizes (150/125 – 125/80 – 80/32 μm) in the spectral range from 1 to 4.8 μm.

The collected data will help the interpretation of VIR remote spectra from Europa, Pluto’s moons, Enceladus and other icy celestial bodies surface where NH₄ minerals have been reported. Moreover, the study of ammonium bearing minerals and their behaviour at very low temperature constrains the phase transition affects and shape and position of bands in the reflectance spectra. Overtones and combinations of NH₄ bands are in the 1-3 μm range, whereas fundamental vibrational modes (ν₁ and ν₃) are present in the ~3 μm area.

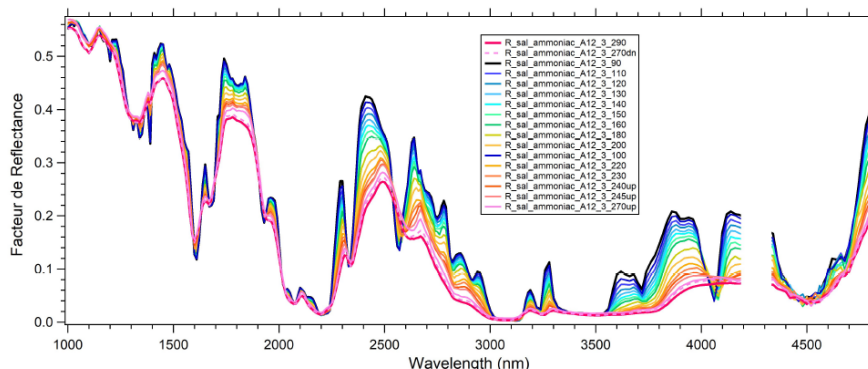


Figure 1 Reflectance spectra of sal-ammoniac collected from room temperature (R7) to 90K (L7). At ~2550 and ~4070 nm after 240K (red line) additional peaks are presents in relation to λ -transition (order-disorder type). The white area at ~4200 nm corresponds to the removal of atmospheric CO₂ features.

The Atomki ion irradiation and impact facility (TA 2.11) has hosted two visits. A remote visit was completed and a physical visit was partially completed.

5 days of beamtime out of 10 were provided between 30 of November and 4 of December for the TA project 20-EPN-043:A Systematic Study of Sulfur Ion Radiolysis of Simple Oxide Ices. Zuzana Kanuchova and Duncan V. Mifsud, University of Kent, were present at the facility. Initial findings of the proposal were presented at the TA application workshop and covered extensively on the website and through social media (see NA1 report). The second part of the visit is scheduled for February 2021.

Application 20-EPN-016 was conducted between 12 and 26 of October. This 10 day TA mission was accomplished through remote access. Title of the project: 'Formation and fate of methyl formate isomers in space' by Sergio Ioppolo and Alejandra Traspas Muina, Queen Mary University of London.

1.3 Impact

The visitors who have conducted TA visits to date have all committed to make presentations of their results at EPSC 2021. Despite only partial completion, 5 days of 10, TA project 20-EPN-043: A Systematic Study of Sulfur Ion Radiolysis of Simple Oxide Ices has been the subject of significant outreach efforts on social media and the website (see WP11 NA1 report) and was discussed as an example of a successful application at the TA application workshop.

1.4 Access provisions to Research Infrastructures (if applicable)

Extensive discussions and planning have been conducted to develop remote access procedures to the TA2 facilities. Several remote visits are planned for the start of 2021 and two have already been conducted in 2020. The major development in respect of TA2 access has been the addition of 11 new facilities at KBSI to be included in TA Call 2.

2. Update of the exploitation & dissemination plan

Extensive communication with the community has been undertaken to keep them informed of the impact of COVID-19 on the implementation of TA visits. This has clearly been successful as there were 25% more applications in TA Call 2 than Call 1, despite the impact of COVID-19 on access to TA facilities.

3. Update of Data Management Plan

Not applicable; Data Management plan (Deliverable D1.3) is in place.

4. Follow-up of recommendations & comments from previous review(s)

Not applicable as too few TA visits have been conducted at present due to the pandemic. Informal feedback from the TA review board is that we have been effective in maintaining contact with the community and stimulating applications for TA visits.

- **5.1 Tasks**

5. Deviations from Annex 1 (DoA)

Explain the **reasons for any deviations, the consequences & proposed corrective actions.**

5.1 Tasks

COVID-19 has had major impact on the start of the implementation of TA visits. Hence, the implementation of visits at all TA facilities are behind schedule. Procedures for remote access have been established and TA visits have started but most TA visits will be undertaken in 2021. The period of time over which the implementation of a TA visit can be undertaken has been extended to 18 months.

5.2 Use of resources

COVID-19 has had major impact on the start of the implementation of TA visits. Hence the expenditure of all TA facilities are behind schedule. Procedures for remote access have been established and TA visits have started but most TA visits will be undertaken in 2021. The period of time over which the implementation of a TA visit can be undertaken has been extended to 18 months.

5.2.1 Unforeseen subcontracting

None

5.2.2 Unforeseen use of in-kind contributions from a 3rd party against payment or free of charge

None