MERIT REPORT OF A LAUREATE
TEAM PROGRAMME

Project title:	**Mars: another planet to approach geoscience issues**		
Reporting period:	from **01.05.2014** to **31.10.2014**	**Period no.**	**7**
Agreement No.:	**TEAM/2011-7/9**	from **01.09.2011** to **30.06.2015**	
Laureate:	**Daniel MEGE**		

ATTENTION: the information given below should regard only the realization of the project in the reporting period indicated above.

1) INFORMATION CONCERNING THE PROGRESS OF THE RESEARCH (from 1000 to 5000 words)

Most tasks follow the research performed by the TEAM PhD students and postdocs. Period 7 is the last period prior to starting writing of the PhD manuscripts of the TEAM PhD students. A lot of effort was put during Period 7 to the dissemination of the scientific results obtained so far to international conferences.

a) The progress of the research tasks

Research Task 1 – A Valles Marineris synthesis

Geologic mapping has continued during Period 7. After completing the geomorphologic elements listed during Period 6, mapping of the Valles Marineris canyons has proceeded, separating landfoms observed on the main (middle) part of the slopes, bottom landforms, and summital landforms.

The map had initially to include the whole Valles Marineris canyon system, which covers a surface area of 2000 x 650 km. Due to the level of details mapped, the objectives of this task were downsized to the geology of the western canyons only, which covers 1/3 of the system. This region has not been investigated as much as the others in the past.

Research task 2 – Diagnostic climate signatures of basalt alteration on Earth and Mars

The method of rock sample analysis described in the 6th periodic report, based on a combination of Atomic Force Microscopy (AFM) and Scanning Electron Microscopy (SEM), was applied to more samples, and for a given sample, to the fresh (internal) and altered (outer) parts.

Research task 3 – Deep-seated gravitational spreading on Mars and Earth

This task is twofold: (1) Quantification of gravitational spreading of topographic ridges on Mars from orbital imagery (Mars) and study of terrestrial analogues from field work; (2) Numerical simulations of the geologic processes involved.

- ***Quantification of topographic ridge spreading*** **–** Statistical analysis of the GPS datasets collected in the Tatra mountains has been done by TEAM member Olga Kromuszczyńska, using a Matlab-based software written by TEAM postdoc Luigi Castaldo designed to evaluate the accuracy of GPS topographic measurements using to GPS mode: non-differential, and wide-area differential.

- ***Numerical simulations*** **–** Modelling of possible causes and tectonic effects of postglacial gravitational spreading of mountain slopes was continued, and the article reporting the first results was in final stage of preparation.

Research task 4 – Landslides on Mars and Earth

Following a meeting with the main collaborators for this task, Profs. Anne Mangeney and Patrick Richard on May 27th, full rewriting of the article manuscript presented by PhD student Timur Borykov during Period 6 has been undertaken during Period 7. New and deeper analysis of landslide propagation was necessary.

Research task 5 – Thermal properties of Martian landforms

Thermal properties of landforms provide important information on the composition and porosity of surface rocks (in this respect, it very usefully complements the data from the SHARAD ground penetrating radar used in Task 6), which are important for constraining the geologic evolution of planetary surfaces in the absence of field observations. New TEAM postdoc Marta Kubiak is developing a scheme for processing high resolution thermal infrared data of the surface of Mars (from the Themis imaging spectrometer onboard the Mars Odyssey orbital spacecraft) to obtain its apparent thermal inertia. Such processing schemes already exist; however, the one developed in Task 5 goes further than the existing (published) ones. The latter do not take the effect of slope values and orientation on the apparent thermal inertial into account. As a result, thermal mapping is reliable *only* when the terrain is horizontal. It is not adapted to hilly or mountainous terrains, which are regions that interest geologists th most. The processing scheme developed here does take this important relief correction parameter into account.

Research task 6 – Ice processes and landforms

- ***Global Mapping of the dielectric constant of the surface of Mars*** – The dielectric constant maps of Mars obtained from processing of the SHARAD orbital ground-penetrating radar, calculated with the objective of identifying ice in the Martian subsurface (Period 6), have been integrated to an article in progress. In order to refine the interpretations, SHARAD data calibration was performed by comparing the theoretical dielectric constant of ice with the dielectric constant of the north polar

cap of Mars, which, from independent evidence (geomorphology, gamma-ray spectrometry), is made of almost pure ice.

- ***KBO ices*** – New experiments of tholin spectral identification in ices were planned during Period 7. The experimental strategy and protocol for these new experiments was determined; the experiments will be conducted during Period 8 (November 2014).

b) Summary of the results of the research tasks

Research Task 1 – A Valles Marineris synthesis

The current state of the map is on Figure 1. Mapping has revealed the importance of glacial landscapes in the study area, and an increase of evidence of past glaciations toward west. A viscous flow has been identified on the canyon floor in the westernmost area that has not been described before. It will be more investigated in the forthcoming months.

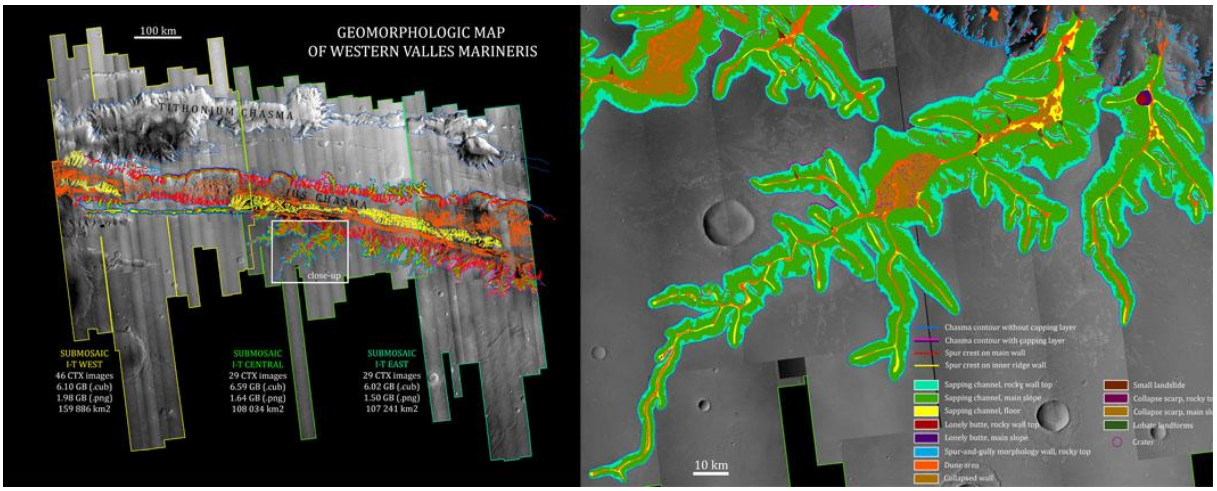

Figure 1. Current stage of development of the western Valles Marineris map, with emphasis on the sapping channels (channels forming by retrogressive erosion of the valley head) observed on the southern slopes. Document: Krzysztof Dębniak.

Research task 2 – Diagnostic climate signatures of basalt alteration on Earth and Mars

Figure 2 shows an example of joint AFM and SEM analysis of a basalt from the Baikal rift region obtained during Period 7. The SEM data (Figure 2, top left and bottom) allow mineral identification and determination of composition. The AFM data (upper right) emphasize the difference between olivine alteration, which has produced a nearly smooth microtopographic surface, and pyroxene alteration, resulting in a very rough microtopography. Comparison between various samples altered in contrasted climate conditions during the remaining periods will help determine whether these alteration patterns do or do not depend on climate conditions.

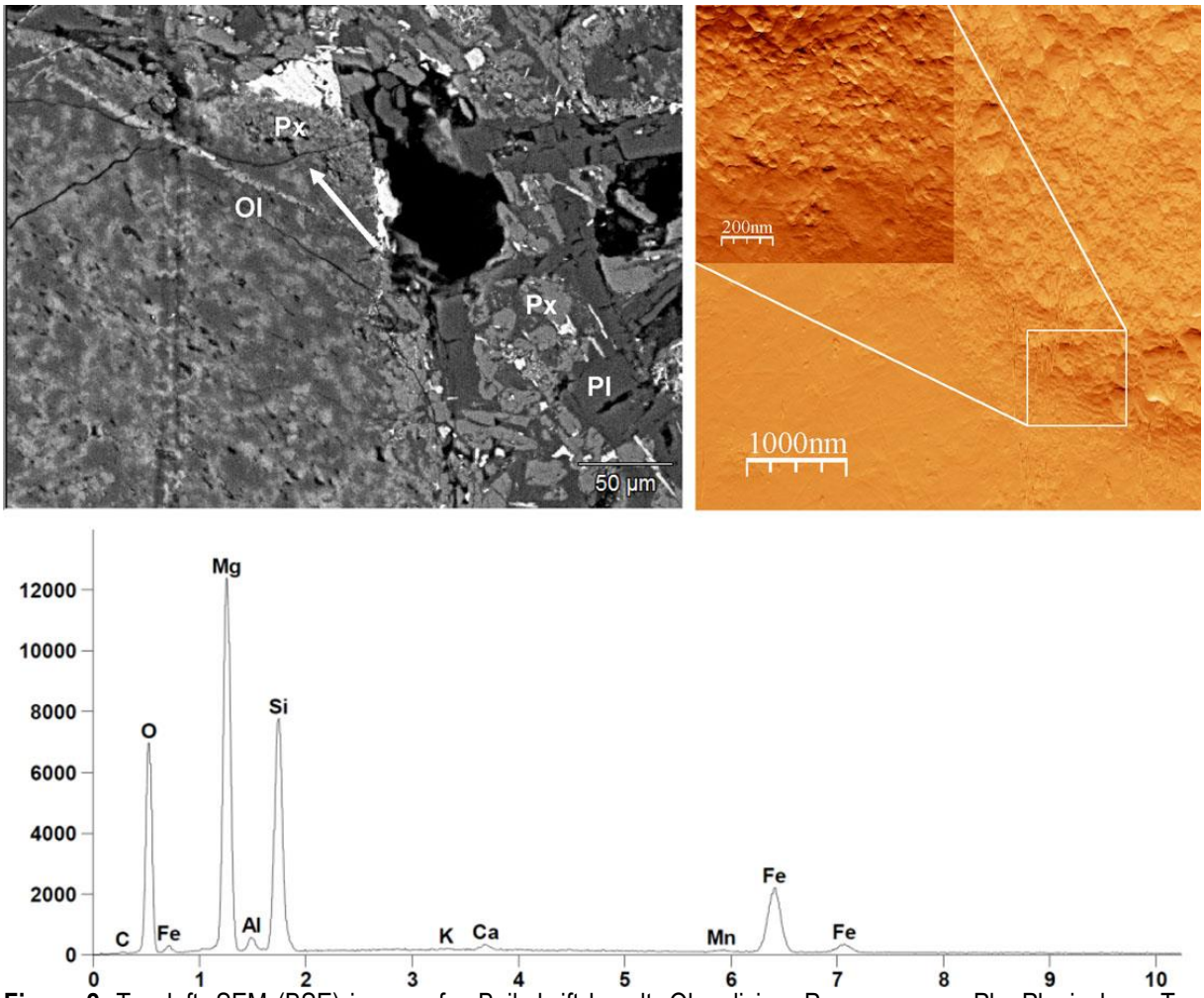

Figure 2. Top left: SEM (BSE) image of a Baikal rift basalt. Ol = olivine, Px = pyroxene, Pl = Plagioclase. Top right: Topography of the Px/Ol boundary (not to be confused with a neighbouring black crack on the SEM image) indicated on by an arrow on the SEM image. Bottom: elemental composition of the pyroxene. Document: Marta Skiścim.

An article describing this new method of rock surface analysis is now in progress.

Research task 3 – Deep-seated gravitational spreading on Mars and Earth

- ***Quantification of topographic ridge spreading*** – The usefulness of GPS measurements to measure small topographic variations is synthesized on Figure 3, which provides a comparison between 16 GPS profiles measured along the same traverse at the top of the Tatra Mountains. WAD1 to WAD4 were measured using the Wide Area Differential GPS (WADGPS) mode. Then the mode was changed to non differential GPS and GPS1 to GPS4 were measured. After GPS4, the device was turned off and on again after thirty minutes. Profiles GPS5 to GPS8 were measured using non differential GPS. The mode was changed again to WAD GPS for profiles WAD5 to WAD8. Horizontal, vertical, and averaged horizontal and vertical profile similarity were quantified by comparing the 16 profiles (Figure 3a). Figure 3 shows

that horizontally (b), there is no correlation between the GPS mode and profile repeatability, with the exception of the measurement subset GPS5-8, which gives a good internal coherence. Restarting the device does not affect the similarity with previous profiles in a significant way. Vertically (c), every profile subset (GPS1-4, WAD1-4, GPS5-8, WAD5-8) is coherent, and repeatability is good, with the exception of the WAD5-8 subset, which for an unidentified reason is significantly different from the other subsets. Combining the horizontal and vertical statistics (d) emphasizes the general internal coherence of each measurement subset, but also the overall measurement variability.

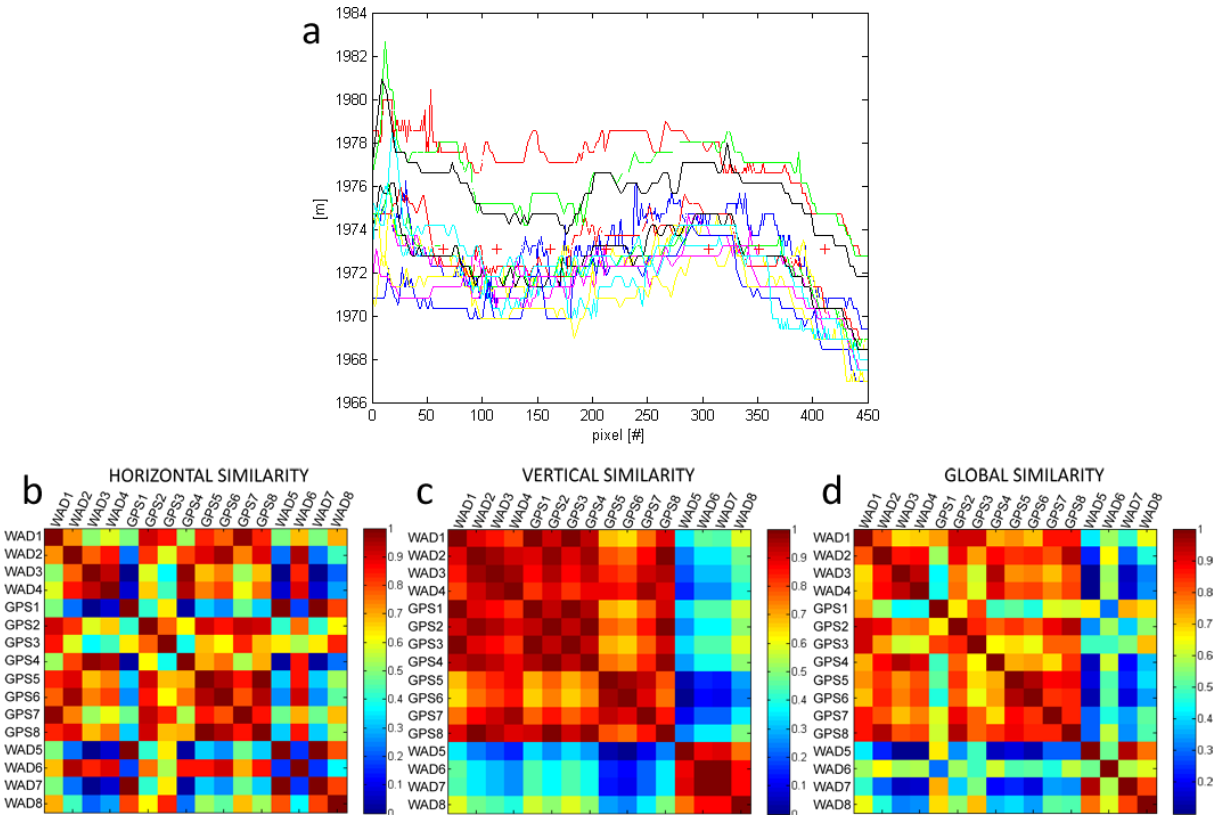

Figure 3. GPS and WADGPS measurement of a slope at the top of the Tatra Mountains. (a) Comparison between the 16 measured topographic profiles; (b) profile similarity in the horizontal direction; (c) profile similarity in the vertical direction; (c) global profile similarity (horizontal + vertical). The similarity index is 1 for for identical profiles, and 0 for totally uncorrelated profiles. Document: Olga Kromuszczyńska/Luigi Castaldo.

Surprisingly,the differential GPS mode does not improve the quality of measurements obtained using a classical GPS mode, and even results in more unstable measurements. this is an important conclusion that is opposite to the expectations, WADGPS corrects GPS signal in real time as a function of atmosphere conditions and is expected to improve profile accuracy and therefore, stability.

A first draft of the article manuscript on GPS use for quantitative geomorphology analysis (Period 6) is now finished.

- ***Numerical simulations*** **–** It was postulated (report for Period 6) that three possible slope destabilisation factors may contribute to gravitational spreading: (1) Glacier loading and unloading; (2) Activation of pre-existing faults, joints, and water circulation; (3) Rock anisotropy resulting from layering. It was shown during Period 7 that the first factor is not enough to produce significant slope destabilisation. However, combined to factor (2) or (3), glacial debuttressing is able to explain the two basic types of observed gravitational slope destabilisation. These results will be presented and discussed in the article.

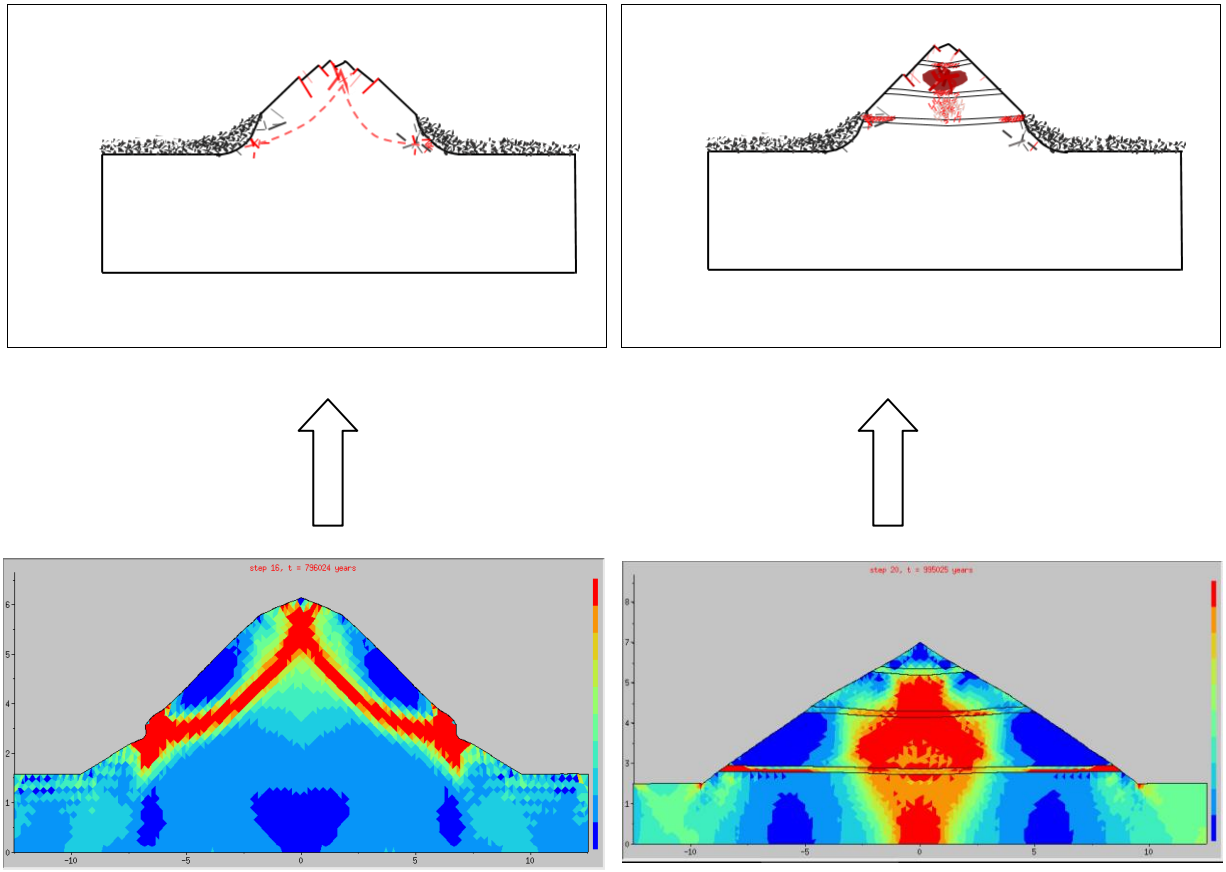

Figure 4. A and B: two tectonic expressions of gravitational spreading observed on Earth and Mars, correlated with results of finite element modelling. C and D: plastic strain when glacial debuttressing is combined with activation of pre-existing faults, joints, and water circulation (C) and with horizontal layering (D). In both cases, slope angle is 30° and friction angle is 15°. Document: Magdalena Makowska.

Research task 4 – Landslides on Mars and Earth

A new article outline was proposed and new figures were prepared. At the same time, more in-depth analysis of landslide propagation was conducted (see Timur Borykov's TEAM member report).

Research task 5 – Thermal properties of Martian landforms

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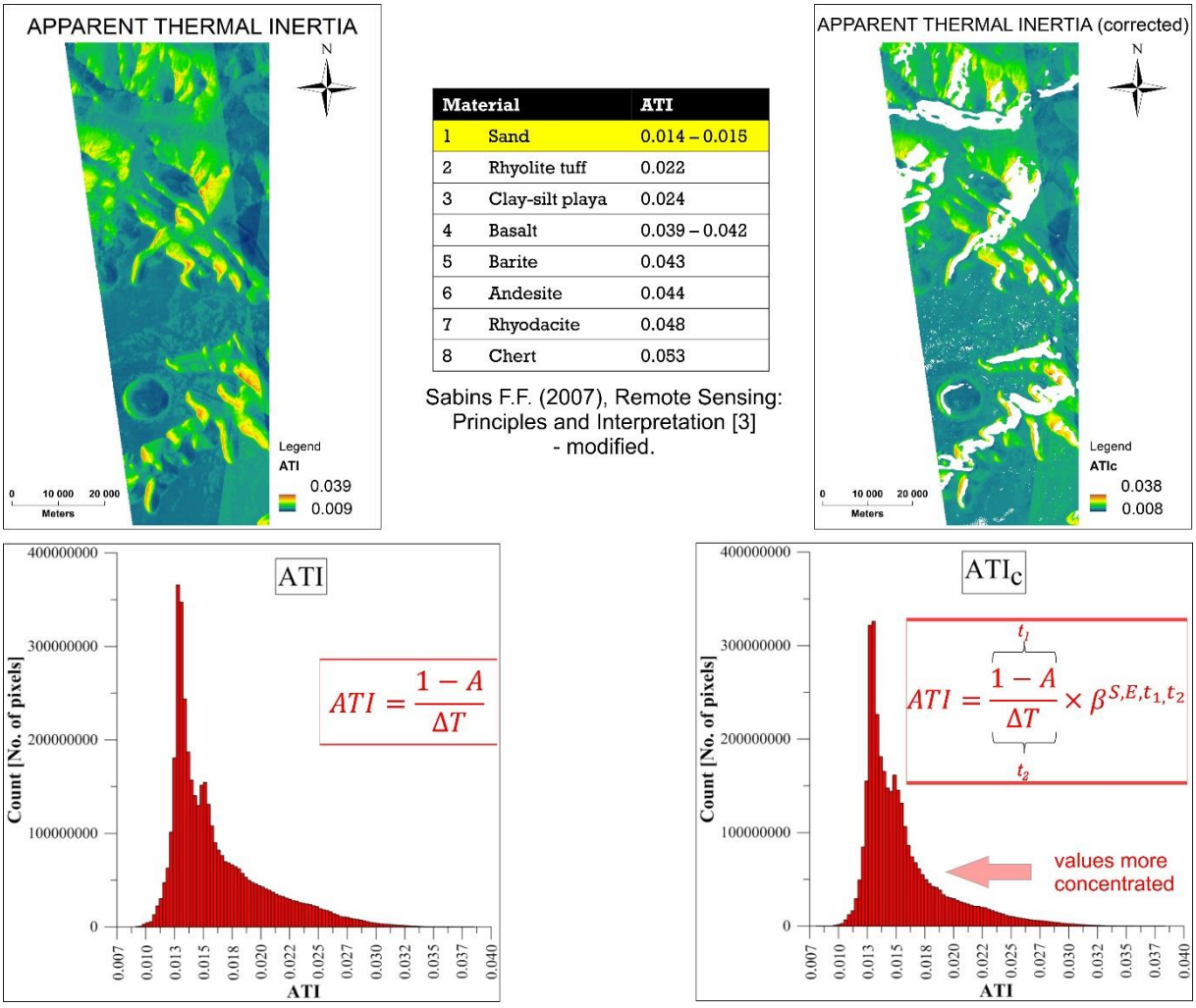
Figure 5 illustrates how taking relief correction (slope value and orientation) into account changes the apparent thermal inertia of surfaces. In the study area, this correction indicates that the abundance of sands is higher than would be predicted if relief correction were not taken into account.



	Material	ATI
1	Sand	0.014 – 0.015
2	Rhyolite tuff	0.022
3	Clay-silt playa	0.024
4	Basalt	0.039 – 0.042
5	Barite	0.043
6	Andesite	0.044
7	Rhyodacite	0.048
8	Chert	0.053

Sabins F.F. (2007), Remote Sensing: Principles and Interpretation [3] - modified.

Figure 5. Maps of apparent thermal inertia (ATI) values for the test area within Valles Marineris region (275.2°E, -7.4°N). Left: ATI map without relief correction. Right: ATI map with relief correction. The ATIc map comprises relief correction β of albedo (A) dependent on slopes (S), aspects (E) and time (t). The results indicate the presence of sand (see the table in the middle of the figure). Relief correction allows to remove errors resulting from the impact of slope exposure and aspect on the amount of incoming solar radiation. It narrows the range of ATI in the study area. Document: Marta Kubiak.

At the end of Period 7, the first version of the thermal data processing scheme was completed.

Research task 6 – Ice processes and landforms

- ***Global Mapping of the dielectric constant of the surface of Mars*** – Calibration of SHARAD data using the north polar cap of Mars was used to infer the presence of ice on the south polar cap. The ice distribution map for the south polar cap (Figure 6) is correlated with geological formations in some areas. In other areas the correlation is loose, reflecting the long-lasting problem of the nature of the south polar cap.

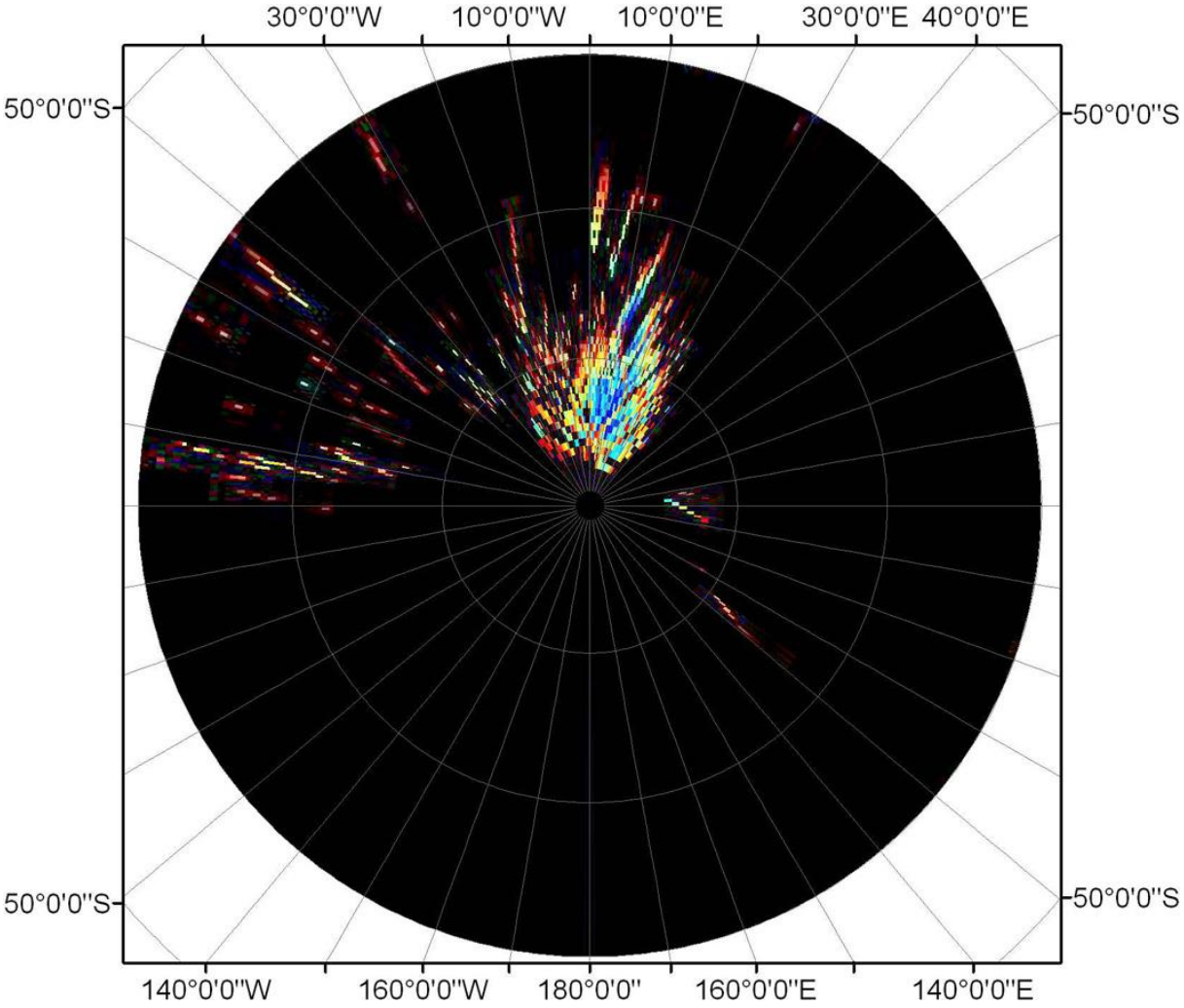


Figure 6. Map of subsurface ice distribution in the south polar cap of Mars after SHARAD data calibration on the north polar cap. Blue areas are the most ice-rich. Document: Luigi Castaldo.

- ***Recurring Slope Linae (RSL)*** – Following the work done by Marion Massé while she was a TEAM postdoc, a new article was published in the journal Planetary and Space Science (Massé et al. 2014, PSS 92, 136–149, doi: 10.1016/j.pss.2014.01.018).
- ***KBO ices*** – Some of the results obtained during Period 5 have been presented during Period 7 to an international conference in Japan (Nna-Mvondo, D., McKay, C.P., Chevrier, V.F., Singh, S., Mège, D., Lemouélic, S., Tobie, G., 2014. Laboratory investigation of Titan's surface compositions: Infrared spectroscopy of amino acids derived from Titan's tholins and tholins in organic solvents. In: Origins 2014, The

International Astrobiology Society and Bioastronomy Joint International Conference, Nara, Japan, 6-11 July 2014).

Period 5 experiments were about infrared spectral characterisation of tholins in methane ice. In the experimental strategy defined during Period 7, the new experiments during Period 8 will refine the experiments conducted during Period 5, using an updated and more accurate methodology. Other experiments will aim at characterising tholin infrared spectra in very cold water ice (~85 K). Both series of experiments, with frozen methane and low-temperature water ice, aim at preparing the interpretation of infrared spectral data that will be obtained by the NASA/New Horizons spacecraft during a Pluto flyby in July 2015. Telescope data suggest that tholins mixed with methane and/or water ice may cover huge areas at the surface of Pluto (Figure 7).

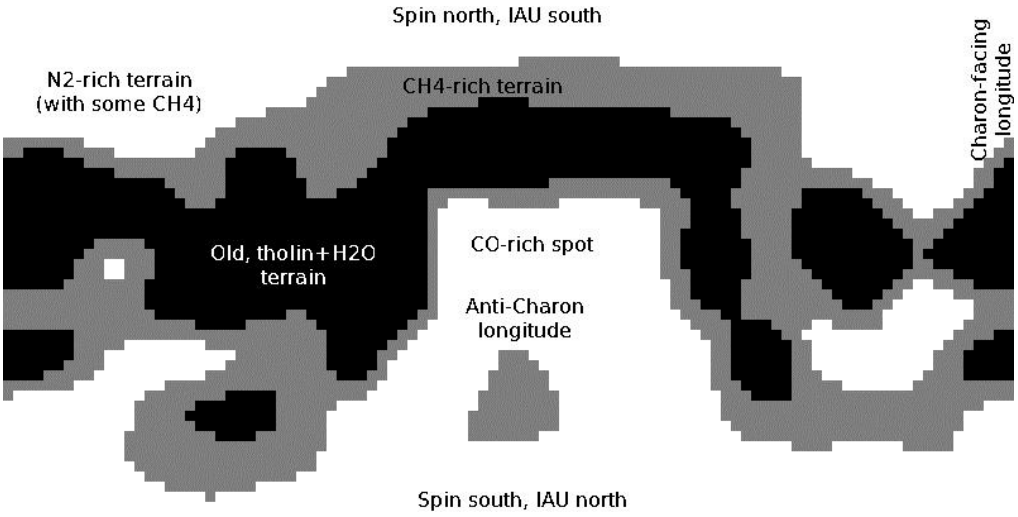


Figure 7. Composition map of the surface of Pluto from telescope observations in the infrared, after Grundy and Buie (2001, Icarus 153, 248–263). Tholins mixed with frozen methane and water ice are expected in the darkest areas of the surface of Pluto, here in grey and black. Pluto flyby by the New Horizons spacecraft on July 14th, 2015 will provide images and hyperspectral data that will revolutionize the knowledge of the surface of Pluto; the experiments conducted in the TEAM project will help in interpreting these datasets in the dark zones of the surface.

2) AWARDS AND DISTINCTIONS

Best Lecturer of the Year (2013/2014) awarded by *Uniwersytet Dzieci* to TEAM PhD student Krzysztof Dębniak and TEAM employee Olga Kromuszczyńska for a lecture: *„Czy ludzie kiedyś zamieszkają na Marsie?”*

3) INFORMATION ON MASTER'S THESES AND OTHER SCHOLARLY DEGREES OR TITLES EARNED BY RESEARCHERS INVOLVED IN THE PROJECT as a result of the realization of the project (concerning team members who are not stipendees).

4) INFORMATION ABOUT PARTNERS

a) Description of the cooperation with foreign partners

Only the partners with which cooperation was active during Period 6 are mentioned below.

1. CO.RI.S.T.A., Napoli, Italy

- *Researchers from foreign partner*: Giovanni Alberti
- *Researchers from TEAM project*: Luigi Castaldo, Daniel Mège, Joanna Gurgurewicz
- *Topic of cooperation*: (1) Dielectric constant mapping of Mars; (2) Interpretation of the deep structure of the Valles Marineris region on Mars from ground penetrating radars (Mars Express/MARSIS, Mars Reconnaissance Orbiter/SHARAD)
- *New or established cooperation*: new
- *Type of cooperation during this reporting period*: SHARAD radar data processing

2. IFSTTAR Bouguenais, France

- *Researchers from foreign partner*: Patrick Richard
- *Researchers from TEAM project*: Timur Borykov, Daniel Mège
- *Topic of cooperation*: Molecular dynamics modeling
- *Type of cooperation during this reporting period*: Development of molecular dynamics code for landslide propagation investigations within the framework of T. Borykov's PhD thesis

3. Institut de physique du globe de Paris, France

- *Researchers from foreign partner*: Anne Mangeney
- *Researchers from TEAM project*: Timur Borykov, Daniel Mège
- *Topic of cooperation*: co-supervision of 1 PhD student
- *New or established cooperation*: Cooperation started in 2006 with co-supervision of another PhD student by A. Mangeney and D. Mège, Antoine Lucas (currently at AIM laboratory, see item #8). With MW and PL: new cooperation (Period 4)
- *Type of cooperation during this reporting period*: Paper writing with A. Mangeney.

4. Istituto Nazionale di Astrofisica, Bologna, Italy

- *Researchers from foreign partner*: Roberto Orosei
- *Researchers from TEAM project*: Luigi Castaldo, Daniel Mège, Joanna Gurgurewicz
- *Topic of cooperation*: (1) Dielectric constant mapping of Mars; (2) Interpretation of the deep structure of the Valles Marineris region on Mars from ground penetrating radars (Mars Express/MARSIS, Mars Reconnaissance Orbiter/SHARAD)
- *New or established cooperation*: since TEAM Period 3
- *Type of cooperation during this reporting period*: Scientific task for new TEAM postdoc Luigi Castaldo, SHARAD radar data processing

5. Paris–Diderot University, AIM Laboratory (Astrophysique, Interactions, Multi-échelles), Paris, France

- *Researchers from foreign partner*: Antoine Lucas
- *Researchers from TEAM project*: Olga Kromuszczyńska, Timur Borykov, Daniel Mège
- *Topic of cooperation*: High resolution stereo-derived digital topography of Mars
- *New or established cooperation*: since 2005
- *Type of cooperation during this reporting period*: Computation of digital elevation models of Valles Marineris for PhD work

6. University of Arkansas, Fayetteville, AR, USA

- *Researchers from foreign partner*: Vincent Chevrier, Sandeep Singh
- *Researchers from TEAM project*: Daniel Mège
- *Topic of cooperation*: Future interpretation of data from the New Horizons mission in 2015
- *New or established cooperation*: new
- *Type of cooperation during this reporting period*: Presentation of results obtained during Period 5 in international conferences. Preparation of the design of a new Pluto simulation chamber at University of Arkansas

7. University of Montpellier, Géosciences Montpellier Lab, France

- *Researchers from foreign partner*: Frédéric Gueydan
- *Researchers from TEAM project*: Magdalena Makowska, Daniel Mège
- *Topic of cooperation*: co-supervision of 1 PhD student
- *New or established cooperation*: since TEAM Period 2
- *Type of cooperation during this reporting period*: Co-advising of PhD student Magdalena Makowska, especially during her two-month stay in Montpellier

8. University of Nantes, Planetology and Geodynamics Lab, France

- *Researchers from foreign partner*: O. Bourgeois, V. Carrère, A. Gaudin, Y. Morizet, D. Nna-Mvondo
- *Researchers from TEAM project*: Joanna Gurgurewicz, Daniel Mège, and Marta Skiścim
- *Topic of cooperation*: (1) geology and mineralogy of Mars, as well as various issues relating to processing and interpretation of remote sensing datasets; (2) ice dynamics of polar dunes; (3) spectral signature of tholins
- *New or established cooperation*: This partnership is established for many years.
- *Type of cooperation during this reporting period*: Work on glacial postglacial geomorphology of the Valles Marineris canyons on Mars (revision of an article which is now in press); laboratory measurements of tholin spectra

9. University of Uppsala, Sweden

- *Researchers from foreign partner*: Greger Thornell
- *Researchers from TEAM project*: Daniel Mège, Joanna Gurgurewicz
- *Topic of cooperation*: Instrumental development for the hopter project (see Section 7.1)
- *New or established cooperation*: new
- *Type of cooperation during this reporting period*: Miniaturized magnetometer design

b) Description of the cooperation with Polish partners – if applicable

1. Polish Academy of Sciences, Space Research Centre, Warsaw

- *Researchers from Polish partner*: Jerzy Grygorczuk, Łukasz Wiśniewski, Hans Rickman, Marek Banaszkiewicz, Agata Nicolau-Kuklińska, and others
- *Researchers from TEAM project*: Daniel Mège, Joanna Gurgurewicz
- *Topic of cooperation*: (1) Highland Terrain Hopper concept development; (2) environment conditions on early Mars
- *New or established cooperation*: established (2010)
- *Type of cooperation during this reporting period*: ERC AdG project preparation, presentation during XVII Lower Silesian Science Festival

2. University of Wrocław, Faculty of Physics and Astronomy, Institute of Experimental Physics

- *Researchers from Polish partner*: Leszek Jurczyszyn, Leszek Markowski
- *Researchers from TEAM project*: Marta Skiścim, Joanna Gurgurewicz, Daniel Mège
- *Topic of cooperation*: nanoscale characterization of surfaces, specifically altered basalt
- *New or established cooperation*: started in Period 1
- *Type of cooperation during this reporting period*: Daily cooperation through PhD student M. Skiścim, who is doing another PhD in this institute

3. Astronika Sp. z o. o., Warsaw

- *Researchers from Polish partner*: Jerzy Grygorczuk, Łukasz Wiśniewski, Marta Tokarz
- *Researchers from TEAM project*: Joanna Gurgurewicz, Daniel Mège
- *Topic of cooperation*: Development of the planetary hopper concept
- *New or established cooperation*: new
- *Type of cooperation during this reporting period*: ERC AdG project preparation

4. University of Wrocław, Faculty of Earth Sciences and Environmental Management, Institute of Geological Sciences

- *Researchers from Polish partner*: Wojciech Bartz
- *Researchers from TEAM project*: all TEAM members
- *Topic of cooperation*: Lower Silesian Science Festival
- *New or established cooperation*: established for several years
- *Type of cooperation during this reporting period*: hosting events prepared by WROONA Group for XVII Lower Silesian Science Festival

5) IS THE PROJECT COMPATIBLE WITH THE HORIZONTAL POLICIES SPECIFIED IN ARTICLES 16 AND 17 OF COUNCIL REGULATION (EC) NO. 1038/2006 (I.E. THE POLICY OF EQUAL OPPORTUNITIES AND ENVIRONMENTAL PROTECTION, AND WHETHER THE PROJECT IS CARRIED OUT IN COMPLIANCE WITH THE PRINCIPLE OF SUSTAINABLE DEVELOPMENT)?

YES ☒ NO ☐

If Community policies are not being followed, please provide an explanation as to what irregularities there have been and what remedial action has been planned and undertaken.

6) IS THE PROJECT BEING REALIZED ACCORDING TO THE SCHEDULE ATTACHED TO THE CONTRACT ?

YES ☒ NO ☐

If the answer is NO, please provide an explanation :

7) ADDITIONAL INFORMATION

Other important information relevant to the project

7.1. TEAM Group activities for space exploration

Figure 8. A Martian hopter jumping in Valles Marineris (background digital elevation models generated from NASA/MRO/CTX images, no vertical distorsion).

- ***The Highland Terrain Hopper project.*** As indicated in the report for Period 6, a project to develop this new concept of locomotion system on planetary bodies and small Solar System bodies was submitted during Period 7. The HOPTER project (Figures 8 and 9) was submitted to the ERC Advanced Grants programme in the categories Earth Sciences/planetary sciences and Robotics. If accepted, the project will be hosted at the Space Research Centre PAS, in collaboration with the ÅngströmLab (University of Uppsala, Sweden), Planetology and Geodynamics Lab (Univ. Nantes, France), and Institut de Physique du Globe de Paris (France).

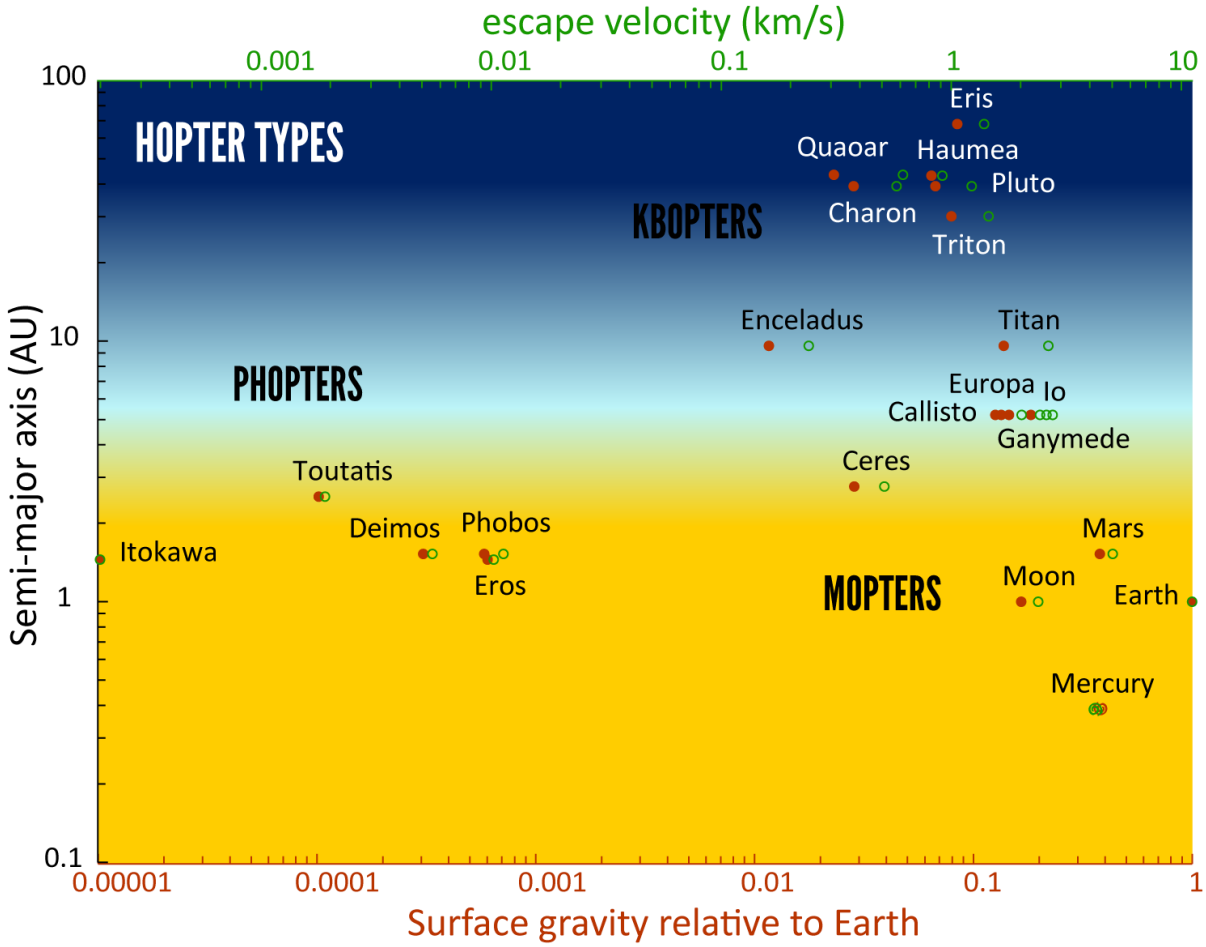


Figure 9. The main hopter categories: mopters (Mars-Moon conditions), phopters (ultra-low escape velocity conditions) and kbopters (ultra-cold conditions requiring special thermal system protection). The ERC AdG project aims at developing 3 prototypes of mopters and test them in Earth conditions. Yellow background indicates where solar batteries can be used.

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7.2. Organisation of science conferences

- **Organisation of the Second conference "Mars – Connecting planetary scientists in Europe" (MPSE 2014)**

This conference (see report for Period 6), held in Warsaw on June 3-5, was chaired by the TEAM project PI, and co-chaired by the TEAM project deputy PI and members of the European Space Agency (ESA), Space Research Centre PAS, the Institute of Geological Sciences PAS, and the Department of Geography and Geology of the University of Poznań. It was sponsored by ESA, SRC PAS, IGS PAS, and Astri Polska.

Conference web site: http://wroona.pl/MPSE2014/home.html

7.3. Public Outreach

- ***XVII Lower Silesian Science Festival*** (Figure 9)

Figure 9. Moments at the XVII Lower Silesian Science Festival in Wrocław (19-20 September 2014). Upper left: lecture *Meeting with a comet*; upper right: illustration of comet degassing; lower left: presentation of CHOMIK, an instrument similar to the MUPUS penetrator built at SRC PAS that will land on comet Churyumov-Gerasimenko as payload of the Philae lander of the ESA/Rosetta mission on November 12, 2014; lower right: 3D photographic exhibition p, comets and Mars.

W ramach „Weekendu z geologią” zespół geologów planetarnych WROONA z Instytutu Nauk Geologicznych PAN, podobnie jak w poprzednich edycjach Dolnośląskiego Festiwalu Nauki, przygotował dwudniowy (19–20 września) cykl wykładów i pokazów, warsztaty oraz wystawę. Tym razem uczestnicy imprezy mieli okazję udać się w podróż do najdalszych zakątków Układu Słonecznego, na spotkanie z kometą.

Wykład "W stronę Marsa i dalej: spotkanie z kometą" (1) składał się z trzech części.

W pierwszej części przybliżono słuchaczom pojęcie komety: jak duża jest kometa, z czego jest zbudowana, skąd pochodzi, jakie zmiany zachodzą w jej wyglądzie podczas obiegu wokół Słońca. Obecni na wykładzie dowiedzieli się, kiedy tworzy się koma czyli otoczka gazowa, kiedy powstają warkocze gazu i pyłu, który z nich tworzy się jako pierwszy. Omówiono też, czym różni się kometa od planetoidy. Zastanawialiśmy się również, czy komety przyniosły wodę na Marsa i na Ziemię. Następnie została przedstawiona historia badań komet, w tym misja Stardust (NASA), która zebrała pył z warkocza komety Wild 2, oraz misja Deep Impact (NASA), która badała kometę Hartley 2 zawierającą wodę o takim samym składzie izotopowym jak woda w ziemskich oceanach. Pierwszą część wykładu zakończył 6-minutowy film, dotyczący zarówno historii badań, jak i natury komet, wraz z komentarzem prowadzącego. Słuchacze oglądali go z uwagą i dużym zainteresowaniem.

Drugą część stanowił quiz, zawierający 15 pytań. Odpowiedzi należało udzielić w oparciu o wiedzę zdobytą podczas pierwszej części wykładu. Uczestnikom bardzo zależało na udzieleniu poprawnych odpowiedzi, które zaznaczali ze skupieniem na przygotowanych przez prowadzących formularzach.

Trzecia część wykładu poświęcona była europejskiej misji Rosetta, która rozpoczęła się w maju 2004 roku. Wyjaśniono, co jest celem misji, skąd pochodzi jej nazwa, a następnie zaprezentowano etapy ponad dziesięcioletniej podróży kosmicznej sondy, która w sierpniu tego roku zbliżyła się do komety, aby nie tylko prowadzić jej obserwacje z orbity, ale przede wszystkim, by wylądować na powierzchni jej jądra i badać panujące tam warunki oraz aktywność komety. Przedstawiono wyniki uzyskane od momentu wejścia sondy na orbitę komety, w tym pierwsze zdjęcia jądra komety wykonane z odległości około 100 kilometrów. Omówiono poszukiwania miejsca lądowania oraz planowany dalszy przebieg misji.

Na zakończenie słuchacze dowiedzieli się o mającym wkrótce nastąpić, problematycznym "spotkaniu" komety Siding Spring z powierzchnią Marsa. Po zakończeniu prezentacji zostały podane poprawne odpowiedzi do quizu, czemu towarzyszyło dużo emocji i wybuchów radości. Wręczono nagrody (zestawy do gry w kometkę) i wyróżnienia (smycze, pinsy), a każdy z uczestników wykładu otrzymał pamiątkowy długopis (materiały WROONA/ING PAN).

Wykład odbył się czterokrotnie. Większość uczestników stanowili uczniowie szkół podstawowych i gimnazjów; w sobotę znaczną część słuchaczy stanowiły osoby dorosłe i rodziny z dziećmi. Na jednym z piątkowych wykładów liczba uczestników przekroczyła planowaną – było 50 osób, z kolei w sobotę dołączyła dodatkowa grupa 20 osób. Na

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wykładach pojawiły się też osoby (w tym dwóch opiekunów grup zorganizowanych), które brały udział w imprezach przygotowanych przez grupę WROONA w poprzednich edycjach festiwalu.

Uzupełnieniem wykładu był pokaz instrumentu CHOMIK (zorganizowany z udziałem Centrum Badań Kosmicznych PAN), służącego do badań właściwości gruntu ciał niebieskich, i będącego późniejszą, zmodyfikowaną i rozbudowaną wersją instrumentu MUPUS, który znajduje się na pokładzie lądownika Philae misji Rosetta. Obydwa urządzenia należą do grupy tzw. penetratorów planetarnych, których budowę omówiono z użyciem posteru. Osiągnięcia Centrum Badań Kosmicznych PAN w zakresie penetratorów planetarnych przedstawione zostały również w formie prezentacji multimedialnej. W ciągu dwóch dni stoisko odwiedziło około 250 osób, w tym 8 grup zorganizowanych ze szkół. Dzieci wykazywały zainteresowanie prototypem instrumentu i chętnie udzielały odpowiedzi na zadawane pytania. Najwięcej pytań ze strony dzieci dotyczyło działania instrumentu: czy jest on zdolny do samodzielnej pracy? w jaki sposób się go kontroluje? jak odkręca się w nim pojemnik na grunt? Wiele pytań dotyczyło również samych misji kosmicznych. Prowadzone dyskusje pozwoliły na uzupełnienie wiedzy o aktualnie prowadzonych misjach i technologiach kosmicznych.

W ramach pokazu "Spotkanie z kometą" (2) wykonywane były uproszczone modele jądra kometarnego. Modele tworzone były na oczach uczestników z suchego lodu, wody, piasku, ziemi, sody oczyszczonej oraz sosu sojowego, reprezentującego materię organiczną. Pod wpływem suchego lodu wszystkie składniki bardzo szybko scalały się, wywołując spektakularny efekt. Można było również obejrzeć modele przygotowane parę godzin wcześniej i zaobserwować zmiany, jakie zaszły w komecie wraz z upływem czasu. Posługując się tymi modelami, prowadzący wyjaśniali, na czym polega aktywność komety. Pokazom towarzyszył poster, na którym przedstawione zostały m. in. budowa, rozmiary i pochodzenie komet. Pokazy dedykowane były przede wszystkim uczestnikom ze szkół podstawowych i gimnazjów. Z uwagi na bardzo duże zainteresowanie przeprowadzono dwa dodatkowe pokazy. Łącznie w pokazach wzięło udział około 120 osób.

Warsztaty "Rzeźbimy Marsa – geomorfologiczne spotkanie w "piaskownicy" (3) przeprowadzono dla dwóch grup: pierwszą stanowiło 16 uczniów szkoły podstawowej, drugą – 20 uczniów gimnazjum. Obie grupy z ciekawością brały udział w modelowaniu procesów kształtujących powierzchnię Marsa, obejmującym tworzenie koryt rzecznych, osuwisk, kraterów impaktowych oraz model lodowca z przedstawionym w formie posteru przebiegiem modelowania w czasie. Zgodnie z oczekiwaniami największe wrażenie zrobiło modelowanie kraterów impaktowych przy użyciu petard. Zaprezentowane eksperymenty pozwoliły uczestnikom lepiej zrozumieć procesy wpływające na ukształtowanie powierzchni Marsa oraz ułatwiły identyfikację poszczególnych form morfologicznych na zdjęciach powierzchni Czerwonej Planety, które posłużyły jako podkład do wykonywanych przez uczestników map geomorfologicznych. Uczniowie szkoły podstawowej z nieco większym entuzjazmem niż gimnazjaliści podeszli

do wykonywania swoich map, na podkładzie ze zdjęć pochodzących z kamery CTX misji Mars Reconnaissance Orbiter.

Powyższym imprezom towarzyszyła wystawa "Oko w oko z kometą" (4). Pierwsza część wystawy przedstawiała obrazy uzyskane podczas obserwacji teleskopowych oraz podczas starszych i młodszych misji kosmicznych. Kolejną część stanowiły najnowsze, spektakularne zdjęcia powierzchni jądra komety wykonane przez kamerę misji Rosetta. Trzecia cześć wystawy związana była z problemem dostarczenia wody na Marsa przez komety podczas Wielkiego Bombardowania. Zaprezentowane zdjęcia powierzchni Marsa przedstawiały struktury świadczące o obecności wody w przeszłości. Większość zdjęć komet oraz wszystkie zdjęcia Marsa stanowiły obrazy stereoskopowe (oglądane z użyciem specjalnych okularów), które cieszyły się największym zainteresowaniem i wywoływały najwięcej emocji, zwłaszcza wśród najmłodszych zwiedzających. W ciągu dwóch dni wystawę odwiedziło łącznie około 450 osób, co jest rekordowym wynikiem na przestrzeni trzech lat. Znaczną część zwiedzających stanowiły grupy i osoby uczestniczące w pozostałych częściach imprezy.

Dodatkowo, na specjalną prośbę uczestników sobotniej części imprez, "odpalono" kilka modeli "wodnej rakiety kosmicznej", przygotowanych przez najmłodszych z pomocą prowadzących. Aktywność ta sprawiła dzieciom dużo radości, co dowodzi, że ten rodzaj atrakcji powinien powrócić w kolejnej edycji "kosmicznych" imprez "Weekendu z geologią".

(1) http://festiwal.wroc.pl/2014/index.php?c=events&year=2014&do=detail&id=11427
(2) http://festiwal.wroc.pl/2014/index.php?c=events&year=2014&do=detail&id=11430
(3) http://festiwal.wroc.pl/2014/index.php?c=events&year=2014&do=detail&id=11433
(4) http://festiwal.wroc.pl/2014/index.php?c=events&year=2014&do=detail&id=11432

Pozostałe adresy:

http://www.festiwal.wroc.pl/2014/index.php?c=article&id=1261
http://www.festiwal.wroc.pl/english/index.php?c=article&id=241

- ***Film***

A 15 min movie (funded by the Atlab project of the RegPot FP7 programme) describing some of the activities of the TEAM group and collaborators has been shot and is available online:

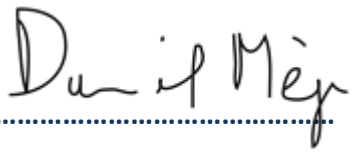
http://www.youtube.com/watch?v=InrLZ9rZoE0&list=UU-eH8ZJXxcOlu5etN-9Cosg

of giving untrue information in a legally significant situation, as stated in article 271 of the Penal Code.

Appendixes to the merit report in the electronic version:
- Project realization indexes (on-line data base),
- Scientific Achievements of the Laureate and Stipendees (on-line data base),
- List of conferences and scientific exchanges,
- merit reports of the Stipendees.

Appendixes to the merit report in the hard copy:
- documents confirming the execution of payments of pension and retirement insurance premiums (for PhD students) – only in paper form.

Date: November 4th, 2014

Laureate Signature  **……**

Institution Stamp…….

TEAM PROGRAMME

LIST OF CONFERENCES AND SCIENTIFIC EXCHANGE ACTIVITIES

Attachment to merit report

Project title:	Mars: another planet to approach geoscience issues		
Reporting period	from 01/05/2014 to 31/10/2014	**Period no.:** 7	
Agreement no.:	TEAM/2011-7/9	holding from 01.09.2011 to 30.06.2015	
LAUREAT:	Daniel MEGE		

ATTENTION: the information given below should regard only the realization of the project in the reporting period indicated above.

1. CONFERENCES

1.1 Participation of persons involved in the realisation of the Project in national and international conferences:

NO.	NAME AND SURNAME	CONFERENCE TITLE	COUNTRY, CITY	DURATION OF STAY (DATES)		TITLE OF THE PRESENTATION	TYPE OF PRESENTATION (ORAL / POSTER)
				FROM	TO		
1.	Magdalena Makowska	Tectonomechanics Meeting	Switzerland, Zurich	05.05.2014	06.05.2014	*Numerical modelling of deep-seated gravitational spreading in Coprates Chasma, Valles Marineris, Mars*	Oral
2.	Daniel Mège, Joanna Gurgurewicz (co-authors)	3rd workshop on penetrometry in the Solar System	AustriaSeggau Castle	19.05.2014	21.05.2014	*Planetary highland hopper*	Oral
3.	Timur Borykov	VII ING PAN Programme Conference	Poland, Baranów Sandomierski	21.05.2014	23.05.2014	*Rectangular and axi-symmetric spreading of initially vertical granular columns under gravity simulated using discrete element method*	Oral
4.	Luigi Castaldo	VII ING PAN Programme Conference	Poland, Baranów Sandomierski	21.05.2014	23.05.2014	*Application of spaceborne sounding radar data to geological problems on Mars*	Oral
5.	Marta Kubiak	VII ING PAN Programme Conference	Poland, Baranów Sandomierski	21.05.2014	23.05.2014	*Thermal properties and their geological correlations in Valles Marineris based on THEMIS data*	Oral
6.	Magdalena Makowska	VII ING PAN Programme Conference	Poland, Baranów Sandomierski	21.05.2014	23.05.2014	*Deep-seated gravitational slope deformation on Mars: mechanical approach*	Oral
7.	Marta Skiścim	VII ING PAN Programme	Poland, Baranów	21.05.2014	23.05.2014	*Alteration features in basalts identified by atomic force microscopy and implications for Mars*	Oral

		Conference	Sandomierski				
8.	Timur Borykov	MPSE 2014	Poland, Warsaw	3.06.2014	5.06.2014	*Landslide propagation: simulations of granular gravitational collapse using molecular dynamics*	Poster
9.	Luigi Castaldo	MPSE 2014	Poland, Warsaw	3.06.2014	5.06.2014	*SHARAD data mapping for surface ice detection*	Oral
10.	Luigi Castaldo	MPSE 2014	Poland, Warsaw	3.06.2014	5.06.2014	*SHARAD data mapping for surface composition detection*	Poster
11.	Krzysztof Dębniak	MPSE 2014	Poland, Warsaw	3.06.2014	5.06.2014	*Detailed CTX-based geomorphologic mapping in western Valles Marineris, Mars*	Oral
12.	Joanna Gurgurewicz	MPSE 2014	Poland, Warsaw	3.06.2014	5.06.2014	*Alteration on Mars: study of near-infrared spectra of terrestrial basalts altered in contrasted climate conditions*	Oral
13.	Olga Kromuszczyńska	MPSE 2014	Poland, Warsaw	3.06.2014	5.06.2014	*Ornak (Tatra Mountains) as a terrestrial analogue for Martian deep-seated gravitational spreading (sackung)*	Oral
14.	Marta Kubiak	MPSE 2014	Poland, Warszawa	3.06.2014	5.06.2014	*Thermal data processing for high-resolution mapping of Valles Marineris, Mars*	Poster
15.	Magdalena Makowska	MPSE 2014	Poland, Warsaw	3.06.2014	5.06.2014	*Mechanical modelling of deep-seated gravitational spreading in Valles Marineris, Mars*	Oral
16.	Daniel Mège	MPSE 2014	Poland, Warszawa	3.06.2014	5.06.2014	*Origin of the observed deformation in Valles Marineris: an equatorial fossilised glacier system and no regional tectonics*	Oral
17.	Daniel Mège	MPSE 2014	Poland, Warszawa	3.06.2014	5.06.2014	*Exploration of Mars and Phobos with Galago, the Highland Terrain Hopper*	Poster
18.	Daniel Mège and Joanna Gurgurewicz (co-authors)	MPSE 2014	Poland, Warsaw	3.06.2014	5.06.2014	*Technological features and concept of planetary highland terrain hopper*	Oral
19.	Marta Skiścim	MPSE 2014	Poland, Warsaw	3.06.2014	5.06.2014	*Examination Of Alteration Features In Basalts Outcropping In Extreme Climate Conditions And Implications For Mars*	Oral
20.	Daniel Mège*	Late Heavy	Poland,	23.06.2014	26.06.2014	*The Martian cryosphere and its geologic evolution*	Oral

		Bombardment Workshop	Gdynia				
21.	Daniel Mège (co-author)	International Astrobiology Society and Bioastronomy Joint International Conference	Japan, Nara	6.07.2014	11.07.2014	*Laboratory investigation of Titan's surface compositions: Infrared spectroscopy of amino acids derived from Titan's tholins and tholins in organic solvents*	Poster
22.	Joanna Gurgurewicz	40th COSPAR Scientific Assembly	Russia, Moscow	2.08.2014	10.08.2014	*The Highland Terrain Hopper: a new locomotion system for exploration of Mars and other low-gravity planetary bodies*	Poster
23.	Timur Borykov	8th Int Conf on Mars	USA, Pasadena, California	14.07.2014	18.07.2014	*Discrete element modeling of landslide dynamics: the influence of friction and aspect ratio*	Poster
24.	Luigi Castaldo	8th Int Conf on Mars	USA, California, Pasadena	14.07.2014	18.07.2014	*Ice Detection over Martian Surface Using Sharad Data*	Poster
25.	Joanna Gurgurewicz	8th Int Conf on Mars	USA, California, Pasadena	14.07.2014	18.07.2014	*Can information on the Martian alteration conditions be inferred from near-infrared spectra?*	Poster
26.	Marta Kubiak	8th Int Conf on Mars	USA, California, Pasadena	14.07.2014	18.07.2014	*High-resolution apparent thermal inertia mapping of Valles Marineris (Mars)*	Poster
27.	Daniel Mège	8th Int Conf on Mars	USA, California, Pasadena	14.07.2014	18.07.2014	*Exploring Martian mountains with Galago, the highland terrain hopper*	Poster
28.	Marta Skiścim	8th Int Conf on Mars	USA, California, Pasadena	14.07.2014	18.07.2014	*Atomic force microscopy as a tool to identify alteration features in basalts exposed to contrasted climate conditions and implications for Mars*	Poster
29.	Krzysztof Dębniak	European Planetary	Portugal, Lisbon	06.09. 2014	13.09.22014	*Geomorphologic studies on western Valles Marineris, Mars – landforms and processes*	Poster

		Science Congress					
30.	Olga Kromuszczyńska	European Planetary Science Congress	Portugal, Lisbon	06.09. 2014	13.09.22014	*Geometric comparison of deep-seated gravitational spreading features on Mars (Coprates Chasma,Valles Marineris) and Earth (Ornak, Tatra Mountains).*	Poster
31.	Magdalena Makowska	European Planetary Science Congress	Portugal, Lisbon	07.09.2014	12.09.2014	*Mechanical approach on Deep-seated Gravitational Spreading in Coprates Chasma, Valles Marineris, Mars*	Oral

** Invited talk*

2. SCIENTIFIC EXCHANGE – other than conferences

2.1. Official international trips:

NO.	NAME AND SURNAME	SCIENTIFIC UNIT	COUNTRY, CITY	DURATION OF STAY		AIM OF THE STAY
				FROM	TO	
1.	Daniel Mège	Planetology and Geodynamics Lab	France, Nantes	18.06.2014	22.06.2014	Work with TEAM collaborators
2.	Daniel Mège	Planetology and Geodynamics Lab	France, Nantes	29.09.2014	05.10.2014	Work with TEAM collaborators
3.	Daniel Mège	Southwest Research Institute	USA, Boulder, Colorado	26.10.2014	01.11.2014	New Horizons Science Team meeting

2.2. *Official domestic trips:*

NO.	NAME AND SURNAME	SCIENTIFIC UNIT	COUNTRY, CITY	DURATION OF STAY		AIM OF THE STAY
				FROM	TO	
1.	Daniel Mège	-	Poland, Gdynia	22.06.2014	26.06.2014	Invited talk, Late Heavy Bombardment Workshop (NCN project)
2.	Daniel Mège	CBK PAN	Poland, Warsaw	17.09.2014	17.09.2014	Polish Mars consortium project; ERC Advanced Grant project

Guests invited in connection with the realization of the Project (national and / or foreign):

NO.	NAME AND SURNAME	SCIENTIFIC UNIT	COUNTRY, CITY	DURATION OF STAY		AIM OF THE VISIT
				FROM	TO	
1.	Patrick Richard	IFSTTAR	France, Nantes	26.05.2014	27.05.2014	Discussion about PhD thesis of TEAM student Timur Borykov
2.	Anne Mangeney	IPGP	France, Paris	27.05.2014	27.05.2014	Discussion about PhD thesis of TEAM student Timur Borykov
3.	Jonathan Besserer	University of California	USA, Santa Cruz	11.05.2014	13.05.2014	TEAM seminar: Enceladus: An active tiny moon TEAM seminar: Enceladus and the Moon: Baking soufflés on planetary surfaces
4.	Agata Nikolau-Kuklińska	SRC PAS	Poland, Warsaw	18.09.2014	20.09.2104	Presentation of the Polish instrument *CHOMIK* (penetrator onboard the Phobos-Grunt spacecraft) from SRC PAS at the Lower Silesian Science Festival event organised by the TEAM members
5.	Kerry Leigh	Technical University Munich	Germany, Munich	25.09.2014	25.09.2014	TEAM seminar: Stress changes and geomorphologic evolution in alpine valleys
6.	Petr Brož	Institute of Geophysics,	Austria, Prague	22.10.2014	23.10.2014	TEAM seminar: Small-scale volcanoes on Mars: types, distribution and their morphology

		ASCR; Charles University				