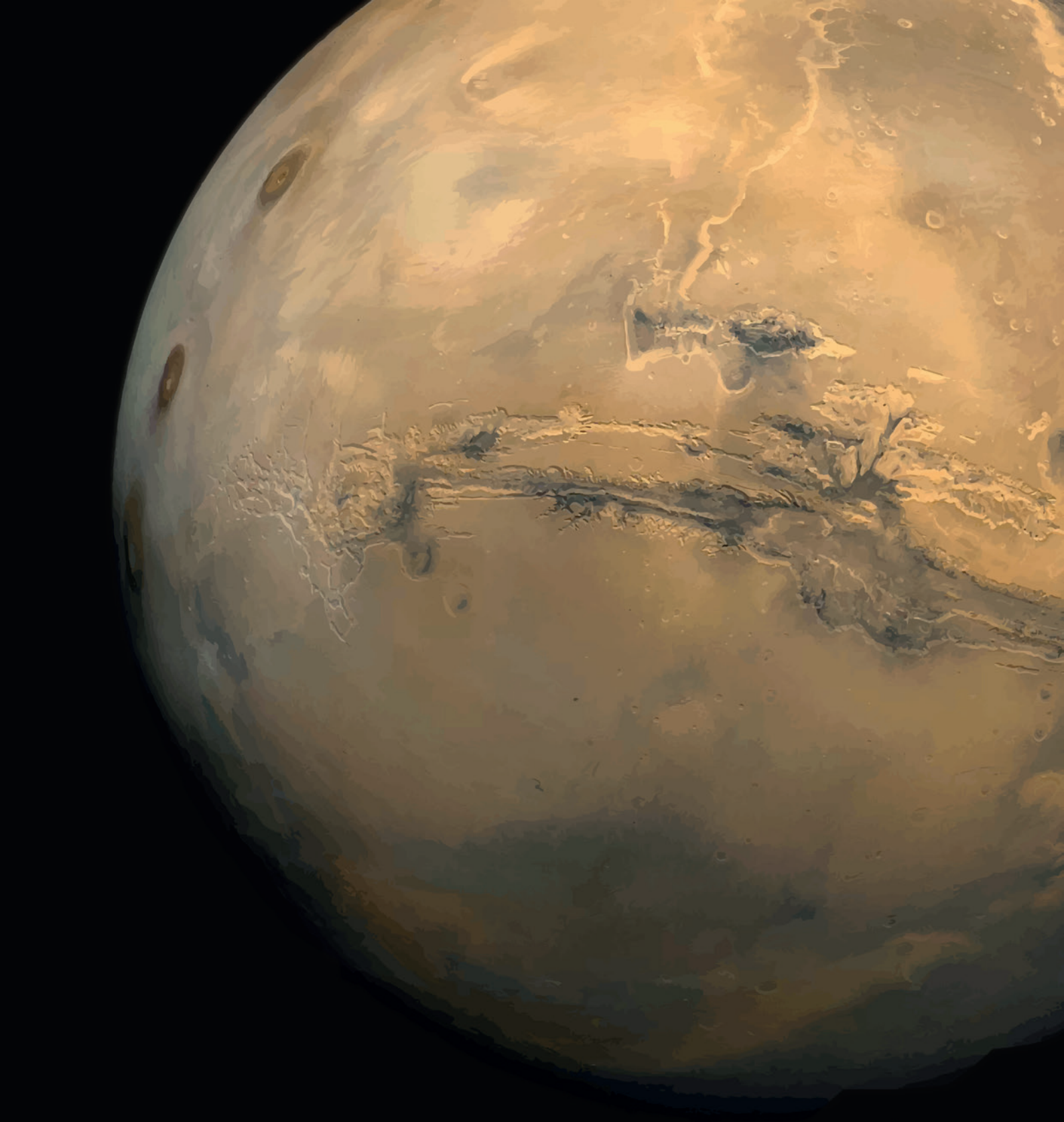

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18.10.2019

# Pierwsze Ogólnopolskie Seminarium Marsjańskie

**BOOK OF ABSTRACTS**

UNIWERSYTET JAGIELLOŃSKI W KRAKOWIE

Wydział Fizyki, Astronomii i Informatyki Stosowanej

www.mars.if.uj.edu.pl

18.10.2019

# Pierwsze Ogólnopolskie Seminarium Marsjańskie

## *Planetary geology activities on the Wroclaw side of the Space Research Centre*

**Prof. Daniel Mège CBK PAN**

A summary of the activity of our group is presented. The FNP/TEAM/EXOMHYDR project studies the hydrothermal activity of the large volcanic regions of Mars, in connection with the instrument teams of the ExoMars Trace Gas Orbiter mission. It is complemented by the NCN/OPUS/V-MACS project, a magmatic and tectonic study of the Valles Marineris canyon system; the Europlanet/TA1/Danakil Depression hydrothermal activity project, a terrestrial analogue study; and the MIRORES concept, providing SRC engineers with the scientific expertise for a far infrared spectrometer that would be specifically dedicated to the study of distribution of sulphides at the surface of Mars. SOSYPOL is a spectroscopic database of basalts and tholins included into the Europlanet/SSHADE infrastructure. The ESA-funded GALAGO project aims at building a prototype of all-terrain hopping robot dedicated to investigations of the lunar surface, in which we provide scientific expertise to Astronika, the main contractor.

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# Pierwsze Ogólnopolskie Seminarium Marsjańskie

## *Martian scientific projects in Krakow*

**Dr Joanna Kozakiewicz OA UJ**

In this presentation, we summarize the aims and the results of three Martian projects currently carried out in Krakow by three interdisciplinary research groups from the Jagiellonian University, and the AGH Science and Technology University. The aim of the first project is to develop a novel technique for the Martian subsurface tomography using electromagnetic waves of extremely low frequency (ELF). In the second project, we focus on determination of aeolian transport in equatorial regions on Mars using experimental and numerical simulations as well as investigating Martian analogs on Earth. The aim of the last project is to provide and develop IT tools for automatic processing and analysis of data acquired during Mars missions, which is crucial for all projects as the number of available data increases significantly.

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Pierwsze Ogólnopolskie Seminarium Marsjańskie

## *Active magmatism in Tharsis on Mars*

**Dr Jakub Ciążela CBK PAN**

[POSTER]

Vanishing magnetic field and the absence of plate motion led us believe the Martian core have solidified too early to sustain late magmatism. However, young volcanic rocks (2.4-250 Ma) are ubiquitous on the Mars surface and atmospheric CO2 isotopic signatures indicate recent volcanic degassing. Here, we provide evidence for active magma chambers on Mars. We modelled magma fluxes in the two largest Martian igneous provinces, Tharsis and Elysium, and found the largest volcanoes of Tharsis still to erupt ~150 km3/Myr on a long term. We predict the largest active magma reservoirs to feed Olympus Mons and the Tharsis Montes, which with the current volcanic dormancy implies ongoing hydrothermal activity. Active hydrothermal gases would be consistent with inferences from the Thermal Emission Spectrometer and could be sporadically identified by the Trace Gas Orbiter spectrometers of ExoMars in the future.

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# Pierwsze Ogólnopolskie Seminarium Marsjańskie

## *Thermal mapping of the martian surface*

**Dr Marta Ciążela CBK PAN**

[POSTER]

Thermal data usefully complement other datasets used in geological interpretations, with the capability of mapping the distribution of rock types of distinct thermophysical properties, the activity and diversity of slope processes, the distribution of shallow ice and its seasonal variations, or variations of dust thickness. We illustrate some of these capabilities. Using THEMIS data, the apparent thermal inertia (ATI) and differential apparent thermal inertia (DATI) methods make it possible to map thermal inertia of the surface of Mars using available data only, with no data interpolation in contrary to conventional thermal inertia mapping, and is particularly efficient at mapping thermophysical contrasts on slopes > 10°. Using a database of 1,424,366 surface temperature retrievals from PFS distributed over 18438 Mars Express orbits covering 9 martian years (Ls=331.18° of MY 26 to Ls=21.17° of MY 34), seasonal surface changes can be tracked and characterised, for instance in polar caps

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## *Structural and compositional mapping of shear zones in northern Valles Marineris*

**Dr Joanna Gurgurewicz CBK PAN**

[POSTER]

We report the existence of NE-SW oriented dextral brittle-plastic shear zones exposed in the deepest parts of Ophir Chasma and Hebes Chasma. Structural and composition maps are presented based on HiRISE and CRISM observations. The structure of the shear zones is interpreted in terms of kinematics. Their age and development is put into the broader geologic context of Valles Marineris. Their orientation and kinematics is consistent with Valles Marineris extension perpendicular to the main chasmata. Shear zone composition and geometry place constraints on the deformation depth and the erosional processes that make possible their current exposure at the surface.

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# *New possibilities for data analysis on board of satellites and space crafts*

**Dr Piotr Korcyl IF UJ**

[POSTER]

In this poster we present computational possibilities offered by modern FPGA devices. We propose to use them on board of satellites and space crafts for real-time data analysis using machine learning techniques thus reducing the required bandwidth in craft-control center data transmission. We present some publicly available information related to the resistance to temperature changes as well as programming methods which allow to reduce radiation induced errors.

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## *Aeolian sediments in Meridiani Planum*

**Dr Joanna Kozakiewicz OA UJ**

[POSTER]

The Opportunity rover, during its 15 years long mission, acquired thousands of images of Martian aeolian forms and material in Meridiani Planum. In this work, we present results of comparison of granular materials (sand and small gravels) deposited along the traverse of the Opportunity rover, from its start in the Eagle Crater to its end in the Endeavour Crater. The microscopic data from the MI instrument were analyzed using the PADM algorithm, a semi-automatic tool that enables studying the size and shape of grains in digital images.

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# Pierwsze Ogólnopolskie Seminarium Marsjańskie

## *Thrilling complexity of Valles Marineris evolution revealed by structural mapping*

**Prof. Daniel Mège CBK PAN**

[POSTER]

In spite of intense erosion, the Valles Marineris region still bears evidence of tectonic deformation, some of it dating back to the earliest stages of trough system development, if not earlier. Ongoing structural mapping reveals an amazingly rich polyphase tectonic history, in which brittle shears (Hydrae Cavus) echo brittle-plastic shear zones (Ophir Chasma), crustal folds turn to volcanic complexes (Ophir Planum), dyke swarms denote chasma-parallel dilation, but also oblique and perpendicular dilation (Coprates and Ophir chasmata) kinematically consistent with overlooked normal faulting on the Valles Marineris plateau, and compressional wrinkle ridges follow narrow grabens. An overview of this diversity is presented.

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# *Late Amazonian parasitic cones of giant Tharsis volcanoes give insight into regional magmatic plumbing system*

**MSc Bartosz Pieterek IG UAM**

[POSTER]

Although Tharsis is the largest volcanic province on Mars, the origin of numerous small volcanic cones in this area is not yet fully explained. Characterizing the system of small volcanic cones in terms of space and time is essential to determine whether or not they are geologically associated with the giant Tharsis volcanoes. To remedy this gap we analyzed (1) the spatial distribution of small volcanoes, (2) orientation of volcano summit craters or central fissure vents, as well as dating to estimate (3) surface age of their flanks. We identified at least five parasitic cone systems related to the giant Tharsis volcanoes (Olympus Mons, Alba Mons, and three Tharsis Montes volcanoes: Arsia Mons, Pavonis Mons, Ascraeus Mons). These systems have been fed by recent and potentially still active magma chambers connected to a system of radial dikes as controlled by regional stress regime and magma pressure related to magma supply.

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# *Dunes in the north-western part of Gale Crater*

**MSc Rafał Stec ING UJ**

[POSTER]

The poster presents an outline of the dune analysis in the north-western part of the Gale crater. The aim of this work is to analyze a spatial planning of dunes, their morphology (shape) and dimensions. The distribution of wind directions in the dune field was determined in the NE-NW range, using the ArcMap and MS Excel program. Analysis of the data measured lead to conclusion that wind direction modelling dunes has been changing in accordance to daily shadow zone wandering, cast during the day by the central mound and the crater edges.

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## *Hydrae Cavus: a tectonic basin in the Valles Marineris region*

**MSc Pierre-Antoine Tesson CBK PAN**

[POSTER]

Marineris is probably composed of large sheared tectonic blocks that moved relative to each other while Valles Marineris was being stretched perpendicular to its main, ESE trend. We have sought other evidence of NE-SW shears in the vicinity of Valles Marineris, and found it at Hydrae Cavus, a 20 by 60 km, 1600 m deep basin located 130 km east of Candor Chasma. Using available data, we carried out new mapping of the tectonic features in and around the depression. We interpret Hydrae Cavus as a pull-apart basin, with a stretching direction N-S and a strike-slip movement along ENE-WSW. Morphology of the basin indicates a dextral movement. The basin kinematics is consistent with the kinematics of the brittle-plastic shear zones in the Hebes and Ophir Chasma.

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## *Volcanic system of Isidis Planitia*

**Dr Natalia Zalewska CBK PAN i SB Łukasiewicz – IL**

[POSTER]

In the 1970s, data sent by the Viking probes showed fields of cones of unknown origin on images from the northern areas of Mars. Cones on Isidis attract special attention of scientists because it is not known why they are arranged in a kind of linear structure with a characteristic arched shape Arched cone structures called „thumbprint terrains" on Isidis are being described in the literature for years, but definitive interpretation of the mechanism forming these cones is yet to be discovered. The reason for the shape of these linear structures has not been explained. There are many hypotheses about the genesis of these linear cones, from postglacial forms, through ash degassing. We suspect that cones may be formed similarly to Icelandic volcanic system from the Reykjanes Peninsula, where the pressure of magmatic chamber causes the crust to tear in a characteristic linear and concentric way producing dikes. Another considered phenomenon is volcanic mud emanating from the crevices.

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i Informatyki Stosowanej

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DTP: Nikodem Frodyma