SYLLABUS

1. Course title: **Planetary geology and natural resources of the Moon and Mars**

2. Course coordinator: **dr Jakub Ciążela**

3. Course lecturer: **dr Jakub Ciążela**

4. Field, type and level of studies, year of study: **geology, full-time doctoral studies, all years of study**

5. Course character: **elective-compulsory lecture** (see point A.1.2 in the *Curriculum of the full-time Doctoral Programme* – at least 4 ECTS points have to be gained during the studies)

6. Teaching method: **traditional** (personal contact with the lecturer)

7. Language: **English**

8. Course type and number of hours: **lecture (6 h) + exercises (9 h)**

9. Estimated amount of student's independent work: **35 h**

10. Total workload and number of ECTS points: **50 h, 2 ECTS**

11. Short description and the main focus of the course:
The course aims to provide students with a basic understanding of geological procecesses on other terrestrial bodies in the solar system. The special focus will be on planetary resources could be transported from the Moon to the Earth, or used in situ both on the Moon and Mars.

The course consists of three lectures:

1. Introduction to cosmochemistry and planetary geology
2. Geology of the Moon and its resources
3. Geology of Mars and its resources

And exercises:

Exercises and the project will be mostly related to geological mapping, surface dating, and mineralogical interpretation of infrared spectra (mostly CRISM instrument) from Mars in the context of ore prospecting. Facultatively, few projects may be related to the description of martian meteorites in thin sections with a focus on ore minerals.

12. References:

- Mangold, N., Baratoux, D., Witasse, O., Encrenaz, T., & Sotin, C. (2016). Mars: a small terrestrial planet. The Astronomy and Astrophysics Review, 24(1), 1-107.
- Jolliff, B. Science and Exploration of the **Moon**: Overview. Oxford Research Encyclopedia of Planetary Science. Available at: https://oxfordre.com/planetaryscience/view/10.1093/acrefore/9780190647926.001.0001/acrefore-9780190647926-e-19.
- Abbud-Madrid, A. **Space Resource Utilization**. Oxford Research Encyclopedia of Planetary Science. Available at:

https://oxfordre.com/planetaryscience/view/10.1093/acrefore/9780190647926.001.0001/acrefore-9780190647926-e-13.
- **CRISM** Science Oparation Centre, 2019. The MICA files. p. 111. Available at: http://crism.jhuapl.edu/data/mica/MICA_Files_2019_v1p.pdf

13. Educational outcomes:
KNOWLEDGE: cosmochemical processes in the Solar System, geological characterization of various terrestrial bodies in the Solar System, geological and resources of the Moon and Mars.
PRACTICAL SKILLS: detection of geological structures on the Mars surface using the CTX and HiRISE Mars Reconaissance Orbiter images. Geological mapping of these structures in a GIS software, for example ArcGIS, and dating these structure using CraterTool and CraterStats tools. Identification of hydrothermal minerals using data from the CRISM near infrared spectrometer and the ENVI software

14. Evaluation of the educational outcomes: Written test + written report on a practical case given individually to each student

15. Criteria to complete the course: 30% - course attendance and activity, 35% - test score, 35% - the quality of the report