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Geological trainings for analogue astronauts: Lessons learned from MARS2013 expedition, Morocco

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1. Introduction

The Austrian Space Forum (OeWF) is a national organisation for space professionals and space enthusiasts. In collaboration with internal partner organisations, the OeWF focuses on Mars analogue research with their space volunteers and organises space–related outreach/education activities and conducts field tests with the Aouda.X and Aouda.S spacesuit simulators in Mars analogue environment. The main project of OeWF is called “PolAres” [1].

As the result of lessons learned from the Río Tinto 2011 expedition [4], we started to organise geological training sessions for the analogue astronauts. The idea was to give them basic geological background to perform more efficiently in the field. This was done in close imitation of the Apollo astronaut trainings that included theoretical lectures (between Jan. 1963 – Nov. 1972) about impact geology, igneous petrology of the Moon, geophysics and geochemistry as well as several field trips to make them capable to collect useful samples for the geoscientists on Earth [3] [5].

In the last year the OeWF has organised three geoscience workshops for analogue astronauts as the part of their “astronaut” training. The aim was to educate the participants to make them understand the fundamentals in geology in theory and in the field (Fig. 1.). We proposed the “Geological Experiment Sampling Usefulness” (GESU) experiment for the MARS2013 simulation to improve the efficiency of the geological trainings. This simulation was conducted during February 2013, a one month Mars analogue research was conducted in the desert of Morocco [2] (Fig. 2.).

2. Methods

2.1 Geological Training Sessions

In the End of March 2012 geological trainings did start in Austria. First, we organised lectures, which were related to the fundamentals of geology, such as mineralogy, petrology, physical and structural geology as well as observation methods in the field. These presentations focused on the description of the outcrops from the distance to closer view and aimed to provide the “big picture”, which is useful in the field. Second, we conducted two-day field trips in Italy (Fig. 1.) and in the Northern Calcareous Alps in Innsbruck, Austria to practice geological field observations in a “real” environment. After the training we finalised a preliminary version of the “Geological Manual”.

Figure 1: OeWF analogue astronaut is using hammer with the gloves of Aouda.X spacesuit simulator in Blaetterbach canyon, Italy.

2.2 MARS2013 – GESU experiment

In the desert of Morocco, four analogue astronauts underwent separate EVAs (Extra Vehicular Activity) along the same pathway (e.g. valley) to collect samples each time they find a new geological layer or something interesting for the scientists in the Mission Support Centre in Austria. Based on the geological trainings, suit-testers should have been able to recognise different type of rocks (sedimentary, igneous or metamorphic rock) on the field or they should have been able to realise

different appearing rocks. The suit-testers have diverse backgrounds (e.g. geophysics, physics, pilot, biology), and in March, August and October 2012 they received the same geological training.
Using the results of GESU experiment we were analysing the personal skills and decision working flow during the implementation of the procedure and which skills were more influencing than others.

Figure 2: GESU experiment with Aouda.X spacesuit simulator. Photo: Katja Zanella-Kux

3. Discussion & Conclusion

The GESU experiment was implemented by four analogue astronauts with different success. The observation and description style of each analogue astronaut was different, but they had similar decision patterns in 40%.

The quantity of the geological training sessions was not enough to implement complex geological field work for future analogue missions, thus we need to continue these trainings. The astronauts were not capable enough to describe the different geological features in detail in order to be understood by professional geologist. Future human Mars exploration definitely needs trained geologists among the crew members.

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