

# Master Thesis (MA, 30 ECTS)

## Stability Analysis of Martian Lava Tubes

### Description

A crewed mission to Mars is one of the most ambitious challenges of the 21<sup>st</sup> century. Besides the search for traces of life, Mars missions shall characterize the (paleo-)environment, including geotechnical investigations that consolidate our understanding about the planet's (sub)surface. They also serve as a basis for future construction projects on Mars, also in hindsight of future settlements. As part of the logistical preparations for such a mission, it is necessary to think about possible locations for a human base on the red planet. Such a location must provide shelter from cosmic radiation, micro-meteorites, winds, dust storms, high temperature fluctuations etc. Lava tubes (i.e. natural, tunnel-shaped cavities within the planet) are considered to be prime locations for human habitation.

This thesis' goal is to conduct a stability analysis of Martian lava tubes under consideration of the special circumstances of the planet (i.e. lower gravity, extreme weather conditions...). Questions that should be answered are: How big can Martian Lava tubes theoretically be? What is the minimum stable thickness of a lava tube's roof (in relation to the tube's diameter)? Which lava tube - geometries are the most stable ones?

### Workflow:

1. Literature research concerning the formation, shape, rock strength properties and stability of terrestrial lava tubes.
2. Adapting a typical workflow of numerical stability analysis for the special circumstances of Mars.
3. Conducting stability analyses for various Martian lava tube scenarios.
4. Evaluation and interpretation of the results.

The study will be done in close cooperation with the Austrian Space Forum.



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