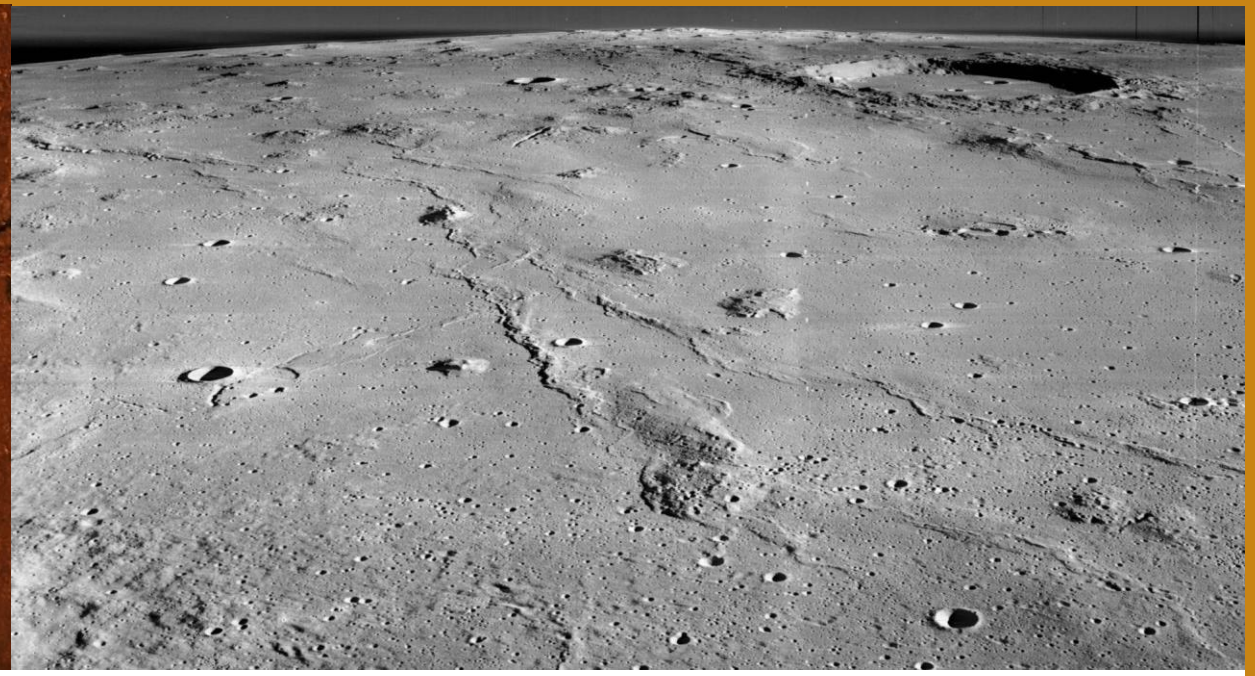

Mini Grant

ANTHELIA - ANalysis of illumination and THermal Environment of Lunar pIts and lavA tubes

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Stato di avanzamento, Novembre 2023

ANTHELIA - ANalysis of illumination and THermal Environment of Lunar pIts and lavA tubes

Objectives: this research aims to characterize the complex illumination and thermal conditions within lunar pits and lava tubes to

- support future lunar missions,
- improve our understanding of lunar cave thermal behavior,
- investigate the link between their size, morphology, and latitude with the thermal behavior,
- study the thermal stress they undergo as a result of temperature changes,
- investigate the extent of any temperature changes to identify what the depth of a tunnel might be to ensure a thermally stable environment,
- constrain theories about lunar vulcanism and lava-flow thermodynamics,
- study the possible presence of water ice by investigating how temperature, geometry, and latitude affect its stability.

Method: development and application of a ray-tracing illumination and thermal model to synthetic lunar pits and caves

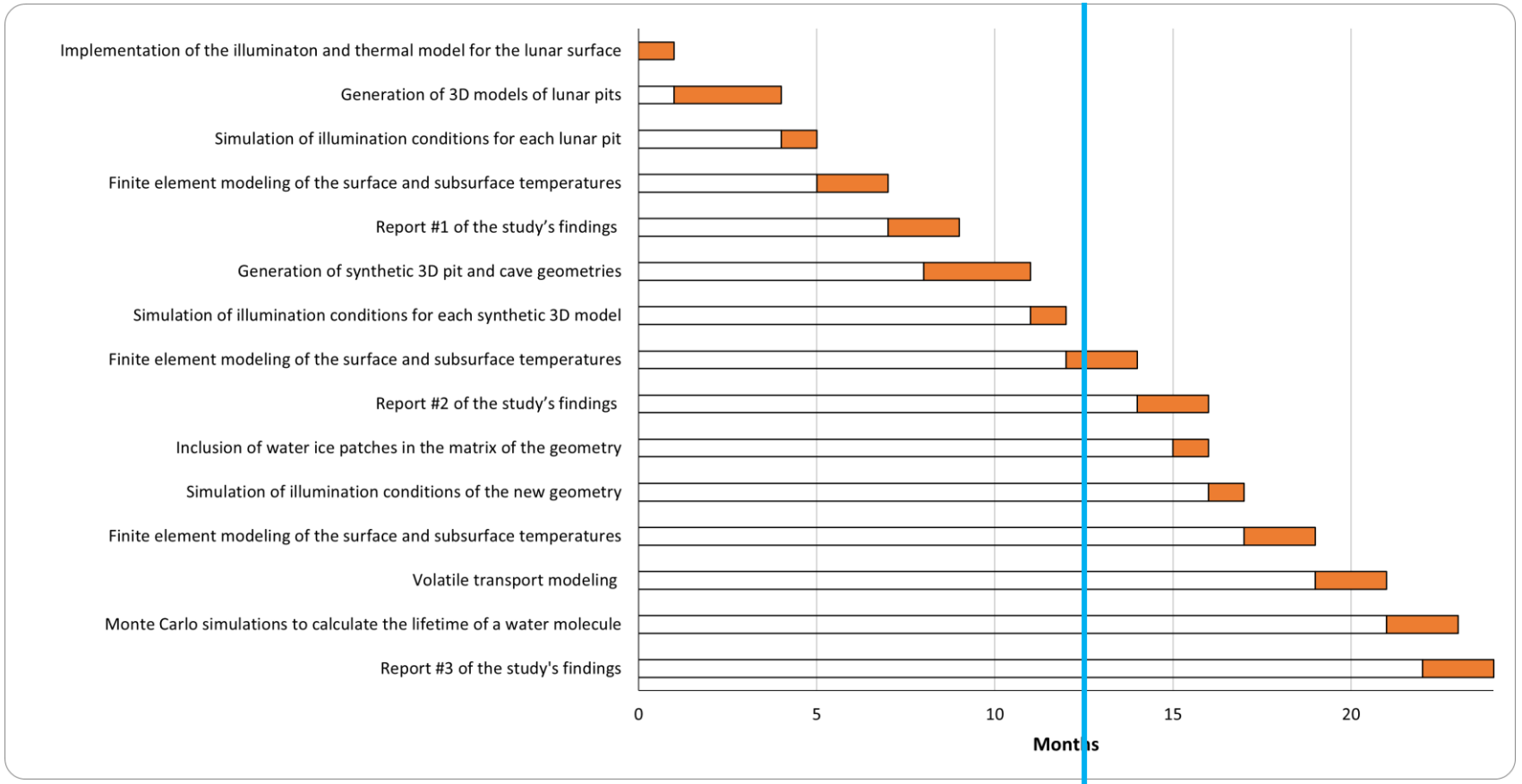
Deliverables:

DONE IN PROGRESS

- **First Step:**
  Generation of 3D models of lunar pits and caves with different entrance size, slopes of the walls, and depth;
  The floor has been modified by adding boulders of different size (collapsed material);
- **Second step:**
  Generation of a ray-tracing illumination model to simulate the illumination conditions of lunar pits including the scattering of the light;
  Generation of a 3D thermal model to perform finite element modeling of the temperature of the geometry;
- **Third step:**
  Inclusion of water ice patches in the matrix of the geometry;
  Generation of a volatile transport model and Monte Carlo simulations to investigate the stability of different volatiles.

ANTHELIA - ANalysis of illumination and THermal Environment of Lunar pIts and lavA tubes

Milestones:



Stato di avanzamento al 30/10/2023

Pubblications:

Congresses (2023):

- CAVES conference, Lanzarote, May 4-7, 2023.
- European Lunar Symposium, Padova, June 27-29, 2023.
- EPSC-DPS, San Antonio (TX), October 1-6, 2023.

Referred Pubblications (2023):

- ANTHELIA – ANalysis of Illumination and Thermal Environment of Lunar pIts and lavA tubes. Cambianica et al., in preparation.

Future congresses (2024):

- LPSC – March 11-15, 2024
- ELS – June 16-21, 2024
- EPSC – September 8-13, 2024

Future Referred Pubblications (2024):

- Stability of volatiles in Lunar Pits and caves