

# Mars' Ancient Dynamo and Crustal Remanent Magnetism

A white paper prepared for the 2021 Planetary Science Decadal Survey

Primary author:

Anna Mittelholz      University of British Columbia  
(604-446-0634; amittelh@eoas.ubc.ca)

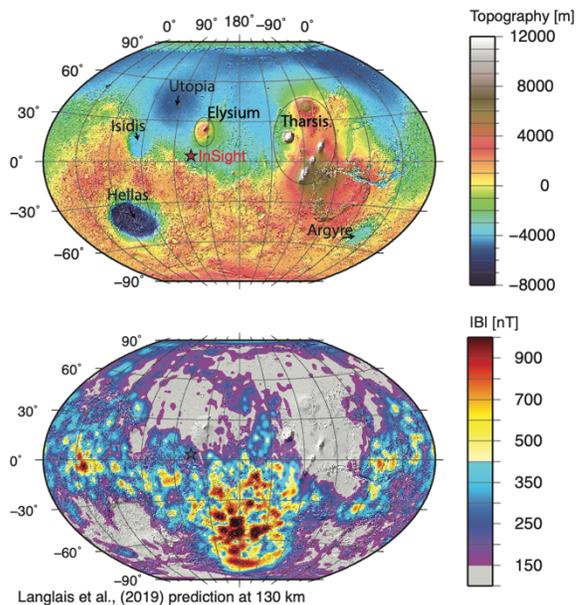
Co-authors (alphabetically):

Fu, R.      Harvard University  
Johnson, C. L.      University of British Columbia  
Langlais, B.      CNRS/University of Nantes, France  
Lillis, R. J.      University of California Berkeley  
Morschhauser, A.      GFZ Potsdam, Germany  
Vervelidou, F.      Massachusetts Institute of Technology  
Weiss, B. P.      Massachusetts Institute of Technology  
Volk, M.      Harvard University

**Brief Description:**

Expanding our understanding of crustal magnetism on Mars, elucidates questions on characteristics and the timing at which the martian dynamo operated, as well as (near-)surface processes that have modified crustal magnetic fields throughout time including impacts, water interactions (fluvial and hydrothermal), volcanism and tectonics. Thus, magnetic fields hold broad implications for Mars' early habitability, interior structure, thermal history, and for the fundamental physics of planetary dynamos.

The main goal of this white paper is to motivate high-precision, high resolution regional mapping



and local investigations of crustal magnetic fields on Mars to focus on important open questions:

- 1) What is the **nature of martian crustal remanent magnetism**?
- 2) What are **magnetization acquisition processes** producing sources responsible for Mars' remarkable crustal magnetic fields?
- 3) What were the **characteristics of the martian Dynamo**?

As recommendations for the 2021 Decadal Survey we suggest that NASA will focus on the following topics:

- Investigate placing a magnetometer on an aerial platform such as a drone or long-lived balloon to obtain low-altitude magnetic measurements over tens or hundreds of kilometers.
- Begin planning for the return to Earth of a variety of differently aged and oriented bedrock samples for magnetic and radioisotope analysis in terrestrial laboratories.

**Status:** First draft circulated amongst co-authors mentioned.

Thus, we are mainly seeking members from the community interested in joining as co-signatories, but of course invite members to contribute more actively if they want to.

Please co-sign using this [link](#) or e-mail me.

([https://docs.google.com/spreadsheets/d/19fE1J0dKVNJe\\_K4XGY1y3h4nYpD3032EZFtmBun4z7k/edit#gid=0](https://docs.google.com/spreadsheets/d/19fE1J0dKVNJe_K4XGY1y3h4nYpD3032EZFtmBun4z7k/edit#gid=0))