

Clays and sulfates in Meridiani Planum: constraining the climate of ancient Mars

Check out full abstract here



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INTRODUCTION AND BACKGROUND

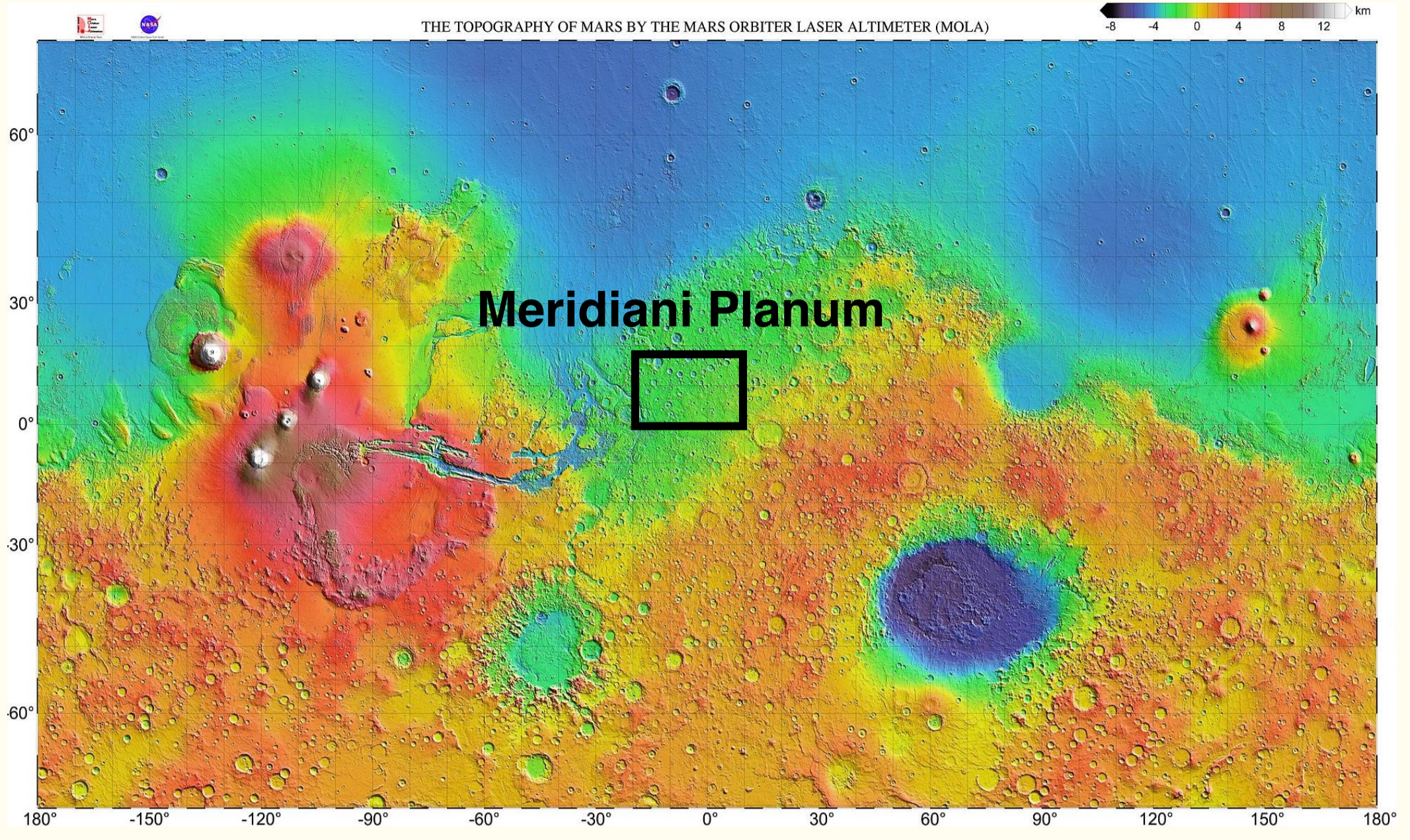
The characteristics and evolution of Mars' ancient climate are highly debated topics among the scientific community. It is commonly assumed that, during the Noachian, Mars experienced a "warm and wet" period, while the Hesperian was characterized by increasingly dry conditions. However, we still don't know much about the characteristics of the **Noachian-Hesperian climatic transition: how did surface conditions change? How many times?**

MERIDIANI PLANUM

Elements of interest:

- Valley networks [1];
- Abundant sulfate and clay sediments [2, 3];
- Karstification [4];

Age: the majority of the terrains exposed formed at the **Noachian-Hesperian boundary** [5].



AIM OF THIS WORK

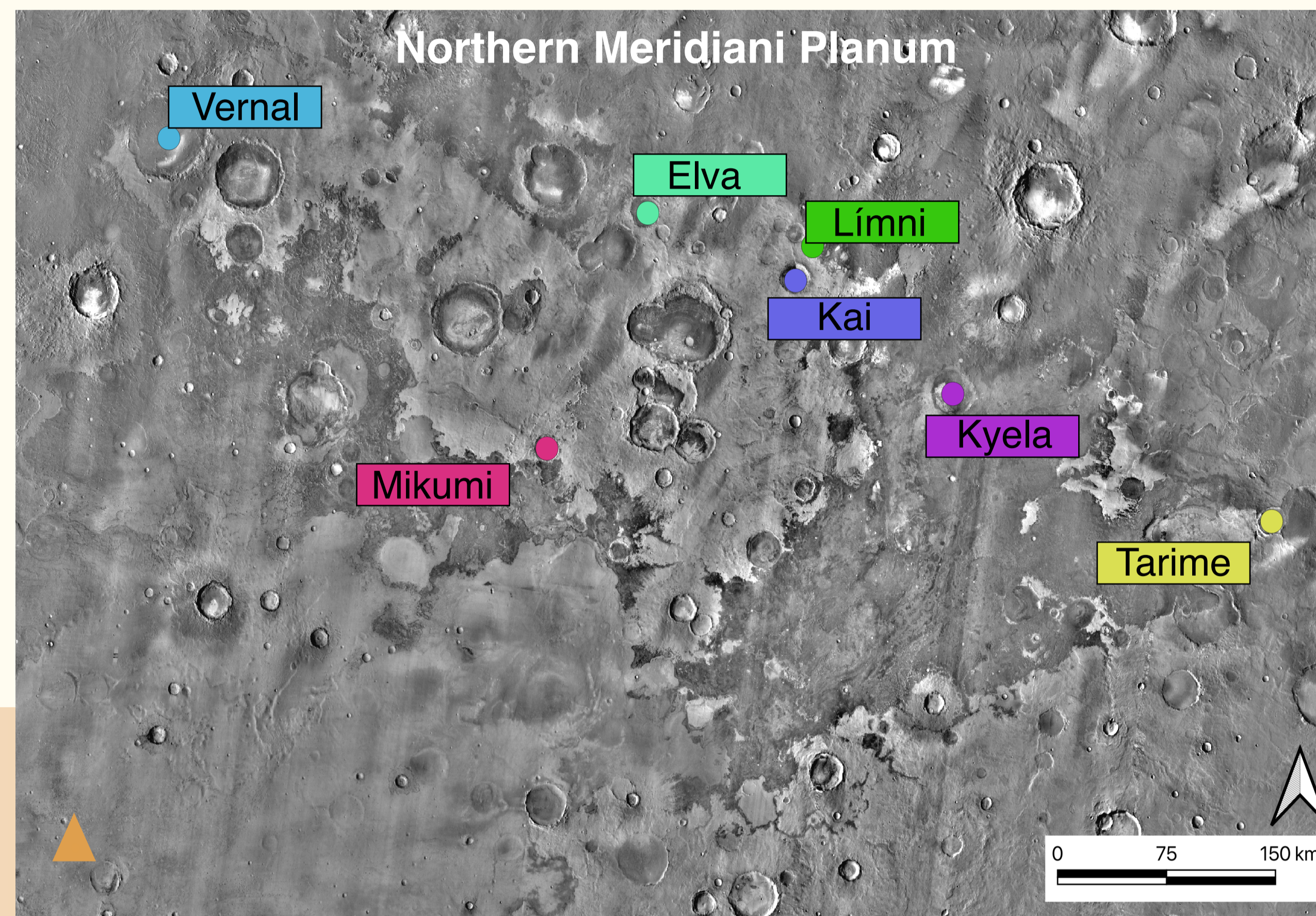
Investigate **7 craters** filled with Noachian-Hesperian sediments in northern Meridiani Planum.

Study the **stratigraphy, mineralogy, and morphology** of the sedimentary units.

Look for evidence of **climate change** in the sedimentary sequences.

DATASETS AND METHODS

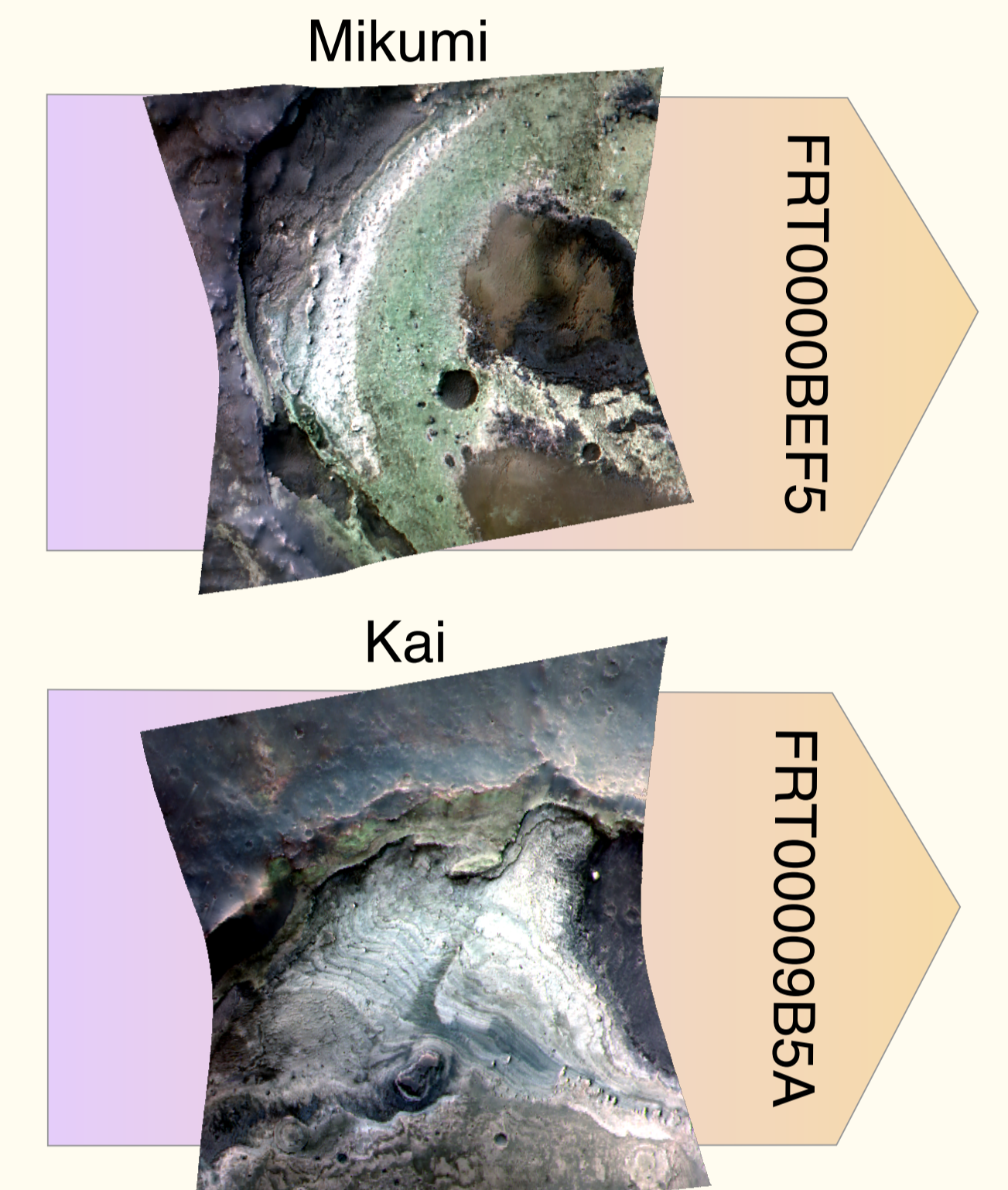
- **CRISM** hyperspectral data to investigate the mineralogy;
- **CTX** and **HiRISE** high-resolution data and stereo pairs for stratigraphy and morphology.



Names recently approved by IAU!

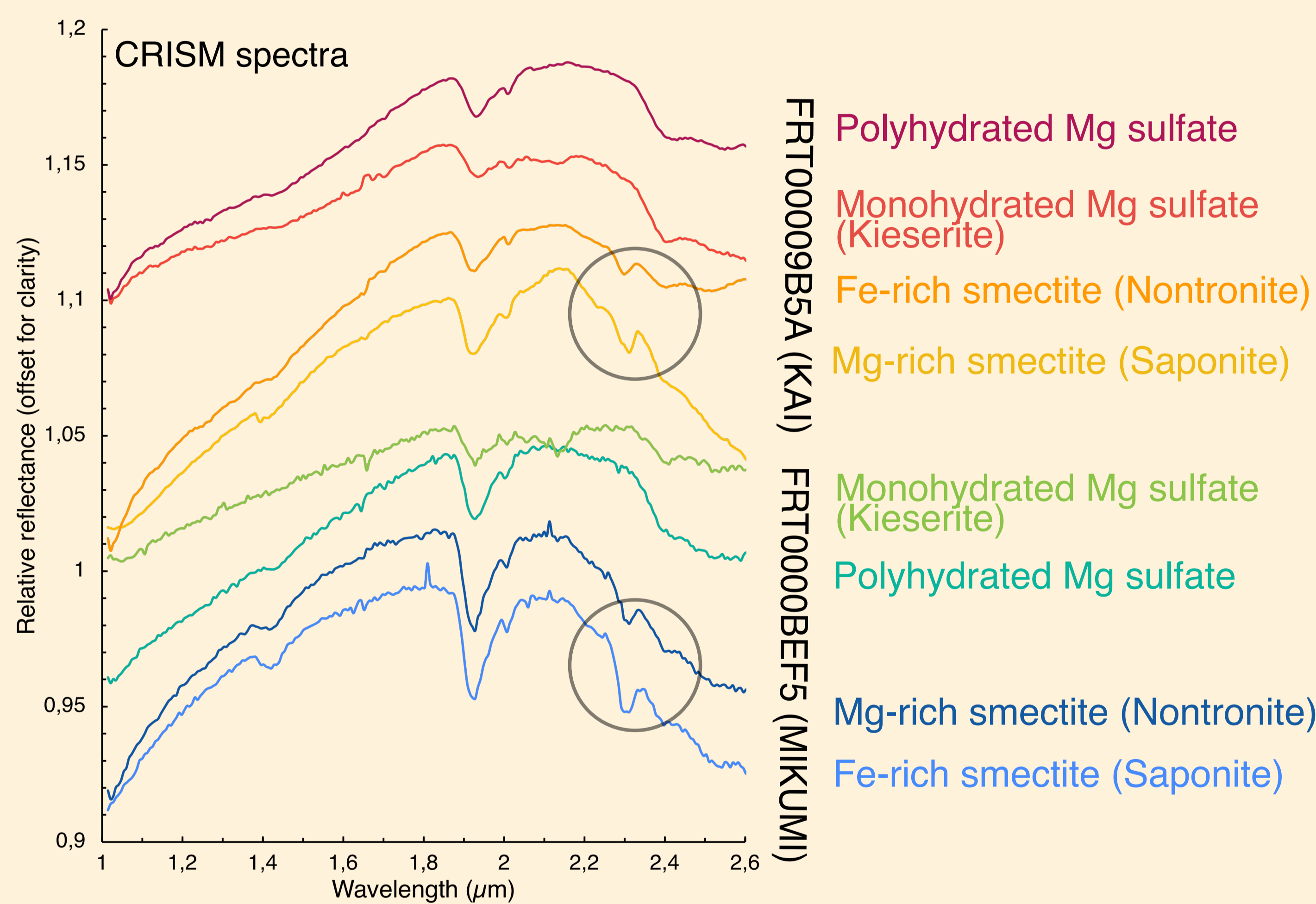
Names Approved for Mars: Kyela, Kai, Elva, Tarime, and Limni
22 August 2022
The IAU Working Group for Planetary System Nomenclature has approved names for five craters on Mars: *Kyela*, *Kai*, *Elva*, *Tarime*, and *Limni*. For more information, please see the [MC-12 map](#) in the *Gazetteer of Planetary Nomenclature*.

We show here some **preliminary results** from 2 of the 7 craters

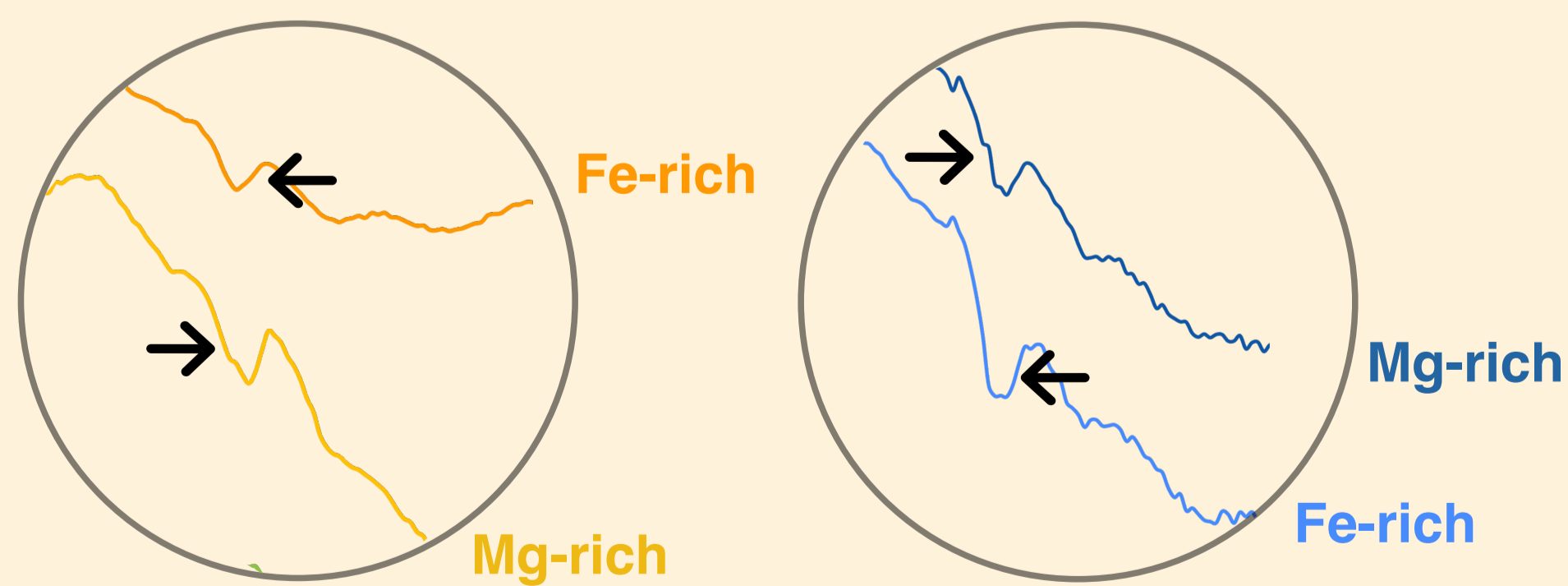


RESULTS AND DISCUSSION: mineralogy

In both craters, we observe Fe/Mg clays and sulfate mineralogy.

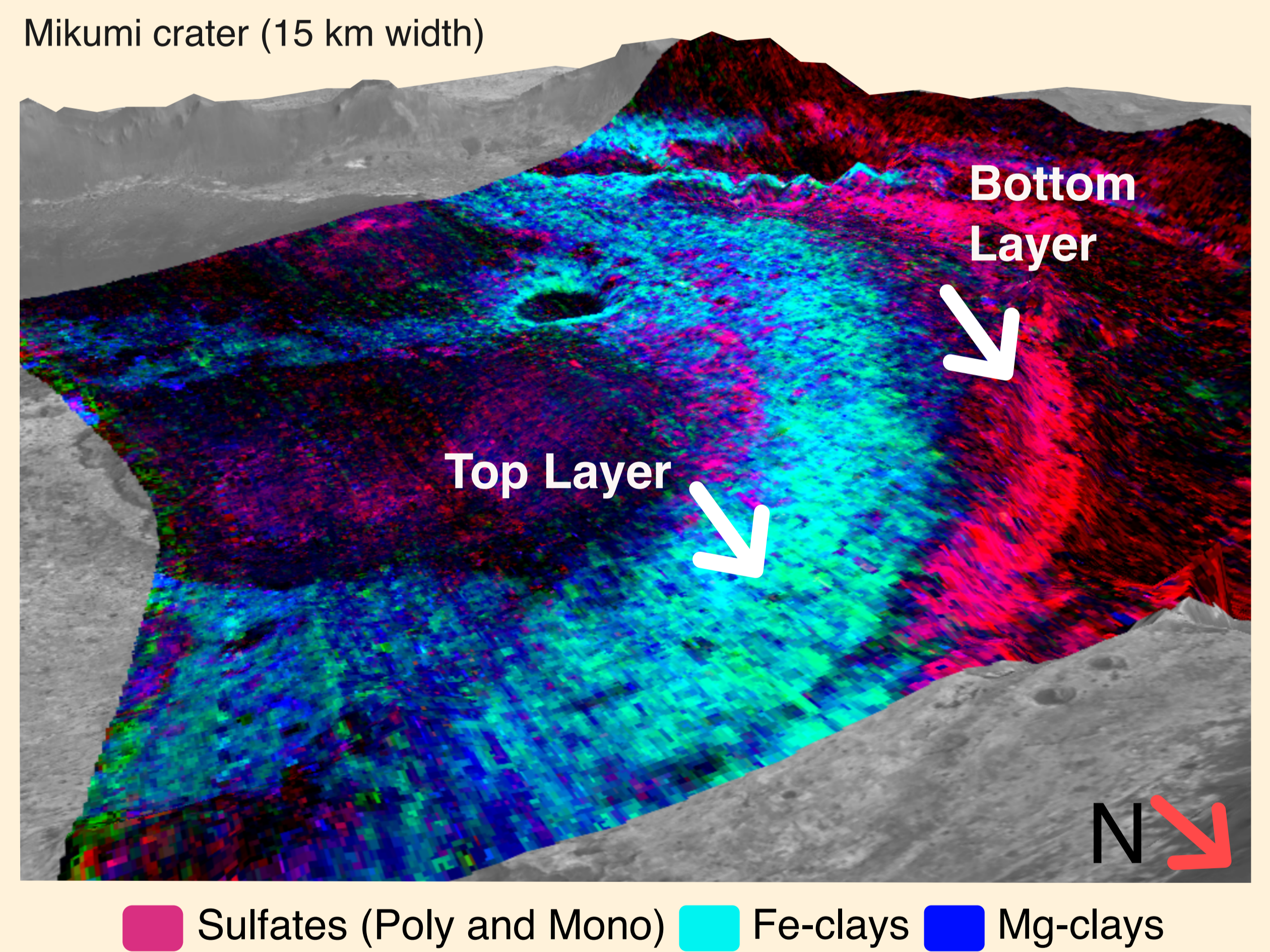


Fe and Mg clays: how do we distinguish them?
the 2.3 μm absorption shifts



RESULTS AND DISCUSSION: stratigraphy

In both craters, clays are stratigraphically on top of sulfates. A 3D view of Mikumi crater showing the distribution and stratigraphy of clay and sulfate minerals is displayed below.



Clays and sulfates on Mars are commonly associated to **different epochs and genetic conditions** [6]:

- Clays: Noachian Mars, abundant water and alkaline conditions;
- Sulfates: Hesperian Mars, scarce water and acidic conditions.

Sulfates should be on top of clays, as they formed later in the Martian history. **But here is clays on top! What does it mean?**

KEY RESULTS: it's not that simple!

- The distinction between a clay-rich Noachian and a sulfate-rich Hesperian **oversimplifies** the history of the aqueous chemistry and of climate of Mars.
- Mars experienced **several distinct climatic episodes** at the Noachian-Hesperian boundary.

What's next?

Explore the mineralogy and stratigraphy of remaining craters and correlate the observed characteristics on a regional scale.