

Tectonic mapping of Hydræ Cavus in the Valles Marineris region

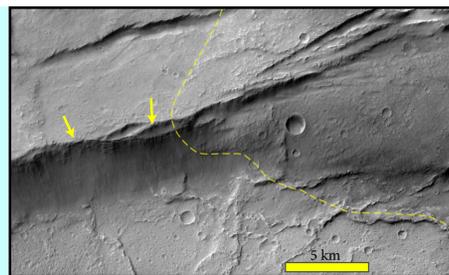
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Geological context

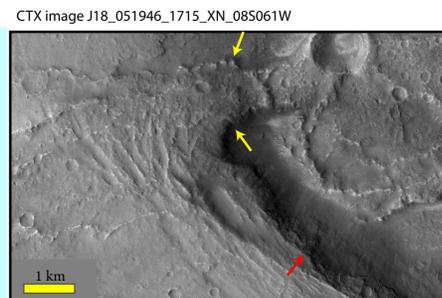
Hydræ Cavus is a 20 by 60 km, 1600 m deep tectonic basin [1] located 130 km east of Candor Chasma and 64 km north-east of Pital crater. The depression lies within Early Hesperian volcanic units, which are meters to tens of meters thick lava flows sourced from regional fissure and vent systems [2]. South of Hydræ Cavus, those units are covered by ejecta-blanket from Pital impact crater. Ejecta and volcanic units are covered by different lobate flows originated from Ophir Catena and Hydræ Chasma. These lobes were interpreted as groundwater outflows in a previous study [1].

The NW rim of the basin is bounded by a major SSE-dipping normal fault with a vertical offset of 1.2 km (arrows). This fault overcuts a first unit (eHv 1) but is covered in the East by a more recent terrain (eHv 2 - dashed line). These units are Early Hesperian lava flows [2]. This indicates that this first deformation episode and lava flows outpouring may have occurred simultaneously.



CTX image P16_007271_1731_XN_065061W

The Hydræ Cavus basin floor unit includes a lava flow that cuts one of the main basin border faults, dipping East (yellow arrows), whereas an older flow is cut by this fault (red arrow). This fault is therefore contemporaneous to the basin floor unit.

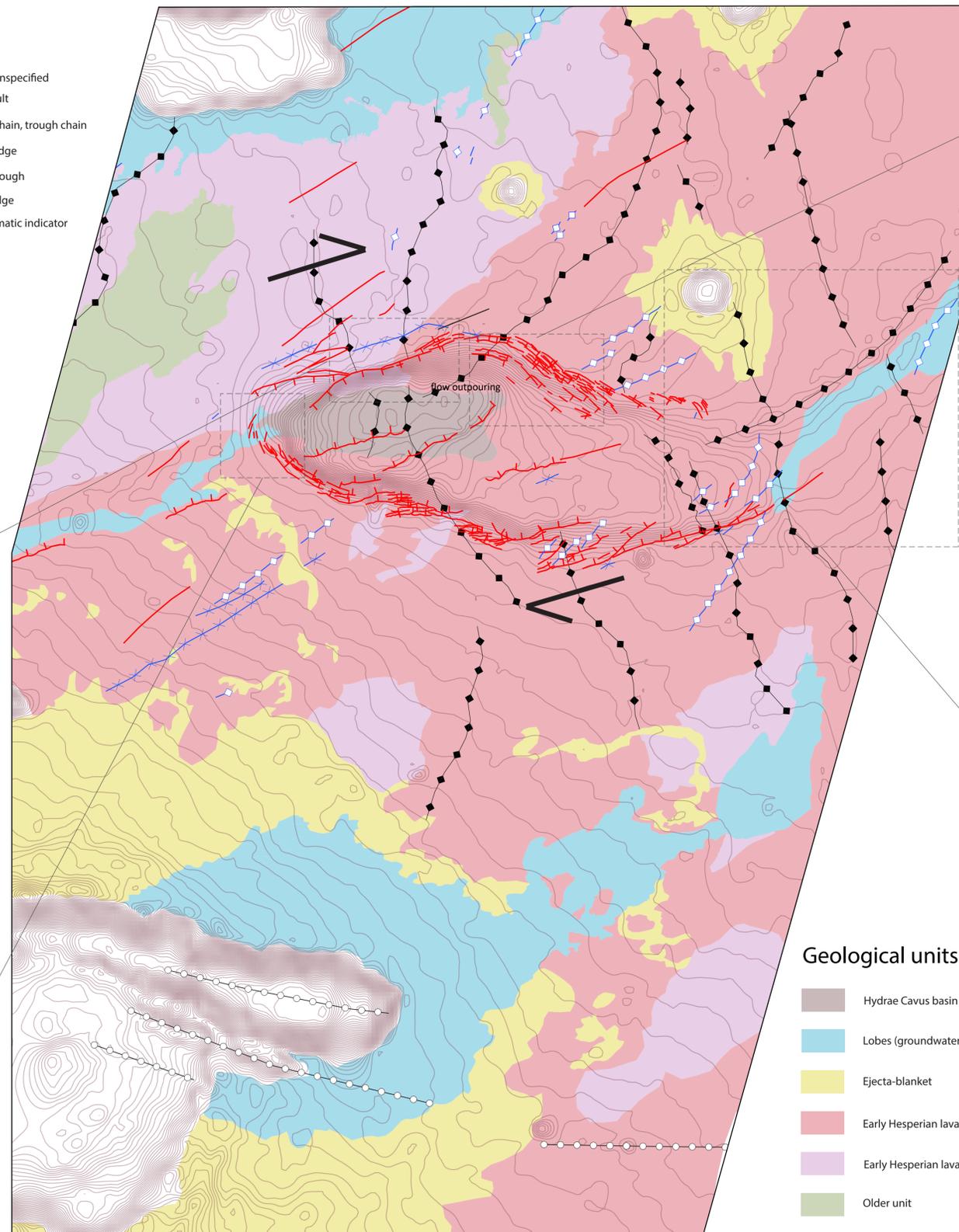


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Tectonic mapping reported here shows Hydræ Cavus is a transtensional basin coeval with Hesperian lava flow outpouring

Tectonics

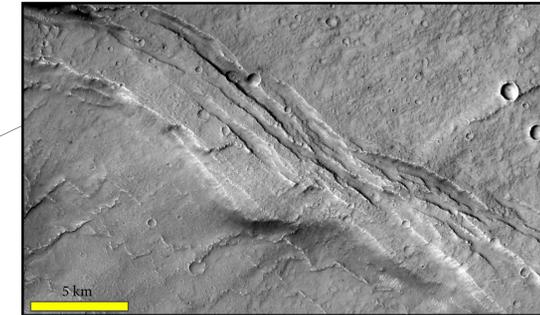
- Fracture, unspecified
- Normal fault
- Pit crater chain, trough chain
- Tectonic ridge
- Tectonic trough
- Wrinkle ridge
- Fault kinematic indicator



Geological units

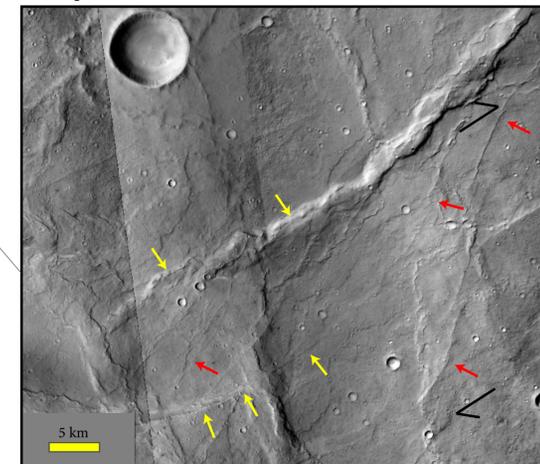
- Hydræ Cavus basin floor
- Lobes (groundwater outflows)
- Ejecta-blanket
- Early Hesperian lava flood 2 (eHv 2)
- Early Hesperian lava flow 1 (eHv 1)
- Older unit

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The NE and SW rims of the basin display a series of N100 and N90 normal faults, each of them with a few meters vertical offset. These faults overcut the more recent lava flow showing indicating a second deformation phase with a different trend.

CTX image D05_029094_1730_XI_075061W



N070 structures (yellow arrows) and associated N020-N030 sigmoidal structures (red arrows) indicate right-lateral strike slip faulting. The N070 structures are polyphase and were also activated in extension and compression.

References

- [1] Marra et al., 2015. Pressurized groundwater systems in Lunae and Ophir Plana (Mars): insights from small-scale morphology and experiments. *GeoResJ*, 8, 1-15
- [2] Tanaka et al., 2014. Geologic map of Mars: U.S. Geological Survey Scientific Investigations Map 3292, scale 1:20 000 000, pamphlet 43 p.