

DETAILED GEOLOGICAL MAPPING OF NORTHERN ASTKHIK PLANUM, LADA TERRA, VENUS

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Introduction: We present 1:500,000 scale mapping and insights thus far into the structures, flows and graben of northern Astkhih Planum (AP) (4.5–23° E, 36–44.5° S). This mapping is a continuation of mapping completed for southern AP [1], so their combination will give the overall geologic history of AP.

Graben: Lineaments (consisting of grabens, fractures and fissures and interpreted to overlie dykes) are separated into 24 sets, and their sources were identified. Herein graben sets will be referred to by the numbering found in the legend of Fig. 1.

Kink in Trend. Graben sets 14 and 22 have SE and SW trends, respectively. Once they enter AP, their trends change to NS-trending; set 14 experiences a gradual change, whereas set 22 has an abrupt “kink”. Neither set appears to be influenced by Selu Corona (SC), so we assume SC was not tectonically active or did not exist yet. The kink aligns with the AP topographic change, which is a few hundred meters above the outside plains. This stress field change is local to AP, but the cause of the N-S σ_1 stress is unknown.

Brynhild Fossae Continuation. Graben set 22 is a possible continuation of Brynhild Fossae (BF), sourced from Fatua Corona (17.6° E, 16.1° S)[2]. They have the same trend (before the set 22’s N-S kink), but with 660 km of younger volcanism between them. Partially flooded remnants of same-trend graben are present throughout the gap, supporting the interpretation.

Selu Corona (SC): Belonging to the NW-trending Alpha-Lada extensional belt running through AP, SC is a 400 km diameter corona-nova at the NW corner of AP (42.5°S, 6°E). SC is composed of: (1) a radiating graben center; (2) two elevated annuli (inner and outer) with graben; (3) Yenkhoboy Fossae extending 1500 km south, outside of AP; (4) “master” graben radiating east. Sections of the center are partially flooded by lava spilling from the radiating set, and the NE portion is completely flooded. The outer annulus is ~50% intact, whereas the inner is ~25%.

Outer Annulus. The outer annulus graben are divided into: (1) graben set 5 which has a constant SE-trend despite the overall annulus curving. We propose this set radiates from Eve Corona, 1230 km NW of SC, and is only visible in the SC annulus because its high topography escaped flooding; (2) graben set 9 which continuously changes trend to curve around SC and thus is a SC circumferential set (Fig.1).

Radiating “Master” Graben. Large graben (part of graben set 11) radiate east from SC and are continuous through Tyche Tessera (TT) for 660 km. Some that radiate further north through AP plains are flooded for 500 km. They pick up past the flooding and have total distances up to 900 km. Their continuation through the area of flooding is inferred from flooded narrow valleys (originally graben) cutting through TT remnants.

Flows: Related flows are grouped and named after their relative compass directions. There are the North, South, East and West Stages contained within AP, and the Northwest Stage, that flows out of AP (Fig. 2).

Southern Stage. The Southern Stage (**fS**) is within a basin that we propose formed by the basalt-eclogite phase transition under sufficient loading by flow accumulation (~50 km thick); eclogite’s higher density causes subsidence, as proposed for the Columbia Basin [3,4]. **fS** is a 40,000 km² area with multiple generations flowing east with no distinguishable source. There is an older generation of radar-bright lobate flows (**fS-1**) and a younger heterogeneous radar-intermediate one (**fS-2**). Their relative ages were discerned by **fS-2** dissecting **fS-1** and shaded relief (produced by subtracting right-looking SAR from left-looking SAR [1]), showing **fS-2** to be 10’s of meters higher, accounting for flow thickness.

Northwest Stage. The Northwest Stage (**fNW**) is multiple flow generations that exit AP and they do so at the NW corner through a gap between SC and Vaidilute Rupes (VR). **fNW** allows us to relate the history of AP to the outside lowland plains, as well as extend the map area in the future. The lowland flow in contact with **fNW** is younger because it cuts **fNW** off.

Splotch. There is an irregular feature (12.2°E, 40.1°S) that has a radar-dark centre surrounded by radar-bright that fades out to fuzzy boundaries. We interpret this to be a splotch that was caused by the shockwave from a bolide airburst [5].

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References: [1] MacLellan L. M. et al. (2021) ESR, 220, 103619. [2] Bethell E. et al. (2019) Jour. Maps, 15:2, 471-486. [3] Perry-Houts J. and Humphreys E. (2018) Geology, 46:7, 651–654. [4] Herzog S.G. and Hess P.C. (1996) LPS XXVII. [5] Antropova E.G. et al. (2022) LPSC, in-prep.

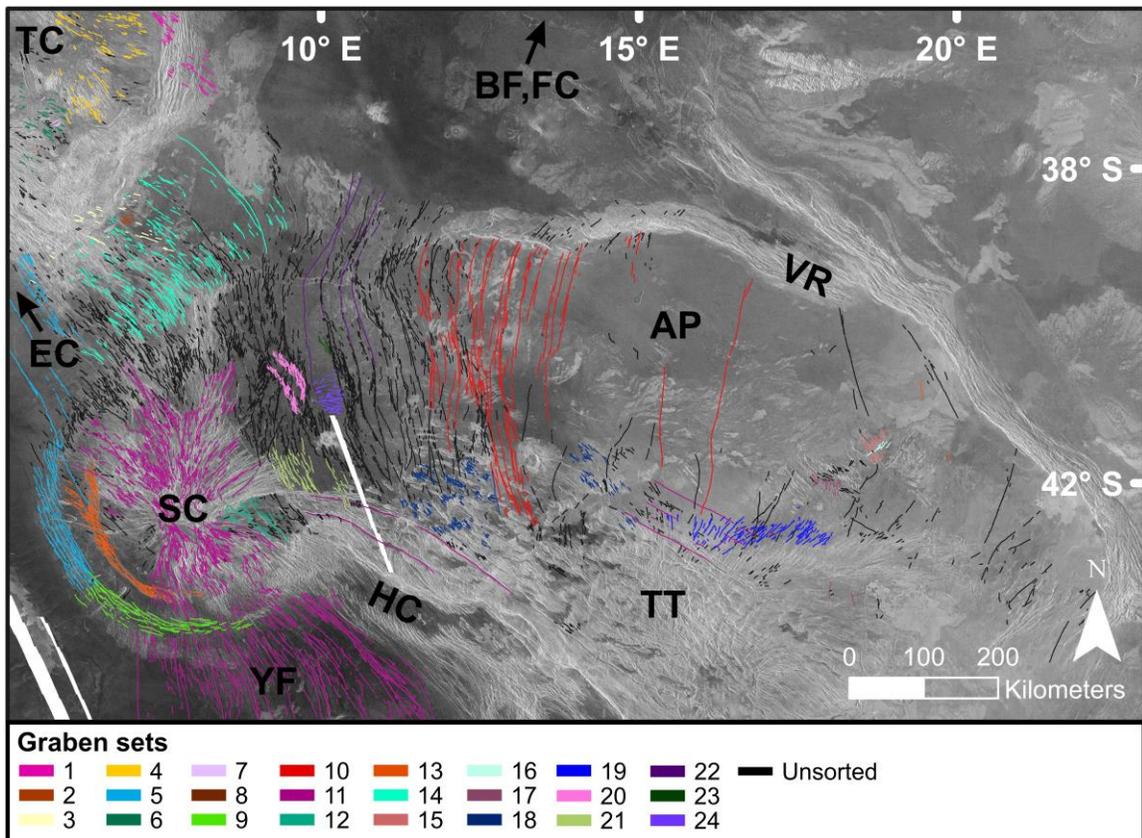


Fig. 1. Structural map of northern Astkhik Planum (AP) graben sets. BF = Brynhild Fossae, EC = Eve Corona, FC = Fatua Corona, HC = Hanghepiwi Chasma, TC = Tamfana Corona, TT = Tyche Tessera, VR = Vaidilute Rupes, YF = Yenkhoboy Fossae. NW-trending white bands represent missing Magellan data.

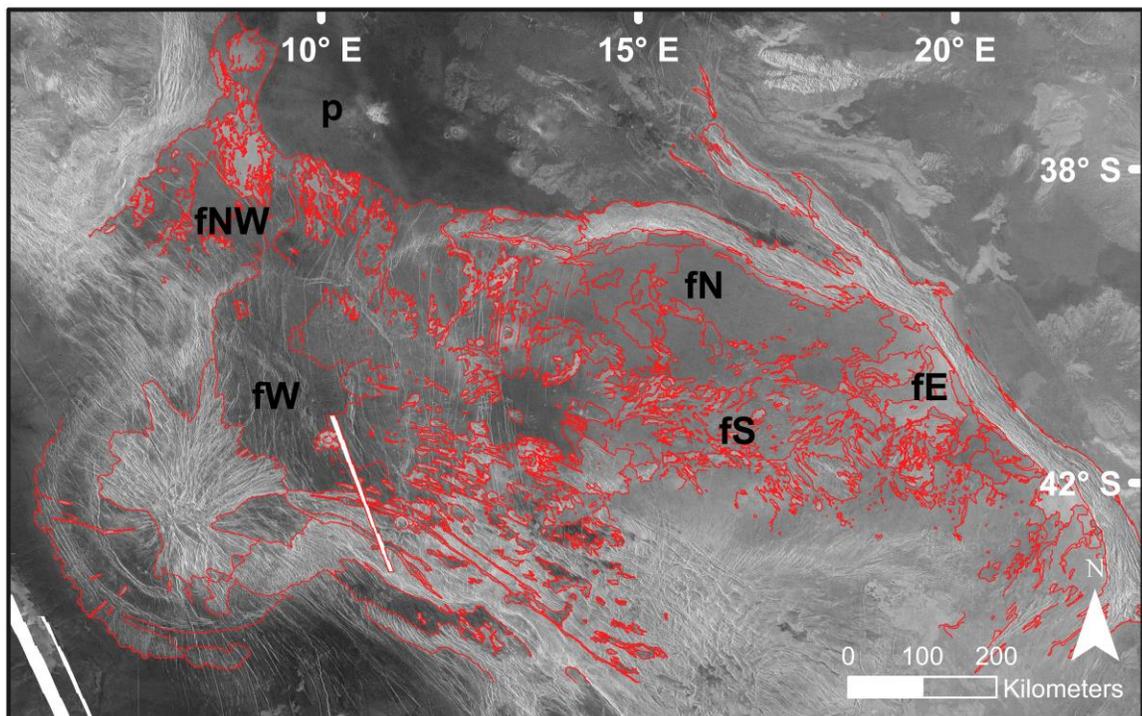


Fig. 2. Outlines of the northern Astkhik Planum (AP) flows. fE = Eastern Stage, fN = Northern Stage, fNW = Northwestern Stage, fW = Western Stage, p = plains. NW-trending white bands represent missing Magellan data.