

A CANDIDATE SPREADING CENTER IN WESTERN ATLA REGIO,
VENUS

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Herrick's¹ model for Venus resurfacing history posits shutdown of plate mobility at ~.8 Ga. Magellan-based 1:5,000,000 geological mapping of Atla Regio Quadrangle (0-25° N, 180-210°) supports early plate tectonics in this region by identifying: 1) A candidate fossil spreading center extending north-south across the western quarter. 2) Hot spot tracks, including a large volcano (Sapas Mons) that subsided following earlier passage over a now 280 km-distant plume (at 7.5° N, 185°); and 3) passive margins of thicker and older rifted crust (tessera units). The suite of local features suggesting the spreading center include: elliptical domes and split bow structures, elongate axial highs and axial summit calderas, tectonic spreading fabric, and ridge discontinuities including possible transform faults, oblique shear zones, overlapping spreading centers, and higher order ridge offsets.

The crater Blackburne is superposed on the spreading center features in Atla Regio and is not itself deformed (figure). Also, plains lavas in the southwestern portion of the quadrangle partially embay and bury the older landforms, including the flanks of the spreading center. Thus, spreading has apparently terminated. The younger plains host a series of sub-parallel wrinkle ridges that are commonly interpreted as low angle thrust faults or folds. Plains emplacement and subsequent dispersed faulting are compatible with the termination of plate tectonics in this region. Cessation of spreading while subducting slabs still remained would have favored intra-plate tensile membrane stresses² and extrusion of plains lavas. Further planetary cooling and decreasing mantle/crust density contrasts may then have ended subduction and caused a bias switch back to compressional stresses and wrinkle ridge development.

An early period of mobile plates and at least limited plate-plate interactions is suggested by the complex geology and structure of this quadrangle, by the compressional-tensile stress bias reversals, and by the preserved spreading center axis. Major structures related to plumes and plume-related extension, such as Ganis Chasma^{1,3}, post-date the evidence in Atla Regio for leaky transform faulting, pull-apart basins, and spreading centers.

References: 1.Herrick, R.R.*Geology* **22**, 703-706 (1994);
2.Sleep, N.H. *Jour.Geophys. Res.* **99**, 5639-5655 (1994);
3.Senske, D.A., Schaber, G.G. & Stofan, E.R. *Jour. Geophys.Res.* **97**, 13,395-13,420 (1992)

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Figure. A portion of western Atla Regio between lat. N 8-16 and long. 182-187. Crater Blackburne (diameter ~30 km) is at center. White arrows show inferred left-stepping, left-lateral strike-slip faults; spreading center morphology occurs in vicinity of inner arrows.

T= rifted tessera units;
S=lava flows from Sapas Mons;
Sp= smooth lava plains.

Circle marks location of +120 mgal gravity high; Sapas Mons summit lies 280 km to east