INDENTATION AND LATERAL ESCAPE IN WESTERN ISHTAR TERRA, VENUS — AN ANALOG FOR DEFORMATION OF THE ARCHEAN ABITIBI SUBPROVINCE, SUPERIOR CRATON, CANADA WITHOUT PLATE TECTONICS. Lyal B. Harris[1] and Jean H. Bédard[2],
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Introduction: Evidence for modern plate tectonics in the Archaean Earth is equivocal to absent [1], however an alternative mechanism must be found to explain regional shortening and deformation of greenstone belts without plate tectonics. Venus is presented as an analogue for a non-plate-tectonic Archaean Earth. Because of its high surface temperature, the form, scale, and geometry of folds, brittle-ductile shear zones, and faults interpreted on the surface of Venus from radar imagery are comparable to mid-upper crustal structures on Earth. Radar interpretations surrounding Lakshmi Planum in western Ishtar Terra are compared to shear zone/fault patterns mapped and interpreted from enhanced aeromagnetic images in the Abitibi Subprovince of the Superior Craton, Canada. Their striking resemblance suggests a similar tectonic origin.

Indentation and lateral escape tectonics in W Ishtar Terra: The Lakshmi Planum area of W Ishtar Terra, Venus, is a highland plateau rimmed by mountain belts. Although its surface geology is mapped as different basaltic flow types [2], negative Bouguer gravity anomalies suggest an underlying crust partly felsic in composition. Magellan radar images portray a broad fold and thrust/dextral transpressional belt in the mountainous region on its N margin. Folds (some truncated by reverse faults) and faults with sinistral offsets or 'drag' of marker horizons along the NW planum margin define a sinistral transpressional regime. Both regional dextral and sinistral strike-slip belts are interpreted NE of Lakshmi Planum; dextral shears are closest to the NE planum margin. The scale and kinematics of structures in W Ishtar Terra closely resembles the Indian-Eurasian collision zone where structures NE and E of Lakshmi Planum are identical to lateral escape structures in Indochina. Graben are interpreted from radar images along the S planum margin. A linear Bouguer gravity high, punctuated by sub-circular lower Bouguer anomalies, defines a zone of crustal rifting and mantle upwelling linking mantle plumes, similar to rift-plume interaction on Earth [3]. We propose that northward displacement and indentation of Lakshmi Planum resulted from mantle flow directed away from collinear mantle plumes acting upon the base of its thick lithosphere.

Comparison with the Abitibi Subprovince, Superior Craton: In the Abitibi Subprovince of the Superior Craton, Canada, 3D S-wave seismic tomographic images reveal a symmetrical rift in the sub-continental lithospheric mantle (SCLM), with no evidence for 'fossil' subduction zones. Geodynamic processes similar to those on Venus, without modern-style plate tectonics, are ascribed to the formation of granite greenstone sequences in a mantle plume-related volcanic plateau. Early rift structures localized subsequent deformation during N-S shortening and lateral escape ahead of a southwardly moving indenter (the Northern Superior Craton/Hudson Bay terrane) in the ca. 2696 Ma Shebandowanian orogeny. The geometry of reverse and strike-slip shear zones in the Abitibi Subprovince resembles structures western Ishtar Terra, Venus, developed ahead of a rigid indenter whose displacement is attributed to mantle tractions. Similarly, shortening and rift inversion in the Abitibi is ascribed to cratonic mobilism [1,4] where displacement of the N Superior Province 'protocraton' resulted from mantle flow acting upon its deep lithospheric keel. Deformation in other Archaean cratons may also be the result of similar, mantle-driven processes and not plate tectonics.

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