A GLOBALLY FRAGMENTED AND MOBILE LITHOSPHERE ON VENUS. Paul K. Byrne[1], Richard C. Ghail[2], A. M. Celâl Şengör[3], Peter B. James[4], Christian Klimczak[5], and Sean C. Solomon[6], [1]Planetary Research Group, Department of Marine, Earth, and Atmospheric Sciences, North Carolina State University, Raleigh, NC 27695, USA (paul.byrne@ncsu.edu); [2]Department of Civil and Environmental Engineering, Imperial College London, London, SW72AZ, UK; [3]Department of Geology, Faculty of Mines and the Eurasia Institute of Earth Sciences, Istanbul Technical University, 34469 Maslak, İstanbul, Turkey; [4]Department of Geosciences, Baylor University, Waco, TX 76798, USA; [5]Department of Geology, University of Georgia, Athens, GA 30602, USA; [6]Lamont-Doherty Earth Observatory, Columbia University, Palisades, NY 10964, USA.

Introduction. Tectonic deformation on Venus is often concentrated into narrow curvilinear zones of extensional or shortening structures ("groove belts" and "ridge belts," respectively) [e.g., 1]. These belts commonly delimit low-lying areas that are infilled with smooth plains. Some belt-bound lowlands—which we term campi (singular *campus*)—extend laterally up to 2000 km, whereas others are much smaller. The interior plains are themselves deformed by sets of wrinkle ridges (i.e., folds) but are always much less distorted than the intensely deformed perimeter belts. Strain-compatible structures from the surrounding highly strained margins regularly deform and thus presumably post-date the emplacement of the plains infill.

Block Tectonic Pattern. Groove and ridge belts frequently intersect to form a distinctive cellular pattern. One such example area is Lavinia Planitia [1], where multiple belts demarcate a set of campi. Evidence of transpression and transtension (i.e., the simultaneous accommodation of lateral shear in addition to extension and shortening) within these intersecting belts is the rule [e.g., 2]. The strains recorded in the belts here imply both horizontal block translations and rotations, with lateral motions of several tens of kilometers in places [3].

These observations signify that the network of campi within Lavinia Planitia corresponds to a set of mechanically coherent but discrete blocks that have moved relative to one another in a manner similar to jostling pack ice, with that motion resulting in the highly strained belts that demarcate campus margins. The superposition of tectonic structures emerging from ridge and groove belts and deforming the campus interiors points to at least some block motion since the time of emplacement of the local plains materials.

This cellular pattern of intersecting tectonic belts is widespread across Venus. In addition to the example in Lavinia Planitia, networks of campi characterize much of the lowlands of Helen, Nsomeka, and Nuptadi Planitiae in the high southern latitudes, most of Akhtamar, Bereghinya, and Guinevere Planitiae at low northern latitudes, and a vast region that encompasses Atalanta, Ganiki, Vellamo, and Vinmara Planitiae that extends almost to the north pole.

Mantle-Driven Deformation. This tectonic style resembles that within continental interiors on Earth, including the Tarim and Sichuan basins in China, the Amadeus basin in central Australia, the Moesia block in Bulgaria and Romania, the Bohemian Massif that underlies much of the Czech Republic, and the Black Sea and South Caspian basins [e.g., 4,5]. Such deformation is facilitated by a weak lower crust, a scenario that likely applies to Venus because of the high surface temperature [6,7]. It may be, then, that a weak, ductile zone within the Venus lithosphere permits the transmission of subcrustal stresses [e.g., 8] to the near surface.

Indeed, in calculating the stresses associated with gravitationally inferred mantle flow [9], we find that peak stresses for a nominal lithospheric thickness of 100 km readily exceed 100 MPa, much greater than the expected yield strength of the lower crust at Venus for crustal thickness values ≤20 km [7], a thickness limit that likely characterizes much of the planet's low-lying terrain [9]. The combination of mantle flow and a weak lower crust therefore provides a basis by which some interior motion has been transferred to the surface.

Outlook. Our results provide an observational basis for the concept of a continuum of lithospheric mobility, with Earth's "mobile lid" tectonics at one end, the "stagnant lid" tectonics of Mercury, Mars, and the Moon at the other, and Venus somewhere in between. The planet's style of tectonics might characterize Earth-mass exoplanets in the "Venus zone" [10], and could even provide new insight into some tectonic processes away from subduction zones in the early history of our own planet during the "permobile" regime [11], before the onset of full-scale plate tectonics [12].

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