

# Evaluation of instability of Venus lithosphere by linearized analysis

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From the linearized stability analysis of simple cooling model of Venus mantle, we show that a secondary convection starts in a few million years after catastrophic overturn of lithosphere. Lithospheric instability develops in upper mantle of Venus for initial (i.e., immediately after catastrophic overturn) mantle temperature of 1600, 1500, and 1400 K by plate age of 100, 200, and 400 Ma and growth time of 100, 300, and 500 Myr, respectively. Those results based on initial mantle temperature of 1500 and 1400 K are consistent with crater retention age of  $500 \pm 200$  Ma. Wavelength of instability for initial temperature of 1500 and 1400 K ranges between 800 and 1200 km. The fact that such wavelengths are the same order of magnitude with planetary radius indicates that lithospheric instability on Venus might result in global event. It should be noted that scales of many geologic features on Venus, such as diameters of basins and large volcanoes, are in the same range as those wavelengths. The lithospheric instability induced by secondary convection can be an efficient planetary cooling mechanism as mantle temperature is 1600 K at 0.5 Ga, 1700 K at 1.5-2.5 Ga, and 1800 K at 3.5 Ga, respectively. In addition, a comparison between the Earth and Venus reveals that age of both initiation and growth time of secondary convection for the Earth are less than those for Venus by an order of magnitude. It is inferred that existence of water in upper mantle has a significant influence on tectonic evolution of the planets.