LITHOSPHERIC DELAMINATION ON EARTH AND VENUS; Lewis D. Ashwal, Kevin Burke, and Virgil L. Sharpton, Lunar and Planetary Institute, 3303 NASA Road One, Houston, TX 77058

Lithospheric delamination differs from subduction in that subduction involves recycling of the whole lithosphere, whereas in delamination, only the lower parts of the lithosphere are recycled. On Earth, delamination has been suggested in three different environments: (a) at Tibetan-style continental collision, during which the sub-continental lithosphere becomes detached from overlying crust and sinks into the mantle [1,2], (b) at the collision of island arcs with continents or with other arcs, during which the lower parts of arc crust become similarly detached [3], and (c) at sites of basaltic underplating of continental crust, where ultramafic cumulate portions of gabbroic intrusions sink [4]. These mechanisms may play an important role in the recycling of continental components into the mantle.

Effects of lithospheric delamination may explain the geographic distribution of young volcanic rocks in Africa, originally described by Thorpe and Smith [5]. We interpret the occurrence of Neogene and younger volcanic rocks in Pan-African reactivated areas of the African continent and the absence of such volcanic rocks from cratonic areas (Fig. 1 and ref. 5) as evidence that the Pan-African areas are underlain by fertile lithospheric mantle and the cratons by depleted lithospheric mantle. In Fig. 2 we show a sequence of events in which continental crust originally formed by assembly of collided island arcs is underlain by depleted mantle [6]. At Tibetan-style collision, such as happened during Pan-African times [7], this depleted mantle lithosphere is delaminated [1,2], and its place taken by fertile mantle.

When approximately 500 Ma after the Pan-African events the African plate came to rest over the mantle circulation pattern [8], interaction with the underlying circulating mantle extracted magmas from the fertile but not from the depleted lithosphere. This explanation of the restricted distribution of Neogene volcanic rocks requires recycling of the mantle lithosphere at collision of the kind suggested by Bird, McKenzie and O'Nions [1,2].

On Venus, the equatorial highlands topography has been cited as evidence both for (9) and against (10) an extensive process of lithospheric recycling similar to plate tectonics on Earth. In either case it is clear that new crustal material is generated at least by locally restricted volcanism (e.g., 11) but evidence of subduction is not observed on Venus. The extensive deformation seen on the Venusian surface ("crumpled terrane") suggests that the "lithosphere" is far from rigid, and is only locally overlain by undeformed volcanic rocks. This lithosphere appears to form a conductive boundary layer which, unlike that of Earth's oceans, is not <u>completely</u> involved in convective recycling. Coronae appear to be expressions of the sites of upwelling convective circulation seen vaguely through the crumpled lithosphere [12]. Delamination of the lower part of the Venusian lithosphere (Fig. 3), therefore, may be the dominant, or only mechanism of lithospheric recycling on Venus.

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Fig. 1

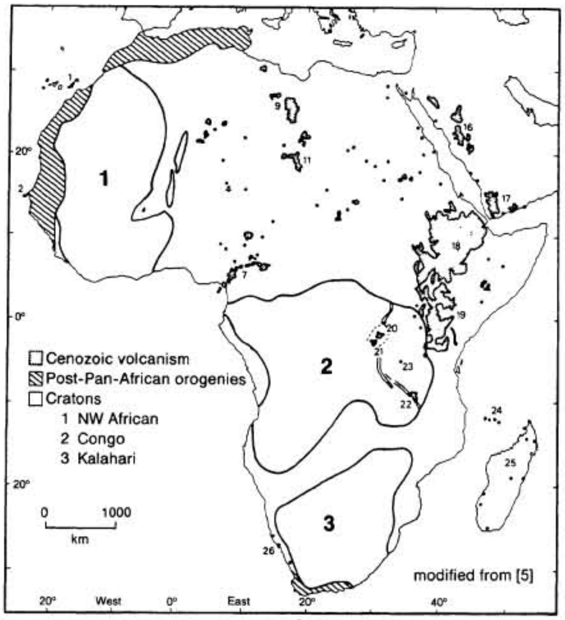

Fig. 2

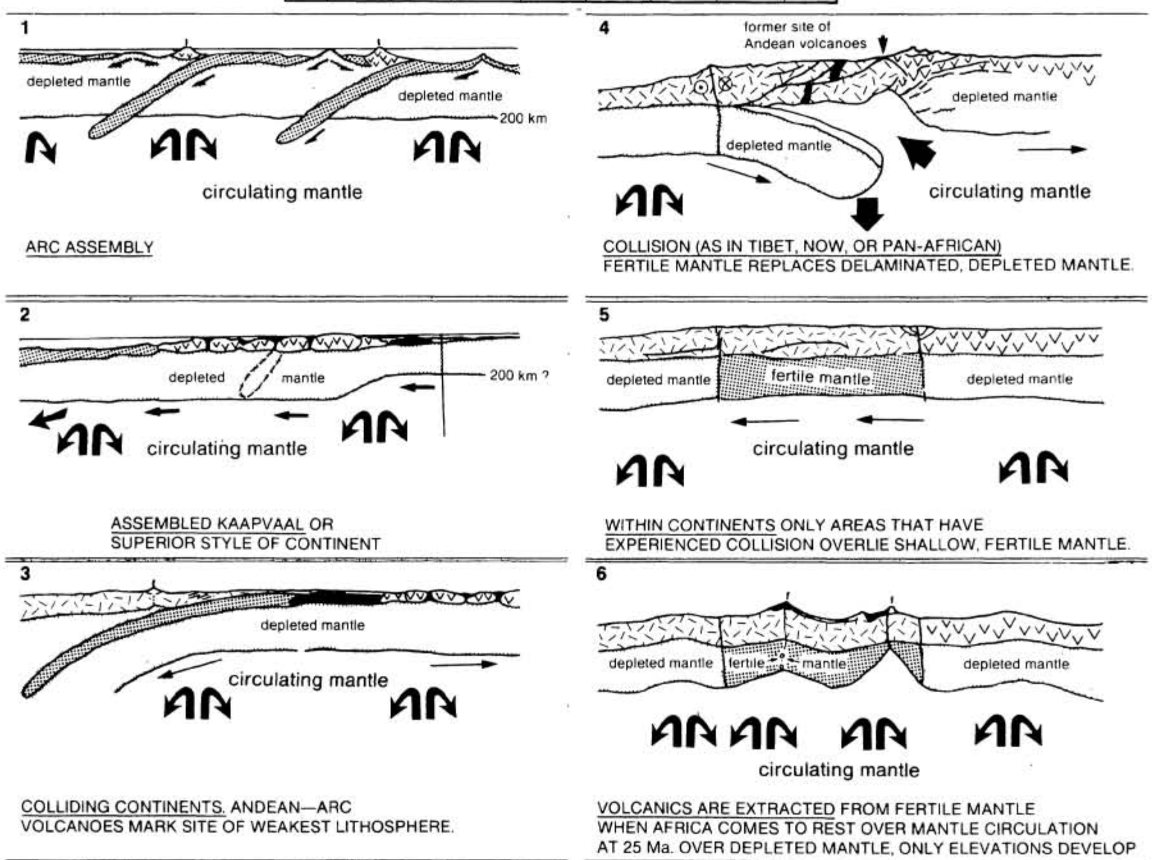

Fig. 3