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Mantle plumes and their LIPs and dyke swarms: Integrating lessons from Earth and Venus

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Large magmatic events on Venus are considered analogous to terrestrial Large Igneous Provinces (LIPs) [1,2]. Both are generally interpreted to be derived from underlying mantle plumes or smaller-scale diapirs. Herein, we compare LIPs on the two planets in order to better characterize plume-generated magmatism. On Earth, LIPs are often fragmented and deformed by plate tectonic processes and their surface expression and volcanic component (flood basalts) are usually lost to erosion. In contrast, on Venus, where plate tectonics is absent and erosion over much of the planet's history is minimal, LIPs remain intact and their surface expression and volcanic component (flow fields or flucti) are preserved. The plumbing system of LIPs is comprised of giant radiating dyke swarms (cf. novae on Venus) and circumferential dyke swarms (cf. coronae on Venus), sill provinces, and other intrusions [1-4]. The dyke swarms can be utilized to determine plume head size. On Earth, much of the plumbing system is exposed by erosion and can also be studied by geophysical (aeromagnetics, gravity) methods. On Venus, however, the plumbing system is not exposed, but dykes can be mapped in detail from overlying surface grabens and some intrusions can also be detected from overlying surface depressions [3,4]. Although the link between the plumbing system and volcanic component is seldom visible on Earth, on Venus volcanic flows can sometimes be seen emanating directly from grabens above radiating or circumferential dykes. Other LIP-related features that can be studied on the two planets include: shield volcano clusters, calderas above the plume centre, plume-related domal uplift, plume-related triple-junction rifting, and plume/corona clusters. Combining these and other characteristics of LIPs from studies on Venus and Earth is allowing a clearer understanding of these important features.

[1] Ernst, R.E (2014). Large Igneous Provinces. Cambridge University Press. [2] Buchan, K.L., Ernst R.E. (2021) Gondwana Research, v. 100, p. 25-43. [3] El Bilali et al. (2023) *Communications: Earth and Environment,* 4, 235. [4] El Bilali, H., Ernst, R.E. (2024) Nature Communications,15, 1759.