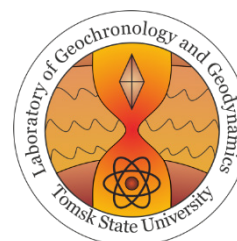


МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ РОССИЙСКОЙ ФЕДЕРАЦИИ  
НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ  
ТОМСКИЙ ГОСУДАРСТВЕННЫЙ УНИВЕРСИТЕТ



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ИЗМЕНЕНИЯ, МЕТАЛЛОГЕНИЯ, ФОРМИРОВАНИЕ НЕФТИ И ГАЗА,  
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# THE DERCETO-KALLISTOS LIP EVENT, LADA TERRA, VENUS

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## Introduction

Derceto Corona, previously known as Ammavaru Caldera (Lancaster et al, 1995) is an elliptical-shaped corona occupying northern Lada Terra on Venus. It is centred at

-46.8°N latitude and 20.2°E longitude, with a maximum diameter of 200 km along a north-west to south-east axis. We propose that this corona is a part of a regional volcanic event herein termed the Derceto-Kallistos large igneous province (LIPs) event (Fig. 1). This event includes: 1) two stages of flows on the eastern flank of a broad uplift spatially associated with Derceto Corona, 2) the Kallistos Vallis system which begins as a collapsed magma chamber 100 km south-west of Derceto Corona, and which feeds the Ubastet Fluctus (flow field) and 3) a separate flow system that extends from the Corona to the west (outside of the map area shown in Fig. 1).

The two eastern stages of flows and the Kallistos Vallis system are blocked on the eastern side by the pre-existing Vaidilute Rupes (a 2000 km long ridge system), but locally breach it and spread to the east of the ridge.

The order of discussion will reflect the suggested emplacement order of the volcanism, as determined by cross-cutting relationships and morphological characteristics (cf. López, 2011).

Although some of the above-mentioned features have formerly been mapped, they have not previously been considered collectively as an integrated magmatic event. Kallistos Vallis was mapped and determined to be a compound channel by Baker et al (1992), and both eastern stages were mapped by Lancaster et al (1995).

The purpose of this project is to develop a preliminary geological history of the Derceto-Kallistos LIP, and compare it with terrestrial LIPs (Ernst et al. 2019). As the first stage of this research, we provide a detailed map of the important elements of this magmatic system (Fig. 1). Mapping utilizes SAR images from the Magellan mission with a resolution of 100 m/pixel

## Stages of Flow Emplacement

### *Eastern Stage 1*

The eastern flank of the Derceto Corona regional uplift is covered by a fan-shaped distribution of lava flows. These flows head downslope toward Vaidilute Rupes and locally breach the ridge from the west side and continued to the east for another 200 km. The overall length of this flow stage is at least 550 km. The flow terrain is characterized as being radar-dark, meaning that it likely pahoehoe basaltic lava, rather than a'a (e.g. Keresztur et al, 2014).

Eastern Stage 1 is also locally overprinted by Eastern Stage 2, particularly on the lower slopes of the uplift. As well, the termination of the radar-dark Stage 1 flows to the east of Vaidilute Rupes is difficult to determine given that the regional plains volcanism is also radar-dark.

### *Eastern Stage 2*

At a lower elevation of the eastern flank of the uplift, there is a stage of radar-bright lobate flows. They appear to be fed from multiple NW to NNW trending grabens that likely represent an underlying regional dyke swarm. Looking at all the individual flows together, a radial trend outward from Derceto Corona is observed.

These Eastern Stage 2 flows are radar-bright and have clear lobate boundaries, so they are easily discernable as a separate unit. Some of these flows breach the Vaidilute Rupes and continue to the east for another 300 km. Throughout their extent the Eastern Stage 2 radar-bright flows are superimposed onto the Eastern Stage 1 radar-dark flows.

### *Western Stage*

A separate stage of radar-bright lava flows extend to the west of the uplift and seem to be fed from individual circumferential grabens (of Derceto Corona)

### *Kallistos Vallis-Ubastet Fluctus Stage*

Kallistos Vallis begins as a collapsed magma chamber 100 km south-west of Derceto Corona. It continues as an anastomosing channel system for 900 km by first progressing south and then east until it reaches Vaidilute Rupes, where it travels north alongside the ridge. It then breaches Vaidilute Rupes (at the same place as both eastern stages) and continues to the east supplying the lava flow field known as Ubastet Fluctus. This stage also includes channel overflows that are associated with the portion of Kallistos Vallis on the west side of Vaidilute Rupes. In Kargel et al (1994) it is stated that the Kallistos Vallis channel system begins at a topographic high and experiences an elevation drop from 1300 m to 800-900 m. On the steeper slopes, Kallistos Vallis exhibits a series of braids and meandering paths, many terminating or rejoining the main path. After this drop, the terrain flattens into a delta-like feature; this flatter portion of the channel system is associated with the lava overflow outside the channel.

### *Discussion*

Major volcanic features in this northern region of Lada Terra are combined into a single event consisting of the elliptical Derceto Corona, two volcanic stages on the eastern flank of the uplift associated with the corona, one on the western flank and another stage (Kallistos Vallis) emanating from a collapsed magma chamber on the southern flank about 100 km from the corona's centre, and feeding Ubastet Fluctus. This combined magmatic event is inferred to be similar to LIP events on Earth and hence is labelled as the Derceto-Kallistos LIP event. On Earth the plume centre regions are typically deformed and the volcanic material removed by erosion. On Venus, the volcanic features are typically not eroded and so the recognition and characterization of Venusian LIP analogues

provides an opportunity to better understand the primary volcanic patterns in the plume centre region of terrestrial LIPs.

We infer a provisional magmatic history beginning with Derceto Corona (and its associated circumferential graben system) then the three flank eruption stages: two on the east side and one on the west side, and finally Kallistos Vallis and its links with over bank flows and with Ubastet Fluctus.

The setting of Kallistos Vallis is interesting because its source area is the collapsed magma chamber on the flanks of the uplift associated with Derceto Corona, and it can be inferred to be associated with a magma chamber offset from the mantle plume that would be centred under the Corona (cf. plume-related LIP plumbing system model of Ernst et al. 2019).

As noted above, Vaidilute Rupes is a pre-existing ridge system that blocks and deflects lavas of this LIP event and is breached in only one place by Eastern Stage 1, Eastern Stage 2 and the Kallistos Vallis-Ubastet Fluctus flows. The location of this breach is where the Vaidilute Rupes ridge seems offset. This offset and resulting breach may be explained by an approximately 30 km left lateral strike slip fault that predates the Derceto-Kallistos LIP event.

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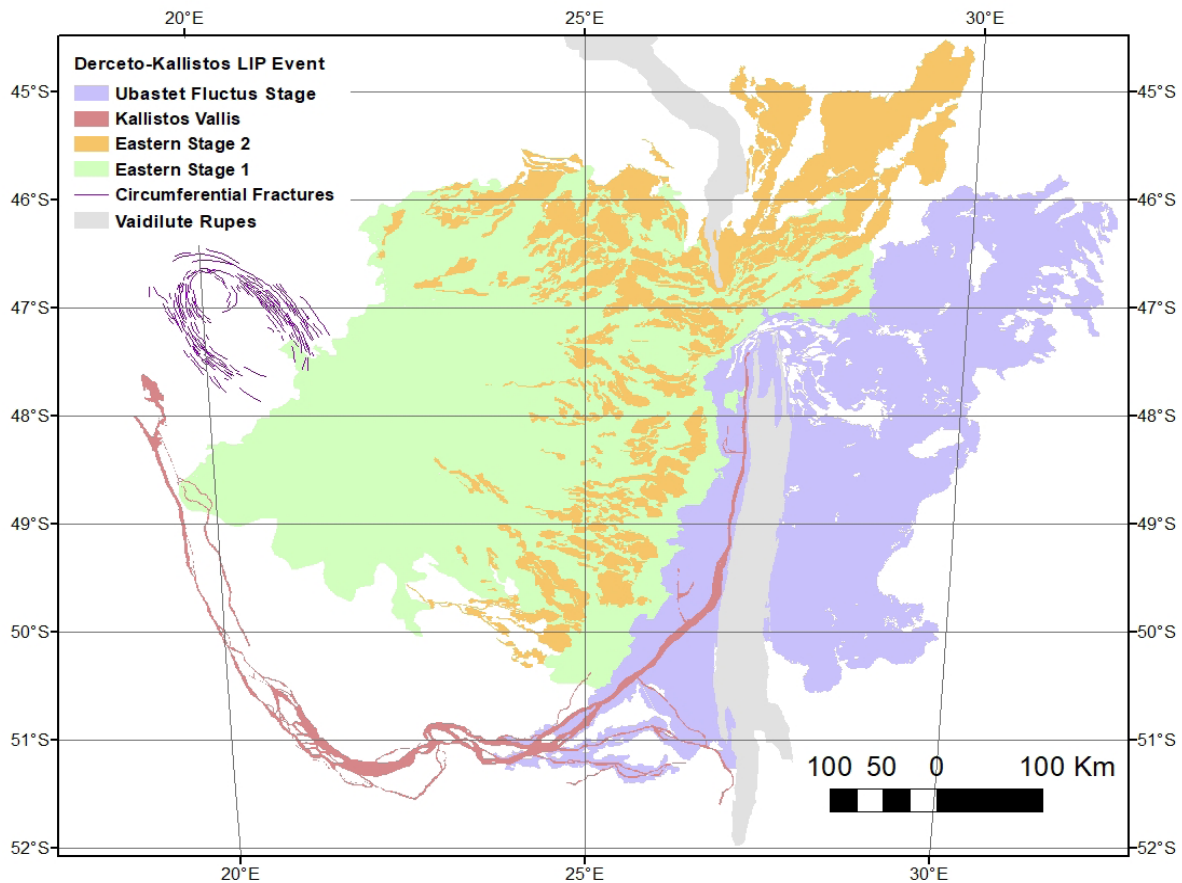


Fig. 1. Preliminary geological map of the Derceto-Kallistos LIP event.