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# The Idunn Mons-Olapa Chasma system as the candidate site for studying ongoing volcanotectonic activity on Venus

**Piero D'Incecco** (1), Ivan López (2), Attila Komjathy (3), James A. Cutts (3), Siddharth Krishnamoorthy (3). (1) Arctic Planetary Science Institute, Berlin, Germany (piero.dincecco@planetaryscience.de), (2) Universidad Rey Juan Carlos, Madrid, Spain, (3) Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California (US)

## 1. Introduction

Previous works have identified Idunn Mons – the 200 km diameter large volcano located at Imdr Regio – as the possible site of recent volcanism on Venus [1,2].
Here, we investigate with greater detail the geology of this area, with a particular focus on the tectonic interaction between Idunn Mons and Olapa Chasma, the rift zone where the volcano is located. In fact, the first indications from our mapping suggest that – being a site of recently active volcanism – Idunn Mons would consequently be a site of active tectonism as well.
The close relation between an eventual ongoing volcanic activity and active tectonism makes Idunn Mons as a credible candidate site for future missions, whose goal is that of studying volcanism and surface geochemistry [3,4] as well as the seismic activity [5] on Venus.

## 2. Methodologies

The preliminary assessment was conducted relying on the 1 μm emissivity anomalies observed by the VIRTIS instrument of the Venus Express mission and analysed in detail by previous studies [1,2].
For the geologic interpretation, we base on the Magellan right and left looking radar images at the highest available resolution (75 m/px). The mapping is performed through a combination of GIS and vector graphics editor software.

## 3. Geologic context

### 3.1 Morphology

Based on the existing morphologic classification of the large volcanoes on Venus, Idunn Mons belong to the class VII, which includes the volcanic edifices arranged along the axis of a rift trend [6].
Idunn Mons presents a flat-topped summit that can be observed in backscatter differences in the left-looking image and more clearly in the right-looking image (Fig. 1). On Earth, the formation of volcanoes with flat-topped morphology is still object of debate and includes two main hypotheses: constructional [i.e., 7] and destructive/erosional [8].
In the constructional hypothesis scenario, the morphology of the volcano is the result of lava flow eruptions originating from a ring dyke on the top of the edifice [7]. However, Idunn Mons lacks evidence of having circular fractures on its summit that would be the evidence for the presence of ring dykes under the surface (Fig. 1).
In the destructive (or erosional) hypothesis, the flat-topped morphology of the volcano would be the result of alternating effusive and erosional episodes, where the erosion produced the formation of a stepped topography over which late volcanic effusive materials are emplaced, adapting to and mimicking the flat and stepped topography that resulted from the previous erosional stage [8, 9].

### 3.2 Tectonism

While it is clear that the wrinkle ridges in the surroundings of the study area predate the formation of both Olapa Chasma and Idunn Mons, the tectonic setting of the volcano is closely interconnected with that of the rift zone.
In fact, the fractures characterizing Idunn Mons are characterized by an "hour-glass" pattern that is typical of areas where the stress fields forming a rift interact with the stress fields related to the eruptive episodes originating the volcanic edifice within the rift.
The syntectonic character of the Idunn Mons and Olapa Chasma is shown by the fact that some lava flows in the vicinity of the top and eastern flank of the volcano predate while other lava flows get locally disrupted by the rift-related fractures, disposed radially and concentrically to its summit (Fig. 2).
In this scenario, also the collapse events that we observe on the summit and flanks of the volcanic edifice would be just due to the volcano-rift tectonic interaction. This would also explain the flat-topped morphology of Idunn Mons.

For this reason, the tectonic processes behind the formation of Idunn Mons and Olapa Chasma are most likely recent and synchronous and we talk about Idunn Mons-Olapa Chasma (IMOC) system.

## 4. Overview

Previous studies based on the analysis of the Venus Express 1 μm emissivity indicated Idunn Mons as a recently active volcano [1,2].
Our detailed geologic analysis of the study area highlights the syntectonic charater of the IMOC system. Hence, the IMOC system could be volcanically as well as tectonically active.
For this reason, we propose this area as the candidate site for the mission concepts which are currently being proposed, involving both in-situ geochemical analyses performed by landers [3,4] and the detection of Venus-quakes associated with volcanic eruptions [5].

## References


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## 5. Figures

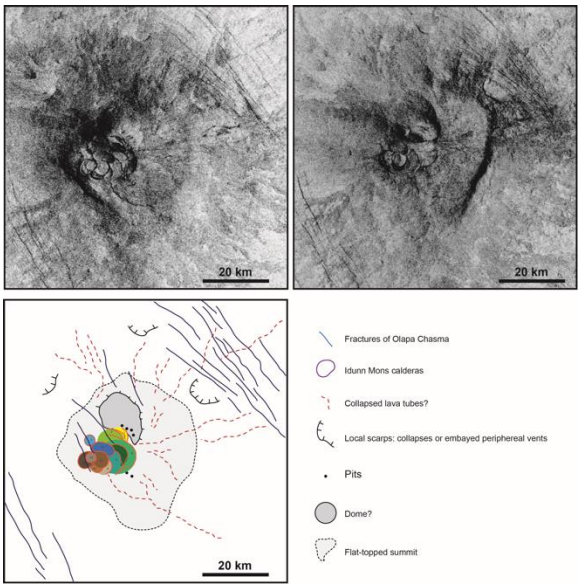


Figure 1 - The summit of Idunn Mons

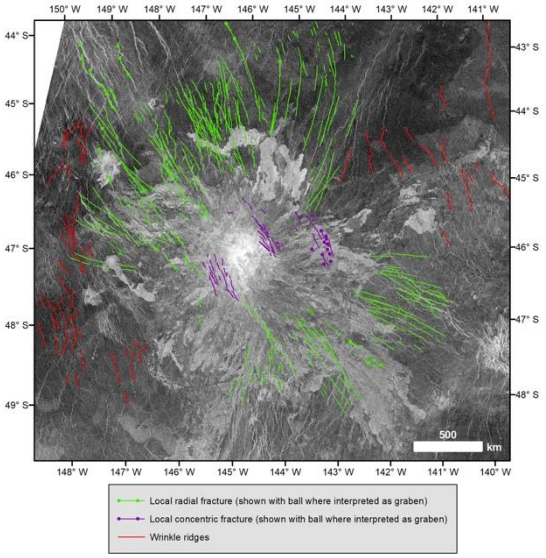


Figure 2 - Tectonic setting of the Idunn Mons-Olapa Chasma (IMOC) system