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# Study of rootless cones on Olympus Mons Aureole, Mars

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## Abstract

Rootless cones, also known as pseudocraters, are the product of the interaction of lava with ground ice or near surface water. The study carried out on the north region of Olympus Mons Aureole where the cone structures identified. Large number of cones were analysed based on its morphological features, which will be compared with the cones of other region majorly comprised nearby the equator.

## 1. Introduction

The rootless cones forms due to continuous phreatomegmatic process where lava flows over water or ice rich surface/subsurface[1], [2]. It is known as rootless cones as there is no direct source which feed these cones but far from the location of cone construct[3]. First clear identification of cones were possible due to Viking data which imaged the Mars regions includes; Chryse Planitia[3], Deuteronimus Mensae, Acidalia Planitia[4], Islidis Planitia[5] and later Mars Orbiter Camera(MOC) acquired higher resolution images of Cerbus plains, Marte Valles, Amazonis Planitia, Olympus Mons[6] regions. In most of the cases, cones are modified by the geological erosion process; including impact process, mud flow, aeolian effect; however none of these able to explain the complete characteristics of cones[3].

## 2. Study region and geological settings

The survey area selected is located at north of Olympus Mons (between 34°-40° N and 215°-250°W). The region is characterized by rivers of lava flow and or mudflow, ridges and grabens[7]. During Amazonian period the volcanic flow might have descend from Tharsis region, Alba Patera, Amazonian Planitia and/or Olympus Mons itself which may have generated the deposit of aureole that covers more than 1.7million $km^2$ area[8]. The observed cones are scattered nearby the outer boarder of aureole deposits. Distinct termination between deposit and surroundings point towards the periodic process of eruption [7].The ridges and troughs are around 10-100km long and 5-10km wide[9] which are prominently visible in the center of the deposits, however from the center towards outward boundary the signature gets saturated due to erosion processes.

The rootless cones in this region was identified long ago[10] but detail study has not been carried out. Thus, the objectives to study cones of Olympus cones is to look for the cone features; measure morphometry of cones and analyse the frequency distribution of cones which will help us to understand the larger view of volcanic process and lava flow.

## 3. Observation

Total 2480 rootless cones identified using 12 ConTexT Camera (CTX)[11]images. The horizontal resolution of CTX images are 6 m/pixel and used to identify the locations of cones. However, for the morphological inspection High Resolution Imaging Science Experiment (HiRISE)[12] data were considered due to high spatial resolution of >0.25m/pixel. Nevertheless, due to limitation in coverage 8 images were found in study area. Based on HiRISE visual analysis the cones broadly divided into two categories: simple cones with smooth crater terrain; complex cones with rough crater terrain. The simple cones are usual structure that has already been identified in many regions of Mars[3], [6], [13]. Usually the cones have conical structure with depression and crater at the summit (Fig 1a).In case of complex cones, the crater present at the summit has rough terrain (Fig 1b). However, the process behind this has not understood yet. The major difference between these cones is in terms of diameters of crater. According to primary observation the complex cones seem to have higher average crater diameter than the simple ones.

## 4. Further Research

The motive behind analyzing rootless cones is to try to evaluate the volcanic activity on terrestrial planets. Further, author is trying to establish link between cones of various regions on Mars that may guide to different eruption process throughout the planet. This can lead us towards the better understanding of evolution of volatiles, past and current Martian climate condition, igneous processes and favourable locations for the biotic development.

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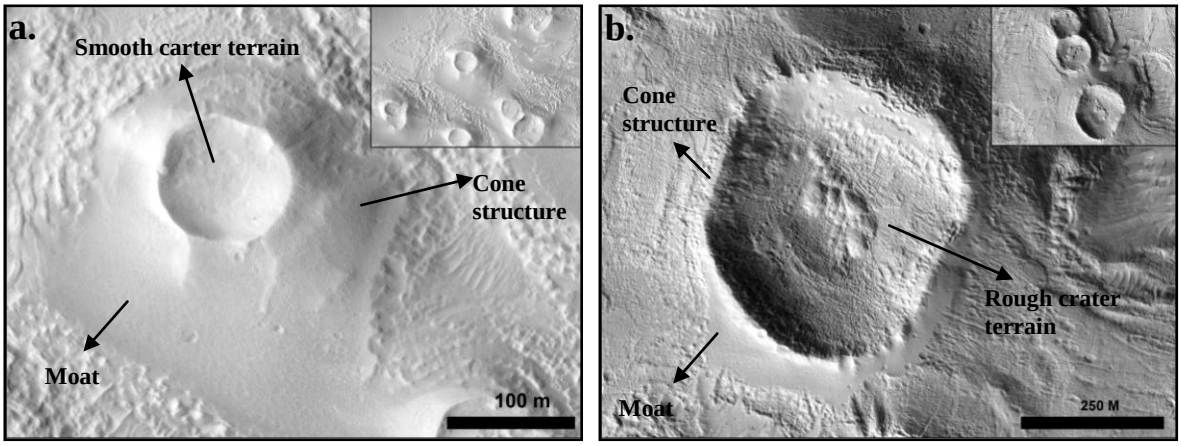


Figure 1 Typical example of simple cone(a) and complex cone(b) in Olympus Mons aureole (HiRISE image ID: ESP_034740_2145_RED and ESP_012363_2145_RED respectively).North upside