Impact craters as indicators of tectonic and volcanic activity in the Beta-Atla-Themis region, Venus

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ABSTRACT
Various features on Venus have been attributed to plumes or diapiric upwellings: the nine regiones, broad topographic rises extending thousands of km; approximately two hundred radial graben-fissure systems, extending hundreds of km; and three- to five hundred quasi-circular coronae with an average diameter of ~250 km. For each of these structures, alternative explanations have been proposed. Venus hosts nearly one thousand impact craters, which indicates that the planet was resurfaced ca 750–300 Ma; the presence of dark parabolic deposits provides age estimates for some craters. A minority of craters has been modified by tectonic and/or volcanic activity. Using the impact crater distribution and modification, we assess competing explanations for each of the suggested plume-related features in the Beta-Atla-Themis (BAT) region. The BAT region includes the planetary geoid and topographic highs, profuse volcanism, the intersection of three major rifts, and numerous coronae. Furthermore, although the BAT region covers just one-sixth of the surface, it contains 61% of the craters that are both tectonized and embayed. Using Magellan radar and altimetry data to establish uplift and deformation, detailed interpretations are given for six craters: three for Atla Regio (Uvaysi, Piscopia, Richards) and three for Beta Regio (Truth, Sanger, Nalkowska). Most impact craters dip away from Atla's geoid high, but on Beta, dip directions are more random, which may indicate that Atla is younger and more active than Beta. Within radial systems, minimal volcanic modification of craters has occurred, and crater dips do not suggest recent uplift. Modification and deficit of craters near and within coronae indicate that volcano-tectonic processes, possibly plumes, form them and may still be active.