Geophysical Research Abstracts
Vol. 15, EGU2013-11326, 2013
EGU General Assembly 2013

Identification of possible recent water/lava source fissures in the Cerberus Plains: stratigraphic and crater count age constraints

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The Cerberus plains are one of the youngest surfaces on Mars. They are thought to have been formed by lava and/or water flows, but there is considerable debate regarding the source of this material. Much of the material forming the western plains, including the Athabasca Valles outflow channels, appears to have flowed from the region of the Cerberus Fossae graben system [1,2,3] and limited areas forming the eastern plains may have been erupted by low shield volcanoes [4,5]. However, flow of material from west to east is obstructed by a ridge centred on 157^0E, 7^0N and, prior to this study, vents which might be the source of fluid of a low enough viscosity to form the majority of the flat eastern plains had not been identified. We studied new HiRISE (25cm/px, High Resolution Science Imaging Experiment) images of the ridge between the east and west plains and observed possible source vents for this material: the ridge is cut by a series of pits and fissures which lie at the heads of flows and channels extending towards the surrounding plains. In order to establish the stratigraphic relationships between the vents and plains, this study produced large scale geomorphological maps based on the HiRISE images. The mapping showed that both incised channels and leveed flows extend onto the plain to the south of the ridge and that these were the final phase of plains-forming activity in that region. Conversely, to the north, ridge-sourced deposits only form the plains surface close to the ridge - beyond that, they are overlain by large-scale regional flows that appear to have originated from the direction of Athabasca Valles. In the southeast, a large-scale flow which does not emanate from this ridge forms the plains surface, but there is evidence that the youngest outflow activity from the ridge was contemporaneous with emplacement of this unit. We also performed crater counts to age-date the surfaces and these indicate that plains-forming and ridge-sourced units are of a similar Late Amazonian age (<100Ma), with the latest activity tentatively dating to 10Ma. Thus, this study implies that very recent outflows from these vents contributed to the formation of the Cerberus Plains. It also constrains the timing of other large-scale plains-forming flows in the region and suggests that outflows from this ridge were part of a broader process of Cerberus plains formation from multiple sources [6].

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