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Morphological analysis of Holocene scoria cones and maar volcanoes of the alkaline Bayuda Volcanic Field in NE Africa (Sudan): new insights into the structure and evolution of a monogenetic volcanic field

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Quantitative characterization of the size and shape of volcanic edifices is an essential step towards the understanding of factors controlling volcano growth and morphology [1]. Due to its remote location, very limited research has been carried out on the Holocene Bayuda Volcanic Field (BVF) [2, 3]. The BVF comprises at least 57 scoria cones, 15 maars and voluminous lava fields that cover an area of approximately 480 km^2 in the Bayuda desert in the north of Sudan. The cones are dominated by scoracious lapilli tephra units, emplaced mainly by pyroclastic fallout from strombolian eruptions. Many cones are breached and are associated with a'a lava flows. The subordinate phreatomagmatism represented by maar volcanoes suggests the presence of ground and/or shallow surface water during some of the eruptions. The deposits constituting the rims around the maar volcanoes are interpreted as having mostly formed due to pyroclastic surges. Each of the tephra rings around the maars is underlain by thick older lava flows. These basalts are inferred to be the horizons where rising magma interacted with the groundwater.

In order to quantify the volcanic features of the BVF, for the first time, a project was initiated to analyze the morphology of the BVF's scoria cones and maar volcanoes and establish a morphometric statistic. The work was carried out using a GIS based approach by means of freely available AsterDEM data. With the help of the ArcGIS program, the basic parameters of height, width, depth, volume, and the width-height and crater depth-height ratios of the cinder cones and maars were measured. The preliminary results show that the height of the cones range from 30 to 250 m with an average of 97 m and the diameter of the cones extend from 250 m to 1800 m with an average of 850 m. These values are similar to those observed in other platform volcanic fields and slightly higher than the modal average for cone fields located on volcano flanks [4]. The maars have a crater diameter ranging from 290 m to 1370 m with an average of 580 m, which is lower than the global average, i.e. 600-700 m [5]. The mostly breached cones show predominant breach directions of roughly NE and SW, respectively, and may therefore be related to the extensional stress regime of the East African Rift System.

Further analyses and their interpretations in the course of this project will shed new light on the processes that formed the volcanic features of the BVF and its inherent stress regime.

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