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The Bláfjall tuya in North Iceland, morphological characteristics and effect of ice flow and icesheet slope on edifice form

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Tuyas are basaltic to intermediate glaciovolcanic edifices, formed in a body of meltwater within an ice sheet, in an ocean or a lake. The most common tuya stratigraphy consist of a lowermost layer or a mound of pillow lava, overlain by hyaloclastite tuffs and capped by a layer of subaerially-formed, horizontally bedded, lava flows. The parts of the lava flows more distant from the vent are built on flow-foot breccias, with the transition from subaerially-formed lava flows and breccias being a distinct stratigraphic boundary: the passage zone. The elevation of the passage zone marks the water level in the englacial lake into which the evolving tuya was built. At many locations the elevation of the passage zone appears to vary considerably from one location on a tuya to another. Some tuyas are elongated. One idea is that the elongation is predominantly in the direction of ice flow at the time of eruption.

By studying tuyas through aerial photography, satellite imagery and ground observations, the edifices variations in the elevation of the passage zone can be studied. This provides information on the eruption processes and environmental conditions at the time of formation. We have analyzed the variation of passage zone elevation with distance along strike of a selected set of tuyas in Iceland. These include Bláfjall, located in Northern Iceland. It was formed within a Pleistocene ice sheet a continuous, prolonged eruption, or in a series of eruptions, closely spaced in time. The lava cap reaches a maximum thickness of approximately 100 m but is only a few meters to a few tens of meters thick on average, showing clear signs of influence from the ice sheet. Apparently, both the thickness of the ice sheet and the direction of ice flow direction exerted major control on the height and elongation of the Bláfjall tuya. The eruption took place well to the north of the ice divide at the time, and the flow of ice was predominantly from south to north, with the elongated structure of the tuya oriented parallel to the flow of the ancient glacier. The thickness of the lava cap is greatest in the north part and generally decreases towards south. This is despite the fact that the elevation of the mountain increases southwards. This indicates that the northern part is mostly formed by an advancing lava delta, propagating in the direction of ice flow and that the level of the water body present at the end of the advancing lava delta become progressively lower towards north. This suggests a sloping ice sheet at the time of formation, or possibly a receding ice sheet, leading to gradual thinning with time as the eruption progressed.