Volcanology of the upper cone of the Rockeskyller Kopf volcano, West Eifel volcanic field, Germany

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Rockeskyller Kopf in the West Eifel volcanic field of Germany is a composite volcanic complex that was erupted onto Devonian dolomite at around 500 ± 100 ka BP. The eruption style evolved as interaction with ground- and surface-water decreased; from maar-like deposits in the oldest volcanic edifice to weakly phreatomagmatic scoria deposits topped by a 10 – 50 m thick lava flow in the youngest part of the complex. The youngest deposits are a scoria cone and lava flow that is exposed in a near perfect radial cross-section in a disused quarry on the west side of the hill. The scoria cone was erupted in three main stages: a) initial crater wall building stage (≈10 m thick) that is characterized by poorly layered to massive, subangular, welded scoria, that average 1.25 cm in size. The middle five meters include a succession of coarsening-upwards, ash to 6 cm lapilli, layers. b) The main stage deposits, ≈14 m thick, exhibit well-developed, meter-scale bedding, with the majority of the units containing lapilli up to 6 cm and bombs as large as 1m. The lapilli are round to subround and vesiculated; bombs range from vesiculated to weakly vesiculated and round to angular. c) Waning stage deposits (≈12 m thick) are characterized by a reduction in lapilli size and smaller scale, better defined layering. These deposits comprise ≈2 cm, vesiculated, and round to subround lapilli, with sparse bombs up to 15 cm.

Bomb size and frequency increase and then decrease along with lapilli size. Several features such as the proportion of basement rock fragments and variations in bomb morphology also highlight this waxing and waning characteristic noted throughout the section. This has implications for the intensity of eruption and magma chamber dynamics as well as the eruption mechanism.

The crater wall deposits are disconformably overlain by crater fill deposits that pinch out at the edge of the crater. These fill deposits are up to 2.5 m thick at the base of the crater and are composed of poorly layered and poorly sorted lapilli averaging 2 cm. Two welded scoria with ash layers are draped over the entire crater wall unit, from the bottom of the crater to the outer most exposure of the wall. The next stage of eruption was dominated by effusive eruption producing spattered material including fragments with flow structures as well as bread crust bombs that filled and spilled over the crater wall.

We interpret the crater wall deposits to have been formed by Strombolian activity. The initial stage is composed of massive Strombolian deposits with a minor phreatomagmatic component. Within the main stage, the eruption style changed from Strombolian to more phreatomagmatic deposits which are concentrated toward the top of this sequence. In the waning stage activity became less explosive; however, the occurrence of abundant basement rock fragments in these deposits indicates that the eruption had sporadic phreatomagmatic phases. The crater fill deposits are interpreted to be the result of fire-fountaining with the formation of spatter deposits and local bomb-rich horizons. This fire-fountaining activity culminated in the formation of a thick lava flow.