Persistent shallow magma storage beneath Katla volcano

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The Katla Volcanic Complex (KVC), one of northern Europe's most active and hazardous volcanic centres, is characterised by mainly basaltic activity, >300 explosive basaltic eruptions in the last 8.4 ky, and occasional silicic eruptions. Previous petrological investigations on historical Katla tephras suggest a state of simple plumbing which currently supplies Katla with magma from a deep reservoir system [*1*].

Here we derive crystallisation temperatures and pressures from clinopyroxene and plagioclase from historical and prehistoric Katla tephra samples which allow us to assess long-term changes in magma reservoir depth through time. In the lead up to the 940 AD Eldgjá Fires, geobarometric models suggest a gradual shallowing of the Katla plumbing system from 8 to 1.25 ky BP, with the emergence of a pronounced zone of magma crystallisation at ≤5 km depth revealed in the 1.25 ky tephra.

Geobarometry conducted on the 1918 tephra indicates that the system could be building up again, as the data parallel the pattern seen in the prehistoric samples, including evidence of shallow (≤5 km) crystallisation, consistent with seismic data and surface deformation that imply shallow present-day upper-crustal magma storage also [*2–4*].

As Katla now seems to be re-establishing its pre-Eldgjá plumbing pattern, mafic replenishments could intersect this shallow reservoir and lead to another, albeit likely bigger Eyjafjallajökull-style eruption, without much prior warning. This new information is relevant for disaster management, contingency planning and hazard mitigation in respect to disruptive volcanic consequences to northern Europe and beyond.

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