The temporal evolution and volcanic plumbing system beneath the southeast Lammersdorf Volcanic Center, West Eifel Volcanic Field, Germany

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The West Eifel Volcanic Field, western Germany, comprises ~240 volcanic edifices spread over ~600 km^2. Magma intruded into Devonian and Triassic meta-sedimentary rocks over the period 940 ka BP to 11 ka BP. Low velocity anomalies indicate the presence of a thermal plume containing 1–2% melt in the asthenosphere below the field. Since there are several large towns in the region and the Eifel is on the flight path for many major airports, any assessment of volcanic hazard must be based on the dynamics of magma emplacement. The Rockeskyllerkopf Volcanic Complex (RVC) first erupted the Southeast Lammersdorf volcanic center at ~474 ka BP with the final eruption of the Rockeskyllerkopf volcanic center, at ~360 ka BP. The deposits of the first eruptive event contain mantle-derived and high pressure cumulate xenoliths that were entrained in rising magma. Numerous studies have shown that the olivine in mantle xenoliths is in disequilibrium with the magma that brought them to surface; this is reflected in the development of Fe-Mg diffusion profiles. Olivine was analyzed in 9 peridotite and 5 clinopyroxenite xenoliths. Fe-Mg diffusion times in peridotites indicate xenoliths took less than one week to reach the surface whereas olivine from fragmented xenoliths of clinopyroxenites records a contact time a week to one year. Variations in forsterite compositions and melt Mg# indicate the presence of more than one magma in the volcanic plumbing system beneath RVC, possible re-equilibration of olivine, and a vein network of magma interacting with lithospheric mantle ~25 years before magma ascent into crust. Additionally, results indicate that magma was present within the crust below the RVC for up to as much as one year prior to the first eruption. As such, precursor activity ought to be expected as much as one year prior to eruption, however, there will be little warning.

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