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Numerical simulation of dike ascent below Etna and the Hyblean plateau, Sicily.

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Mt. Etna in Italy is an active intraplate volcano whose melting source has been debated. The ideal model should adequately explain the location of Mt. Etna, offset by several tens of km from the proposed asthenospheric tear below the Malta Escarpment (ME), address the earlier Hyblean volcanism more to the south, and explain the overall northward migration over time of the eastern Sicilian volcanism. We simulate numerically magma pathways in eastern Sicily from Moho depth to surface, accounting for regional tectonics and crustal decompression due to the deepening of the ME. Our models show that the overall northward migration of volcanism and the shorter-term westward migration of the eruptive vents within the Hyblean and Etnean phases may arise from variations in the ratio of tectonic extension (or compression) stress to crustal decompression, σT/Pu. If variations consistent with the stress history of Eastern Sicily are considered, a melt pooling region located below the ME may be reconciled with the location of both the Hyblean and Etnean surface volcanism and with the orientation of feeder dikes in the field. Our results show that evaluating the variations in the stress history of the crust may be critical to explain intraplate volcanism and its wandering.