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Emergence and evolution of Santa Maria Island (Azores)

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Santa Maria Island is an ocean-island volcano located in the SE corner of the Azores Plateau, resting on top of young lithosphere, being barely 480 km away from the Mid-Atlantic Ridge. Like most other islands in the Azores Archipelago, Santa Maria should be experiencing subsidence. Yet, the island exhibits features such as submarine volcano-sedimentary sequences and raised marine terraces at considerable elevations, which suggest an uplift trend instead. We have recently reconstructed the evolutionary history of Santa Maria with respect to the timing and magnitude of its vertical movements, using detailed field work and 40Ar/39Ar geochronology. Our work revealed a complex evolutionary history spanning ∼6 m.y., with considerable subsidence up to ca. 3.5 Ma followed by uplift, similar in magnitude but at a slower rate, extending to recent times. The reversal from subsidence to uplift roughly coincided with the apparent waning of volcanism, at 3.5-2.8 Ma. The fact that an island located in young lithosphere experienced a pronounced uplift trend is remarkable and raises important questions concerning possible uplift mechanisms. Localised uplift in response to the tectonic regime affecting the southeastern tip of the Azores Plateau is possible but unlikely, since the area is under transtension. Our analysis shows that the most likely mechanism to explain the uplift trend is crustal thickening by basal intrusions, suggesting that magmatic activity at Santa Maria continued beyond the demise of surface volcanism and, consequently, that intrusive processes play a significant role even on islands standing on young lithosphere, such as in the Azores.

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