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Where has the mush gone? A tale of a rejuvenated system

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Stromboli volcano (Southern Italy) is well-know for its persistent volcanic activity of periodic discrete mild Strombolian explosions, episodic lava flows and more violent explosive events (paroxysms) occurring at intervals of a few years. The shallow magmatic reservoir (highly porphyritic or *hp*-magma) is continuously refilled by more mafic magma (low porphyritic or *lp*-magma) at a near constant rate and accompanied by mixing, crystallisation and eruption. The *lp*-magma is erupted only during the paroxysms. The two most recent paroxysms occurred at very short timescales, on 3 July and 28 August 2019, prompting the question if any changes in the plumbing system have caused these unusual eruptions. We investigated the clinopyroxene populations of the two 2019 paroxysms and normal activity, determining timescales of magma injections events alongside P-T-X conditions, and comparing these with published data for the activity of the past decades at Stromboli.

Both types of magmas were erupted during the 2019 paroxysms in the form of black scoriaceous bomb and spatter (*hp*-magma) and light pumice (*lp*-magma), alongside mingled *hp*-*lp* products. Clinopyroxenes are characterised by chemical heterogeneities similar to previous products with diopsidic compositions (Mg# >80) represented by very rare antecrystic cores and frequent rims, and augitic compositions (Mg# <80) recorded by cores and rims representing the resident *hp*-magma. Diopsidic compositions are inherited from a mush region and are markers of mush remobilisation and recharging events of the more primitive *lp*-magma. In marked contrast with previously erupted products, the 2019 volcanics show a clear paucity of antecrystic cores alongside a strong low-amplitude oscillatory zonation of augitic crystals. Diopsidic rims record the timescales of triggering events (1-85 days) for the 2019 paroxysms, whereas a few crystals of the normal activity record slightly longer timescales of up to 6 years. The lack of longer timescales, which are instead typical of the previous activity (decades to hundreds of years), alongside the scarcity of antecrysts cores strongly suggests that the previously well-established crystal mush has been completely eroded, via cannibalisation processes, leading to a rejuvenated magmatic system in which fast and continuous inputs of *lp*-magma can lead to paroxysms over timescales of around 1 month.