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Etna 2011-2021: focus on a decade of paroxysmal eruptions at the volcano

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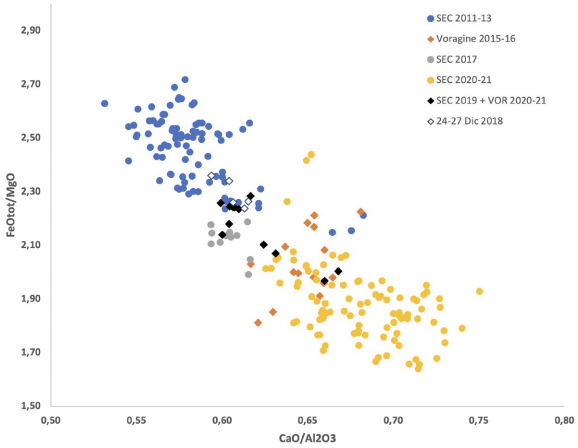

Mt. Etna is well known for its persistent degassing and volcanic activity dominated by effusive to low intensity Strombolian eruptions that occasionally evolves to more energetic manifestations. Looking at the last decade, more than 100 paroxysmal eruptions generating vigorous lava fountaining have occurred at the volcano summit, mainly at the South East Crater and Voragine. The most recent paroxysmal sequence began on 13-14 December 2020 and consists of 60 episodes at the South East Crater at the date of 23 October 2021, with two further episodes taking place during February 2022. These phenomena produced energetic lava fountaining up to 1.5 km above the crater edge and eruptive columns up to 15 km a.s.l., which caused intense tephra fall-out in the neighboring areas and ash dispersion very far from the volcano. In this contribution, we present a comprehensive record of petrological data such as bulk rocks, textural and chemical zoning of crystals, melt inclusion/tube compositions integrated with real-time geophysical signals (basically ground deformations and volcanic tremor), which have been collected for all the 62 eruptions occurred throughout the period 2020-22. Our data have been used to unravel the nature and timescales of magma dynamics during pre-to-syn-eruptive stages through diffusion modeling of major, minor and volatile elements in crystals and melt inclusions/tubes. The petrological variability of products erupted during the 2020-22 paroxysmal eruptions is also illustrated and interpreted within the framework of the exceptional post-2011 activity at the volcano. The whole dataset leads to the most accurate reconstruction available for the current plumbing system configuration of Mt. Etna, emphasizing the ability the volcano has now to frequently activate deep storage zones and to transfer rapidly very basic and undegassed magmas upward to shallower levels. The opportunity for these magmas to be stored into shallow storage zones and degas or not the markedly high pristine H2O and CO2 contents has the final consequences on the eruptive behavior observed at the surface, which can therefore span from almost wholly effusive eruptions up to astonishing lava fountaining even when largely comparable magmas from a compositional standpoint are involved.