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Magmatic processes leading to the 1650 CE explosive eruption at the Kolumbo submarine volcano, Greece.

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Kolumbo is the largest of twenty submarine volcanic cones, tectonically aligned in the transtentional Anydros basin, one of the most seismically active zones in the South Aegean Volcanic Arc, whose magmatism is related to the subduction of the African Plate beneath the Aegean microplate. Kolumbo explosively erupted in 1650 CE, causing the death of 70 people on Santorini, which is only 7 km SW of Kolumbo. Explorative cruises employing ROVs discovered a high temperature (220°C) hydrothermal field with CO2-rich discharges and accumulation of acidic water at the bottom of the crater (505 m b.s.l.), increasing the related hazard. A possible magma chamber was recognized below the crater at depth 9-6 km by seismic data [Dimitriadis et al. 2009]. Geochemical data [Klaver et al. 2016] suggest that Kolumbo have a different mantle source and storage system from Santorini. It is fundamental to understand the behaviour of this volcano, and how its storage and plumbing system works, to correctly assess risk for nearby islands.

We present petrographic, geochemical and isotopic data of samples collected during the cruises and by divers. Most samples represent the juvenile products of the 1650 CE activity, characterizing different magmas interacting before the eruption. They consist of white rhyolitic pumices with grey and black bands, also including basaltic-andesitic enclaves. Plagioclase, biotite, pyroxenes are the main mineral phases; olivine is found in the mafic enclaves. Minerals show quite complex zoning and a large compositional variability. Fresh lithic lavas were sampled; they also have amphibole and can be subdivided in three groups with distinctive petrographic textures that are well reflected in their different chemical compositions. They give information on the early history of the volcano and on how the rhyolitic magma could have been generated.

Our data suggest the presence of a complex storage system where the most evolved magma differentiated by assimilation and fractional crystallization, undergoing several inputs of mafic magmas. Early batches of new melts initially mixed with the resident ones, whereas later arrivals only mingled with the rhyolitic magma, thus possibly representing the final trigger of the eruption.