

***Volcanological and petrological evolution of the volcanic island of Nisyros, Greece**

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The volcanic island of Nisyros is located at the easternmost end of the Aegean volcanic arc, in the Dodecanese archipelago between the islands of Kos and Tilos. Based on field mapping at the 1:5'000 scale, we present in this work a geological map of the island at the 1:10'000 scale. The level of detail is improved in comparison to the previously published geological maps, with 35 mapped units of epiclastites, lavas, tephra and lakebed deposits.

A study of entire stratigraphic succession shows that early tectonic events affected the first, submarine lavas. At least one caldera collapse event was evidenced during the growth of a first central andesitic edifice as a consequence of the Lakkì explosive eruption. We hypothesise that another caldera collapse also occurred following the Melisseri explosive phase. Volcanic activity then moved first to the South, then was spread over the whole island and located along major tectonic trends (N030°, N070°, N120° and N340°). The identification of debris avalanche deposits and horseshoe-shaped scars imply the occurrence of a sector collapse in the Northern part of the island at that time.

New eruptive models are proposed for the Lower Pumice (LP) and Upper Pumice (UP) eruptions, based on new interpretation of the pyroclastic deposits. In particular, they imply two phases of eruption in the case of the LP with activation of multiple vents, and an off-centered tuff cone activity and reactivation of fractures in the case of UP.

Petrological and geochemical work demonstrated the importance of fractional crystallisation in the evolution of the island's magmas with superimposed processes, such as magma mingling, magma mixing, crystal re-entrainment and possibly crustal assimilation. However, clues indicated that another dominant process was involved. Based on geochemical modelling and thermobarometric calculations, it was hypothesised that dacites and rhyolites (units 17, 18, 19, 26/27, 29, 31, 32 and 35) evolved in a reservoir located at a depth of ~20 km, whereas basaltic andesites and andesites evolved in a shallower reservoir at approximately 10 km in depth.

Based on tectonic arguments, we demonstrate that that major changes in the stratigraphy (i.e. related to synthematic changes), geochemistry, morphology and type of volcanic activity can be related to changes in the dominant stresses affecting the island. In particular, it evidenced the existence of a major regional tectonic event, likely responsible of an important reworking of the magmatic feeding system (units 22/23) and hydrographical system (unit 24).

As a summary, we propose a new evolutive model for the entire island, with synthems representing the major phases and breaks being explained either by volcanic, magmatological or tectonic factors.

Finally, taking in consideration the types of activity displayed in the deposits of Nisyros both recent and ancient, we propose a set of four hazard maps. The most pressing hazards at present are related to phreatic eruptions in the Southern Lakkì plain and landslides, in particular for the villages hanging on the caldera rim (Emboriò and Nikià) and for houses located below the cliffs of Panaghia Spiliani Monastery in Western Mandraki. However, for worst-case scenarios involving magmatic eruptions, the entire island would likely have to be evacuated.