Tectonic influences on Quaternary volcanism of Methana, South Aegean arc, Greece

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The peninsula of Methana is a complex andesite-dacite volcanic centre near the western end of the active South Aegean arc. The most recent eruption was in 230 BC and all radiometric ages are younger than 1 Ma. This study investigates the role that neotectonics has played in localizing volcanic eruptions and its possible influence on magma genesis. To the south of Methana, most active Quaternary normal faults trend N-S, whereas to the north, the regional trend of active normal faults is ESE-WNW. Previously published maps were used as a basis for volcanological observations, sampling and measurement of structures that cut volcanic rocks of different ages. All structural and map data were assembled in a GIS project. Petrographic thin sections and geochemical analyses were made of representative rock samples.

The volcanic succession is divided into eight periods, based on superposition, geomorphology, and a few radiometric dates. At a map scale, many domes are elongate in an E-W direction and previous studies have suggested that stratovolcanoes formed at the intersection of E-W and NE-SW fault systems. Even the youngest volcanic units (period 8) show some tectonic deformation, with subvertical E-W trending shear fractures. Older rocks of periods 6-3 show predominant N-S faulting, although most map-scale fissures trend E-W. In period 2, small flow-banded eruptions are common, with sub-vertical flow banding trending either NE-SW or NW-SE. In period 1, sparse sub-vertical flow banding trends N-S and the faulting patterns are complex, probably reflecting changes in stress fields. The changing patterns of fault deformation can be related to regional changes in fault patterns through the Quaternary in the Aegean arc, with extension across older east-west faults resulting from strike-slip on NE- or NNE-trending faults.

The volcanic rocks are principally andesite and dacite, with some basaltic andesite. Many petrographic textures indicate the importance of magma mixing, including complexly zoned plagioclase with spongy cellular zones, ovoidal crystals, and mafic enclaves with chilled and lobate margins. The relationship of evidence of mixing to the fault patterns has been investigated.

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