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Active tectonics, volcanism and related mineralisation in Milos Island, Aegean Sea, Greece.

Konstantina Bejelou (1), Dimitrios Papanikolaou (1), Paraskevi Nomikou (1), Stephanos Kilias (1), and Jonathan Naden (2)

(1) Department of Geology and Geoenvironment, National and Kapodistrian University of Athens, Panepistimioupoli Zografou, 15784 Athens, Greece, (2) British Geological Survey, Keyworth, Nottingham NG12 5GG, UK.

Milos, a recently (<3 Ma) emergent volcanic island, is located at the southwestern Cyclades along the modern (5 Ma-to-present) Aegean volcanic arc. Its structure comprises neotectonic and active extensional forms of horsts and grabens, hosting the volcano-sedimentary fomations of Pliocene-Quaternary age, over the metamorphic Alpine basement, made of the Tertiary Cycladic blueschists. Thus, the Milos volcanic edifice has been established over an Early Tertiary HP/LT metamorphic complex, exhumed during Miocene.

The neotectonic and active structure is characterised by the intersection of major tectonic fault zones, creating tectonic blocks with differentiated movements either vertical, with uplifting or subsiding blocks, or more complex movements like tilting and/or rotations around inclined axes. The tectonic throws can be estimated on the basis of stratigraphic and/or morphotectonic criteria, since the overall volcano-sedimentary stratigraphy is well established with biostratigraphic as well as geochronological data. The tectonic blocks of the western part of Milos are dominated by E-W major faults, which do not continue to the eastern part of Milos, where N-S faults dominate, but they are separated by the prominent NW-SE graben structures of the intermediate Milos Gulf. A migration of the volcanic centres is observed with older features in Western Milos (Pliocene), followed by younger ones in eastern Milos (Early Pleistocene) and the most recent volcanic centres observed in the northern Cape Trachilas (400 Ka ago) and in the southern Fyriplaka area (80-100 Ka ago).

Milos features a rare, transitional between marine and terrestrial, paleogeothermal system where mineralisation dating back to$\sim$2.0 Ma is associated with contributions from magmatic volatiles, seawater, and meteoric-derived water, and emergent volcanism. The modern, active, shallow-marine geothermal system is considered the largest such system described to date. Geothermal fluids have used the faults bounding the fault blocks of the island with alterations of the adjacent volcano-sedimentary formations, giving rise to a spectrum of exploitable industrial mineral and hydrothermal deposit types; the latter range from marine, base metal-rich, volcanic rock-hosted massive sulfides to shallow marine exhalative manganese mineralization and precious metal-rich vein-style deposits resembling epithermal deposits on land. In addition, Milos hosts Earth's youngest Algoma-type banded iron formation (BIF) analogue. These mineralization styles have been uplifted and preserved intact, and provide an on-land natural laboratory for studying volcanic-hydrothermal processes in the submarine environment and developing a range submarine exploration strategies. It is interesting that only a few of the onshore tectonic structures continue in the offshore area around Milos Island.

Several other volcanic centres have been developed in the surrounding islands of Kimolos, Polyaegos, Antimilos and other minor islets as well as in the submarine domain like. Correlation of the onshore and offshore structures around Milos is under way, trying to establish an overall model of the tectonic structure and evolution of the volcanic edifice since its onset during Early Pliocene, and integrate this with metallogenic knowledge concerning the major tectonic controls on resource location, and, bathymetry, LiDAR and photogrammetry data and derived products (e.g. fault/lineament maps), to produce mineral potential maps of the submarine environment.