On the partially submerged active hydrothermal system of a rifted volcanic arc complex: insights from the PGG Milos cruise

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Résumé

The PGG Milos (*Physiography and Geology of the Gulf of Milos*) oceanographic mission provided the first comprehensive detailed mapping (resolution < 2 m) of the Gulf of Milos in the Cyclades (Greece) and the Sarakiniko offshore area in its immediate north-eastern vicinity (3 km). This unprecedented dataset allows us to understand the feedback between tectonic, volcanic, gravitational and hydrothermal processes in the most important volcanic centre in the Aegean Arc, the most promising high-enthalpy geothermal field of Greece, the most mineralized island in Europe in terms of surface area, and a zone with a remarkable combination of geological hazards (*e.g.* earthquakes, phreatic eruptions, tsunamis). The PGG Milos mission was carried out from 22 April to 11 May 2025 (2 legs) aboard the French Ocean Fleet ship Europe. Using data from the EM2040 multibeam echosounder (bathymetry, acoustic measurements in the water column and reflectivity, 1643 km, 197 km2), VHR seismic reflection (Sparker, 1310 km) and magnetometry (SeaSpy, 1398 km), the scientific team explored, identified and documented **(i)** tectonic morphologies and structures (*e.g.* horsts, grabens, fault scarps, dips, relay, length and connectivity), **(ii)** volcanic morphologies (*e.g.* cones, domes, size and direction of lava flows / pyroclastic flows), **(iii)** sedimentary morphologies and architectures (*e.g.* talwegs, canyons, channels, tributaries, deltas, sedimentary wedges, hydraulic dunes), **(iv)** gravitary morphologies (*e.g.* landslides and rockfalls) and **(v)** zones showing hydrothermalism (*e.g.* submarine depressions, dissolution features, gas plumes in the water column). Unusually for marine seismic data interpretation, the data were partially calibrated with the geological architecture observed onshore on the island and its cliffs, *i.e.* petrographic observations (e.g. domes, flows, published radiochronological ages), multi-scale tectonic structures (e.g. fault zonation, offset, petrography), stratigraphy and geomorphology. We attempt to establish a relative chronology between the different process markers (i, ii, ii, iv and v) in order to understand their dynamic interactions.

Mots-Clés: Géothermie, tectonique active, minéralisation, hydrothermal seeps

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