

Subaqueous Eruption and Emplacement of the Filakopi Pumice Breccia, Milos, Western Aegean, Greece

A L Stewart (Centre for Ore Deposit Research, University of Tasmania, GPO Box 252-79, Hobart, Tasmania 7001, Australia; ph. Int +61 3 6226 2478, fax Int +61 3 62267662; e-mail:als@utas.edu.au); J McPhie (Centre for Ore Deposit Research, University of Tasmania, GPO Box 252-79, Hobart, Tasmania 7001, Australia; ph. Int +61 3 6226 2892, fax Int +61 3 62267662; e-mail: J.McPhie@utas.edu.au)

The Filakopi Pumice Breccia (FPB) is a Quaternary pyroclastic formation exposed on Milos and Kimolos in the western Aegean, Greece. It is part of a submarine volcanic succession which has a thickness of 70 m and includes fossiliferous and bioturbated units indicating water depths up to several hundred metres. The FPB has a minimum bulk volume of 1.8 km³, the dominant component of which is glassy dacitic pumice. Pumice blocks and coarse lapilli are prismatic with tiny normal joints at their margins and internal polyhedral joints.

The FPB is up to 45 m thick and consists of three main units: (A) basal lithic breccia (4-8 m); (B) stratified pumice-lithic breccia (16-17 m); and (C) coarse pumice breccia at the top (6.5-20 m). Unit A is inversely to normally graded, clast-supported and poorly sorted. It is polymictic, with angular to subangular lithic clasts up to several metres in diameter, including andesitic and dacitic lavas, sedimentary rocks, basement-derived schist and pumice. The features of Unit A are consistent with deposition from a high-particle concentration submarine gravity flow. Unit B comprises several massive or internally diffusely stratified, wedging, very thick (0.9-4 m) beds. The beds are poorly sorted and consist of both pumice (2 mm-1.5 m) and lithic clasts (2 mm-100 mm). The bedforms suggest rapid deposition of waterlogged pumice from submarine gravity flows. Unit C is a widespread (> 18 km²) and very thick (up to 20 m) tabular bed of well sorted, reversely graded, coarse (64 mm-6.5 m) pumice clasts set in matrix that grades upwards from diffusely stratified fine pumice lapilli and ash at the base to laminated fine ash at the top. Unit C thus has a strongly bimodal grain size distribution. The framework of coarse pumice clasts was deposited by settling from suspension. This was initially accompanied by deposition of fine lapilli and ash matrix from weak, waning currents. The framework in the upper part was progressively filled by water-settled fine ash.

We infer that the large volume of finely fragmented, highly vesicular pumice in the FPB was produced by an explosive eruption. The uniform composition, presence of gravity-flow-generated bedforms (Units A and B) and lack of evidence for reworking suggest that submarine deposition of the FPB was continuous and probably syn-eruptive. The coarse lithic breccia (Unit A) at the base and overlying pumice-rich gravity flow deposits (Unit B) collectively record the eruption climax.

These two units may be submarine analogues of the basal coarse lithic breccia and overlying ignimbrite typically produced by large subaerial explosive eruptions. In Unit C, the progressive upward increase in the size of the coarse pumice clasts resulted from the slower waterlogging, and hence delayed settling, of larger pumice clasts relative to smaller pumice clasts. Thus, the coarsest pumice clasts may have been generated at the start of the eruption even though they were deposited at the top of the section, analogous to the opening fallout phases of subaerial events.

The FPB is not unique; at least one other formation in the submarine succession on Milos shows a similar internal stratigraphy. Giant pumice clasts are preserved at several levels in the stratigraphy. We conclude that submarine felsic explosive eruptions occurred repeatedly and that they generated distinctive facies and facies associations that can be taken as typical of both the setting and style of eruption.