Silicate melt and fluid inclusions in the grey tuffs of Monte dei Porri, Island of Salina, Aeolian Islands, Italy.

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The Aeolian Magmatic Arc is an arcuate chain of volcanic islands, islets and submarine seamounts located in the southern Tyrrhenian Sea, southern Italy. The island of Salina is the second largest of the Aeolian Islands and lies in the centre of the arc. Salina exhibits the largest range in compositional variation in its erupted products across all of the Aeolian Islands, ranging from high-alumina basaltic to dacitic lava flows to rhyolitic pumice tephras erupted from 6 volcanic centres.

The Monte dei Porri eruptions were the last cone-building events on the island, occurring between 67 ka and 13 ka. They occurred after approximately 60 ka years of repose. The units consist of basaltic-andesite to dacitic lava flows interlayered with tephras. One is a red, welded agglomerate and the other, an unconsolidated, grey tuff known in the literature as the "*Grey Porri Tuff*" (Keller, 1980). The Grey Porri Tuffs are widely distributed and are comprised of up to 70 m thick deposits of scoriae and pumaceous lapilli, with many meter thick deposits identified on other Aeolian Islands and Capo Milazzo, on the northern coast of Sicily, over 30 km away (Lucchi et al. 2008).

Samples were taken at two outcrops on the flanks of Fosse della Felci volcano on the island of Salina. The first outcrop (SAL10-4a, b, c) is an unconsolidated tephra exhibiting three clear horizons defined by changes in clast size, and consists of juvenile scoria fragments of varying sizes and entrained lithics. The scoria is crystal-rich, with a phenocryst assemblage consisting of feldspar (calcic plagioclase), olivine, clinopyroxene and small amounts of quartz. The second unit (SAL10-11a, b) has two horizons consisting of rhyolitic pumice and entrained lithics. This unit is dominated by large, clear olivine, feldspar (calcic plagioclase), clinopyroxene ± quartz and orthopyroxene. However, as will be discussed later, the origin of the quartz is yet unknown.

Silicate melt inclusions are ubiquitous in the tephra units and appear mainly as rounded, glassy inclusions with a single bubble. However, a number of inclusions in both units show more than one bubble (Fig.1), indicating that the melt was either saturated in volatiles at the time of trapping or became saturated after trapping but before the inclusion cooled through the glass transition temperature (Frezzotti, 2000). Raman spectroscopic analysis identified H_2O in the melt inclusion glass. H_2O was not detected in the bubble, and CO_2 was not detected in the glass or vapour bubbles.

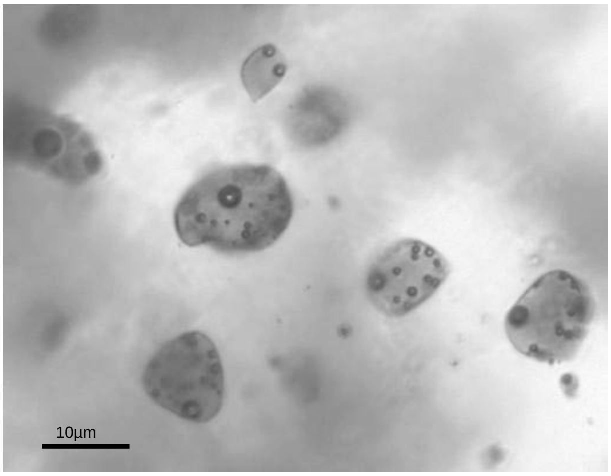

Fig. 1. Silicate melt inclusions with multiple bubbles in feldspar from scoria unit (SAL10-4b).

Silicate melt inclusions are found only rarely in olivine and pyroxene in the pumice units, but are relatively abundant in feldspar and quartz. Inclusion size is typically small, averaging ~10-15 µm in diameter. In the scoria units, melt inclusions are found in all phases but are particularly abundant in feldspar and quartz. Inclusions in the scoria units vary in size, with some particularly large inclusions (up to 100 µm in diameter), but average inclusion size is ~10-20 µm.

Unidentified opaque minerals are present in inclusions of all phases from the scoria units. The volume ratio of the opaque phase appears to be constant in most inclusions, suggesting that the phase is a true daughter minerals. However, in some MI the opaque occupies a large volume proportion, suggesting that the phase represents a trapped solid. These two occurrences of opaques within the same group of MI suggests that the melt was saturated in that phase and that it was actively precipitating from the same melt that was being trapped as MI. If the unidentified opaque phase represents a sulphide, this would provide evidence of liquid immiscibility in the melt (Roedder, 1984).

Two-phase (liquid + vapour) fluid inclusions that occur along growth or dissolution surfaces and are interpreted to be primary are present in quartz phenocrysts in the pumice unit (Fig. 2). However, the quartz may not represent a phenocryst phase but may instead represent material that was removed from the conduit during magma ascension.

Studies are currently underway to determine the geochemistry of the melt inclusions and the homogenization temperature of the fluid inclusions.

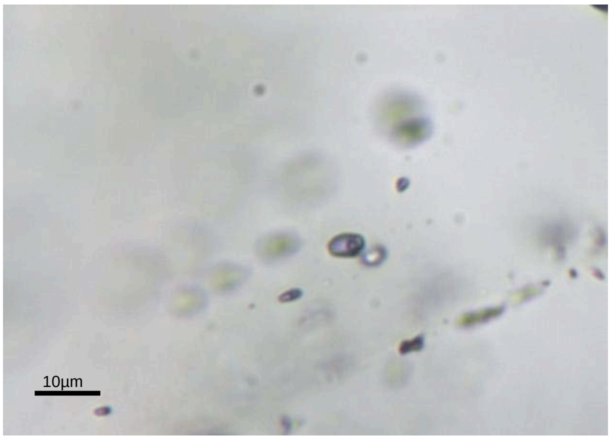

Fig. 2. Primary-appearing fluid inclusions in quartz of the pumice unit (SAL10-11a).

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