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Mingling processes at Panarea Volcano (Aeolian Islands, Italy): results from M73/2 cruise drilled cores

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The last Meteor 73/2 cruise drilled several lava cores in the southern Tyrrhenian Sea, close to Panarea Island and surrounding islets (Aeolian archipelago, Italy), at depths comprised between 50 and 70 m bsl. These rocks - unconformably covered by unconsolidated lapilli tuffs - revealed different lithologies and mineralogical assemblages corresponding to different compositions (hereafter A & B), as then evidenced by ICP-MS analyses (major and trace elements) performed on selected rock-samples. The cores also displayed several, cm-sized, rounded enclaves of the A-type dispersed in the B-type. The petrographic study on textures and microprobe analyses on glass shards and mineral phases finally concurred in identifying two magmas with different history and quite complex interaction. Rock A is a holocrystalline shoshonite (SHO) - showing plagioclase (pl - An%=62-74) and clinopyroxene (cpx) as main phases, plus subordinate amphibole and biotite phenocrysts, rare and small olivines (Fo≈89%) – which represents the first magma, usually in form of enclaves. Notably, the SHO shows intersertal vesicularity and scarce glass. Rock B is a porphyritic rhyodacite (RD) characterized by pl (An%=32-52), and biotite phenocrysts, with minor cpx phenocrysts and microphenocrysts. Pl and cpx show both alternate and normal zoning, and the former have frequent K-rich reaction rims. Similar mineral phases and frequent sanidine microlites characterize the alkali-trachyte glassy groundmass of rock B. This rock hosts the SHO and represent the most voluminous magma. Overall, these features indicate a quite complex history of magma interaction(s) as well as a polybaric crystallization, which lead the volatiles abundance and behaviour. From the study of the highly irregular edges observed along their contacts, we argue intrusive and visco-plastic relationships between A and B. Moreover, the presence of irregular vesicles and vugs bounded by pl microlites suggest an emplacement at shallow level where cooling favoured both slow degassing and pervasive crystallization. Textural and compositional data concur in indicating that the two magmas mingled at depth. Noteworthy, enclaves of a third rock type - very limited in volume – is present along some of the collected cores. It is a reddish low-porphyritic lava similar to the RD lava in terms of mineralogical composition, but showing a higher amount of microlites with smaller size if compared to the main RD host-rock. This could indicate that at some extent also mixing occurred.
The multiple similarities of our rocks with lavas of the Panarea islets or other acid volcanics containing mafic-intermediate enclaves and outcropping on other Aeolian Islands, suggest that mafic magma uprising “within” resident magma with subsequent mingling is a recurrent process in these volcanic systems and may be the trigger for the eruption of acid melts.