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Permeability of Campi Flegrei magmas: examples from the Campanian Ignimbrite and Monte Nuovo eruptions

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We performed permeability measurements on trachy-phonolitic pyroclastic products from the Campanian Ignimbrite and Monte Nuovo, two explosive eruptions from the active Campi Flegrei caldera, Southern Italy. Viscous (Darcian) permeability spans a wide range between 1.22x10-14 and 9.31x10-11 m2. Inertial (non-Darcian) permeability follows the same trend as viscous permeability: it increases as viscous permeability increases, highlighting the strong direct correlation between these two parameters. We observe that vesicularity does not exert a first order control on permeability: the Monte Nuovo scoria clasts are the most permeable samples but not the most vesicular; pumice clasts from the Campanian Ignimbrite proximal facies, whose vesicularity is comparable with that of Monte Nuovo scoriae, are instead the least permeable. In addition, we find that sample geometry exhibits permeability anisotropy as samples oriented parallel to vesicle elongation are more permeable than those oriented perpendicular. We compare our results with permeability values of volcanic products from effusive and explosive activity, and discuss the role of melt viscosity and crystallinity on magma permeability.