The establishment of the steady-state activity at Stromboli volcano (Italy): evidence from diffusion and mixing processes revealed at mineral scale

ELEONORA BRASCHI[1], CHIARA M. PETRONE[2], LORELLA FRANCALANCI[13] AND SIMONE TOMMASINI[3]

[1] CNR-IGG, Sezione Firenze, Via G. LaPira, 4, Firenze, Italy
[2] The Natural History Museum, Dept Earth Sciences, Cromwell Road, SW7 5BD London, UK
[3] Università degli Studi di Firenze, Dipartimento di Scienze della Terra, Via G. La Pira, 4, Firenze, Italy

The present-day activiy of Stromboli is characterized by strombolian explosions ejecting black scoriaceous lapilli and ash. This persistent activity is interrupted by effusive eruptions and more energetic explosions (paroxysms) also emitting a small volume of light pumices. The entire system is in a persistent steady-state activity whose driving forces are still not completely understood. Investigating the evolution of the plumbying system toward the present-day condition is thus crucial to better constrain and understand the onset and development of the present-day activity.

We studied in detail two selected samples representative of the transitional eruptive period from the more explosive phase forming the Pizzo Sopra la Fossa tuff cone (ca. 2 ka) to the present-day activity: (i) an older spatter-lava sample (shoshonite) from the Post-Pizzo fountain-fed fallout activity; (ii) a large and flattened, black scoriaceous spatter (shoshonitic basalt) probably ejected during one of the early paroxysms of the present-day activity. Both samples have similar paragenesis with phenocrysts of olivine, clinopyroxene, plagioclase. We recognize several types of clinopyroxene textures with different recurrence among the two samples. In detail, multiple banded clinopyroxene with evident resorption features, characterizes the older sample, recording several pulsatory intrusions of new mafic magmas into the system and pointing to the establishment of the steady-state condition. Contrarily, single diffused band and/or patchy cores are found in the present-day sample. We applied the diffusion chronometry to suitable clinopyroxene crystal zones to estimate the timing of these refilling events in the shallow magma reservoir from the Post-Pizzo period onward pointing to a progressive,transition toward the present-day steady-state conditions.

A $\delta^{13}C$ record from marine carbonates deposited below diamictites between ca. 2430 and 2440 Ma

A.T.BRASIER[1]*, A.P. MARTIN[2], V.A. MELEZHIK[3,4], A.R. PRAVE[5], D.J. CONDON[2] AND A.E. FALLICK[6]

[1] FALW, Vrije Universiteit Amsterdam, De Boelelaan 1085, 1081HV Amsterdam, The Netherlands (*correspondence: a.t.brasier@vu.nl)
[2] NIGL, BGS, Keyworth, UK
[3] Geological Survey of Norway, Postboks 6315, Slupen, NO-7491, Trondheim, Norway
[4] Bergen Univ., Postboks 7803, NO-5020 Bergen, Norway
[5] Dept of Earth and Env. Sciences, Univ. of St Andrews, St Andrews, KY16 9AL, Scotland, UK
[6] SUERC, East Kilbride, Scotland, G75 0QF

Palaeoproterozoic Polisarka Sedimentary Formation diamictites underlain by marine carbonates and overlain by volcanic ash sediments were recovered from International Continental Scientific Drilling Program Fennoscandian Arctic Russia - Drilling Early Earth Project (ICDP FAR-DEEP) Hole 3A (Kola Peninsula, NW Russia). The tuff yielded 2434 Ma dated zircons, constraining deposition of the diamictites and underlying carbonates to within an interval ca. 2430 to 2440 Ma. The carbonate rocks originally included aragonitic limestones deposited mostly in a deep-water setting. They record two inorganic carbon $\delta^{13}C$ excursions, from values of ca. 0‰ to minima of ca. -5.4‰ as the diamictite is approached. Mg/Ca ratios correlate strongly with $\delta^{13}C$ in the sections containing the excursions. Combined with petrographic observations, this correlation reflects secondary alteration of the first excursion, and resedimented dolostone clasts in the second excursion. It is tempting to speculate that these dolostone clasts were deposited in penecontemporaneous shallow-marine waters as the global glaciation began. Their low $\delta^{13}C$ values might reflect input of oxidised atmospheric methane to the ocean surface (and therefore the cause of the glaciation), while the majority of the ICDP FAR-DEEP Hole 3A carbonates record deeper-marine inorganic carbon $\delta^{13}C$.

DOI:10.1180/minmag.2013.077.5.2
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