Tracing the origin and evolution of the parental magmas of the Grey Porri Tuffs, island of Salina, Italy.

DOHERTY, A.L.[1]*, BODNAR, R.J.[2], CANNATELLI, C.[3], ESPOSITO, R.[3], DE VIVO, B[3] AND MESSINA, A.[3]

[1] University of Mesina, Messina, Italy (*correspondence: doherty.angelal@gmail.com)
[2] Virginia Tech, Blacksburg, VA, USA
[3] University of Naples (Federico II), Naples, Italy

The interbedded scoria-pumice-ash tuffs of Monte dei Porri, known as the Grey Porri Tuffs (GPT), appear to be the result of the mixing of two or more compositionally-different magmas. A more evolved trachyandesite-trachydacite magma, represented by melt inclusions (MI) trapped in feldspar of the pumice, was intruded by a basaltic magma, represented by MI in olivine of the same unit.

H_2O/CO_2 modelling indicates that MI in the feldspars of the pumice units were entrapped at ~0.6 kb. Magma-wall interaction had begun, evidenced by slight positive Zr anomalies and also low volatile element abundances (primarily: 1.7-2.8 wt % H_2O and 1019-1749 ppm S) which may indicate shallow system degassing. Feldspars of the pumice unit also show strong zonation and more sodic compositions than the scoria, which range from An_{58-81}.

The MI in olivine of the pumice units, interpreted to represent the mafic magma, were entrapped at higher pressures, ~1.7 kb, based on H_2O/CO_2 modelling. The olivine hosts had Fo-contents of Fo_{79-83}. The intrusion introduced a large amount of volatile components into the system; it contained 4.1-5.1 wt % H_2O, 3227-4032 ppm S, 187-492 ppm CO_2 and 3149-3855 ppm Cl. The subsequent eruption entrained the feldspar and clinopyroxene from the evolved melt, and the olivine from the mafic intrusion, and deposited the pumice units, which have an andesitic bulk composition.

Subsequent evolution in the mixed remnants of the magma produced a melt with a composition that is intermediate between the previous two. MI in the calcic feldspar (An_{84-93}), olivine (Fo_{71-82}) and clinopyroxene (augite and diopside) show overlapping major and trace element compositions, suggesting they may have had similar evolutionary histories. MI compositions and volatile element abundances approach those of the pumice units (the olivine-hosted MI contain 2.4-3.8 wt % H_2O, 169-570 ppm CO_2, 1495-3587 ppm S and 3165-3705 ppm Cl), suggesting that there may have been continual input from below, with the bulk rock compositions of the erupted GPT scoria units having a low-silica basaltic-andesite composition, more mafic than the majority of the MI from the same units.

Acid rock drainage in Antarctica – importance for global iron cycling in the Southern Ocean

DOLD, B.[1], GONZALEZ-TORIL, E.[2], AGUILERA, A.[2], LOPEZ-PAMO, E.[3], CISTERNAS, M.E.[1] AND AMILS, R.[2]

[1] Instituto de Geología Económica Aplicada (GEA), Universidad de Concepción, Concepción, Chile. (Bernhard.Dold@gmail.com), (mcistern@udec.cl)
[2] Centro de Astrobiologia (INTA-CSIC), Madrid, Spain. (etoril@cbm.uam.es,)(aaguilera@cbm.uam.es), (ramils@cbm.uam.es)
[3] Instituto Geológico y Minero de España (IGME), Madrid, Spain. (e.lopez@igme.es)

We describe biogeochemical processes that lead to the generation of acid rock drainage (ARD) and rock weathering on the Antarctic landmass and describe why they are important sources of iron into the Antarctic Ocean. During three expeditions, 2009 – 2011, we examined three sites on the South Shetland Islands in Antarctica. Two of them displayed intensive sulfide mineralization and generated acidic (pH 3.2 – 4.5), iron-rich drainage waters (up to 1.78 mM Fe), which infiltrated as groundwater (as Fe^{2+}) and as superficial runoff (as Fe^{3+}) into the sea, latter with the formation of schwertmannite in the sea ice. The formation of ARD in the Antarctic was catalyzed by acid mine drainage microorganisms found in cold climates, including *Acidithiobacillus ferrivorans* and *"Thiobacillus plumbophilus"*. The dissolved iron (DFe) flux from rock weathering (non-mineralized control site) was calculated to be 0.45 x 109 g DFe yr-1 for the nowadays 5468 km of ice-free Antarctic rock coastline what is in the order of magnitude of glacial or aeolian input to the Southern Ocean. Additionally, the two ARD sites alone liberate 0.026 and 0.057 x 109 g DFe yr-1 as point sources to the sea. The ARD point sources are between 1000 and 2300 times more efficient than non mineralized rock weathering for iron liberation. The increased iron input correlates with increased phytoplankton production close to the source. This might even be enhanced in the future by a global warming scenario, when more of the Antarctic coastline will be ice-free, and could be a process counterbalancing global warming.

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