Low $\delta^{18}O$(Zrc) in plagiogranites at Oman: Evidence for remelting

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Early, high temperature (T) infiltration of seawater may significantly impact late magmatic processes during growth of ocean crust. Magmatic $\delta^{18}O$ from zircons in plagiogranites from northern Oman ophiolite (Stakes & Taylor 1992 JGR) provide new evidence for the role of seawater in formation of oceanic plagiogranite. Zircons were separated and imaged by SEM at WiscSIMS prior to analysis of $\delta^{18}O$ and trace element (TE) using a Cameca 1280. Many zircons are oscillatory zoned (OZ) or contain OZ domains, but CL imaging also reveals late rims, and irregular/chaotic zoning sometimes associated with porous areas. Similar textures are reported in zircons from mid-ocean ridge (MOR) plagiogranite, and highlight potential concerns with geochemical analysis of whole crystals without prior imaging.

Igneous OZ zircons from Oman plagiogranites range in $\delta^{18}O$ from 3.9-5.2‰ VSMOW, averaging 4.6 ± 0.6‰ (2SD). This average value is distinctly lower than the average determined on a large suite of zircons from 43 rock samples of slow-spreading ocean crust (5.2 ± 0.5‰; n=221; Grimes *et al*. 2010) and lower than $\delta^{18}O$ of zircon in high-T equilibrium with the mantle (5.3 ± 0.6‰, 2SD; Valley *et al*. 2005 CMP). Average [Ti] (11 ppm; ~750° uncorr. Ti-in-zircon) and U/Yb ratios of Oman zircons and MOR plagiogranite zircons are equivalent, arguing against differences in magma source or crystallization T as a cause of lower $\delta^{18}O$ for Oman zircons. Instead, the low $\delta^{18}O$ (Zrc) can be explained by formation of the parent magmas by melting of a protolith altered at high T by a low $\delta^{18}O$ fluid. The Oman ophiolite has been interpreted to represent ancient fast spreading ocean crust, formed either at a MOR or backarc spreading center. These new low $\delta^{18}O$ (Zrc) data contrast with slow-spreading MOR zircons and could thus reflect 1) contrasting high T hydrothermal circulation systems at different spreading rates, with lower water/rock in slow spreading centers, or 2) melting of preexisting, hydrothermally altered crust in a backarc setting.

Single particle analysis of aerosols from El Chichón and Stromboli

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Particulate matter emission into the troposphere by continous smaller eruptions and degassing of quiescent volcanoes has not been given the same attention as to stratospheric aerosols produced by large eruptions. The effect on the radiation budget of the volcanogenic tropospherical sulfur containing aerosols (sulfuric acid, sulfates) is, however, considered to be at least as high as the antropogenic contribution. Previous investigations on the mineralogy of the aerosols and the condensation processes were done mainly by remote sensing and on bulk aerosol samples. Computer controlled SEM and EDX allows to gather quantitative information on a single particle basis. In 2009, we collected aerosol samples on Stromboli, Italy, a volcano with continuous moderate eruptive activity, and El Chichón, Mexico, a quiescent volcano with fumarolic activity. The particles were collected actively onto Nuclepore filters and Transmission Electron Microscopy grids. At El Chichón the sampling devices, an active PM10 and a corrosion resistant electrostatic sampler, were located close to the fumaroles and on the crater rim. On Stromboli, samplers were placed on the crater rim and on three locations along the coast. Over 2000 particles per sample were analyzed. Particles from the steam dominated fumaroles at El Chichón consist mainly of sulfuric acid, silicates and minor alkali sulfates. The composition of the aerosol does not change in composition during transport to the crater rim 200m above. Total sulfuric acid and sulfate particle flux out of the crater is estimated at 0.1 kgs^{-1}. A different picture is seen at Stromboli. The aerosol at the crater rim is dominated by submicronic K and Na bearing sulfates, almost no sulphuric acid droplets were found. The sulfate fraction in the samples collected in the three other locations, however, consist of sulphuric acid and Mg or Ca-bearing sulfate phases, which are rare in the crater samples. The change in sulfate mineralogy from the top to the lower parts of the volcano is either due to the increased mixing between volcanic and sea aerosols, or may reflect a change in the chemistry (ph, fO2) of the volcanic gas plume itself. The low concentration of sea salt particles in the latter speaks in favor of an evolution in plume chemistry.