Seismic constraints on temperature structure and magma production in arcs and backarcs

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Seismic velocity and attenuation can provide constraints on dynamic processes in arcs and backarc spreading centers. We combine seismic tomographic images, geodynamic models, and inferences from experiments on the seismic properties of mantle materials to gain insights into the temperature structure and the spatial distribution of fluids and melt in the mantle wedge.

We use *P* and *S* velocity and attenuation tomographic models for the Tonga-Lau and Mariana regions obtained from a combination of land and ocean bottom seismographs. The use of all 3 types of seismic observables (*Vp*, *Vs*, and *Q*) is highly desirable to provide several semi-indpendent constraints on the problem. All the images show high velocity, low attenuation subducting slabs and low velocity, high attenuation in the mantle wedge.

Mantle temperature fields from the geodynamic models are used to calculate forward models of *Vp*, *Vs*, and *Q* for comparison with the observed tomographic images, assuming the seismic anomalies are due to temperature variations. The observed anomalies at depths less than 100-150 km beneath the arc and backarc are much larger than predicted by temperature alone, suggesting the presence of melt and/or fluids. The higher resolution Mariana results show a distinct separation between low velocity, high attenuation anomalies associated with the arc volcanos and backarc spreading center, implying spatial separation between these melt production zones in the upper 100 km. Comparison between the magnitude of the seismic anomalies and the petrologically inferred upper mantle water content suggests that the backarc anomalies result from melt and not water. The Mariana backarc anomaly is also rather narrow (~75 km) and concentrated in the upper 100 km, providing constraints on the spatial dimensions of the magma production zone. The Tonga-Lau system shows larger seismic anomalies than Mariana, suggesting higher mantle potential temperatures and/or greater in-situ upper mantle melt content.

Primary producers in extreme arid environment of the Atacama Desert: Where, how and when?

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The Atacama Desert is considered to be the driest desert on Earth. The only sources of liquid water in its hyper-arid region are dew and fog. Both in terms of soil chemistry and liquid water availability, the Atacama Desert represents the best terrestrial analogue to the extreme arid conditions on Mars [1]. Therefore, the study of terrestrial life in hyper-arid deserts provides a first approximation to assessing the potential for life on Mars. We have recently shown that primary productivity in the Atacama Desert could occur within hygroscopic halite crusts [2], and that this is likely due to mineral deliquescence, which provides liquid water at relative humidity well below atmospheric condensation levels [3]. Gypsum and anhydrite are also widely distributed throughout the Atacama Desert and represent other potential lithic habitats for microorganisms. The aim of this study was to characterize the endolithic microbial communities and their microhabitats within the evaporitic crusts.

The endoevaporitic community is represented mainly by primary producers, including cyanobacteria and free-living algae, which are accompanied by heterotrophic bacteria and archaea. The metabolism and physiology of endoevaporitic microorganisms remains largely unexplored. We hypothesize that the interior of evaporitic salts provides protection from extreme temperature fluctuations, radiation and at the same type favour the cells hydration when the surrounding environment remains stubbornly dry. The habitability of evaporitic minerals is constrained by high ionic-strength conditions that occur in the presence of liquid water. Following the analogy with Mars, we propose that this type of deposits may have provided one of the last available niches for a putative Martian biosphere.

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[3] Davila *et al.* (2008) *J. Geophys. Res.* **113**, G01028.