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Advances in seismic tomographic imaging of magmatic systems

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Seismic tomography is the state-of-the-art technique for imaging the Earth. When applied to magmatic systems, phase-dependent imaging (e.g. travel-time tomography or noise interferometry) has shown the potential to broadly resolve magmatic anomalies. Here, I show recent advances in tomographic imaging of collisional continental structures at the upper mantle scale in SE Asia, with their influence on the distribution of magmatic systems. Then, I focus on the latest results of seismic attenuation (amplitude) tomography applied to crustal magmatic systems using both coherent waves and the stochastic signature of heterogeneities on seismic wavefields. The development of sensitivity kernels modeled using a multiple scattering description of seismic wavefields provides improved models of heterogeneous structures and better connections with alternative volcanological observations. The examples provided will span the Cascadian Arc (Mount St. Helens), Campi Flegrei caldera (Southern Italy) and Deception Island (Antarctica). Advanced imaging techniques, as full-waveform inversions and amplitude interferometry, remain biased in magmatic systems, without an improved understanding of the physics underlying anisotropy, multiple-scattering propagation and shallow-heterogeneity interaction, even if coverage substantially improves.

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