

## Magmatic Recharge Events and Long-Term Storage Conditions at El Chichón Volcano, Chiapas, Mexico

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Experimental phase equilibria and phenocryst zoning patterns indicate magma recharge is a frequent process at El Chichón Volcano and that recharge events do not always trigger eruption. El Chichón Volcano has erupted at least 12 times during the past 8000 years. The magmas tapped by this series of eruptions are compositionally monotonous trachyandesites with little isotopic variation and the same phenocryst assemblage. Experimental phase equilibria indicate the El Chichón magmas were stored at 825-850 °C and 125-250 MPa prior to each eruption. Compositional and textural zoning of phenocryst phases, however, record numerous fluctuations in temperature and/or pressure of up to 100 °C or 100 MPa between eruptions. In addition, plagioclase phenocrysts are isotopically zoned with lower  $^{87}\text{Sr}/^{86}\text{Sr}$  ratios mirroring zones with increased anorthite content, followed by high  $^{87}\text{Sr}/^{86}\text{Sr}$  ratios and decreased anorthite content; this pattern likely records input of hot, isotopically primitive magma to the system followed by assimilation of colder, isotopically evolved rock. Interestingly, multiple phenocrysts from single pumice record different zoning patterns and thus different histories of recharge, mixing, and assimilation. Estimates of crystal residence times based upon diffusion of Sr within plagioclase suggest that it is unlikely that individual phenocrysts were stored at magmatic temperatures for more than 500-1000 years and thus the disparate zoning patterns cannot be explained by mixing old (>8 ka) and young populations of crystals. Further, although the rim compositions of plagioclase are similar between the different eruptions and provide an estimate of the baseline storage temperature, the frequency and magnitude of deviations from that composition vary between the eruptions and shows that different populations of phenocrysts were tapped by each eruption. We propose that the El Chichón magmatic system is frequently recharged by small volumes of hot, isotopically primitive magma. Because the recharge events are small relative to the magma chamber as a whole, only those regions near the recharging magma are heated significantly (>100 °C), whereas phenocrysts farther away may not be heated at all. As a result, different phenocrysts can have different records of the same event. The compositional effects of recharge are balanced by assimilation, thus there is no long-term trend in chemical or isotopic composition. The system is well-mixed and of limited volume (~1 km<sup>3</sup>).