



IAVCEI 2008
General assembly
Reykjavík - ICELAND



2006-2007 explosive activity and erupted products of Ubinas volcano (Peru)

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Topic

Integrated Monitoring and Modelling of Volcanic Activity

Keywords

Ubinas, explosive activity, tephra, petrology

Abstract

Ubinas, the most historically active volcano in southern Peru, has shown 24 degassing and ashfall episodes since A.D.1550. A population of ~3500 is living within 12 km of Ubinas and has been periodically affected by ash fall and gas. The most recent explosive activity started on 27 March 2006, while degassing still continues. Based on the erupted products and the explosive behaviour, the eruptive episode has shown four stages: 1) the initial phreatic and phreatomagmatic activity (27 March to ~19 April 2006), which included eruption columns that spread ashfall as far as 7 km from the summit; 2) vulcanian explosions (~20 April to 11 June 2006) forming 3 to 4 km-high columns, from which blocks up to 40 cm in diameter were ejected to distances 2 km from the vent; fresh lava reached the vent bottom on 20 April; 3) strong degassing was interspersed with at least 12 events (mid June 2006 - April 2007) that produced 2-3 km-high vulcanian columns and ashfall as far as 40 km from the summit; 4) mild degassing since May 2007 produces a permanent 200 to 800 m-high plume and occasional light ashfall around the summit. Erupted ash fallout, ballistic scoriae and crust bombs represent an estimated volume of ~106 m³, while fresh lava of unknown volume has been emplaced at the bottom of the vent 200 m below the summit caldera floor. The composition of the ejecta is 56-57% SiO₂ and 6.16-6.30% K₂O+Na₂O, and is similar to the average composition of historically erupted andesite at Ubinas. Petrographic textures and the chemical zoning pattern of phenocrysts show dusty-rimmed plagioclase with reverse zonations (An₃₃₋₅₆ cores, An₄₁₋₅₉ rims), clinopyroxene with reverse zonations (Mg#71 cores, Mg#73 rims), amphibole with reaction rims, and olivine xenocrysts. This indicates that part of the mineral assemblage is not in equilibrium with the average mineral suite or with the melt, a process that may have occurred prior to, or during, the 2006 eruptive activity. Such characteristics suggest a recharge of "fresh" erupted andesite and another 'old' andesite bearing a mineral assemblage inherited from a previous magma batch within the conduit.