Large-Volume Dacitic Ignimbrites erupted from Batur Caldera Formation, Bali, Indonesia

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Abstract

Batur is one of the finest known calderas on Earth, and is the source of at least two major ignimbrite eruptions with a combined volume of some 84 km^3 and 19 km^3. These ignimbrites have a similar compositions, raising the question of whether they are geneticaly related. The Batur Ignimbrite-1 (BI-1) is crystal poor, containing rhyodacitic (68 - 70wt % SiO_2), white to grey pumices and partly welded and unwelded. The overlying Batur Ignimbrite-2 (BI2) is a homogeneous grey to black dacitic pumices (64 - 66 wt % SiO_2), unwelded and densely welded (40 - 60% vesicularity), crystal and lithic rich. Phase equilibria indicate that the Batur magma equilibrated at temperatures of 1100 - 1300^oC with melt water contents of 3 - 6 wt%. The post-eruptive Batur magma was cooler (<1100^oC) and it is melt more water rich (> 6 wt % H_2O). A pressure of 20 kbar is infered from mineral barometry for the Batur magma chamber. Magmatic chamber model is one in which crystals and melt separate from a convecting Batur magma by density differences, resulting in a stratified magma chamber with a homogeneous central zone, a crystal-rich accumulation zone near the walls or base, and a buoyant, melt-rich zone near the top. This is consistent with the estimated magma temperatures and densities: the pre-eruptive BI-1 magma was hoter (1300^oC) and more volatile rich (6 wt % H_2O) with density 2.25 g/cm than the BI-2 magma (1200^oC; 4 wt % H_2O) in density was higher (2.50 g/cm). Batur melt characteristics and intensive parameters are consistent with a volatile oversaturation-driven eruption. However, the higher H_2O content, high viscosity and low crystal content of the BI-1 magma imply an external eruption trigger. Those ignimbrite deposites have been develoved to make up the Batur Unesco Global Geopark and conservation the area.
Keywords: Batur caldera, Batur ignimbrite, rhyodacite, dacite, melting zone, magma chamber model, conservation, Batur Unesco Global Geopark.