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Degassing-induced crystallization in silicate melt inclusion: evaluating the role of post-entrapment changes in melt inclusion from the SW volcanic flows of Deccan Large Igneous Province (Deccan LIP) lava.

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Melt inclusions represent sampling of magma during their growth in magma chambers and during ascent to the surface. Several studies of melt inclusions in Large Igneous Provinces (LIPs) in different parts of the world have been documented in the literature (Sobolev et al. 2011; Kamenetsky et al. 2012). Melt inclusions study from Deccan LIP can provide new insights into the physio-chemical conditions and evolution of this important LIP. The Deccan LIP was fissure eruption mainly emplaced over a very short duration at 66 Ma (Schoene et al. 2015). To better characterize and explain the diversity in geochemical composition, petrogenesis and volatile degassing, melt inclusions studies have been carried out in clinopyroxene and plagioclase feldspar from a suite of samples in the Western Ghats section. Samples were obtained from the upper three formations (the Wai subgroup). The inclusions are primary and range in shape and size varies from a few microns, up to 100 microns. The inclusions are crystalline, and contain daughter phases. Some are glassy, with or without a shrinkage bubble. The melt inclusions show substantial variations in major element composition. Inclusions are significantly enriched in TiO_2 (3.68 to 0.08 wt%) and FeO (18.3 to 2.63 wt%). SiO_2 ranges from 43.4-66.8 wt% and classification diagrams of total alkali (Na2O+K2O) Vs. silica melt inclusions show that most inclusions are of sub-alkaline to mildly alkaline composition. $Al2O_3$ ranges from 9.7- 22.4wt % and MgO 18.3-1.6. EPMA measurements demonstrated the presence of daughter crystals, such as magnetite and titanomagnetite, and high FeO, TiO_2 and CaO within melt inclusions among the silicate daughter crystal clusters. Volatiles are determined have wide range in composition in both plagioclase- and pyroxene-hosted melt inclusions by using FTIR technique, values up to 2wt% H_2Ototal and 1808 ppm CO_2. Moreover the variability in composition and volatiles the melt from the samples in a single flow suggests that trapped melts were significantly affected by degassing and the post-entrapment changes. After each hiatus of the magmatic pulse the differentiated residual magma was enriched in Fe-Mg-Ti. Post-entrapment crystal aggregates contribute to the alteration of the melt phase within the inclusions (Choudhary and Jadhav 2010) i.e. fractionating tholeiitic lavas follow a trend that reflected by iron saturation until Fe-Ti oxides start to precipitate. Compositional concentrations are affected by diffusion from the plagioclase host into the inclusion, e.g. precipitation of host, resulting the high $Al2O_3$ .Therefore melt inclusions showed evolved fractionated melt with the presence of aggregated crystals indicating that formation of these Fe-Ti oxides have occurred in an aqueous condition. As well, the formation of daughter mineral assemblages (titanomagnetite, and magnetite crystallization inside the inclusions) promotes the diffusion of hydrogen out of the inclusions.