ERUPTIVE MECHANISM OF PHREATOMAGMATIC VOLCANOES FROM THE PINACATE VOLCANIC FIELD: COMPARISON BETWEEN CRATER ELEGANTE AND CERRO COLORADO, MEXICO

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Abstract

The Pinacate Volcanic Field is located just near the northern end of the Gulf of California (Sea of Cortez) in Sonora, Mexico. Extensive lava flows cover an area similar to 2000 km² and which is cut through by more than 400 vents, predominately scoria cones. Eight of the vents are maar-like and represent remnants of the pre-magmatic lava flows, which are exposed in the crater wall. Two of the phreatomagmatic vents are especially spectacular by their size and volume, and their contrasting architecture. Crater Elegante and Cerro Colorado. Crater Elegante is about 1500 m across with a crater that is about 200 m deep, which is surrounded by a few tens of metres complete crater rim. Elegante is inclined to the SW and its pyroclastic deposits are dispersed more than a km away from the crater rim. The crater Elegante contains a dome-shaped collapsed vent, over a maar-like lava flow exhibiting phreatomagmatic features over deposits such as pressured edges and tephra blankets of the pre-eruption phases. Pyroclastic units are predominantly lapilli tuffs that are rich in fine ash, rounded angular, non-vesicular or bronzite-phenocrystic glass grains and lapilli-like to phenocrystic and composition. The final lapilli bed and lapilli units about a few hundred metres away from the rims are typically rich in angular fragments that are loosely packed. Sources of the pyroclastic succession are calcite cemented. There is a notable trend in a quick reduction in the volume of pyroclastic vent-accompanied lithic fragments downflow which various pre-eruption phases in the lapilli tuffs from the crater rim toward distal areas. Bedding characteristics of the pyroclastic succession are predominantly massive to well bedded in near-near settings that quickly change to dune bedded successions with dunes having a few dm wavelengths over metres wide. These characteristics of deposition from sudden blast triggered base surges are present in the pyroclastic succession in Cerro Colorado. The crater Elegante is a few tens of metres below the inferred syn-volcanic surface and forms a ~100-m-radius flat depression. The crater Elegante wall is mantled by the collapsed blocks of lapilli breccia and lapilli tuff bed that is very rare in volcanic centres. The pyroclastic succession of Cerro Colorado is significantly coarser grained, and thick bedded lapilli tuff bed than the Crater Elegante succession. Lapilli tuffs and lapilli beds, which are rich in aeroball-shaped nodules, are highly vesicular or bronzite-phenocrystic glass and consist of lapilli-like to phenocrystic materials that are interbed by gel palagonite. Intact gravel pebble of mud and sub-rounded to sub-angular, non-vesicular spheroidal glass shards are typical. Intact gravel pebble of mud and sub-angular, non-vesicular spheroidal glass shards are typical. Volcanic surface and forms a ~600-m-wide, flat depression. The crater floor is about 25 m below the crater rim. Mudcracks suggest intensive dewatering of the tephra after deposition. Massive, weakly stratified lapilli tuff in the crater wall of the Cerro Colorado. Pyroclastic units are predominantly lapilli tuff bed. The crater Elegante is about 1600 m across with a crater that is about 300 m deep, which is surrounded by a few tens of metres complete crater rim. Elegante is inclined to the SW and its pyroclastic deposits are dispersed more than a km away from the crater rim. The crater Elegante contains a dome-shaped collapsed vent, over a maar-like lava flow exhibiting phreatomagmatic features over deposits such as pressured edges and tephra blankets of the pre-eruption phases. Pyroclastic units are predominantly lapilli tuffs that are rich in fine ash, rounded angular, non-vesicular or bronzite-phenocrystic glass grains and lapilli-like to phenocrystic and composition. The final lapilli bed and lapilli units about a few hundred metres away from the rims are typically rich in angular fragments that are loosely packed. Sources of the pyroclastic succession are calcite cemented. There is a notable trend in a quick reduction in the volume of pyroclastic vent-accompanied lithic fragments downflow which various pre-eruption phases in the lapilli tuffs from the crater rim toward distal areas. Bedding characteristics of the pyroclastic succession are predominantly massive to well bedded in near-near settings that quickly change to dune bedded successions with dunes having a few dm wavelengths over metres wide. These characteristics of deposition from sudden blast triggered base surges are present in the pyroclastic succession in Cerro Colorado. 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Volcan Crater Elegante

Volcan Cerro Colorado

Volcanic lithic bedrock lapilli succession (base surge) near the western crater rim of the Crater Elegante. Volcanic lithics (Vl) are derived from the pre-maar lava units.

Facies changes of base surge beds with increasing distance from the crater centre.

SEM photo of a lapilli tuff from the Cerro Colorado. Note the bright coloured pyroclastic fragments and calcite-cemented volcanic lithic lapilli-rich lapilli tuff succession.

SEM photo of a sideromelane glass shard from a lapilli tuff from the Cerro Colorado. Note the rounded opaque inclusions in the vesicular breccia glass shard.
Eruptive mechanism of phreatomagmatic volcanoes from the Pinacate Volcanic Field: comparison between Crater Elegante and Cerro Colorado, Mexico.

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