8 Ma time series of explosive volcanism at the Central American Volcanic Arc (marine tephras from ODP and DSDP sites)

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The Central American Volcanic Arc (CAVA) is, and has been, one of the most active volcanic regions on earth and generated numerous Plinian eruptions along his 1200 km extension.

Numerous ash layers up to 8 Ma, which occur in ODP and DSDP cores of Legs 66, 67, 170, 202 and 205, originated in Central America and southern Mexico. The best preserved tephra archive lies in the cores across the ash distribution areas expected from dominant wind directions as identified by mapped fallout deposits. We analyzed > 150 ash layers of all Legs for first detailed analysis of these sites to 1) built up a arc-wide recent to Tertiary tephrostratigraphy and 2) evaluate how magmatism, and especially the influence of subduction parameters, sediment input and crustal assimilation/interaction change with time at the CAVA.

The black to gray to white ash layers have commonly sharp contacts at the bottom and diffuse transitions to terrigenous and pelagic sediments at the top. Ash layer thicknesses range from 0.5 to 60 cm with typical grain sizes from medium silt to coarse sand. The mineral assemblages are typical for arc volcanism (plagioclase, pyroxene, hornblende, and olivine). The most evolved tephras also contain biotite.

Electron microprobe analyses of 1748 glass shards yield compositions ranging from basalt to rhyolite and trachyte. Felsic ashes can be divided into seven compositional groups by means of silica and potassium contents. Definition of source areas on land, but also their variations are based on major element geochemistry of glasses and minerals, and trace element data from LA-ICP-MS analyses combined with Ar/Ar age dating. First results show that source areas of the ash layers are distributed along the entire CAVA, as well as at the Southern Mexican Arc. Making use of typical systematic CAVA along-arc variations of trace-element characteristics (Zr/Nb, Ba/La, Ce/Yb, La/Yb and Ba/Zr) of the arc rocks with time is the main key to unravel the long-term changes in magmatic variability and its causes along the arc in future.

Therefore, the marine tephra record provides important data for ongoing studies of CAVA volcanism: (a) dating of undated land tephra by correlation with marine ashes and the ages derived by sedimentation rates and Ar/Ar dating; (b) regional stratigraphic correlations along the entire arc; (c) reconstruction of long-term changes in magmatic evolution of volcanic complexes.