Geophysical Research Abstracts
Vol. 15, EGU2013-4093, 2013
EGU General Assembly 2013

Magnetic fabrics in sub-caldera plutons recording magma ascent and fault-caldera interactions, the Štiavnica volcano-plutonic complex, Western Carpathians

Filip Tomek and Jiří Žák

Institute of Geology and Paleontology, Faculty of Science, Charles University, Albertov 6, Prague, 12843, Czech Republic (filip.tomek@natur.cuni.cz)

The Štiavnica volcano–plutonic complex in the Western Carpatians exposes a spectacular section through middle Miocene stratovolcano (50 km in diameter) built on Variscan basement and late Paleozoic to Cretaceous sedimentary rocks. The stratovolcano consists of early andesite lava flows, extrusive domes, and pyroclastic flow deposits intruded by andesite and andesite porphyry sills and laccoliths. At around 14.5–15.5 Ma, the pre-volcanic basement beneath the central portion of the stratovolcano was intruded by a diorite stock and a voluminous bell-jar granodiorite pluton followed by quartz diorite to granodiorite porphyry dikes and stocks. The pluton emplacement led to the development of a 20 km wide collapse caldera associated with late andesite and dacite extrusive domes, dome flows, pyroclastic deposits, and quartz-diorite porphyry dikes and sills. Subsequently, the central domain underwent resurgence accompanied by intrusion of small rhyolitic and granite porphyry bodies. The present-day exposure with significant vertical relief cuts through all these units including the sub-caldera plutons and their flat roof which represents the volcano basement. The sub-caldera plutons exhibit contrasting magnetic fabrics as revealed by anisotropy of magnetic susceptibility (AMS). The diorite is characterized by very low degree of magnetic anisotropy (less than 10 %) and both prolate and oblate AMS ellipsoids. Magnetic foliations are mostly sub-parallel to the nearby pluton roof margin and are associated with steep lineations. In contrast, the younger granodiorite shows slightly higher degree of magnetic anisotropy (up to 12 %) and chiefly oblate susceptibility ellipsoids for the same magnetic mineralogy (both plutons are ferromagnetic, with the AMS carried predominantly by magnetite). Unlike fabric in the diorite, magnetic foliations are homogeneously oriented and dip moderately to the W to WNW whereas magnetic lineations vary from down-dip to subhorizontal. We interpret the two different magnetic fabrics in these sub-caldera plutons as recording magma emplacement interacting with tectonic deformation of the volcano basement. In the diorite, the steep fabric results from intrusive strain during vertical magma flow along a steep segment of the pluton roof. On the contrary, fabric in the granodiorite presumably reflects inclined magma flow converted from up-dip to subhorizontal stretching during synchronous dextral strike-slip faulting in the pluton roof. Such a conclusion is in agreement with published paleostress estimations. Finally, using the Štiavnica volcano–plutonic complex as a case example, we develop a general model for three-dimensional fabric and inferred strain patterns in the crestal portions of granitoid plutons as a response to main modes of caldera collapse in various tectonic settings.