Dipartimento
di Scienze della Terra

Sapienza
Università di Roma

RESEARCH INTERESTS

My researches concern the petrological processes controlling the evolution of magmas during fractional crystallization, magma assimilation, and mixing. I investigate the geochemical anomalies generated by magma-crust interaction processes and/or variable cooling regimes experienced by magmas during their emplacement. I interpret the elemental and isotopic compositions of mantle-derived magmas in terms of mantle processes. I also determine how these mantle processes may be in parted or completely overprinted by open-system processes during intracrustal evolution and differentiation. My research studies evidence that magmas follow diverse polybaric, multicomponent, multiprocess evolution paths wherein mantle geochemical signatures are invariably compromised. At these conditions, assimilative reactions can modify the original magma composition as a function of the degree of assimilation. When the crust is incapable of imposing a marked isotopic signature on mantle-derived melts, however, it has the compositional leverage to modify their major and trace element concentrations. Major and trace element concentrations of mineral and residual glasses may also be altered through disequilibrium growth processes that take place during magma ascent and emplacement. Mineral and glass compositions are commonly used to estimate magma storage conditions and modes of magma transport. However, such models nearly always assume that natural systems approach equilibrium. But just because a mineral happens to be included in a volcanic rock is not a guarantee that equilibrium has been achieved. Crystals may grow rapidly, and in the process, may deviate from equilibrium, even if the mineral is indeed contained within the liquid from which it grew. I investigate, by means of experimental and field observations, the compositional variations of minerals growth under variable cooling rate conditions. I compare such disequilibrium compositions with those of crystals equilibrated at isothermal temperatures in order to improve the predictive power of thermometers, barometers, and hygrometers. Upon the effect of fast undercoolings, the growing crystals may potentially record the closure P-T-X-fO_2 conditions of the system. This opens new important perspectives in the interpretation of the petrochemical characteristics of igneous rocks, allowing to reconstruction the history of volcanic rocks through geospeedometers based on the kinetics of cation exchanges between crystal and melt.