



Melt/fluid immiscibility in common magmas: melt inclusion approach and implications

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Common silicate melts undergo immiscibility (unmixing) at some point during their decompression, cooling, crystallization, mixing or contamination. The immiscible products are believed to be other silicate melts, non-silicate melts (chloride, carbonate, sulfide etc) and fluid-like phases (aqueous and carbonic). Magmatic unmixing and related immiscible volatile-rich phases can be important in pre-concentrating metallic elements that are potentially carried and deposited by “hydrothermal solutions”. We usually observe only the consequences of unmixing, but records of exact moment of immiscibility and exact composition of immiscible phases virtually do not exist in nature. As the magmatic immiscible phases are inherently ephemeral, only melt/fluid inclusions hosted in magmatic minerals can represent “snapshots” of corresponding phases at the time of their formation. Such inclusions are the closest approximation of naturally exsolved volatile-rich phases. The study of immiscibility starts with identification of temporal populations of inclusions and their genetic relationships. This is followed by identification of inclusions with variable amounts of two or more supposedly unmixed but coexisting phases. Heating stage experiments with visual control are used for studying in-situ separation of immiscible phases within a given inclusion. Mineral constituents and bulk chemical composition of immiscible phases, analyzed by in-situ microbeam methods (EDS, Raman spectroscopy, LA-ICPMS, PIXE etc), are proved to contain high concentrations of volatile elements and metals. Combined empirical, experimental and analytical studies of melt inclusions help recognition of the compositional signature of the immiscibility processes, element partitioning and ultimate fate of volatile and economic elements.