Abstract

The principal goal of this Ph.D. Thesis is to contribute to the research on formation of compositional and textural zoning in shallow-level plutons. Processes responsible for emplacement of individual plutons/pulses and the origin of compositional zoning in are addressed in a great detail, from the pluton-scale down to the micro-scale.

The main emphasis in the more focused part of this text is on a combination of various quantitative data sets from two well-selected plutons (the Říčany Pluton in the Central Bohemian Plutonic Complex and the Melechov Pluton in the Moldanubian Batholith). These detailed studies are supported by further research on the Štěnovice, Čistá and Ševětín plutons. In this way we cover the evolution of Variscan magmatism in the heart of Bohemian Massif in its entirety, from Late Devonian till Permian.

The thesis is based on combining field and structural studies (including the anisotropy of magnetic susceptibility, AMS), textural analysis, petrological, geochronological and geochemical methods with geophysical investigations. Mathematical approaches have been designed and applied to the interpretation of geochemical data, with potential applications to other igneous systems.

I strongly believe that only such comprehensive studies on well-selected case examples have a potential to provide a generally applicable, in-depth understanding of zoning origin, mechanisms of pluton construction, and melt sources/evolution in the composite magmatic systems.

The most important conclusions of the thesis are as follow:

1. Using the case study of the Říčany Pluton, a new model for the origin of reverse zoning is proposed invoking a thermally-driven overturn of a deeper stratified magma chamber. Information about sources and geochemical evolution of highly fractionated nested granite pulses is reported and the behaviour of many trace elements in differentiation of the felsic granitic system is described. Lastly, a new mechanism of helicoidal magma flow is formulated on example of the Říčany Pluton.
2. Quantitatively characterized variations in magnetic fabric throughout the Melechov Pluton and the AMS-to-strain inversion method (SUSIE) are used to infer the strain distribution in the proposed Melechov diapir head. Data are compared with theoretical models for diapiric structures; the applicability of the SUSIE method for strain analysis in granite plutons is also discussed.

3. Much of the research effort was concerned with the regional tectonic setting and large-scale fabric patterns in granitoid plutons in the Bohemian Massif, from Late Devonian subduction, through Early Carboniferous collision till Permian orogenic collapse. Particular problems were addressed using case studies of subduction-related Štěnovice and Čistá plutons as well as the post-orogenic collapse-related Ševětín Pluton.

Taken together, the integration of field and quantitative data sets obtained by range of methods on several selected plutons has provided new insights into emplacement mechanisms of granitoid magma in the upper crust and the origin of modal/compositional zoning. Moreover, the study brings broader implications for timing, sources and development of Variscan plutonism in Bohemian Massif and as such to the magmatic and tectonic evolution of the Variscan orogen as a whole.