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Review of the habilitation thesis by Dr Alessandro Fabbrizio

Esteemed Prof. Ing. Shah Wali Faryad,

I am writing in response to your request to review the habilitation thesis of Dr Alessandro Fabbrizio for the title of Associate Professor at your institution.

I met Dr Fabbrizio at ETH Zurich in 2005, but I already knew some of his research articles that were of interest for my master thesis (completed in 2003).

Dr Fabbrizio has prepared an habilitation thesis that summarises precisely the core skills he has acquired during his academic career. He is an experimental petrologist that has been working on the generation of mineral and glass chemistry proxies that can be used to retrieve pre-eruptive conditions from the analyses of volcanic rocks. Additionally, he has contributed to develop the field of kinetic disequilibrium, which is extremely important because abundant evidences exist for non-equilibrium processes dominating the pre-eruptive phase of volcanic systems. Both these research lines are essential as the lack of experimental data inhibits our capacity to extract the full complement of information from the magmatic rock record.

The thesis is structured as a collection of articles that best represent the skills and career path of Dr Alessandro Fabbrizio and is opened by an introductory chapter explaining the scientific targets that his research is addressing.

In a first contribution, a single author paper, he presents the results of a clever study on rocks collected during the cooling of the Kilauea Iki lava lake (Hawaii). Using this lava lake as a large-scale experiments. Dr Fabbrizio showed how the geochemical signals produced by cooling and magma evolution can be distinguished by those produced by competition between diffusion of elements and crystal growth.

A second scientific article of the thesis, is a collaboration across a number of institutions and presents the results of a series of experiments the result of

which allow to determine the dependency of element partitioning on growth rate of crystals. These data constitute the base to create a new approach to the study of timescales in magmatic systems.

In another contribution, Dr Fabbrizio was part of a team that worked on melt inclusions in olivine from various basalt emitted either subaerially or In a submarine environment. They demonstrate how post-entrapment crystallisation leads to crystallisation at the rims of the melt inclusions, generating compositional profiles in the melt, which can be exploited to retrieve the cooling rate of these basalts.

A series of scientific articles describes the research he carried out while at ETH Zurich for a postdoctoral fellowship, which was centred on the determination of crystal/melt partition coefficients of Ra. Previously, Ra was assumed to behave as Ba, however, the small difference in ionic radius between these two elements would potentially result in large uncertainties in isotopic disequilibrium dating. Dr Fabbrizio for the first time conducted technically challenging experiments that have significantly reduced the uncertainty of this dating method

The last part of the habilitation thesis includes the early work of Dr Fabbrizio on experimental phase equilibria. These experiments were carried out to retrieve the pre-eruptive conditions of several volcanic systems and are the data required to calibrate proxies allowing to determine pre-eruptive conditions from the analysis of the products of volcanic eruptions.

The thesis is well structured and clearly demonstrate the importance of Dr Alessandro Fabbrizio's work. More specifically, Dr Fabbrizio has constructed a well-defined career path based on his background in experimental petrology, which he does not use to repeat studies on different systems, but rather uses to always broaden his scientific horizons. The results presented in the thesis are of outmost importance to improve our capacity of decipher the chemical signals recorded in magmatic rocks and determine the processes that control the transfer, emplacement and migration of magma in the Earth's crust. A number of the article presented make also clear that Dr Alessandro Fabbrizio is capable of designing and completing original studies that serve to open new approaches to quantify intensive parameters in magmatic systems. The methods used to address the different scientific problematics are appropriate and based on the strong experimental petrology background of Dr Fabbrizio.

In conclusions, I find the thesis to be an excellent representation of the core skills of Dr Alessandro Fabbrizio and in my opinion there is no doubt that his scientific productivity are of the quality required to grant him the title of Associate Professor.

Yours Sincerely,

Luca Caricchi