ProDoc School 4D-ADAMELLO 2009-2012:

An integrated approach to understand crustal growth processes from a geodynamical, petrological and isotope geochemical perspective.

Collaborative PhD research and teaching program between the Universities of Lausanne, Geneva and ETH Zurich

Research module:
The fourth dimension: resolving the time-scales of magma evolution

2 open PhD positions

Aim of the programme

In the framework of a newly established research and educational PhD program of the Swiss National Science foundation (ProDoc) we invite applications of highly motivated individuals for eight PhD positions (each for 3 years) within this project. The goal is to create an integrated, dynamic and cross-disciplinary research and training environment. The team of PI's for this ProDoc project combines research and teaching expertise in geochemistry, geochronology, experimental and theoretical mineralogy, structural-metamorphic and magmatic petrology, geodynamics and numerical modeling

Contents of the research

The advent of ultraprecise U-Pb age determination and microanalytical geochemical and isotopic techniques have provided new tools for tracing geochemical processes as a function of time and space, in order to understand emplacement mechanisms and their timescales better. In particular, U-Pb ID-TIMS dating has reached a point where the age precision of single zircons is far better than the duration of a magmatic system. Whereas ten years ago one would ask what the "crystallization age" of a pluton is, today we can ask over what period of time are plutons constructed and by what processes?

With this research initiative we want to understand a complex magmatic system, which integrates between several 100ky up to a few My of magma transport, assembly and emplacement? In the course of this project we will carry out precise age determinations on zircon and other accessory minerals, coupled with geochemical and isotope analyses, such as oxygen or hafnium isotopic compositions, and rare earth element concentrations in zircon, oxygen fugacity, Ti-in-zircon thermometry and many more. To achieve such a goal we will need a variety of microchemical and in-situ techniques, partly well established, but partly to be developed.

The Adamello case

The composite Adamello batholith records some 12 My evolution of magma emplacement between 42 and 30 Ma. Spectacular field exposures, a wealth of existing whole-rock and mineral geochemical data, and the relatively young age make it an excellent case study to investigate magma emplacement processes. Previous field and geochemical studies have documented a rich magmatic history in the Adamello batholith, such as the accumulation of melt batches from lower and middle crustal levels, melt extraction from crystal mushes, crystallization and possibly remelting of solidifying crystal mushes, mixing and mingling of melt batches, transfer of pheno- and xenocrysts between melt portions. The two planned PhD projects will deliver a quantitative dataset for the temporal dimension of batholith emplacement, and enables the students from the other research modules, and the ProDoc school as a whole, to arrive at a time-resolved thermomechanical model of batholith emplacement. Because the Adamello batholith is similar to other large batholiths around the world in terms of its composition and the magmatic processes observed in the field, the outcome of this project can serve as a model for batholith construction in general.

Research tasks

The first PhD project will be devoted to the already well-studied southern Adamello unit. It will test different chemical and isotopic techniques to date the moment of zircon saturation in different rocks, to characterize equilibrium conditions during growth and to trace the growth history of zircon. The second PhD student will focus on the lesser known middle and northern part of the Adamello batholith, where preliminary geological maps exist but no adequate geochemical or geochronological data are available.

Applications

The positions are available from April 2009. Working place will be University of Geneva, Department of Mineralogy, but mobility and short visits in associated research laboratories will be strongly recommended. Candidates should have strong field, analytical and computational skills, and a firm interest in petrology, structural geology and geochemistry. Fluency in English is mandatory. Applications should include a CV, a one page statement of interest and the names and contact information of two referee's. They should be sent to Anne-Marie Chagros (anne-marie.chagros@unil.ch) no later than 31.12.2008, indicating the title of the research module "*The fourth dimension: resolving the time-scales of magma evolution"*. The Universities of Lausanne, Geneva and ETH Zurich are equal opportunity employers.

Further information

Interested PhD candidates should consult http://www.unil.ch/4-D Adamello for further information and details on individual PhD projects, or Prof. Othmar Müntener (othmar.muntener@unil.ch) for further information.

For more information on the 2 projects at University of Geneva please visit http://www.unige.ch/sciences/terre/mineral/ or contact directly Prof. Urs Schaltegger (urs.schaltegger@unige.ch).