Discipline Information

The following dates are in (dd/mm/yyyy) format.

Code: GSA5873 - 1 Type: POS
Name: Low Temperature Thermochronology
Concentration area: Geotectônica (44141)

Approval dates:
CCP: 02/02/2015 CPG: 12/02/2015 CoPGr:
Activation date: 12/02/2015 Inactivation date:

Workload:
Total: 60 h Theory: 20 h Practice: 4 h Study: 6 h
Credits: 4 Duration: 2 weeks

Professors: 9432631 - Mauricio Parra Amézquita - 12/02/2015 until today

Objectives:

The course aims at providing the student with the fundamental concepts and analytical methods of low-temperature thermochronology, allowing for focusing in topics such as (1) active orogenesis, (2) tectonic evolution of passive margins, (3) denudation and landscape evolution, (4) sedimentary basin formation and thermal evolution.

Rationale:

The study of the thermal evolution of rocks in the colder, uppermost crust provides information on the age and rates of various geodynamic processes of interest for both the general geotectonic understanding of a particular region, and for its application to the exploration of mineral resources. These processes include tectonic deformation and uplift, burial of sedimentary basins, fluid flow, and potential exogenous feedback mechanisms such as climate and erosion. The contents covered in the course are relevant for graduate students interested in research related with these processes at multiple time scales and in various geodynamic settings. The course aims at training students in the whole spectrum of thermochronometric analyses, including data acquisition, interpretation and modeling, with emphasis in low-temperature systems such as fission track and (U-Th)/He and their interrelationships with stratigraphy, petroleum geology, and geotectonics.

Content:

1. Paleothermometry vs Thermochronometry: Definitions, history, paleothermometric methods, rock heating mechanisms, reconstruction of amount of erosion in sedimentary basins, accumulation of thermochronometic age, closure temperatures, Dodson equation. 2. Fission-track Thermochronometry: nuclear fission, track formation and recording, fission-track age equation, track stability and annealing, analytical procedures, analysis and graphic representation of results, main thermochronometric systems, geotectonic applications. 3. (U-TH)/He Thermochronometry: fundamentals of noble gas geochronology, diffusion, determination of diffusion parameters in apatite and zircon, mechanisms controlling diffusion kinetics, case studies. 4. Detrital Thermochronometry: Deconvolution of detrital age distributions, lag-time and application in exhumation histories, application for sedimentary provenance studies. 5. Quantitative Thermochronometry: general heat transfer equation, thermal effects of exhumation, 1D thermal histories (QTqt and HeFTy), 2D steady state heat transport (age-elevation profiles), transient 3D heat transport (Pecube), sampling strategies 6. Case studies: Denudation and landscape evolution in passive margins, thermochronometry in active margins, thermochronometry applied to petroleum geology.

Bibliography:

BERNET, M. & SPIEGEL, C. (eds), 2004, Detrital Thermochronology: Provenance Analysis, Exhumation, and Landscape evolution of Mountain Belts. Geological Society of America, Special Papers Nº378, 126p. BRAUN, J., VAN

DER BEEK, P. & BATT. G., 2006, Quantitative Thermochronology: Numerical Methods for the Interpretation of Thermochronological Data, Cambridge University Press, 272p. LISKER, F., VENTURA, B & GLASMACHER, U.A., (eds.) 2009, Thermochronological Methods: From Paleotemperature Constraints to Landscape Evolution Models. Geological Society, London, Special Publication nº 324. REINERS, P. & EHLERS, T.A. (eds.), 2005, Low-temperature thermochronology - Techniques, Interpretations and Applications. Reviews in Mineralogy & Geochemistry Vl. 58, Mineralogical Society of America, 622p. WAGNER, G. A., & VAN DEN HAUTE, P., 1992, Fision-Track Dating. Kluwer Academic Publishers, 285p. Artigos Selecionados

Type of Assessment:

Practical exercises and seminars