



## **Quaternary palaeoecology: reconstructing past environments**

a Latin American workshop sponsored by **PAGES**

23rd November – 4th December 2015 San Rafael, Mendoza, Argentina

**Sonia Fontana** and **Thomas Giesecke** University of Göttingen

Local organizers: **Leandro Rojo** and **Natalia La Spina**, Univ. of Cuyo; with the collaboration of **Sabina D'Ambrosio**, IANIGLA, **Marcos Echeverria**, Univ. of Mar del Plata and **Daniela Piraquive Bermúdez**, Univ. Javeriana, Colombia

### **Registration deadline: Tuesday 15th September 2015**

**Cost:** The course will be limited to c. 30 participants: postgraduate students and young scientists based in Latin-American institutions. There is no registration fee, however this year participants will have to pay accommodation cost (in shared rooms), in addition to their own travel cost and meals. The course will take place in a resort of cabañas, soon we will publish more information (we are looking for a quote). If you are interested in participating, send a CV (2 pages max.) and a short motivation letter (up to 300 words) to **Sonia Fontana** ([sonia.fontana@biologie.uni-goettingen.de](mailto:sonia.fontana@biologie.uni-goettingen.de)). Please combine both documents in one pdf file, and identify the file with your name and country. The documents can be written in Spanish, English or Portuguese.

### **Overview**

This intensive two-week course is designed for postgraduate students and young scientists based in Latin-American institutions, undertaking research in palaeoecology, with emphasis on microfossil analysis: e.g. pollen, charcoal, plant macrofossil remains, ostracods, diatoms, other. It aims to provide (1) an outline of the principles, methods and applications of selected proxies; (2) an overview of methods and software use for data analyses; and (3) an overview of spatial and evolutionary responses of organisms to different Quaternary driving forces, providing insight into general questions of species survival, spread and biodiversity.

The course will be taught in Spanish and English, over 12 days and introduce the use of multi-proxy analyses for palaeoenvironmental reconstructions as well as current procedures for handling biostratigraphical data. It will consist of lectures, seminars, discussions and practical classes, including 2 field excursions. The first part of the course will focus on data collection: site selection and coring; sub-sampling techniques; routine sediment analyses; overview of biological proxies: pollen, charcoal and macrofossil analyses. The second part of the course will consist of data handling: chronology; data analyses: zonation, ordination techniques, diversity estimates, rate of change. Emphasis will be placed on the application of the different proxies to Quaternary research, as well as on the different forcing factors responsible for change in South America: external factors (climate, fire, volcanic eruption, human impact) and internal dynamics (migration, competition, succession).

Special weight will also be placed on: (i) Data collection and associated errors – Confidence intervals: analysis of error in the data. Calculating percentages and establishing the size of the sum; proportion within the sum of the taxon of interest. Concentrations: volume, exotic added, exotic counted and size of the count of the taxon of interest. Accumulation rates: concentration and sediment accumulation uncertainties. (ii) Data handling with the computer programs: psimpoll and Tilia, for plotting and analysis of pollen and other microfossil data; BCal, Calib, Oxcal, Clam, Bacon, R, CANOCO. Data format, file conversion and moving data between packages.

The course aims to bring together postgraduate students and young scientists from Latin America working with different proxies of environmental change research for the Quaternary period. It offers a rich learning experience for attendees, who will have plentiful opportunities to learn and interact with the docents. The course provides a unique opportunity to Latin American students and researchers to meet and discuss, and to enhance contacts, exchanging perspectives and increasing interaction among the regional scientific community and with colleagues from overseas.

## Supplementary activities



### Synergy LATINA

**a collaborative project of young palaeo-scientists from Latin America:** participants working on different proxies will be able to engage in co-operative research, with the goal of combining their skills and knowledge in order to address research questions jointly. A working team will design a palaeoecological multi-disciplinary research project, based on the samples collected during the fieldwork (second day of the course), making use of theoretical concepts, methods and techniques learned throughout the course. The initial phase of the project will be conducted during the course (e.g.

description and sub-sample of the sediment core), while the analyses of the different proxies will be carried out at a later stage, at the home institutions of the different team members. Findings from this research will be presented at international conferences and submitted to a peer-review journal.

It is expected that the proposed work will be a pilot study, leading to a proposal of larger scale joint investigations. The exchange of knowledge should lead to the development of new ideas and research questions and stimulate continued cooperation.

**Contribution of scientific papers:** participants present a poster related to their research projects, including an abstract which is published online in <http://www.uni-goettingen.de/en/488293.html>

## **Preliminary agenda 23rd November - 4th December 2015**

**Sunday 22:** arrival, evening ice-breaker

**Monday 23 – Quaternary palaeoecology:** introduction. **The palaeoecological record:** types of deposits, and the archive of lake and bog sediments.

*Practical* – Site selection: use of maps, satellite images, air photographs and Google Earth. Collection of cores: coring equipment. Overview and download of computer programs: *psimpoll*, Ghostscript, Ghostview, BCal, Calib, Clam, Bacon, R, R-Studio, Google Earth.

**Tuesday 24 – Field work:** retrieving a sediment sequence. Description of the catchment area and the basin: bathymetry, and the use of ground penetrating radar. Gravity and piston corers: collection of the water-sediment interface and coring. Russian corer for peat bogs. Transport and storage of samples.

**Wednesday 25 – Palaeoecology of the oceans:** foraminifera and its application for reconstructing sea-surface temperature. Oxygen isotopes: stratigraphic markers. Earth's orbit variation, glaciations. Evolution in space and time: e.g. *Globorotalia*.

**Overview of selected palaeoecological analyses:** sedimentological and biological indicators (e.g. content of organic matter and carbonates, magnetic susceptibility, pollen, plant macrofossil remains, charcoal, ostracods and charophytes).

*Practical* – Core description and magnetic susceptibility analysis. Sub-sampling. Measure of organic matter and carbonate content by loss on ignition.

**Thursday 26 – Long Quaternary terrestrial records with multiple glacial-interglacial oscillations:** e.g. (i) Funza, Bogotá-Colombia; (ii) Tenaghi Philippon, north-eastern Greece; (iii) Lynch's crater, Queensland-Australia; (iv) Monticchio, south Italy; (v) Ioannina, north-western Greece. Variability on the vegetation responses. Correlation of terrestrial long-cores with marine records, and with isolated interglacial periods.

**Pollen:** principles of pollen analysis. Pollen diagrams. Pollen sums. Databases.

*Practical* – data presentation introduction to *psimpoll*. Description of laboratory techniques and preparation procedures.

**Friday 27 – Global Quaternary palaeoecology:** key sites for the last glacial-interglacial transition. Forcing factors for vegetation and environmental change: e.g. fire in Patagonia, soil in Hungary, climate variability in Sahara. Packrat middens. Glacial-interglacial transition in the tropics.

*Practical – Pollen (cont.):* Pollen counting: calculating percentages and confidence intervals.

### **Saturday 28 – Palaeogenetics, molecular clocks and aDNA**

**Pollen (cont.):** Interpretation of pollen diagrams: pollen production, dispersal and transport to basins; pollen taphonomy and preservation. Vegetation changes during glacial and interglacial periods.

*Practical* – Introduction to *Tilia*.

### **Sunday 29 – Excursion**

**Monday 30 – Refugia:** origins and definition. Types of 'refugia': altitudinal, cryptic, tropical and Holocene refugia. Fossil and molecular evidence. The role of mid-latitudes. Species responses.

**Establishing the chronology:** radiocarbon dating, radiocarbon ages and terminology. Dating the recent past with  $^{14}\text{C}$ .

*Practical* – Calibration and calibration curves, age estimators. Calibration programs: BCal, CALIB y CALIBomb.

**Tuesday 1 – Communities:** historical thinking Darwin, Clements, Gleason. Evidence from the palaeorecord: variable behaviour, non-analogue communities. Vegetation maps in North America and Europe. Intermingled fauna. Turnover.

**Age-depth models:** construction, selection and pitfalls. Calculating concentration and accumulation rates: errors and confidence intervals.

*Practical* – Calibration and age-depth models: construction, selection and pitfalls.

**Wednesday 2 – Plant migration.** Movement of taxa on long-timescales. Pollen evidence for migration on glacial-interglacial timescales. Rates of migrations. Factors that enable migration.

*Practical* – Reservoir effect and correction of  $^{14}\text{C}$  ages. Age-depth models using clam and Bacon.

**Thursday 3 – Quaternary extinctions.** Tree extinctions, large vertebrates, historical extinctions. Causes.

Analysis of stratigraphical data. **Zonation:** methods and implementation. **Rate of change.**

*Practical* – Examples of palaeoecological use of zonation and rate of change analysis.

**Friday 4 – Evolution.** The role of Quaternary palaeoecology (last 2 Myr) for understanding evolutionary patterns. Historical background: diversity, Linnaeus, Lyell, Agassiz, Darwin, Mayr. The fossil evidence. Phylogenetic and fossil DNA contributions. Organism responses to environmental change: stasis, extinctions, evolution, speciation. Significance of the Quaternary in the evolutionary patterns.

**Ordination methods:** principal component analysis (PCA) and detrended correspondence analysis (DCA). Rate of change. **Diversity estimates:** palynological richness: gamma diversity or within landscape diversity; compositional change: beta diversity, diversity between habitats or communities within a landscape.

*Practical* – Examples of palaeoecological use of ordination techniques. Rarefaction analysis and detrended canonical correspondence analysis (DCCA).

*What's up?* **Databases. Quantitative vegetation reconstructions. Vegetation modelling. Palaeoecology and palaeogenetic. Latinoamérica: dónde estamos?**

**Farewell dinner**

**Saturday 5: breakfast, departure**



**Sonia Fontana** has research interests in late-Quaternary palaeoclimate, vegetation history and environmental change using multi-proxy analyses of lake sediments, with particular significance on plant diversity and vegetation dynamics. This involves plant macrofossil, microfossil (pollen, charophytes and ostracods) and charcoal of lacustrine deposits from South America and Europe.

**Thomas Giesecke** is a palaeoecologist, studying Quaternary vegetation dynamics on local to continental scales based on pollen and macrofossil analysis and including insights from vegetation model experiments and phylogeography. His interest in modern pollen deposition is motivated by the aim to improve quantitative estimates of past changes and to gain a better understanding of the signal in pollen data including aspects of floristic and landscape diversity.

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