IAS Postgraduate Grant Scheme

Scientific Report:

The Sabiñánigo delta complex:

Coupled basin and delta evolution within the Jaca Basin, Northern Spain

The Eocene Sabiñánigo delta complex forms part of the southern Pyrenean foreland basin fill and was deposited in the eastern part of the Jaca basin. This thrust-top basin formed when the N-S trending Boltaña anticline emerged in early Eocene times, separating the Jaca basin from the neighbouring Aínsa basin. Affected by syn- and postsedimentary tectonic movements, caused by continuing southward propagation of the underlying thrust-sheets, the deposits of the Jaca basin were folded and thrusted, without prominent internal deformation occurring in the Sabiñánigo sandstones.

The objectives of this research-project comprise different parts that in the end will be composed into one resulting model to unravel the interaction between the evolution of the Jaca basin on one hand and the evolution of the Sabiñánigo delta complex on the other hand.

To determine the depositional environments several vertical profiles were recorded, and their sedimentary facies and facies patterns were analysed. By correlating the vertical profiles to lateral transects a section of the basin infill could be displayed, forming the basis for sequence stratigraphic interpretations and correlation with contemporaneously deposited successions of the southern Pyrenees.

Some of the questions appearing concern the source area of the sediments deposited within the Sabiñánigo delta complex, the thermal, uplift and denudation history.

Therefore low-temperature thermochronological analysis was used, as with this method an approach to both of these questions can be made:

a) Particular source areas can be concluded from resulting age populations within the samples.

b) The thermal history of the studied sedimentary rocks can be quantified.

Hence, one part of the research-project comprises low-temperature thermochronological analytical work. The apatite-fission track analyses of samples from the study area were

performed at the fission-track lab (Prof. G. A. Wagner) of the Max-Planck-Institute of Nuclear Physics in Heidelberg. This technique covers the thermal history between 120 °C and 60 °C. The recent fast developments in understanding of the retention behaviour of ^{4}He in apatite can be briefly summarized by a closure temperature of about 75 °C. In addition, laboratory defined diffusion kinetics are used to model the t-T path in the He-partial retention zone of apatite. The overlap of both independent thermochronometers allows a reliable quantification of the general low-temperature thermal history.

In the frame of the research project, I will combine the results of apatite fission-track and apatite (U-Th)/He thermochronology to establish the thermal, uplift and denudation history of this region and to distinguish from the resulting age populations between different source areas.

In part, this aim will be achieved by 2-D thermokinematic modelling, integrating surface processes by using/customizing existing computer codes. Testing model solutions (i.e. predictions) obtained for the multidimensional parameter space (thermal parameters, uplift-, erosion rate, tectonic boundaries/relative movements) against the real thermochronolgical data set, the most likely combinations of parameter values can be constrained.

A cooperation with Dr. P. Reiners, Yale University, USA, was started to perform the (U-Th)/He thermochronological analytical work on apatite samples. First measurements on 16 apatite samples (37 single grains) of the working area were carried out during a five-weeks stay at Yale University, New Haven.

The first age results indeed display at least two age populations, so different source areas can be assumed. Furthermore, the single ages display a thermal overprint that has not reached a complete diffusion of He out of the apatite crystals. If a thermal gradient of 30°C/km is assumed not more than about 2 km of sediments were deposited in late Paleogene to Neogene time. Further modelling including fission-track ages have to be made prior to be able to present more detailed conclusions concerning thermal history and source area determination.

I would like to thank the IAS very much for supporting this project and giving the chance to realize the cooperation with Dr. P. Reiners.

Sincerely,

Friederike Bauer

Final budget:

Transportation: 556, - EUR

Flight: Frankfurt – Boston – Frankfurt 461, - EUR

Greyhound-Bus: Boston – New Haven – Boston 112, - $ (95, - EUR)

Lodging: 345, - EUR

Sublet: 19.05.2005 – 21.06.2005 406, - $ (345, - EUR)

Sample preparation: 157, - EUR

Costs for sample preparation (measurements were paid by the University of Heidelberg).

37 Samples x 5 $ = 185, - $ (157, - EUR)

Total amount: 1058, - EUR