Geophysical Research Abstracts, Vol. 8, 02875, 2006
SRef-ID:

Orogenic exhumation of the central Himalaya recorded by detrital fission-track thermochronology of Siwalik sediments, Nepal

P.A. van der Beek (1), M. Bernet (1), R. Pik (2), P. Huyghe (1), J.-L. Mugnier (1) and E. Labrin (1)

(1) Laboratoire de Géodynamique des Chaînes Alpines, Université Joseph Fourier, Grenoble, France (pvdbeek@ujf-grenoble.fr), (2) Centre de Recherches Pétrographiques et Géochimiques (CRPG-CNRS), Vandoeuvre lès Nancy, France

We report new detrital zircon and apatite fission-track data from Miocene to Pliocene Siwalik Group sediments in central and western Nepal, which provide important new insights in the long-term exhumation history in the central Himalaya, as well as on the thrust propagation sequence and burial-exhumation history of the foreland fold-and-thrust belt.

Zircons were dated in order to estimate long-term exhumation rates using the lag-time concept (cooling age - depositional age) and for analyzing the overall pattern of exhumation. Our zircon data indicate three main age groups, which are found consistently in our samples. The oldest age group shows constant peak ages between 80-120 Ma, demonstrating recycling of zircon with pre-Himalayan cooling ages. The second age group reflects a second static peak at 15-18 Ma, which may be related to a major exhumation and cooling event around 18 Ma and/or to episodic movement along major thrust-faults. The youngest age group displays a moving peak with a relatively constant lag-time of 4 My, which translates into a long-term exhumation rate of 1-1.5 km/My. This peak first appears around 11 Ma and is evidence of continuous exhumation, probably driven by continuing uplift and river incision in the High Himalaya.

We have developed a technique to double-date single-grain zircons using the FT and U-Pb methods, in order to discriminate different potential sources and to identify systematic relationships between source area and exhumation rate. Zircons with pre-Himalayan FT ages characteristically have U-Pb ages of 500-1000 Ma, indicating they

were likely derived from Tethyan Himalaya sedimentary rocks or now nearly completely eroded Higher Himalayan protoliths. U-Pb ages are spread between $\sim$1000 and $\sim$2500 Ma for zircons belonging to both other FT age groups, suggesting both the Higher and Lesser Himalayas to be sources for these zircons.

The complementary, lower temperature AFT system allows testing for shorter-term variations in exhumation rates. Because of its relatively low closure temperature, AFT thermochronology is also sensitive to the thermal evolution of the foreland basin itself. AFT samples from above $\sim$2500 m stratigraphic depth are unannealed and reveal source-area age signals in all three sections. AFT lag times indicate higher source exhumation rates ($\sim$2.5 km/My) for central Nepal as compared to western Nepal. The most recent samples show increasing lag times upsection, which we interpret as increasing input of recycled material. This study shows how the combination of different thermochronological techniques on the same samples (or even the same mineral grains) may provide important new insights on the evolution of both the source area and the sedimentary basin from which the samples were collected. A companion study (Robert et al., this meeting) shows how annealed apatite samples from the same sections can be used to infer the kinematic history of the fold-and-thrust belt.