Geophysical Research Abstracts, Vol. 9, 09015, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-09015

Integrating 3D information from thermochronological data over unknown spatial scales

K. Gallagher (1), J. Stephenson (2), R. Brown (3) and C. Holmes (4)

(1) Université de Rennes, Rennes, France (2) British Petroleum, Chertesey, England (3) University of Glasgow, Glasgow, Scotland (4) University of Oxford, Oxford, England (kerry.Gallagher@univ-rennes1.fr)

Low temperature thermochronological methods, such as apatite fission analysis and (U-Th)/He are used to constrain models of long term landscape evolution, while higher temperature systems such as ^{40}Ar/^{39}Ar are more directly applied to understanding tectonic processes. Each of the methods has a different range temperature sensitivity and, in principle, each will be sensitive to different length scales during the evolution of a landscape. In general, therefore, we would like to combine different data types and combine multiple samples in an integrated modelling approach. However, both faulting and spatial variable surface process can disrupt the anticipated relationship, leading to short scale or local variations in the signal recorded by each system being imprinted on the longer scale regional record.

Here we give an overview of a modelling strategy developed recently to address the problem of inferring such discrete changes in the cooling history recorded by multiple samples in three dimensions. The approach is formulated such that we identify subgroups of spatial distributed samples which have a consistent, or similar cooling history. A major advance is that we do not need to specify the number or nature of these subgroups in advance, but estimate these at the same time as inferring the cooling histories. The methodology we advocate is fully probabilistic, and so provides uncertainty (in terms of probability) on all unknown parameters such as where rapid spatial changes occur in the cooling histories. Our strategy is entirely general and can be used on multiple thermochronological systems with multiple samples in three spatial dimensions. In practice, however, the ability of each system to resolve the geological cooling history will limit the detail that can be inferred concerning spatial variations in the cooling history.