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The real face of Corsica: evaluation of local slope histograms reveals hidden structural features

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Introduction

The western Mediterranean island of Corsica (France) provides interesting features in all geoscientific aspects. The Cenozoic tectonic setting is characterised by Alpine collisional orogenic evolution followed by extensional collapse, continental break-up and oceanic basin formation accompanied by passive margin uplift. Moreover, the topographic pattern shows also wide variety from moderate to rugged relief.

In geological sense the island is divided into two parts: the western 2/3rds form the Variscan basement, while the ENE part is made of Alpine nappes. This division has also topographic expression: while the Alpine part of Corsica has moderate relief, the Variscan block is rather mountainous exceeding 2700 m a.s.l. altitudes. The latter region is characterised by SW-NE valley pattern having confined, elongated catchments separated by crests dipping gradually towards SW.

Classical tectonic models of the Variscan part focus mainly on this very conspicuous SW-NE topographic and tectonic framework. From lithological point of view, Variscan Corsica displays a certain homogeneity: this tectonic block is dominated by granites, which provides good possibilities for instance for the thermochronological studies.

The fission track pattern of Corsica

A number of low-temperature thermochronological studies have been carried out (CARPÉNA *et al.*, 1979; LUCAZEAU & MAILHÉ, 1986; MAILHÉ *et al.*, 1986; CAVAZZA *et al.*, 2001, ZARKI-JAKNI *et al.*, 2004) including our recent activity

(KUHLEMANN *et al.*, in press; DANIŠÍK *et al.*, subm.). The density of sampling points now reached a critical level, so that the results show a rather mosaicked pattern with somewhat sudden changes within surprisingly small distances. Since the statistic properties of our fission track data are extremely good in comparison with the common standards and are typically corroborated by track length measurements as well, this variation cannot be considered as statistical error. Consequently, the explanation should be provided by the surface evolution of the area.

DEM processing

As a descriptive analytical tool, in our earlier studies we have developed a sophisticated evaluation of the DEM data, the analysis of local slope histograms (SZÉKELY 2001, SZÉKELY *et al.*, 2002). This technique was found to be useful to correlate the surface ruggedness and the exhumation history in the Eastern Alps (SZÉKELY *et al.*, 2002), and also found to be applicable to indicate pattern differences caused by tectonic dismembering (SZÉKELY & KARÁTSON, 2004).

In a previous study (KUHLEMANN *et al.*, in press) we have already tackled the question of local slope histograms of Corsica, but in that paper the focus was on the average slope angle and the standard deviation of the slope distribution. The conclusion of that study was that there is a complex pattern in the spatial distribution of the slope histograms: a chesstable-pattern was found in the standard deviation map which showed similarities with the spatial pattern of the fission track distribution.

In the hope that an even more detailed analysis may resolve some contradictions in the fission track pattern, a detailed study of local slope histograms has been carried out. More than 10,000 circular local histograms with radius of 5 km have been computed providing a very good resolution of 1 histogram/km^2 for the 8682 km^2 area of the island. The typically 2,500-pixel statistic of each histogram (except in the vicinity of the coast line) ensures robust statistical properties.

Results and conclusion

The analysis of the results revealed hidden structural features completing the well-known SW-NE fault pattern. The newly applied technique enhances a system of NW-SE "corridors" overprinting the other, already known features; therefore they are interpreted as inherited forms partly surviving the Late Cenozoic uplift history of the Corsican block. This interpretation is supported by the correlation between the topography-derived data set and the fission track ages. With the aim of this new theory a part of the questions of the complex fission track age pattern can be answered, especially why the changes in the fission track ages are unexpectedly large in short distance.

In the light of the new digital geomorphic results, the tectonic pattern and the surface

evolution history of Corsica seems to be a target of some reconsideration: a plausible explanation should be found for the existence of NW-SE corridors. The results reported here may also modify the sampling strategy of the low-temperature thermochronology in the Mediterranean and, perhaps, worldwide.

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