Geophysical Research Abstracts
Vol. 15, EGU2013-1770, 2013
EGU General Assembly 2013

Quaternary incision rates in the Vesubie River, Southern Alps, France, from cosmogenic nuclides datings: implications for recent tectonics and climate controls.

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River incision rates at a given point of the channel are governed both by the amount of run-off water and by the downstream slope. Whereas the first parameter is dominantly controlled by the climatic conditions, slope can be modified either by climate-related (i.e. baselevel drop or rise) or by tectonics-related (i.e. local uplift) parameters. Mean incision rates at a given point of the channel stream therefore depend on both climatic and tectonic changes. Deciphering the importance of tectonic activity requires precise dating of incised surfaces and comparison with climate changes.

Cosmogenic nuclides have been widely used for ∼20 years to date the age of surface exposure of quartz-bearing rocks, using the 10Be. In carbonate-bearing rocks, the 36Cl cosmonuclide has been used more recently for similar purposes. Up to now however, no attempt has been made to date the rate of river incision in carbonates by this method. In this study, we focus on incision rates quantification in the Var catchment area, which is the widest catchment draining external Southern Alps, from a ∼E-W drainage divide located in the Argentera-Mercantour massif to the Mediterranean Sea. We have dated about 10 samples across a ∼25 m high, almost vertical polished river surface formed in upper Jurassic limestones in the lower stream of the Vésubie River, a triburary of the Var River.

Our results evidence an almost linear increase of the surface age with altitude, indicative of a nearly constant incision rate since the last 15 ka. We then compare these results with previously obtained 10Be incision rates in the uppermost valley of the Tinée River, the largest high-altitude Var tributary running across the crystalline Mercantour Massif. It appears that Holocene incision rates in high altitude areas are one order of magnitude larger (i.e. 1-2 cm/yr) than in the lower Vésubie stream, which suggests increased erosion in the stair-shaped former glacier valleys.