

Rates of valley incision in the European Alps approached by cosmogenic nuclides



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Intro: The presented work focuses on burial age dating of cave sediments north and south of the Eastern Alps (Fig. 1). Burial age dating provides a new tool to date Pliocene and Pleistocene sediments. Quartz grains exposed to cosmic radiation at the surface accumulate ²⁶Al and ¹⁰Be with a definite ratio of 6.8:1. When the quartz grains are buried, the different half-life of these radioactive nuclides causes the ratio to decrease with time. This decrease is the key to determine the time since the grain was buried. River incision rates are based on the correlation between cave levels and river planation levels. Thus, cave sediments are a key to valley incision.



Salzburg-area: In this region (compare Fig. 2) more than 850 caves are known. As in most of the other Austrian karstic areas, three main cave levels could be determined. There is also a general agreement that the uppermost phreatic caves (~2000 m a.s.l.) are of Oligocene age, the next (1500 m) are Mio- to Pliocene age, and the lowermost (900 m) are of Plio-Pleistocene age. Therefore the lower levels up to ~1500 m are sampled in the project and will be dated by cosmogenic isotopes.



Fig. 2: Foto Tennengebirge

Slovenia: There are several caves that display a correlation to ancient valley bottoms. For example Tisnik mountain (Fig. 3) shows five recognisable speleogenetic phases. Each of this levels is connected with a former valley bottom. In the project samples from four different regions (Tisnik mountains, Kamnik Alps, Julian Alps and Udin Borst) are investigated.

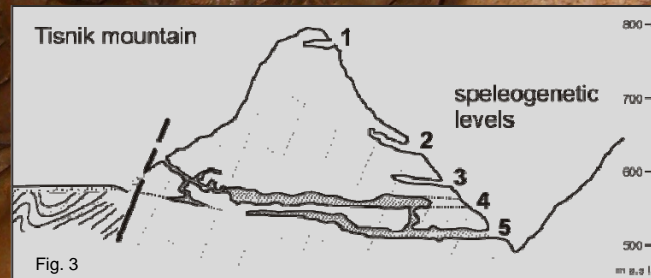


Fig. 3

Graz-area: Several samples have been investigated from the Graz area (eg. Lurgrotte, Perco Höhle, Hochbrand-Kogel etc.). Fig. 4 shows a first approach. Using the data sets, a four-fold increase of the incision rate is assigned to the Pliocene-Pleistocene boundary. But it seems that at least some of the material is resedimented and thus the calculated rates are probably too high.

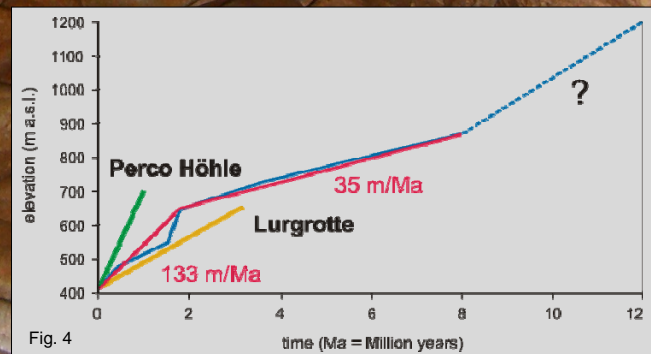


Fig. 4

Outlook: In the Western Alps, the incision of the Aare valley is estimated to be 0.14 mm/a during the Pliocene and 1.1 mm/a during the middle (and upper) Pleistocene (Häuselmann et al. 2007). For the Graz area, the calculation of the incision rates based on cosmogenic nuclides is not yet really working. The reason is probably that most samples were resedimented during younger phases after the cave genesis. For Salzburg and Slovenia work is still in progress. Further sampling and investigation is necessary.

Literature:

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