

Burial dating of River Rhine terrace sediments, Lower Rhine Embayment, Germany.

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The system of the River Rhine is one of the major fluvial networks in Central Europe and connects the main areas affected by Quaternary glaciations, i.e. the Alps and the European plain. Sediments deposited by the River Rhine document in detail climatic and environmental changes since Late Cenozoic times, thereby forming an excellent terrestrial stratigraphical archive. However, there are enormous problems associated with establishing absolute chronologies for such sediments. Burial dating of (fluvial) sediments using in-situ produced cosmogenic nuclides could provide absolute ages for sediment sequences, which are difficult or even impossible to date with other well-established techniques.

Burial dating utilises the fact that sediment was exposed to cosmic radiation prior to burial and that individual cosmogenically-produced nuclides decay at a constant rate once this sediment has been buried. In this case, the decay ratio of the cosmogenic nuclides ^{26}Al and ^{10}Be , which are abundant in quartz minerals, can be used to calculate the time when sediment was shielded from cosmic rays. The upper dating limit is around 5 Ma due to technical evolution of the accelerator mass spectrometry (Granger and Muzikar 2001). Burial dating with ^{26}Al and ^{10}Be is quite well developed in the field of cave sediments (e.g. Anthony and Granger 2004), but there are only a few studies that have attempted the dating of fluvial terraces (e.g. Wolkowinsky and Granger 2004).

We are currently testing to date fluvial sediments of the River Rhine using the burial dating approach outlined above. For this, we have obtained samples from two pits in the Lower Rhine Embayment (LRE), Weilerswist, an open gravel pit south of Cologne and Hoher Stall, a clay pit close to Brüggen-Bracht in the northern part of the LRE. Three units are exposed in both pits: the Kieseloolite Formation, the Reuver clay, and the Upper Terrace Formation (UT). The stable heavy mineral composition indicates a Pliocene age for the Kieseloolite Formation, while a less stable heavy mineral assemblage can be found in the Lower Pleistocene sediments of the UT. These fluvial gravel strata are separated by the Reuver Clay. This clay is an important marker horizon in the whole LRE. It contains a polarity change, interpreted as the Gauss-Matuyama boundary and its base coincides with typical Tertiary pollen assemblages. It can also be correlated with the Neogene Mammal Zones NM16a and MN16b (Boenigk and Frechen 2006). These marker strata, which are relatively easy to identify, provide reliable independent age control against which our burial dating results can be compared. First results of this work will be presented at the conference.

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