Geophysical Research Abstracts, Vol. 9, 06445, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-06445

4D modelling of alluvial fans

B. Salcher (1), R. Faber (2), M. Wagreich (1)

(1) Department for Geodynamic & Sedimentology, University of Vienna, Althanstrasse 14, A-1090, bernhard.salcher@univie.ac.at (2) Terramath Company, Heiligenstädterstrasse 107, A-1190, robert.faber@terramath.com

Challenges of the presented study are:

a) The generation of a high resolution 4D (space + time) sequence stratigraphy model of alluvial fans in interaction with the formation of the Mitterndorf pull apart basin.

b) Work out of the importance of various environmental parameters to be able to streamline workflows (data acquisition & preparation) and to estimate model quality in other regions with similar conditions.

The Mitterndorf basin at the transition of Alpine and Carpathian orogenic belt represents a Pleistocene active pull apart basin. The basin is about 50 km long, up to 10 km wide and covers an area of nearly 410 km^2. Sediment is mainly being delivered by Piesting River in the west and Schwarza River in the south. Large, low gradient (approx. 0.0065 degree) alluvial fans of approximately 90 km^2 and 120 km^2 are being accumulated where the rivers leave the Alps into the subsiding Mitterndorf basin. Depositional units can be correlated to Pleistocene Glacial/Interglacial Cycles. Fan sequences comprises more than 90% massive, matrix supported or crudely bedded gravels with a maximum thickness of more than 170 m. Gravels are intercepted by very few but widespread, brown to red palaeosoil sequences which reach a maximum thickness of only some decimetres. They can be correlated to interglacial periods with warm and humid climate. Due to an intensive exploration of groundwater, gravel and hydrocarbon deposits the data density derived from outcrop-, borehole-, airborne-, geoelectric-, seismic- & gravimetrical measurements in the investigated area is very high. This offers a great possibility to test and calibrate forward numerical models on alluvial fans.

The software package WinGeol (by R. Faber, TerraMath) with SedTec extension was used to simulate 4 dimensional processes of deposition, erosion in dependency on topography, fault movements and lithological properties. Input data for simulation include elevation, lithology, fault data and tabular data from various data sets such as marker horizons or control points (e.g. well data) in general. Faults are defined by their geometry, geographic position, time interval of activity, and a displacement vector. Rock types in the catchment area are characterized by their resistance to erosion and grain size reduction during sediment transport.

To work out the dependencies of various parameters the modelling process is started with simplified assumptions like time independent climate and subsidence rates or uniform rock properties. Subsequently the input factors converge to more detailed and realistic assumptions. Distribution of sediments and sedimentary structures of each model is compared with the above mentioned data and previous calculations. This approach was chosen to show effects of various factors and to predict consequences on the model output quality in case other areas with similar environment but lower data quality are modelled. Moreover it will give the possibility to streamline workflows (concentration on most important data & factors) and to simplify the handling of the software as the experiences of the study will influence the design of the used software.