

Basin Modelling and Sediment Simulation

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Numerical basin modelling and stratigraphic simulations display processes of basin formation, basin evolution and basin fill in time. Forward and inverse stratigraphic modelling is a major tool in assessing fundamental problems in basin history and allow experiments in stratigraphy. Numerical simulations have been used to investigate the combined effects of sedimentation and tectonics based on real cases studies. Software packages used include PHIL, which models mainly stratal patterns in relation to sediment volume and type, subsidence, compaction, water level, erosion rates, and pre-existing topography. FUZZIM, a stratigraphic simulation programme based on fuzzy logic, allows a 3D approach to modelling where a dense grid of data is available. WinGeol/SedTec, a 3D simulation software package (Faber & Wagreich, 2005), allows the simulation of sedimentation and topography in relation to differential fault movements and different source areas.

Sedimentation has been simulated for parts of the southern Vienna Basin based on a 3D seismic section (OMV AG). Sequence stratigraphy provides the basic data for this Karpatian to Sarmatian succession. Both PHIL and FUZZIM reproduced the geological features and the original geometry of the basin fill in general. In PHIL, deposition of carbonates was simulated after the limiting siliclastic sedimentation rate was taken into consideration.

A second case study is in progress in the Pleistocene Mitterndorf basin, an active pull apart formed along prominent sinistral strike-slip faults. The software package WinGeol/SedTec (Faber & Wagreich, 2005) simulates erosion and deposition in dependency on topography, fault movements, lithological properties and sea level. Sediment transport such as mass and suspension flows are induced by elevation or concentration differences between neighbouring cells. Faults are defined by their geometry, geographic position, time interval of activity, and a displacement vector. The preliminary simulation runs of the Mitterndorf basin with WinGeol/SedTec incorporate a strongly simplified digital elevation model including a mountainous metamorphic basement source area and a carbonate mountainous source area (Northern Calcareous Alps). Sediment input was mainly controlled by lateral paleovalleys, resulting in a fan-like sedimentation pattern of the Neunkirchen fan and the Wöllersdorf fan. The two fans and a cyclic trend in carbonate clast sedimentation have been successfully modelled.

The interplay between faulting and sedimentation has been analysed by applying fault backstripping for several fault blocks of the southern Vienna Basin. Based on subsidence plots, rates of fault movement per time interval have been reconstructed. For assessing the error range of the subsidence process, a Monte Carlo simulation process has been incorporated in the subsidence analysis tool of the WinGeol software.

Several projects have contributed to basin modelling and stratigraphic simulation work: FWF-Project P13740; ENTEC EU Training and Network Project; FWF-Project P18203.

Faber, R. and Wagreich, M. (2005): Modelling of topography and sedimentation along synsedimentary faults: WinGeol/SedTec. *Austrian Journal of Earth Sciences*, 97.