A simple approach to modelling sedimentation along synsedimentary faults: WINGEOL / SEDTEC

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WinGeol/SedTec is a software package developed at the Institute of Geology (University of Vienna), which simulates erosion and deposition in dependency of topography, fault movements, lithological properties and sea level.

Sedimentation modelling is based on a cellular automata approach. Sediment transport is induced by elevation or concentration differences between neighboring cells. In the first case a topographic driven mass transport is generated, in the second case sediment transport due to suspension is modeled. Grain size reduction during sediment transport is included. The spatial distribution of different rock types are extracted from a lithological raster map at the beginning of the simulation process. Rock types are characterized by their resistance to erosion and grain size reduction during sediment transport. The progress of the simulation can be checked with control point data, which define maximum sedimentation rates at certain locations.

Input data for simulation include elevation, lithology, fault data and tabular data from various data sets:

- digital elevation model (simple plane or real world model)
- fault data (optional)
- lithological raster map (optional)
- lithological parameters (resistance to erosion, ...)
- sea level (single value or curve)
- control points (optional)

Faults are defined by the following parameters:

- geographic position
- start and end time of activity
- displacement vector (direction and length)
- translation and/or rotation

Examples simulated with WinGeol/SedTec include landscape deformations due to translation and rotations of several fault blocks, erosion and deposition along a steep scarp and grain size distributions in small grabens and pull apart basins.

Geology of the Galila region in the southern Afar depression, Ethiopia: preliminary report

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The geological and petrological investigations (FWF Project P15196) in the southern Afar depression of Ethiopia support an international palaeoanthropological research-team (PAR) under the leadership of Horst Seidler from the Institute for Anthropology, University of Vienna. The research area is situated within the district of the village Gadamaitu [N 9° 44.101’, E 40° 27.368’], towards the east of National Road No. 18 to Aseb. Mount Galila forms the centre of the research area, situated about 20 km towards the east of the recently active rift axis (Hertale Graben). The NNE-SSW striking Hertale Graben represents a northern segment of the Main Ethiopian Rift (MER) thus being northern part of the East African Rift system.

Stratigraphically, the fossiliferous lacustrine and fluvial deposits, as well as the intercalated volcanic layers of the Galila area, belong to the “Upper Stratoid Series” (5-1.4 Ma) and will be named the Galila Formation. They are similar to some sedimentary successions of the Awash Group to the northwest, from which very famous early hominid fossils have been described (e.g. "Lucy" *Australopithecus afarensis,* 3.4 Ma; “Bodo”-skull *Homo heidelbergensis,* 0.6 Ma). The sedimentary and volcanic succession represents an older rift sedimentation, due to Miocene–Pliocene opening in the Afar depression. Presently, they are exposed on the eastern shoulder of the rift structure, which has been active since c. 2 Ma.

In the Galila Formation, 7 main volcanic, pyroclastic and tuffitic horizons have been observed as marker beds, which can be used for subdivision into members. The volcanic rocks comprise basaltic lavas, ignimbrites, tuffs and tuffites and represent short volcanic events. Radiometrically dated pyroclastic horizons and their geochemical fingerprints will be helpful in establishing a tephra stratigraphy for long-distance correlations with other hominid sites of the northern East African Rift.

Besides the volcanic horizons, characteristic sedimentary layers, such as a micritic lacustrine limestone bed with desiccation cracks and a cellular limestone layer, occur over the whole area, below a distinct grey ignimbrite bed. Strongly cemented gastropod limestone beds, as well as thin diatomites, are also widely exposed. In poorly sorted sheet flood deposits below a typical basalt horizon, a tooth of an *Australopithecus* cf. *afarensis* and some primate remains accompanied by a rich vertebrate fauna, have already been detected.

The tectonic situation, typical for a continental rift system, shows a “horst and graben” structure, formed by NNE-SSW striking normal faults, related to c. ESE-WNW extension. This young fault system, which dissected the Pliocene deposits of the Galila Formation, esentially follows the main tectonic trend of the Hertale Graben and was formed during the uplift of the rift shoulder.

In-situ neutron diffraction of reaction kinetics of 1.13 nm tobermorite

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Calcium-Silicate-Hydrates (CSH-phases) are formed during the hydrothermal treatment (autoclaving) of ground quartz sand, quicklime and water to produce steam cured building materials. 1.13 nm tobermorite is the predominant CSH-phase in aerated autoclaved concrete (AAC) with semi-crystalline CSH I and CSH II as minor components. The major aim of our investigations was to determine in-situ reaction mechanism and kinetics of the formation of 1.13 nm tobermorite. Neutron diffraction has the capacity to collect data of the reaction progress in-situ. An autoclave cell has been designed (Fehr et al., 2002) for performing time-resolved neutron diffraction analyses (1 minute) of the dynamic processes during the hydrothermal reactions. Experiments were conducted at 190 to 210°C under saturation pressure and within a time-range of 6 hours. In the experiments the amount of quartz decreases with time. The fraction of poorly crystallized CSH-phases rises to a maximum of 36 wt% in 3½ hours and decreases with the time by continous crystallisation of 1.13 nm tobermorite. Tobermorite is not formed initially but by the reaction of poorly crystallized CSH-phases with quartz. The precursor CSH-phases are more Ca-rich and vary in their Ca/Si in the range of 1.1 to 1.3, characteristic for poorly crystalline phase C-S-H (I) displaying no constant Ca/Si due to its disordered structure. The primarily crystallized tobermorite display (hk0)-reflections only, implying the existence of ab-planes. With increasing time the ab-planes of 1.13 nm tobermorite are forming stacks along the c-axis, indicated by the existence of a (002)-reflection. The mechanism of the reaction can be described by the reaction conversion of quartz according to Chan et al. (1978). In this early stage of the hydrothermal hardening process the reaction is determined by the solution of quartz. The reaction kinetics can be described according to an Avrami equation and the reaction rate can be calculated to k= 0.1017(52) at 190°C.

Palaeozoic tectono-metamorphic development and geochronology of the Orobic Chain (Southern Alps, Lombardy, Italy)

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In the Orobic chain an almost monoclinic east-west striking ‘Orobic fold nappe’, overlying a parautochton, has been identified. This fold, interpreted as a Variscan structure and forming the greater part of the exposed basement, consists of two structural units. The lower unit, which contains schists and metabasites of volcanic origin, was affected by a pre-Variscan event, probably the Early to Middle Ordovician ‘Sardic’ metamorphic- and deformation phase, and contains slightly peraluminious granodioritic augengneisses, which protoliths are of Late ‘Sardic’ age. The Middle- to Late Ordovician volcano-sedimentary upper sequence, with rhyolites, was deposited onto ‘Sardic’ metamorphic basement of the lower unit.

The main metamorphic phase jointly affected both sequences. The combination of monazite-xenotime thermochronometry, geothermobarometry of rock-forming minerals and phase relationships indicate that the