to the size of the slump body. Given the nature of a typical outcrop, which is usually 2D and some ten meters long, this requirement will not be met, and the sample will be incomplete, giving unreliable information. In the outcrop described here, typically 1-4 slump fold axis measurements per slumped bed could be made, which is not sufficient to interpret slump dynamics. Only the assumption of unchanged slope throughout deposition of the Ammergau Formation and the treatment of all collected data together allows an interpretation.
The Upper Jurassic to Lower Cretaceous Ammergau Formation of the Ampelsbach gorge in the Achensee region has many slumps. They are typically restricted to single or multiple beds between undisturbed beds. Some slumps are erosionally truncated or sealed at the top, whereas the base shows gradual increase in deformation. Slump folds have typically axial surfaces parallel or slightly inclined to bedding and fold style of most folds is similar, only few parallel folds were observed. Facing of folds is not systematic. Type 3 fold interferences are more common than type 2 fold interferences. In the latter case, the refolded fold is of similar type, whereas the overprinting fold is of parallel type. Lineations on folded bedding planes are parallel to hinges of similar folds. Tensional structures, i.e. listric normal faults and boudins are abundant, but are not observed together with folds. Axes of similar style slump folds cluster about an E-W direction, hinges of parallel folds trend N-S. Neither slump folds nor normal faults do indicate a preferred direction of slump movement. However, total thickness of the Ammergau Formation increases to the west from 80m in the studied section to 600 m 10 km to the SW (Nagel et al. 1976), giving an independent estimate of paleoslope orientation. Therefore we interpret a westdirected slump movement.
Various aspects of slump sheet kinematics can be described by (1) a dislocation model (Farrell 1984) and (2) a shear zone model (Ortner 2007). The first model describes orientation of fold axes on the scale of the slump as a function of the maximum offset across the basal glide plane relative to its size. It neglects the effects of large simple shear strain during transport, which leads to a downslope reorientation of foldaxes, change of fold style from parallel to similar and rotation of axial planes of folds toward parallelity with bedding, and formation of stretching lineations. Therefore we suggest (also) to use a shear zone model when interpreting slump deposits.

Farell, S.G. (1984): A dislocation model applied to slump structures, Ainsa basin, South Central Pyrenees. - Jour. Struct. Geol., **6**: 727-736, Oxford.
Ortner, H. (2007): Styles of soft-sediment deformation on top of a growing fold system in the Gosau Group at Muttekopf, Northern Calcareous Alps, Austria: Slumping versus tectonic deformation. - Sed. Geol., **196**: 99-118, Amsterdam.

Stratal patterns of clastic wedges in transpressive systems: Gosau Group of Muttekopf revisited

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Cretaceous nappe stacking in the Northern Calcareous Alps took place in a transpressive setting. Initial thrust sheet detachment and subsequent (N)NW-directed transport was accompanied by dextral shear along NW-striking high-angle faults. Deposition of deep water sediments started before and outlasted Late Cretaceous thrust activity.
Deposition on thrust-sheet-tops was controlled by internal thrust-sheet deformation during transport. Upper Cretaceous thrust-sheet-top sediments of the Northern Calcareous Alps are locally characterized by very coarse clastic facies and syndepositional growth of WSW-trending folds resulting in the development of progressive unconformities.
In well-studied continental growth strata of the southern Pyrenees (e.g. at the classic locality of Sant Lorenc de Morunys), folds are more or less cylindrical and the characteristics of unconformities do not change significantly in different cross sections. The Gosau Group at Muttekopf is preserved in the core of the Muttekopf syncline and on top of the southerly adjacent anticline. Three sections across successive parts of the Muttekopf syncline are fundamentally different and show, from W to E, (1) combined rotational offlap-onlap, (2) combined rotational offlap-onlap-overlap and (3) rotational overlap in the growth strata. Section (2) crosses a high-angle fault with 1 km offset associated with a change from a fold domain in the west, where the Gosau Group is restricted to the core of a kilometric syncline, and a fault domain in the east, where the Gosau Group overlaps a hectometric system of thrust-related anticlines and synclines along the southern basin margin.
A detailed study of the main unconformity in cross section (2) which displays combined rotational offlap-onlap-overlap revealed that the offlap-onlap pattern is mainly produced by changes in strike instead of changes in dip as seen in the classic examples. The geological map of the area shows that the cross sections displaying rotational offlap-onlap (1) and rotational overlap (3) are located between high-angle faults, whereas the main unconformity in cross section (2) is located above a high-angle faults crossing the basin.
We imagine a basin in which dextral shearing and folding in the bedrock of the growth strata were contemporaneously active. This would cause both tilting of fold limbs and offset across the high-angle faults. Given some surface topography of the depositional system, lateral offset would create topography which would be onlapped by younger sediments. At the transition from the slope related to fold growth to the slope related to high-angle faults strike changes across angular unconformities. Therefore the apparent offlap-onlap-overlap pattern produced by changes of strike rather documents the activity of high-angle faults than folding.

Geometry and sequence of thrusting in the Subalpine Molasse of western Austria and Bavaria

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Paleomagnetic data from all main external tectonic units of the Western part of the Eastern Alps indicate large differential vertical axis rotations between the foreland and the Subalpine Molasse, and between the Helvetic nappes and the Subalpine Molasse.

Large rotations of large blocks can only be accommodated by thrust planes, as rotation between vertical faults would create major space problems. Differential rotations should be expressed in differential shortening across the Alpine thrusts. As available shortening estimates of the Subalpine Molasse are far too small to be compatible with paleomagnetic data, we re-examined several cross sections.
The southernmost part of the autochthonous Molasse is deformed into an anticline an top of a triangle zone at depth, which is replaced by a foreland-facing fold east of Lechbruck. The southerly adjacent Subalpine Molasse of Western Austria is formed by a varying number of slices that show a synclinal geometry and pass laterally into horses separated by SSE-dipping thrusts. The basal thrust superimposes these slices out-of-sequence onto the foreland Molasse and therefore truncates the passive backthrust on top of the triangle zone. The thrust at the base of the southernmost slice superimposes the deepest part of the foreland sequence onto intermediate parts. Seismic sections show that this slice sits on top of a major upper footwall flat and the northerly adjacent slice is a footwall imbricate. The footwall flat reaches far south beneath tectonically higher units. The northern duplex slices are frontal hanging-wall imbricates of a major thrust sheet. Out-of-sequence thrusts dissecting the southernmost slice cut down to the basal detachment and stack older thrusts. An older triangle zone forms the contact to the tectonically higher Helvetic and Flysch nappes, which is exposed at Grünten (Allgäu), but also indicated by an apparently undisturbed stratigraphic profile across the frontal Helvetic thrust (Marienstein gallery, Bavaria), which probably is a passive backthrust .
The age of triangle zone formation at the tectonic front of the Alps is constrained by southward wedging and onlap of Middle to Late Miocene (16-7 Ma) deposits against the triangle zone. The end of tectonic activity is not constrained, because the youngest deposits still dip 15° to the NNW. Out-of-sequence thrusting of the northernmost Molasse slices onto the triangle marks the end of foreland propagation and the onset of internal thickening of the orogenic wedge during the Tortonian. Apatite fission track dating in a well penetrating the southernmost Molasse slice in Eastern Switzerland revealed more than 1 km exhumation relative to the more northern slices postdating the Early Pliocene (4.7 Ma), which was related to thrusting (Cederbom et al. 2007). It shows that out-of-sequence thrusting started to propagate further into the Alpine orogen in the Pliocene.

Cederbom, C., Schlunegger, F., Sinclair, H. D. & Van Der Beek, P. (2007): What can the Swiss Molasse basin tell us about the Late Neogene development of the Alps? - Abstr. 8th WAGS Davos, 10-11, Bonn.

Age-dating catastrophic rockslides in the Alps

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In carbonate-lithic rockslides, the hitherto undocumented phenomenon of diagenetic cementation of the sturzstrom deposits is used to determine proxy ages of rockslide events by $^{234}U/^{230}Th$ disequilibrium dating of cements. Large-scale rockslides exceeding 10^6 m^3 in volume not only are a major process of mountain erosion and orogenic mass balance but, in densely populated regions such as the Alps, also represent a major threat to humans and facilities. Establishing the distribution of rockslides in time is a prerequisite of hazard assessment for future events and for a better understanding of potential triggers, such as climatic change or phases of enhanced earthquake frequency. The ages of many rockslides of the Alps, however, still are poorly constrained.
Our preliminary investigations of major carbonate-lithic rockslides of the Alps revealed that indeed *nearly all* of them contain pockets, thicker crusts and patches wherein the rockslide material underwent cementation into a breccia. As already proven for the Fern Pass rockslide (Austria), breccia cement can provide a proxy age of the sturzstrom event by dating the cement with the $^{234}U/^{230}Th$ disequilibrium method. A cross-check of the U/Th age with ^{36}Cl surface exposition ages underscored the validity of the U/Th age, and showed that the U/Th age constrains the comparatively wide error range of exposition dating (Ostermann et al. 2007). The common phenomenon of cementation in rockslide deposits to date is practically unknown to the geoscientific community. Our preliminary data strongly suggest that these cements may be routinely used for U/Th proxy-dating the events. In addition, different 'generations' of cement as distinguished by petrographic analysis may provide time constraints on the further post-depositional development of a rockslide mass. The U/Th disequilibrium method has recently been successfully applied to age-date cements of Quaternary deposits of the Alps, such as talus breccias, fluvial conglomerates and spring tufas. In the frame of a new FWF-Project, age determination of selected rockslides shall be done by both U/Th dating of cements and by surface exposition dating with cosmogenic radionuclides. Exposition dating has the advantage to provide the 'direct' age of the rockslide event, yet the resulting ages are fraught with wide 2ó standard errors. Combining surface exposition dating with U/Th dating of cements thus has the potential to arrive at more precise proxy ages of rockslides than can be achieved by a single method alone.

Ostermann, M., Sanders, D., Prager, C., Kramers, J. (2007): Aragonite and calcite precipitation in „boulder-controlled“, small-scale diagenetic systems on the Fern Pass rockslide (Northern Calcareous Alps, Austria): implications for absolute age-dating of catastrophic mass failures. - Facies, **53**: 189-208.

Das Verhalten und die Stabilität von TiO_2 Nanopartikeln in aquatischen Systemen.

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Titandioxid Nanopartikel (TiO_2 NPs) sind sowohl für die Industrie und für die Wissenschaft von wachsendem Interesse. Dies ist nicht zuletzt auf ihre besonderen Eigenschaften zurückzuführen und finden somit Anwendung in Kosmetika, Farbe und in der Wasseraufbereitung. Nanopartikel (1 nm-100 nm) zeichnen sich durch eine große, zum Teil modifizierte spezifische Oberfläche aus. TiO_2 NPs besitzen die Eigenschaft an ihrer besonders großen Oberfläche reaktive Sauerstoffspezies (ROS) zu bilden, die sich potentiell negativ in der Umwelt und auf Organismen auswirken. Der Verbleib und das Verhalten von TiO_2 NPs in der Umwelt ist stark von ihrem Aggregationsverhalten abhängig. Die Aggregation bzw. Stabilität in Gewässern wird durch das Vorhandensein unterschiedlicher Substanzen (z. B. Ionen, organische Substanzen), deren Konzentrationen und dem pH Wert bestimmt. In diesem Zusammenhang haben wir die Persistenz von TiO_2 NPs in unterschiedlichen aquatischen Systemen getestet. Hierfür wurde eine Test-Matrix mit sich verändernden Parametern wie Ionenstärke, Ionenzusammensetzung, Zugabe von organsicher Substanz und Variation des pH Wertes entwickelt. Die Aggregation, bzw. Stabilität der Partikel in Suspension in verschiedenen Milieus wurde mittels dynamischer Lichtstreuung und Laser-Doppler-Anemometrie auf Partikelgröße und Oberflächenpotential getestet. Die Gesamtkonzentration an TiO_2 in Suspension wurde mittels Ele-