the question of the emplacement of the Alpine salt deposits is to date the surrounding sedimentary rocks (radiolarites, siliceous limestones to siliceous marls). We examine, therefore, the radiolarian age of one sample (BNU) that derives from the end of the borehole BHTNU 040 of the Hallstätter Salzberg in the Salzkammergut area.

The sample is a dark grey laminated siliceous limestone, in which most radiolarian tests are calcitised and only few ones are preserved as quartz. Following radiolarians are identified: *Archaeodictyomitra amabilis, Archaeodictyomitra rigida, Cinguloturris carpatica, Cinguloturris primorika, Cyrtocapsa mastoidea, Dibolachras chandrika, Dictyomitrella kamoensis, Droltus hecatensis, Droltus galerus, Eucyrtidiellum circumperforatum, Eucyrtidiellum ptyctum, Eucyrtidiellum unumaense, Gongylothorax favosus, Gongylothorax oviformis, Gongylothorax* sp. C, *Guexella nudum, Helvetocapsa matsuokai, Hiscocapsa acuta, Hsuum brevicostatum, Hsuum. maxwelli, Loopus doliolum, Neorelumbra skenderbegi, Parahsuum* sp. S, *Parvicingula cappa, Podobursa nodosa, Praewilliriedellum spinosum, Praezhamoidellum buekkense, Protunuma matsuokai, Podobursa nodosa, Quarticella ovalis, Saitoum levium, Spongocapsula* sp. A, *Stichomitra annibill, Stichocapsa convexa, Stichocapsa imedaruma, Stichocapsa japonica, Stichocapsa tegiminis, Stichocapsa naradaniensis, Stichocapsa* sp. E, *Tetracapsa himedarum, Theocapsomma cordis, Theocapsomma medvednicensis, Tricolocapsa conexa, Tricolocapsa fusiformis, Tricolocapsa plicarum, Tricolocapsa tetragona, Tricolocapsa undulata, Tricolocapsa* sp. S, *Triversus hexagonatus, Triversus hungaricus, Unuma typicus, Unuma gorda, Williriedellum crystallinum, Williriedellum dierschei, Williriedellum marcuccia, Zhamoidellum ovum, Zhamoidellum ventricosum*.

This fauna resembles the Brielgraben fauna, which is dated by ammonites at the base as a Middle Callovian age, and it is included in the *Protunuma lanosus* subzone in the *Zhamoidellum ovum* zone. To correlate these with the Japanese radiolarian zone, some important species can be mentioned, which indicate a horizon around the boundary between *T. plicarum* and *T. conexa* zones: *C. mastoidea, T. plicarum, T. conexa, T. fusiformis, T. tetragona, E. ptyctum*. Although *T.* aff. *fusiformis* has a smaller basal appendage than typical *T. fusiformis,* the species is commonly included in the samples from Brielgraben of the Middle Callovian, it has not so far been found in BNU of the Hallstätter Salzberg. Taking the occurrence of *Z. ovum*, *S. annibill* and *G.. favosus* into consideration, the horizon of the sample BNU is located above the lowermost Callovian. Therefore, the age is Lower or Middle Callovian.

The age determination of the samples from the borehole clearly confirms that the Alpine Haselgebirge of the Hallstatt salt mine lies tectonically on top of radiolarites of the Lower Callovian to Upper Oxfordian Ruhpolding Radiolarite Group. The salt mine is overlain by the shallowing-upward sequence of the Plassen Carbonate Platform, of which sedimentation had started here in (early) Kimmeridgian time.

Callovian to Early/Middle Oxfordian radiolarians from hemipelagic sequences from a „Slovenian Trough"-like sedimentary succession in the Karavank Mountains

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The Karavank Mountains display a suite of several different individual stratigraphic successions of partly different palaeogeographic derivations, today forming imbricates along the Periadriatic Lineament of variable size, stratigraphic range, facies, thickness and diagenetic/thermal overprint.

An isolated imbricate with a „Slovenian Trough"-like Triassic-Jurassic sedimentary succession is located between the Maria-Elend Sattel and the Schwalbenwand. This succession consists of Late Triassic to Middle/Late Jurassic hemipelagic dolomites to cherty limestones, similar to the sedimentary sequence know from the „Slovenian Trough" south of the Julian Alps. Above grey thin bedded turbiditic to bioturbatic Sevatian to Rhaetian radiolarian-rich limestones with mass-flow deposits and sliding complex horizons (= Frauenkogel Formation) and the Rhaetian to Early Jurassic grey argillo-calcareous bioturbate to turbiditic wackestones (= Hahnkogel Formation) follow grey thin bedded, turbiditic radiolarian-rich siliceous wackestones of late Middle/early Late Jurassic age (= Kahlkogel Formation, as a part of the Ruhpolding Radiolarite Group).

The occurrence of Callovian to Early/Middle Oxfordian radiolarians is reported from these sediments: *Bernoullius cristatus, Archaeodictyomitra* sp., *Hsuum* cf. *brevicostatum, Parvicingula* cf. *dhimenaensis, Dictyomitrella* sp., *Triversus* cf. *hungaricus, Podobursa* cf. *nodosa, Unuma gorda, Quarticella* cf. *ovalis, Williriedellum dierschei, Williriedellum glomerulus, Zhamoidellum* cf. *ovum, Stylocapsa oblongula, Gongylothorax* aff. *favosus, Gongylothorax* sp. C, *Theocapsomma medvednicensis, Tricolocapsa conexa, Tricolocapsa undulata, Praewilliriedellum* cf. *spinosum, Stichocapsa convexa, Eucyrtidiellum* cf. *unumaense, Eucyrtidiellum unumaense,* and *Eucyrtidiellum* cf. *ptyctum*. The last appearance horizon of *E. unumaense* is revised at least to early Late Oxfordian (upper limit of the *Williriedellum dierschei* subzone of the *Zhamoidellum ovum* zone). The radiolaria *Z. ovum* (Callovian to Early Tithonian) is the index species for the *Zhamoidellum ovum* zone (Callovian to Oxfordian). *G.* aff. *favosus* is defined for the U.A. Zones 7-8 (Late Bathonian to Early Oxfordian), respectively for the *Protunuma lanosus* subzone (Callovian) to *Williriedellum dierschei* subzone (Early to Middle Oxfordian) of the *Zhamoidellum ovum* zone.

Thus, recent systematic studies on *G.* aff. *favosus* obtain in this sample an atypically species, with an inflated, less depressed cephalis in the thoracic cavity. The radiolaria *P. nodosa* indicate only a Middle to early Late Jurassic horizon. *T. hungaricus*, originally described in the *Unuma echinatus* zone of southwest Japan and Hungary are determined to be Bajocian in age. Consequently, radiolarians from these radiolarian-rich wackestones of this imbricate south of Maria Elend indicate a Callovian to Early/Middle Oxfordian age.

Hence, the sedimentation until the late Middle/Late Jurassic in these belt is in line with the model of out-of-sequence thrusting in the Juvavicum since the Early/Middle Jurassic boundary, and continuous sedimentation on the backlimbs of the nappes. Lateral motions since the Turonian formed a mega-imbricate zone between the Dinarides and the Eastern Alps contemporaneous with the movements of the Drau Range and the Transdanubian Range towards the east, to their present position.

The new Kahlkogel Formation as part of the Ruhpolding Radiolarite Group is introduced for these siliceous wackestones reported for the first time from this area of the Karavanks in a „Slovenia trough"-like Triassic-Jurassic sedimentary succession.

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Some geoscientific applications of Airborne Laser Scanning DTMs in Austria

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The knowledge of the exact position and extent of various topographic features has increasing importance in geosciences. This is especially true if the features are or can be related to possible natural hazards like landslides, snow or rock avalanches, torrential precipitation discharge, etc. The dynamic character of some surface processes demands high accuracy DTMs (digital terrain models) for the detection and possibly for forecasting events of the aforementioned phenomena.
A very effective and straightforward way of topographic data acquisition is Airborne Laser Scanning (ALS, also known as LiDAR). High precision DTMs , derived from LiDAR data via sophisticated processing, has typically 1 m horizontal resolution or higher, while the vertical accuracy is on the order of ±10 cm depending on the LiDAR point density and the terrain slope. The determination of ground surface is possible even for forested or densely vegetated areas. This is an important benefit of LiDAR compared to other DTM generation techniques. The resulting vast amount of high-resolution digital elevation data makes it possible to outline microtopographic features that are often related to active tectonics, to recognize precursors of future mass movements or areas with increased erosion.
Our contribution deals with case studies from areas of the Austrian federal states of Burgenland and Vorarlberg. Neotectonic features are detected in the Seewinkel, an extremely flat area that also host playa lakes, and in the Leitha Mts., that has a unique tectonic position at the boundary of the Eastern Alps and the Pannonian basin. The latter tectonic boundary is neotectonically active and the movements can also be traced in microtopographic features.
Further examples are shown from Vorarlberg, both from a high-relief area of Montafon, near to the Silvretta block and a medium relief area where active fluvial incision is combined with tectonic activity, causing major landslides (locality Doren). In both cases the microtopography provides evidence for active geomorphic processes. In the case of Doren multitemporal LiDAR data are available that show the post-event evolution of the landslide mass and the reaction of the fluvial system on the creeping material.
The analysis of LiDAR DTMs together with the necessary field observations and on-the-spot verification of the results provide comprehensive knowledge on microtopography and often lead to conclusions that may contribute to deeper understanding concerning natural hazard issues, like slope stability and tectonic activity.

Tectonic geomorphic microstructures in an Airborne Laser Scanning DTM in the Seewinkel Area, Little Hungarian Plain

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Our study area, the NW corner of the Little Hungarian Plain, at the junction of the Eastern Alps, the Pannonian Basin and the Western Carpathians, is a neotectonically active region forming the transition zone between the Eastern Alps and the partly subsiding Little Hungarian Plain. The on-going deformation is verified by the earthquake activity in the region. A part of the area, east of Lake Neusiedl, the so-called Seewinkel, has been measured by ALS technique, resulting in a DTM with 1 m horizontal resolution and vertical accuracy better than 10 cm. This area is an extremely flat vineyard region dominated by alluvial gravel deposits of uncertain age (Riss/Würmian?). The lack of significant outcrops renders structural geologic mapping of the area difficult.
Potential neotectonic structures of the DTM have been evaluated together with geological maps, regional tectono-geomorphic studies, geophysical data, earthquake foci, as well as geomorphic features and Quaternary sediment thickness values of the juxtaposed Parndorf plateau. The combined evaluation of these data supports the recognition of several tectonic features in the DTM that have a relief less than 2 m and therefore would not be visible in other datasets. The length of these linear geomorphic structures ranges from several hundred meters up to several kilometers. The most prominent of them forms a linear, elongated, 15 km long, 2 m high NE-SW trending ridge with gravel occurrences of average grain size of up to 5 cm on its top. We conclude that this feature is linked on a regional scale to the Mönchhof fault, which previously has been recognized in seismic sections only.This multi-disciplinary case study shows that ALS DTMs are extremely important for tectono-geomorphic investigations, they are even essential for the accurate location of neotectonic structures, especially in low-relief areas.

Influence of the Bohemian Spur on the evolution of the Eastern Alps

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The Bohemian Massif projects below the Eastern Alps and the Vienna Basin as a basement promontory often referred to as the Bohemian Spur. This salient defines a large concave to the SE segment of the European margin which is interpreted as a lower-plate margin of the Magura Basin. Based on academic and industry reflection seismic data in the NW Pannonian Basin, the Bohemian Spur can be traced much further to the SE than previously thought. In the easternmost Eastern Alps, in the area of the South Burgenland Swell, the European crystalline basement has not been penetrated by exploration wells. However, the Penninic outcrops of the Rechnitz Window group, interpreted as a metamorphic core complex, clearly indicate the presence of the Bohemian Spur underneath. The top Penninic surface was mapped in the subsurface on a sub-regional scale by seismic data and it can be used as a proxy for the extent of the underlying Bohemian Spur.
As the southwestern edge of the Bohemian Spur was controlled by a transform fault, this suggests that the Spur itself developed as a marginal ridge, very similarly to well-known examples of the equatorial Atlantic region. Thus, the extension of the Bohemian Spur to the SE as a pelagic swell with a conceptually predictable Jurassic facies succession, is interpreted to be the Czorsztyn