

### **Landslides**

In the landslide research, the team concentrates on multidisciplinary studies of various types of slope processes, ranging from deep-seated landslides through debris flows to rockfalls, with our study sites spread both in the Czech Republic and worldwide (Peru, Svalbard, Kyrgyzstan, Austria, Canary Is., etc.). In our work we apply innovative methods and approaches, including geophysical, geodetical, remote sensing and monitoring techniques, combined with various environmental data to assess the landslide hazard and to propose suitable mitigation measures. We therefore often work as consultants for both state institutions and private enterprises.

### **Tectonics**

The research focus of the team is the monitoring of the slow, yet omnipresent aseismic creep along tectonic faults. These movements, with velocity varying from centimetres in highly active areas to less than 0.01 millimetres/year in less active regions, accommodate part of the tectonic stress and thus their understanding is one of the crucial conditions for the development of forecasting of the earthquakes, the ultimate goal of tectonic and seismic research. Our dedicated network for the fault monitoring TecNet covers many countries in Europe and the World. Recently, we have advanced towards calculation of current stress field and its changes, based on our direct measurements on tectonic faults.

### **Monitoring and instruments development**

Since 1970ies, the department team is very active in the development and applications of monitoring devices. Our specialty is a very precise 3D dilatometer TM-71, continuously developed from the first optical-mechanical models towards the current device with better precision, automatic reading, data transfer and processing. The improvements are partly aided by in-house design and production of new parts using 3D printing technology. We also test and apply the cutting-edge technologies and methods like TLS (terrestrial laser scanner or LiDAR), modern geophysical methods or UAVs (unmanned aerial vehicles or drones).

## **Other current research interests and undertakings**

### **Slope tectonics**

Newly emerging field of research brings together our two main topics: slope processes and tectonics. It was revealed that many especially deep-seated slope deformations can originate or be activated by tectonic faults, both passively (as weakness zone) and actively (by their movement). Our team members are active on this field by doing research in the Bohemian massif, Alps and volcanic islands, such as El Hierro. The growing attention given to this new topic is illustrated by series of dedicated conferences on “Slope tectonics”, in collaboration and participation also with members of our department.

### **Rock weathering**

Some of our studies deal with various aspects of rock weathering, mineral changes and their slope stability consequences. On this research, we cooperate with internationally renowned teams. One of the main results describes a quantitative method for calculating a weathering index for carbonate rock samples based on a range of petrophysical models. For example, physical modelling was used to simulate weathering and decay of the UNESCO World Heritage site of Petra (Jordan).

### **Research for practice**

Although the bulk of the work undertaken in the Department of Engineering Geology focuses on basic research and publishing the results in scientific journals, we also maintain and further develop our strong collaboration with various partners from public institutions and private enterprises bridging often a wide gap between the science and practice. Most often we work on the assessment of rockfalls and landslides in various environments estimating the hazard and designing mitigation measures. For example, the team prepared an analysis of causes of a devastating landslide that hit the construction of a D8 motorway in 2013.

### **Monitoring networks**

The department of engineering geology runs three networks, monitoring various geodynamic movements. The most extensive is the TecNet, observing the slow movements on tectonic faults using the [TM-71 3D extensometers](#), then there is the geodynamic network GEONAS, dedicated to GNSS measurements at selected stabilised geodetic points, and finally SlopeNet, fast-developing network monitoring the slope deformations using various direct movement observations and environmental monitoring sensors.

## Databases

As a result of our research, we built and run several databases on the various aspects of the geodynamic phenomena. Recently we started to build a **world-wide database of large volcanic island flank collapses**, which often also act as triggers of dangerous and far-reaching tsunamis. As concerns popularization of the landslide science, we compile a [landslide occurrence database for the Czech Republic](#), based on public news and other internet sources. Since 2020 we share this data with [NASA global landslide database](#). Also we have created a [database of old photos of landslide phenomena](#), named after one of the founders of engineering geology in Czechoslovakia and also of our department, Prof. Quido Záruba.