The Swiss Geological Survey – the authority for subsurface
The Swiss Geological Survey at swisstopo is the federal competence centre for the collection, analysis, storage and provision of geological data. Our staff of 50 employees prepare decision-making bases for shaping our living space and promoting the comprehension of our landscape.

- We organise geological investigations and surveys of Switzerland in the fields of geology, geotechnics and geophysics.
- We coordinate the Swiss geological community with local authorities, universities, the private sector and international organisations.
- We prepare geological maps, data and models for local authorities, research, the private sector and the public.
- We collect data on mineral deposits and make them available for further purposes.
- We provide data for underground construction projects and offer our support in the search for appropriate sites.
- We document the historical and current use of the subsurface.
- We carry out research for a better understanding of the subsurface.
- We compile reports, make recommendations and advise local authorities and the private sector.
We are involved in the following domains with our products and services:

1. Protection against natural hazards
2. Mobility in the subsurface
3. Supply of mineral resources
4. The energy transition
5. Deep repository for radioactive waste
6. Geology and living space
7. Underground spatial planning
8. Coordination of geological activities in Switzerland
Can your house trust its substratum?

The ground is not always as stable as it looks. It can start vibrating during an earthquake, or earth masses can slide downhill during a landslide. These aspects should be taken into account in new construction projects.

In Switzerland, rock falls, rock avalanches, debris flows and landslides are widespread. Geologists can localise relevant danger zones with the help of geological mapping. At a scale of 1:25,000, the Geological Atlas of Switzerland provides them with valuable initial information. The adverse effects of natural hazards can thus be minimised by zoning, organisational or structural protective measures.

The effect of an earthquake on a house depends partly on the substratum’s reaction to earthquakes at that location. The properties of the substratum can reinforce the effects of ground motion during an earthquake: this is why also the damage from an earthquake varies according to the type of substratum. Geological maps are an important basis for the “Maps of Subsoil Classes”. This classification enables builders to avoid soft substratum during construction.

The Swiss Geological Survey produces accurate geological maps at a scale of 1:25,000, in print and digital forms (map.swisstopo.admin.ch). These maps allow geologists to judge whether a building is standing on a stable and thus safe ground.
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Work area in the Gotthard Base Tunnel
Tunnel construction: what is the best location?

Whether building the Gotthard Base Tunnel or planning the Cargo Sous Terrain (CST), the Swiss Geological Survey’s technical skills help geologists find the best layout and sites for underground constructions.

The shortest route is not necessarily the quickest. This principle also applies to tunnel construction. When planning a tunnel, geologists optimise the layout, taking into account natural risk areas such as fault zones and groundwater aquifers.

Investigations like these were also carried out for the Gotthard Base Tunnel, today’s longest in the world with a length of 57 kilometres. In the course of construction, geologists inspected the tunnel daily. They recorded the geological and hydrogeological conditions. They were responsible for the continuous measurement of temperatures and naturally occurring radioactivity, as well as for taking water samples.

There are limits to the expansion of traffic infrastructures. Cargo Sous Terrain (CST) is an innovative private-sector solution intended solely for freight traffic. The purpose of CST is to relieve and complement above-ground traffic at some time in the future. A 70 kilometre-long tunnel, 20 to 60 metres beneath the earth’s surface may make it possible as of 2045 to conduct automated underground freight traffic.
Swiss gravel, cement, clay, gypsum, salt: for how much longer?

Road salt, gravel, railroad ballast, gypsum, roof tiles and cement are many of the products from domestic natural resources that play an important role in daily life.

Switzerland can cover most of its requirements of mineral commodities, such as gravel and sand, gypsum, salt and raw materials for cement, from domestic mining sites. Sand and gravel quarries, cement factories, brickworks and plaster manufacturers have turnovers in the billions from the processing of mineral resources.

Recently, a shortage of some domestic resources has been noted, arising from two causes. Firstly, usable reserves of natural mineral resources are declining. Secondly, some reserves cannot be exploited because of conflicts with public interests, such as environmental or landscape protection and other social needs (the preservation of agricultural areas, urban development, tourism, private claims).

To guarantee Switzerland’s supply of mineral resources, geologists are examining the subsurface with regard to occurrences of minerals and rocks suitable for industrial processing.

Ensuring the long-term supply of mineral resources for Switzerland is in the national interest.

In collaboration with the Swiss Geotechnical Commission (SGTK), the Swiss Geological Survey manages the “Swiss mineral resource information system” (sgtk.ch). The Swiss Geological Survey coordinates at the federal level the guarantee of long-term reserves of minerals such as gravel, sand, gypsum and natural building stone.
Photo: City of St. Gallen

Geothermal drilling
How much geothermal energy is stored beneath the ground?

Harnessing geothermal energy has a future. For it to become a reality, we need information on the subsurface. This amount of information requires hundreds of pieces of the jigsaw puzzle that the Swiss Geological Survey helps to put together.

In the context of climate preservation and the Energy Strategy 2050, fossil fuels will be gradually replaced by renewable energies. In the future, the demand for electric power in Switzerland is to be met with a combination of hydraulic power and renewable energies. One of these energies is deep geothermal energy. Its potential has been evaluated as high in Switzerland. By 2050, deep geothermal plants should account for seven percent of the yearly electricity production. To exploit geothermal energy, the Swiss Geological Survey is creating a geological 3D model of the Swiss Central Plateau (*Mittelland*) to scales of 1:200,000 and 1:50,000. This data can be accessed through the Federal and cantonal geodata portals. In addition, the Swiss Geological Survey harmonises and stores seismic data, drilling data and geological profiles that are important for geothermal energy use.
In the future, deep geological repositories in Switzerland will be used for the disposal of radioactive waste. These are located several hundred metres below the earth’s surface in geologically stable rock strata. Opalinus Clay, a marly clay with various proportions of sand and limestone, is considered to be the only reliable mineral substance in which highly radioactive waste can be stored. This dense clay is over 170 million year old and its water permeability is very low. Opalinus Clay binds pollutants very well, thus preventing their dispersal. It also manages to automatically close cracks and crevices that appear near springs. The Mont Terri rock laboratory is located within the Opalinus Clay strata of St. Ursanne in the Canton of Jura, near the Mont Terri highway tunnel. The presence of this clay was the impetus for constructing and operating the underground rock laboratory. This laboratory is located about 300 metres beneath the earth’s surface and, since 1996, has been used to perform tests on the long-term behaviour of Opalinus Clay and, much more recently, experiments on CO₂ storage. The latter poses the question, whether Opalinus Clay remains impermeable also with the storage of gas at great depths. The rock laboratory is intended only for research purposes. Storing radioactive waste there is out of the question.

Swiss geologists would not store highly radioactive waste in granite or conglomerate. They have found something much better: Opalinus Clay.

The Swiss Geological Survey at swisstopo is in charge of the international Mont Terri research project for the disposal of radioactive waste. It works with 17 project partners from Europe, Japan, Canada and the USA. It operates a visitors centre and organises tours of the underground laboratory (mont-terri.ch).
Calcareous marble and dolomite, Simplon Pass
The Swiss Geological Survey is involved in different projects to make a wide audience more aware of geology. The often complex geological publications contain highly interesting information that is typically comprehensible only to professionals. With our simplified publications and events, we make the work done by the geological community understandable to laypersons. These include, for example teaching aids for schools, geological hiking guides, the international “Via GeoAlpina” project and excursions led by experts through the “Experience Geology (Erlebnis Geologie)” association. Geology also plays an increasingly important role in tourism. In this context, the Swiss Geological Survey collaborates with the visitors centres of the Swiss Tectonic Arena Sardona, a UNESCO World Heritage site. With its own publications and by participating at fairs and professional events, the Swiss Geological Survey monitors the pulse of its clients.

The earth is round. Geo-logical, or not?

Our head is round so that our thoughts can change direction, and our earth is round because it wants to stimulate our thoughts.

The Swiss Geological Survey produces combined hiking and geology maps at a scale of 1: 50,000 as well as other publications for adventures in the great outdoors (map.swisstopo.admin.ch). Each summer, it organises a series of free, guided geological excursions and hikes for adults and children (swisstopo.ch/geologicalhike).
In a country progressively under development, the pressure of urbanisation exists in all directions and increasingly involves the subsurface as well. Faulty planning (first come – first served) as well as unanswered questions concerning underground property rights lead to conflicts. Subsurface spatial planning is a major challenge for all those involved. Particularly in large densified urban agglomerations, it is very important to have quick and easy access to relevant data. Linking basic geological data with civil engineering information – such as Building Information Modeling (BIM) or the cadastre – makes high-quality 3D spatial planning cost-effective and sustainable.

The Swiss Geological Survey is the federal competence centre for the collection, analysis, storage and provision of digital geological data of national interest. It provides a wide range of basic digital geological data for public use (map.swisstopo.admin.ch).
Network of neurons

Image: Dmitry Rytkov
Is there a common Swiss geological community?

There are more than 1,500 active geologists in Switzerland. They work in 300 geology bureaus, 7 universities, 26 cantons, 30 committees and the federal administration. What is the common denominator?

The Swiss geological community is diversely organised and its activities are uncoordinated. For this reason, access to geology-relevant data, information and services is often difficult or limited. Data producers and suppliers use different distribution channels, making the search for data a challenging, time-consuming and costly undertaking.

The Swiss Geological Survey is committed to coordinating geological, geotechnical and geophysical surveys. It runs the central offices of the Federal Geological Commission (FGC) and the Federal Coordination Body for Geology (KBGeol), organises the annual conference of cantonal geologists and represents Switzerland at EuroGeoSurveys (EGS), an organisation of over 30 national geological surveys throughout Europe.

The Swiss Geological Survey maintains the Geology Portal together with the Swiss Academy of Sciences (SCNAT) and the Swiss Association of Geologists (CHGEOL), and it promotes a better understanding of geology for everyone through its public relations work (geologyportal.ch). It networks with partners in geology at the national level and represents Switzerland at EuroGeoSurveys in Brussels.
The Swiss Federal Office of Topography swisstopo is Switzerland’s geoinformation centre. We provide accurate, updated and reliable fundamentals for the surveying of Switzerland, collect data on the landscape and its subsurface and document them over time. Thanks to swisstopo, every location in Switzerland can be determined down to a centimetre. swisstopo thus fulfils a federal task. Our products include national maps, elevation and landscape models, aerial images, orthophotos as well as geological data and maps online and as mobile phone apps. The Federal Geoportal at map.geo.admin.ch in particular plays a central role for our products.