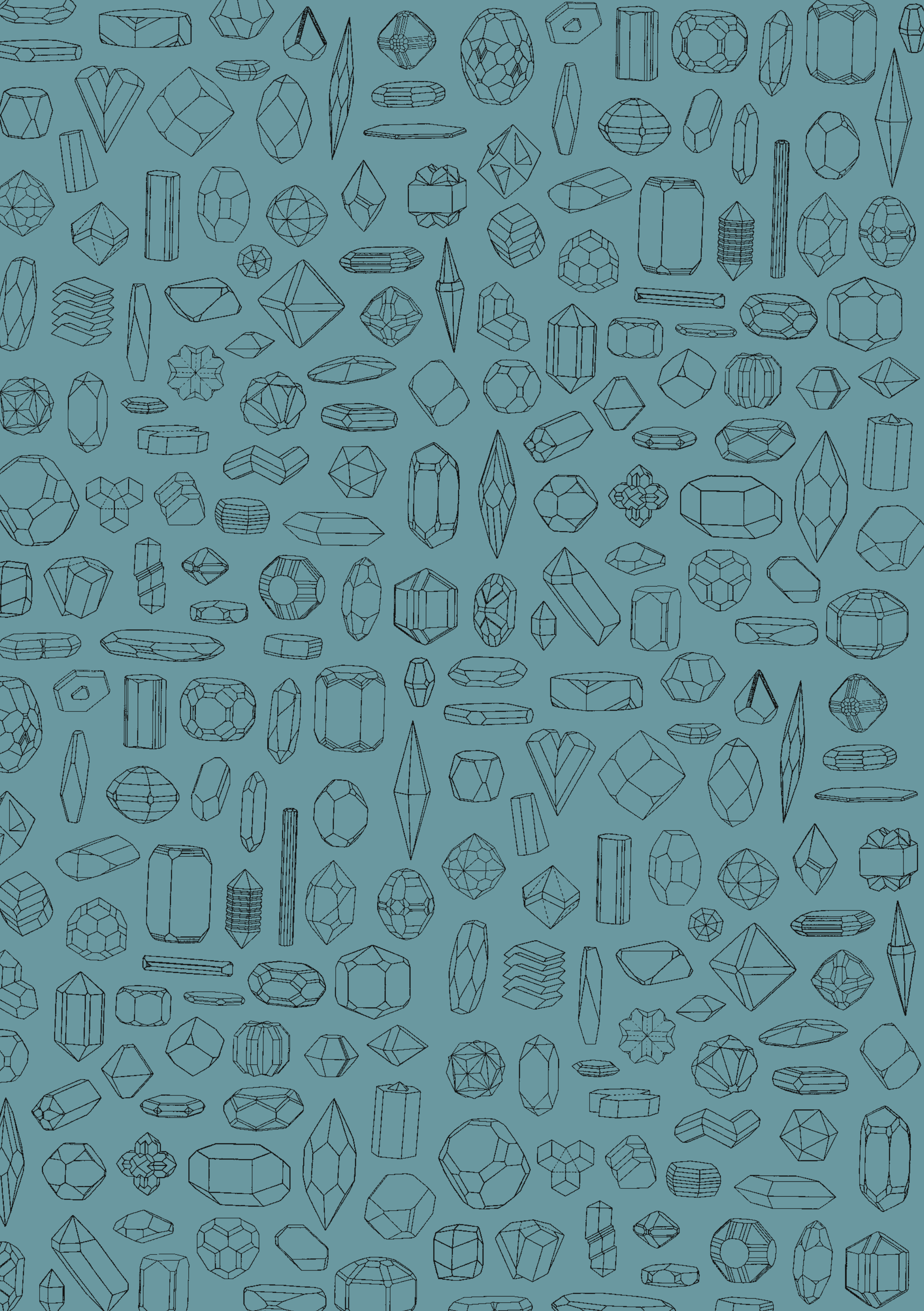
GIANT CRYSTALS

THE PLANGGENSTOCK TREASURE

ROCKS OF THE EARTH



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AND

ROCKS OF THE EARTH

4th print

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FOREWORD

Crystals hold an extraordinary fascination for us humans, and since time immemorial have been used to make tools, decorative vessels, religious objects and jewellery. Although their internal structure is strictly geometric and the number of types of crystal in existence is finite, their variety is inexhaustible and their form and dazzling beauty a source of mystery and charm.

The Planggenstock Treasure, which the Natural History Museum made accessible to the public in 2011, is one of the most significant crystal finds ever to be made in the Alps. Those who discovered it invested over a decade of commitment, money and hard physical work in bringing it to light. The “treasure chamber” contains almost 2 tonnes of quartz which is rare in its beauty and unique in its radiance.

Alongside these wonderful gems and a cross-section of the Museum’s geological treasures, the exhibition tells the fascinating stories behind the objects on display, detailing the extreme conditions under which minerals are formed, the surprising connections between humans and minerals, and giving the visitor the chance to witness unusual sights such as meteorites from the moon, radioactivity made visible and lots more.

Christoph Beer, Director

GIANT CRYSTALS

The Planggenstock Treasure

On September 21st 2005 the crystal hunters Franz von Arx and Paul von Känel opened up a cavity in the rock of their exploratory mine on the Planggenstock peak in the canton of Uri. There, glinting in the light of their torches, were almost fifty large, unusually clear and perfectly formed quartz crystals and crystal clusters. The two were looking at one of the largest and most important finds which the Alps had yielded for around 300 years. In 2010, this unique treasure was acquired by the Natural History Museum Bern. Since May 2011 it has been part of the Museum's significant collection of Alpine minerals, evoking awe and wonder in everyone who sees it.

The exhibition is divided into three sections. The central part is the "treasure chamber", a darkened room where subtle lighting appears to illuminate the crystals from within. In the "cinema" area, visitors can watch a short film documenting the life and work of the two crystal hunters in their mine on the Planggenstock and learn about the lengths they went to in bringing their precious find to the surface.

The section "Crystal Trivia" features a range of fascinating pictures, objects and texts which deliver all kinds of surprising facts about crystals, from the origins of a kidney stone to how the crystals got into the mountain in the first place.

The largest group of crystals weighs 300 kg. The central crystal in this wonderful composition is 107 cm long.

Immersed in the world of crystals in the "Crystal Trivia" section of the exhibition.

THE HISTORY OF THE FIND OF A CENTURY

In May 2011, the Natural History Museum celebrated the opening of the exhibition “Giant Crystals – the Planggenstock Treasure”. The unearthing of this treasure took its finders almost 13 years of work, dedication and money.

In 1994, high above the Göscheneralpsee, 2,600 m above sea level, Franz von Arx and Paul von Känel began work on the site that would one day reveal the find of a lifetime. The previous year, von Känel had found some large pink fluorites near the entrance to the cleft on the Planggenstock peak and recognised this as a sign that the mountain may hold more treasures within. The men had to shift blocks of granite weighing several tonnes to even reach the entrance, but there indeed lay the first in what would turn out to be a series of crystal cavities, and one which appeared to be very promising. This discovery led the pair to make looking for minerals their fulltime occupation.

After eleven years of hard work, the first really extraordinary crystals finally came to light, twenty metres into the mountain. The most attractive of these impressive smoky quartz clusters is on display in the Museum today.

The Göscheneralpsee with the Planggenstock in the background.

Franz von Arx (front) and Paul von Känel admire their find in the Planggenstock cleft.

Encouraged, the men continued their explorations until in autumn 2005 they finally came upon a group of giant crystals unparalleled in size and quality. Here, finally, was the "Planggenstock Treasure". In the summer of 2006, von Känel and von Arx brought the crystals out of the cleft and put them on display in the church in Flüelen. In May 2008, they made another extraordinary discovery which established the Planggenstock cleft as one of the most significant in the Alps.

In January 2009, the Museum Commission decided to acquire the sensational find of 2005/2006 and in December of that year the Burgher Community of Bern approved the money which would make it possible to purchase the crystals. The Canton of Bern put half a million francs out of the Lottery Fund towards restructuring work in the Museum, and a large number of private donors also contributed to the ambitious project of making the find of a century accessible to the public in Bern. In 2010 the giant crystals finally changed hands for 4.5 million francs.

The giant crystals are finally brought to the surface.

Both the lower and the upper entrance to the cleft are situated on horizontal fissures in the rock. This is typical of clefts found in massive granite.

THE AAR MASSIF – CRYSTALS GALORE

The Planggenstock cleft is located in the granite of the Aar Massif. This basement rock houses the largest and richest crystal cavities the Alps have to offer.

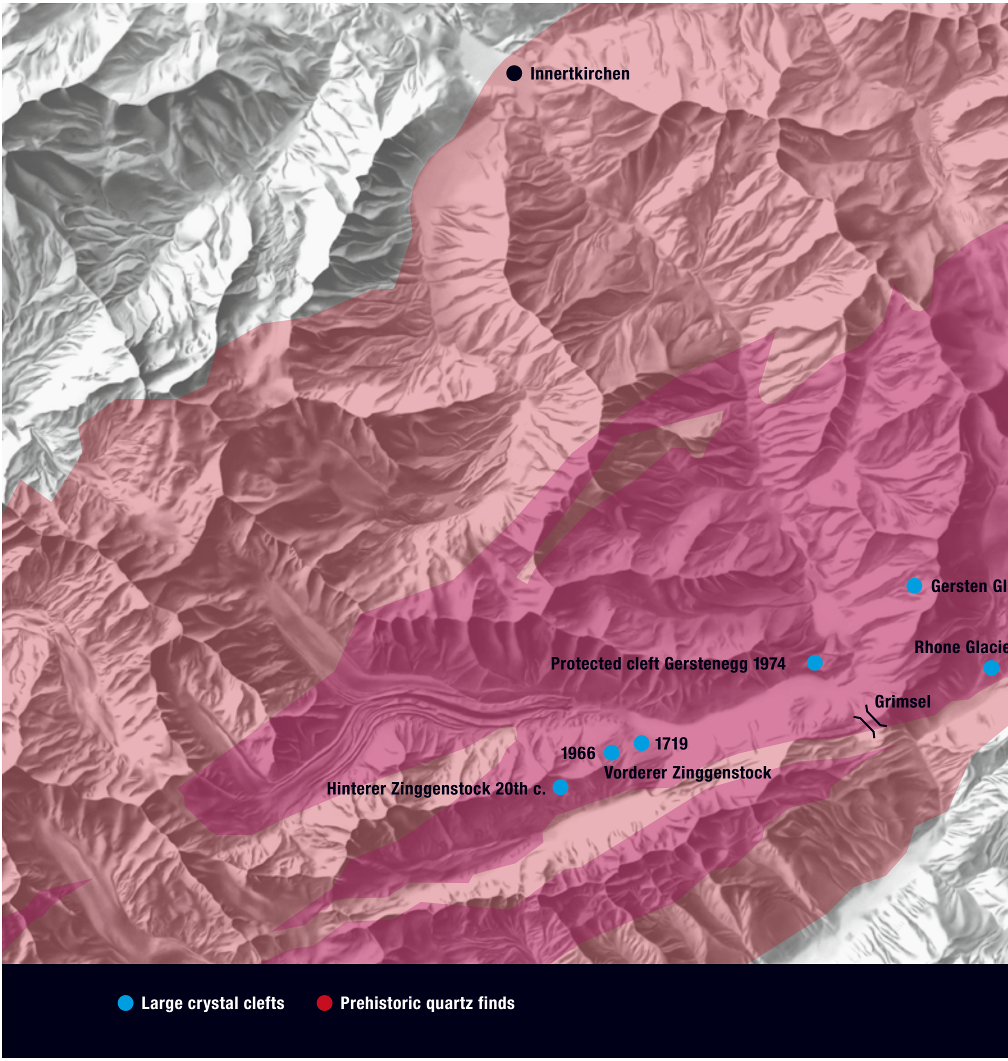
Crystal cavities are dotted along the granite formation of the Aar Massif almost like beads on a string ➤ see the map on p. 16.

While other types of rock were squeezed and moulded like dough during the formation of the Alps, some parts of the granite remained unscathed apart from a few cracks. Inside these fissures, the crystals were able to grow undisturbed ➤ see “How the crystals came into being” p. 20.

Almost none of the crystals found at older, historic sites such as the Sandbalm or Pfaffensprung cavities are still around today: until it was possible to produce high quality glass in large quantities, clear quartz was, almost without exception, sold to crystal grinders in Milan and there turned into *objets d’art.*

Very few quartz crystals found in times gone by remain intact.

Large quartz vase from the 17th century. 43 cm.


Innertkirchen
Gersten Gl
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1719
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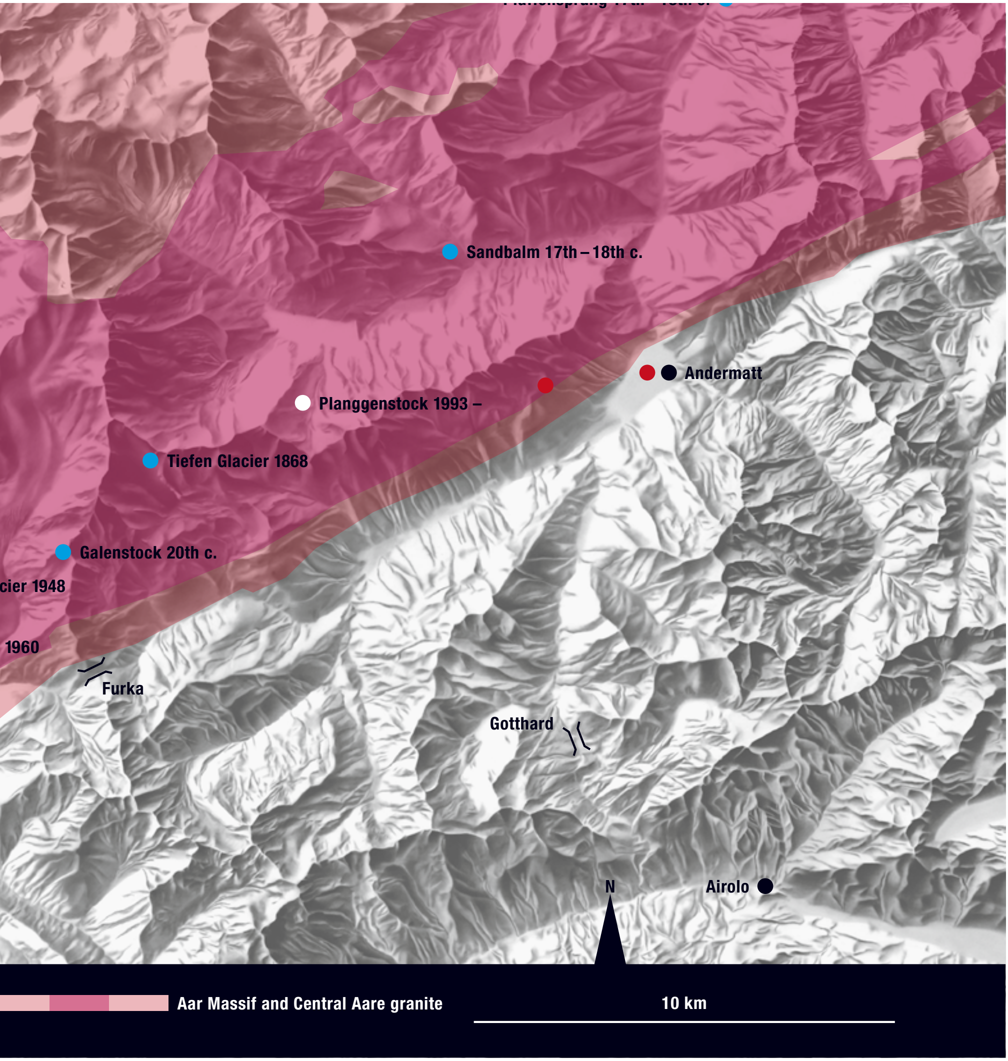
Vorderer Zinggenstock
Hinterer Zinggenstock 20th c.
Large crystal clefts
Prehistoric quartz finds



Sandbalm 17th – 18th c.
Andermatt
Planggenstock 1993 –
Tiefen Glacier 1868
Galenstock 20th c.
cier 1948
1960
Furka
Gotthard
N
Airolo
Aar Massif and Central Aare granite
10 km

ROYAL REGALIA – CRYSTALS FOR KINGS

Altar crosses, receptacles and chandeliers made of Swiss quartz decorated churches and the palaces of the rich and powerful for centuries.

In the course of the Crusades in the 12th and 13th centuries, any number of finely polished quartz vessels made their way from the Orient to Western Europe. Although crystal cutting and polishing was known in Europe at this time, it now underwent a drastic boom.

The first receptacles to be produced from quartz were reliquary caskets – sumptuous containers for the mortal remains or personal items of saints. Soon, however, ostentatious quartz vessels began to be prized at the royal courts of Europe. The large, clear quartz crystals sent from the Swiss Alps found particular favour with the crystal grinders of Milan, for it was they that yielded the most splendid objects.

Eventually, sumptuous crystal receptacles began to go out of fashion. The "cristallari", looking to start a new trend, began to adorn hanging candleholders with beads of polished quartz. The age of the royal chandelier only really began with the Sun King, Louis XIV, in the mid 17th century, however. These dazzling and incredibly heavy

Precious quartz, silver and enamel cutlery from the 15th century.

Sumptuous crystal receptacles adorned banquet tables and were a symbol of immense luxury. 39 cm.

light fittings were less about illumination and more about demonstrating the power and wealth of their owners.

Towards the end of the 18th century it finally became possible to produce good quality, polishable glass in large quantities. Though quartz then lost its significance as a luxury good, it began increasingly to attract the interest of collectors and scientists.

This is the period from which the oldest objects in the Museum's collection stem: quartz crystals from the Zinggenstock peak ➤ see the map on p. 16 and "Major crystal finds in the Swiss Alps", p. 40.

❖ "Royal regalia – crystals for kings", screen presentation in the "Crystal Trivia" section of the exhibition.

HOW THE CRYSTALS CAME INTO BEING

Around 50 million years ago, the African continent, drifting northwards, collided with Europe. This marked the beginning of the formation of the Alps, in the course of which the crystals came into being.

The granite of the Aar Massif in which today's crystal cavities are found was about 15 kilometres underground at the time of the slow collision of the continents. Massive forces wrenched the solid rock apart and cavities, or Alpine clefts as they are known scientifically, appeared – fissures in the rock up to a metre wide.

There in the inner depths of the earth, temperatures were fierce and the pressure was high, like in an enormous pressure cooker. The water that filled the cracks in the basement rock was over 300° C. It dissolved the quartz and other minerals deposited in the granite like sugar, leaching them out of the rock.

Then, around 15 million years ago, this mass of rock began to surface from the deep. The mountain range that would become the Alps rose by a few millimetres every year. As a result, the hot mineral water in the cavities started to cool down, by about 30° C every million years. As the

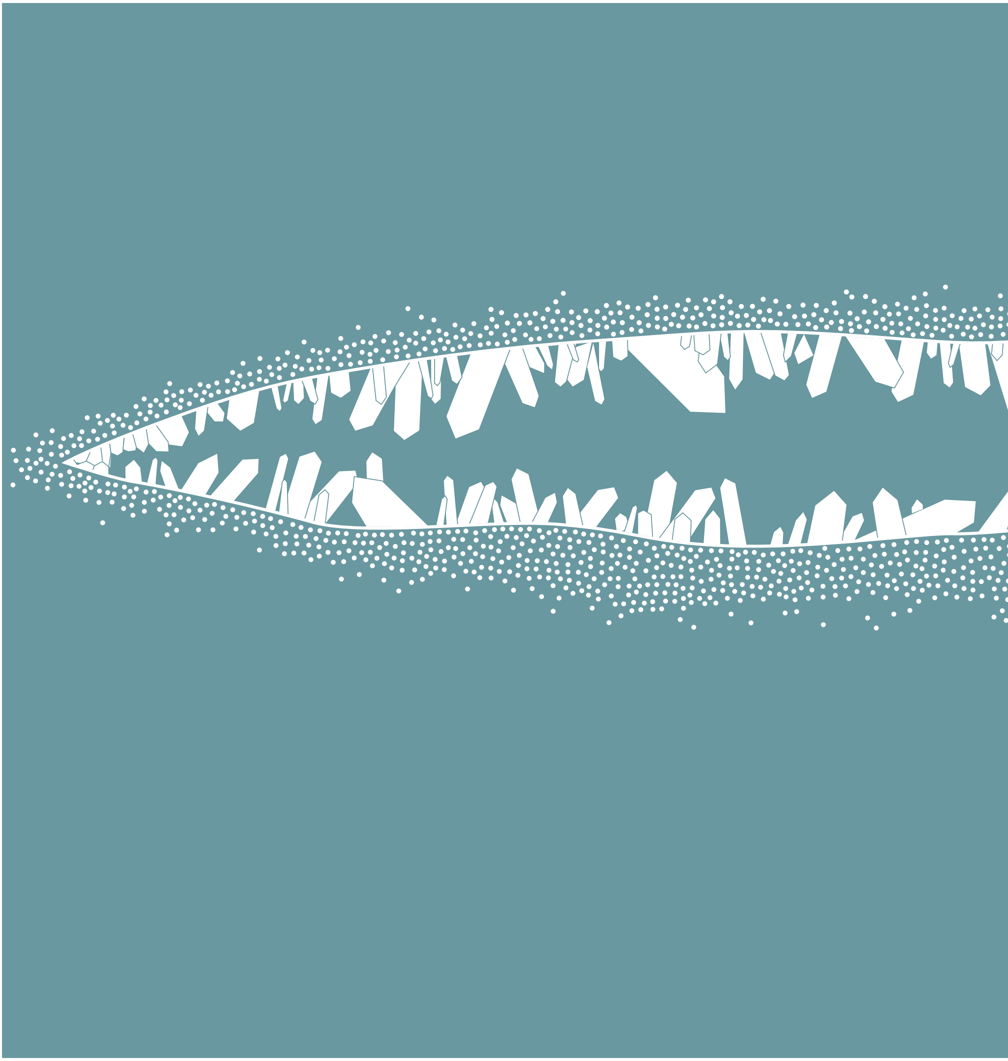
Loved for their colour, the pink fluorites from the Planggenstock are unusually large. Up to 8 cm.

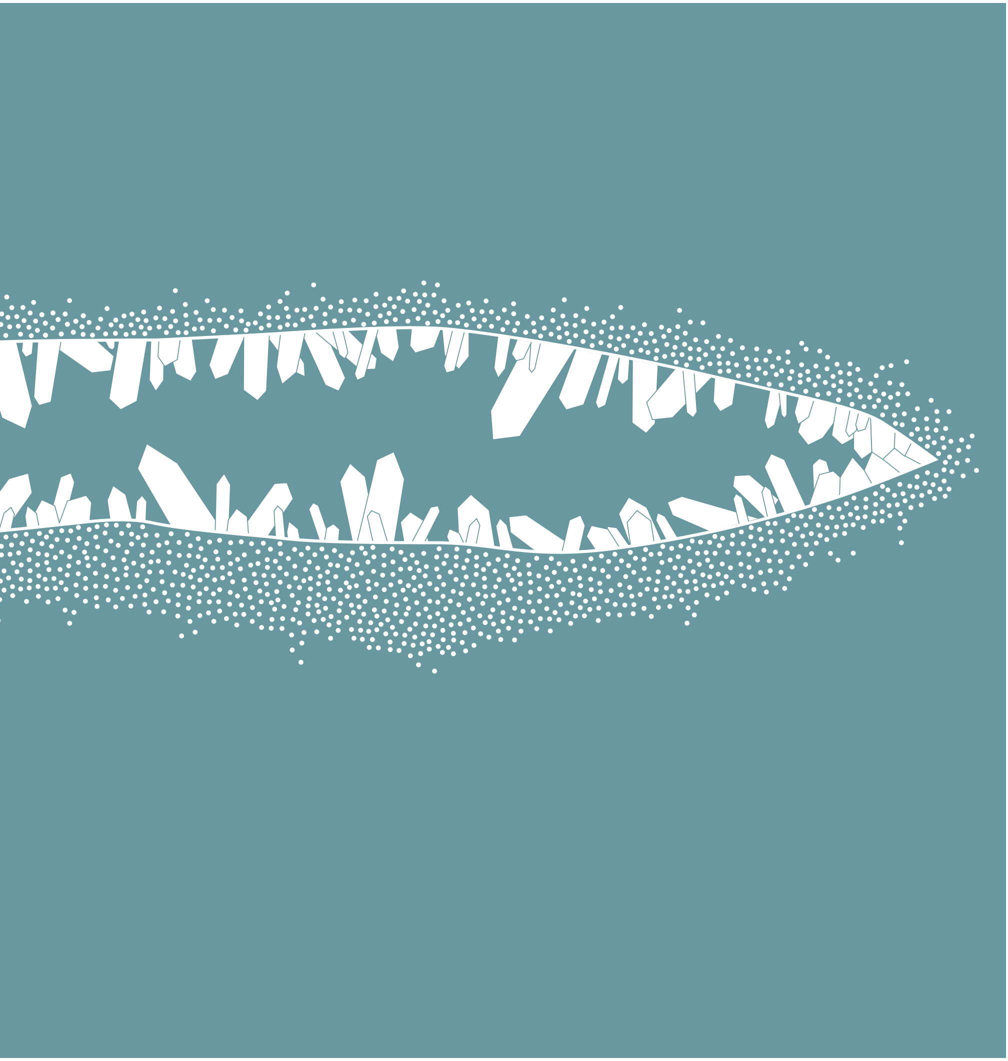
A 106 kg quartz from the Planggenstock cleft. 105 cm.

water cooled, the minerals dissolved in it began to harden on the walls of the fissures and the crystals began to grow – at a rate of a few millimetres per 10,000 years. It took millions of years for the crystals to grow to the size they are today, by which point the dissolved quartz had been used up and the water had cooled down.

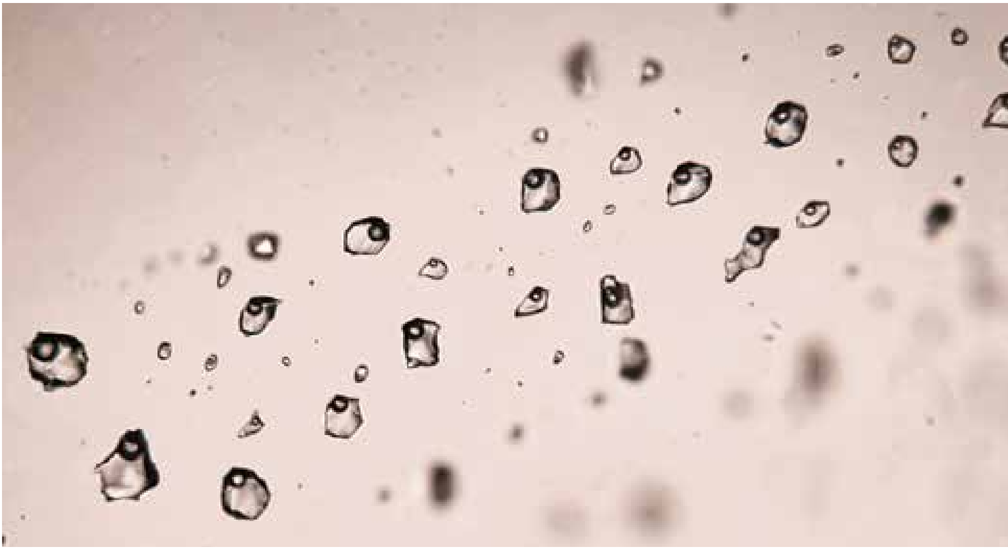
The extremely slow growth of the minerals in Alpine clefts is probably the main reason for their extraordinary size and transparency. With their gleaming surfaces and absolutely regular forms, the crystals are natural masterpieces – perfect gems even before undergoing artificial cutting or polishing.

❖ "How did the crystals get into the mountain?" A colourful short film in the "Crystal Trivia" section of the exhibition.





Cross-section of an Alpine cleft: the crystal cavity is situated inside solid granite but the rock around it is leached and porous. 50 – 500 cm.



QUARTZ CLOSE UP

The treasure chamber contains almost two tonnes of crystals and crystal clusters, all of which are rare in their beauty. However, hardly any of them are absolutely flawless. On close inspection clouding, cracks and discolouration become apparent – all features which have something to tell us about the multi-million year formation history of the minerals.

Lots of crystals have cracks in them – a direct consequence of the mighty earthquakes that were triggered by the collision between Africa and Europe. Some of these cracks closed up again as the crystals grew, filled in by the quartz that was still freely available. All that remains are traces of the damage, sometimes visible as shimmering bubbles inside the crystal. These contain tiny amounts of the water out of which the minerals grew. “Inclusions”, as they are known, are also the reason that some of the crystals appear cloudy.

Cracks which appeared towards the end of the growth phase, however, could only be partially “mended” as the quartz supply was running low. During the various ice ages which followed, the pressure of the ice in the cleft caused yet more cracks.

Quartz always contains minuscule inclusions of gas and water. 175 x magnification.

These inclusions are visible in the crystal as cloudy, opaque patches. 5 cm.

Another striking feature of some of the crystals is their dark colouring. These crystals are known as smoky quartz and their colour is the consequence of exposure to radioactivity. The granite of the cavity in which the crystals grew contains uranium, thorium and potassium, including a radioactive variant of this element. Because the extent to which the crystals came into contact with the granite differed, their colours too differ in intensity.

Some of the crystals have mat, greenish surfaces which are the result of inclusions of tiny grains of chlorite. As the crystals were growing, a layer of chlorite sand built up on the floor of the cleft. The crystals which grew on the floor thus contain chlorite, while those which grew on the ceiling remained as clear as, well, crystal.

This cluster displays "vicinal faces" – triangular structures which occur as the result of specific disturbances in the growth of the crystal. 80 cm.

In the cleft: the radioactivity of the granite surrounding the crystal cavity colours the adjacent quartz a yellowish brown. 75 cm.

This crystal shows clear cracks which were probably caused by an earthquake and then only partially healed. 40 cm.

VARIETIES AND STRUCTURE OF QUARTZ

Around 4,000 different minerals are known to date – a small number compared to the millions of animal and plant species known to exist. However, the same mineral often occurs in a number of different variations, as is the case with quartz. One thing that all minerals have in common is their strictly geometric internal structure.

Quartz is one of the most common minerals available to humans, and among those which exhibit the greatest variety. It is often white or colourless, but can also occur in brown, purple, green, yellow or red. The mineral is found in every size, from grains as fine as dust to 10 metre-long giants.

All these varieties of quartz consist of silicon and oxygen, the two most common chemical elements in the Earth's crust, the outer layer of the Earth. The chemical formula of quartz is SiO_2, silicon dioxide. The different colours are caused by inclusions of other minerals, the integration of trace elements, or exposure to radioactivity, among other things.

The best-known Alpine quartz is the clear kind, sometimes also known as "rock crys-

Red quartz, known as eisenkiesel, gets its colour from inclusions of the iron-rich mineral haematite. Madagascar, 10 cm.

Prase is green quartz, depicted here with inclusions of the mineral hedenbergite. Serifos, Greece, 18 cm.

Fenster quartz has a complex surface framework. Alpine limestone, Bernese Oberland, gifted by Paul v. Känel, 2011, 20 cm.

tal". It was originally thought to be unmeltable ice, which is how it got its name: crystal comes from the Greek word *krystallos*, meaning ice.

As in all crystals, the tiny components, or atoms, which make up quartz are neatly arranged in a regular pattern. It is this strict internal structure that gives the mineral its spectacular appearance – its smooth, shiny surfaces and perfect geometric forms that seem to have been precision-cut.

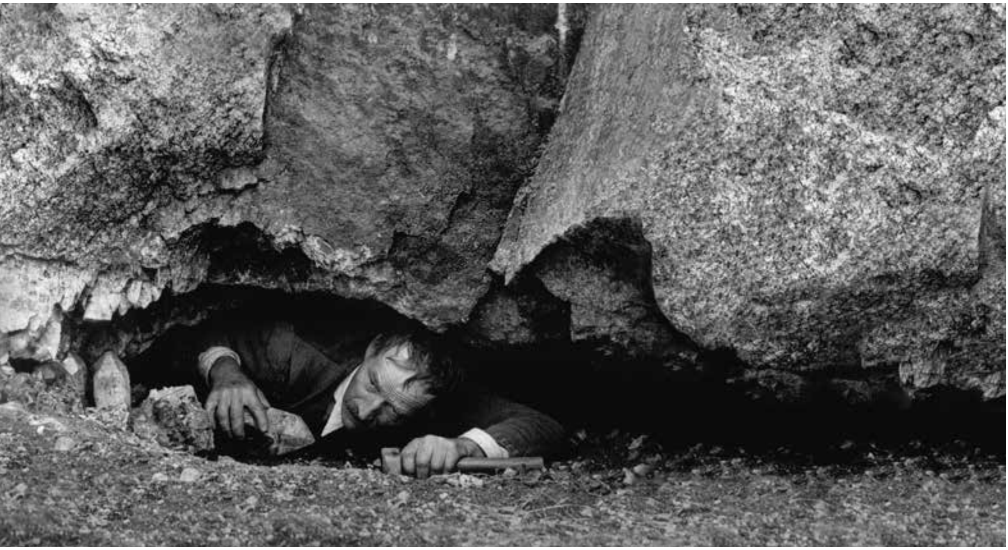
❖ Large atom model of quartz in the "Crystal Trivia" section of the exhibition.

ALPINE CRYSTAL HUNTERS

"Strahl" is an old Swiss German word for rock crystal (clear quartz). People who look for crystals in the Alps are still known as "Strahler" today.

For a long time, hunting for crystals offered a welcome way for mountain farmers to earn a little extra income. Quartz was in great demand among crystal grinders as a raw material to be turned into dazzling objects for the rich and powerful. In the 19th century, scientists, museums and private collectors also began to take an interest in minerals. In the mid-20th century, collecting minerals became a popular pastime and demand was so high that the few crystal hunters there were could no longer satisfy it. Many collectors began to look for crystals themselves, and some crystal hunters turned the hobby into a fulltime job.

This boom soon called for clear rules and regulations. Traditionally, crystal hunters would claim a cleft as their own by leaving a tool in front of the entrance, but this simple sign gradually ceased to suffice. Crystal hunters organised themselves into a series of regional associations under the auspices of a national umbrella organisation known as the Swiss Association of Mineral and Fossil Collectors (SVSMF).



Crystal hunters from the canton of Uri, around 1940.

The SVSMF formulated a Code of Ethics designed to avoid disputes between crystal hunters. Some cantons and districts eventually took this code as the basis for their laws. Hunting for crystals is not governed by uniform national legislation, however. Permits are only required in certain places and are issued by different authorities in different cantons.

If crystal hunters are in possession of all the necessary permits, and pay the required fees, and if the canton does not raise a claim of its own, any find they make belongs to them.

ROCKS OF THE EARTH

The exhibition "Giant Crystals – the Planggenstock Treasure" which opened in May 2011 is part of the "Rocks of the Earth" exhibition, a presentation of a cross-section of the Museum's geological treasures. The two aspects of the collection which feature most prominently are minerals, the crystalline building blocks which make up the Earth, and meteorites, mysterious messengers from outer space. Most of the oldest section of the exhibition, "Earth – planet and habitat" had to make way for the restructuring work that was necessary to house the Planggenstock Treasure.

Divided into the topics "Minerals of Switzerland", "Minerals and humans", "Where do minerals come from?", "Diamonds" and "Meteorites", the exhibition boasts an incredible number of fascinating objects and stories that bring the world of stones to life and illustrate the enormous importance of minerals to humans. Take a little time to discover not just the sparkling stars of the Alps but many other extraordinary things, such as radioactivity made visible, or a meteorite from the moon.

MINERALS OF SWITZERLAND

Minerals and the Alps go hand in hand in Switzerland – finds from the Jura or the Swiss Midland look almost paltry compared to the treasures of the Alps. The Natural History Museum Bern owns one of the largest collections of Alpine minerals in the world, and various standard works on Alpine mineralogy have been based on it.

Abundant crystal cavities such as that on the Planggenstock are not just found in the Aar Massif. Crystal hunters can also try their luck in the Surselva in the Upper Rhine Valley, in the Binn Valley in Valais, or in northern Ticino. The number and type of minerals in a cleft vary according to the kind of rock the cleft is found in. Rock crystal and smoky quartz are the most common, but Alpine crystal cavities contain a whole lot of other minerals as well, some of which were first discovered in the Swiss Alps.

Gold, too, occurs in small quantities in the Alps, in places including Gondo (Valais) and the Disentis region. In some places, gold was mined right up until the Second World War, and mining companies are currently investigating whether it may once again prove profitable in the future. In the meantime, panning for gold in rivers and streams is a popular pastime.

A striking crystal from the Saint-Gotthard Massif: green fluorite with a pink centre, found in 1959 on Piz Blas GR. 8 cm.

In 1998, Switzerland's second largest gold nugget was found in Val Somvix GR. The "Rüüdige Cheib" weighs almost 102 g. 4.4 cm.

One of Switzerland's most beautiful fluorite clusters: pink fluorite on quartz, discovered in 1958 in a power station tunnel near Göschenen UR. 14 cm.

MAJOR CRYSTAL FINDS IN THE SWISS ALPS

The Planggenstock Treasure may be a spectacular find, but it is not the first group of large quartzes to come out of Switzerland. A number of impressive crystals have been discovered over the centuries.

Not many of the early finds can still be admired today as most clear quartz was sold to the crystal grinders of Milan ➤ see “Royal Regalia – Crystals for Kings”, p. 18.

The only remaining testament to the early days of crystal hunting in Switzerland dates from 1719 and was found in a bountiful crystal cavity on the Zinggenstock mountain ➤ see map p. 16. The three large rock crystals were given to the city library as a tax payment in 1721, and later to the Museum. Today they form the oldest objects in the Museum’s collection.

Another major find came to light in 1868 on the Tiefen Glacier. The group of crystal hunters from Guttannen secretly brought a haul of huge, almost black smoky quartzes known as morions into the Bern region. In total, the spoils from this breakneck scheme weighed around 10 tonnes, and the heaviest crystal 133 kg.

The oldest objects in the Museum's collection are three rock crystals found in 1719 on the Vorderer Zinggenstock. 90 cm.

The most significant find of large, clear quartz in the 20th century was made by Casimir Simmen in 1960. 150 cm.

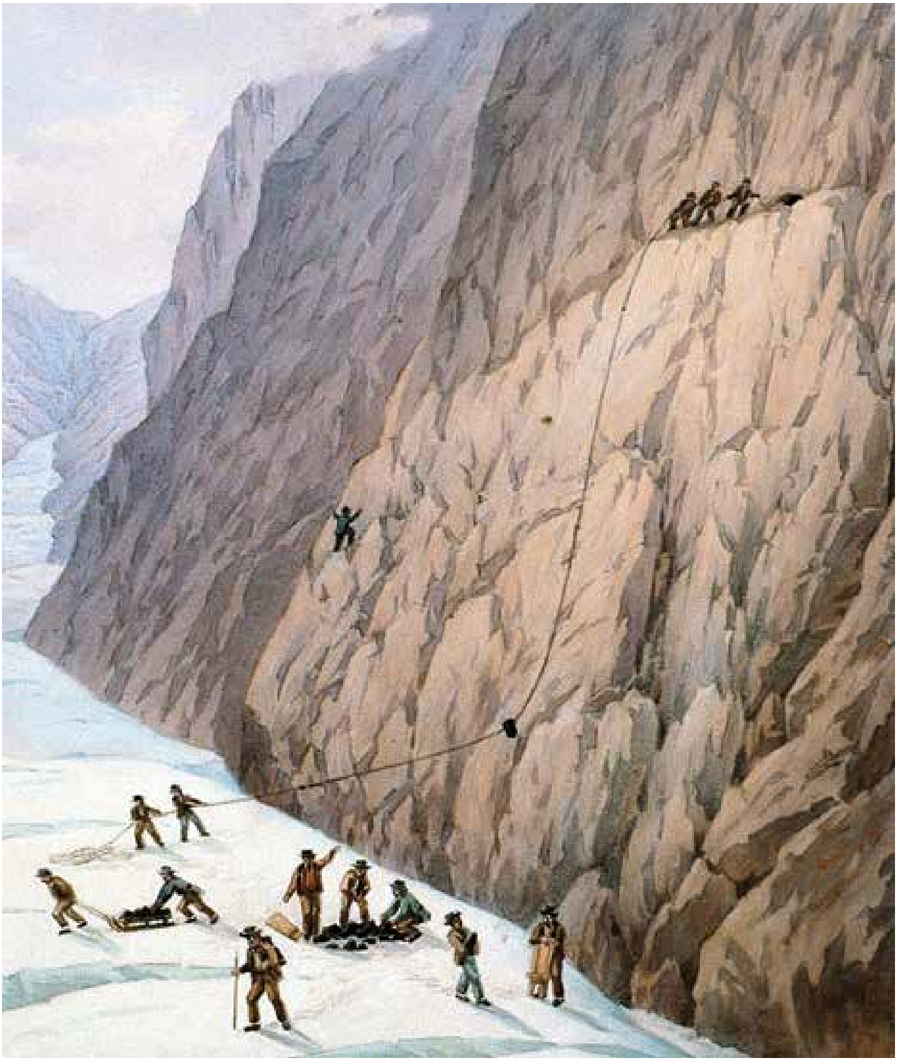
In 1949, more large morions were discovered on the Gersten Glacier. The largest crystal weighed 47.5 kg, the total find 770 kg. In 1960, Casimir Simmen found 200 kg of unusually clear, large rock crystals in a cleft left by the retreating Rhone Glacier. The total weight of the crystals displayed here is 162 kg.

The last major find was in 1974. During the construction of a tunnel for a power station near Gerstenegg, workers chanced upon a large cleft which was immediately placed under a conservation order and has been open to the public since 1987.

The heaviest quartz crystal known to have been found in the Alps did not stay in Switzerland but ended up in the Muséum national d'Histoire naturelle in Paris. Known as the "Quartz Napoléon", the crystal is said to have been found near Fisch in Valais and was given to Napoleon in 1798 by the République de Valais. The quartz weighs a whopping 800 kg, but it does have one flaw – it is dull and milky and lacks the dazzling clarity of rock crystal.

Rock crystals from the Marmotta (marmot) Cleft in the Grimsel region. Crystals in front of the animals' den revealed the existence of the cleft.

Morions from the Tiefen Glacier, discovered in 1868. Their colour is the result of exposure to radiation from granite near the crystal cavity. 120 cm.



A watercolour from the period shows the breakneck recovery of the smoky quartzes from the Tiefen Glacier in 1868.


MINERAL UND MENSCH

MINERALS AND HUMANS

From its outer crust to its innermost depths, the Earth, like all solid celestial bodies, is made up predominantly of naturally occurring crystals known as minerals. Minerals are extremely important to us humans, giving shape and form both to our environment and our bodies. As rock they constitute the ground beneath our feet and inside us they furnish a hard scaffold of bones and teeth.

In addition, minerals are indispensible as raw materials for a huge range of different purposes. Flint, a particularly tough form of quartz, enabled humans to create the first sharp tools. Nowadays, quartz and the silicon extracted from it are an important component of many high-tech devices. Furthermore, minerals are an essential ingredient in metals, colour pigments and numerous chemicals. They form the basis of our material world, from railway tracks to baby powder.

Minerals are also responsible for a lot of scientific insights. Almost every solid since the Big Bang has been made up of minerals, which puts them in a position to deliver valuable information about the origins of the Earth and the solar system.

Most people, however, love minerals as jewellery and precious stones. From quartz crystals to diamonds, minerals have been prized and treasured for millennia.

Rutile forms the basis of innumerable products – from white paint to titanium aeroplanes. Rutile (sagenite), titanium dioxide TiO_2, Tavetsch GR, 2.5 cm.

The main component of rust is called goethite, after Goethe. Lots of minerals are named after distinguished figures. Iron oxide FeOOH.

Apatite, a mineral rich in calcium and phosphorus, makes bones hard and gives teeth their bite. Apatite, Val Casatscha GR, 1.5 cm.

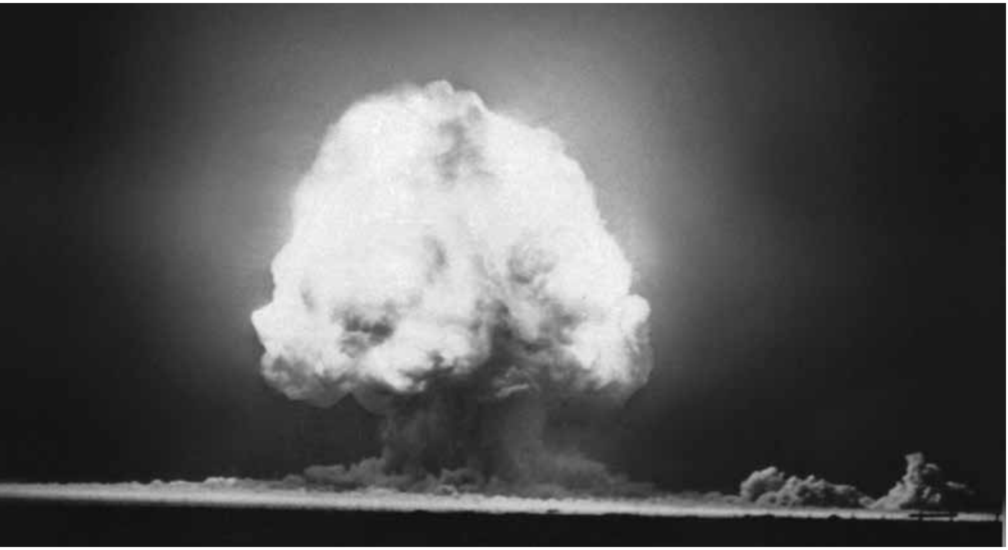
Once a “miracle” fibre, now a banned substance: the fine mineral fibres of asbestos cause serious illnesses. Serpentine asbestos, Piedmont, 5 cm

A MINERAL CHANGES THE WORLD

Minerals are extremely versatile and can be put to any number of different uses, both peaceful and military. Uraninite, for instance, the mineral with the highest uranium content, changed the world forever by providing the uranium necessary to create both atomic bombs and nuclear power stations.

After radioactivity was discovered in 1896, the radium which occurs in traces in uraninite was used to treat cancer. Shortly before the Second World War came the discovery of the unbelievable power set free by the splitting of the uranium atom. The Americans used this knowledge to develop the ultimate weapon – the atomic bomb. In August 1945, two of these bombs were dropped on the Japanese cities of Hiroshima and Nagasaki, killing hundreds of thousands of people. Attempts were also made to find a peaceful use for the incredible energy released by the splitting of the atom, however, and in 1955 the first nuclear power station was commissioned in Russia.

By 2010 around 13% of the electricity produced worldwide came from nuclear power stations, and almost all the uranium necessary to run them was extracted from



The raw material behind nuclear power: uraninite or pitchblende. Black uraninite in calcite, Ore Mountains, CZ, 6 cm.

The first atomic bomb was detonated in 1945 in New Mexico in what was known as the Trinity Test.

uraninite. Nuclear reactors convert the energy released by the splitting of uranium atoms into electrical energy. There is a hitch, however. If the reactor leaks, highly radioactive substances can escape which pollute the environment for a very long time. No truly safe solution has ever been found to the problem of storing radioactive waste, either. The serious reactor accidents at Chernobyl in 1986 and Fukushima in 2011 have reduced people's trust in nuclear power even further, and the future of the technology hangs in the balance.

Radioactivity is not just a side effect of nuclear power but something which also occurs naturally. Many rocks, including Alpine granite, contain uranium, an element which breaks down – via various intermediate products – into lead. During this process, the radioactive noble gas radon is produced, the substance responsible for two thirds of natural radiation in Switzerland.

❖ Radioactivity is made visible in the cloud chamber in the "Minerals and Humans" section of the exhibition.

WHERE DO MINERALS COME FROM?

Minerals occur everywhere on and in the Earth. Among the reasons for their enormous variety are huge differences in the pressure and temperature they are exposed to as they form, from below freezing to body temperature to thousands of degrees Celsius. The raw materials they are made from also vary immensely: minerals are combinations of around 90 different chemical elements.

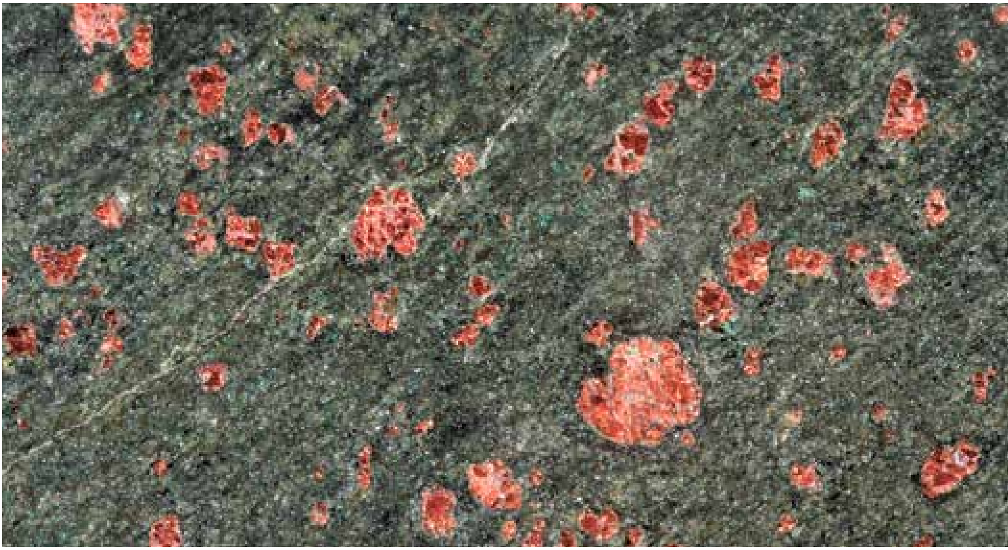
Some minerals are formed when magma, liquid rock, slowly solidifies inside the Earth. Others are created from the magma spewed to the surface by volcanoes. Water, too, plays an important role, dissolving, deep in the earth, chemicals and minerals out of the rock at temperatures of around 300 – 400° C. When the water cools, these substances crystallize – often changing size, shape and composition as they do so. This is how quartz is formed, and explains the existence of some gold deposits.

Many natural crystals are actually produced by living things. From snail shells to backbones, hard material is often needed to protect or support the body. The minerals calcite and aragonite which sea creatures produce to make their shells and exoskeletons have left huge deposits over millions of years, sometimes forming whole mountain ranges.

Springs are involved in the formation of many minerals on the Earth's surface: calcareous spring water has left this bird's nest encased in calcite.

Blue topaz is a coveted gemstone. It forms at around 500° C and requires water with a high fluorine content. Murzinka, Ural Mountains, Russia, 9 cm.

This gold was deposited together with quartz by hot water in a fissure in the rock. Eagle's Nest Mine, California, USA, 8 cm.



FROM THE SURFACE TO THE DEPTHS

The minerals in the bowed display case are arranged according to where they are formed, from the surface of the Earth to deep in its crust or even its mantle, a zone characterised by extreme heat and intense pressure.

On the Earth's surface, minerals form in lakes and oceans and as a result of the weathering of rocks and ores. They also occur in sediments – material transported by wind and water which often builds up to form thick layers on land and in the sea.

Some crystals come about as the result of human intervention, but these are not called minerals: the term is reserved for crystals which grow naturally. Crystals produced artificially, such as the extremely hard abrasive silicon carbide, or industrially produced quartz, are not minerals, though they are identical to natural crystals in every way.

The distinction between natural and artificial is not always clear. There is a grey zone of "crystalline structures" which grow naturally, but only in environments created by humans. Calcite crystals in water pipes are a good example, as are certain types of crystal which only grow in mountain tunnels. There are any number

Rocks from the Earth's mantle are rare. This garnet peridotite comes from a depth of around 100 km. Alpe Arami TI, 10 cm.

Grimselite only occurs in the Sommerloch-Gerstenegg tunnel on the Grimsel Pass. Grimselite, 5 cm. $K_3Na(UO_2)(CO_3)_3 \cdot H_2O$

of manmade niches in which "semi-artificial" minerals are found.

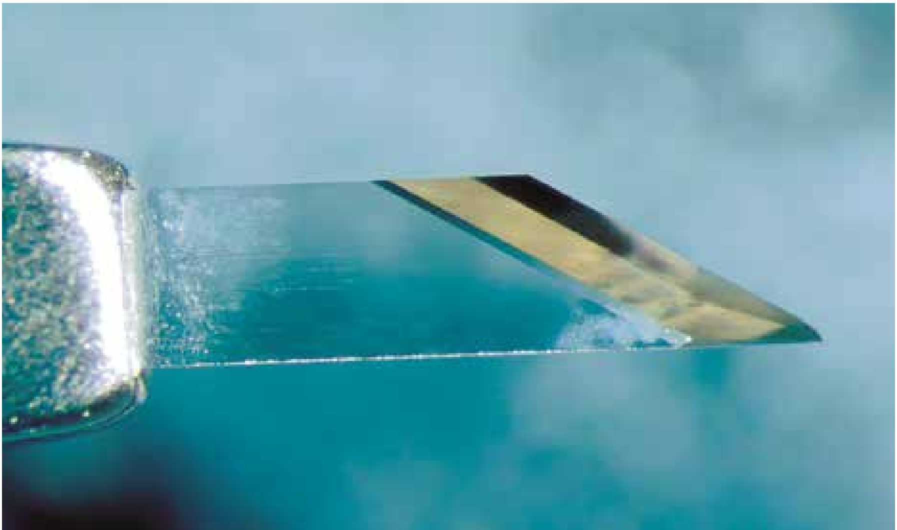
Around four fifths of our planet's minerals lie out of reach in the Earth's mantle, the layer underneath its outer crust. They only reach the surface occasionally as the result of movements of the crust or of volcanic activity. Only minuscule traces of the minerals formed at depths of 400 – 650 km are found on the Earth's surface, and these are hidden in diamonds.

DIAMONDS

The first sharp tools in the history of humankind were made of stone, and one particular stone is still used to make tools today. Diamonds are the hardest mineral in the world and are used in the precision cutting and polishing of numerous materials. For this reason it can be said that the importance of diamonds lies not in their splendour as crown jewels, but in their indispensability to industry, technology and medicine. Most natural diamonds originated at depths of over 160 km, pressures of around 50,000 bar and temperatures of about 1,200 °C.

Meteorites, too, sometimes contain tiny diamonds. These are like natural data storage media, bringing us information not just from the depths of the Earth but from outer space too.

Diamonds are extremely rare. Only around 9 grams of diamond are found per 100 tonnes of rock in South African diamond mines. Most diamonds are mined by large companies using modern methods. In crisis regions, however, workers are often forced to dig for the precious mineral under deadly conditions, and the proceeds from the trade in diamonds are sometimes used by local potentates to finance civil wars. These stones are known as blood diamonds and held in general contempt.



Scalpel blades made of natural diamonds cut with incredible precision and are often used in eye operations. 1 cm.

The unit of weight used for diamonds is the carat (0.2g), from the Arabic *kirat*, or pip. Originally, seeds of the carob tree were used. 0.5 cm.

Messenger from the depths: diamond with inclusion of pyrope garnet, a mineral occurring at a depth of over 160 km. South Africa, ca. 0.1 cm.

Artificial diamonds are used in modern industry and technology. Before their availability, the diamond variety Carbonado was much sought-after. 4 cm.


ERDE-PLANET UND LEBENSRAUM

METEORITES

Every year around 30,000 tonnes of fine dust reach the Earth from outer space. Larger rocks, or meteorites, are much less common, with only a few tonnes per year falling from the sky.

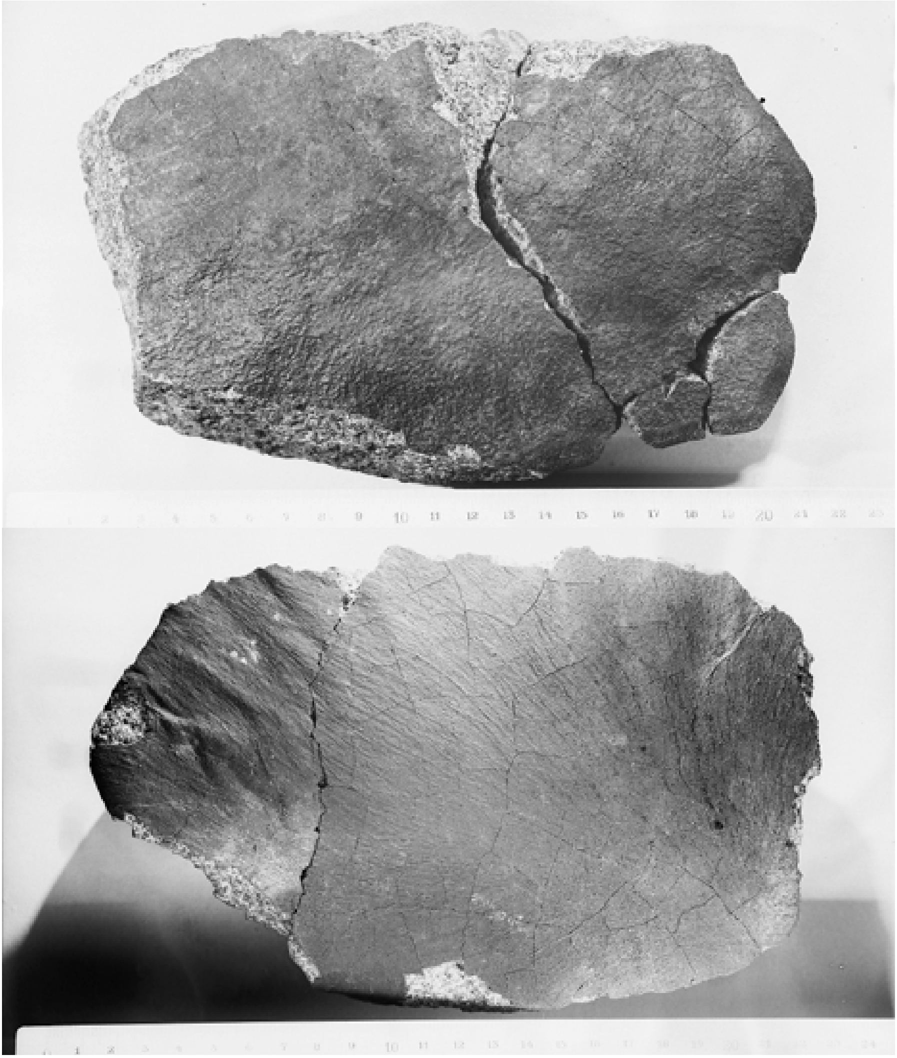
Most meteorites are fragments of asteroids, small celestial bodies which have hardly changed in the approximately 4.5 billion years since the solar system originated. As a result, meteorites provide valuable information about the early history of the solar system and are useful objects of research.

Scientists from the Natural History Museum Bern and the University of Bern have been searching the desert in Oman for meteorites since 2001 – the stones are best visible against light-coloured backgrounds such as limestone. By 2012 around 760 different meteorites had been collected, including some particularly interesting rocks from Mars and the moon.

Meteorites from Switzerland:
Rafrüti* (BE), found 1886, iron, 18.2 kg
Chervettaz (VD), fell 1901, stone, 750 g
Menziswyl (FR), fell 1903, stone, 28.9 g
Ulmiz* (FR), fell 25.12.1926, stone, 76.5 g
Utzenstorf* (BE), fell 1928, stone, 3.422 kg
Twannberg* (BE), found 1984, iron, ca. 23 kg
Langwies* (GR), found 1985, stone, 16.5 g
Ste-Croix (VD), found 1988, iron, 4.8 g.

* on display in the Museum

An “old cannonball” found in 1886 was recognised as an iron meteorite in 1900 and named “Rafrüti” after the place of discovery. 20 cm.



On August 16, 1928 this stony meteorite (a chondrite) fell in the heart of the town of Utzenstorf near Berne. 21 cm, 3.4 kg.

The lower image shows *flow lines*. These are frozen traces of the air jet passing over the meteorite's friction melted surface.

In 2000, Marc Jost found a fragment of the "Twannberg" iron meteorite in an attic in Twann. The main mass was discovered in 1984. 11.5 cm.

During the fall event, „Twannberg" burst into numerous fragments. Up to August 2016, about 600 fragments were found in the *strewn field*. 3.5 cm.

Together with local geologists, the Natural History Museum is investigating factors including the distribution and frequency of meteorites in Oman.

A rare find: *Sayh al Uhaymir 169*. This 3.9 billion-year-old moon rock landed in the Omani desert around 12,000 years ago. 7 cm.

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Saturday, Sunday	10 a.m. – 5 p.m.

CLOSED
1st of January, Good Friday
Easter Sunday, Whit Sunday, 1st of August
Zibelemärit (fourth Monday in November)
24 December, 25 December, 31 December

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