A Mineralogist Abroad

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How the traveler willing to leave the beaten track can visit many fascinating mines and quarries, and build up his own collection of semiprecious stones and minerals

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ONE goes to Europe to see art museums, to study architecture, to hear music, or just to get away from it all; but, unless one is peculiar that way, one seldom goes to "do" Europe mineralogically. However, for those who fall in the latter group, there is a great attraction in a trip through Central Europe, especially Germany. It is there that mineralogy got its start as an independent science, and there that many of the world famous mineral localities are, or were.

The explanation of the rarity of mineralogical visits lies in the last word, for today many of the old mines of Schneeberg and Johanngeorgenstadt, famous in their own right for their productivity and made better known by their literary and historical associations, are hardly to be found. Of many, even the dump has disappeared; hauled away to be used in roads or so overgrown that it looks like little more than a natural mound.

Some mines are still in operation, however, and new ventures have been started at old localities. In addition, fine collections may be inspected, unparalleled specimens seen, and some of the older mineralogists may be met and talked with. There is so surprisingly much to be seen and found on such a trip that it well repays the effort.

Transportation difficulties

Traveling through Germany in a leisurely fashion and collecting minerals at more or less remote localities involves certain transportation difficulties. The happiest solution to the problem seemed to be the bicycle, a universally used vehicle in Germany. The practicality of the bicycle was proved at the first locality visited, the strontianite occurrence at Drensteinfurt near Münster in Westphalia, for the owners of the mine simply mounted upon their bicycles and all rode companionably out to the mines.

Old hunting grounds

These were formerly very active, but few are now in operation. One of the most famous, the Grube Mathilda, is marked only by a dump today, the Anna Mine, next in line along the same vein, closed down this summer to give way to the Eleonor Mine, still farther along the vein. The vein continues for a long distance across the country, cutting across the nearly horizontal sedimentary formations and widening out at intervals into lens-like pockets, on which the different mines are situated. It was discovered and traced by borings, no outcrops showing on the flat topography of the region.

Each owner has named the mine for his wife; and as the mines outlasted the wives and the owners, no complications over names have so far ensued. Good crystals of strontianite are still to be found, small and colorless or larger and white, attached to matrices of calcite or fibrous strontianite. The present demand for strontium is slight and much of the production is probably used in the manufacture of fire-

works for the castle illuminations at Heidelberg, Wurzburg, and along the Rhine. It was formerly used in greater quantities in the manufacture of sugar, but other processes have largely superseded the strontium hydroxide separation method.

The route south of Münster, through the Ruhr valley, leads to Cologne, with its magnificent cathedral. The cathedral has mineralogical as well as æsthetic appeal, for Krantz, the famous mineral dealer in Bonn, admits that his source of the well-known Drachenfels sanidine porphyry is not that castle-crowned peak, but the Cologne cathedral. Its periodic partial renovations release somewhat weathered blocks which are more easily broken to reveal the crystals in the finer matrix. The original source, near Bonn, is a popular climb for visitors to that city. Near the summit, along the main path, vertical cliffs mark an old quarry face, at the foot of which loose blocks are abundant and good specimens easily collected, though not without the attentions of a gathering of curious people and donkeys. Crystals showing several habits and different types of twinning may be found. As the tabular crys-

MINERALOGICAL HIGH SPOTS

The region visited by Doctor Pough, showing the most famous mineral localities of Germany and Austria. A serpentine trip of 2200 miles made on a bicycle

tals have a tendency toward orientation in parallel planes, it is necessary to find the proper plane and break the block to develop maximum surfaces in this plane.

Bonn itself has a fine mineralogical institute and its former head, Prof. R. Brauns, though retired, is still active and is probably the best known of living German mineralogists. The collections contain many specimens of minerals from the Eifel, a volcanic region lying to the west of the famous scenic stretch of the Rhine.

Beautiful conical peaks and crater lakes with frequent lava flows are scattered over the landscape, showing by their perfection of form that they have not long been extinct. Quarries are numerous, for the lava is made to serve many purposes. Chief among them is the manufacture of road blocks, so popular as a paving material in Germany. Skillful workers chip curbings and millstones out of the material, without the aid of any machines. The columnar basalt prevailing in several quarries is very simply put to use without even the necessity of shaping the blocks. They are whitewashed and erected along the roads to serve as guards and markers. Piles of these columns, looking for all the world like cordwood, may be seen along the Rhine, near Remagen.

A famous mineral region

The region is famous mineralogically, partly for the crystals of such minerals as zircon, apatite, and hauynite found during the quarrying operations, and still more for the rarer minerals occurring in the sanidinite blocks that were thrown out of the volcanic vents during eruptions. Collecting over this terrain is fascinating, with always the chance of discovering a good specimen. Fresh blocks are uncovered by every storm and every plowing so the field is perpetually rejuvenated, and actively working quarries are always productive collecting sites. Fall, after the potato harvest, is the best time for search, offering the largest number of freshly exposed blocks with peaceful working conditions. At other times the farmers are less enthusiastic about people strolling through their fields.

A little south of the Eifel lies Idar, the home of the German gem industry, where all phases of the trade may be seen and wonderful stores of raw material examined. Still farther south is Heidelberg, the seat of the oldest German university, on the edge of the Odenwald, where the Neckar enters the Rhine graben. Heidelberg is famous in the history of geology and mineralogy, for Rosenbusch and Goldschmidt, two of the masters of the science, worked here and many of the best known American geologists studied here under their guidance. The famous Seligman collection of minerals, one of the finest private collections in Europe, is now in Heidelberg, the property of Gehr. Bosch, of the German Dye Trust. The Victor Goldschmidt Institut für Kristallforschung, carrying on the work of its former head, and the Rosenbusch petrographic collection are also in Heidelberg. *Homo heidelbergensis,* another old resident, is still to be seen, investigations into his ancestry having revealed no reason for his banishment from the place of honor in the university.

Fluorite mines

Though formerly the site of much mining, southwestern Germany produces little of interest today, and one must go eastward nearly to the Czechoslovakian border before mineralogical interest is again aroused. The limonitic iron ore mines near Amberg occasionally yield interesting phosphate minerals. Far overshadowing these in interest, however, are the famous fluorite mines of the Wölsenberg.

Wölsendorf, the nearest village, will not be found on any but the most detailed of maps, for it contains but a few houses, and no road, just a winding path, leads to it. The approach along a road from Schwandorf leads across a bridge, where a sign marked Wölsendorf indicates a trail, but the path soon divides into several forks each leading to a different cluster of houses off against the hills. One must be psychic to select the right group from this lot, but eventually, by making enough inquiries, it can be found. The several mines, of which two are in operation, lie behind the town at the edge of the hill. With luck interesting specimens can be collected, showing crystals of fluorite or nice banding reminiscent of the famous English "blue-john." The fluorite is used for the manufacture of acid and in the aluminum and steel industries.

The most interesting minerals of the deposit (and they are only to be found at the *Johan-*

nisschacht) are the associated uranium minerals occurring in masses of the dark fluorite, which emit a strong odor upon fracture. This type of fluorite is known by the appropriate name of *"Stinkspath"*; the smell is said to be that of free fluorine and resembles an exploded firecracker more nearly than anything else in common experience.

The rare uranium minerals are found in cavities in this material, and the beautiful yellow needles of uranotile are well known to collectors. Somewhat rarer are the square platy crystals of uranocircite, of a yellow-green color varying according to the light source. An intense fluorescence is responsible for the green tones and is very noticeable in ordinary sunlight. Many of the Belgian Congo uranium minerals have been found in small quantities at this deposit; and pitchblende, the original uranium mineral, may occasionally be found. Quartz druses, earlier than the secondary uranium minerals and brilliant red in color, with yellow barite crystals are common.

Unique phosphate pegmatite dikes

Not far north are the unique phosphate pegmatite dikes of Pleystein and Hagendorf. At Pleystein is the Kreuzberg, an isolated abrupt peak in the middle of the town, about two hundred feet high and not more than a quarter of a mile across. The nearly vertical walls are composed of white quartz, and at their top is a monastery, giving the hill its name. The quartz is a pegmatite outcrop and for a time was actively quarried for road material. During this activity the rare minerals kreuzbergite, phosphosiderite, strengite, kraurite, and so on, were found, but as the work endangered the buildings above, operations were halted and the entire hill is under *Naturschutz*. A fine little collection of the minerals of the vicinity, made up by a resident of Pleystein, may be seen in a small museum maintained by the town.

Hagendorf is near by and is the most famous of the pegmatite regions. Here there are two mines, producing feldspar, but only one was in operation during the summer, and that, mineralogically is the less interesting. Apatite and other phosphates are sometimes found in this dike, but the knots of mica in which the cavities containing the beautiful crystals of phosphophyllite, vivianite, wentzelite, fairfieldite and other minerals are found, are restricted to the border zones of the other pegmatite. After the manager is convinced that the visitor is not a Czech who wishes to spy, there is no trouble about inspecting the plant or collecting on the dump.

Not far north, on the borders of the Erzgebirge, the greatest mining center in Germany, is another fluorite deposit of a unique character and of interest for the fluorite itself. This is at Schönbrunn, by Oelsnitz and not far from Plauen. The deposit consists of two nearly vertical, banded veins showing successive layers of fluorite in crusts of octahedral crystals, alternating with bands of feldspar and quartz. At the center is a later fluorite in larger masses in cubic crystals. Late hydrothermal action has altered and decomposed the feldspar, so that it is not difficult to secure good specimens of the octahedral crystals by splitting the specimen at the contact of the fluorite with a later layer of feldspar. Sometimes deep purple octahedrons are found perched upon the apices of larger green octahedrons; curved octahedrons, nearly spherical in form, and dodecahedrons are known. Crystals of this earliest generation never occur in vugs, the few vugs that are found appear to have been later in their formation and to have been largely filled by a late generation of secondary fluorite in small cubic crystals. Associated with this late phase are sulphide minerals and beautiful iridescent crystals of goethite.

Topaz crystals

From here it is not far to Schneckenstein, one of the most famous of the old localities. Schneckenstein means "snail-stone" and refers to the original shape of a mass of rock projecting above the ridge upon which it stands as an erosional remnant. Schneckenstein was described and pictured in one of the oldest mineralogical works and looks today much as it did then. For a number of years the rock was actively quarried for the topaz found in it. Numerous stones cut from this topaz may be seen among the Saxon crown jewels in the Grüne Gewölbe, in Dresden.

The remnants of the old workings and a large dump may still be seen with topaz crys-

tals everywhere abundant. Signs proclaim it under *Naturschutz* and prohibit all collecting, as they prohibit everything else in Germany, but for once their message is not heeded, and nearly always someone is sitting on the dump and pounding away at the fragments, seeking topaz for collections or for cutting purposes. The present abundance of topaz, despite several centuries of such collecting, proves that it was not rare here, although good cuttable crystals are not common. Finding good specimens, as is often the case, is merely a matter of hard work and a little luck. Topaz is by no means restricted to this rock mass, it is to be found in a narrow zone several miles long which has been subjected to a topazing alteration, and the result seems to have depended upon the nature. A breccia, with many vugs filled partly or completely by crystals of quartz, topaz, columbite, wavellite, and other minerals has been formed at Schneckenstein. A little to the north of the Schneckenstein is an outcrop of a porphyry, in which the feldspar has been altered to topaz and the ground mass to a sugary mass of quartz.

Old specimens at Schneeberg

Schneeberg, lying in the heart of the Erzgebirge, was once the source of the most beautifully crystallized specimens of some of the secondary cobalt minerals and other rare minerals. Today there is but little mining there, mostly of bismuth for pharmaceutical preparations, but one may visit the offices of the company, and after a little persuasion, view the old specimens. Incomparable crystals of erythrite, roselite, sphaerocobaltite, troegerite, walpurgite, zeunerite, and so on in numerous examples may be seen. The best specimens were found between 1870 and 1900; since then little worthwhile has appeared. The employees still wear the old garb indicative of their position as white collar mine workers; a short black jacket with much fringe and some gold decorations, with buttons marked by the crossed hammers, the emblem of mining throughout Germany.

Johanngeorgenstadt, a few miles away, with its mines now under the same direction, is another famous old mining town, with but one mine, the Wildman, still in operation. On the plain a little above and behind the town, is the "*Pferdegöpel*" a mine more than two hundred years old, which was running until twenty-five years ago. The power was supplied by a team of horses which walked around a circular track within a conical building, turning a drum which raised or lowered the skips in an inclined shaft 67 *Lachten* deep, a *Lacht* being about six feet. The buildings are said to be the only ones of the type preserved in Germany today. Johanngeorgenstadt is now the center of glove manufacture and most foreign visitors today are the glove buyers. A tablet in the hotel commemorates Goethe's visit to the mines, with a quotation from a letter written there describing his awe and wonder at the subterranean world.

Silver "thalers"

St. Joachimsthal, or Jáchymov as it is now called, is just over the border in Czechoslovakia and is best known as a bath resort purporting to cure nearly anything with its potent radium waters. Radium is actually mined in the town in the form of pitchblende or uraninite, and this is the source of all the radium sold by the Czechoslovakian government. The earliest mining operations were for silver, and during the fifteenth and sixteenth centuries more than 1,200 men were employed, working the rich proustite, pyrargyrite, and native silver deposits. Silver was so abundant that a mint was established in 1518, and coins known by an abbreviation of the name simply as "Thalers" were made. Because of the purity of the silver they were in great demand, and the name widely known. After going through several transformations it has emerged to give us our name for our unit of coin, dollar, the word having been derived from the old name for these coins.

As the mines deepened, the silver began to diminish and they were operated more for their bismuth, cobalt, and nickel ores. Uraninite was known but thrown away until 1852, when it was discovered that good pigments could be made from it. Ever since, this has been primarily a uranium mine. The secondary uranium minerals found in recent years in the mine are the result of reactions between the pitchblende and the products of oxidation of marcasite with which it is sometimes in contact. As the oxidation can only take place

after exposure to the air through the mining operations, uraninite is the only uranium mineral occurring altogether naturally in the mine.

Above Jáchymov, extending to the border of Germany, is a high, bare, rolling mountain region which is a popular winter resort, and ski-school after ski-school dot the landscape. It is a barren, bleak land, giving an impression of being much higher than it is, and must be wonderful skiing country.

From there the famous tin and tungsten mines of Ehrenfriedersdorf are not far, but the purple apatite which abounds in many collections comes, not from the mines, but from a comparatively small granite quarry on a hill known as the Greifenstein, above the town. On the summit are a series of granite needles, forming prominent pinnacles which serve as a background for a *Festspiel*. The granite quarry is in the woods, not far from the summit, and the stone is quarried for roads and building purposes.

Luck and patience

A narrow vein, not over four inches wide in most places, cuts through the granite in one corner of the quarry, and from this single vein all the apatite specimens have come. It appears to be richest in apatite where the vein is thinnest and the quartz at a minimum, with crystals of both minerals attached to granitic matrix. As the vein widens and the quartz increases, the apatite disappears, fluorite or torbernite in rare crystals occurring in its stead. Without luck, nothing will be found, as the workers collect the good specimens to sell as soon as they are revealed, but by digging around in the dirt which has been washed down at the side of the quarry where the vein disappears into the granite, it is possible to find quite nice specimens.

Across the road in the woods adjoining this quarry, is a small prospect pit, in which was uncovered a quartz vein with embedded colorless to pale blue crystals, about half an inch long, of brilliant, well-terminated topaz. The most difficult part is locating the pit; once found, specimens are easily collected.

Mecca, for the mineralogist, is Freiberg in Saxony, for it was here that Abraham Gottlob Werner, credited with being the founder of the science of mineralogy, taught, as a professor in the world-famed mining academy. The *Bergakademie* has a fine new building now, but the mines of Freiberg are a thing of the past, and except for the historical interest of the town and collections on display, there is little to be seen. The collections are well worth a visit, however, for the specimens of crystallized Freiberg ore minerals are unequalled elsewhere. Freiberg still lives in its past and one sees many relics of the heyday of its mines. The crossed hammer insignia are everywhere, figurines of miners in their traditional uniforms, with their leather knee pads and leather aprons worn behind instead of before, are to be seen in many shop windows. A search may even reveal miners' *Batten*, axe-like implements formerly used as weapons or tools, old miners' tallow lamps, or even an ancient copy of *Agricola*.

To the east of Freiberg lies Dresden, one of the most fascinating cities in Germany and the capital of Saxony. In one of the former palaces, the Zwinger, is a small collection of minerals. The Grüne Gewölbe contains the crown jewels, including the famous Dresden green diamond, and a collection of worked objects; precious stones, carved crystal, amber and ivory. An interesting pair of figurines in bronze portrays two negro boys bearing rich emerald specimens from the mines of Columbia, but to which, alas, the best crystals have been attached by man and not by nature.

Through Czechoslovakia

South of Dresden the route lies through the crest of the Erzgebirge, past the former tin mines of Zinnwald, threads between the volcanic peaks of northern Czechoslovakia, source of beautiful zeolite specimens in the collection of the American Museum, and out on to a plain which extends all the way to Prague. In the immediate vicinity of Prague there is little of mineralogical interest, but the museum has a fine collection, well displayed in stepped cases. The Czechoslovakian university has a well-equipped mineralogical institute with Prof. Slavík at its head; there is a German university as well but it seems to be less prosperous.

A big jump from here takes us into the Tyrol; across glacial outwash plains, up terraced valleys, into the very heart of the moun-

tains. The region known as the Salzkammergut is scenically superb and receives its name from the many salt deposits worked in the area. These salt beds are not horizontal, as are those of northern Germany, but are highly folded and contorted by the forces responsible for the mountain structures.

Unsurpassed scenery

The most interesting portion of the Tyrol, however, is the mountains known as the Hohe Tauern, lying to the south and west of Salzburg. The range is composed of two peaks, the Gross Glockner, up which an automobile road has just been built, and the Gross Venediger. They are large mountains, covered by glaciers and rising over 3,500 meters. Four valleys, running side by side on the northern slope of the Gross Venediger, have produced most of the minerals for which the Tyrol is famous. They are: the Hollersbachtal, the Habachtal, the Untersulzbachtal, and the Obersulzbachtal. Most collections contain specimens recognizable to most collectors on sight as epidote crystals from the Knappenwand of the Untersulzbachtal, a locality which has long since ceased to yield specimens, but which will undoubtedly remain as the most beautiful of all epidote occurrences. The Habachtal is nearly as famous for its emerald mine. It is a wild and rugged region, visited only by climbers. A road of a sort extends halfway up the valley to several climbers' inns; beyond, the floor soon rises above timber line and becomes very rocky. At the end the Habach glacier perches above a cirque and its melt-water flows in a white cascade over the lip, down to the floor a thousand feet below. As a collecting ground for minerals it is scenically unsurpassed, with the white summit of the Gross Venediger looming in the distance.

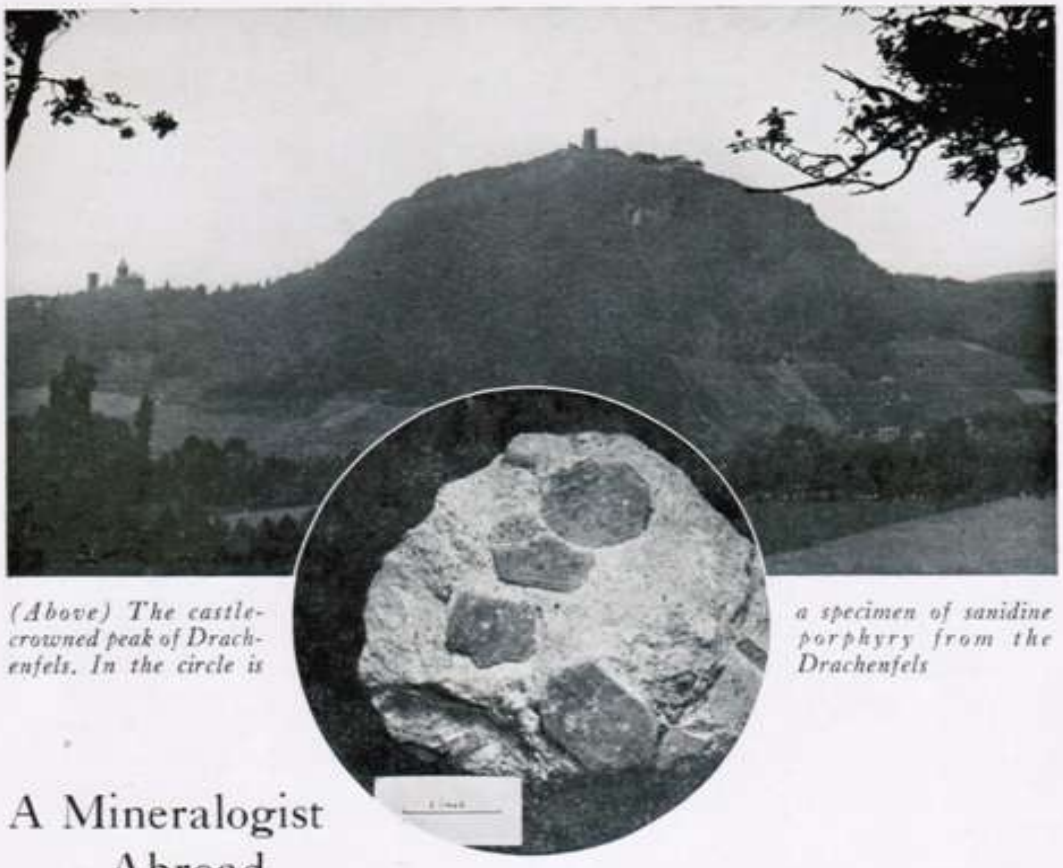
The region has been carefully studied and its geology is well known. A progressive metamorphism toward the granite core has been noted and the minerals to be expected from each point along the ridges on either side can be predicted. The old emerald mine lies near the uppermost of the inns but about three thousand feet above it, just below the crest of the ridge. The workings may still be seen and bits of the mica schist in which the crystals occur can be collected. As gems the emeralds were never of very high quality but this sort of an occurrence of emeralds in metamorphic rocks is unique.

Less well known are the specimens of emerald in a serpentine or talc schist, apparently derived from an alteration of the original mica schist with the emerald surviving, relatively unaffected. There are three dumps, two of which are now pretty thoroughly picked over, while the third, usually covered by a snow bank, is seldom accessible. The mine now belongs to an English company, but probably never will be reopened.

The other specimens for which the Habachtal is famous are those of adularia, quartz, and sphene, which may be found along the entire inner third of the valley. Naturally, after generations of collectors, good specimens are not easy to find, but the occurrence may be seen and specimens showing the associations collected without leaving the main trail up the valley. The country rock is a mica schist, through which quartz veins cut at all angles, widening out or narrowing down with great irregularity. Here and there vugs occur, and in these vugs adularia, calcite and quartz crystals are common, with occasional sphene in brilliant golden yellow transparent crystals.

The higher slopes still abound with good specimens; and the less energetic collector may, with some hope of success, search over the talus on the floor below, for it is being continually renewed by bowlders showering down from the cliffs above. But for the "Mohammeds" who insist upon going to the mountains, it would be possible to wait for the mountains to come to Mohammed. However, one does not begrudge the effort, for the possibility of collecting superb specimens, coupled with the magnificent scenery, make it truly a collector's paradise.

The rewards waiting for the traveler who makes such a journey and visits these places are manifold. The many mines that are still in operation, the collections to be seen, the inspiring men to meet, all serve to make such a trip memorable and one worth any inconvenience and difficulty it may involve. The mineralogist sees not only all that the tourist sees, but finds things of intense interest where the ordinary traveler sees nothing, and perceives a deeper significance where the tourist sees only the superficially interesting aspects.



(Above) The castle-crowned peak of Drachenfels. In the circle is a specimen of sanidine porphyry from the Drachenfels

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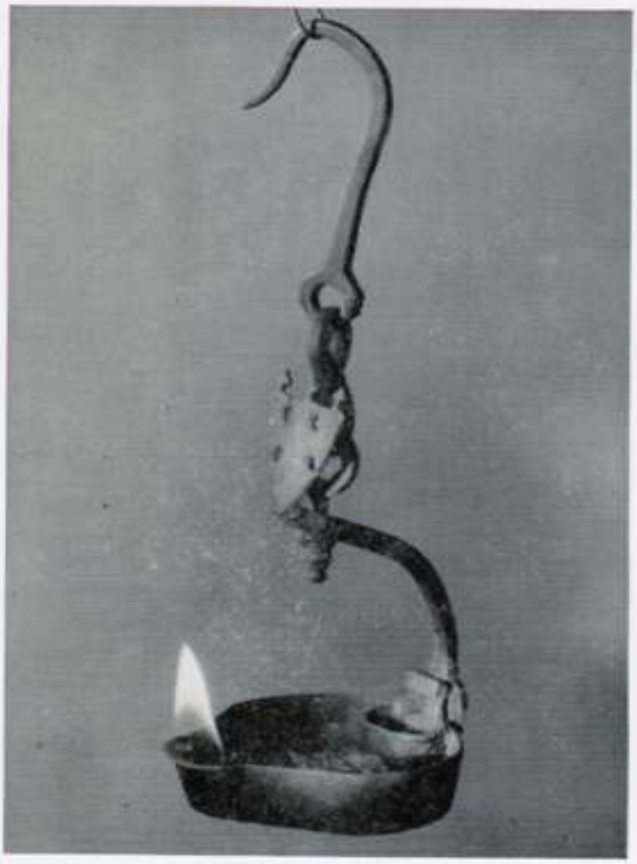
(Below) Volcanic peaks in the Eifel. Bell lies in the valley between two flows of lava, with typical low conical peaks in the background

(Above) The Palisades of the Hudson in miniature,—a basalt quarry on the Rhine. (Circle) Future road guards piled for shipment

(Below) The Pferdegöpel at Johanngeorgenstadt. The last survivor of horse-powered mine shafts, over 200 years old

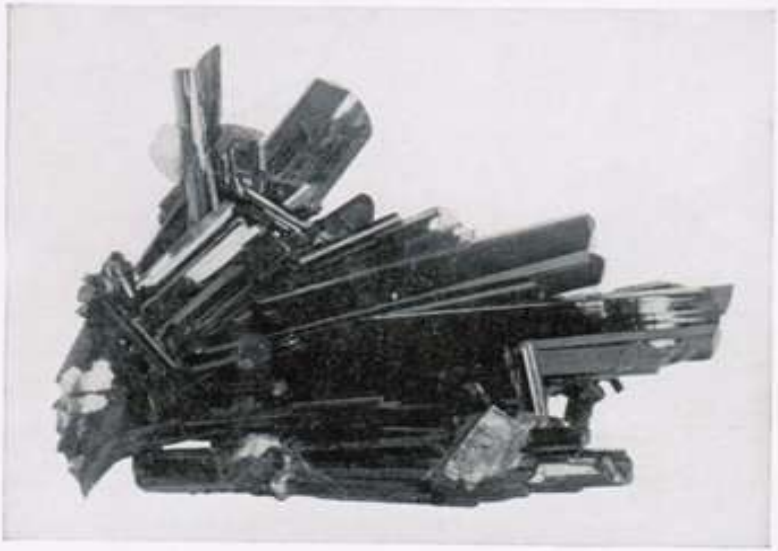
UTILIZING NATURE'S PRODUCTS

(Below) Hand-picking the ore in Germany's most interesting but little known fluorite mine, at Schönbrunn near Plauen in Vogtland. In the circle are some octahedral crystals of fluorite in a matrix of quartz and feldspar from this mine



Miners' lamp of hand-wrought iron used in the sixteenth century in the Erzgebirge. The bright flame emanates from the original wick burning the ancient tallow with which it is soaked. In use the lamp was hung from a timber, or mounted upon a stick fitted into the socket at the back

(Below) The entrance to a drift of the famous Stahlberg mine in Müsen. The crossed hammers, symbol of mining, are the emblem of the Bergakademie in Freiberg



(Upper) The upper Habachtal. The talus slopes and shoulders to the immediate right and left are productive collecting grounds of the minerals for which the valley is famous. (Lower) Epidote from the Untersulzbachtal, the neighboring valley to the east

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