

Summary

With monograph **The Mineral Riches** of Slovenia we covered all the known significant mineral sites together with their minerals. It consists of four major parts of which the first covers the most important mines. The second part is devoted to numerous locations with calcite crystals that were formed in carbonate rocks covering the largest part of Slovenian territory. The third and the most extensive part describes the so-called surface finds related to abandoned mine workings and stone quarries, different construction works on highways and roads, and some coincident findings. The concluding part presents institutional and private mineral collections in Slovenia that are open to the public.

The **first part** commences with the Idrija mine that operated for more than 500 years and had been the source of cinnabar and metacinnabar crystals, followed by less known Šentanski mercury mine. Widely known Mežica mines, in which lead and zinc ore was mined, were the source of many excellent wulfenite specimens that, owing to the size and characteristic crystal forms, constitute a part of all significant institutional and private collections world-wide. Cerussite, anglesite, hemimorphite and smithsonite are described in detail as well. A special attention was dedicated to calcite crystals and other minerals from this ore deposit. At Litija, not far from Ljubljana, a highly interesting Sitarjevec ore deposit is situated. Native lead in very rare wire-like crystals and very large and still growing limonite stalactites were found there. Knapovže, an abandoned mine some 14 km northwest from Ljubljana, is known for yet another ore deposit, in which native mercury and cinnabar crystals were found. Stibnite in macroscopic crystals is fairly rare in Slovenia. Decades ago it used to be mined between Trojane and Znojile and at Lepa Njiva, while more recently quartz crystals as well as large crystals of arsenic pyrite with scorodite coatings were discovered. The largest deposit of siderite iron ore in Slovenia is Savske jame near Jesenice. Realgar and arsenolite are two of other interesting minerals from this ore deposit. The Remšnik mine is one of the rare mines in Slovenia with its own monograph with an emphasis on the description of minerals. In addition to barite and rosasite, some rare minerals have been found in it, such as beaverite and brianyoungite. The Okoška gora polymetallic ore deposit in Pohorje mountains is the site of small but interesting sphalerite, pyrite, chalcopirite and quartz specimens. The largest pyrite crystals in Slovenia originate from the abandoned Pohorje mine at Janezov graben. The Žirovski vrh uranium mine has a rich uranium paragenesis. Petrified wood impregnated with torbernite crystals, smoky quartz and other minerals are presented. Historically and genetically significant is the copper ore deposit at Škofje near Cerklje, in which tiny crystals of copper minerals sporadically occur. The same holds true for copper and barite ore outcrops at Počivalnik and in Dolžanova soteska, and below the mountains of Stegovnik, Ruš, Fevči and Virnikov Grintavec. Manganese minerals in macroscopically developed crystals are rare. For that reason manganese ores and mines are given by a single contribution. Amongst the manganese special features, dendrites and manganese-iron crusty concretions are mentioned together with Jurassic limestone including ammonites. During the construction of the Karavanke Tunnel, pink gypsum was found. In the kaolin mine at Črna near Kamnik, illite clay was mined. At Podčetrtek, near the boundary with Croatia, numerous small iron ore mines used to exist. Today, they are a part of Kozjansko Regional Park and its geological educative path. Well-developed aragonite crystals can be seen there. Melite, a rarity of the Trbovlje coal mine, concludes this chapter.

Slovenia is to a large extent covered by carbonate sedimentary rocks. Within the framework of **Calcite Carrying Slovenia**, the characteristic types of calcite crystals found in active or abandoned mines and stone quarries are presented. The most striking among them are scalenohedral and rhombohedral crystals of various habits with many transitions between them. A special attention was dedicated to calcite crystals showing growth in two generations. The description of sites is followed from the west towards the east and from the north towards the south. In a certain geographical entity, we first of all usually describe the central or the most important site, followed by description of the remaining sites in the neighbourhood.

A significant site of calcite crystals in the Gorenjska region is situated in the vicinity of Kropa, where diverse calcite crystals can be found. The largest cluster of calcite crystals, now exhibited in the Slovenian Museum of Natural History, is known from this site. The nearby Jelovica mountain is home to the largest calcite crystals (up to 1 m in size) in Slovenia. In the area slightly more to the north, near Bled, a location of calcite scalenohedrons is situated. At Hotavlje in the Poljanska valley there is a periodically active quarry, in which saddle shaped dolomite together with calcite crystals can be found. At the Hrastenice quarry, which is known particularly for its fossils (ammonites), some rare calcite crystals have been discovered. On the case of calcite found in abandoned Povodje quarry we tried to link different types of its crystals with separate tectonic phases. The most interesting among the several quarries situated between Ljubljana and Maribor is the one at Velika Pirešica in which numerous well-developed scalenohedral calcite crystals have been found. Very rare cyclic marcasite twins were found there, too. At Železno, not far from Velika Pirešica, calcite crystals with oxidised pyrite coatings were discovered. Between Celje and Štore lies the abandoned Pečovnik quarry, whose major characteristics are, apart from rounded clusters of marcasite, calcite crystals in well-developed rhombohedrons. Quite different is the case at Liboje, where a negative rhombohedron predominates on calcite crystals. Calcite and pyrite were further found in an abandoned quarry near Šentjur. Some interesting features can also be disclosed at some other small calcite sites, discovered purely by chance during road reconstructions. Such is the case of calcite from Tremerje, where calcites of two generations were found. Near Slovenske Konjice, a quarry with rich fossil inventory is situated. Calcite, gypsum, dolomite and pyrite were found. Pyrite and marcasite can often be discovered in stone-quarries.

As calcite is the main mineral of the karst underground, we described its forms found there in a greater detail. In the Primorska region, there are some quarries that unveiled calcite crystals from the karst underground as well. Calcite crystals from the quarries of Črnotiči and Mali Medvejk near Sežana are described. Special features of Mali Medvejk are calcite lateral twins which, however, were also found at the entrance to a karst cave under the mountain of Stegovnik. Some karst caves in Slovenia are known as home to aragonite crystals. Two of them are presented: the Ravenska and Kamniška caves. Gypsum crystals are rare in karst caves; their origin and occurrence in the cave south of Velenje and at Bohinj are described herewith. At the end of this chapter, calcite in the form of tufa is presented.

The most extensive is the thematic block entitled **Surface Finds**. It begins with pyrite from Dolžanova soteska near Tržič, which is in fact the cradle of mineral and fossil collecting in Slovenia. This is followed by a series of contributions in which minerals from Koroška, Kobansko and Pohorje mountains are described. A very popular site is at Strojna north of Ravne na Koroškem, where schorlite, garnets, micas and beryl crystals were found in pegmatites. The Dobrova site nearby is known as the locus typicus of dravite. The Pohorje mountains hide in themselves numerous mineralogical particularities. Minerals, such as omphacite, kyanite, zoisite, corundum and minerals

of the garnet group are described. In the vicinity of Tinjska gora in the southern Pohorje mountains and at Bistriški vintgar, sites of opals, chalcedony and magnesite as well as eclogite outcrops were found. Magnetite ore is characteristic of Kope, where andradite, grossularia and melanite can also be found. In carbonate veins at Puščava in the Pohorje mountains, red fluorescent calcite and barite crystals can be admired. In the alpine veins in the northern Pohorje mountains and at Kobansko, the characteristic association of minerals can be studied: quartz, chlorite, titanite, adularia, pyrite and epidote. These veins are disclosed especially in the two active quarries at Cezlak. Apart from the mentioned minerals, smoky quartz, scolecite and chabasite can be found there. Special features from the Zeleni pruh quarry are bluish beryl crystals, apatite and quartz with actinolite inclusions. In a schists quarry situated at Koritno above Oplotnica, amethyst in attractive crystals on matrix was found for the very first time in the territory of Slovenia. Frajhajm in the Pohorje mountains is known for its large site of epidote. The largest actinolite and chrysotile crystals in Slovenia are located in the Donik quarry that has become known particularly for its smoky quartz and beryl finds. In Bistriški jarek and Vudov potok, old mining pits have been preserved. Košenjak is a magnesite locality. A characteristic mineral in metamorphic rocks is staurolite whose crystals and twins can be found at Leše.

The area between Škofja Loka, Žiri and Polhov Gradec has become rich with mineral finds largely owing to collectors. Quartz crystals from the long-known locality at Črni Vrh near Polhov Gradec are described. Smoky quartz crystals were found at Žirovski vrh, while needle quartz crystals were discovered at Zadobje. At Sovodenj, carbonate concretions with pyrite crystals were found. The most interesting mineral site in this part of Slovenia is Osojnik below the Blegoš mountain, where quartz, stibnite, valentinite and barite can be found in addition to fluorite. The mentioned minerals were morphologically researched in greatest detail and their crystallisation sequence established. Račeva near Žiri is the site of native sulphur, accompanied by calcite, fluorite, dolomite and gypsum crystals. Well-developed calcite twins on a matrix are known from Selce, where marcasite, fluorite and barite can also be found. Calcite from the vicinity of Gorenje Jazne exhibits intensive yellow fluorescence in UV light. Calcite crystals were additionally found in Kurja dolina and on the mountain of Raduha. At Hrastnik near Škofja Loka, large quartz crystals were discovered. Their morphologic properties are described in detail. Minor sites of quartz with pink zoned growth are situated at Zakladnik near Bitnje and at Žiri, whereas a major site of quartz crystals is located in the vicinity of Crngrob near Škofja Loka. Apart from the find itself, we thoroughly described the morphological characteristics of quartz crystals and the occurring paragenesis. Quartz can be found in the belt between Škofja Loka and the Sora river as well, where it occurs together with dolomite.

Agate, laumontite and prehnite can be found at Smrekovec. The traces of volcanism can also be studied in the vicinity of Grad at Goričko, where olivine nodules and phillipsite crystals occur. At Sotina, crystals of quartz, calcite and ankerite are found.

During the construction of a highway between Pesnica and Šentilj, septarian concretions were discovered at Gornji Štrihovec. They contain a unique mineral paragenesis consisting mainly of barite and calcite, and of small ferrierite and heulandite crystals that show an intense fluorescence under a UV light. Faden-forming elongation of barite crystals and its two-generation growth are described. Today, some more sites of septarian concretions are known from this part of Slovenia. Finds from the following localities are described: Štrihovec, Polički vrh, Polička vas, Vajgen, Jareninski vrh, Hlapje, Borl near Ptuj, and Vransko. Concretions with pyrite crystals occur in Tunjice hills.

When the Trojane-Blagovica highway section was being built, pyrite needle crystals were discovered, whereas at the section near the Boštajev grič near Domžale, morphologically interesting calcite crystals were found. In 1995, quartz crystals with rutile inclusions were discovered at Krašnja. However, recent finds greatly surpassed all expectations. At Zagradišče near Ljubljana, there is a site of quartz crystals placed in quartz conglomerates. In the vicinity of Cerknica as well as between Grosuplje and Rašica (Dolenjska region), quartz crystals in carbonate rocks were found with a highly interesting barbell form. At Haloze, several sites with quartz crystals were surprisingly discovered, the first one at Kuzminci and the more important at Dobrina. At Meljski hrib near Maribor, there is a minor site of quartz and calcite.

At Lemberg, we discovered clusters of pyrite crystals and carried out morphological research on them. At Debeli vrh we found marcasite and described its crystals and twins. The epitactic relationship of marcasite and pyrite is described on the samples found under the Prisojnik mountain. The diversity of pyrite crystal morphology is further presented with samples found on the mountain of Matajur.

Along the Slovenian Littoral, barite crystals were found in the crevices of flysch rock. At the Strunjan and Sečovlje salt-pans, clusters of halite crystals can be found. From the Austrian Hohe Tauern, gold reaches Slovenian territory, where it can be washed out in the Drava and the Mura rivers. Organic matter has also been found: amber and bitumen. Vivianite crystals occur on coal from the Kočevje mine and in bones of some mammalian fossils from Ljubljansko barje. Very interesting is the native sulphur in petrified snails from Račeva near Žiri and pyritized fossils from Tunjice hills. One would dearly love to discover the meteorite that has presumably fallen on the territory of Slovenia, but so far this has not been the case.

In the concluding part, the **publicly accessible collections** are presented. The first and in a cultural-historical sense the most important one is Zois's collection of minerals kept by the Slovenian Museum of Natural History. The geological study collection of Idrija Mercury Mine discloses over 800 different samples of rocks, ores and minerals that were found in this mine. In the Mežica mine museum, the characteristic minerals from lead-zinc ore deposits are exhibited. The Department of geology at the Natural History – Technical Faculty, University of Ljubljana, keeps the largest study collection of rocks and minerals in Slovenia. Franc Pajtler gathered numerous minerals, rocks and fossils from Slovenia for the Institute of Culture in Slovenska Bistrica. Seidl's collection of minerals, rocks and fossils is a historic collection, professionally set up by Renato Vidrih and Vasja Mikuž in Novo mesto Grammar School. Franc Braniselj, who keeps the largest systematic collection of minerals in Slovenia, donated part of it to the Loka Museum, where a central collection of radioactive minerals in Slovenia is being planned. Renato Vidrih, on the other hand, turned part of his private home into a museum and exhibited his collection at Studeno near Postojna.

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