



SCOPOLLIA

Revija Prirodoslovnega muzeja Slovenije
Journal of the Slovenian Museum of Natural History

53 | 2004



Glasilo Prirodoslovnega muzeja Slovenije, Ljubljana
Journal of the Slovenian Museum of Natural History, Ljubljana

Izdajatelj / Edited by:
Prirodoslovni muzej Slovenije, Ljubljana, Slovenija
Slovenian Museum of Natural History, Ljubljana, Slovenia

Sofinancirata / Subsidised by:
Ministrstvo za kulturo in Ministrstvo za šolstvo, znanost in šport
Ministry of Culture and Ministry of Education, Science and Sport

Urednik / Editor:
Janez GREGORI

Uredniški odbor / Editorial Staff:
Breda ČINČ-JUHANT, Boris KRYŠTUFEK, Lojze MARINČEK, Ignac SIVEC, Kazimir TARMAN,
Nikola TVRTKOVIĆ (HR), Tone WRABER

Naslov uredništva in uprave / Address of the Editorial Office and Administration:

Prirodoslovni muzej Slovenije, Prešernova 20, p.p. 290, SI – 1001 Ljubljana, Slovenija
Slovenian Museum of Natural History, Prešernova 20, p.p. 290, SI - 1001 Ljubljana, Slovenia

Račun pri UJP / Account at UJP:
01100-6030376931

Lektor (za slovenščino) / Reader (for Slovene):
Cvetana TAVZES

Lektor (za angleščino) / Reader (for English):
Henrik CIGLIČ

Oblikovanje / Design:
Jurij KOCBEK

Tisk / Printed by:
Schwarz d.o.o., Ljubljana

Izideta najmanj dve številki letno, naklada po 600 izvodov
The Journal appears at least twice a year, 600 copies per issue.

Natisnjeno / Printed:
september 2004 / September 2004

Fotografija na naslovnici / Front cover:
Kalcit (5 x 3 cm) iz rudnika Mežica / Calcite (5 x 3 cm) from the Mežica mine
foto/Photo: Miha Jeršek

Revija je v podatkovnih bazah / Journal is covered by
COBIB, BIOSIS Zoological Record

SCOPOLIA No 53: 1-29 (2004)

The morphology of calcite crystals in the Mežica mines

Miha JERŠEK¹, Vladimir ZEBEC², Breda MIRTIČ³,
Vladimir BERMANEC⁴, Tadej DOLENEC³, Franc KRIVOGRAD⁵

UDC (UDK) 549.08:548.1(497.4 Mežica)

ABSTRACT

From over 500 samples 58 calcite crystals from the Mežica mines were selected and their habitus, crystal forms and the crystal type determined. We identified 59 different forms and coordinated their indices with the parameters of the unit cell. Five main types of calcite crystals were distinguished: 1st type: scalenohedral crystals with the dominant crystal form $\{21\bar{3}4\}$, 2nd type: rhombohedral crystals with the dominant crystal form $\{10\bar{1}4\}$, 3rd type: rhombohedral crystals with the dominant crystal form $\{01\bar{1}8\}$, 4th type: prismatic crystals with the dominant crystal forms $\{10\bar{1}0\}$ and $\{01\bar{1}8\}$, and 5th type: rhombohedral to scalenohedral crystals with acute negative rhombohedrons and scalenohedrons as the dominant crystal forms. Two additional types of crystals were distinguished. The first one comprises barrel-like crystals without any dominant crystal forms and crystals with faces formed by dissolution of crystals. Of the twins the most frequent occur those with the twinning planes $(01\bar{1}8)$ and (0001) , while twins with the $(01\bar{1}2)$ twinning plane are the rarest. The morphology of crystals was linked to their place of nucleation in the Mežica mines, and some of the characteristics of calcite crystal described with respect to their position in the mines and to the parageneses in which they appear. According to the morphology also the succession of crystalization of calcite crystals was determined.

Key words: calcite, crystal morphology, twins, crystalization succesion, Mežica Mines

IZVLEČEK

Morfologija kristalov kalcita iz mežiških rudišč. - Izmed več kot 500 vzorcev kristalov kalcita iz mežiških rudišč smo jih izbrali 58, jim določili kristalne like, habitus in jih razvrstili v posamezne kristalne tipe. Določili smo 59 različnih kristalnih likov in njihove indekse uskladili s parametri osnovne celice. Ločili smo pet različnih tipov kalcitnih kristalov: 1. tip: skalenoedrski kristali s prevladujočim kristalnim likom $\{21\bar{3}4\}$, 2. tip: romboedrski kristali s prevladujočim kristalnim likom

$\{10\bar{1}4\}$, 3. tip: romboedrski kristali s prevladujočim kristalnim likom $\{01\bar{1}8\}$, 4. tip: prizmatski kristali s prevladujočima kristalnima likoma $\{10\bar{1}0\}$ in $\{01\bar{1}8\}$, in 5. tip: romboedrski do skalenoedrski kristali s prevladujočim kristalnim likom strmega negativnega romboedra in strmega negativnega skalenoedra. Ločili smo še dva tipa kristalov, in sicer sodčkaste kristale, pri katerih ne dominira noben izmed kristalnih likov, in kristale s ploskvami, ki so nastale kot posledica raztapljanja kristalov. Med dvojčki so najpogostejši tisti z dvojčičnima ravninama $(01\bar{1}8)$ in (0001) , medtem ko so dvojčki z dvojčično ravnino $(01\bar{1}2)$ najredkejši. Morfologijo kristalov smo povezali z njihovo geografsko lego oziroma višino v rudišču in opisali nekatere značilnosti pojavljanja kristalov kalcita v rudišču oziroma paragenezu, s katero nastopajo. Na osnovi morfologije kristalov kalcita smo določili zaporedje kristalizacije.

Gljučne besede: kalcit, morfologija kristalov, dvojčki, vrstni red kristalizacije, Rudnik Mežica.

¹ Slovenian Museum of Natural History, Prešernova 20, 1000 Ljubljana, Slovenia, mjersek@pms-lj.si

² Croatian Museum of Natural History, Detrova 1, 10000 Zagreb, Croatia

³ Department of Geology, Faculty of Natural Sciences and Engineering, University of Ljubljana, Aškerčeva 12, 1000 Ljubljana, Slovenia

⁴ Department of Geology, Faculty of Science, University of Zagreb, Horvatovac b.b., 10000 Zagreb, Croatia

⁵ Pod Gonjami 59, 2391 Prevalje, Slovenia

Introduction

Calcite is one of the most frequent minerals in Slovenia, and composed of calcite are our most common rocks including limestone, calcitic dolomite, tuff and marble, to mention only a few. A vast majority of the karst phenomena, among them various flowstone formations, are closely related to calcite (KNEZ & ZUPAN, 1992). But deposits of fully developed calcite crystals, such as the calcite crystal occurrences in the Mežica mines, are much sparser (VIDRIH & MIKUŽ, 1996). The Mežica Mines were one of the largest mines of metallic minerals in Slovenia. Elsewhere in the world the Mežica Mines were known for the lead-zinc ore and also for some minerals which attracted the attention of many experts, scientists and amateurs because of their highly diverse morphology. One of the minerals is the coarse grained calcite which is a gangue mineral and for this reason rarely the subject of expert or scientific discussions. It is well known that calcite is a mineral with an exceptionally rich morphology, and with an exceptional number of crystallographic forms that occur in more or less complex combinations (KLEIN & HURLBUT, 1999). The calcite from the Mežica mines is no exception in this respect, and it undoubtedly ranks among the morphologically most interesting minerals in Slovenia.

About the Mežica Mines

The area of the Mežica lead and zinc mines and their wider territory is situated in one of the more complex geological structures in Slovenia. The reason for this is undoubtedly the Periadriatic lineament, which is expressed as a 2-3 km wide strip in the Koroška region passing through the upper valley of the Meža river. The lead-zinc ore occurs in the Mesozoic carbonate rocks north of the Periadriatic lineament that are shifted several ten kilometres eastward in relation to the rock on the lineament's southern side (ŠTRUCL et al, 1999).

The narrower area of the Mežica mines is composed of Ladinian, Karnian, Norian and Rhaetian beds that together compose a 2000 to 2500 metre thick rock succession overlying the Anisian beds (DOLENEC et al, 1982). In economic terms the most important were the ore bodies in the Ladinian rocks which are mostly present in the facies of Wetterstein limestone.

The Wetterstein limestone is significantly karstified and cracked, which is one of the preconditions for the formation of fully shaped calcite crystals. In most part the cracks formed during Alpidic orogenesis, and partially already during diagenesis or during Triassic paleokarstic processes (FAJMUT-ŠTRUCL & ŠTRUCL, 1992). Since the cracks were below the underground water table before mineralization, the cave carbonates and stalactite formation could not develop, but what occurred instead were large amounts of coarse grained calcite and other minerals that compose the paragenesis of the Mežica Mines (FAJMUT-ŠTRUCL & ŠTRUCL, 1992). The Mežica Mines extend within an area of 19 km² and are divided into districts. The Stari Fridrih district lies to the north, the Peca and Topla districts to the west, and the Graben (MEŽNAR & URAN, 1965) and Mučevo districts to the east (ŠTRUCL, 1984). The central Mežica Mines comprises Navršnik, Moring, Union, Helena-Igrčevo, Fridrih, Srednja Cona (Middle Zone), Srce, Staro Igrčevo and Luskačevo (TOMŠE, 1996). The listed districts lie between two large faults – the Peca and `umah faults; between them occurs a range of more or less parallel faults, which gives the appearance of a terraced structure (ŠTRUCL, 1984).

The mineral paragenesis in the Mežica mines consists mainly of the primary ore minerals galena and sphalerite and a great number of secondary minerals that formed during the oxidation processes. Among them there are also ore minerals, such as cerussite and wulfenite (ŠTRUCL, 1984).

The latter was described in detail by ŽORŽ et al. (1998) who linked its morphology to the location of its occurrence in the mines. The characteristics and some of the occurring forms of the minerals of the Mežica mines oxidation zone were described by ZORC (1955) and ŠTRUCL (1984). Calcite is the most common among the gangue minerals.

Calcite from the Mežica mines

The calcite from the Mežica mines can be found on the walls of the cracks and in smaller caverns (ŠTRUCL, 1984). It can be covered by coatings of other minerals, for example wulfenite or hydrozincite. Calcite is a typical mineral of the Mežica mines' oxidation zone, unless it is not formed from hydrothermal solutions (DOLENEC et al, 1982). The latest calcite crystals are recurrent in old abandoned mine workings in which calcite, aragonite and hydrozincite occur in cave carbonates (ŠTRUCL, 1996). Mežica Mines are also known for unusually shaped calcite crystals with inclusions of galena that gives them a grey appearance (VIDRIH & MIKUŽ, 1995).

Two types can be distinguished according to habitus (TOMŠE, 1996; ŠTRUCL, 1984). The calcite which TOMŠE (1996) calls the older calcite and that occurs with mineralization, has a scalenohedral habitus and a subordinate prismatic habitus. The calcite of the oxidation zone has a rhombohedral habitus (TOMŠE, 1996).

Until now the discussions about calcite in Slovenia (KNEZ & ZUPAN, 1992; VIDRIH & MIKUŽ, 1995, VIDRIH & MIKUŽ, 1996) and the Mežica calcite (ZORC, 1955; ŠTRUCL, 1984, ŠTRUCL & ŠTRUCL-FAJMUT, 1992; DOLENEC et al, 1983; TOMŠE, 1996) have not concerned the morphological aspect of calcite crystals as it could be established by goniometric measurement. Thus the paper at hand is the first to systematically deal with the morphology of calcite from the Mežica mines. The investigation links the crystal morphology to the place of their formation and succession of crystallization.

Calcite in general

The calcite, CaCO_3 , crystallizes in the hexagonal scalenohedral symmetry $3\bar{2}R/m$. The widely used axial ratio $a : c = 1 : 0,85$ is not in agreement with the unit cell parameters (PALACHE, BERMAN & FRANDEL, 1951). Unit cell parameter yield to axial ratio $a : c = 1 : 0,379$. In that case cleavage of calcite in accordance with unit cell, is perfect on $\{10\bar{1}4\}$.

Materials and methods

Out of more than 500 calcite samples from public and private collections about 58 were selected for analysis in detail. The samples were from the districts, sub-sections and sections (Fig. 1): Union, Moring, Helena, Navršnik, Igrčevo, Staro Igrčevo, Fridrih, Stari Fridrih, Rišperg, Doroteja, Mučevo and Graben, and are therefore equally from the lowest parts of the mines (Union, +300 m) as well as from some higher parts (Doroteja, +925 m).

The powder x-ray diffraction analysis was used for determining the mineral composition of the samples and the unit cell parameters for the chosen calcite samples.

A model A goniometer after V. Goldschmidt was used for determining the crystal forms. On crystals without clearly developed and flat crystal forms, which are suitable for goniometric investigation, the top of the crystals was cut to provide the cleavage plane $(10\bar{1}4)$. According to this plane the crystal could be precisely placed on the goniometer for the goniometric measurement. Idealized crystals (single and twins) were drawn using a computer program KRISTAL 2000.

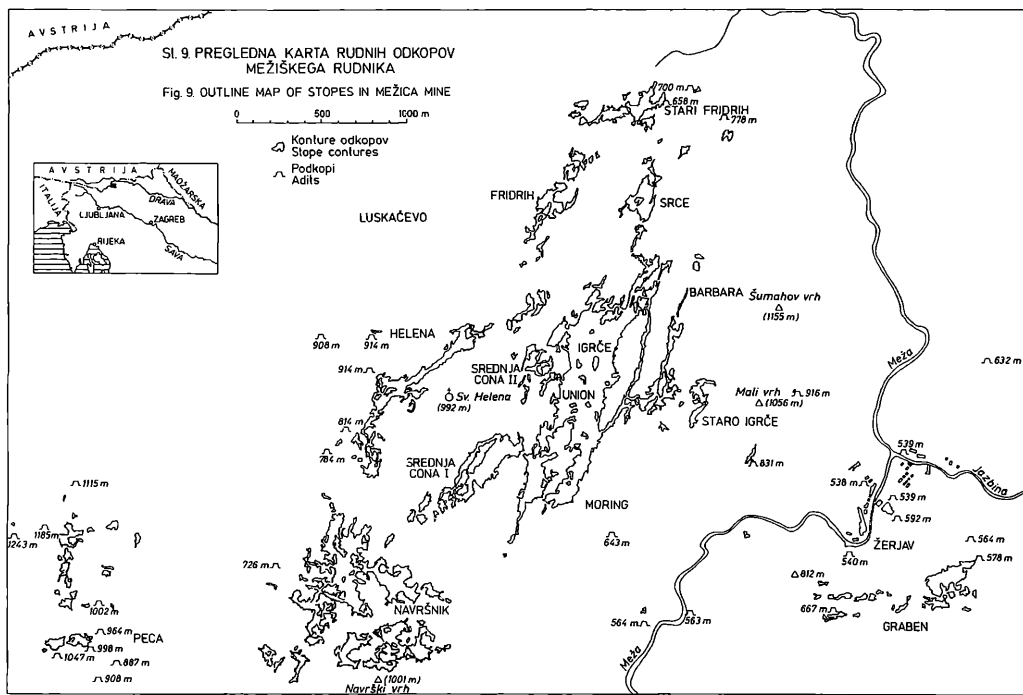


Fig. 1 Districts in Mežica mines (ŠTRUCL, 1984).

Results

UNION DISTRICT

The Union district is a part of the Central mine, which was known for rich wulfenite localities. We investigated the calcite crystals from levels 4, 5, 7 and 18.

Union district, below level 4

Calcite crystals from this location of the Union district were found in a geode in the section of the excavation where the layer of lead-zinc ore forms a wedge that thins out in the relatively pure limestone. They are translucent, colourless and partially milky white, up to 4 cm in size with a developed rhombohedral habitus, and they are similar to crystals of 2nd type from the Union district, level 18 (Fig. 6)

and from Moring district, level 10 (Fig. 10). The crystals are not suitable for goniometric measurement. The only known specimen is kept in the Slovenian Museum of Natural History

Union district, level 5

During exploration works before 1960 while progressing through the exploration drift on level 5 of the Union district, a crack opened and revealed calcite crystals. The crack had been severely tectonically affected, and there was a significant presence of mylonite powder. The calcite crystals occurred along the crack in the powder in which the so-called floaters were found.

Calcite crystals from level 5 of the Union district were colourless and transparent. At some locations they appear milky white because of the matrix. Morphologically they are diversely and perfectly developed. Characteristically striped rhombohedral crystals with the well marked face $\{01\bar{1}8\}$ are prevalent. The matrix is composed of crystals up to 1 cm in size. From it grow crystals that are 3 cm in size. Apart from the forms $\{01\bar{1}8\}$ and $\{07\bar{7}8\}$ occur identified forms $\{10\bar{1}0\}$, $\{10\bar{1}4\}$, $\{10\bar{1}1\}$, $\{h0\bar{h}1\}^2$ (close to position $\{50\bar{5}1\}$), $\{7.1.8.24.\}$, $\{4.1.5.12.\}$, $\{21\bar{3}4\}$, $\{hk\bar{i}1\}^3$ (close to position $\{14.1.\bar{1}5.2.\}$) $\{1.6.\bar{7}.10.\}$, $\{13\bar{4}4\}$ and $\{1.16.\bar{1}7.20.\}$ on the calcite crystals from level 5 of the Union district (Figs. 2a, 2b and 2c).

Relatively large calcite crystals at level 5 of the Union district were found in a lenticular cavern in the connection drift between two parallel exploration drifts in the direction towards the northern part of the mine. They are covered with a yellowish-orange coating, have a rhombohedral habitus of the 3rd type with the dominant crystal form $\{01\bar{1}8\}$ and a diameter of up to 7 cm. Similar crystals were found at level 8 of the Moring district in the direction towards the Navršnik district.

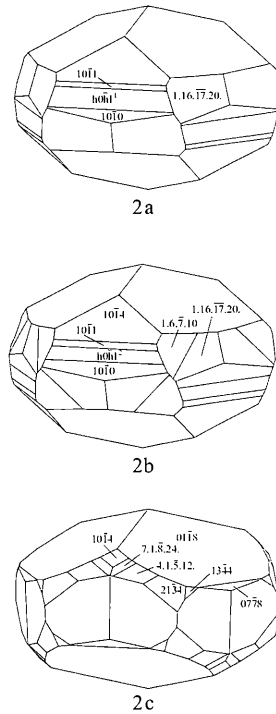


Fig.2. Rhombohedral crystals of calcite with the most developed form $\{01\bar{1}8\}$, 3rd type crystals, Union district, level 5. They have rarely developed form $\{10\bar{1}0\}$ (Figs. 2a and 2b). Instead of that it is developed acute rhombohedrons (Fig 2c).

Union district, level 7

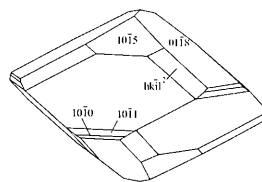
The calcite crystals from level 7 of the Union district were found in situations similar to those at level 5. They appear mostly on the walls of cracks in a mylonitic zone.

These calcite crystals are colourless and transparent. They are up to 1 cm in size. Their habitus is rhombohedral, 2nd type with predominant form $\{0\bar{1}\bar{1}8\}$ and subdominant form $\{01\bar{1}8\}$. The following forms on the crystals: $\{10\bar{1}0\}$, $\{10\bar{1}5\}$, $\{10\bar{1}1\}$, $\{4.1.5.24.\}$, $\{hk\bar{i}l\}^2$ (close to position $\{12.1.\bar{1}3.56.\}$), $\{7.1.8.24.\}$ and $\{12\bar{3}2\}$ were determined in addition (Figs. 3a, 3b and 3c).

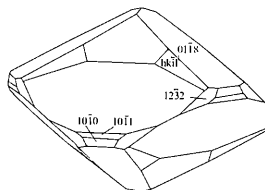
Calcite basal twins with the only $\{01\bar{1}8\}$ form are especially characteristic for level 7 of the Union district; their twinning plane is $\{0001\}$ (Fig. 4). The crystals are colourless or greyish due to inclusions, and mostly translucent or in rare cases transparent. They are usually up to 1 cm in size, and only rarely up to 4 cm; they stand out from the carbonate matrix containing smaller calcite crystals of an equally rhombohedral habitus. They are found on the crack walls. Equal crystals were found at the same level in the Moring district where they are almost totally black and opaque, probably due to galena inclusions.

One of the calcite crystal sites known at level 7 of the Union district was in a crack opened at the transformer station. At this site the crystals were still rhombohedral, but of quite different appearance. Rhombohedral and scalenohedral forms dominate these crystals that are similar to the calcite crystals from the Union district at levels 7 and 18 (Fig. 5) and Moring district, level 10 (Fig. 8) The crystals are mostly colourless, sometimes milky or grey due to inclusions, and translucent to transparent. These types of crystals can be fully developed, and they were preserved in the core of the mylonitic zone. They are up to 1 cm in size and occur often in more or less uneven druses.

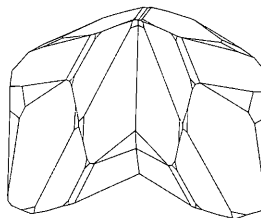
The nests in the Union district, level 18, were the largest at the aforementioned trans-



3a



3b



3c

Fig. 3. Calcite crystal with predominant forms $\{0\bar{1}\bar{1}8\}$ and $\{10\bar{1}4\}$, 3rd type crystals, Union district, level 7 (Fig. 3a). Calcite crystal of 3rd type (as showed on Fig. 3b), could be twinned with twinning plane $\{01\bar{1}8\}$, Union district, level 7 (Fig. 3c).

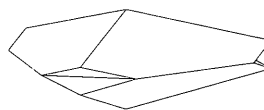


Fig. 4. Calcite twin of calcite crystals of 3rd type with twinning plane $\{0001\}$, Union district, level 7.

former station, but smaller ones were present throughout the level 7.

The calcite crystals are colourless, at times milky white or grey due to inclusions. The crystals with a developed $\{10\bar{1}4\}$ form are at first sight similar to this 2nd type of crystals in the Union district at level 18, except that they are larger (see fig. 5). Exceptionally they can be up to 1 cm in size. This type of crystals often occurs on a 2 cm thick matrix where crystallization was interrupted many times.

Union district, level 18

Calcite crystals occurred directly at the ore in the Union cracks, in several lenses 10 cm in size. The calcite was found in the well known drift No. 51, where glossy cerusite and anglesite crystals up to 5 cm in size occur.

The calcite crystals are colourless and sometimes appear grey due to the dark matrix. Their habitus is characteristically rhombohedral (2nd type crystal). The crystals are composed of forms $\{10\bar{1}4\}$, $\{01\bar{1}8\}$, $\{5.1.\bar{6}.28.\}$, $\{hk\bar{i}l\}^2$ (close to position $\{12.1.\bar{1}\bar{3}.56.\}$), $\{7.1.\bar{8}.24.\}$, $\{6.1.\bar{7}.20.\}$, $\{4.1.\bar{5}.12.\}$, $\{21\bar{3}4\}$, and $\{53\bar{8}8\}$. They are among the most significant crystals for the Mežica mines (Fig. 6).

The crystals with expressed $\{01\bar{1}8\}$ form (3rd type) are up to 0.5 cm in size, and less often up to 1 cm (Figs. 7a, 7b and 7c). The crystals are composed of forms $\{10\bar{1}0\}$, $\{10\bar{1}4\}$, $\{10\bar{1}1\}$, $\{hk\bar{i}l\}^1$ (close to position $\{12.1.\bar{1}\bar{3}.56.\}$), $\{6.1.\bar{7}.20.\}$, $\{4.1.\bar{5}.12.\}$, $\{21\bar{3}4\}$ and $\{hk\bar{i}l\}^4$ (close to position $\{34.1.\bar{3}\bar{5}.4.\}$).

Rhombohedral calcite crystals of 3rd type are covered with minute almost black descloizite crystals of up to 1 mm in size. They are especially characteristic for the Union district. A rich occurrence of this paragenesis exists around the Union main shaft to level of the Union district. Brown descloizite crystals rarely cover the calcite crystals in level 8 of the Union district.

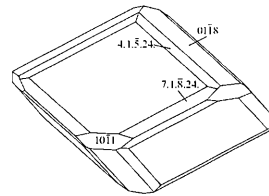


Fig.5. Calcite crystal with predominant crystal forms $\{10\bar{1}4\}$ and $\{01\bar{1}8\}$, 2nd type crystal, Union district, level 7.

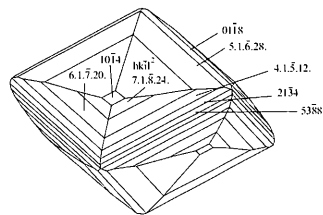
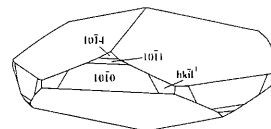
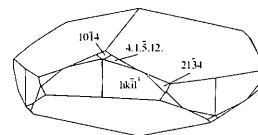


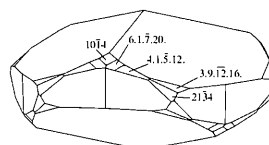
Fig.6. The most significant calcite crystal from Mežica mines, 2nd type crystal, Union district, level 18.



7a



7b



7c

Fig. 7. Calcite crystals with predominant form $\{01\bar{1}8\}$, 3rd type crystals, Union district, level 18. Some of them have well developed form of prism (Fig. 7a) and some of them have forms of acute rhombohedrons (Fig. 7b and 7c).

MORING DISTRICT

The Moring district lies south from the Union district. Calcite crystals from levels 7, 8 and 10 were investigated.

Moring district, level 7

The conditions of crystalization in the Moring district, level 7, appear to have been very similar to those in the Union district, level 7. Therefore the morphology of the calcite crystals is not described at this place again.

Moring district (South), level 8

On the way towards Moring, past Stari Fridrih, Fridrih and Union, there is, before the central part of the Moring district, a turning towards its southern part. In a rich zinc orebody there occur some other minerals (as hemimorphite), otherwise rare in the Mežica mines. Calcite was found there in ore excavation in pipe shaped caverns up to 3 metres long and between 50 and 70 cm across.

Calcite crystals from level 8 of Moring South are notably coarse grained, colourless, milky white or dark grey due to inclusions of dark grey material. Occasionally they are covered with a black, red, orange, yellow or brown coating of fine grained minerals. In some places the calcite crystals contain large amounts of black mineral inclusions, so that they are completely opaque or black. Rhombohedral crystals of 3rd type with prevailing negative rhombohedron $\{01\bar{1}8\}$ forms are most frequent. The rare twins have developed $\{01\bar{1}8\}$ forms (3rd type) and a twinning plane (0001), which are the same as for crystals from the Union district level 7 (see Fig 4). Usually the calcite crystals from level 8 of Moring South are from 1 to 3 cm in size, but can also reach 8 cm and more.

By their habitus and characteristic crystal forms they resemble the crystals from the Union district level 18. They differ from them by being

larger and usually less pure and with less lustre. They are distinguished from the calcite crystals of level 5 of the Union district by being flatter – the latter having more distinctive prismatic and scalenohedral forms. Most of the crystals from level 8 of the Moring South are considerably larger than those in the Union district.

Very rarely are the calcite crystals from Moring South covered with very fine, up to 1 mm, brownish yellow hemimorphite crystals. In rare cases the bottom edges of the calcite crystals are coated with white hydrozincite, while hemimorphite covers the upper parts of the crystals. This occurs only in the caverns directly next to the ore, where there were conditions for its oxidation and crystallization of these minerals.

Moring district, level 10

The area of the Moring district level 10 extends within the limits of the Union faults. The crystals grow on the walls of the cracks, in minor nests and in lenses. Calcite appears also in tectonically ground or crushed limestone where calcite crystals act as cement between the limestone particles. Crystals are up to 2 cm in size, and are more or less covered with limonite, which is characteristic for the calcite from level 10 of the Moring district.

Calcite crystals are colourless, transparent and rich in forms. They have a characteristic rhombohedral habitus with a typical morphology of $\{10\bar{1}4\}$ and $\{01\bar{1}8\}$ forms. Such crystals are considered as of the transitional type between 2nd and 3rd type. Also the forms $\{10\bar{1}0\}$, $\{h0\bar{h}1\}^2$ (close to position $\{50\bar{5}1\}$), $\{11\bar{2}6\}$, $\{12\bar{3}4\}$ and $\{1.6.\bar{7}.10\}$ were identified on the calcite crystals from level 10 of the Moring district (Fig.8).

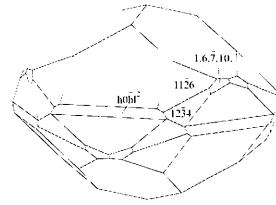


Fig. 8. Characteristic calcite crystal with predominant forms $\{01\bar{1}8\}$ and $\{10\bar{1}4\}$, transition type between 2nd and 3rd type, Moring district, level 10.

NAVRŠNIK (BARGATE) DISTRICT

Navršnik district is in the southwest of the Central part of Mežica mines. The lowest level was at +347 m, and the highest is the level 4 (+662 m). Calcite crystals from levels 7, 10, 12, between 12 and 13, and from level 14 were investigated.

Navršnik district, level 7

Calcite crystals from the Navršnik district (named after Navrški Vrh), popularly called Bargate (after the Englishman Bargate), are associated with large lenses or caverns in tectonically crushed dolomitized limestone. There is a considerable limonite content and relatively little galena. Clay filled the caverns and the spaces around them. Calcite deposits were associated mostly with the rocks near the power station at the Navršnik main shaft.

Calcite crystals from the Navršnik district are characteristically scalenohedral. The type with prevalent form $\{21\bar{3}4\}$ is classified as 1st type calcite crystals (Fig. 9). The crystals are usually green-grey to greenish. Where protected in soft clay they could also become yellowish. They are mostly opaque, sometimes translucent and rarely transparent. Tiny scalenohedral calcite crystals tend to grow out of individual crystal faces. Individual crystals can measure 5 cm and more. However, since they grow together, only the tips of the scalenohedrons are visible from the matrix. The crystals are usually up to 3 cm high. Scalenohedral crystals can be covered by a red coating. Apart from individual crystals also various types of twins in the druses are found which are generally larger than other crystals (Figs. 10, 11a and 11b). These are simple crystals with developed form $\{21\bar{3}4\}$ and with a $\{01\bar{1}2\}$ or $\{01\bar{1}8\}$ twinning plane.

Some crystals might have dropped from upper parts of the caverns into the clay or directly on the bottom. There simple scalenohedral

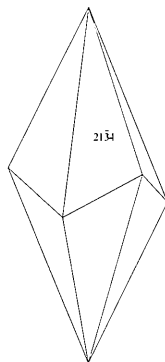


Fig.9. Calcite crystal with $\{21\bar{3}4\}$ form, 1st type crystal, Navršnik district, level 7.

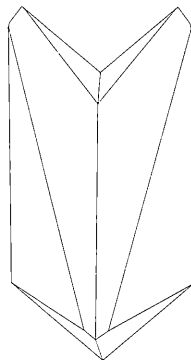


Fig. 10. Calcite twin with twinning plane $\{01\bar{1}2\}$, Navršnik district, level 7.

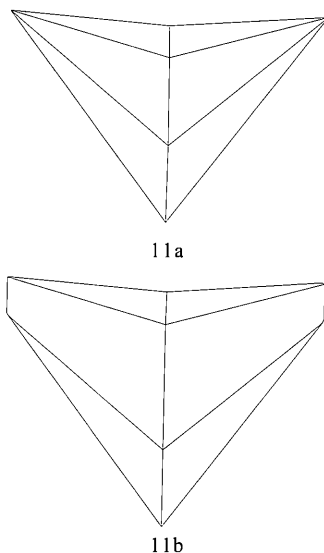


Fig. 11. Calcite (crystals of 1st type) twin with twinning plane $\{01\bar{1}8\}$, Navršnik district, level 7.

crystals can be found with developed forms $\{21\bar{3}4\}$, broken at the feet or already "cicatrised" with form $\{01\bar{1}8\}$ (Fig. 12).

In some specimens the growth of calcite crystals in two generations is obvious. Scale-nohedral crystals with a well developed $\{21\bar{3}4\}$ and subordinate $\{10\bar{1}4\}$ are characteristic for the early generation (1st type), while the later generation of calcite is represented by crystals with a morphology defined by $\{hk\bar{l}\}$ ³ (close to position $\{14.1.\bar{1}5.2.\}$), $\{21\bar{3}4\}$, $\{7.1.\bar{8}.24.\}$ and $\{4.1.\bar{5}.12.\}$, while forms $\{01\bar{1}8\}$ and $\{01\bar{1}5\}$ only finish the crystal into a comprehensive body (6th type of calcite crystal - barrel-like crystals without any dominant crystal forms) (Fig. 13). This type of crystals are corroded and relatively poorly preserved.

Examples of phantom growth are easily visible on individual broken parts of scale-nohedral calcite crystals. The matrix of the crystal druses is also composed of tiny carbonate layers up to 1 mm thick which are well differentiated. Light-brown and green-grey layers alternate. This is especially distinctive in cases of crystals found on the ground of the level of the Navršnik district. Well defined calcite twins with a $\{01\bar{1}8\}$ twinning plane have grown on such a matrix.

Navršnik district, level 10, far west

At some point the extension of an ore vein rich in impregnation type galena was being traced in the extreme western part of level 10 of the Navršnik district. The exploration drift was not as successful as expected, but a rich calcite crystal locality was discovered instead. Calcite grew on walls of larger caverns which were filled with soft chocolate brown clay. The caverns were so large that passages could lead through them (up to 2 metres high).

Calcite crystals from level 10 of the Navršnik district have developed short to medium length prisms $\{10\bar{1}0\}$ and rhombohedrons $\{01\bar{1}8\}$. Such crystals are classified among the 4th type of calcite crystals. Additionally to the hexagonal

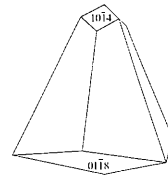


Fig 12. Calcite crystal from Navršnik district, level 7, seems to be hemimorphic. The crystal has well developed forms $\{21\bar{3}4\}$ and $\{10\bar{1}4\}$ (1st type). It is recrystallised from the bottom with form $\{01\bar{1}8\}$ (3rd type).

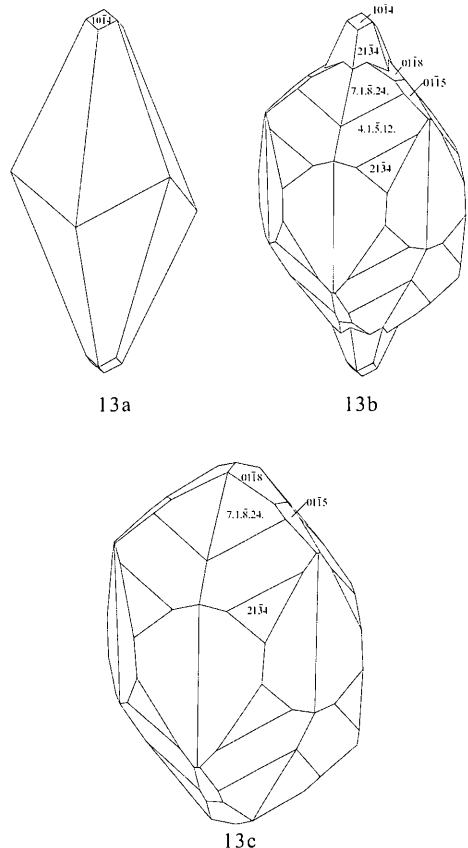


Fig. 13. Calcite crystals from Navršnik district, level 7. Calcite crystal with well developed $\{21\bar{3}4\}$ and $\{10\bar{1}4\}$ forms of early generation (1st type) (13a). The late generation of barrel-like calcite crystal (6th type) partially (13b) or completely (13c) overgrows the calcite crystal of early generation.

prisms, striped rhombohedron faces occur on individual crystals (Fig. 14). They are usually colourless or milky white and up to 8 cm in size. They are often coated by other minerals of light or dark brown or brownish yellow colour, and sometimes the crystal druses are covered by a brown and white coating.

Navršnik, level 12

Calcite appears on the walls of minor cracks along the drifts of level 12, in the extension between Srednja Cona (Middle Zone) towards Navršnik. Major concentrations of galena and anglesite on galena have been found there. Limonite is characteristic for the entire Navršnik district, and many minerals are coated with it.

Calcite crystals from level 12 of the Navršnik district are seldom preserved. In approximately 1968 a minor crack was opened by a drift, and a single calcite specimen was found there; it is kept now at the Slovenian Museum of Natural History. The crystals are colourless and transparent to translucent. The crystals on the matrix are up to 1 cm in size. We determined forms $\{10\bar{1}0\}$, $\{10\bar{1}4\}$, $\{10\bar{1}1\}$, $\{01\bar{1}8\}$, $\{4.1.\bar{5}.12.\}$, $\{1.6.\bar{7}.10.\}$ and $\{13\bar{4}4\}$ (Fig. 15). In some crystals two generations of calcite were identified. The early generation are scale-nohedral crystals with developed forms $\{10\bar{1}0\}$, $\{10\bar{1}4\}$, $\{30\bar{3}2\}$ and (1st type), often completely overgrown by fully developed and rich crystal forms on barrel like crystals of 6th transitional type. We determined forms $\{10\bar{1}0\}$, $\{10\bar{1}1\}$, $\{01\bar{1}8\}$, $\{6.1.\bar{7}.20.\}$, $\{1.8.\bar{9}.16.\}$, $\{2.7.\bar{9}.12.\}$, $\{13\bar{4}4\}$, $\{12\bar{3}2\}$ and $\{1.0.\bar{1}.16.\}$ on these crystals (Fig. 16).

Some calcite crystals in the Navršnik main shaft resemble the crystals in the Graben district. They were found in the zone of crushed limestone in which the calcite crystals cement the rock fragments. They are usually up to 1 cm, and rarely 1.5 cm in size.

In level 12 of the Navršnik district individual crystals can be up to 10 cm in size. Here a unique specimen with an interesting morpho-

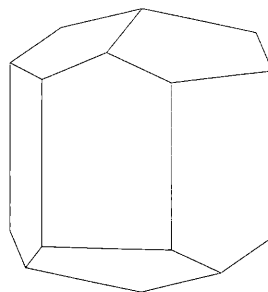


Fig. 14. Calcite crystal with prevailing forms $\{10\bar{1}0\}$ and $\{01\bar{1}8\}$, 4th type crystal, Navršnik district, level 10, far west.

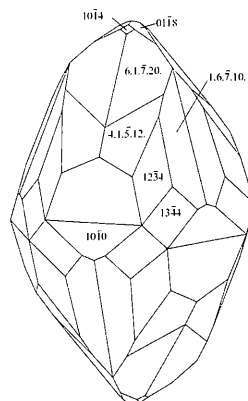


Fig. 15. Barrel – like calcite crystal, 6th type crystal, Navršnik district, level 12.

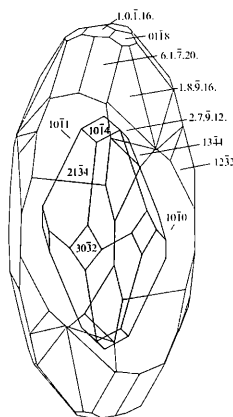


Fig. 16. The calcite crystal of 1st type is overgrown with barrel-like calcite crystal of 6th type, Navršnik district, level 12.

logy was found and identified. The crystals are translucent and partially colourless to milky white. They are distinguished by their unusual morphology which could not be determined by goniometric measurements because of large size of crystals. On smaller crystals basal twins with developed acute rhombohedral and scalenohedral forms were identified. We determined $\{30\bar{3}2\}$, $\{01\bar{1}8\}$, $\{03\bar{3}8\}$ and $\{03\bar{3}4\}$. Their singularity are the scalenohedral forms $\{2.11.\bar{1}3.8.\}$ which form the re-entrant angle, and with it their characteristic morphology. (Fig. 17).

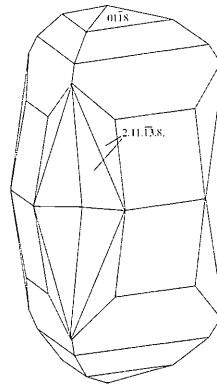


Fig. 17. Characteristic calcite twin crystal from Navršnik district, transition type to 5th type, level 12.

HELENA DISTRICT

The Helena district covers a fairly large area. We have subdivided it in terms of calcite occurrences, which are the topic of this discussion, into the following sections:

- Barbara level, Christmas drift
- Dorojeja section
- Rišperg section
- Igrčevo sub-section
- Staro Igrčevo sub-section
- Carbonate level
- III^d Ceiling level

Barbara level, Christmas drift

Large caverns are opened in the dolomitized limestone along an exploration drift at the Barbara level. The dolomitized limestone was crushed and calcite crystals of rich forms are strewn in it. At places calcite was so abundant that it served as cement of the rock fragments.

The calcite crystals (Helena district, Barbara level) are interesting because they appear in various morphological forms, in several generations and also because they are still accessible even today when most of the Mežica mines calcite occurrences can no longer be visited. The primary crystals are of the scalenohedral habitus with the most developed $\{21\bar{3}4\}$ forms (1st type). These types of crystals are usually

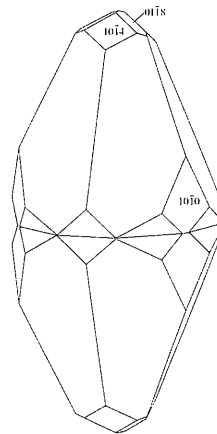


Fig. 18. Calcite twin with twinning plane (0001), 1st type, Helena district, Barbara level, Christmas drift.

up to 1 cm, and very seldom up to 3 cm in size. They are usually translucent or opaque and dark grey, more seldom yellowish or brownish yellow. We determined also forms $\{10\bar{1}0\}$, $\{10\bar{1}4\}$ and $\{01\bar{1}8\}$ on twins with twinning plane (0001) (Fig. 18).

A characteristic calcite crystal from the Christmas drift is shown on fig. 19, too. Such crystals have uniformly developed all present crystal faces, and they belong to the group of barrel-like crystals. We determined forms $\{10\bar{1}0\}$, $\{01\bar{1}8\}$, $\{01\bar{1}5\}$, $\{0.3.\bar{3}.14.\}$, $\{21\bar{3}4\}$, $\{53\bar{8}8\}$, $\{hk\bar{i}l\}^5$ (close to position $\{1.12.\bar{1}3.48.\}$), $\{3.9.\bar{1}2.16.\}$ and $\{25\bar{7}4\}$.

Barrel-like calcite crystals could be twins with a twinning plane (0001). We determined forms $\{10\bar{1}0\}$, $\{01\bar{1}8\}$, $\{01\bar{1}5\}$, $\{0.3.\bar{3}.14.\}$, $\{01\bar{1}2\}$, $\{1.1.\bar{2}.12.\}$, $\{21\bar{3}4\}$, $\{53\bar{8}8\}$, $\{hk\bar{i}l\}^5$ (close to position $\{1.12.\bar{1}3.48.\}$) and $\{25\bar{7}4\}$ (Fig. 20).

Calcite of at least two generations could be clearly distinguished on some of the specimens. The early generation has a developed scalenohedral habitus and belongs to the 1st type of the crystals. We determined forms $\{21\bar{3}4\}$ and $\{01\bar{1}2\}$ (Fig. 21a). The late generation of calcite in most parts covers the early generation, but the original crystal can still be seen clearly at specific spots (Fig. 21b). We determined forms $\{10\bar{1}0\}$, $\{10\bar{1}4\}$, $\{01\bar{1}8\}$, $\{0.3.\bar{3}.14.\}$, $\{hk\bar{i}l\}^1$ (close to position $\{12.1.\bar{1}3.60.\}$), $\{21\bar{3}4\}$, $\{12\bar{3}2\}$, $\{6.18.\bar{2}4.7.\}$ and $\{39.12.\bar{5}1.4.\}$. Scalenohedral and prismatic forms with subordinate rhombohedrons are prevalent on the late generation crystals (Fig. 22).

Calcite crystals from the Christmas drift are usually colourless, grey or occasionally yellowish brown, and translucent. Very rarely are they colourless and transparent. Interestingly, they are distinctively smaller than other individual calcite crystals, despite of being twinned. They do not exceed 1 cm. The twinning plane of these twins is $\{01\bar{1}8\}$, but scalenohedron forms $\{21\bar{3}4\}$ are predominant on 1st type calcite crystals, while the tops are formed of $\{10\bar{1}0\}$, $\{01\bar{1}5\}$, $\{1.1.\bar{2}.12.\}$ and $\{25\bar{7}4\}$ (Fig. 23).

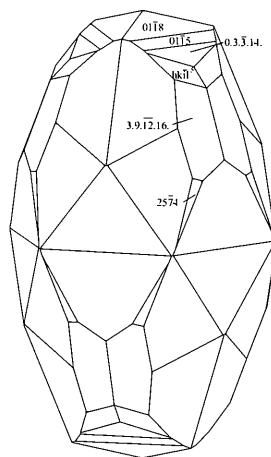


Fig. 19. Barrel-like calcite crystal, 6th type, Helena district, Barbara level, Christmas drift.

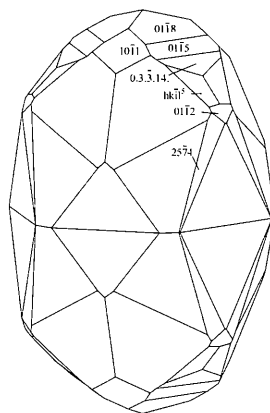


Fig. 20. Calcite twin with twinning plane (0001), 6th type, Helena district, Barbara level, Christmas drift.

In the eastern part of the Barbara level, slightly higher above it, at level +817 m, rhombohedral calcite crystals (2nd type and transition type between 2nd and 3rd type) up to 1.5 cm in size were identified. The predominant crystal forms are $\{10\bar{1}4\}$ and $\{01\bar{1}8\}$, and crystals by their morphology strongly resemble the calcite crystals from the Moring and Union districts (Figs. 5, 6 and 8). They are interesting primarily because of inclusion of a dark grey mineral, most probably galena, while in their turn they are covered with wulfenite crystals.

Doroteja section, level 925 m

The calcite localities in Doroteja were found in large caverns up to 3 x 4 metres in size. The walls were covered with calcite of a distinctive gloss because of which they appear bluish. The fragments that fell from the cavern walls on the floor were cemented by calcite and wulfenite.

Calcite crystals in Doroteja are mostly translucent to transparent, colourless, or grey and opaque. They are usually up to 1cm in size and seldom any bigger. In places the calcite can be strongly corroded and can also contain inclusions of a dark mineral. This gives it a slightly pink appearance. The calcite is distinctively rhombohedral with the dominant crystal form $\{01\bar{1}8\}$ (3rd type). We determined forms $\{10\bar{1}0\}$ and $\{hk\bar{l}\}^1$ (close to position $\{12.1.\bar{1}3.60.\}$) on these crystals, too. (Fig. 24a). Also twins with a twinning plane (0001) were identified (Fig. 24b). They can be covered by bipyramidal wulfenite on which a late generation calcite has grown. The latter is, compared to the earlier generation, fine-grained and frequently snow white. This is probably the calcite deposited in conditions that currently still exist in the mines.

A large geode was opened in the drift in the Rišperg direction, about the level at 940 m. The geode walls were overgrown by grey scalenohedral calcite crystals with dominant crystal form $\{21\bar{3}4\}$ (1st type). The crystals are translucent to opaque, up to 6 cm and more in size.

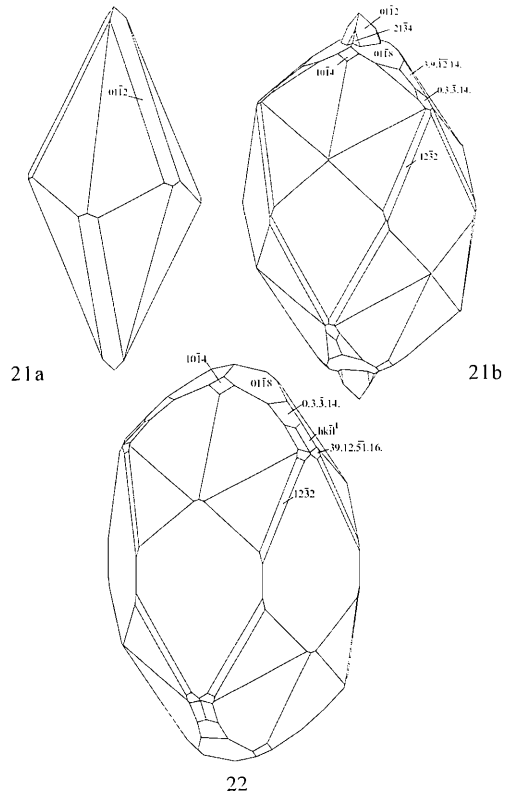


Fig 21. Calcite crystals from Helena district, Barbara level, Christmas drift. The early generation of calcite crystal (1st type) has scalenohedral habit with prevailing forms $\{21\bar{3}4\}$ and $\{01\bar{1}2\}$ (Fig 21.a). The late generation of barrel-like calcite crystal (6th type) partially (Fig. 21b) or completely (Fig. 22) overgrows the calcite crystal of early generation.

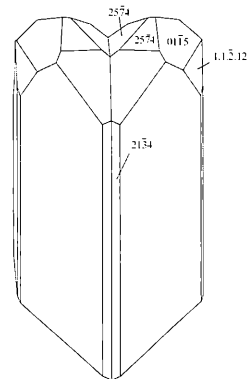


Fig. 23. Calcite twin with twinning plane (01 $\bar{1}8$), 1st type crystal, Helena district, Barbara level, Christmas drift.

Their appearance and morphology resemble the scalenohedral calcite crystals from level 7 of the Navršnik district (Fig. 9). They are distinguished by their matrix – the calcite crystals from level 7 of the Navršnik district grow on a matrix with substantial clay admixture, while those from Doroteja section, level 940 m, are fixed on limestone.

Rišperg section

The typical calcite crystals in Rišperg can attain the size of a fist. Normally they measure from one to two centimeters in diameter. They are translucent, colourless or slightly dim and grey. Characteristic are calcite crystals with predominant forms $\{01\bar{1}8\}$ and $\{10\bar{1}4\}$, 2nd type, and of transition type between 2nd and 3rd type. Also twins with a twinning plane (0001) were identified which are very similar to those from Doroteja. At places they can be covered by a yellow-orange coating.

Igrčevo sub-section

The Igrčevo sub-section is exceptionally rich in diversely shaped calcite. The deposits can be in large, but more often in small caverns. The surrounding rock has been considerably affected by tectonic activity.

Calcite crystals from the Igrčevo sub-section are mostly transparent and colourless. Due to inclusions of galena, they can be grey, or with yellow or orange coatings. The red coated calcite with wulfenite crystals is characteristic here. Calcite crystals are of various morphology.

The Slovenian Museum of Natural History keeps an exceptional specimen of a calcite druse in which the crystals are in the core translucent and slightly dim, but towards the outside they turn yellow and finally almost brown. They are distinguished by an interesting morphology. The crystals on the matrix have well-marked forms $\{10\bar{1}0\}$, $\{0.7.7.12.\}$, $\{05\bar{5}6\}$ and $\{1.9.\bar{1}0.8.\}$ (Fig. 25). They are determined as 5th type of calcite crystals. Additionally to that occur

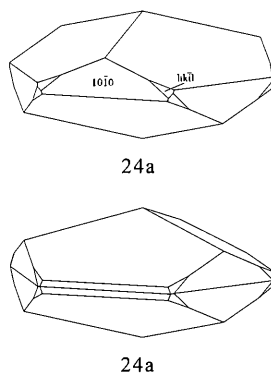


Fig. 24. Rhombohedral crystals of calcite with the most developed form $\{01\bar{1}8\}$, 3rd type crystals, Helena district, Doroteja section (Fig. 24a). Such crystals could be twinned with twinning plane (0001) (Fig. 24b).

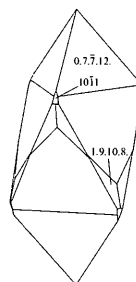


Fig. 25. Characteristic calcite crystal, 5th type, Helena district, Igrčevo sub-section.

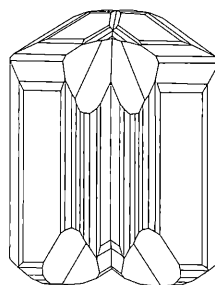


Fig. 26. Calcite twin with twinning plane (0118) from Helena district, Igrčevo sub-section, crystals of 2nd type. The single crystals are one of the most characteristic calcite crystals from Mežica mine (see Fig. 6).

crystals 6 cm in size, of a morphology that has not yet been fully determined.

The crystals on the matrix are translucent, of a characteristic rhombohedral habitus with predominant form $\{10\bar{1}4\}$, and belong to the 2nd type of the calcite crystals. Transparent and colourless crystals grow from this matrix, they are partially covered with a brown coating and up to 3 cm in size. Individual crystals have developed scalenohedron and rhombohedron forms, and they resemble the crystals from level 5 in the Union district (see Fig. 6). These are twins with a twinning plane $\{01\bar{1}8\}$ with individual crystals up to 3 cm in size (Fig. 26)

Greenish grey calcite crystals compose nicely shaped druses, are translucent and mostly have a scalenohedral habitus with dominant form $\{21\bar{3}4\}$ (1st type). They measure up to 1 cm in size. Twins with (0001) (Fig. 27) and (01 $\bar{1}8$) twinning plane are present. They are similar to those from the Navršnik district, level 7 (see Figs. 11a and 11b). An interesting feature is the relatively small size of twins with a twinning plane (01 $\bar{1}8$), not exceeding the height of 0.6 cm, while the basal twins can be up to 3 cm high.

The calcite crystals are translucent, slightly yellowish to colourless, and partially covered with a yellow-orange coating. Scalenohedrons $\{3.1.\bar{4}.12.\}$ prevail, accompanied by prismatic form $\{10\bar{1}0\}$ and subordinate form $\{21\bar{3}4\}$ (7th type). Such crystals are formed by dissolution of primary crystals which were most probably the crystals of 1st type with prevailing form $\{21\bar{3}4\}$. Tiny colourless rhombohedral crystals with dominant crystal form $\{01\bar{1}8\}$ and less developed forms $\{hk\bar{1}l\}$ ⁵ and $\{10\bar{1}4\}$ (3rd type) can be found on the tips of these crystals or on the edges between two such crystals, which gives an impression of their oriented overgrowth (Fig. 28).

Some interesting calcite crystals also identified in the Igrčevo sub-section are colourless or translucent due to inclusions of dark grey galena. Their interesting morphology is emphasised with acute rhombohedrons. We

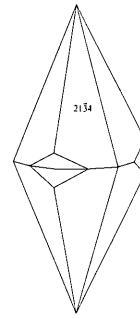


Fig. 27. Calcite (1st type) twin with twinning plane (0001) from Helena district, Igrčevo sub-section.

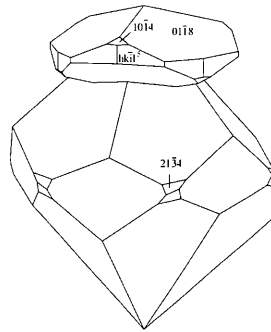


Fig. 28. Two generations of calcite crystal from Helena district, Igrčevo sub – section. The habit of the early crystals is a result of solving the primary crystals. Such crystals belongs to the 7th type. They could be overgrown with calcite crystals of 3rd type.

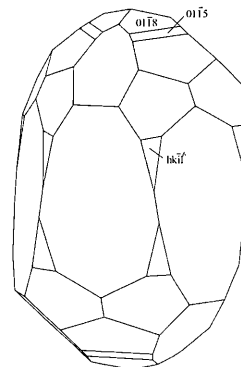


Fig. 29. Calcite crystal from Helena district, Igrčevo sub – section, 5th type.

determined $\{01\bar{1}8\}$, $\{01\bar{1}5\}$, $\{01\bar{1}4\}$, $\{03\bar{3}8\}$, $\{01\bar{1}2\}$, $\{0k\bar{k}1\}$ $\{3.1.4.12.\}$, $\{hk\bar{i}l\}$ ⁴ (close to position $\{34.1.35.4.\}$), $\{14\bar{5}8\}$, $\{hk\bar{i}l\}$ ⁶ (close to position $\{3.14.17.8.\}$) (Figs. 29 and 30). These are usually up to 1 cm and only exceptionally up to 2 cm high. Basal twins are also present.

A genuine karst cave with stalactites was discovered in the Igrčevo section, too.

Staro Igrčevo sub-section

The calcite occurs in large caverns, cracks and smaller or larger lenses. Calcite crystals from the Staro Igrčevo sub-section (+820 m) are transparent, greyish due to galena inclusions, or yellowish to orange due to coatings of other minerals. They are distinguished by their shiny crystal forms and prismatic habitus. We determined forms $\{10\bar{1}0\}$, $\{01\bar{1}8\}$, $\{03\bar{3}8\}$ and $\{01\bar{1}1\}$ (Fig. 31). The crystals are up to one centimetre in size and only exceptionally up to 2 cm.

Additionally to the prismatic crystals, barrel-like calcite crystals (6th type) are found in the Staro Igrčevo area. We determined forms $\{10\bar{1}0\}$, $\{10\bar{1}4\}$, $\{6.1.7.20.\}$, $\{21\bar{3}4\}$, $\{12\bar{3}8\}$, $\{13\bar{4}4\}$ and $\{hk\bar{i}l\}$ ⁶ (close to position $\{3.14.17.8.\}$) (Fig. 32). They are milky to colourless and translucent to transparent. In places they are covered with a coating of brown minerals and yellow to yellow-orange flat wulfenite crystals. Most of the crystals are 1 to 2 cm in size, only exceptionally up to 3 cm. On rare occasions there are wulfenite and descloizite crystals next to the calcite crystals. Such specimens were also found in the Igrčevo area.

A special feature from this part of the mines are twins with a twinning plane $\{01\bar{1}8\}$ (Fig. 33). Along it the prismatic crystals are twinned and at the same time rotated which results, from the morphological aspect, into a unique twin (Figs. 33a, 33b, 33c, 33d, 33e and 33f).

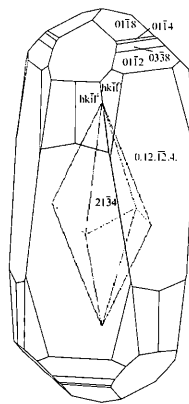


Fig. 30. Two generations of calcite crystal from Helena district, Igrčevo sub – section. The early generation is scalenohedral calcite with developed form $\{21\bar{3}4\}$ (1st type) and late generation of calcite crystal with dominant acute rhombohedrons (5th type).

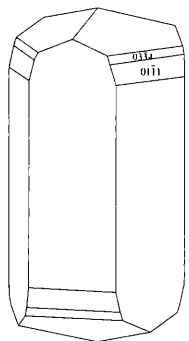


Fig. 31. Calcite crystal of 4th type with prevailing form $\{10\bar{1}0\}$ and well developed form $\{01\bar{1}8\}$ from Helena district, Staro Igrčevo sub – section.

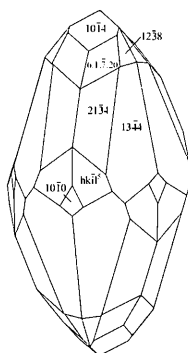


Fig. 32. Calcite barrel – like of 6th type crystal from Helena district, Staro Igrčevo sub – section.

Carbonate level

Rhombohedral calcite crystals of the 2nd type are characteristic for the Carbonate level. They are of interest because of their hydrozincite coating, and are for this reason snow white and opaque. They measure up to 1 cm in diameter and resemble the crystals from the Union or Moring districts, very similar to those shown on Figure 2.

At the Carbonate level occur rare calcite crystals up to 2 cm in size with prevalent rhombohedron forms $\{10\bar{1}4\}$. We determined also $\{10\bar{1}0\}$, $\{10\bar{1}1\}$ and $\{01\bar{1}8\}$. These types of crystals can be termed basal twins (Fig. 34a). Especially interesting are cases of two such basal twins overgrowing each other, as shown in Figs. 34b and 34c.

IIIrd Ceiling level

The IIIrd Ceiling level is situated below the Doroteja level at 845 m. The calcite in these higher areas of the mines is coated with des-cloizite or limonite. Galena inclusions and clay admixtures are also present.

The calcite crystals are translucent to transparent, colourless or, due to inclusion, greyish. They can be covered with a yellow, orange or brown coating. They are up to 2 cm in size, and seldom bigger. The crystals are distinctly rhombohedral, 3rd type, with prevailing form $\{01\bar{1}8\}$, and similar to those at level +300 m of the Union district and those in level 7 of the Union–Moring districts.

Calcite crystals from the IIIrd Ceiling level can occur also in a scalenohedral habitus, belonging to the 1st type of calcite crystals. They are translucent and yellowish to milky white. The crystal faces are distinctively dull. We identified a basal twin of scalenohedral habitus with the prevailing form $\{21\bar{3}4\}$ (see Fig. 27). This specimen is of special interest mainly because of its matrix that is composed of white dolomite crystals up to 2 mm in size.

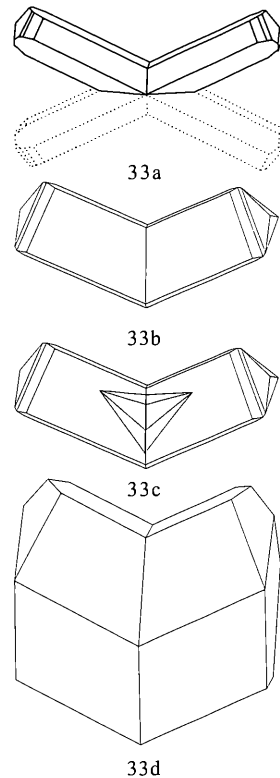


Fig. 33. Characteristic and unique calcite twinn crystals (4th type) from Staro Igrčevo (Fig. 33a). Their twinning plane is $\{01\bar{1}8\}$ (Fig. 33b). They could have overgrown a twinned crystals of 1st type with the same twinning plane (Fig. 33c). Calcite twinn crystal from Staro Igrčevo with twinning plane $\{01\bar{1}8\}$ (Fig. 33d).

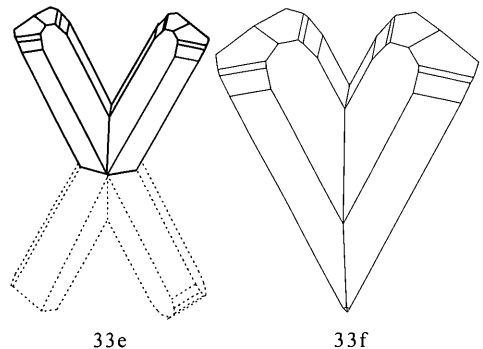


Fig 33. Single calcite crystals of type 4 from Staro Igrčevo (see Fig.31) form twins with a twinning plane $\{01\bar{1}8\}$. Their idealised drawing is shown on Fig. 33e while the real crystal looks like that on Fig.33f.

FRIDRIH DISTRICT

The Fridrih district is in the northeastern part of Mežica mines. Calcite crystals from level 5 were investigated.

Fridrih district, level 5

On level 5 of the Fridrih district, stopes no. 2, level +602 m, wulfenite and anglesite were found additionally to calcite. At this location in the Mežica mines anglesite was first found in crystals visible to the naked eye. Anglesite always appears with galena and in limonitized cracks. The empty spaces were filled with mineralized water from which the anglesite crystallized.

Calcite crystals from level 5 of the Fridrih section are translucent to transparent, and colourless. Sometimes the crystals appear milky white because of the matrix and the small size of the crystals. Generally the crystals are relatively small, up to 3 mm, but larger crystals can grow from this matrix, most often as twins. These can be up to 1.5 cm in size. The crystals have well developed forms $\{21\bar{3}4\}$ and $\{01\bar{1}8\}$, while the $\{10\bar{1}0\}$, $\{10\bar{1}4\}$ and $\{01\bar{1}2\}$ are poorly expressed (Fig. 35a). Such crystals are classified to the transitional type between 1st and 3rd type. They can be twins with a twinning plane (0001) (Fig. 35b).

STARI FRIDRIH DISTRICT

The Stari Fridrih district is in the north-eastern part of the Central mine in Mežica. It is one of the oldest districts in the Mežica mines. Characteristic for the Stari Fridrih district at level 651 m are occurrences of “cave pearls” which are of light to dark brown colour. Other forms of calcite were not identified.

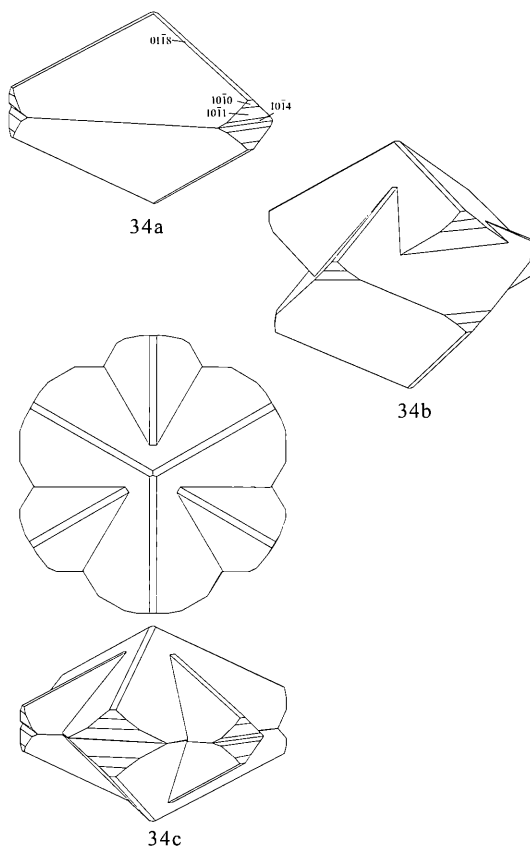


Fig. 34. Calcite twinn crystals from Helena district, Carbonate level. Calcite crystal of 2nd type with dominant form $\{10\bar{1}4\}$ could be twinned with twinning plane (0001) (Fig. 34a). Penetration twins (Fig. 34b) of twinn crystals (as shown on Fig. 34a). The penetraton twins viewed in the clinographic projection and in the direction of axis c (Fig. 34c).

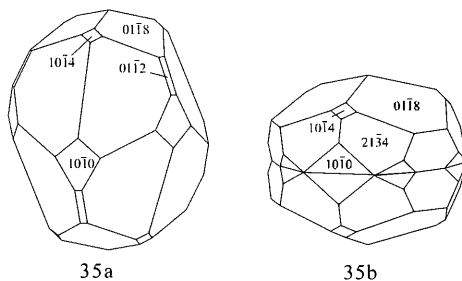


Fig. 35. Calcite crystal of transitional type between 1st and 3rd type with dominant forms $\{21\bar{3}4\}$ and $\{01\bar{1}8\}$ from Fridrih district, level 5 (Fig. 35a) and the same crystal as basal twin (Fig. 35b).

GRABEN DISTRICT

The Graben district is probably the oldest district in the Mežica mine. The documents show that it was mined almost 300 years ago.

The calcite crystals from levels 8, 12 and 12 to 14 were investigated. A special feature of level 5 of the Graben district are the “cave pearls” coated by hydrozincite and therefore white.

Graben, level 8

A nest was opened in the exploration drift on level 8 of the Graben district, with walls covered by tiny calcite crystals.

The calcite crystals in level 8 of the Graben district are in its western part essentially colourless with a developed acute negative rhombohedrons and acute negative scalenohedrons (5th type, Fig. 36). We determined forms $\{10\bar{1}0\}$, $\{7.0.\bar{7}.16.\}$ and $\{07\bar{7}8\}$. In places occur inclusions of black or red minerals in them, which gives them a red or black appearance. In some cases phantom growth is clearly visible, when there are inclusions of a black mineral in early generation calcite with prevailing forms $\{10\bar{1}0\}$ and $\{01\bar{1}8\}$ (4th type), and both are overgrown with late generation calcite. There is a similar phenomenon with red inclusions. Individual crystals are usually up to 0.5 cm in size, and rarely reaching 1 cm.

Graben, level 12

Level 12 of the Graben district was a working drainage drift in the past between Moring and Graben. Jagged calcite crystals appeared in cracs filled with clay. These crystals are translucent and colourless. Their tips are shaped so that they appear serrated. Such growth usually appears in places where rhombohedral forms would be expected. These types of crystals can be turbid, milky or, due to inclusions, light brown. They reach up to 5 cm. In their matrix occur crystals with developed acute

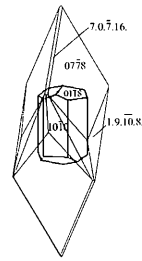


Fig. 36. Two generations of calcite crystals from Graben district, level 8. The early generation of calcite crystals belong to 4th type and overgrown crystals belong to 5th type with prevailing forms $\{07\bar{7}8\}$.

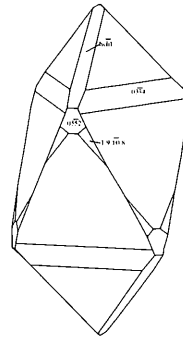


Fig. 37. Calcite crystal with dominant forms $\{012\}$ and $\{07\bar{7}8\}$ from Graben district, level 12 (5th type).

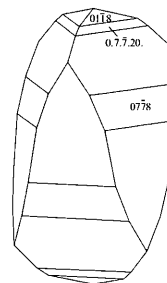


Fig. 38. Characteristic calcite crystal of 5th type, Graben district, level 12.

negative rhombohedrons and acute negative scalenohedrons, and they belong to the 5th type. We determined forms $\{h0\bar{h}l\}^1$ (close to position $\{17.0.\bar{1}7.64.\}$), $\{01\bar{1}8\}$, $\{0.7.\bar{7}.20.\}$, $\{01\bar{1}2\}$, $\{03\bar{3}4\}$, $\{07\bar{7}8\}$, $\{05\bar{5}2\}$ and $\{1.9.\bar{1}0.8\}$ (Figs. 37, 38 and 39).

The crystals from level 12 of the Graben district appear translucent to opaque, light brown and of simple morphology. Crystals with a developed form $\{07\bar{7}8\}$ are prevalent. The crystal faces are uneven, and the entire crystals do not exceed the height of 1cm, only exceptionally 1.5 cm. In several cases two generations of calcite could have been established. Characteristic of the early generation are relatively narrow crystals stretched in the direction of the c axis, with developed negative scalenohedron $\{1.9.\bar{1}0.8.\}$, and subordinate $\{03\bar{3}4\}$ and $\{30\bar{3}2\}$ forms (Figs. 40a and 40b). These types of crystals can be surrounded by simple $\{07\bar{7}8\}$ rhombohedral crystals of the second generation (Fig. 40c), which usually completely cover the scalenohedral crystals (Fig. 40d).

Graben, Komore, levels 12 to 14

Characteristic for the Graben district is the relatively large amount of magnesium. Small geodes were found in the levels 12 to 14 with dolomite and calcite crystals (8 to 0.5 cm) surrounded by asbestos.

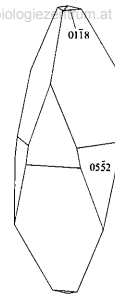
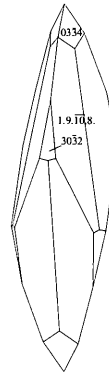
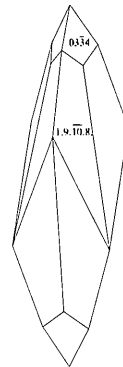


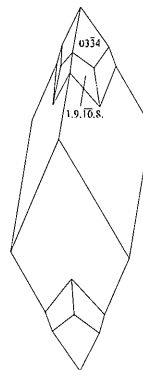
Fig.39. Calcite crystal of 5th type from Graben district, level 12.



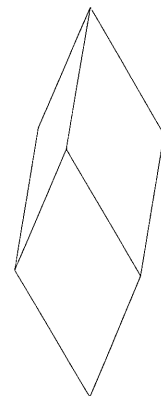
40a



40b



40c



40d

Fig. 40. Calcite crystals of 5th type from Graben district, level 12. Calcite crystals of early generation with prevailing acute negative scalenohedron of 5th type (Figs. 40a and 40b) could be partially (Fig. 40c) or completely (Fig. 40d) overgrown with calcite of late generation with prevailing acute negative rhombohedron of the 5th type, too.

Table 1: Identified calcite crystal faces and indices corrected to real unit cell parameters.

Tabela 1. Določeni kristalni liki kalcita ter indeksi, ki so usklajeni s parametri realne osnovne celice

No	Forms	
	a : c = 1:0,373	a : c = 1:0,855
1	{10 $\bar{1}$ 0}	{10 $\bar{1}$ 0}
2	{10 $\bar{1}$ 5}	{40 $\bar{4}$ 5}
3	{10 $\bar{1}$ 4}	{10 $\bar{1}$ 1}
4	{h0 \bar{h} l} ¹ ~ {17.0. $\bar{1}$ 7.64.}	{h0 \bar{h} l} ¹ ~ {17.0. $\bar{1}$ 7.16.}
5	{30 $\bar{3}$ 8}	{30 $\bar{3}$ 2}
6	{7.0. $\bar{7}$.16.}	{70 $\bar{7}$ 4}
7	{10 $\bar{1}$ 1}	{40 $\bar{4}$ 1}
8	{30 $\bar{3}$ 2}	{60 $\bar{6}$ 1}
9	{20 $\bar{2}$ 1}	{80 $\bar{8}$ 1}
10	{h0 \bar{h} l} ² ~ {50 $\bar{5}$ 1}	{h0 \bar{h} l} ² ~ {20.0. $\bar{2}$ 0.1.}
11	{0.1. $\bar{1}$.12.}	{01 $\bar{1}$ 3}
12	{01 $\bar{1}$ 8}	{01 $\bar{1}$ 2}
13	{01 $\bar{1}$ 5}	{04 $\bar{4}$ 5}
14	{0.3. $\bar{3}$.14.}	{06 $\bar{6}$ 7}
15	{01 $\bar{1}$ 4}	{01 $\bar{1}$ 1}
16	{0.7. $\bar{7}$.20.}	{07 $\bar{7}$ 5}
17	{03 $\bar{3}$ 8}	{03 $\bar{3}$ 2}
18	{01 $\bar{1}$ 2}	{02 $\bar{2}$ 1}
19	{0.7. $\bar{7}$.12.}	{07 $\bar{7}$ 3}
20	{03 $\bar{3}$ 4}	{03 $\bar{3}$ 1}
21	{05 $\bar{5}$ 6}	{0.10. $\bar{1}$ 0.3.}
22	{07 $\bar{7}$ 8}	{07 $\bar{7}$ 2}
23	{01 $\bar{1}$ 1}	{04 $\bar{4}$ 1}
24	{03 $\bar{3}$ 2}	{06 $\bar{6}$ 1}
25	{05 $\bar{5}$ 2}	{0.10. $\bar{1}$ 0.1.}
26	{0k \bar{k} l} ¹ ~ {03 $\bar{3}$ 1}	{0k \bar{k} l} ¹ ~ {0.12. $\bar{1}$ 2.1.}
27	{1.1. $\bar{2}$.12.}	{11 $\bar{2}$ 3}
28	{11 $\bar{2}$ 6}	{22 $\bar{4}$ 3}
29	{4.1. $\bar{5}$.24.}	{41 $\bar{5}$ 6}
30	{hk \bar{i} l} ¹ ~ {12.1. $\bar{1}$ 3.60.}	{hk \bar{i} l} ¹ ~ {12.1. $\bar{1}$ 3.15.}
31	{5.1. $\bar{6}$.28.}	{51 $\bar{6}$ 7}
32	{hk \bar{i} l} ² ~ {12.1. $\bar{1}$ 3.56.}	{hk \bar{i} l} ² ~ {12.1. $\bar{1}$ 3.14.}
33	{3.1. $\bar{4}$.12.}	{31 $\bar{4}$ 3}
34	{7.1. $\bar{8}$.24.}	{71 $\bar{8}$ 6}
35	{6.1. $\bar{7}$.20.}	{61 $\bar{7}$ 5}
36	{4.1. $\bar{5}$.12.}	{41 $\bar{5}$ 3}
37	{21 $\bar{3}$ 4}	{21 $\bar{3}$ 1}

38	{5388}			{5382}		
39	{12.1.13.16.}			{12.1.13.4.}		
40	{hkīl} ³	~	{14.1.15.2.}	{hkīl} ³	~	{28.2.30.1.}
41	{hkīl} ⁴	~	{34.1.35.4.}	{hkīl} ⁴	~	{34.1.35.1.}
42	{hkīl} ⁵	~	{1.12.13.48.}	{hkīl} ⁵	~	{1.12.13.12.}
43	{1238}			{1232}		
44	{1.4.5.12.}			{1453}		
45	{1.8.9.16}			{1.8.9.4}		
46	{1458}			{1452}		
47	{1234}			{1231}		
48	{2.7.9.12.}			{2793}		
49	{3.9.12.16.}			{3.9.12.4.}		
50	{1.6.7.10.}			{2.12.14.5.}		
51	{1344}			{1341}		
52	{1.16.17.20.}			{1.16.17.5.}		
53	{1232}			{2461}		
54	{1.9.10.8}			{1.9.10.2.}		
55	{2.11.13.8.}			{2.11.13.2.}		
56	{2574}			{2571}		
57	{hkīl} ⁶	~	{3.14.17.8.}	{hkīl} ⁶	~	{3.14.17.2.}
58	{3.9.12.14.}			{6.18.24.7.}		
59	{39.12.51.16.}			{39.12.51.4.}		

Conclusion

The calcite from the Mežica mines crystallized on the walls of cracks and smaller caverns, as reported by ŠTRUCL (1984). Fully developed crystals can also be found in the clay-filled parts of the cracks and caverns.

The calcite crystals were classified according to their morphology into seven main types (GRIGORJEV & ŽABIN, 1975):

1. type: scalenohedral crystals with dominant crystal form {2134},
2. type: rhombohedral crystals with dominant crystal form {1014},
3. type: rhombohedral crystals with dominant crystal form {0118},
4. type: prismatic crystals with dominant crystal forms {1010} and {0118},
5. type: very acute rhombohedral to scalenohedral crystals with dominant crystal forms of negative scalenohedrons and negative rhombohedrons,
6. type: barrel-like crystals with no dominant forms and
7. type: crystals with forms which are the result of partial dissolution of crystals of earlier generation with dominant form {3.1.4.12.}.

We identified 59 different forms and coordinated their indices in accordance with the parameters of the unit cell (Table 1.).

The early generation of calcite crystals are scalenohedral crystals of the 1st type with the dominant form {2134}. Later generation of calcite crystals are prismatic crystals of 4th type and

rhombohedral crystals with dominant crystal forms $\{10\bar{1}4\}$ (2nd type) and $\{01\bar{1}8\}$ (3rd type). The acute rhombohedral and acute scalenohedral crystals are significant for the latest generation of calcite crystals (5th type).

Coarse grained calcite crystals from the Mežica mines are mainly associated to the Union system cracks that cover the following parts of the sections (ŠTRUCL, 1984):

1. Barbara – east (from 985 to 758 m),
2. Igrčevo (from 758 to 604 m),
3. Staro Igrčevo (from 900 to 664 m),
4. Union (from 604 to 300 m) and
5. Moring (from 604 to 300 m).

In addition to the above there are also calcite deposits in the Navršnik (Bargate), Fridrih, Stari Fridrih, Graben and Mučevo districts. Calcite from the Mežica mines has a very diverse morphology. We have identified seven habitus of calcite crystals as it was already mentioned.

The most characteristic habitus of calcite from the Mežica mines is the rhombohedral habitus with prevalent positive rhombohedron form $\{10\bar{1}4\}$ and negative rhombohedron form $\{01\bar{1}8\}$. These types of crystals are especially characteristic of the Union, Moring and Helena districts. They are usually colourless, milky white and translucent to transparent. In the Moring district (south, level 8) the crystals have well developed rhombohedral forms $\{10\bar{1}4\}$ and $\{01\bar{1}8\}$, while the prismatic $\{10\bar{1}0\}$ and scalenohedral form $\{21\bar{3}4\}$ are poorly expressed. In the Navršnik, or Bargate district scalenohedral crystals with dominant form $\{21\bar{3}4\}$ are more common. They are in most cases grey to greenish-grey and grow from a matrix in which light and dark carbonate alternates with argillaceous layers. Scalenohedral crystals with dominant form $\{21\bar{3}4\}$ are also characteristic of the Igrčevo section where they rarely reach over 1 cm in height. Very rare scalenohedral crystals with dominant form $\{21\bar{3}4\}$, similar to those from the Navršnik district, were found in the passage between the Doroteja and Rišperg sections. They differ by their matrix. In the latter the greenish-grey calcite crystals grow on a compact rock matrix, and are without clay admixtures. Scalenohedral crystals with dominant form $\{21\bar{3}4\}$ can also be found in the third Ceiling level and in the Staro Igrčevo sub-section. Here they are milky or colourless and translucent. Rarely they are accompanied by desclouzite and wulfenite crystals. The rarest are long prismatic calcite crystals with dominant forms $\{10\bar{1}0\}$ and $\{01\bar{1}8\}$, which were also identified in the Staro Igrčevo sub-section. Short and medium long prismatic calcite crystals with dominant forms $\{10\bar{1}0\}$ and $\{01\bar{1}8\}$ are more frequent in the extreme western part of level 10 in the Navršnik district. Some very rich calcite localities were found in this part. The crystals were located in caverns up to 2 m high filled with chocolate-brown clay. The calcite in Doroteja was also found to occur in large caverns. These measure up to 3 x 4 metres. Crystals with dominant form $\{01\bar{1}8\}$ are predominant. They can be covered by wulfenite on which a later generation of calcite has grown. Several generations of calcite were identified also in samples from some other parts of the Mežica mines. Thus, for example, on level 7 of the Navršnik district the early generation of calcite with dominant form $\{21\bar{3}4\}$ (type 1) is overgrown by a late generation of calcite with well developed crystals with no dominant forms (type 6).

The case of the calcite from the Graben district and that from Christmas drift (Barbara level) is similar. The Christmas drift is famous for calcite rich in forms with well developed crystals of two generation. Another characteristics of the Graben district are crystals with acute negative scalenohedron form $\{1.9.\bar{1}0.8\}$ and acute negative rhombohedron form $\{0778\}$. These are in most part small and of simple morphology. In morphological terms they cannot be linked with the

majority of the calcite from other districts of the Mežica mines. It is more than obvious that the crystallization conditions in the Graben district were different. This is further confirmed by calcite and dolomite crystals overgrown with asbestos.

Twinned crystals from the Mežica mines are well developed. Usually they are two to five times the size of single crystals grown on the same specimen. The most frequent are basal twins, somewhat rarer are twins with the twinning plane $(01\bar{1}8)$, and the rarest those with twinning along plane $(01\bar{1}2)$. The latter type of twins was found only in the Navršnik district.

Table 2. Identified calcite twins from Mežica mines

Tabela 2. Določeni kristali dvojčki kalcita iz mežiških rudišč

Crystal type / Twinning plane	(0001)	$(01\bar{1}8)$	$(01\bar{1}2)$
1 st	x	x	x
2 nd	x	x	
3 rd	x		
4 th	x	x	
5 th	x		

Legend:

identified twin

not identified twin

Calcite from the Mežica mines is often coated with thin film of some other minerals which can be yellow, brown, orange or red coloured. They probably consist of various forms of iron oxide. Calcite crystals can also be covered with snow white hydrozincite, which is especially characteristic for calcite from the Carbonate level. On rare occasions the calcite crystals are covered by minute yellowish-brown hemimorphite crystals. This phenomenon is tied to the part of the mines where the calcite and zinc ore deposits occur close together. Such is the case in the southern part of level 8 in the Moring district. Calcite crystals can be covered by wulfenite crystals. This mineral occurs mostly in the higher levels of the mines, like Staro Igrčevo or Doroteja and Rišperg. In some cases, calcite was found together with saddle shaped dolomite crystals, as for instance in the IIIrd Ceiling level and in the Graben district. Among other characteristic calcite coatings by descloizite crystals up to 1 millimetre in size should be mentioned. They are characteristic mostly for the Union district next to the Union main shaft. They are dark brown to almost black and in nice contrast with yellow wulfenite.

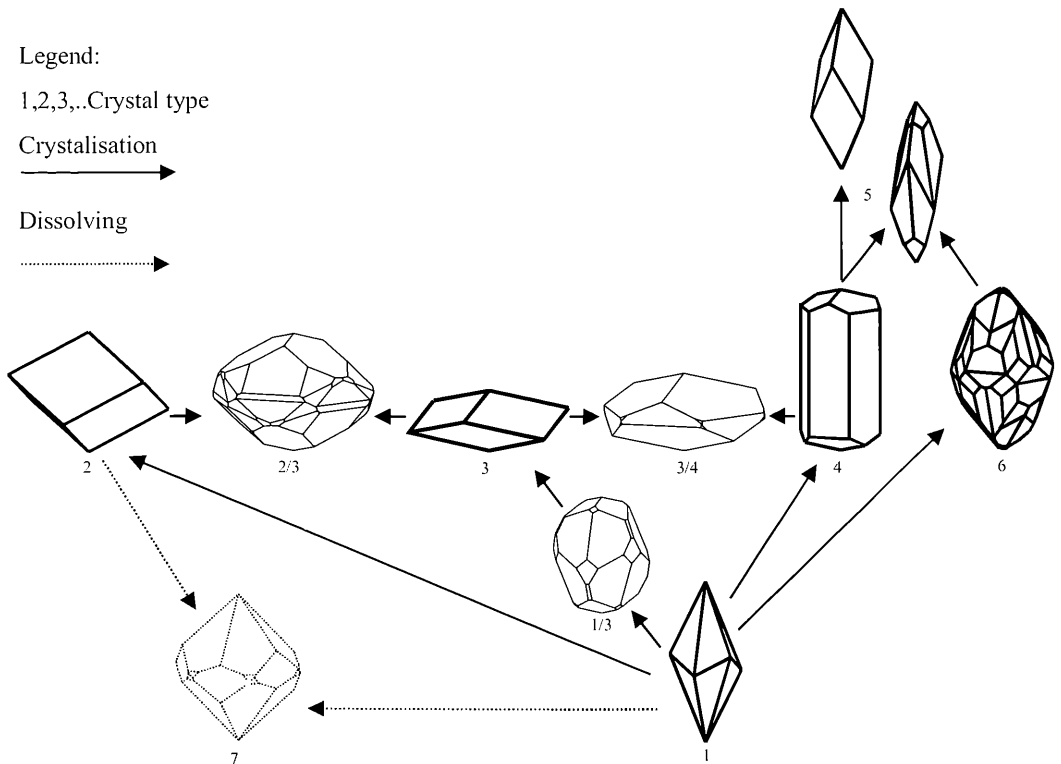


Fig. 41 Succession of crystallization of calcite crystals in Mežica mines.

It can be summarized that calcite crystals grew under varying conditions, as proved by their morphology. The crystals of 1st type have been formed before crystals of type 2, 3, 4 and 6. The crystals of type 4 crystallized before those of type 5. The position of calcite crystals of 2nd and 3rd type is not certain. It seems that crystals of type 1 were the first generation of calcite crystals, while those of 5th type were one of the latest formed in the Mežica mines. The crystals of type 7 were formed by dissolution of the type 1 and 2 crystals. The succession of crystallization of calcite crystals in Mežica mines is presented in fig. 41.

Povzetek

Članek obravnava značilnosti pojavljanja in morfologijo kristalov kalcita iz mežiških rudišč. Na 58 kristalih kalcita smo določili 59 različnih kristalnih likov in njihove indekse uskladili s parametri osnovne celice. Glede na habitus kristalov kalcita smo ločili romboedrske, skalenoedrske in prizmatске kristale in jih še podrobneje razvrstili v podskupine glede na razvitost posameznih kristalnih likov. Ločili smo posamezne kristale in kristale dvojčke. V nekaterih primerih smo lahko na osnovi morfologije ločili kalcite vsaj dveh generacij. Za prvo je značilen izrazito skalenoedrski habitus, medtem ko ima druga generacija kalcita poleg skalenoedrov razvite vsaj še ploskve prizem in romboedrov. Zadnji so kristalih strmoromboedrski in strmoskalenoedrski kristali kalcita.

Acknowledgements

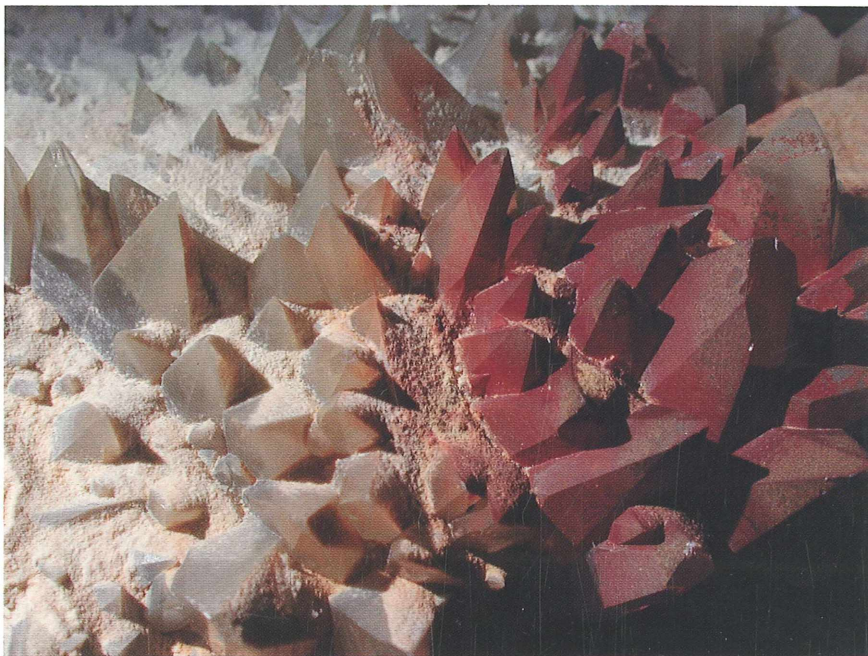
The authors of this paper would like to thank several institutions for their cooperation in permitting us to inspect their collections. These are the Slovenian Museum of Natural History, the Geology Department of the Faculty of Natural Sciences and Engineering, Ljubljana, the Lead and Zinc Mines of Mežica (undergoing closure) and the Croatian Natural History Museum in Zagreb. The research would be incomplete without the cooperation of a number of experts and private collectors. We would therefore like to thank everyone who had cooperated and in any way contributed that the crystals in the tunnels below the Peca mountain are still accessible even now when the mines are being closed down.

The investigations which made the results presented in this paper possible received the financial assistance of the MESS (Ministry of Education, Science and Sport) of the Republic of Slovenia within a framework of international cooperation between Croatia and Slovenia.

References

- Dolenc, T., J. Kušej, & J. Pezdič, 1982: Izotopska sestava kisika in ogljika v prikamnini in kalcitu diskordantnih rudnih teles unionskega sistema v Mežici. Zbornik radova jubilarnega kongresa geologa Jugoslavije (Budva), pp. 693 – 710.
- GREGORJEV, D. P. & A. G. ŽABIN, 1975: Ontogeneza mineralov. Izdajateljstvo Nauka, pp. 133-135, Moskva.
- FAJMUT-ŠTRUCL, S. & I. ŠTRUCL, 1992: Minerals in the karstifield triassic orebearing carbonate rocks of the northern Karavanke. *Acta carsologica* **21**, pp.137 – 150.
- KNEZ, M. & N. ZUPAN, 1992: Minerali v slovenskih kraških jamah. Inštitut za raziskovanje Krasa ZRC-SAZU, pp. 43, Postojna.
- KLEIN, C. & C. S. HURLBUT, 1999: Manual of mineralogy, (after James J. Dana). John Wiley & Sons, pp. 405-408.
- MEŽNAR, F. & S. URAN, 1965: Razvoj jam in načina rudarjenja. v: Geološke značilnosti mežiških rudišč in njih okolica. Zbornik »300 let mežiški rudniki« (urednik: I. Štrucl), pp. 115-139, Mežica.
- PALACHE, C., H. BERMAN, & C. FRONDEL, 1951: Dana's System of Mineralogy, Seventh edition, Vol. II – J. Wiley / Sons, Inc. & Chapman and Hall LTD, 1124 pp., New York – London.
- ŠTRUCL, I., 1984: Geološke, geokemične in mineraloške značilnosti rude in prikamnine svinčevo-cinkovih orudenj mežiškega rudišča. *Geologija – Razprave in poročila*, 27. Knjiga, pp. 215 – 327.
- ŠTRUCL, I., S. BRUMEN, M. PUNGARTNIK, B. OGORELEC, M. TRAJANOVA, & B. BOLE, 1999: Geološka zgradba okolice Črne na Koroškem. Poročilo, Geološki zavod Slovenije in Rudnik svinca in cinka Mežica v zapiranju, pp. 15, Ljubljana.
- TOMŠE, P., 1996: Minerali oksidacijske cone mežiških rudišč. Pripraviška naloga, pp. 36, Mežica.
- VIDRIH, R. & V. MIKUŽ, 1996: Kalcit v Sloveniji. Galerija Avsenik, katalog 4. razstave, pp. 9 – 19, Begunje na Gorenjskem.
- VIDRIH, R. & V. MIKUŽ, 1995: Minerali na Slovenskem. Tehniška založba Slovenije, pp. 379, Ljubljana.
- ZORC, A., 1955: Rudarsko geološka karakteristika rudnika Mežica. *Geologija*, 3. knjiga: 24 – 80.
- ŽORŽ, M., R. ALEKSANDER, B. MIRTič, & F. KRIVOGRAD, 1998: Morphology of wulfenite crystals from Mežica Mines. *Materials and Geoenvironment*, Vol. **45** (3-4): 315 - 344.

SLIKOVNA PRILOGA / APPENDIX



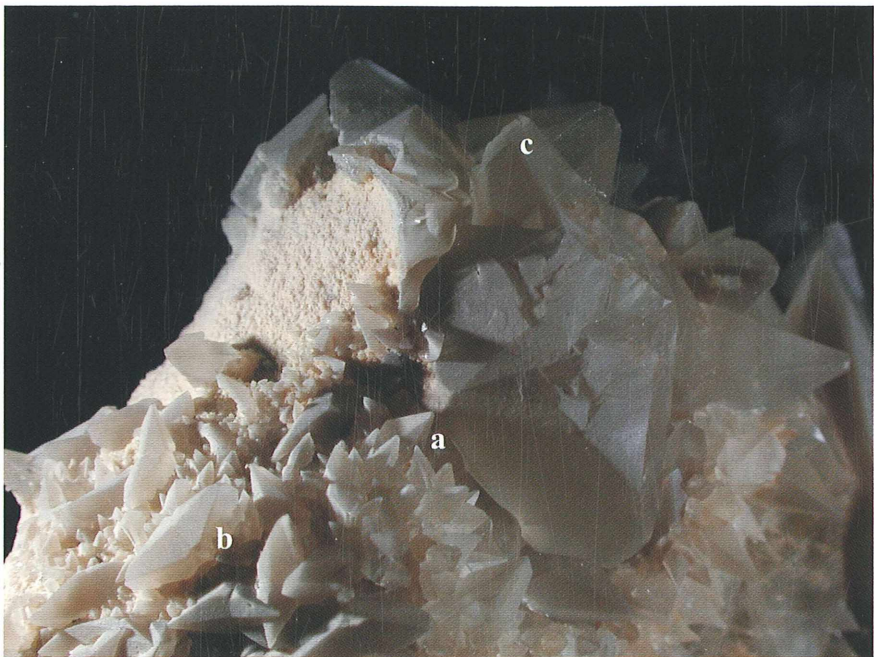
01. Typical scalenohedral crystals (1st type) of calcite from Bargate district, level 7. Coatings could cover some of them. They measure up to 2 cm along axis *c*.



02. Scalenohedral crystals from Third Ceiling level are actually basal twins with twinning plane (0001). They are up to 7cm high.



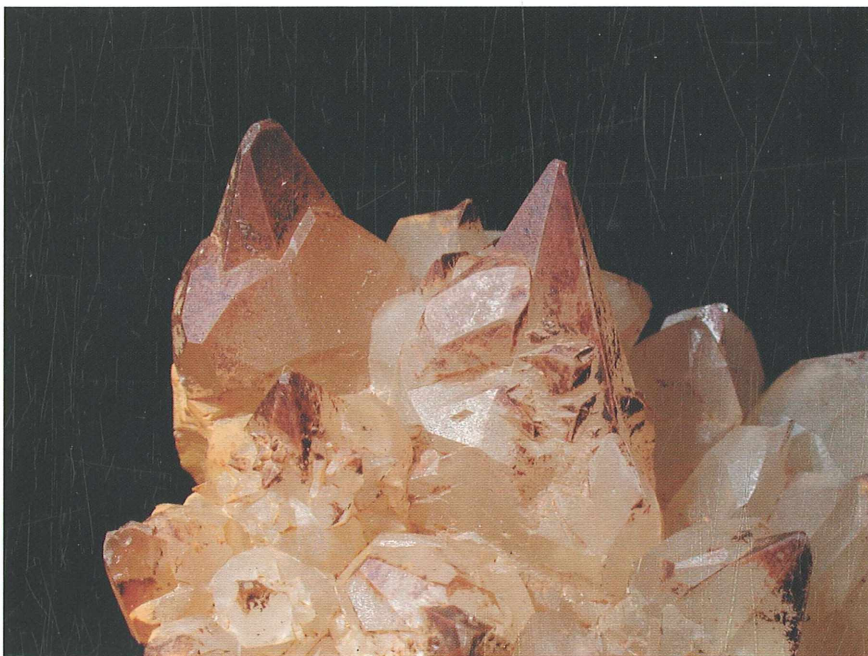
03. Scalenohedral crystals (1st type) of calcite from Bargate district, level 7. Broken crystals are “rehealing” with crystal forms, which are significant for the 3rd type of calcite crystals.



04. Scalenohedral crystals of calcite of 1st type from Igrčevo section are twins with twinning planes $(01\bar{1}8)$ -a, $(01\bar{1}2)$ -b and (0001) -c. The crystal group measure 7 x 4 cm.



05. Scalenohedral crystals of calcite are twins with twinning plane $(01\bar{1}8)$. The crystals are up to 3cm high. They are typical of Bargate district, level seven.



06. The first generation of calcite crystals are crystals of 1st type with developed scalenohedral habit. They are partially covered with barrel-like calcite crystals of 6th type. Bargate section, crystals measure up to 3 cm.



07. Two calcite generations from Bargate section, level 7. The specimen is 1.5 cm high.



08. A group of rhombohedral calcite crystals of 2nd type from Union district, level 4. They measure 4 cm in diameter.



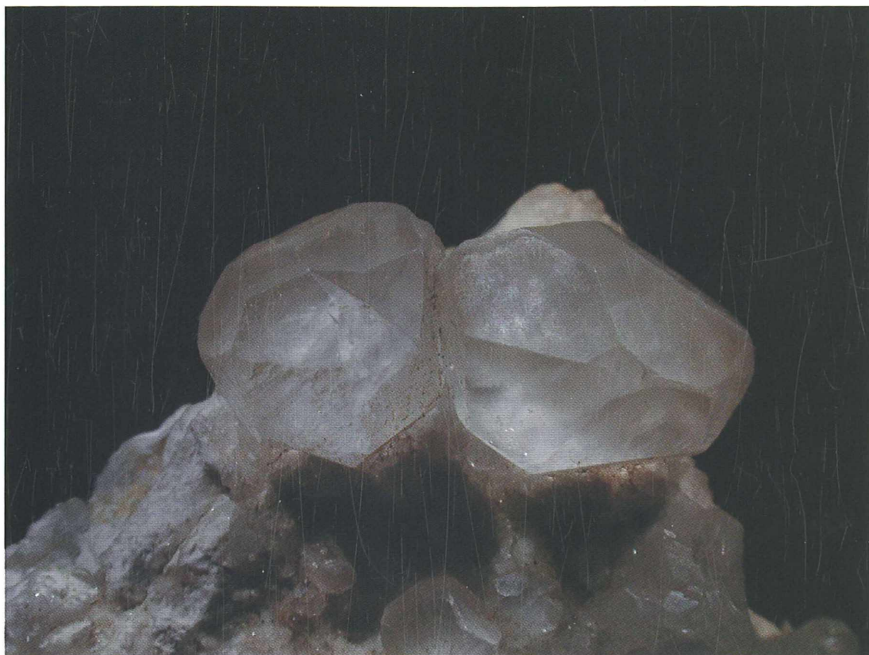
09. Calcite twin with twinning plane $(01\bar{1}8)$ from Helena district, Igrčevo sub-section, crystals of 2nd type measure up to 2 cm.



10. Typical rhombohedral crystal (3rd type) of calcite from Moring district with orange coating. The crystal shown in picture is 1.5 cm high.



11. Calcite twin with twinning plane (0001) with inclusion of dark grey mineral. Calcite crystals are of 3rd type. The specimens from Moring district measure 2 cm in diameter.



12. Colourless calcite crystals from Stari Fridrih district are twins with twinning plane (0001). They are up to 1.5 cm high and belong to the transitional type between 1st and 3rd types.



13. Crystals of calcite from Bargate section, level 10 far east, are covered with brown and/or white coating.



14. Prismatic crystals (4th type) of calcite from Staro Igrčevo section. They are up to 2 cm high.



15. Calcite crystals of 5th type from Graben district, level 8. They measure up to 1 cm.



16. Characteristic calcite crystals of 5th type from Graben district, level 12. They measure up to 2 cm.



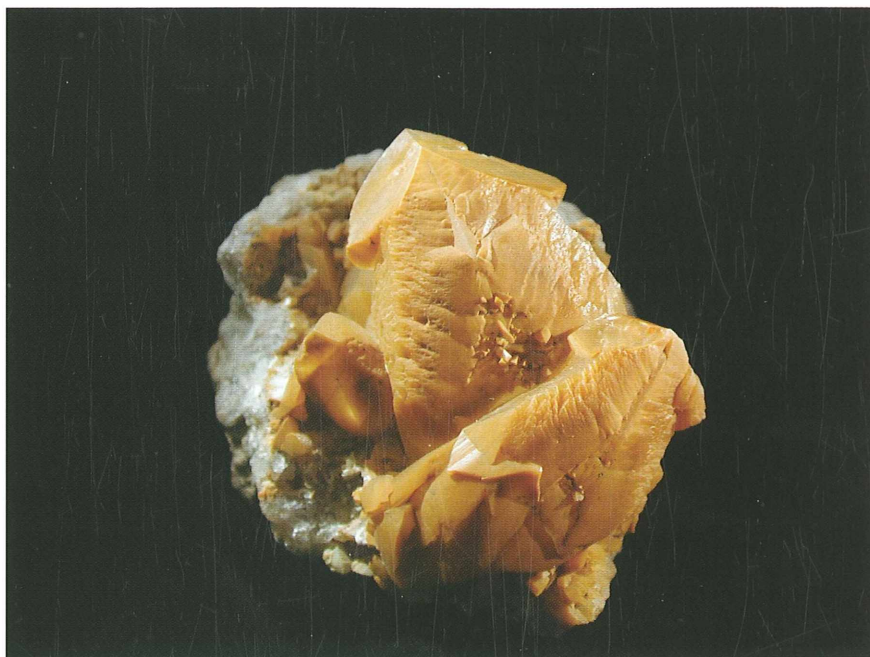
17. Crystals with prevailing negative rhombohedrons (5th type) are significant for Graben district, level 12. They measure up to 2 cm.



18. Two generations of calcite crystals. The early generation is represented by crystals of 7th type, and late generation by crystals of 3rd type, Helena district, crystals are 1 cm high.



19. Calcite (1st type) twin with twinning plane $(01\bar{1}8)$ from Helena district, Barbara level, Christmas drift. The twin measures 0.5 cm.



20. Calcite crystals from Igrčevo section. The morphology of large crystals was not studied. On matrix are calcite crystals of 5th type. The crystal group measures 8 x 6 cm.



21. Scalenohedral crystal of calcite (1st type) is 7 cm high. It is from the Third ceiling level and interesting due to the small white dolomite crystals on matrix.



22. Scalenohedral crystals from Igrčevo section are intergrown with descloizite and wulfenite. The detail measures 3 x 2 cm.



23. Rhombohedral crystal of calcite (3rd type) is covered with wulfenite and calcite crystals of the second generation. They are from Rišperg section and measure up to 2 cm.



24. Crystals of calcite from Moring district, level eight, are rarely covered with hemimorphite crystals measuring up to 1 mm.



25. Rhombohedral crystals (3rd type) of calcite from Union district are covered with small crystals of descloizite measuring up to 0.2 mm.



26. Rhombohedral crystals (3rd type) of calcite are covered with white hydrozincite. Specimens like these are significant for the Carbonate level. They measure up to 2 cm.

53 | 2004

Vsebina / Contents:

Miha JERŠEK, Vladimir ZEBEC, Breda MIRTIČ, Vladimir BERMANEC,
Tadej DOLENEC & Franc KRIVOGRAD

The morphology of calcite crystals in the Mežica mines

SOOPORNA

ZOBODAT - www.zobodat.at

Zoologisch-Botanische Datenbank/Zoological-Botanical Database

Digitale Literatur/Digital Literature

Zeitschrift/Journal: [Scopolia, Journal of the Slovenian Museum of Natural History, Ljubljana](#)

Jahr/Year: 2004

Band/Volume: [53](#)

Autor(en)/Author(s): Jersek Miha, Zebec Vladimir, Mirtic Breda, Bermanec Vladimir, Dolenc Tadej, Krivograd Franc

Artikel/Article: [The morphology of calcite crystals in the Mezica mines. 1-29](#)