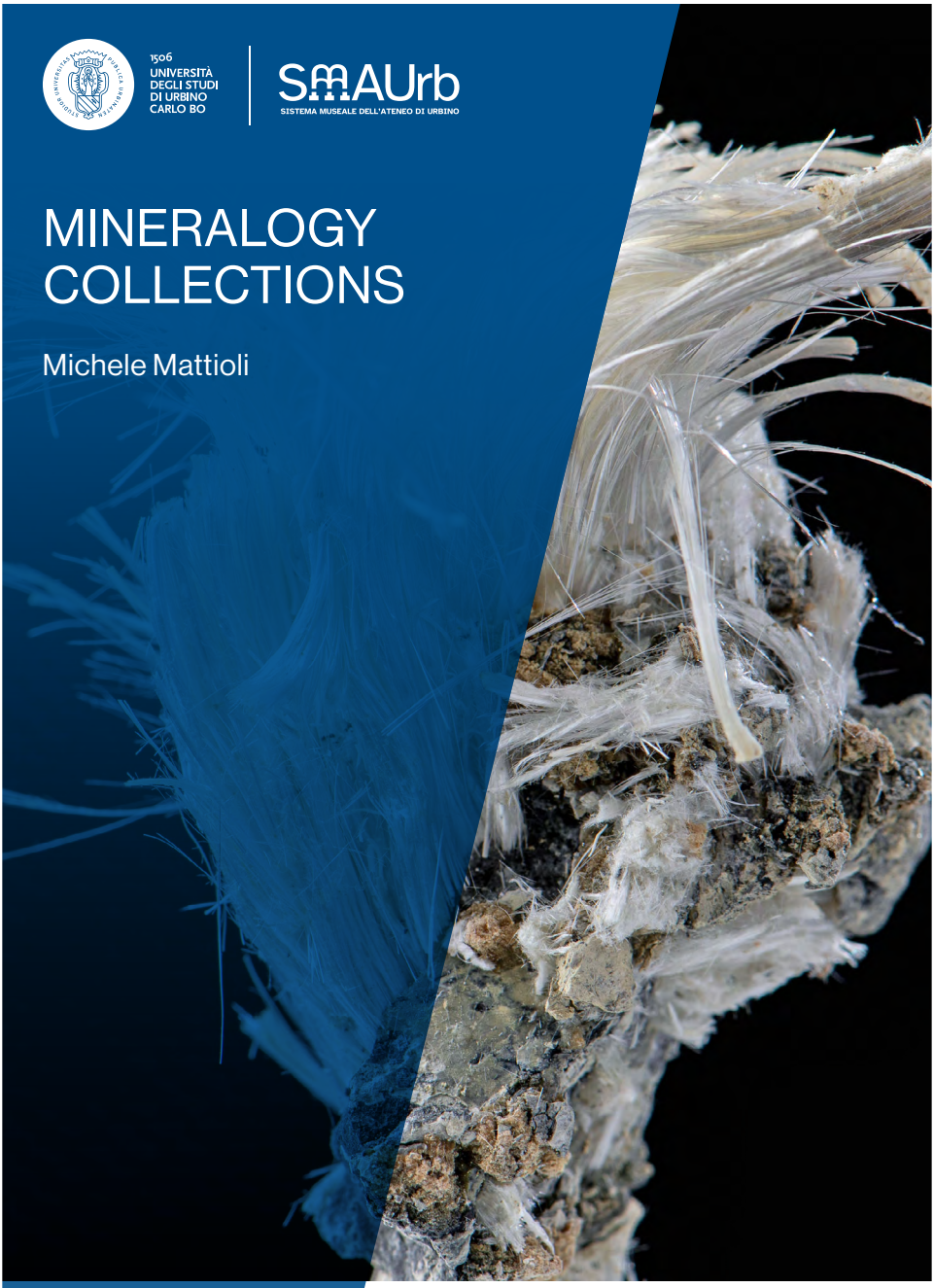
1506
UNIVERSITÀ
DEGLI STUDI
DI URBINO
CARLO BO

SMAUrb
SISTEMA MUSEALE DELL'ATENEO DI URBINO

MINERALOGY COLLECTIONS

Michele Mattioli



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I Quaderni dello SMAUrb
A series conceived and directed by Anna Santucci

Launched in 2024, *I Quaderni dello SMAUrb* is a series dedicated to promoting the knowledge, preservation, enjoyment, and valorization of the cultural heritage of the University of Urbino Carlo Bo. *I Quaderni dello SMAUrb* are short guides designed to introduce and enhance visits to the University's cultural treasures, encompassing a wide range of expressions: architectural, historical-artistic, archaeological, scientific, naturalistic, bibliographic, archival, and more.
By utilizing multimodal and multimedia editorial formats - including Open Access (OA), print-on-demand editions, audio readings, and interactive features linked to the Sanzio Digital Heritage display case - *I Quaderni dello SMAUrb* offer visitors flexible, customizable itineraries tailored to their available time, interests, and preferred modes of engagement.

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Summary

1. Introduction

Minerals have played a key role throughout human history, shaping the development of civilizations. They reveal the geological processes that have formed our planet and have provided essential materials for economic, social, and cultural growth. Over time, people have sought and used the elements found in minerals based on the technology available to them. Early examples include flint and copper, which were crucial for early societies. Today, minerals like pentlandite, millerite, columbite, and tantalite, which contain nickel, niobium, and tantalum, are vital for modern technologies. Some minerals, like gold, silver, copper, and diamonds, remain in constant demand, particularly for their use as precious gems. Studying minerals offers insights into nature, revealing the processes that led to their formation and growth. Their shapes and structures are tied to their internal makeup, and their colors often make them visually striking.

Minerals also hold scientific and cultural significance, thanks to the efforts of collectors, scientists, and researchers. The work of these people has created mineralogy collections such as the ones at the University Museum System of Urbino, which offer a unique educational experience in the heart of the city.

1.1 A Brief History of the Mineralogy Collections of the University of Urbino

The history of the Mineralogy Collections at the University of Urbino began in 2009, rooted in friendship and a generous act. The friendship

was between me, a professor of mineralogy at the university, and Enzo Franchin, a geologist from Vicenza who had collected about seven hundred stunning mineral samples from around the world. Enzo made a generous gesture by donating his entire collection to the university, saying he wanted it to be a lasting educational tool for students and a scientific and cultural asset for Urbino. The collection was added to the university's holdings in November 2009, and a group of geology students documented, photographed, and classified each piece under the professor's supervision. The Franchin Collection was publicly displayed in May 2010 at the Mattei Science Campus.

This act of generosity inspired others. Soon after, another collector, Emilio Sergio Lorenzini from Bologna, expressed his desire to donate his mineral collection to the university, impressed by the work done with the Franchin Collection. Although Emilio died shortly after, his wife fulfilled his wish by donating the collection in April 2014. Again, students documented and classified the minerals, and the Lorenzini Collection was put on public display alongside the Franchin Collection in May 2016.

In 2019, Sergio Pegoraro, also donated his collection of over 3,500 mineral samples and historical scientific instruments to the university. Pegoraro also established a scholarship to support a student who would help analyze and classify the collection. The Pegoraro Collection was presented in September 2021 during the opening of a new exhibition space dedicated to all the mineral collections.

Today the University of Urbino's mineral collections, housed in the SMAUrb, represent a valuable scientific, educational, and cultural resource. This guide offers visitors biographical notes on the donor of each collection and highlights the most significant pieces in each one.

1.2 Exhibition Layout and Criteria

The first museum exhibition of the Mineralogy Collections was set up in 2010 when the Franchin Collection was opened to the public at the Enrico Mattei Science Campus. In 2016, the Lorenzini Collection was also added to this space. However, the collections had to be relocated due to renovations at the Mattei Campus in 2020. They were moved to a new exhibition area in the Paolo Volponi Scientific-Educational Hub,

which also included the Pegoraro Collection, donated during that time. The latest exhibition space was inaugurated in September 2021.

This relocation revitalized the display of over 4,500 mineral samples. The collections were arranged in three distinct sections, each with its own set of display cases, maintaining the unique identity of each collection. Color-coded panels accompany the exhibits, guiding visitors through a narrative and educational experience.

All the samples from the different collections are organized systematically, according to the classification system recommended by the International Mineralogical Association (IMA). This system is based on the chemical composition and the structure of the minerals. It was developed by German mineralogist Karl Hugo Strunz and first published in 1941 in his work *Mineralogische Tabellen*. The current reference version is from the 9th edition (Strunz and Nickel, 2001), in which minerals are divided into ten classes based on their main anions, anionic groups, or absence.

I Elementi nativi	VI Borati
II Solfuri	VII Solfati e cromati
III Alogenuri	VIII Fosfati e arseniati
IV Ossidi e idrossidi	IX Silicati
V Carbonati e nitrati	X Composti organici

Tabella 1. Classification of minerals by chemical-structural criterion, as suggested by the Nickel-Strunz classification.

Each mineral sample is displayed on a plexiglass base, accompanied by a simple label that includes the mineral's name, chemical formula, and the location where it was discovered (if known). The labels are color-coded to match one of the ten mineral classes listed in Table 1 to make it easier for visitors to find and identify samples.

The exhibition space also supports educational activities, workshops, and outreach events for various groups, including university students, pupils, general public, and tourists. The collections will also be accessible through Sanzio Digital Heritage using the QR codes provided in this guide. In the digital format, each mineral is presented according to the standards of the Ministerial Catalogue of the Central Institute for Cataloguing and Documentation (ICCD, Ministry of Culture).

ENZO FRANCHIN COLLECTION

Educational and training activities on the samples from the Franchin Collection were conducted with students of the Geological Sciences degree program at the University of Urbino during 2009-2010. In the upper photo, from the left, seated: Leonardo Celli, Marco Taussi, Sara Sanchi, Ilaria Mencarelli, Giacomo Bompani, and Andrea Fraternali, with Michele Mattioli standing. Below, Benedetta Caldarella, Leonardo Celli, and Danilo Marcolini are also featured.

EMILIO S. LORENZINI COLLECTION

Educational and training activities on the samples from the Lorenzini Collection were conducted with students of the Geological Sciences degree program at the University of Urbino between 2014-2016. In the upper left photo: Bimla Tamburini; in the upper right: Alessia Falasconi and Pierluca Arcangeli; and below: Alessandro Serafini, Matteo Giordani, and Samantha Mosconi.

SERGIO PEGORARO COLLECTION

Lorenzo Brocani, winner of the scholarship promoted by Sergio Pegoraro, working on the samples of the homonymous Mineralogical Collection, 2020-2021.

2. The Enzo Franchin collection

2.1 The collector

Enzo Franchin was born on July 26, 1936, in Agugliaro, a small town in Bassa Vicentina. He was very energetic as a child and struggled in school. He was held back in Italian in second grade, and the same happened in fourth and fifth grades. To help him improve, his father sent him to the Collegio Manfredini in Este, where he started doing better. Enzo was passionate about Earth Sciences, minerals, and fossils during this time.

In 1957, he enrolled in the Geology program at the University of Padua, where his love for geology grew. He discovered a talent for observing microscopic details and identifying minerals. By the time he graduated in 1962, he had a small collection of 30 mineral samples. In 1969, he connected with the Geological Mineralogical Association of Verona, which helped him to grow his collection. Over the years, this collection expanded significantly through excursions, research, and attending exhibitions.

Enzo Franchin built an impressive collection of high-quality mineral samples throughout his life, thanks to his keen eye for beauty and his expertise in mineralogy.

Enzo Franchin, during the presentation ceremony of his collection at the University of Urbino (Campus Scientifico E. Mattei, May 20, 2010).

2.2 The Minerals

The Franchin Collection consists of seven hundred mineral specimens from all over the world, generally ranging from 10 to 20 cm in size. It is a classic, systematic collection showcasing popular minerals among enthusiasts. Except for organic compounds, each mineral class is well-represented with some samples having significant aesthetic value.

Highlights include a gold sample on matrix from the Chamousira Fenilliaz mine in the Aosta Valley, one of the region's most important gold mines, and a native silver sample with branching structures. Of particular interest are a kimberlite rock fragment containing two natural diamonds (about 1 carat each) and a bituminous rock featuring perfectly shaped rhombic sulphur crystals from the Perticara mine.

The sulfide class is especially well-represented, with various samples, including pyrite, known for its variability in crystal forms, such as cubic, pentagonododecahedral, and octahedral shapes. Pyrite is also a significant source of iron. Other notable sulfides include high-quality galena and blenda specimens from which zinc and lead are extracted. The collection also features cinnabar, realgar, and orpiment, minerals historically used for pigments in red and yellow paints. However, they require careful handling due to their toxic mercury and arsenic content.

Among the halides in the Franchin Collection, dozens of fluorite samples display various colors, from colorless to shades of purple, green, blue, and yellow, many of which are visually striking. Notable pieces include a blue halite crystal (rock salt) from the Racalmuto mine in Sicily and an atacamite sample from the Atacama Desert in Chile, where this mineral was first discovered in 1801. Atacamite was once used in Europe as a drying powder for writing.

In the oxides category, quartz dominates with various shapes and colors, from transparent hyaline quartz from Carrara to deep purple amethysts, orange citrine, red hematitic quartz, and black quartz crystals. The collection also features scientifically important samples including perovskite, a mineral abundant in the Earth's mantle but rare on the surface, and gem-quality rubies and sapphires with crystals up to 10 cm in diameter.

The carbonates class includes many calcite specimens with various crystal shapes and colors, ranging from white and yellow to orange, purple, and colorless. Some calcite samples have perfect rhombohedral crystals, while others display scalenohedral, flattened, or globular shapes. Dolomite, the mineral after which the UNESCO World Heritage Dolomites mountains are named, is also represented by pink rhombohedral crystals and selliform crystals that curve as they grow. Copper carbonates are especially attractive, with fine samples of green malachite and blue azurite, sometimes found together in a single piece, showing how one phase can transform into another.

In the sulphate class of the Franchin Collection, the gypsum crystals stand out for their impressive size - with one crystal reaching 40 cm - as well as their diverse shapes and colors. These range from perfectly geometric, transparent crystals to yellow and green tabular crystals, colored by copper oxides, and even the sand-colored variety known as "desert rose." Despite its name, Celestine displays various colors, from the typical sky blue to white, yellow, golden, and even wholly colorless forms.

The phosphates category includes many samples of apatite and hydroxyapatite, minerals that form the structure of bones and teeth. Some of these crystals have gemological significance. One noteworthy piece is a deep green sample of anapaite, a rare mineral from the Ural Mountains in Russia. There is also a striking green vivianite that can produce a pigment known as Harlem's Land.

The silicate class, which includes the most common minerals in the Earth's crust, is the largest in the Franchin Collection, with over 230 pieces. Notable specimens include gem-quality beryl, seen in its colorless form (goshenite), as well as its more famous varieties: aquamarine (blue) and emerald (green). The emeralds are impressive and include a high-quality crystal from Colombia, tiny crystals from Pizzo Marcio in Val Vigezzo, and a rare red hexagonal crystal of scarlet beryl.

The Franchin Collection also features rare and aesthetically remarkable minerals. Notably, it includes samples of alexandrite, considered the rarest gemstone in the world, and cyanite with its striking blue color. Garnets in various shapes, colors, and tourmalines range from the typical black variety (schorlite) to multicolored crystals (elbaite). The collection also includes a blue lazurite crystal in the lapis lazuli variety from Afghanistan's remote mines. Historically, this mineral

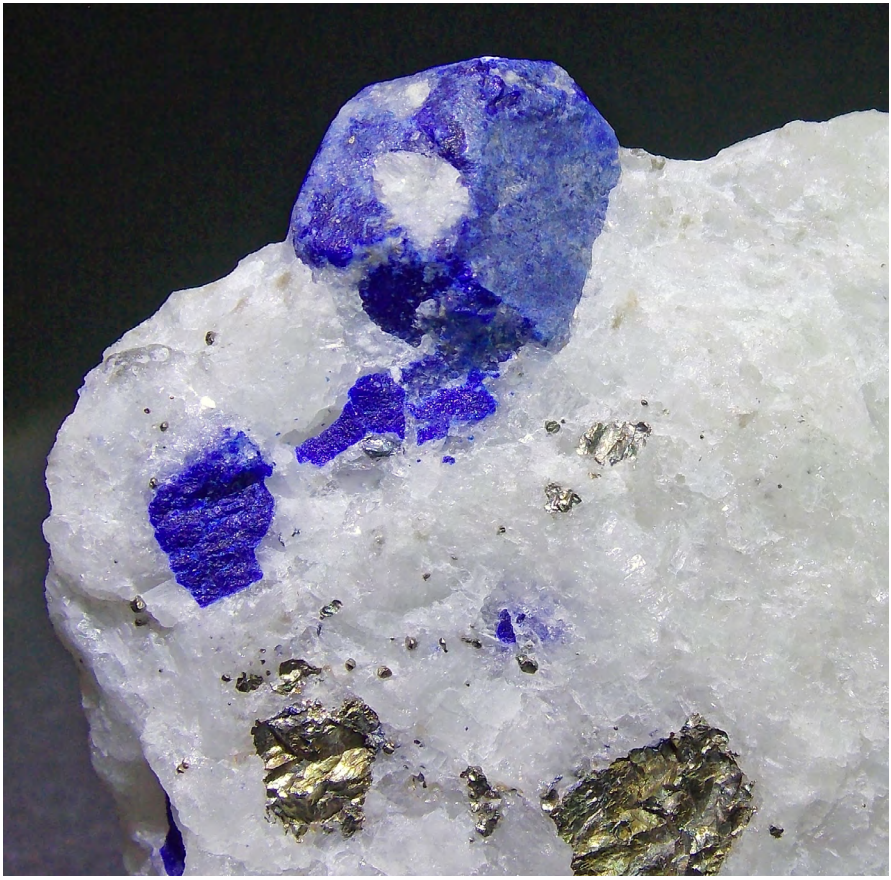
was ground to create an intense and durable blue pigment used in art, though it was costly in ancient times.

Scientifically significant samples include large pegmatitic crystals, such as a 20 cm orthoclase covered with golden-yellow muscovite crystals and rare green-blue microcline crystals (amazonite variety). There are also large plagioclase crystals with iridescent effects.

The zeolite group is well-represented, with notable geodes from the Deccan Traps in India, one of Earth's most extensive lava plateaus, reaching up to 2,000 meters thick. These geodes contain spectacular mineral formations, including prismatic, acicular natrolite, scolecite, and fibrous okenite resembling cotton balls. The collection also features cavansite, a rare deep blue mineral found in only four locations worldwide: Pune (India), Aranga (New Zealand), Owyhee (Oregon), and Rio Grande do Sul (Brazil).

The silicate class also includes valuable asbestos samples, such as chrysotile and fibrous tremolite, which are carcinogenic when inhaled. For safety reasons, these samples are stored in sealed, transparent containers to prevent any risk of exposure.

The entire mineralogical collection can be viewed in the *Sanzio Digital Heritage* showcase



LAZURITE

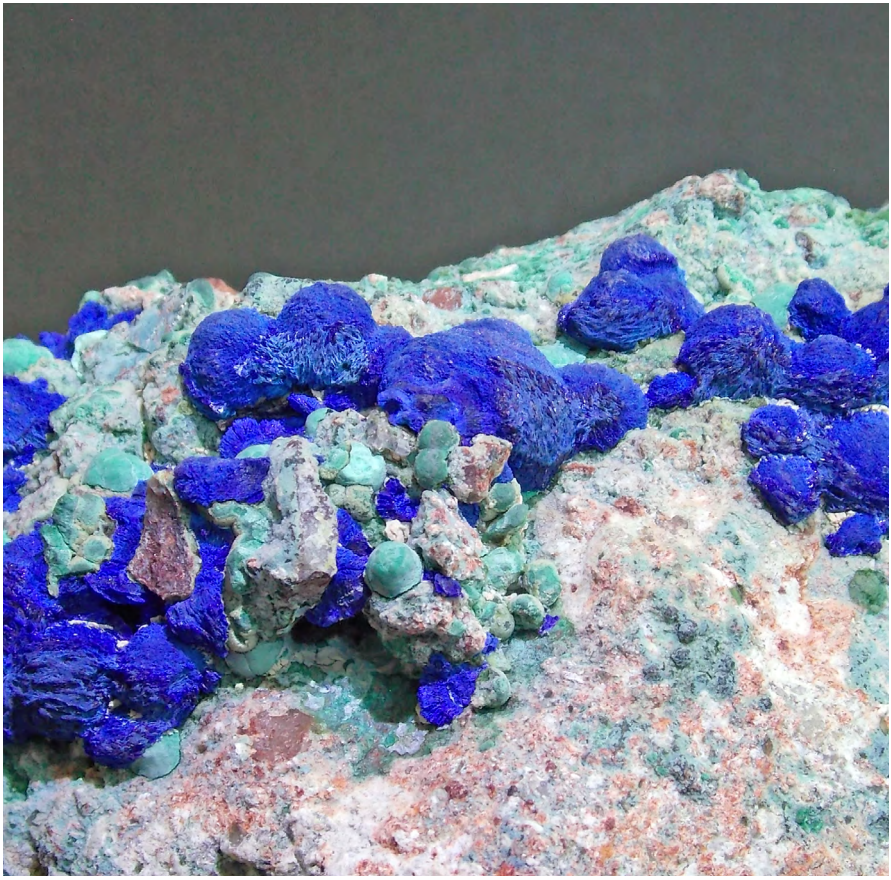
CRYSTALS ON CARBONATIC MATRIX WITH PYRITE AND CHALCOPYRITE

Lazurite is a silicate mineral from the cancrinite-sodalite group, known for its deep blue-violet crystals. Although lazurite is often mistaken for lazulite or considered a variety of lapis lazuli, it is the primary component of this ornamental stone. The sample from the Franchin Collection comes from the Sar-e-Sang mine in Afghanistan, one of the most significant sources of lapis lazuli worldwide (Photo by Carlo Andrea Mattioli).

GOLD

NATIVE GOLD WITH DENDRITIC MORPHOLOGY ON QUARTZ

Gold is considered a noble metal par excellence. It has a bright, characteristic yellow color and is extremely dense (19 g/cm^3). Due to its ductility, malleability, rarity, and low reactivity - resistant to most chemical compounds - gold is one of the most valued metals. This sample comes from the Chamousira Fenilliaz mine, also known as Brusson, in the Aosta Valley, Italy (Photo by Carlo Andrea Mattioli).



AZZURRITE

THE DRUSES OF MICROCRYSTALLINE GLOBULAR AGGREGATES

Azurite is a basic copper carbonate, $Cu_3(OH)_2(CO_3)_2$, known for its intense light blue color and monoclinic crystal structure. It often forms in well-faceted crystals or, more commonly, as concreted masses, globular aggregates, and crusts, frequently found alongside malachite. This sample is from Midelt, in Khénifra, Morocco (Photo by Carlo Andrea Mattioli).

QUARTZ

AMETHYST VARIETY

Amethyst is one of the most valuable varieties of quartz (SiO_2), known for its distinctive purple color, which can vary in intensity between shades of purple and blue. This sample features a large, flower-like crystal formation with perfectly shaped rhombohedral prisms. It originates from the renowned mineral-rich region of Minas Gerais, Brazil.

OKENITE

DRUSA WITH SPHERICAL AMYGDALA OF ACICULAR CRYSTALS

Okenite is a silicate belonging to the zeolite group, commonly found in the cavities of basaltic rocks. It forms acicular (needle-like) crystals arranged in radiating aggregates or spherical fibrous masses, giving it a distinctive fluffy appearance. The crystals are soft, flexible, and fragile, typically white but sometimes with faint bluish or yellowish hues. The primary deposits are in Pune, India, where this sample originates (Photo by Giancarlo Gobbi).

CHRYSOCOLLA

BOTRYOIDAL MICROCRYSTALLINE CRUSTS

Chrysocolla is a widely used hydrated copper silicate that forms an alteration product of other copper-containing minerals, often serving as an essential indicator of exploitable copper deposits. Its distinctive green-to-blue color has made it a popular choice for producing inorganic pigments. This particular sample comes from Fundert Inca de Oro, Chile (Photo by Giancarlo Gobbi).

STURMANITE

DRUSA WITH BITERMINATED CRYSTALS

Sturmanite is an extremely rare calcium and iron hydrous sulfate, belonging to the ettringite group and minerals like charlesite, ettringite, and thaumasite. Comprising about 46% water (H_2O), sturmanite was only recently discovered in 1981 at the Black Rock Mine in the renowned manganese fields of the Kalahari, South Africa, which is also the origin of this sample.

CORUNDUM

RUBY VARIETY

Ruby is the most precious variety of aluminum oxide (Al_2O_3), a mineral known as corundum, which is highly allochromatic (showing color variations due to trace elements). This sample features a large red ruby crystal (a variety of corundum) embedded in a unique metamorphic rock from Zambia called anyolite. Anyolite consists of bright green chromium-zoisite, dark green pargasite, and porphyroblasts of corundum.

KYANITE

LARGE PRISMATIC CRYSTALS IN METAMORPHIC ROCK

Kyanite is an anhydrous aluminum silicate (Al_2SiO_5) distinguished by its characteristic blue color, which inspired its name. Previously called distene, this name referred to its notable anisotropy in hardness, which varies significantly depending on the crystal's direction. Barra do Salinas in the Brazilian state of Minas Gerais is renowned for exceptional cyanite specimens, including this sample.

GYPSUM

DRUSA WITH RADIATED AGGREGATES OF GREEN PRISMATIC CRYSTALS

Gypsum is a hydrated calcium sulfate ($CaSO_4 \cdot 2H_2O$) that typically forms monoclinic crystals, which are colorless or white. However, in the presence of impurities, gypsum can display various colors, such as green, resulting from copper oxides. This particular sample originates from Swan Hill, Victoria, Australia.

ANDRADITE

DEMANTOID VARIETY, RHOMBODODECAHEDRAL CRYSTALS ON SERPENTINE

Demantoid is a rare variety of andradite, a nesosilicate belonging to the garnet group containing calcium, iron, and chromium. This gemstone is known for its vibrant green color and exceptional brilliance. The finest specimens are sourced from Namibia, the Urals, and the Malenco Valley in the province of Sondrio, Italy, which is also the origin of this sample.

PEROVSKITE

PSEUDOCUBIC CRYSTALS ON SERPENTINITE MATRIX

Perovskites are extremely rare minerals on the Earth's surface but are the most abundant minerals in our planet's mantle. The crystals in this sample are cubic in shape and composed of calcium and titanium. This specimen comes from Rocca Sella in Valle Susa, Piedmont, Italy (Photo by Carlo Andrea Mattioli).

SILVER

NATIVE SILVER WITH FILAMENTOUS HABIT

Silver is a native element known for its high ductility and malleability. It often crystallizes in arborescent, dendritic, filamentous, and coral-like forms, exhibiting a shiny white metallic luster. Silver has the highest electrical conductivity of all metals, more than copper, although copper is more widely used due to its lower cost. This particular sample originates from the Silver Sarbay mine in the Kostanay Region of Kazakhstan.

CAVANSITE

SUB_SFERICAL AGGREGATE ON STILBITE

Cavansite is a silicate mineral composed of calcium, vanadium, and silicon, reflected in its name. It displays a color that ranges from intense blue to greenish-blue and typically occurs as a secondary mineral in volcanic rocks, often found alongside zeolites like stilbite. This sample is from Wagholi, Pune, India (Photo by Giancarlo Gobbi).

RED BERYL

HEXAGONAL CRYSTAL ON A RHYOLITIC MATRIX

Red beryl is an extremely rare beryl, more commonly recognized in its green (emerald) and blue (aquamarine) forms. Previously referred to as bixbite, this name was discontinued to avoid confusion with another mineral called bixbyite. The striking red color of red beryl is caused by the presence of manganese ions (Mn^{3+}) that replace some aluminum ions in its crystal structure. This particular sample originates from the Wah-Wah Mountains in Utah, USA.

FLUORITE

GROUP OF PURPLE CUBIC CRYSTALS

Fluorite, also known as calcium fluoride, is celebrated for its beautiful mineral crystals, which are notable for their size, color, elegance, and transparency. However, these crystals are fragile and delicate, making extensive, intact specimens rare. This particular sample comes from the Minerva Mine in southern Illinois, USA.

CALCITE

RADIATED SCALENOHEDRAL CRYSTALS

Calcite is a widely used mineral of calcium carbonate ($CaCO_3$) that crystallizes in the trigonal system, typically forming rhombohedral and scalenohedral shapes. While pure calcite is limp and colorless, it can display various colors due to different chemical elements or inclusions, making it opaque. In this sample, the calcite crystals radiate, exhibit scalenohedral forms, and are yellow. This sample comes from the Nebida mine in Sardinia, Italy.

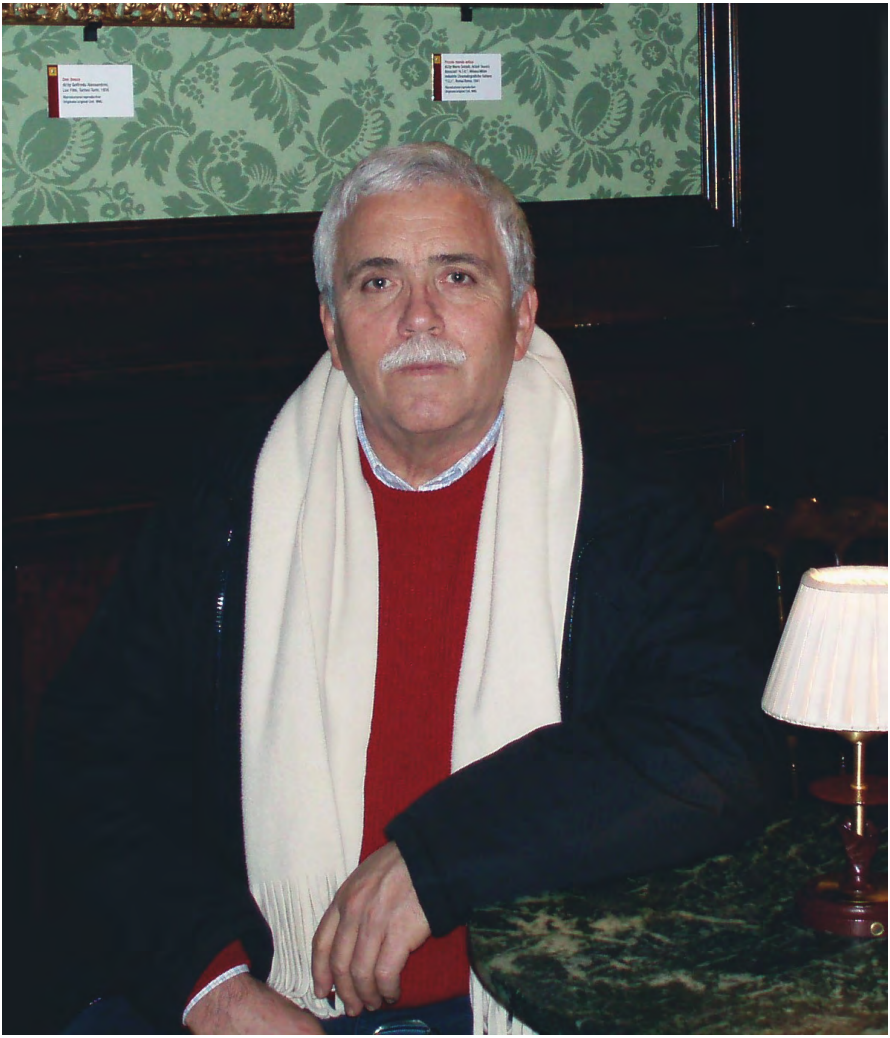
3. The Emilio S. Lorenzini collection

3.1 The collector

Emilio Sergio Lorenzini was born in Monterenzio (BO) in 1946. After finishing his studies, he worked as a technician at Officine Rizzoli in Bologna, receiving the Star of Merit as a “Master of Work” in 1999. Emilio began collecting mineral samples as a boy; he spent his weekends exploring collection sites, driven by a deep passion for minerals.

In 1969, together with some friends from AVIS, a volunteering organization where he held leadership roles, he founded the GAMS Club (AVIS Mineralogia Speleologia Group). The club aimed to organize exhibitions about minerals and promote cultural activities. Over the years, it evolved into the "Bologna Mineral Show," now one of the most significant international mineral exhibition markets.

Emilio collected samples from around the world through exchanges, purchases, and personal finds, which he took great pride in. He meticulously organized his minerals in a filing cabinet, noting their names, formulas, data, and places of origin. Emilio was not just a collector, he was also a passionate expert in minerals, appreciating their complexity and beauty. His collection included several hundred specimens at the time of his death in 2013..



Emilio Sergio Lorenzini, captured during one of his many activities.

3.2 The minerals

The Lorenzini Collection features six hundred pieces of various sizes, including many thematic samples with local origins and others from around the world. The local, thematic samples primarily focus on three mineralogical peculiarities of the Tuscan-Emilian-Romagnolo Apennines: "Messinian gypsum," "morion quartz," and "hopper quartz."

Messinian Gypsum: this gypsum resulted from the Messinian salinity crisis, which caused the significant evaporation of minerals in the Mediterranean. In the Romagna Apennines, this led to the formation of the "Vena del Gesso," which contains sixteen gypsum layers with crystals up to two meters long. Notable sites include the Monticino quarry in Brisighella (RA), now a geopark, and the Cava Fiorini (BO), where Lorenzini's specimens originate. You can find macrocrystalline gypsum (often called selenitic) in various forms here. These include single crystals that range from transparent to yellowish, polychrome samples showing growth patterns, and beautiful aggregates of prismatic or twinned crystals, often shaped like lenses with rounded faces or even in rosette forms. There are also fibrous crystals with a curved habit, resembling coral (the sericolite variety).

Morion Quartz: Morion quartz, or black quartz, is a rare quartz that appears in dark colors (from brown to black and occasionally bluish) with a unique crystal structure. The crystals typically have a hexagonal bipyramidal shape and lack a prism, giving them a squat, almost round appearance. The triangular faces can reach several centimeters in length. The black color in these quartz crystals is usually the result of microcrystalline magnetite inclusions. The samples in the Lorenzini collection come from various locations in the Val Sillaro, within the Bologna Apennines, particularly along the Ossa stream.

Hopper Quartz: Hopper quartz is a unique variety distinguished by its crystals, which have much more developed edges than their faces. This results in characteristic step-like depressions and irregular shapes resembling hoppers. The formation of hopper quartz is influenced by the deposition of clay or organic material on the crystal surface during growth. This material restricts growth primarily to the edges, allowing them to develop more prominently. Rapid temperature fluctuations can

also create discontinuities in growth, contributing to the distinct hopper shape. Another notable feature of hopper quartz is the internal cavities that often contain fossilized liquid-gaseous hydrothermal solutions (like water and methane), leading to their alternate name: "aerohydric quartz." These crystals frequently crystallize alongside rhombohedral calcite. One of the most renowned locations for hopper quartz is Fosso Castellina, south of Porretta (BO), within the Suviana Sandstones. Here, fractures perpendicular to the stratification allowed hydrothermal fluids to penetrate and crystallize quartz and calcite. These fractures eventually became filled with yellow or brown clay and fine sand. Areas in Emilia-Romagna, such as Porretta Terme, are particularly famous for their huge crystals and crystal aggregates of this type.

Among the notable mineral samples from Italy are those from Carrara marble, which, although small, often have pure, perfectly shaped crystals. These include hyaline quartz, sulfur, sphalerite, and wurtzite, all beautifully contrasted by the white marble matrix that enhances their color and shape. Another crucial Italian mineral is millerite, a nickel-rich sulfide. Although rare and not practical for extraction, it has acicular crystals ranging from bronze to brass-gray and have a metallic luster. Additionally, there are septaria, which are sub-spherical or ellipsoidal bodies made of marly limestones or clays featuring radial and concentric fissures that create pyramidal fragments. The cracks can cement, forming cavities lined with clear calcite, gypsum, and barite crystals. Fossil amber from Castelvecchio di Prignano (MO) is also noteworthy. This Cretaceous amber appears in fragments or large drops, typically dark red, varying in size from a few millimeters to 6-7 centimeters, and often containing carbonaceous inclusions that darken its color. Beautiful samples of sulfides (like stibine, marcasite, and pyrite) and oxides (such as hematite and pyrolusite) come from the Apennines and the Island of Elba.

Among foreign samples, radioactive minerals like autunite, a calcium and uranium phosphate that crystallizes in yellow-green and fluoresces under UV light, and tobernite, a copper and uranium phosphate with bright green, square crystals, stand out. An exciting sample is columbite, a rare niobium and tantalum oxide from the Kivu region of Congo. Columbite and tantalite (often called Coltan) are highly sought after for extracting essential elements for smartphones and widely used

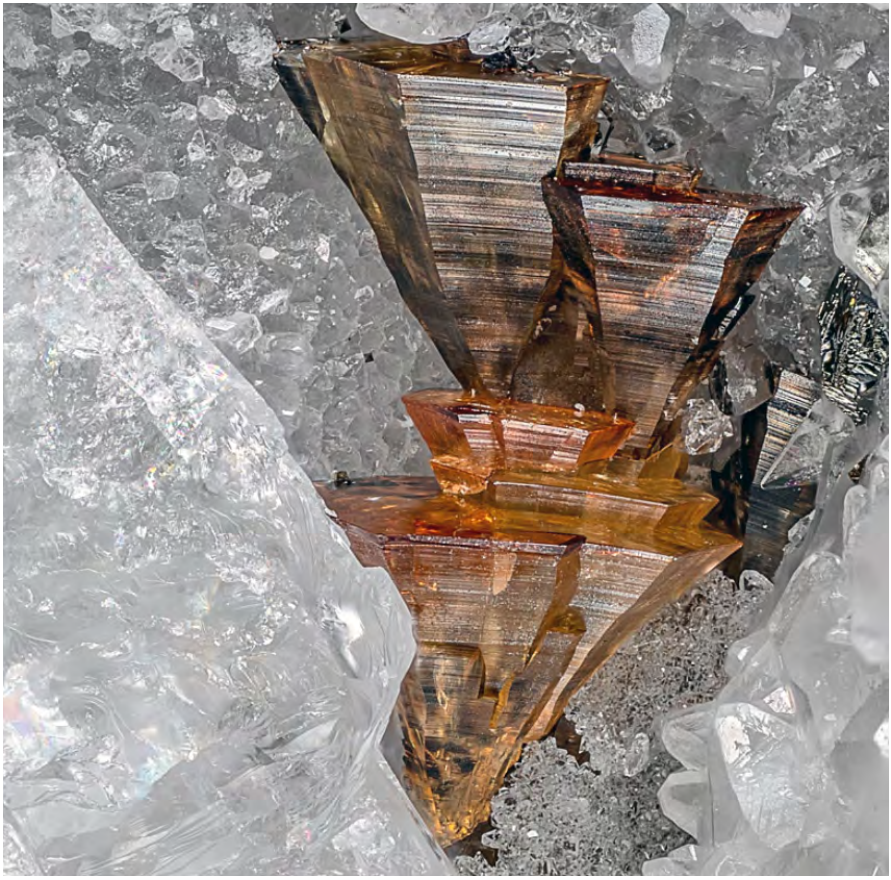
in electronics, computers, and the automotive industry. Additionally, there are samples of fibrous tremolite from Switzerland and a beautiful purple erythrite from Morocco.

The entire mineralogical collection can be viewed in the *Sanzio Digital Heritage* showcase

QUARTZ

ISOLATED CRYSTAL OF HYALINE VARIETY ON CARBONATE MATRIX

This is a variety of pure quartz known as "rock crystal" or "hyaline quartz." It is often found as tiny, clear crystals in geodes and marble from Carrara, Italy, where this sample originates. This variety is highly valued as a gemstone for making lenses, scientific equipment, and ultraviolet lamps (Photo by Mario Miglioli).



WURTZITE

AGGREGATE OF PYRAMIDAL CRYSTALS IN PARALLEL ASSOCIATION ON CALCITE

Wurtzite is a rare zinc and iron sulfide with the formula (Zn, Fe)S. It crystallizes in a hexagonal shape, often forming simple structures where a hexagonal pyramid connects to a flat base. These crystals typically occur in aggregates of many pyramidal crystals stacked together. They are usually transparent and amber-colored, as seen in this sample from the Colonnata Quarry in the Carrara marble basin, Italy (Photo by Gianfranco Ciccolini).

QUARTZ

“HOPPER” CRYSTALS

This is a unique type of quartz in which the crystals, influenced by clay, water, or hydrocarbons in the formation environment, have primarily developed along the edges. This occurs because crystalline growth is stronger there, enabling it to overcome the resistance posed by adsorbed films. This edge-focused growth results in geometric step-like cavities forming at the centers of the crystal faces. These cavities, bordered by surfaces parallel to the crystal edges, are known as "hopper" structures. This variety is called "window quartz" or "fenster quartz." The sample originates from Porretta Terme, located in the Reno Valley, Italy.

GYPSUM

ASSOCIATION OF TWINNED CRYSTALS

This sample is an aggregate of large, prismatic, and twinned crystals of macrocrystalline gypsum, commonly known as selenite, which is gray and shows growth zones. On its surface, you'll find lenticular gypsum crystals with rounded faces, some of which have a rosette shape. This sample is from Cava Fiorini in Italy.

QUARTZ

CRYSTAL WITH BIPYRAMIDAL HABIT, MORION VARIETY

Morion quartz, also known as black quartz, is a rare variety of silica characterized by short crystals with a hexagonal bipyramidal morphology. Its distinct dark coloration - ranging from gray to blackish, and rarely bluish - is due to inclusions of microcrystalline magnetite within the crystals. This particular sample was collected in Monteacuto Ragazza, a hamlet in the municipality of Grizzana Morandi, located in the Bolognese Apennines, Italy. (Photo: Orlando S. Olivieri)

MILLERITE

AGGREGATE OF ACICULAR CRYSTALS ON MATRIX

Millerite, named after mineralogist W.H. Miller, is a very rare nickel sulfide (NiS) that forms in the trigonal crystal system. It is usually found as needle-shaped or acicular brass-colored crystals in cavities of sulfide-rich limestone and dolomite rocks, nickel-iron meteorites, and carbonaceous CK chondrites. This sample comes from Ca' dei Ladri in Gaggio Montano, Italy.

HEMATITE

AGGREGATE OF IRIDESCENT CRYSTALS

Hematite is a common iron mineral found in nature and is classified as an oxide. Its name comes from the Greek word for "blood," referring to the red color of its powder. It crystallizes in the trigonal system and is known as “oligisto iron” when it forms shiny black crystals, sometimes with an iridescent sheen. When it has flat, tabular crystals arranged in layers, it's called “micaceous hematite” or “iron rose.” Hematite is a crucial mineral for iron extraction and is notably found on the island of Elba, where this sample originates.

AMBER

NODULES ON MATRIX

Amber is a fossilized resin from ancient conifer trees, particularly *Pinus succinifera*. Its color ranges from light yellow to brown and can be greenish or reddish. Amber has been found in the Northern Apennines since the 17th century, with the samples from Castelvecchio di Prignano (MO) being highly sought after for their dark red color. These samples appear as fragments and drops, some of which can be 6-7 cm in size, like the one shown here.

PYROLUSITE

DENDRITIC AGGREGATES ON MATRIX

Pyrolusite (MnO_2) is a manganese mineral in the oxide class. Its name comes from two Greek words: *pyros* (fire) and *louo* (to wash), reflecting its use in removing green tones from glass caused by iron. Pyrolusite can be found as prismatic or needle-like crystals, rounded clusters, and dendritic shapes, like this sample from the Bolognese Apennines in Italy.

SEPTARIA

DECIMETRIC SUBSPHERICAL NODULE

Septaria are rounded or oval formations made of marly limestones or clays with a network of cracks (called septa). These cracks form when the clay loses water and shrinks. Then, mineral-rich water seeps in and deposits calcium carbonate as calcite, which fills the cracks and creates the septa. Sometimes, these septa stick out from the surface of the septaria. This sample, about 30 cm in size, comes from the scaly clays of the Emilian Apennines in Italy.

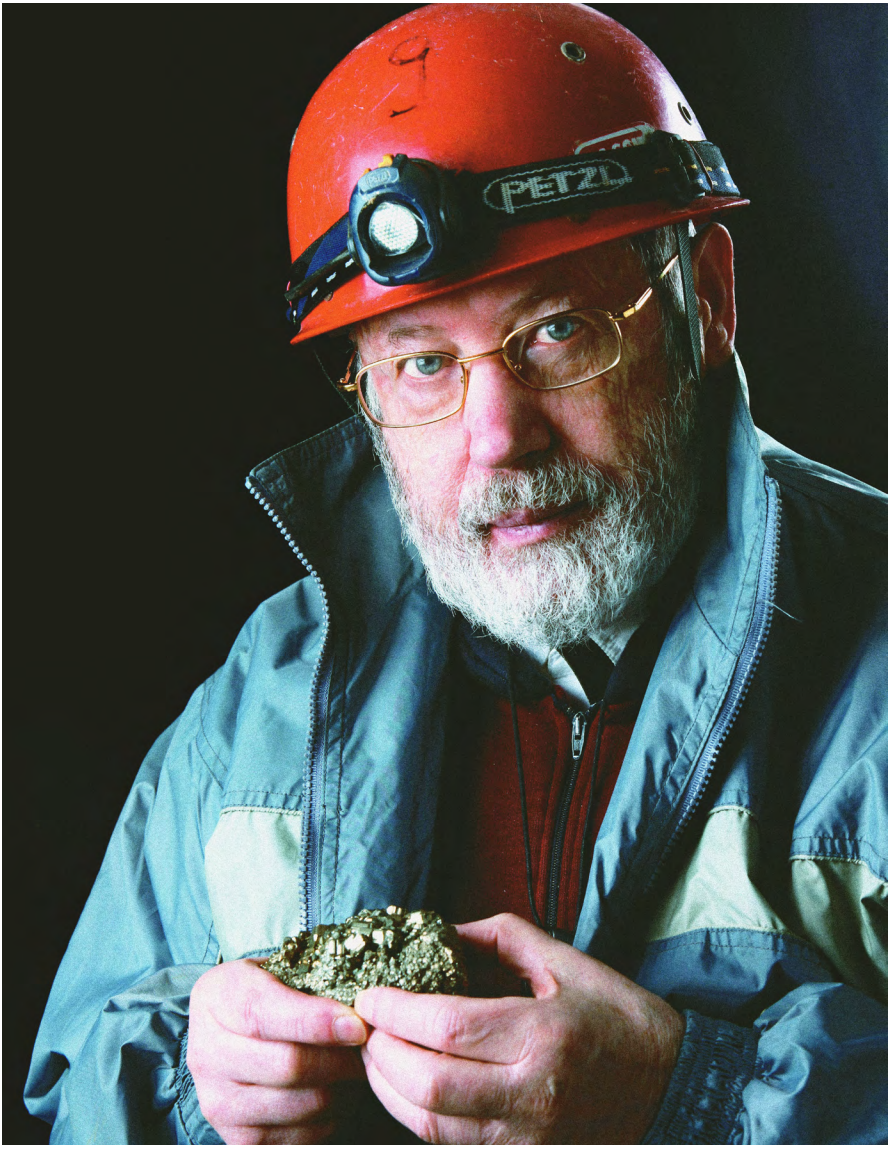
4. The Sergio Pegoraro collection

4.1 The collector

Sergio Pegoraro was born in Schio, northern Italy in 1940. After finishing elementary school, he moved to Milan and earned a diploma in accounting from the Luigi Einaudi Technical Commercial Institute. He worked as the head of general accounting and later became a sector manager and chairman of the board for international companies, including ChemPlast and Henkel, until 1992.

Sergio's interest in minerals began when, as a boy, he received a small stone covered with shiny, gold-colored cubes - later identified as pyrite. This curiosity grew into a deep passion. He joined local mineralogical and naturalist groups (Gruppo Mineralogico Lombardo, Amici del Museo Zannato, Gruppo Mineralogico Scledense), which helped him expand his mineralogical knowledge through research, study, and collaboration. His dedication is evident in his many publications and the scientific precision with which he built and cataloged his collection.

In 2003, while exploring a gallery in Monte Trisa, Torrebelvicino (VI), with friends, Sergio made the remarkable discovery of a new blue-colored mineral, later confirmed as a new montetrisaite species.



Sergio Pegoraro, founder of AMI (Italian Micromineralogical Association), during one of his scientific research activities (2014), holding the first mineral of his collection: a pyrite specimen.

4.2 The minerals

The Sergio Pegoraro collection consists of 550 large mineral specimens and over three thousand micromounts, which are very small but also rare and valuable. The large specimens come from around the world and can be divided into two main groups.

The first group (around 150 pieces) features large specimens, many of which were collected by Pegoraro himself from Romanian mines (Cavnic, Baia Mare, and Baia Sprie). These include minerals from sulfides, halides, oxides, sulfates, and carbonates. Some notable examples are:

Sulfides: Pyrite with pentagonal dodecahedral crystals up to 15 cm; chalcopyrite with yellow-brass color and iridescence; galena with cube and octahedron-shaped crystals, and realgar, which features bright red prismatic crystals.

Halides: Fluorite, with crystals over 10 cm in shades of violet to green.

Oxides: Hematite, often seen as intertwined lamellar crystals forming rosettes with a metallic luster, and quartz, which appears in clear, colorless crystals or clouded by carbonate patinas.

Sulfates: Transparent gypsum with monoclinic crystals or sand-colored gypsum forming large desert rose structures, one measuring 50 cm. Blue or white barite crystals are also notable, often coated with minor sulfides like pyrite and chalcopyrite.

Carbonates: A specimen of aragonite with pseudo-hexagonal prismatic crystals, yellow dolomite with perfect rhombohedral crystals on a quartz matrix, and green malachite from the famous deposits of Congo.

Among the silicates in the Sergio Pegoraro collection, zeolites are particularly notable, featuring large crystals of stilbite and apophyllite. There are also impressive samples of feldspars, including orthoclase and microcline with perfectly geometric crystals and a striking plagioclase crystal showing exceptional labradorescence. In this optical effect, vivid colors shift as the crystal is moved.

The second collection group consists of four hundred smaller specimens equally valuable for their beauty and scientific importance. Some highlights include: cinnabar samples containing millimetric droplets of liquid native mercury; native silver in intricate arborescent and dendritic crystal forms; shiny, elongated stibnite crystals, known for

their flattened and striated appearance. A perfectly geometric crystal of bixbyite (iron and manganese oxide), which is extremely rare in nature, formed as a cube with octahedral cuts at its vertices.

Among the phosphates, collector favorites include: vanadinite in perfect hexagonal, dark red crystals; pyromorphite, also in hexagonal form but with a striking light green color; wavellite, with white or green fibrous-rayed aggregates; crocoite, a rare lead chromate from Australia.

Of particular interest is halotrichite, an iron and aluminum sulfate from the mines of Andalusia, Spain, characterized by shiny, silky, fibrous crystals resembling tufts of silk.

In the silicate category, noteworthy specimens include: dioptase, with intense green crystals tinged with blue, was initially mistaken for emerald when discovered in the 18th century; amesite, a rare chromium-containing phyllosilicate with a distinctive purple color.

The Pegoraro collection includes over three thousand micromounts - tiny mineral samples no larger than two centimeters, often much smaller. Many of these samples have fascinating features only a few millimeters in size. In some cases, small paper arrows are used to point out the most interesting part of the specimen, a common practice in the collection. Although these micromounts are tiny, a ten-power lens is usually enough to admire them, though a stereomicroscope offers a more detailed, three-dimensional view.

Despite their size, micromounts reveal stunning qualities and intricate details. Some contain unknown or rare minerals, as yet not fully studied. The Pegoraro collection includes perfect crystals like anglesite and aurichalcite, vibrant colors like linarite (electric blue) and brochantite (intense green), and unique growth forms like the fibrous-radial malachite. Rare species like acanthite (a silver sulfide with thorn-like crystals) and dundasite (lead carbonate forming small radial aggregates) are also part of this collection.

Sergio Pegoraro himself made a significant discovery while searching for micromounts: montetrisaite, a new mineral species found in the Monte Trisa mine, Vicenza. This blue-hydrated copper sulfate often crystallizes alongside redgillite, a green copper sulfate. With so many micromounts, there may still be more mineral wonders awaiting discovery.

The entire mineralogical collection can be viewed in the *Sanzio Digital Heritage* showcase

BARYTE

DRUSE OF LAMELLAR CRYSTALS WITH HEMATITE

Barite is a barium sulfate mineral (BaSO4), named after the Greek word "barys," meaning heavy, due to its high specific gravity. In this sample, the barite crystals are whitish and covered with small blackish hematite crystals, contrasting its appearance. This particular specimen comes from the Boldut mine near Cavnic, in the Maramures region of Romania.

REALGAR

BITERMINATED PRISMATIC CRYSTALS ON MATRIX

Realgar, whose name comes from the Arabic meaning "mine dust," is an arsenic sulfide mineral (As4S4) known for its ruby red color. Although relatively common, it is rarely found in large quantities or with well-formed crystals. Pliny the Elder referred to it as "sandracca" in his *Naturalis Historia*, and during the Middle Ages, it was called "risigallo." This specimen is from the Herja mine, near Baia Mare in the Maramures region of Romania.

WULFENITE

DRUSE OF TABULAR CRYSTALS

Wulfenite (PbMoO4) is a lead molybdate that is quite rare and, therefore highly sought after. It crystallizes in the tetragonal system, forming tabular crystals with a square or rectangular outline, more rarely with truncated pyramidal shapes of pseudo-octahedral appearance, with colors ranging from yellow to red-orange. This sample comes from Plaka Mines, in the mining district of Lavrion, Lavreotiki, Attica, Greece (Photo Sergio Pegoraro).

LINARITE

GROUP OF CRYSTALS ON MATRIX

Linarite is a basic lead and copper sulfate mineral with $PbCu(SO4)(OH)2$ chemical formula. Its name comes from Linares, Spain, where it was first discovered. Linarite typically forms in the oxidation zones of lead and copper deposits and is known for its striking intense electric blue color. It occurs in radial aggregates or as elongated crystals, either isolated or grouped. This micromount sample is from the Monte Trisa mines in Torrebelvicino (VI), Italy (Photo by Sergio Pegoraro).

VANADINITE

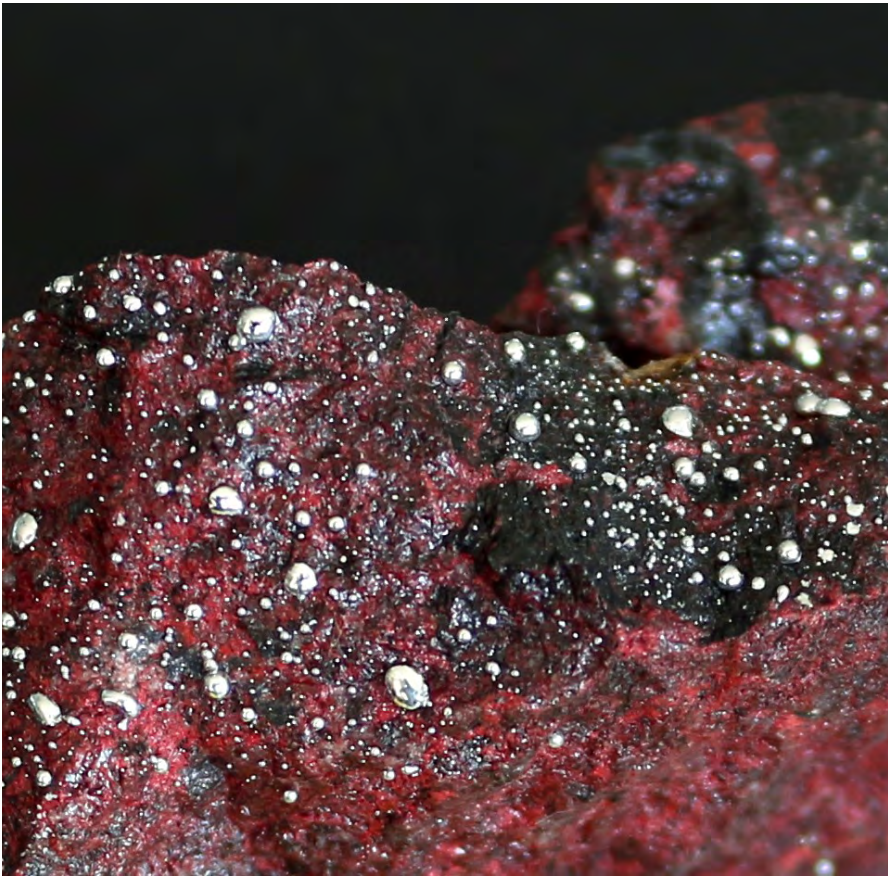
AGGREGATE OF HEXAGONAL CRYSTALS ON BARITE

Vanadinite is a lead chlorovanadate mineral with the chemical formula Pb5(VO4)3Cl, typically forming by altering lead minerals in the upper zones of deposits. It is highly valued for both its aesthetic appeal and geological importance. This particular sample features hexagonal crystals of a striking bright red color, and comes from the Mibladen mining district in Midlet, Draa-Tafilalet, Morocco.

MALACHITE

ACICULAR CRYSTALS GROWN IN FIBROUS-RADIAL AGGREGATES

Malachite, whose name originates from the Greek meaning "mauve green," is a copper mineral belonging to the carbonate class, with the chemical formula $Cu_2(CO_3)(OH)_2$. It is the most commonly found copper compound, forming as an alteration product of other copper-containing minerals. Typically microcrystalline, malachite often occurs in forms such as fibrous layers, kidney-shaped clusters, efflorescences, and fibrous-radial aggregates, as seen in this micromount sample from the mines of Monte Trisa in Torrebelvicino, VI, Italy.



MERCURY

NATIVE MERCURY DROPLETS ON CINNABAR

Mercury is a mineral classified as a native element. It has a melting point of -39°C, which is why it occurs in nature as a liquid, appearing as tiny droplets that saturate the rock around it. This particular sample is from the mines of Almadén in the Ciudad Real mining district of Castile-La Mancha, Spain.

HALOTRICHITE

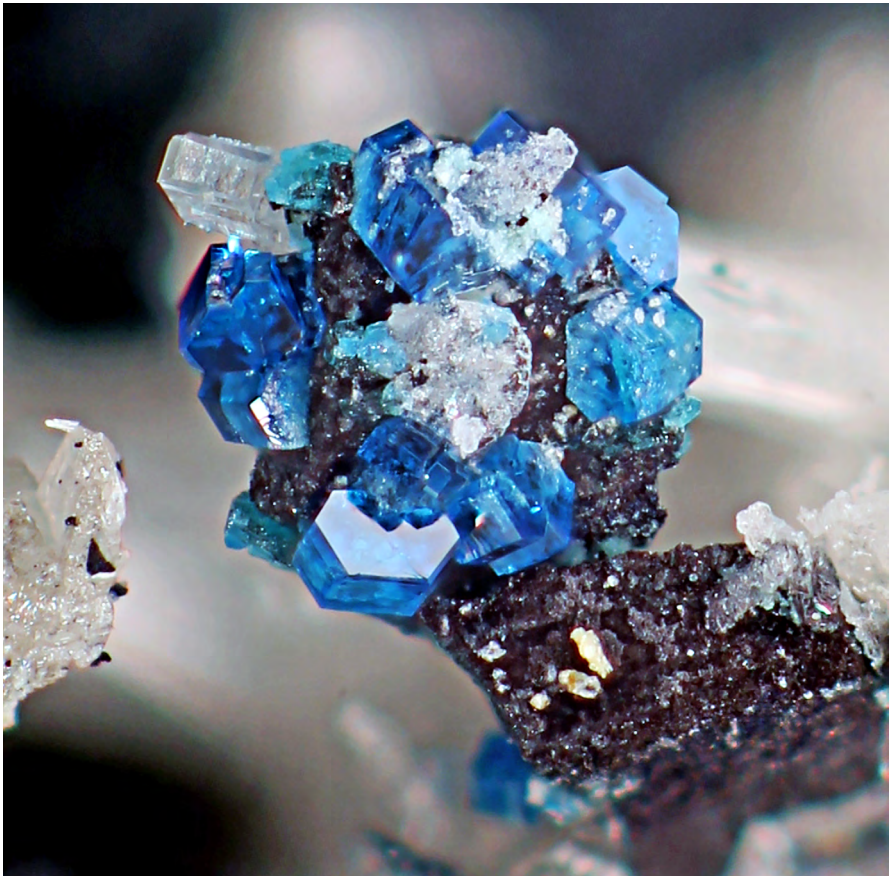
FIBROUS CRYSTAL AGGREGATE

Halotrichite derives its name from the Latin term *halotrichum*, meaning "hair salt." It is a relatively rare sulfate mineral with the chemical formula $Fe^{2+}Al_2(SO_4)_4 \cdot 22(H_2O)$. Highly soluble in water, its crystals can dissolve in high humidity conditions. Typically, it forms silky, fibrous aggregates or needle-like crystals that are whitish in color. This sample is from Rodalquilar, Nijar, Almeria, Spain (Photo by Giancarlo Gobbi).

MONTETRISAITE

PRISMATIC CRYSTAL AGGREGATE

Montetrisaite is a basic hydrated copper sulfate with the chemical formula $Cu_6(SO_4)(OH)_{10}{\cdot}2H_2O$. This rare mineral is known for its distinct blue color. It was recently discovered by Sergio Pegoraro while collecting samples in the ancient mines of Monte Trisa in the Valle dei Mercanti, Torrebelvicino (VI), Italy. This sample comes from that location (Photo by Sergio Pegoraro).



LANGITE

AGGREGATE OF PSEUDOHEXAGONAL CRYSTALS

Langite is a basic and hydrated copper sulfate with the chemical formula $Cu_4(SO_4)(OH)_6{\cdot}2(H_2O)$. It crystallizes in the monoclinic system, but its crystals often exhibit twinning, resulting in pseudo-hexagonal shapes of intense blue color. This sample is from the mines of Monte Trisa in Torrebelvicino (VI), Italy (Photo by Sergio Pegoraro).

ANGLESITE

GROUP OF CRYSTALS IN PARALLEL ASSOCIATION

Anglesite is a mineral first discovered on the island of Anglesey in England, which is how it got its name. It is a lead sulfate with the chemical formula $Pb(SO_4)$, formed through alteration processes in lead deposits. Anglesite has a high specific weight and crystallizes in the orthorhombic system, resulting in prismatic crystals that are often bright and colorless (Photo by Sergio Pegoraro).

AURICALCITE

AGGREGATE OF ELONGATED TABULAR CRYSTALS

Auricalcite is a hydroxycarbonate of zinc and copper, formerly called "brass flower." Its name comes from the Greek, meaning "mountain copper." This mineral forms by altering zinc and copper minerals when exposed to water rich in dissolved CO_2. While it can occur as isolated crystals, it is more commonly found in radial, fibrous aggregates or as tufts and encrustations. The crystals typically appear as elongated rectangular tablets with a light blue color, as seen in this sample from Monte Trisa, Torrebelvicino (VI), Italy (Photo by Sergio Pegoraro).

CROCOITE

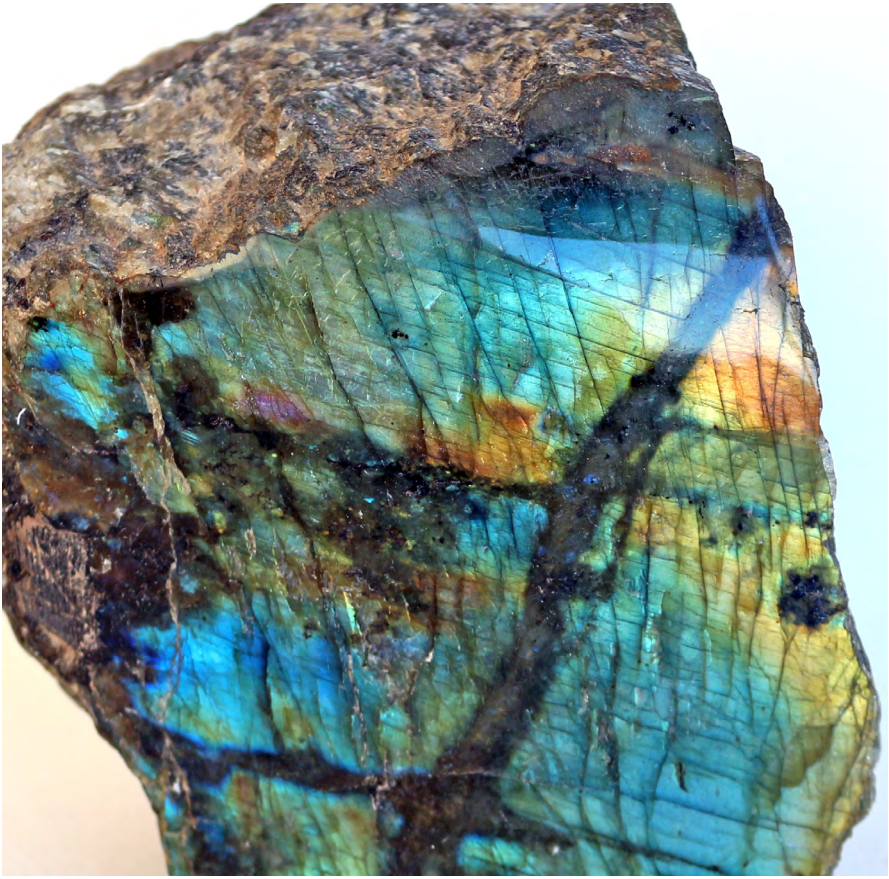
AGGREGATE OF PRISMATIC CRYSTALS ON LIMONITE

Crocoite is a lead chromate mineral with the chemical formula $PbCrO_4$. Its name comes from the Greek word *kròkos*, meaning saffron, which refers to the bright color it takes when powdered. The element chromium (Cr) was first discovered and identified by studying this mineral. Crocoite is quite rare, with the most stunning specimens found in the Adelaide Mine in the Dundas mining district of Tasmania, Australia, which is also the origin of this particular specimen.

PYRITE

GROUP OF PENTAGONODODECAHEDRAL CRYSTALS

Pyrite (FeS_2) is a common iron sulfide known for producing sparks when struck against metal, which is how it got its name. Its yellow color has led to it being called fool's gold. This sample features notably large crystals and originates from the Rio Marina mines on Elba Island, Italy.



PLAGIOCLASE

LABRADORITE VARIETY

Labradorite is a type of feldspar and belongs to the plagioclase series, silicates containing sodium and calcium. Its sodium/calcium ratio ranges from 30/70 to 50/50. This unique composition causes it to display a beautiful play of colors, mainly blues and greens, due to a phenomenon called labradorescence. This effect occurs because of light refraction through its layered structure. This particular sample comes from the Ampanihy district in the Atsimo-Andrefana region of Madagascar.

GYPSUM

AGGREGATE OF LENTICULAR TABULAR CRYSTALS (DESERT ROSE)

In this sample, from Tunisia, gypsum crystals have a particular "rose" appearance, which is typical of formation in arid environments. The crystals are translucent and exhibit an earthy sheen due to sand particles being included during their growth.

Bibliography

AA. VV., 1988. *La grande enciclopedia dei minerali*, Fabbri , Milano.

Bonatti S., Franzini M., 1979. *Cristallografia mineralogica*, Boringhieri, Torino.

Carobbi G., 1971. *Trattato di mineralogia*, vol.I-II, UTET, Firenze

Deer W.A., Howie R.A., Zussman J., 1994. *Introduzione ai minerali che costituiscono le rocce*, Zanichelli, Bologna.

Farndon J., 2018. *The Illustrated Guide to Rocks & Minerals: How to Find, Identify and Collect the World's Most Fascinating Specimens*, Lorenz Books, London.

Filippi F., Mattioli M., Pretto G., 2015. *Offretite ed erionite della Val Grossa di Valdagno (VI).* Grafiche Tipo, Castelgomberto (VI).

Filippi F., Pretto G., Mattioli M., 2018. *I minerali del comprensorio Altissimo-Castelvecchio (VI).* Grafiche Tipo, Castelgomberto (VI).

Gottardi G., 1978. *I minerali*, Boringhieri, Torino.

Johnsen O., 2006. *Guida ai minerali del mondo*, Zanichelli, Bologna.

Klein C., 2004. *Mineralogia*, Zanichelli, Bologna.

Martuscello E., 2012. *Cristalli e minerali*, Giunti Editore, Firenze.

Mattioli M., Cenni M., Raffaelli G., 2008. *I minerali del Veronese: le mineralizzazioni secondarie delle rocce vulcaniche dei Monti Lessini*. Museo Civico di Storia Naturale, Verona.

Mattioli M., Pretto G., Filippi F., 2017. *I Minerali di Cava Grolla, Spagnago di Cornedo Vicentino (VI).* Grafiche Tipo, Castelgomberto (VI).

Mazzi F., Bernardini G.P., 1983. *Fondamenti di cristallografia e ottica cristallografica*, USES, Firenze.

Mottana A., 1989. *Fondamenti di mineralogia geologica*, Zanichelli, Bologna.

Putnis A., 1992. *Introduction to mineral sciences*, Cambridge University Press.

Strunz, H., Nickel, E. H., 2001. *Strunz Mineralogical Tables*, 9th Edition. Schweizerbart, Stuttgart.

Sitography

Mindat.org	https://www.mindat.org
Mineralogy Database	https://www.webmineral.com
Minerals.net	https://www.minerals.net
Alex Strekeisen	http://www.alexstrekeisen.it
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Sanzio Digital Heritage

1. The “Enzo Franchin” collection

2. The “Emilio S. Lorenzini” collection

3. The “Sergio Pegoraro” collection

The general catalogue of the individual collections is accessible via the *Sanzio Digital Heritage* showcase | https://sanzio.uniurb.it
Scan the respective QR code to consult the contents.

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DEGLI STUDI
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SMAUrb
SISTEMA MUSEALE DELL'ATENEO DI URBINO

This guide serves as a helpful resource for exploring the Mineralogy Collections at the University of Urbino, which consist of three collections in total. Each collection is introduced by a brief biography of the person who established it and donated it to the university: Enzo Franchin, Emilio Lorenzini, and Sergio Pegoraro. The guide showcases a selection of mineral samples notable for their scientific, gemological, aesthetic, or rare qualities, all illustrated in vibrant color.
Additionally, a QR code system allows visitors to access the Sanzio Digital Heritage display case, where they can view catalogue cards for all the minerals in the three collections, totaling approximately 1,800 cards. The guide and digital display case work together to offer flexible visitor itineraries tailored to the time available or the specific interests of each visitor.

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