A petrographic catalogue for the “Onyx Marbles and Alabasters Collection” of The Museum of Mineralogy and Petrography in Turin University

UNIVERSITÀ DEGLI STUDI DI TORINO

A petrographic catalogue for the "Onyx Marbles and Alabasters Collection" of The Museum of Mineralogy and Petrography in Turin University

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Abstract

The paper reports information and results relative the 69 rock samples belonging to the "Onyx Marbles and Alabasters Collection" recently acquired by the "Mineralogy and Petrography Museum" of the University of Turin. The collection is in loan for use to the "Regional Natural Science Museum" of Turin.

This set of specimens represents several *onyx marble* varieties currently available in the Italian ornamental stone market. Most of them are actually calcite-alabasters, a sedimentary rock formed in karst environments. Generally, they show a banded structure having nearly parallel layers that differ, from case to case, in color, fabric and /or mineral composition.

In order to examine the different features of this heterogeneous category, a multi-technique approach has been chosen. Detailed photographic documentation was acquired for each sample of the collection; moreover, a small amount of specimen was collected for chemical analysis and mineralogical investigations. Every sample has been scanned by electron microscopy and, for the most interesting varieties, a thin section was obtained and observed under optical microscopy. MicroRaman spectroscopy was used to determine the mineral phases present in each sample, as well as EDS analysis that added a chemical dataset to the characterization of the mineral species detected. ICP-OES spectroscopic analyses were done for the determination of trace elements of the carbonate fraction of each sample.

All the information obtained were organized in a petrographic catalogue reported at the end of the paper.

Keywords: calcite-alabaster, onyx marble, collection, catalogue

Introduction

The European standard EN 12670:2001 (Natural stone – Terminology) defines as *Onyx Marble* "*any compact, banded stone, consisting of colored and transparent layers of calcite and/or aragonite, and capable of taking a polish*". This term has been taken from the quarrymen language, which sometimes is far from scientific definitions, and is erroneously used as a synonym of alabaster (meant as calcite-alabaster).

Under the name of Onyx Marble are thus grouped many varieties of carbonate rocks with different genesis and petrographic classification. This group comprises calcite-alabaster, marble, limestone and travertine. The common factor is the easiness of cut and polish and (for the majority of varieties) the aesthetical aspect which main feature is the banded structure.

Onyx Marble is a merely commercial definition, on the other hand, the petrographic nomenclature of this group of rocks is quite debated except for limestones and marbles varieties that can be ascribed as Onyx Marbles. The terminological issue concerns the rocks which different authors refer as: alabaster, calcareous sinter, travertine, onyx marble, oriental alabaster. Other times, the same name is used to denominate different stones, or similar varieties are denominated with different names. (EN 12440, 2008). This often results in a great deal of confusion causing misunderstandings.

Surprisingly, this terminological issue is more than a century old. In 1893 the Smithsonian Institute curator George P. Merrill collected many documents and did researches on *onyx marbles*, in his introduction he wrote: "*It is unfortunate in our discussion of the subject in hand, that both the popular names by which these stones are known are erroneous and misleading. The term onyx as properly used, includes a banded variety of chalcedony - a purely siliceous rock[…]. The term alabaster as applied to the stone is even more misleading than onyx, since both stones are used for the same purposes, and when reading published accounts we are not infrequently at a loss, unless descriptive qualities are mentioned, to know at all times whether the material under discussion is a true alabaster (gypsum) or an onyx marble*". After his work, some nomenclature papers have been published by European and American authors but, until now, there is not a standard definition universally accepted. So, the confusion remains.

The current situation is that different research groups use mainly the definitions alabaster and travertine to define the same sedimentary orthochemical carbonate rock. The german researchers Klemm and Klemm (1991) proposed the definition of *calcite-alabaster* for this speleothem-derived rock, while American researcher Harrell (1990) states that the technically correct name for the same

stone is ‘travertine’ and its dense, non-porous character classifies it as the sub-variety ‘calcareous sinter’, contrasting the former definition.
This work is not aimed to deal the nomenclature issue but a few words are spent to justify the set of definitions used in the catalogue.

We decided to follow Klemm and Klemm’s suggestion. The main discriminant in the classification, in our advice, should be the genetic conditions that originated the rock. Travertine is originated in sub-aerial environment while calcite-alabaster precipitates in hypogeal environment such as cave and karst areas. It is a sedimentary orthochemical rock, generally layered alternating opaque brown and translucent white bands. It is composed mainly of calcite, rarely of aragonite. It has hypogeal origin in karst environment, occurring typically as reprecipitated calcite in limestones and/or dolomites (Fairchild and Baker , 2012).

Modern petrographists use the term “alabaster” to define an evaporitic gypsum rock, e.g. Volterra Alabaster. Nevertheless, the term was used since ancient times to define the carbonate rock quarried in Egypt starting from the Predinastic period (Klemm and Klemm, 2001). The origin of the word “Alabastron” could derive from an old Egyptian town and its quarries, near Thebes, where this rock was extracted and carved, or from a traditional typology of Egyptian jar (Harrell, 1995).

The collection

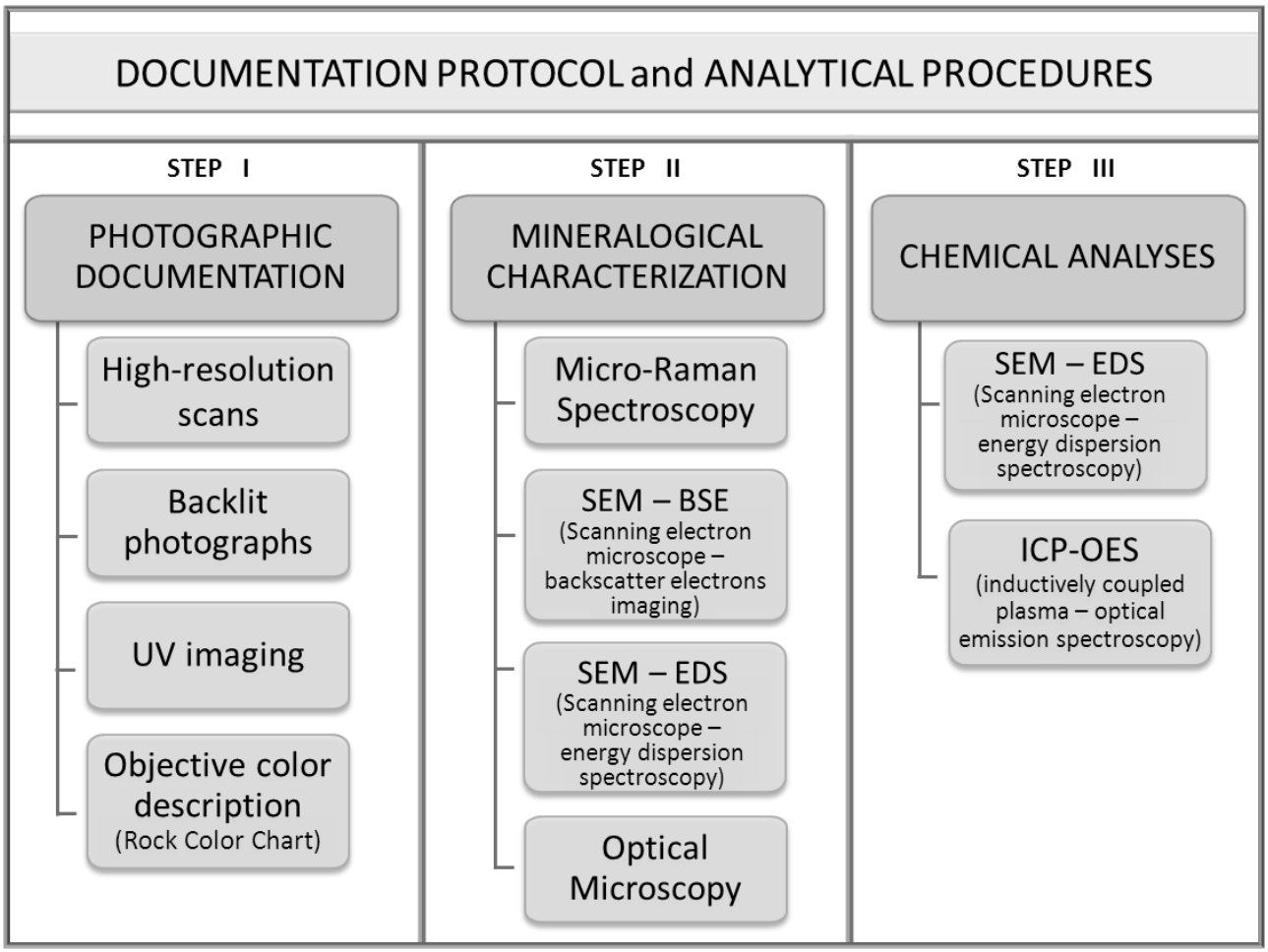
The “Onyx Marbles and Alabasters Collection” has been donated to the Museum of Mineralogy and Petrography of Turin University with the aim of representing the availability on Italian market of this categories of rocks. The editing of this sort of catalogue is framed in a PhD project in progress at the Earth Science Department of the University of Turin. The research project deals with the mineralogical and petrographical characterization of the varieties of ornamental stones called Onyx Marbles (Marengo et al., 2014). During the first step of the project, samples had to be collected; in doing so, we addressed to the Regional Museum of Natural Science and to companies operating in trading and manufacturing of ornamental stones which cooperated to provide the samples dealt in this work (Antolini Luigi & C. S.p.A. provided all of the specimens of the collection). The resulting collection is composed of 69 slabs representing 58 commercial varieties of *onyx marble*. The specimens have the approximate size of 13 x 7.5 x 0.8 cm and are thin rectangular blocks, polished on one side. For every sample, its commercial denomination is reported, additionally to an identification number. The collection comprises also 20 thin sections of the samples chosen among the most interesting varieties from a petrographic point of view.

The specimens can be subdivided in two typologies according to the cutting direction. The “vein cut” slabs (referred as *vc* in the catalogue) are cut normally to the deposition horizons of calcite\aragonite layers (this is also known as cutting “against the vein”); on the other hand “cross cut” slabs (referred as *cc* in the catalogue) are sliced at a 90 degree angle to the vein cut, thus it shows a cross section of the layers in the stone block (it is also called cutting "with the vein"). Some varieties are represented by the two specimens of both kinds. The different cutting directions affect significantly the aesthetical appearance of the material, and this feature has been utilized since ancient times to obtain decorative effects exploiting the particular texture of this rocks.

The provenance localities are several. The most represented countries are Pakistan, Iran, Afghanistan, Mexico, Egypt, Tanzania, Argentina, Turkey, Tunisia and Italy. The locality in detail has not been provided whether the sample is currently commercialized (exact geographical location of the quarries is a confidential information).
The collection has been registered in the Catalogue of the museum with the series of numbers from M/U16701 to M/U16769.

Documentation protocol and analytical procedures

Every item of the collection was characterized using a multi-technique approach. An “analysis protocol” was designed to compile the petrographic catalogue. Non-destructive methods have been preferred to preserve as much as possible the samples. Though, it was necessary, for every specimen to collect a small amount of material (a small rectangular block around one centimeter wide). The analytical protocol is described in the chart below.



I) Photographic documentation:

High-resolution scans of every specimen was made to capture some otherwise unnoticed features. Backlit photographs have been taken only of totally or partially translucent varieties. A peculiar feature of "onyx marbles" and of several calcite-alabaster is the translucence of some laminae. This derives from the morphology of crystals and from the presence or absence of impurities deposited in certain layers. Taking advantage of this characteristic property, backlit pictures improve the visibility of macroscopic crystalline structures such as: crystal growth elongation, approximate size of crystals and sometimes macroscopic inclusions.

Ultraviolet photography is useful to observe how calcite composition influences the color and the intensity of the luminescence, giving a hint on the nature of the fluorophores (usually trace elements and organic matter in calcite).

For an objective description of colors of the samples, they have been compared with the USGS - Munsell Rock Color Chart (1991).

II) Mineralogical characterization:

MicroRaman spectroscopy was used to determine the mineral phases present in each sample, SEM observation in BSE mode has been useful to identify the most common mineral inclusions in the

samples and give complementary information in the cases where the inclusion was too small to be analyzed through MicroRaman spectroscopy. SEM-EDS analysis added a chemical dataset to the characterization of the mineral species detected. Statistically significant is the presence of barite, fluorite, strontianite and manganese and iron compounds.

On the whole 20 thin sections have been obtained and observed under traditional optical microscopy in transmitted light.

III) Chemical analyses:

Mean chemistry of the samples is useful to characterize the formation environment and to understand how the initial conditions can influence the genesis of the rock; this could help to associate specific features to a particular compositional range. SEM-EDS analyses were done for the determination of major (and minor) elements of the carbonate fraction of each sample, ICP-OES spectroscopy, was used to detect trace elements. The most explicative and immediate example of how chemical composition and physical characteristics are related is the color of the rock. Despite the fact that both calcite and aragonite have no intrinsic color, onyx marbles are representative of a wide color range, from translucent white to opaque black, most commonly occurring colors are honey yellow, orange and various shades of brown; a little less common are bright green, red and purple. Several banded varieties often display many colors and the prevalent pattern is white translucent bands alternated with brown opaque ones. Many authors refer to the band alternation as an "annual lamination"; every couplet, e.g. white-brown or white-green bands, is developed in a year-time and the two bands represent the dry and wet season (Baker et al., 2008). Considering the data found in literature it is reasonable to suppose that brown color is due to humic and fulvic acids dissolved in the "mother" solution; these substances are formed in the soil by the breakdown of vegetal material. Red is usually due to the presence of ferric oxides and hydroxides. Green is given by ferrous or copper compounds. Black can be ascribable to the effect of manganese oxides (Hill and Forti, 1997). The eventually detected presence and the nature of chromophore compounds in the samples is reported in the description of the samples in the catalogue.

Analytical setup

Chemical analyses of mineral phases are performed with a Cambridge Stereoscan 360 Scanning Electron Microscope, equipped with an Oxford Inca Energy 200 EDS microanalysis. All spectra are obtained using the following setup: accelerating voltage of 15 kV, working distance of 25 mm, probe current range 800 pA – 1.2 nA and exposure time range 60-500 s. Primary standardization performed on SPI Supplies and Polaron Equipment analytical standards, regularly standardized against a high purity metallic Co standard before each experimental session.

Raman spectra are obtained using a micro/macro Jobin Yvon LabRam HRVIS coupled to an Olympus optical microscope. The signal is collected with a 50× objective for non-oriented crystals. The 632.8 nm line of He-Ne laser is used as excitation; laser power (20 mW) is dosed through a series of density filters. The lateral and depth resolution are around 2 and 5 μm, respectively. The system is calibrated using the 520.6 cm^{-1} Raman band of Si before each experimental session.

Trace elements in the carbonate fraction are detected with a Spectro Iris Advantage II ICP-AES Emission Spectrometer. The instrument is calibrated before and during each experimental section with regularly re-prepared standard solutions (Merck products) obtained for calibration range of 0-1 ppm.

The catalogue

For every item of the collection, the information are organized as follows:

1) MRSN Catalogue Number: here is reported the identification code of every sample. They range progressively from M/U16701 to M/U16769
2) Picture of the sample: it is obtained by high-resolution scanning. The size of the printed picture is slightly reduced from the original size.
2) *Commercial name*: denomination provided by the dealers. For each entry there is also an English translation. Commercial names can vary, different sellers can refer to the same variety (same provenance and aspect) in different ways. The most widely used is given.
3) *Petrographic classification*: the terms are used in the meaning as listed. *Calcite-alabaster*: for its definition see introduction. *Travertine*: sub-aerial carbonate concretion. *Limestone and marble*: both intended in *sensu stricto* as respectively the sedimentary and metamorphic carbonate rock. In some case the correct identification was not feasible by observing the relatively small specimen available; these samples are indicated with the symbol (?) after the classification hypothesis.
4) *Provenance*: as stated previously, the precise location of the quarry was omitted by the providers for several varieties, for commercial reasons. The provenance areas indicated in square brackets are deduced from literature and online resources as stonecontact.com and deutsches-natursteinarchiv.de.
5) *Cutting and finishing*: here are described some technical aspects of the specimens. For every entry are reported the shape of the slab, its size, its cutting direction (indicated with *vc* and *cc*) and the finishing process (polished or smoothed)

6) *Description*: macroscopic features are reported along with microscopic characteristics (where the thin section was available). The color(s) is described with the structure of the rock, information on the mineralogical composition and the porosity are also given.

7) *Other mineral phases*: list of minerals detected by micro-Raman spectroscopy and/or SEM-EDS analyses. The main component (calcite or aragonite) is not reported here but in the *Description* (6). In some cases the certain identification has not been possible even combining the two techniques used (destructive XRD was required). We choose to not collect a further amount of material and to report the chemical nature of the mineral found as a generic indication (e.g. manganese compounds or iron oxide). If a SEM picture is present, it will be a back-scattered electron image (SEM-BSE), in which the different gray tones are related to the mean atomic mass of the object. The higher the atomic mean mass, the lighter the gray tone.

8) *Translucence and fluorescence info*: this section contains the information obtained through the photographic documentation phase. There is also reported, in some cases, the probable causes of the fluorescence color.

9) *Chemical composition of carbonate fraction:* all the concentration values reported unless for Mg have been obtained on 1 g of powdered sample, dissolved by acid treatment and analyzed by ICP-OES (the lettering nd means not determined i.e. the value is below the detection limit of 10 ppm) . So, the values have to be intended as mean concentrations of the sample. Mg values are the average of 5 punctual analyses on calcite crystals by SEM-EDS.

10) *Color*: the objective description of color is obtained by the observation of the dry polished specimens in natural daylight and comparing them to the USGS - Munsell Rock Color Chart (1991). Some samples have been extremely complex to describe using this method, due to the high amount of shades and hues present; reason why only the most represented are listed here.

MRSN Catalogue number: M/U16701

Fig. 1A

Commercial name: Alabastro Egiziano – *Egyptian Alabaster*

Petrographic classification: calcite-alabaster

Provenance: [Egypt]

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), vein cut, polished surface.

Description: the rock is composed of elongated calcite crystals oriented nearly perpendicularly to the growing surface; the color of calcite layers is honey yellow and a parallel banded structure is easily recognizable. Presence of few small cracks filled with white fine grained calcite.

Other mineral phases: Rare inclusions of hematite (Fig. 1B - small white rounded crystals, SEM-BSE image) and muscovite.

Translucence and UV fluorescence info: translucent; white secondary calcite fluoresces in light blue (Fig. 1C)

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16701	52.74	2.55	<1%	20	3970	nd	nd	200	50	nd

Color: mainly 10YR8/6 with N9 veins

MRSN Catalogue number: M/U16702

Fig. 2A

Commercial name: Alabastro Persiano – *Persian Alabaster*

Petrographic classification: calcite-alabaster

Provenance: Central America

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), vein cut, polished surface.

Description: the specimen is light brown with a radial banded structure, typical of speleothems, in which it is recognizable stalactite/stalagmite arrangement. It is composed of calcite; in thin section the sweeping extinction across several individuals gives a *feathered* aspect to the crystals (Fig. 2B, cross polars). The calcite fabric is *elongated columnar* type, with crystals preferentially growing along c-axis. This fabric suggests that probably calcite precipitated under high pH condition of the feeding water (Frisia et al 2010).

Other mineral phases: presence of hematite inclusions (Fig. 2C - small white crystals on calcite background, SEM-BSE image)

Translucence and UV fluorescence info: translucent; light yellow UV fluorescence.

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16702	54.35	1.43	<1%	nd	210	nd	nd	nd	40	nd

Color: principal colors are 10YR7/4, 10YR8/4, 10YR8/2 and N9

MRSN Catalogue number: M/U16703

Fig. 3A

Commercial name: Onice Ambra extra – *Amber extra Onyx*

Petrographic classification: calcite-alabaster

Provenance: [Middle East]

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), cross cut, polished surface.

Description: the main component is calcite, yellowish orange in color. The slab is cut nearly perpendicular to the concretion growth surface, imparting a *cloudy* aspect to the specimen. The layered structure is compact and fine grained.

Other mineral phases: rare inclusions of barite (Fig. 3B - sub-rounded white crystal, SEM-BSE image) and strontianite.

Translucence and UV fluorescence info: translucent; not fluorescent in ultraviolet light.

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16703	54.07	1.49	<1%	nd	2480	nd	nd	800	50	nd

Color: shading from 10YR8/6 to 10YR6/6, N9 veinlets

MRSN Catalogue number: M/U16704

Fig. 4A

Commercial name: Onice Ametista extra – *Amethist extra Onyx*

Petrographic classification: calcite-alabaster

Provenance: Africa

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), cross cut, polished surface.

Description: banded structure, alternating deep red and orange layers of calcite. The particular color is due to numerous micro-inclusion of iron oxides (probable of detrital origin because of their rounded shape); in figure 4B (thin section picture, plane polars), hematite round inclusions of 2-4 μm of diameter are shown. In thin section one can see how the fabric changes from layer to layer. In figure 4C (thin section picture, cross polars) three different fabrics are distinguished: A) (top left) mosaic fabric: anhedral crystals are recognizable. Crystal mean diameter around 70μm. B) (middle) micritic fabric crystals few μm wide. In both cases individuals do not show any preferred elongation C) microcrystalline columnar fabric: crystals have a length/width ratio less than 6/1; they show irregular boundaries, extinction domains where crystallites may not have grown in optical continuity with the substrate. These three kind of fabrics suggest a probable high growth speed rate.

Other mineral phases: hematite and other iron oxides/hydroxides, manganese oxides.

Translucence and UV fluorescence info: the sample is not translucent and does not fluoresce in UV light, likely because of the presence of iron ions which are luminescence inhibitors in calcite.

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16704	52.11	1.43	1.98	nd	3230	nd	nd	600	18050	3900

Color: background is 5R2/6 and 5R3/4, layers are 10YR8/6 and 5YR5/6

MRSN Catalogue number: M/U16705

Fig. 5A

Commercial name: Onice Arco Iris cc – *Arco iris Onyx cc*

Petrographic classification: calcite-alabaster

Provenance: Middle East [Iran]

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), cross cut, polished surface.

Description: homogeneous, ivory colored sample composed of coarse grained calcite. Crystals are cut perpendicularly to the elongation direction showing a sub-rounded section. This sample belongs to the same "onyx" variety of M/U16706 (vein cut).

Other mineral phases: rare inclusions of Mn oxides and compounds.

Translucence and UV fluorescence info: translucent; strong pink fluorescence that could be due to the presence of Mn^{2+} ions (Fig. 5B).

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16705	54.01	1.61	<1%	nd	590	nd	nd	nd	44	2930

Color: 5Y8/1 and 5Y8/4

MRSN Catalogue number: M/U16706

Fig. 6A

Commercial name: Onice Arco Iris vc – *Arco iris Onyx vc*

Petrographic classification: calcite-alabaster

Provenance: Middle East [Iran]

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), vein cut, polished surface.

Description: banded structure, alternating thin dark bands and wide clear layers (see M/U16705). Whitish bands are composed of almost pure calcite while dark bands are full of detrital inclusions. In thin section: crystal show acicular fabric and are grouped in extinction domains (Fig. 6B, thin section picture, cross polars). The elongation of the individuals is along c-axis, lamination is not visible in acicular aggregates. Dark layers may suggest the occurrence of growth hiatuses, evidences show that this type of fabric develops when some periods of dryness occur during the speleothems' accretion (Frisia et al. 2010).
This sample belongs to the same "onyx" variety of M/U16705 (cross cut)

Other mineral phases: fluorapatite (Fig. 6C – in the centre of the picture, the fluorapatite crystal has a rounded shape, the background calcite is not compact as deduced by the presence of black areas corresponding to pores, SEM-BSE image), Mn oxides/hydroxides and compounds, Fe sulfate.

Translucence and UV fluorescence info: lighter bands are translucent and have a pink fluorescence (high Mn^{2+} content), while some not translucent bands have a lower mean quantity of Mn^{2+} implying a bluish fluorescence (Fig. 6D).

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16706	53.92	1.80	<1%	nd	900	nd	nd	nd	110	1490

Color: broader bands are N8, N9, N4, 5Y7/2, 10YR7/4, thinner bands are N1

MRSN Catalogue number: M/U16707

Fig. 7A

Commercial name: Onice Bianco – *White Onyx*

Petrographic classification: calcite-alabaster

Provenance: [Middle East]

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), cross cut, polished surface.

Description: white homogeneous sample, composed of compact fine grained calcite; cut perpendicularly to the stratification, it has a *cloudy* aspect.

Other mineral phases: iron oxides and hydroxides.

Translucence and UV fluorescence info: translucent; strong blue fluorescence despite the high Fe content (Fig. 7B).

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16707	53.62	0.70	1.51	54	1890	nd	nd	45	12100	840

Color: N9 and 5G8/1

MRSN Catalogue number: M/U16708

Fig. 8A

Commercial name: Onice Bianco extra – *Extra white Onyx*

Petrographic classification: calcite-alabaster

Provenance: [Middle East]

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), cross cut, polished surface.

Description: pure white color, extremely compact and fine grained. It is composed of calcite with banded structure and cloudy aspect.
This sample is a finest variety of M/U16707

Other mineral phases: iron compounds.

Translucence and UV fluorescence info: translucent; strong homogeneous blue UV fluorescence (Fig. 8B).

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16708	53.81	0.87	1.33	nd	1580	nd	nd	nd	9600	400

Color: N9 and 5Y8/1

MRSN Catalogue number: M/U16709

Fig. 9A

Commercial name: Onice Black – *Black Onyx*

Petrographic classification: calcite-alabaster

Provenance: Middle East

Cutting and finishing: rectangular slab (13 x 7.5 x 1.8 cm), cross cut, polished surface.

Description: banded structure, uncommon greenish black color, fine-grained calcite crystals having milky appearance in the polished slab. In thin section (Fig. 9B, cross polar picture) the fabric of crystals is recognizable as open columnar because of the length/width ratio of crystals (around 6:1); the presence of micro-pores and the uniform extinction of domains are attributes of this fabric.

Other mineral phases: rare fluorite inclusion (Fig. 9C – SEM-BSE image).

Translucence and UV fluorescence info: not translucent; not fluorescent.

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16709	54.61	1.19	<1%	nd	2320	nd	nd	nd	260	720

Color: 5G2/1, 5Y2/1 with 5Y6/1 veins

MRSN Catalogue number: M/U16710

Fig. 10A

Commercial name: Onice Blue grey – *Blue grey Onyx*

Petrographic classification: calcite-alabaster

Provenance: unknown

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), cross cut, polished surface.

Description: the specimen presents a cloudy aspect because of its cutting direction. It is composed of white and bluish grey calcite stratifications forming a banded structure, It is fine grained with a low porosity.

Other mineral phases: not found in the analyzed section.

Translucence and UV fluorescence info: partially translucent; weak uniform bluish fluorescence (Fig. 10B).

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16710	54.22	1.49	<1%	55	450	nd	nd	nd	30	70

Color: N3, N5, 5Y6/1 on N8 and N9 background

MRSN Catalogue number: M/U16711

Fig. 11A

Commercial name: Onice Brecciato – *Breccia Onyx*

Petrographic classification: calcite-alabaster

Provenance: unknown

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), cross cut, polished surface.

Description: the sample has particular structure and colors. Despite the heterogeneity of the specimen, it is composed of almost pure calcite. Pink fine grained stratifications are recognizable on a medium grained orange background. Presence of oriented and parallel cracks filled with white secondary calcite.

Other mineral phases: not found in the analyzed section.

Translucence and UV fluorescence info: not translucent; pink bands are bright red in fluorescent light (Mn^{2+} ions in calcite) (Fig. 11B)

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16711	54.84	0.86	<1%	nd	1680	nd	nd	1300	400	80

Color: stratifications are identified by 10R6/4, 5YR6/4, 5YR8/4 on a 10YR5/4 and 5YR5/6 background, N9 veins

MRSN Catalogue number: M/U16712

Fig. 12A

Commercial name: Onice Brown – *Brown Onyx*

Petrographic classification: calcite-alabaster

Provenance: unknown

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), vein cut, polished surface.

Description: the sample is light brown, elongated crystals of calcite are disposed in layers of variable thickness. Color is probably due to the presence of organic acids (mainly humic and fulvic acids).

Other mineral phases: not found in the analyzed section.

Translucence and UV fluorescence info: translucent; weak uniform yellowish fluorescence that strongly suggests the presence of organic acids (Fig. 12B).

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16712	54.87	1.01	<1%	30	370	nd	nd	nd	30	710

Color: 10YR6/6 and 10YR8/2

MRSN Catalogue number: M/U16713

Fig. 13A

Commercial name: Onice Canyon cc – *Canyon Onyx cc*

Petrographic classification: calcite-alabaster

Provenance: [United States]

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), cross cut, polished surface.

Description: heterogeneous sample that displays brown, orange and white, concentric stratifications of different grain size. It is mainly composed of calcite and is characterized by presence of many mineral inclusions, especially in darker bands.
This sample belongs to the same "onyx" variety of M/U16714 (vein cut)

Other mineral phases: barite, hematite and other iron oxides and hydroxides, Mn compounds (Fig. 13B – iron and manganese oxides on homogeneous background of calcite; barite is the white mineral, SEM-BSE image).

Translucence and UV fluorescence info: not translucent; partially fluorescent, white calcite fluoresce in red while brown bands have a yellow fluorescence.

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16713	55.17	0.63	<1%	1750	1240	nd	nd	nd	1240	6400

Color: stratifications identified by 5Y7/2, 10YR6/2, 5YR2/1, 5G2/1, 10YR8/6 and 5YR4/4

MRSN Catalogue number: M/U16714

Fig. 14A

Commercial name: Onice Canyon vc – *Canyon Onyx vc*

Petrographic classification: calcite-alabaster

Provenance: [United States]

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), vein cut, polished surface.

Description: heterogeneous sample that displays brown, orange and white concretions of different grain size. It is composed of calcite and is characterized by presence of many mineral inclusions mainly in darker bands. It is compact, but there are cracks of variable size filled with white micritic calcite.
This sample belongs to the same "onyx" variety of M/U16713 (cross cut)

Other mineral phases: barite, hematite and other iron oxides and hydroxides, Mn compounds.

Translucence and UV fluorescence info: not translucent; fluorescent, white calcite fluoresce in blue while brown bands have a yellow fluorescence (Fig. 14B).

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16714	55.75	0.24	<1%	nd	250	nd	nd	nd	890	700

Color: concretions of N9, 10YR5/4, 10YR4/2, 10YR7/4 colors

MRSN Catalogue number: M/U16715

Fig. 15A

Commercial name: Onice Cappuccino – *Cappuccino Onyx*

Petrographic classification: calcite-alabaster

Provenance: unknown

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), cross cut, polished surface.

Description: composed of pure calcite, the specimen is homogeneous honey yellow color. The cross cut gives a cloudy aspect. Color is probably due to the presence of organic acids (mainly humic and fulvic acids).

Other mineral phases: not found in the analyzed section.

Translucence and UV fluorescence info: translucent; light blue and yellowish fluorescence indicating the distribution of organic acids in calcite layers (Fig. 15B).

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16715	55.33	0.51	<1%	nd	nd	nd	nd	nd	40	650

Color: shades of 10YR8/6 and 10YR8/2

MRSN Catalogue number: M/U16716

Fig. 16A

Commercial name: Onice Caramel – *Caramel Onyx*

Petrographic classification: calcite-alabaster

Provenance: [Turkey]

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), vein cut, polished surface.

Description: composed of brownish yellow calcite layers, it is fine grained and its crystals are elongated perpendicularly to the stratification.

Other mineral phases: not found in the analyzed section.

Translucence and UV fluorescence info: translucent; dark red fluorescence due to the high manganese content (Fig. 16B).

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16716	54.83	0.58	<1%	nd	160	240	nd	3650	30	6170

Color: 10YR6/6, 10YR8/6 and 10YR8/2

MRSN Catalogue number: M/U16717

Fig. 17A

Commercial name: Onice cristallo – *Crystal Onyx*

Petrographic classification: calcite-alabaster

Provenance: unknown

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), cross cut, polished surface.

Description: the specimen is a rock of medium sized grains, characterized by parallel bands of elongated calcite crystals cut through the growth direction. The structure is compact with small oriented cracks probably due to cutting process. The cracks and voids are filled with a transparent resin.

Other mineral phases: iron oxides and hydroxides

Translucence and UV fluorescence info: translucent; a uniform strong blue UV fluorescence denoting a homogeneous composition (Fig. 17B)

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16717	53.59	0.53	1.94	nd	nd	nd	nd	nd	12700	620

Color: 5Y8/4 and 5Y8/1

MRSN Catalogue number: M/U16718

Fig. 18A

Commercial name: Onice cristallo striato – *Banded crystal Onyx*

Petrographic classification: calcite-alabaster

Provenance: unknown

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), vein cut, polished surface.

Description: parallel bands of elongated calcite crystals alternating yellowish and whitish layers, crystal size is bigger in darker bands, presence of a big crack that crosses the specimen.
This sample is a finest variety of M/U16717.

Other mineral phases: not found in the analyzed section.

Translucence and UV fluorescence info: translucent; light blue UV fluorescence, one can notice the presence of brownish bands where organic acids are more concentrated (Fig. 18B).

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16718	55.37	0.53	<1%	nd	710	nd	nd	nd	20	430

Color: N9, 10YR8/2, 10YR8/4

MRSN Catalogue number: M/U16719

Fig. 19A

Commercial name: Onice egeo – *Aegean Onyx*

Petrographic classification: travertine

Provenance: [Turkey]

Cutting and finishing: rectangular slab (13 x 7.5 x 1.8 cm), vein cut, polished surface.

Description: the specimen is unusual because of the presence of a thick brown band in the lower part of the sample. In the upper part, thin layers are alternating black and white colors. Despite it is composed of calcite only, it is a rather heterogeneous material because of the presence of many inclusions. Dark layers are characterized by inclusions of manganese and iron compounds, white ones by fluorite and brown layers by the presence of iron compounds. Calcite bands are fine-grained: brown layers are very compact, unlike the black and white ones that are porous with a great amount of cracks. Some of the voids are naturally filled with secondary calcite while others are artificially filled with two different kinds of resin, likely to improve the mechanical properties of the stone and to give a better aesthetical effect.

Other mineral phases: fluorite (Fig. 19B - white particles of fluorite on gray calcite, SEM-BSE image), Mn compounds (Fig. 19C tiny inclusions of manganese oxides, SEM-BSE image), Fe oxides

Translucence and UV fluorescence info: not translucent; white layers are UV fluorescent with pink and bluish colors

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16719	55.31	0.55	<1%	nd	520	nd	nd	nd	4540	830

Color: in the upper part colors are N9, N3, N6, N7 - 10YR8/2; lower part is identified by 10YR4/6 and 5YR3/4

MRSN Catalogue number: M/U16720

Fig. 20A

Commercial name: Onice Fantastico cc – *Fantastic Onyx cc*

Petrographic classification: calcite-alabaster

Provenance: Central America [Mexico]

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), cross cut, polished surface.

Description: the specimen is a rock characterized by fine grained red layers on a whitish background., Red bands are characterized by hematite inclusions deposited between calcite layers. The rock is compact unless for a big crack that splits the specimen in two parts, filled with secondary calcite.
This sample belongs to the same "onyx" variety of M/U16721 (vein cut).

Other mineral phases: Mn compounds, hematite, unidentified arsenate (under investigation)

Translucence and UV fluorescence info: not translucent; the specimen presents a dark red UV luminescence where manganese compounds are more concentrated. The secondary calcite fluoresces in blue.

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16720	54.29	0.15	1.73	nd	250	nd	nd	120	1160	790

Color: layers of 5R3/6 on a 10YR5/4, 5YR7/2, 5YR4/4, 10YR8/2 background

MRSN Catalogue number: M/U16721

Fig. 21A

Commercial name: Onice Fantastico vc – *Fantastic Onyx vc*

Petrographic classification: calcite-alabaster

Provenance: Central America [Mexico]

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), vein cut, polished surface.

Description: unusual specimen with brilliant, red, yellow and orange colors. Banded structure composed by fine-grained layers. The rock is porous, the voids are localized at the layers interface. Some of the bigger voids are filled with small crystals of white calcite. The specimen is characterized by the presence of many mineral inclusions. In thin section (Fig 21B, plane polars), in the lower bands short columnar fabric is recognizable while other bands show mosaic fabric with high porosity

This sample belongs to the same "onyx" variety of M/U16722 (cross cut).

Other mineral phases: hematite, manganese compounds and unidentified arsenate (under investigation)

Translucence and UV fluorescence info: not translucent; secondary calcite gives a blue luminescence

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16721	54.82	0.08	1.25	nd	210	nd	nd	410	9210	140

Color: bands are of different colors N9, 5R3/4, 10YR8/6 and 10R4/6

MRSN Catalogue number: M/U16722

Fig. 22A

Commercial name: Onice Girasole – *Sunflower Onyx*

Petrographic classification: silicatic marble

Provenance: unknown

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), polished surface.

Description: coarse-grained sample showing some crystals of centimetric size. Big white crystals are surrounded by some darker ones. This specimen represents one of the few metamorphic rock of the whole collection. It is composed of calcite and diopside with inclusions of talc, barite and tremolite. In thin section (Fig. 22B, cross polars) it can be seen that many calcite crystals are twinned. The rock is compact with no visible cracks, even under optical microscope.

Other mineral phases: diopside, talc, barite, tremolite

Translucence and UV fluorescence info: translucent; weak pink UV luminescence of calcite

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16722	37.74	15.11	<1%	nd	580	nd	nd	nd	290	130

Color: N9, 10YR8/2 and N1

MRSN Catalogue number: M/U16723

Fig. 23A

Commercial name: Onice Glaciale – *Glacial Onyx*

Petrographic classification: calcite-alabaster

Provenance: unknown

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), vein cut, polished surface.

Description: structure made up by nearly parallel thin calcite layers. It is fine grained, with layers having variable width. In the upper part of the sample there is a strong staining due to the oxidation of the iron compounds present as impurities, while in the lower part of the sample there are white and light blue stratifications. The rock is rather compact.

Other mineral phases: iron oxides and hydroxides

Translucence and UV fluorescence info: translucent; weak diffused pinkish luminescence (Fig. 23B)

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16723	54.25	0.49	1.27	nd	1400	nd	nd	nd	7540	480

Color: layers are N9 alternated with 5B7/1 and 5G8/1, staining is 10YR8/6 with 5R4/6 dots

MRSN Catalogue number: M/U16724

Fig. 24A

Commercial name: Onice Gold – *Gold Onyx*

Petrographic classification: calcite-alabaster

Provenance: [Turkey]

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), cross cut, polished surface.

Description: the specimen color varies from honey yellow to deep orange and has a layered structure. The grain size changes from layer to layer, reaching centimetric diameter. It is composed of calcite, characterized by the presence of detrital minerals deposited on the surface between those layers that present a higher level of porosity.

Other mineral phases: iron oxides and hydroxides

Translucence and UV fluorescence info: partially translucent; the resin utilized to fill cracks and pores luminesces in light blue (Fig. 24B)

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16724	54.28	0.69	1.00	40	2870	nd	nd	nd	7670	470

Color: 10YR7/6, 5YR 4/6, 10YR8/6 and 10YR8/2

MRSN Catalogue number: M/U16725

Fig. 25A

Commercial name: Onice Honey extra – *Honey extra Onyx*

Petrographic classification: calcite-alabaster

Provenance: unknown

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), vein cut, polished surface.

Description: homogeneous, yellowish white sample. The structure is banded and the grain size varies from layer to layer. It is composed of calcite which crystals are well defined and are elongated through the growth axis, which is perpendicular to the stratification. The rock is compact.

Other mineral phases: not found in the analyzed section.

Translucence and UV fluorescence info: translucent; light blue color in UV light that points out some millimetric cracks, otherwise not able to be seen in visible light (Fig. 25B).

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16725	54.51	1.27	<1%	nd	1330	nd	nd	520	25	nd

Color: 5Y8/4 and 10YR8/2

MRSN Catalogue number: M/U16726

Fig. 26A

Commercial name: Onice Incas extra – *Incas extra Onyx*

Petrographic classification: travertine

Provenance: unknown

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm) cross cut, polished surface.

Description: heterogeneous sample in which brown and ochre concretions are associated to white calcite crystals. It is composed of calcite with diffuse inclusions of hematite (Fig. 26B - hematite crystals diffused in calcite background. The inset shows, at a higher magnification, the nodular structure of the metallic oxides, SEM-BSE image).

Other mineral phases: hematite

Translucence and UV fluorescence info: not translucent, white calcite fluoresces in light blue

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16726	49.06	0.3	7.33	nd	nd	nd	140	520	68900	370

Color: concretions of various shades of 5YR3/4, 5YR5/6, 5R3/4 and 5YR2/2 with N9 secondary calcite crystals

MRSN Catalogue number: M/U16727

Fig. 27A

Commercial name: Onice Ivory – *Ivory Onyx*

Petrographic classification: calcite-alabaster

Provenance: Middle East

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), vein cut, polished surface.

Description: the specimen presents a fine ivory color, as suggested by the commercial name. It is composed of elongate crystals of calcite disposed in layers. In thin section (Fig. 27B, cross polars) columnar fabric is clearly recognizable, it is the most common in this type of rocks. Characterized by a translucent appearance in thin this section and a length-width ratio of crystals greater than 6:1, these crystals are elongated along the c-axis, show uniform extinction and there is a regular stacking of crystals in optical continuity. There is no visible lamination.

Other mineral phases: rare inclusions of iron oxides and manganese compounds (Fig. 27C - whitish aggregates of manganese compounds at the edge of a porous area, SEM-BSE image).

Translucence and UV fluorescence info: translucent; pinkish luminescence

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16727	55.21	0.66	<1%	nd	240	nd	nd	nd	nd	1100

Color: 5Y9/1

MRSN Catalogue number: M/U16728

Fig. 28A

Commercial name: Onice ivory extra – *Ivory extra Onyx*

Petrographic classification: calcite-alabaster

Provenance: Middle East

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), cross cut, polished surface.

Description: the specimen belongs to same variety of M/U16727 from which differs because of the cutting direction.

Other mineral phases: small muscovite inclusions

Translucence and UV fluorescence info: translucent; homogeneous pink UV fluorescence.

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16728	53.81	1.80	<1%	nd	1360	nd	nd	nd	40	1110

Color: 5Y8/1 and N9

MRSN Catalogue number: M/U16729

Fig. 29A

Commercial name: Onice Jade – *Jade Onyx*

Petrographic classification: travertine

Provenance: Middle East

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), vein cut, polished surface.

Description: the rock shows a layered structure with brown and yellow bands alternated to lighter layers. It is composed of calcite mixed with aragonite, actually it is the only sample in the whole collection to present both calcium carbonate phases. Many layers are characterized by the presence of inclusions, some of them of detrital origin. The structure is heterogeneous, some layers are compact, while in others big pores can occur (the latter were artificially filled with resin to smooth the polished surface). It can be also seen that there are many cracks naturally filled with white secondary calcite. The calcite/aragonite fabrics vary with the layer, a clue of fast rate changing conditions. In the picture (Fig. 29B, thin section, plane polars) three different kinds of layers are visible. From the top: a dark red layer of an unknown arsenate (a mineral of tricky identification which is still under investigation, see M/U16720-21) deposited in the empty spaces between crystals forming a dendritic-like texture. In the middle, aragonite needles form fan fabric crystals. These are translucent in thin section and show two termination types: square or straight edged (right) and acute or sharp edged (on the left). Aragonite crystals are elongated and radiate outwards from a central nucleus. In the bottom of the picture mosaic fabric calcite crystals are present. They do not show any preferred elongation direction, having almost an anhedral shape. This fabric is commonly found as a replacement of ray and acicular fabrics of aragonite crystals. It is the most clear diagenetic fabric in speleothems (Frisia 2010)

Other mineral phases: most frequent inclusions are: hematite, strontianite, dolomite, manganese and iron compounds (Fig. 29C – concretions of iron and manganese oxides in calcite, SEM-BSE image), copper oxide and smithsonite.

Translucence and UV fluorescence info: not translucent; under UV light only secondary calcite gives a weak bluish luminescence

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16729	51.99	1.41	2.18	nd	5970	60	nd	200	20300	1720

Color: layers are described by these colors 5YR4/4, 5YR8/4, 5YR2/2, 10R4/2, 10R6/2,10YR8/2, 10YR6/6 and N8

MRSN Catalogue number: M/U16730

Fig. 30A

Commercial name: Onice Jasper – *Jasper Onyx*

Petrographic classification: calcite-alabaster

Provenance: Central America

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), cross cut, polished surface.

Description: stratifications of red and orange layers on a white background. Fine grained and compact, it is composed of calcite. Red bands are characterized by hematite inclusions deposited between calcite layers. Some crystals of dolomite are found in the white parts (Fig. 30B, thin section, plane polars). In thin section, millimetric crystals of calcite of anhedral shape are recognizable, presenting no preferential elongation, are interlayered by reddish-brown inclusions of hematite.

Other mineral phases: hematite, dolomite (Fig. 30C - dolomite inclusion [dark grey] in calcite. White small individuals of hematite are spread in the background, SEM-BSE image).

Translucence and UV fluorescence info: not translucent; the specimen presents a weak red UV luminescence where manganese inclusions are more concentrated and may substitute calcium in the white calcite.

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16730	54.34	1.08	<1%	nd	670	nd	nd	nd	6290	500

Color: 10R3/4, 10R4/6 and 5R4/6 on a 5YR5/6 and N9 background

MRSN Catalogue number: M/U16731

Fig. 31A

Commercial name: Onice Kilimangiaro – *Kilimanjaro Onyx*

Petrographic classification: calcite-alabaster

Provenance: [Africa - Tanzania]

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), vein cut, polished surface.

Description: the sample is honey yellow with white bands and dark thin layers. Grain size is variable, some layers show well defined calcite crystals with short columnar habit. In dark layers there is hematite and, rarely, zircon which crystals have a rounded shape, denoting a probable detrital origin (Fig. 31B - zircon [white dot] in a calcite fissure, SEM-BSE image).

Other mineral phases: hematite, zircon

Translucence and UV fluorescence info: translucent; diffused yellow UV luminescence due to the presence of organic acids, dark layers are not UV fluorescent while white calcite fluoresces in blue (Fig. 31C)

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16731	54.97	0.92	<1%	nd	890	nd	nd	830	nd	nd

Color: 5Y8/6, N9, shades of 10YR7/4 and vainlets 10R7/4 and 5Y4/1

MRSN Catalogue number: M/U16732

Fig. 32A

Commercial name: Onice Luna – *Moon Onyx*

Petrographic classification: calcite-alabaster

Provenance:[Turkey]

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), cross cut, polished surface.

Description: peculiar sample with orange and pink layers, it is cut transversally to the concretion path, resulting in a cloudy effect. It is entirely composed of calcite, fine grained pinkish stratifications are alternated with medium grained orange ones.

Other mineral phases: small fluorite inclusions (Fig. 32B - subangular grains of fluorite, SEM-BSE image).

Translucence and UV fluorescence info: partially translucent; pink bands are bright red under fluorescent light while orange layers are yellowish in color (Fig. 32C).

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16732	55.61	0.16	<1%	nd	1430	nd	nd	nd	700	130

Color: stratifications of various colors as 10YR8/6 shaded 10YR6/6, 5Y8/4, 5R8/2, 10R8/2, 5RP8/2, N9 and N1

MRSN Catalogue number: M/U16733

Fig. 33A

Commercial name: Onice Matisse – *Matisse Onyx*

Petrographic classification: calcite-alabaster

Provenance: Central America

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), vein cut, polished surface.

Description: the sample shows a brecciated structure, pink and red layered clasts are surrounded by yellowish secondary calcite. Some thin cracks cross the specimen, they may derive from the industrial cutting process. In figure 33B (thin section, plane polars), short columnar fabric in clear calcite layers with visible lamination is displayed. Crystals show uniform extinction under crossed polars and the length – width ratio is less than 6:1. This type of fabric is characterized by the presence of few defects, with flat faces prevailing (spiral growth mechanisms); this suggests a slow rate growth in an equilibrium environment (Frisia, 2010). Alternated with clean layers, reddish bands are very fine-grained showing micritic fabric, which crystals do not have preferred elongation forming tiny aggregates of sub-euhedral crystals (around 10-15 μm in diameter). The structure of this rock suggests the occurrence of a huge stress event that led to the formation of a brecciated structure. As seen in figure 33C (thin section, plane polars), crystals precipitated in the empty spaces between the clasts consist of non-elongated crystals of an average diameter of 250 μm

Other mineral phases: not found in the analyzed section.

Translucence and UV fluorescence info: translucent; under UV light clasts are pinkish while the background is yellow, suggesting a change in the environmental conditions before and after the stress episode (Fig. 33D).

Chemical composition of carbonate fraction:

(%)			ppm						
CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn

M/U16733	55.53	0.49	<1%	nd	450	nd	nd	1460	60	nd

Color: 10YR8/6 and 5Y8/1 background, layered clasts are 10R7/4, 10R6/2, 10R4/6, 5R4/6 and 5YR8/1 in color

MRSN Catalogue number: M/U16734

Fig. 34A

Commercial name: Onice Mediceo cc – *Medicean Onyx cc*

Petrographic classification: calcite-alabaster

Provenance: Middle East

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), cross cut, polished surface.

Description: heterogeneous sample with brown, orange and white concentric concretions of variable grain size. It is composed of calcite but mineral inclusions in darker bands are present. It is compact unless for some small cracks filled with secondary calcite. In thin section: milky small crystals can be identified with the microcrystalline fabric. Crystals have irregular boundaries and a length-width ratio less than 6:1, except for some layers where elongated crystals occur. In figure 34B (thin section, cross polars) crystals aggregating around a layer composed of small micritic individuals are shown. The aggregate bends on itself, forming a stalactitic-like structure. Layers of acicular crystals with needle-like terminations are well visible while, in the lower part of the picture, a mosaic-like fabric is distinguishable.
This sample belongs to the same "onyx" variety of M/U16735 (vein cut).

Other mineral phases: manganese compounds

Translucence and UV fluorescence info: not translucent; secondary calcite fluoresces under UV light in pink-red and brownish bands in yellow

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16734	54.61	1.21	<1%	nd	1460	nd	nd	nd	140	1050

Color: 10YR8/2, 10YR6/2, 10YR7/4, 10YR4/2 and 10YR3/2

MRSN Catalogue number: M/U16735

Fig. 35A

Commercial name: Onice Mediceo vc – *Medicean Onyx vc*

Petrographic classification: calcite-alabaster

Provenance: middle East

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), vein cut, polished surface.

Description: heterogeneous sample, showing brown and whitish bands of different grain size. It is composed of calcite and is characterized by nearly parallel layers of variable thickness. It is a compact stone.
This sample belongs to the same "onyx" variety of M/U16736 (cross cut).

Other mineral phases: not found in the analyzed section.

Translucence and UV fluorescence info: clearer layers are translucent; under UV light, brown bands fluoresce in yellow (Fig. 35B)

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16735	54.52	1.29	<1%	nd	1280	nd	nd	nd	400	nd

Color: banded with 10YR8/2, 10YR6/2, 10YR5/4, 5YR8/4 and N9 colors

MRSN Catalogue number: M/U16736

Fig. 36A

Commercial name: Onice Miele cc – *Honey Onyx cc*

Petrographic classification: calcite-alabaster

Provenance: unknown

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), vein cut, polished surface.

Description: yellowish white in color, it is a homogeneous sample with a banded structure. Grain size varies from layer to layer, but in general calcite individuals are millimetric to centimetric in size. It is composed of almost pure calcite, crystals are well defined and are elongated through the growth axis. The rock is compact and does not have detected inclusions.
This sample belongs to the same "onyx" variety of M/U16737 (vein cut).

Other mineral phases: not found in the analyzed section.

Translucence and UV fluorescence info: translucent; under UV light the sample is yellowish with some darker bands, probably due to the different concentrations of organic acids (Fig. 36B).

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16736	54.86	0.93	<1%	nd		nd	nd	1200	nd	nd

Color: 5Y8/4 shaded 5Y8/1

MRSN Catalogue number: M/U16737

Fig. 37A

Commercial name: Onice Miele vc – *Honey Onyx vc*

Petrographic classification: calcite-alabaster

Provenance: unknown

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), vein cut, polished surface.

Description: the specimen has a banded structure, with almost parallel layers of yellowish calcite. Crystals are elongated through the growth axis.
As suggested by its commercial name, this sample should belong to the same "onyx" variety of M/U16736 (cross cut), despite petrographic and chemical discrepancies.

Other mineral phases: not found in the analyzed section.

Translucence and UV fluorescence info: translucent; weak yellowish UV-fluorescence (Fig. 37B)

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16737	55.02	0.86	<1%	nd	1550	nd	nd	200	40	nd

Color: 10YR8/6 with 5YR6/4 and N9

MRSN Catalogue number: M/U16738

Fig. 38A

Commercial name: Onice Mirafiori – *Mirafiori Onyx*

Petrographic classification: calcite-alabaster

Provenance: [Afghanistan]

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), cross cut, polished surface.

Description: the sample displays calcite concretions cut perpendicular to the accretion direction. White and light blue layers are alternated and fine grained. Near the edges of the slab there is a strong staining due to the oxidation of the iron compounds present as impurities. The rock is compact.

Other mineral phases: hematite

Translucence and UV fluorescence info: translucent; weak diffused pink UV luminescence (Fig. 38B)

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16738	53.38	0.84	<1%	nd	120	nd	nd	nd	16400	880

Color: 10Y8/2 and 10GY7/2 background with 10YR8/6 and 10YR6/6 staining

MRSN Catalogue number: M/U16739

Fig. 39A

Commercial name: Onice Multicolor Pakistano – *Multicolor Pakistan Onyx*

Petrographic classification: calcite-alabaster

Provenance:[Pakistan]

Cutting and finishing: rectangular slab (13 x 7.5 x 0.5 cm), cross cut, polished surface.

Description: banded fabric with deep red and orange concentric layers. It is composed of calcite, with abundant micro-inclusion of iron oxides which infer to the sample the characteristic color.

Other mineral phases: celestine (Fig. 39B - celestine [white] microcrystalline aggregates in calcite, SEM-BSE image), manganese and iron compounds (Fig. 39C - nebular aggregate of iron and manganese oxide in calcite, SEM-BSE image).

Translucence and UV fluorescence info: not translucent; not fluorescent

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16739	49.80	0.26	5.22	nd	1320	nd	nd	100	25400	2110

Color: concretions of 10R3/4, 5R2/6, 10YR6/6, 5YR3/4 and 5YR2/1 colors

MRSN Catalogue number: M/U16740

Fig. 40A

Commercial name: Onice Nuvolato extra – *Cloudy extra Onyx*

Petrographic classification: calcite-alabaster

Provenance: [Central America]

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), vein cut, polished surface.

Description: the specimen has a banded structure, with almost parallel layers of yellowish calcite. Crystals are elongated through the growth axis, perpendicular to the banding direction.

Other mineral phases: not found in the analyzed section.

Translucence and UV fluorescence info: translucent; weak yellowish UV fluorescence

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16740	54.35	1.43	<1%	nd	3310	nd	nd	480	nd	nd

Color: 10YR8/6 shaded 10R6/6, 5Y8/1

MRSN Catalogue number: M/U16741

Fig. 41A

Commercial name: Onice Pakistano – *Pakistan Onyx*

Petrographic classification: calcite-alabaster

Provenance:[Pakistan]

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), cross cut, polished surface.

Description: in this specimen calcite concretions are cut perpendicular to the accretion direction. It is fine grained, greenish layers have a cloudy aspect. Near the edges of the sample there are some small cracks where strong staining due to the oxidation of the iron compounds (present as impurities) occurs.

Other mineral phases: iron compounds

Translucence and UV fluorescence info: translucent; not UV-luminescent likely because of the relatively high iron content

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16741	53.47	0.52	1.90	nd	3310	nd	nd	120	22550	2650

Color: 5GY7/4, 5GY7/2 with 5YR5/6 staining

MRSN Catalogue number: M/U16742

Fig. 42A

Commercial name: Onice Paradiso – *Paradise Onyx*

Petrographic classification: calcite-alabaster

Provenance: [Afghanistan]

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), cross cut, polished surface.

Description: structure made up by thin calcite layers. It is fine grained, the layers have variable width. White and bluish bands are alternated, oxidation layers are present. The rock is rather compact

Other mineral phases: ilmenite, muscovite, fluorapatite

Translucence and UV fluorescence info: partially translucent; clear bands of calcite show a pink UV luminescence (Fig. 42B)

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16742	54.75	0.31	1.09	110	1890	nd	nd	nd	7710	830

Color: 5BG7/2, 5G6/1 and N9 bands with 10YR8/6 and 5YR5/6 oxidation layers

MRSN Catalogue number: M/U16743

Fig. 43A

Commercial name: Onice Persiano top – *Persian top Onyx*

Petrographic classification: calcite-alabaster (?)

Provenance: Middle East

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), cross cut, polished surface.

Description: greenish white sample. Characterized by an extreme homogeneity. It is fine grained and compact.

Other mineral phases: not found in the analyzed section.

Translucence and UV fluorescence info: translucent; weak pinkish UV fluorescence

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16743	54.18	0.33	1.50	nd	1340	nd	nd	nd	15050	1700

Color: 10Y8/2

MRSN Catalogue number: M/U16744

Fig. 44A

Commercial name: Onice Pink – *Pink Onyx*

Petrographic classification: marble (?)

Provenance: [Iran]

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), cross cut, polished surface.

Description: compact and fine grained specimen displaying a cloudy aspect due to creamy and pinkish stratifications. It is composed of fine grained calcite.

Other mineral phases: not found in the analyzed section.

Translucence and UV fluorescence info: translucent, pinkish layers have a strong pink UV luminescence while creamy layers are weakly luminescent (Fig. 44B)

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16744	53.07	0.79	1.87	nd	940	nd	64	nd	16600	5150

Color: 5YR8/1 shaded 5Y8/1 and 5Y8/4

MRSN Catalogue number: M/U16745

Fig. 45A

Commercial name: Onice Pink top – *Pink top Onyx*

Petrographic classification: marble

Provenance: [Iran]

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), cross cut, polished surface.

Description: it is a finest variety of M/U 16744, compact and very fine grained with pinkish stratifications.

Other mineral phases: not found in the analyzed section.

t **Translucence and UV fluorescence info:** translucent, under UV light one side of the sample is fluorescent in pink while the other side fluoresces in blue (Fig. 45B), denoting a variation in calcite chemical composition

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16745	55.27	0.58	<1%	nd	120	nd	60	nd	50	1100

Color: between 5YR8/1 and 10R8/2

MRSN Catalogue number: M/U16746

Fig. 46A

Commercial name: Onice Rosso Orientale – *Oriental Red Onyx*

Petrographic classification: calcite-alabaster

Provenance: [Middle East]

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), cross cut, polished surface.

Description: red layers on a whitish background, fine grained. It is mainly composed of calcite. Red bands are characterized by hematite inclusions deposited between calcite layers. A crack crosses the sample, probably due to industrial process of cutting or polishing.

Other mineral phases: hematite (Fig. 46B - rounded aggregate of hematite in calcite, SEM-BSE image), Mn compounds

Translucence and UV fluorescence info: not translucent; the specimen presents a very dark red UV luminescence where manganese inclusions are more present.

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16746	55.42	0.21	<1%	nd	320	nd	nd	140	7110	800

Color: 5R4/6, 10R4/6, 5R2/6 crystals on 10YR8/2 background

MRSN Catalogue number: M/U16747

Fig. 47A

Commercial name: Onice Seta – Silk Onyx

Petrographic classification: limestone

Provenance: Middle East

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), polished surface.

Description: the specimen presents a golden yellow color. It is composed of calcite, and is quite porous. The thin section shows, radial aggregates of calcite crystal of spheroidal shape, similar to ooids (Fig. 47B, plane polars)

Other mineral phases: fluorite (Fig. 47C - small crystals of fluorite [white] in calcite. The black areas are pores, SEM-BSE image), iron compounds (Fig. 47D – subangular aggregated crystals of iron oxides, SEM-BSE image).

Translucence and UV fluorescence info: not translucent; secondary calcite fluoresces in blue under UV light

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16747	54.04	1.3	1.01	nd	1570	nd	nd	40	10100	160

Color: 10YR6/6, 10YR8/6 and 10YR6/2 with 10YR2/2 rounded aggregates

MRSN Catalogue number: M/U16748

Fig. 48A

Commercial name: Onice Shadow – *Shadow Onyx*

Petrographic classification: calcite-alabaster

Provenance: unknown

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), vein cut, polished surface.

Description: sample characterized by alternance of brownish red and white bands. The grain size is different varying from band to band, some layers have well defined crystals of calcite with short columnar habit.

Other mineral phases: fluorite

Translucence and UV fluorescence info: not translucent; yellowish UV luminescence probably due to the presence of organic acids (Fig. 48B). Small area filled with resins luminesces in bright light blue.

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16748	54.79	1.07	<1%	nd	950	nd	nd	nd	395	40

Color: N9, 5YR8/4, 10YR8/2, 5YR5/6 and 10YR5/4 bands

MRSN Catalogue number: M/U16749

Fig. 49A

Commercial name: Onice Smeraldo cc – *Emerald Onyx cc*

Petrographic classification: calcite-alabaster

Provenance: Middle East, [Iran]

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), vein cut, one of the surfaces is "leather" finished (smooth surface, not polished).

Description: this sample belongs to the same "onyx" variety of M/U16750 (vein cut). It is the only lithotype composed of aragonite instead of calcite, showing beautiful acicular crystals with vivid emerald green color, due to the presence of copper as a trace element in aragonite (confirmed by μ-XRF analysis). In the specimen are visible fractures filled with secondary calcium carbonate crossing the stratification of the green aragonite strata.

Other mineral phases: manganese and iron compounds

Translucence and UV fluorescence info: green bands are translucent; weak pink UV luminescence diffused throughout the sample (Fig. 49B) The secondary calcium carbonate luminesces in whitish blue.

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16749	53.91	<1%	<1%	nd	19650	900	nd	200	2980	230

Color: 5BG5/2, 5G6/6, 10GY3/2, 5GY7/2, 5YR8/4 and N1 bands

MRSN Catalogue number: M/U16750

Fig. 50A

Commercial name: Onice Smeraldo vc – *Emerald Onyx vc*

Petrographic classification: calcite-alabaster

Provenance: Middle East, [Iran]

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), vein cut, polished surface.

Description: M/U16749 and this sample belong to the same rock variety. It is the only lithotype composed of aragonite instead of calcite, showing beautiful acicular crystals with vivid emerald green color, due to the presence of copper as a trace element in aragonite (confirmed by μ-XRF analysis). In thin section (Fig. 50B), layers of the same unidentified mineral found in other samples (21-47-29) are spread all over the specimen, and is clearly visible in the top of the picture. The huge (green in the macroscopic sample) layer of aragonite crystals shows straight-edged individuals, around 3 mm long and 0,1 mm wide, elongated along the growth axis with uniform extinction and square terminations. Other layers with smaller aragonite individuals occur, their acicular fabric shows needle-like terminations and crystals with a length/width ratio exceeding 6:1.

Other mineral phases: hematite, strontianite, manganese compounds (Fig. 50C - aggregates of manganese oxides and compounds filling the interstice between aragonite crystals), cuprite.

Translucence and UV fluorescence info: green bands are translucent; weakly fluorescent under UV light

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16750	53.77	<1%	<1%	30	19850	990	nd	300	7500	840

Color: 5G6/6, 10GY3/2, 5GY7/4, 10GY4/4, 10Y5/4, N9, N1, 10YR6/2 and 10YR4/2 bands

MRSN Catalogue number: M/U16751

Fig. 51A

Commercial name: Onice Smoky – *Smoky Onyx*

Petrographic classification: calcite-alabaster

Provenance: [Turkey]

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), cross cut, one of the surfaces is "leather" finished (smooth surface, not polished).

Description: in this specimen, concretions alternated in dark grey and white colors give a cloudy aspect. It is a heterogeneous material, composed of calcite, with dark zones characterized by the presence of inclusion of manganese oxides, and clear layers containing quartz inclusions. The grain size is very small, the material is compact, but some pores are found in manganese oxides-rich layers.

Other mineral phases: quartz, manganese oxides

Translucence and UV fluorescence info: not translucent; diffused weak bluish UV fluorescence

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16751	54.46	0.89	<1%	nd	110	nd	nd	nd	160	5630

Color: N,8 N,- N6, N5, N4 with 5YR4/1 and 10YR8/2 veins

MRSN Catalogue number: M/U16752

Fig. 52A

Commercial name: Onice Stratos vc – *Stratos Onyx vc*

Petrographic classification: calcite-alabaster

Provenance: Middle East

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), vein cut, polished surface.

Description: heterogeneous sample with brown, orange and white nearly parallel concretions with variable grain size and well defined crystals. It is composed of calcite with the presence of mineral inclusions, especially in darker bands. It is compact.

Other mineral phases: dolomite (Fig. 52B - dolomite layers included in calcite, SEM-BSE image), celestine (Fig. 52C celestine in light gray calcite background characterized by dolomite crystals, SEM-BSE image).

Translucence and UV fluorescence info: clear bands are translucent, under UV light, white bands have a pink fluorescence while yellowish layers have a strong yellow UV luminescence (probably due to the presence of organic acids).

Minor and trace elements:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16752	53.48	2.11	<1%	nd	1550	nd	nd	nd	1190	600

Color: alternated bands indicated by the colors N9, 5Y8/1, 10YR6/2, 5Y6/1 and 10YR7/4

MRSN Catalogue number: M/U16753

Fig. 53A

Commercial name: Onice Striato d'Oro – *Golden banded Onyx*

Petrographic classification: calcite-alabaster

Provenance: unknown

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), vein cut, polished surface.

Description: the specimen has a narrow banded structure, with almost parallel layers of yellowish calcite. Crystals are elongated through the growth axis. The sample is crossed by very thin veins of spatic calcite, almost perpendicular to the banding direction.

Other mineral phases: iron oxides

Translucence and UV fluorescence info: not translucent; spatic calcite under UV light is fluorescent in blue (Fig. 53B).

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16753	54.25	0.77	<1%	nd	1450	nd	nd	nd	8440	550

Color: 5YR5/6 shaded 10YR6/6 and 10YR8/6

MRSN Catalogue number: M/U16754

Fig. 54A

Commercial name: Onice Sultano cc – *Sultan Onyx cc*

Petrographic classification: calcite-alabaster

Provenance: Middle East

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), cross cut, polished surface.

Description: honey yellow and brownish concretions of variable grain size. It is composed of calcite, with the presence of iron oxides between some bands which show a higher porosity. The calcite crystal columnar fabric is pictured in thin section (Fig. 54B, cross polars). The regular stacking of subangular crystals is recognizable (around 300 μm wide). Bigger calcite crystals are present showing the typical cleavage.
This sample belongs to the same "onyx" variety of M/U16755 (vein cut).

Other mineral phases: hematite, siderite (Fig. 54C - small inclusions of white siderite in calcite, SEM-BSE image), barite.

Translucence and UV fluorescence info: partially translucent, secondary calcite filling cracks and pores luminesce in blue

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16754	54.57	0.41	<1%	nd	nd	nd	nd	nd	4090	120

Color: concretions of various shades of 5YR4/4, 5YR3/4, 10YR7/4 and 10YR5/4

MRSN Catalogue number: M/U16755

Fig. 55A

Commercial name: Onice Sultano vc – *Sultan Onyx vc*

Petrographic classification: calcite-alabaster

Provenance: Middle East

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), vein cut, polished surface.

Description: brown, orange and whitish stratifications have nearly parallel arrangement and variable grain size. It is composed of calcite, but there are many mineral inclusions especially in darker bands.
This sample belongs to the same "onyx" variety of M/U16754 (cross cut).

Other mineral phases: siderite (Fig. 55B – siderite crystals in calcite; black areas are pores, SEM-BSE image), hematite, barite.

Translucence and UV fluorescence info: not translucent; partially fluorescent, clear bands fluoresces in withish yellow (Fig. 55C).

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16755	55.73	0.17	<1%	nd	nd	nd	nd	50	1600	220

Color: banded with 5YR5/6, 5YR4/4 and 5Y8/4 colors

MRSN Catalogue number: M/U16756

Fig. 56A

Commercial name: Onice Sun – *Sun Onyx*

Petrographic classification: calcite-alabaster

Provenance: unknown

Cutting and finishing: rectangular slab (13 x 7.5 x 1.8 cm), vein cut, polished surface.

Description: light brown bands, elongated crystals of calcite are disposed in layers of variable size. The color is probably due to the presence of organic acids in calcite crystals.

Other mineral phases: not found in the analyzed section.

Translucence and UV fluorescence info: translucent; weakly UV fluorescent in blue and yellow (Fig. 56B).

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16756	54.88	1.00	<1%	15	1950	nd	nd	160	30	nd

Color: shades of 5Y7/6

MRSN Catalogue number: M/U16757

Fig. 57A

Commercial name: Onice Tiger – *Tiger Onyx*

Petrographic classification: calcite-alabaster

Provenance: Middle East [Turkey]

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), vein cut, polished surface.

Description: the specimen has a banded structure, with almost parallel layers of yellowish orange and white calcite. Crystals of the white bands are elongated through the growth axis.

Other mineral phases: fluorite (Fig. 57B - fluorite aggregates in calcite background, SEM-BSE image), iron compound.

Translucence and UV fluorescence info: bands with well-defined crystals are translucent; not fluorescent under UV light

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16757	53.16	0.74	2.22	nd	890	nd	nd	nd	22650	550

Color: layers of 5YR3/4, 5YR4/4, 5YR2/2, 10YR6/6, 5Y8/4 and 5R2/2

MRSN Catalogue number: M/U16758

Fig. 58A

Commercial name: Onice Travertine – *Travertine Onyx*

Petrographic classification: travertine

Provenance: unknown

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), vein cut, polished surface.

Description: light colored travertine, with brownish bands. Fine grained and very porous, bigger pores have been filled with an artificial resin to give a better aesthetical effect and to improve mechanical resistance of the material (Fig. 58B – fragments of calcite crystals immersed in resin, SEM-BSE image).

Other mineral phases: hematite.

Translucence and UV fluorescence info: not translucent; diffused bluish UV fluorescence.

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16758	55.45	0.46	<1%	nd	50	nd	nd	nd	79	nd

Color: 10YR8/2, 10YR6/2 and 5YR4/4 layers

MRSN Catalogue number: M/U16759

Fig. 59A

Commercial name: Onice Tropicale – *Tropical Onyx*

Petrographic classification: calcite-alabaster

Provenance: [Mexico]

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), cross cut, polished surface.

Description: quite homogeneous honey yellow sample, showing brownish zones, fine grained and not very compact. It is composed of calcite, iron and manganese oxides were detected mainly in the areas where the sample presents a higher level of porosity.

Other mineral phases: iron and manganese compounds

Translucence and UV fluorescence info: not translucent; not fluorescent

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16759	55.79	0.24	2.04	nd	110	nd	nd	nd	16300	900

Color: between 5YR5/6 and 10YR6/6 with 5YR3/2 dots

MRSN Catalogue number: M/U16760

Fig. 60A

Commercial name: Onice Velluto cc – *Velvet Onyx cc*

Petrographic classification: calcite-alabaster

Provenance: Middle East [Turkey]

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), cross cut, polished surface.

Description: in this specimen, concretions alternated in grey and white colors give a cloudy aspect. It is a heterogeneous material, composed of calcite, with dark zones characterized by the presence of inclusion of pyrite. The grain size is very small and the material is compact.
This sample belongs to the same "onyx" variety of M/U16761 (vein cut).

Other mineral phases: pyrite (Fig. 60B small inclusions of pyrite [white] in calcite, SEM-BSE image), manganese compounds.

Translucence and UV fluorescence info: not translucent, weak whitish fluorescence (Fig. 60C).

Chemical composition of carbonate fraction

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16760	53.8	1.79	<1%	nd	770	nd	nd	nd	60	1430

Color: N8, N9, N7, N6, N5 with 10YR7/4 veins

MRSN Catalogue number: M/U16761

Fig. 61A

Commercial name: Onice Velluto vc – *Velvet Onyx vc*

Petrographic classification: calcite-alabaster

Provenance: Middle East [Turkey]

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), vein cut, polished surface.

Description: the specimen is characterized by thin layers alternated in dark grey and white colors. Calcite bands are fine grained, crystals are visibly well defined, with medium porosity. In thin section (Fig. 61B, plane polars), layers of short columnar crystals are the main feature. Individuals are from 1 to 3 mm long and 0,3-0,5 mm wide. Laminations are visible and defined by the presence of impurities and pores.
This sample belongs to the same "onyx" variety of M/U16760 (cross cut).

Other mineral phases: pyrite, manganese compounds.

Translucence and UV fluorescence info: not translucent; white calcite layers are UV fluorescent in pink due to the presence of Mn (Fig. 61C).

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16761	53.57	1.89	<1%	nd	1330	nd	nd	nd	550	4140

Color: 5Y8/4, 5Y8/1, N6, N5, N4 bands

MRSN Catalogue number: M/U16762

Fig. 62A

Commercial name: Onice Verde Persiano vc – *Persian Green Onyx vc*

Petrographic classification: calcite-alabaster

Provenance: Middle East

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), vein cut, polished surface.

Description: the structure is made up by nearly parallel thin calcite layers. It is fine grained. Characteristic white and green stratifications. The rock is rather compact.
In thin section columnar crystals of different size, elongated perpendicular to the stratification, are visible (Fig. 62B, plane polars). Calcite individuals show uniform extinction and a slight zoning.

Other mineral phases: calcite crystals have Fe-rich zoning (Fig. 62C - Fe-rich [lighter] zoning in calcite layers, SEM-BSE image).

Translucence and UV fluorescence info: translucent, not fluorescent under UV light.

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16762	52.79	0.66	2.46	nd	1890	nd	99	690	25200	7090

Color: 5GY7/4 and 10Y8/2 layers with 5YR5/6 staining

MRSN Catalogue number: M/U16763

Fig. 63A

Commercial name: Onice Verde Persiano light – *Persian light Green Onyx*

Petrographic classification: marble

Provenance: Middle East

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), polished surface.

Description: greenish white sample. Characterized by an extreme homogeneity. It is fine grained and compact. The thin section (Fig. 63B, plane polars) shows a equidimensional, polygonal mass of calcite crystals up to some millimeters. (Fig. 63B)
Other mineral phases: hematite, copper compounds.

Translucence and UV fluorescence info: translucent, blue UV fluorescence.

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16763	54.58	0.48	1.03	nd	1440	nd	nd	nd	10600	850

Color: 5Y8/1

MRSN Catalogue number: M/U16764

Fig. 64A

Commercial name: Onice Vintage – *Vintage Onyx*

Petrographic classification: travertine

Provenance: unknown

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), vein cut, polished surface.

Description: very porous variety of travertine with dark gray and white bands. Fine grained, bigger pores (vacuoles) have been filled with an artificial resin to give a better aesthetical effect and improve mechanical strength.

Other mineral phases: not found in the analyzed section.

Translucence and UV fluorescence info: not translucent; resin used to fill voids fluoresces in strong blue (Fig. 64B).

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16764	55.47	0.27	<1%	nd	760	nd	nd	nd	200	1470

Color: 5YR4/1, 5YR6/1, N4 and 10YR6/6 bands with N9 secondary calcite

MRSN Catalogue number: M/U16765

Fig. 65A

Commercial name: Onice Viola cc – *Violet Onyx cc*

Petrographic classification: calcite-alabaster

Provenance: [Africa]

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), vein cut, polished surface.

Description: dark purple and whitish stratifications have nearly parallel arrangement and variable grain size, some layers have well defined crystals with short columnar habit. It is composed of calcite, presence of mineral inclusions specially in darker bands.
This sample belongs to the same "onyx" variety of M/U16766 (vein cut).

Other mineral phases: hematite (Fig. 65B - hematite in gray background calcite, SEM-BSE image).

Translucence and UV fluorescence info: translucent, slight yellow UV luminescence due to the presence of organic acids.

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16765	54.62	0.38	<1%	nd	640	nd	nd	nd	93	1620

Color: bands describable as 10R7/4, 10R3/4, 10R5/4, 5YR7/2 and 10YR8/2

MRSN Catalogue number: M/U16766

Fig. 66A

Commercial name: Onice Viola vc – *Violet Onyx vc*

Petrographic classification: calcite-alabaster

Provenance: [Africa]

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), vein cut, polished surface.

Description: stratifications of purplish and orange layers. Fine grained and porous , it is composed of calcite. Purple bands are characterized by iron compounds inclusions deposited between calcite layers.
This sample belongs to the same "onyx" variety of M/U16765 (cross cut).

Other mineral phases: goethite (Fig. 66B – goethite inclusions in calcite, SEM-BSE image)

Translucence and UV fluorescence info: not translucent; not fluorescent.

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16766	53.04	1.36	1.17	nd	4940	nd	nd	300	14100	2150

Color: 5R4/2 and 5R2/2 background with 10YR6/6 and 5RP4/2 dots

MRSN Catalogue number: M/U16767

Fig. 67A

Commercial name: Onice Wooden – *Wooden Onyx*

Petrographic classification: calcite-alabaster

Provenance: [Iran]

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), vein cut, polished surface.

Description: sample characterized by brown, orange and white thin bands. The grain size is different varying from band to band, some layers have well defined crystals of calcite with short columnar habit.

Other mineral phases: hematite(Fig. 67B – hematite inclusions in calcite, SEM-BSE image), barite, Cu compounds, Mn compounds.

Translucence and UV fluorescence info: not translucent; clear layers fluoresces in blue.

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16767	55.01	0.58	<1%	nd	300	nd	nd	nd	8650	880

Color: 10YR6/6, 5YR5/6, 5YR3/4, 10YR8/2, N9 and 10YR2/2 bands

MRSN Catalogue number: M/U16768

Fig. 68A

Commercial name: Stalattite Brown – *Brown Stalactite*

Petrographic classification: calcite-alabaster

Provenance: [Europe]

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), vein cut, polished surface.

Description: composed of brownish yellow calcite layers, it is fine grained and its crystals are elongated perpendicularly to the stratification, darker layers are full of impurities.

Other mineral phases: zircon (Fig. 68B - detrital zircon fragment enclosed in intragranular calcite, SEM-BSE image), clay minerals, quartz, rutile, hematite.

Translucence and UV fluorescence info: not translucent; not fluorescent

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16768	55.63	0.23	<1%	nd	1960	nd	nd	nd	1280	130

Color: 10YR7/6 - 10YR4/4

MRSN Catalogue number: M/U16769

Fig. 69A

Commercial name: Stalattite Oro – *Golden Stalactite*

Petrographic classification: calcite-alabaster

Provenance: [Europe]

Cutting and finishing: rectangular slab (13 x 7.5 x 0.8 cm), cross cut, polished surface.

Description: composed of brownish and reddish calcite layers, it is fine grained and has a cloudy aspect, darker layers are full of impurities. In thin section (Fig. 69B, plane polars), radial aggregates of microcrystalline individuals are distinguishable. Milky, opaque, porous appearance, small crystals have irregular boundaries, impurities such as Fe compounds are deposited in intergranular positions. Presence of big pores between the aggregates.

Other mineral phases: hematite (Fig. 69C - small crystallites of hematite diffused in the calcite matrix, SEM-BSE image), goethite.

Translucence and UV fluorescence info: not translucent; not fluorescent

Chemical composition of carbonate fraction:

	(%)			ppm						
	CaO	MgO	FeO	Ba	Sr	Cu	Co	Zn	Fe*	Mn
M/U16769	52.58	1.91	1.11	nd	6610	nd	nd	120	10500	840

Color: 5R2/6, 10YR6/6, 5YR6/4 and 5YR6/1 concentric concretions

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