

ITALIAN TYPE MINERALS

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This book describes one by one all the 264 mineral species first discovered in Italy, from 1546 up to the end of 2008. Moreover, 28 minerals discovered elsewhere and named after Italian individuals and institutions are included in a parallel section. Both chapters are alphabetically arranged. The two catalogues are preceded by a short presentation which includes some bits of information about how the volume is organized and subdivided, besides providing some other more general news. For each mineral all basic data (chemical formula, space group symmetry, type locality, general appearance of the species, main geologic occurrences, curiosities, references, etc.) are included in a full page, together with one or more high quality colour photographs from both private and museum collections, and with small snapshots either of people or of places, after which each mineral took its name. As appendices, lists of Italian mineral sorted by crystal chemical classifications, by region, by mineralogical district, and by year of discovery, a list of authors who first described each mineral, besides general references are given, too.

Cover: Lustrous slender metallic cylinders and skeins of acicular crystals of a potential new mineral UM2007-xxx-S:AgFePbSb (field 3.3 mm) from Biò mines, Borgofranco d'Ivrea, Torino, Piemonte, Italy (G. Dalla Fontana collection, E. Bonacina photo)



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THE AUTHORS

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Then time had come to finally devote himself to his main interest and passion: mineral collecting and related studies. He was the promoter and is now the President of the AMI (Italian Micromineralogical Association), Associate Editor of *Micro* (the AMI magazine), and fellow of many organizations and mineralogical associations. He is the author of papers on topological, structural and general mineralogy, and of a mineral classification. He was awarded the "Micromounters' Hall of Fame" 2008 prize. Etymology, geoanthropology, music, and modern ballet are his other keen interests.

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Besides, her greatest passion is 4x4 off-road; in the last ten years she has repeatedly crossed the African deserts and various US trails, and took part in Italian and European championships gathering a considerable amount of trophies, to her great satisfaction.

Marco Pasero was born in Pisa in 1958. After graduating in Geological Sciences in 1982, he got his Ph.D. in Mineralogy in 1988. Currently, he is associate professor of Mineralogy at the University of Pisa. He authored more than 75 papers on mineralogy and crystallography and a book on "Minerals and stamps", and described 19 new mineral species. Since 1998 he served as the Italian representative within the Commission on New Minerals and Mineral Names, then Commission on New Minerals, Nomenclature and Classification (CNMNC) of the International Mineralogical Association. He is now vice-chairman of the CNMNC.

Besides mineralogy, he is deeply fond of jazz music, both as a listener and a musician. He's got a collection of more than 6,000 jazz LPs and CDs of which he is very proud, and plays acoustic bass in an amateur jazz combo. In 2008, to celebrate his 50th birthday, he run a marathon for the first time in his life.

Ciriotti, Marco E.

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1.1. Definitions

What is a mineral?

A mineral species is a phase (element or chemical compound), thermodynamically stable or metastable at environmental Earth P-T, commonly crystallizing during geo- or cosmochemical processes in a natural physico-chemical system. The composition of a mineral species corresponds to an intermediate chemical phase, conforming to the following predetermined arbitrary criterion: the boundary between the end-members forming a natural continuous solid solution is assumed on the basis of one half of a group of atoms with the same valency state for binary solutions, of one third for ternary solutions, and so on. Polytypes and polytypoids are crystallographic variants of the mineral species.

How many minerals do exist?

It is almost impossible to answer this question, since new minerals are discovered almost every week (on average, some 50-60 new minerals per year). Less frequently, some minerals are discredited, e.g. because they are shown to be identical to other minerals (and in such cases the elder name is retained as the valid one for that species). As of now (end of 2008), mineral species are a little less than 4,500. The international body which is in charge for the definitions, approvals, discreditations of minerals is the International Mineralogical Association (IMA), in particular with a dedicated Commission on New Minerals, Nomenclature and Classification (CNMNC). In the web site of CNMNC the updated list of valid mineral species is available, which also includes the accepted names and simplified chemical formulae. Approximately 70% of the valid mineral species were approved by IMA CNMNC.

How many minerals are there in Italy?

The Italian territory is characterized by a diverse geological environment, and Italy has a well-established tradition in studying and doing research on minerals, for both scientific and economic purposes. Such a tradition dates back to the Romans (the historian and scholar Pliny the Elder is regarded as being one of the fathers of Mineralogy), and even further back to the Etruscan civilization, reaching up to the present day. At the end of 2008, Italy is the type locality of more than 260 mineralogical species, thanks both to a soil which provides in itself a large number of minerals, and to all those people who, for various aims, have exploited, collected, studied, and used minerals so far.

But how many minerals are there in Italy?

An exact reply is not possible. Attempts to evaluations and estimates, based both on the current mindat.org database and on the species that for several reasons are not included there yet, lead to believe that a number between 1,500 and 2,000, probably closer to 1,600-1,650, is likely to represent all the valid mineral species actually existing throughout Italy. Large countries, such as the USA, Russia, and Germany, appear in mindat.org with the following order of magnitude of valid minerals: 1,700, 1,600, and 1,450, respectively. The only well-maintained and kept up to date Italian inventories are those of the Piedmont-Aosta Valley maxidistrict and of the Liguria region, the first including an amount of more than 600 valid species, the second of more than 400.

The title of this book

“Italian Type Minerals” means all those minerals which were discovered for the first time in Italy. The place of the first finding is called the “type locality”. Once it has been properly studied and characterized by means of different analytical techniques, the original sampled material – or at least part of it – represents the “holotype” for that mineral, and is preserved in a public institution, such as a Mineralogical Museum, for comparative purposes and for further studies.

Type minerals, type localities and IMA rules for introduction and acceptance of new mineral species

How the terms type mineral or type locality (*locus typicus*) originated and when they were first introduced is uncertain. Within most older mineralogical publications, the authors do not specifically use these terms, but simply state where the mineral was found first, or include a list of known localities. From the references quoted within the present work, it is possible to infer that the earliest quotation identifies the discovery or type locality. The above mentioned terms are relatively recent and have gained in popularity during the second half of the 20th Century.

The IMA CNMNC, established in 1959, for the first time formalized the rules for the introduction of new mineral species.

One of the mandatory technical data requested in the submission to the CNMNC is the detailed description of the type locality [Nickel, E.H. & Grice, J.D. (1998): The IMA Commission on New Minerals and Mineral Names: procedures and guidelines on mineral nomenclature. *Canadian Mineralogist*, **36**, 3-16]. Prior to the establishment of the CNMNC practically no rules existed.

This is one of the most important reasons for the proliferation of a plethora of obsolete names and synonyms that are no longer valid [see for instance: Hey, M.H. (1975): *An index of mineral species and varieties arranged chemically with an alphabetical index of accepted mineral names and synonyms*. British Museum, Ed., London, U.K., 728 pp; Clark, A.M. (1993): *Hey's mineral index*. 2nd ed. Chapman & Hall, Ed., London, U.K., 848 pp; de Fourestier, J. (1998): *Glossary of mineral synonyms*. The Mineralogical Association of Canada, Ed., Ottawa, Ontario, Canada, 435 pp; Bayliss, P. (2000): *Glossary of obsolete mineral names*. Mineralogical Record, Ed., Tucson, Arizona, USA, 244 pp].

Since 1959, CNMNC has regulated the naming and acceptance of all new mineral species, on the basis of well-established technical requirements and guidelines (Nickel & Grice, 1998). The acceptance and naming of new species undergo a rigorous international peer review, followed by the vote of the reviewers. After a new species has been accepted, the CNMNC chairman notifies the approval to the author (senior author if multiples), and selected information (chemical formula, crystallographic data) are published on the CNMNC website. New minerals are identified with the IMA number: the item of information about the name of the type locality is given at this stage. Moreover, these data are published in one or more scientific journals every year, as well as, monthly, in the IMA CNMNC website.

A full description of the new species, including the mineral name and more bits of information about the type locality, is expected to be published by the authors within two years from the date of approval. Such a publication is regarded as the official entry of a new mineral, and of its name, into the mineralogical world.

Important note: due to the differences in publishing time with respect to peer-reviewed scientific journals, it is possible that, in a few cases concerning newly discovered minerals, the pieces of information presented in this book are being delivered a few months before the appearance of the original paper with the description of the new species. We do not aim at anticipating the authors, our only goal being to provide up-to-date information about all Italian type minerals. The few data included in this book should not be considered in any way as official references for the given minerals. This was done in agreement with the chairman of the CNMNC (all formal procedures within the CNMNC have been completed, and all minerals have been officially approved), and with the explicit consensus of the authors of the proposals, who are credited in each file. We wish to express to all of them our sincere thanks.

1.2. Format of presentation

Heading

The heading consists of two lines: on the left side of the first line, there is the name of the mineral, and on the right, its simplified chemical formula. Both are boxed, and both are taken from the IMA list of minerals. On the left side of the second line, there is the symbol of the Strunz-Nickel classification [Strunz, H. & Nickel, E.H. (2001): *Strunz Mineralogical Tables*, 9th ed. Schweizerbart'sche, Stuttgart, 870 pp], and on the right, some crystallographic parameters: the crystal system (tric: triclinic; mon: monoclinic; orth: orthorhombic; trig: trigonal; tet: tetragonal; hex: hexagonal; cub: cubic), the space group symbol, the unit cell parameters, and Z (number of formula units contained in the unit cell).

Type locality

The type locality is detailed location of the place where the mineral was first found. In the few cases where two or more type localities exist, these are all listed (also in the cases of additional type localities outside Italy).

Status

In the majority of cases, Italian type minerals are marked either as "grandfathered", i.e. described in the pre-IMA era (before 1959), or as "approved", i.e. submitted to the IMA CNMNC (formerly CNMMN - Commission on New Minerals and Mineral Names). For the grandfathered, the given year corresponds to the year of the first description with its presently accepted name. For the approved minerals the IMA code is given (it has the form "IMA xxxx-yyy", where xxxx is the year of submission, and yyy is a serial number).

Appearance

Details are given about the macroscopic features of the mineral (e.g., colour, shape of the crystals, etc.).

Occurrence and distribution

Details are given about the geological environment which is characteristic of that mineral, with special reference to the type locality.

Remarks

In this section, several items of information are given: some more detail about the physical, chemical, and crystallographic features of the mineral, and also curiosities related to the species or to the persons in some way related to the mineral.

References

This section includes, as a rule, in chronological order, the original paper with the first description of each mineral, and a few additional papers devoted to that mineral, selected among the most recent ones.

Photographs

This is of course a relevant part of each file. For each mineral, some images are presented, selected on the basis of their scientific and aesthetic interest. The captions of the mineral pictures include the locality of the sample, a short description of the crystals, as well as the collection/photo credits. In those cases of minerals being named after a person, a small portrait is also included, if existing. In case of species named after a type locality, a small picture of the latter is included, whenever available. A regular authorization is asked to the photographers to reproduce the pictures and an analogous clearance by the editors, whenever available, was claimed for those previously published, insofar as we know, on reviews or books or Internet pages. As a rule, a picture of a specimen from the type locality is represented. However, in some limited cases pictures of another localities replace or accompany the photos of specimens from the type locality.

1.3. World distribution of mineral species

The Table below includes the countries with the greatest number (first 26 places) of firstly described mineral species whose type locality is within the given country. Countries are sorted by number of species, and in the last column the rank in terms of density, i.e. the number of species per surface unit, is also given. The surfaces in km² were taken from the U.S. Central Intelligence Agency's web site (the surface of France includes New Caledonia). The surfaces are those of the land areas; the addition of the relevant water areas would not significantly change the statistics. In the lower part of the table, some countries are included which have a lower overall rank and a high density rank (extract from the first 10 places).

Rank [species]	Country	Species	Surface [km ²]	Density [species/10 ³ -km ²]	Rank [density]
1	USA	699	9161923	0.076	21
2	Russia	622	16995800	0.037	26
3	Germany	308	349520	0.881	4
4	Italy	264	294020	0.898	3
5	Canada	200	9093507	0.022	28
6	Sweden	177	410928	0.431	9
7	Australia	134	7617930	0.018	29
8	United Kingdom	122	241590	0.505	7
9	Japan	118	374744	0.315	11
10	France	109	564690	0.193	16
11	China	103	9326410	0.011	31
12	Czech Republic	101	77276	1.307	2
13	Dem. Rep. Congo	98	2267600	0.043	24
14	Chile	90	748800	0.120	18
15	Namibia	83	825418	0.101	20
16	Greenland	76	2736690	0.028	27
17	Mexico	71	1923040	0.037	25
18	Norway	70	307860	0.227	15
19	Switzerland	66	39770	1.659	1
20	South Africa	62	1219912	0.051	23
21	Brazil	53	8456510	0.006	32
22	Austria	50	82738	0.604	6
23	Argentina	38	2780092	0.014	30
24	Romania	37	230340	0.161	17
24	Tajikistan	37	142700	0.259	13
26	Spain	36	499400	0.072	22
...
35	Belgium	20	30230	0.662	5
45	Macedonia	12	24856	0.483	8
55	El Salvador	7	20720	0.338	10

1.4. Additional information on the minerals included in this book

Only those minerals which are considered valid species are included in the compilation of the *Italian Type Minerals*. Following the IMA CNMNC list of mineral names (updated 2008) the valid species are those marked with "G" (grandfathered = the original description preceded the establishment of IMA in 1959, and those minerals are generally regarded as valid species), "Q" (questionable = status uncertain, typical of some old and poorly characterized minerals, for which we could say "*in dubio pro reo*"), "Rd" (redefined with approval by CNMNC), "Rn" (renamed with approval by CNMNC), and "A" (approved, or revalidated, by CNMNC).

Other species in the IMA list of minerals are marked with "D" (discredited by CNMNC), "H" (hypothetical, e.g. synthetic, anthropogenic, etc.), "I" (intermediate member of a solid-solution series), "N" (published without approval of the CNMNC), and are not included in the compilation.

Of the 264 Italian type minerals, 170 species have been approved by the IMA CNMNC (of which 18 redefined or renamed), 90 have the "grandfathered" status, and 4 have the "questionable" status.

All the new species approved by December 31, 2008 having Italian type locality are included in the compilation.

Of the 170 Italian type minerals approved by IMA CNMNC, 131 are real new species and 39 are approvals of old species (ex grandfathered) by specific Subcommittees or redefinitions, renamings, etc.

80% of the 131 new species approved in the IMA era was made available for study by collectors and/or amateurs mineralogists.

The Italian administrative provinces and regions are always indicated with their Italian names.

The additional 28 minerals, listed in the section of the book "Mineral species named after Italian individuals and institutions", are not included in the graphs and statistics. This section of the book deals with mineral species that were named after Italian citizens and institutions. Obviously, this group includes only minerals with a type locality outside Italy, otherwise the minerals would have been described in the previous section.

Of these 28 minerals, 24 have been approved by the IMA CNMNC, and 4 have the "grandfathered" status.

These minerals can be subdivided into five main categories of honoured Italian persons and institutions:

- scientists active in Italy [17 species]
- scientists active outside Italy [2 species]
- individuals related to mineralogy [3 species]
- individuals not specifically related to mineralogy [3 species]
- institutions [3 species].

1.5. Minerals which could have been included in this book and minerals which could have been excluded

Minerals which could have been included

Iodine, I₂, (a phase currently present, with questionable status, in the official IMA CNMNC list of mineral names) as natural occurrence first recognized at Vesuvius is not included in the compilation of the *Italian Type Minerals* because an attentive reading of the original paper [Matteucci, R.V. (1897): Iodio e bromo nei prodotti delle fumarole dell'eruzione vesuviana del 1895 (Nota preliminare). *Rendiconti dell'Accademia di Scienze Naturali e Matematiche di Napoli*, **7**] leads us to assume that iodine (like bromine) was only an exhalation product and not a sublimation mineral. Raffaele Vittorio Matteucci detected iodine exhalation on fumaroles of the 3 July 1895 Vesuvian eruption.

Ferronybøite, a "named amphibole" with formula $\text{NaNa}_2[\text{Fe}^{2+}_3\text{Al}_2](\text{Si}_7\text{Al})\text{O}_{22}(\text{OH})_2$, is a phase listed as hypothetical in the official IMA CNMNC list of mineral names. The mineral was first found in nature at the Isasca unit of the Dora-Maira massif, Val Varaita, Cuneo, Piemonte in very small quantity as inclusion in a jadeite-bearing fels [Hirajima, T. & Compagnoni, R. (1993): Petrology of a jadeite-quartz-almadine-phengite fels with retrograde ferro-nybøite from the Dora-Maira Massif, Western Alps. *European Journal of Mineralogy*, **5**, 943-955]. It was never formally submitted to the CNMNC for approval, and some basic data (e.g., the unit cell parameters) are lacking. Nevertheless, its chemical composition and name are in keeping with the guidelines set up by the Subcommittee on Amphiboles of the IMA. Therefore, the mineral ferronybøite could be considered an Italian type locality species *de facto*. Since it has never been approved, it was not listed in the 264 Italian type minerals, anyway, and was not included in graphs and statistics.

The type locality of ferroxahydrate in many databases and books is indicated in North-eastern Tatarstan Republic (Tataria), Russia, with the relevant bibliographic reference [Vlasov, V.V. & Kuznetsov, A.V. (1962): Melanterite and the products of its alteration. *Zapiski Vsesoyuznogo Mineralogicheskogo Obshchestva*, **91**, 490-492]. Alfani, at an earlier date [Alfani, M. (1935): Sui sali di ferro delle fumarole vesuviane a cloruri e solfati alcalini del maggio-giugno 1933. *Annali del Reale Osservatorio Vesuviano, Serie 4*, **3**, 83-101], described the finding of a phase that he called "ferrosaidrite" at the Vesuvius fumaroles. Type locality would therefore be Italian and not Russian. During our work we have, instead, discovered that the first description of ferroxahydrate is even earlier [Karnitskii, V.A. & Nekrasova, O.I. (1930): Secondary minerals of the Nikotovka mercury deposit. *Mineralnoye Syr'e*, **1**, 135-138]. The type locality remains therefore Russian. It goes without saying that it is not included in the *Italian Type Minerals* and in the relevant graphs and statistics.

The natural occurrence of tetragonal $\text{Ca}_2\text{MgSi}_2\text{O}_7$ phase was first reported by Freda and accurately identified by Zambonini as minute crystal masses, associated with Cu-diopside, in carbonatic ejecta from Monte Somma, Vesuvius volcanic complex [Freda, G. (1883): Breve cenno sulla composizione chimica e sulla giacitura della molibdenite, galena, pirrotina, blenda e pirite del M. Somma. *Rendiconti della Reale Accademia delle Scienze Fisiche e Matematiche di Napoli, Serie 1*, **22**, 290-295; Zambonini, F. (1910): Mineralogia Vesuviana. *Atti della Reale Accademia delle Scienze Fisiche e Matematiche di Napoli, Serie 2*, **14**, 1-368]. An analogue phase, however, was first described by Vogt as a product of metallurgical slags and named åkermanite [Vogt, I.H.L. (1890): Die Mineralien der Melilithgruppe - nämlich Gehlenit, Melilith und ein neues tetragonales, nicht Al_2O_3 -führendes $(\text{Ca},\text{Mg})\text{O}$ -Silikat (Åkermanit), nebst Zwischengliedern. *Archiv for Mathematik og Naturvidenskab*, **13**, 310-402]. At the above date, of course, the rule concerning the non approval of anthropogenic substances [Nickel, E.H. (1995): Definition of a mineral. *Canadian Mineralogist*, **33**, 689-690] was not in force. The type locality of åkermanite was not indicated in the paper of Vogt, so it remains uncertain. Åkermanite is not included within *Italian Type Minerals* and in the relevant graphs and statistics.

Another potential Italian type mineral has an analogue, but more singular, history.

Mariano Carati, collector and expert on Vesuvian mineralogy, many years ago, bought a sample in a sealed vial which, in his opinion, was erroneously classified as melanothallite. The specimen, originally found within the 1869 fumaroles of the crater, was sent to Department of Mineralogy of British Museum in London; studies confirmed that it was a new species. Carati (1982) anticipated the news [Carati, M. (1982): *Guida alla mineralogia vesuviana*. Calderini Ed., Bologna, Italy, 121 pp]. The mineral was accurately described in all its physico-chemical and structural peculiarities and submitted to the IMA CNMNC under the name of "caratiite", in honour of the finder. The new mineral and its name were accepted [Clark, A.M., Fejer, E.E., Couper, A.G. (1984): Caratiite, a new sulphate-chloride of copper and potassium, from the lavas of the 1869 Vesuvius eruption. *Mineralogical Magazine*, **48**, 537-539; Effenberger, H. &

Zemann, J. (1984): The crystal structure of caratiite. *Mineralogical Magazine*, **48**, 541-546]. Almost at the same time, other researchers studied a mineral found in the Tolbachik 500°C warm fumaroles, and, with a defective work and the name of piypite, proposed it to the IMA CNMMN (proposal 1982-087). Piypite was approved as well [Vergasova, L.P., Filatov, S.K., Serafimova, E.K., Stalova, G.L. (1984): Piypite, $K_2Cu_2O(SO_4)_2$, a new volcanic sublimate mineral. *Doklady of U.S.S.R. Academy of Sciences, Earth Science Sections*, **275**, 714-717]. Later on, the identity of piypite with "caratiite" was demonstrated and the latter was discredited for reasons of priority [Vergasova, L.P., Filatov, S.K., Serafimova, E.K. (1984): The identity of piypite with caratiite. *Doklady of the U.S.S.R. Academy of Sciences, Earth Science Sections*, **275**, 741; Filatov, S.K. & Vergasova, L.P. (1986): Discreditation of caratiite and priority of piypite. *Zapiski Vsesoyuznogo Mineralogicheskogo Obshchestva*, **118**, 88-90]. Of course, piypite is not included in the graphs and statistics.

Does niter have an Italian type locality?

During our work, Christof Schäfer presented the above-quoted possibility. Niter is a natural phase known and used since a long time: its mineral status is grandfathered. The mineral niter is the potassium nitrate, KNO_3 , also known as "saltpeter (saltpetre)". Historically, the term niter (or nitre) – cognate with *natrium*, an old Latin word for sodium, in turn from biblical Hebrew *néter* (נֵתֵר), for salt derived ashes (so the potassium carbonate!) – has been very vaguely defined, and it has been applied to a variety of other minerals and chemical compounds, including sodium nitrate (the mineral nitratine), sodium carbonate (the mineral natron) and potassium carbonate. In all known databases the type locality of the mineral niter is quoted as "unknown", like about 80 other well known mineral species.

The first researches started with the partial reading of the following old mineralogical news: Clarke, W. (1670): *The natural history of Nitre*. London, 93 pp; Clarke, W. (1675): *Naturalis historia Nitri*. London and Hamburg, 79 pp; Louis Lemery, L. (1717): *Mémoire sur le nitre. Memoires del l'Académie des Sciences de Paris*, **1717**, 31-51 and 122-146; Wallerio, J.G. (1749): *Præside. Dissertatio de origine et natura Nitri*. Uppsala, 22 pp; Fortis, A. (1786): *Del nitro minerale. Memoria storico-fisica. Opuscoli scelti*, **11**, 145-169; Ramondini, V. (1787): *Lettera relativa alla quistione insorta tra Angelo Fasano e l'abate Fortis intorno il nitro del Pulo di Molfetta*. 22 pp; Dondi-Orologio, A.-C. (1787): *Lettera intorno alle nitriere di Molfetta, nel Regno di Napoli. Opuscoli scelti*, **11**, 194-196; Dondi-Orologio, A.-C. (1788): *Lettera contenente alcune osservazioni sopra la pietra calcarea o nitrosa del Pulo di Molfetta. Opuscoli scelti*, **12**, 306-308; Maria Giovone, G.M. (1788): *Lettera contenente varie osservazioni sulla nitrosità naturale della Puglia. Opuscoli scelti*, **12**, 309-314; Zimmermann, E.A.G. (1789): *Viaggio alla nitriera di Molfetta, nella terra di Bari in Puglia. Opuscoli scelti*, **12**, 289-306; Zimmermann, E.A.G. (1789): *Voyage à la nitrière naturelle de Molfetta dans la terre de Bari, en Pouille*, 49 pp. (abstr.: *Journal de Physique*, **36**, 109-117); Klaproth, M.H. (1795): *Prüfung des natürlichen Salpeters von Molfetta, Beiträge zur chemischen Kenntniss der Mineralkörper. Erster Band* Rottmann, Berlin, 317 pp; Dryander, J. (1799): *Catalogus bibliothecæ historico-naturalis Josephi Banks*. Typis Gul. Bulmer et Soc., Ed., London, 416 pp.

As of now, it is not assured that the first description and the naming of the natural occurrence of the compound KNO_3 was done for an Italian type locality, although it is possible. Of course, niter is not included in the graphs and statistics.

Can grimaldiite, neptunite and teruggite be included in the section of the species dedicated to Italian individuals and institutions?

The compilation of the mineral species dedicated to Italian individuals and institutions includes exclusively the minerals dedicated to individuals who maintained the Italian nationality, even if they emigrated to a foreign country.

- Grimaldiite and teruggite are two mineral species surely named after individuals with Italian origin: the surname Grimaldi is regularly abundant in all Italian regions; the surname Teruggi, instead, is typical of the Verbano-Cusio-Ossola Piedmontese region. We have no certainty about the maintenance of the Italian nationality from Frank Saverio Grimaldi (b. 1915), formerly chief chemist at the United States Geological Survey (USGS), and Mario E. Teruggi, professor of sedimentology and petrology at the National University of Plata, Argentina. For this reason grimaldiite and teruggite are not included in the section.

Grimaldiite, $Cr^{3+}O(OH)$, trimorphous with bracewellite and guyanaite, was first found at the type locality of the basin of the Merume River, Guyana, as deep red to pinkish brown, metallic, very rarely single rhombohedral crystals, commonly as parallel intergrowths with mcconnellite in tabular rhombohedral crystals, to 1 mm, or in radially bladed to platy or granular aggregates.

Teruggite, $Ca_4Mg[AsB_6O_{11}(OH)_6]_2 \cdot 14H_2O$, was first found at the type locality of the Loma Blanca borate deposit, Coranzulí, Jujuy province, Argentina, as colourless to white, vitreous, acicular to tabular crystals, prismatic with rhomboidal cross-section, to 0.1 mm and aggregated into cauliflower-shaped nodules.

- Neptunite, $KNa_2LiMn^{2+}_2Ti_2Si_8O_{24}$, takes its name from Neptune, sea-god of the Roman mythology; it was so named because of its close association, at the type occurrence, with aegirine, whose name derives from Ægir, the Scandinavian sea-god.

Neptune (Latin: *Neptunus*) is the god of water and sea in Roman mythology, a brother of Jupiter and Pluto.

He is analogous with but not identical to the god Poseidon of Greek mythology. The Roman conception of Neptune owes a great deal to the Etruscan god Nethuns.

Even though the "god persona" is undoubtedly of Roman origin, and therefore Italian, it is not possible to assign an earthly nationality to the deities. For this reason neptunite is not included in the above mentioned section.

Neptunite was first found at the type locality of Narssârssuk, Igaliku, Narsaq, Kitaa province, Greenland, as black, vitreous, prismatic crystals, up to 7.5 cm, typically with square cross sections that can be curved or twisted.

Minerals which could have been excluded

The following mineral species are generally considered of questionable status: chloromagnesite, pseudocotunnite, siderazot, and spadaite. They are marked as "Q" (questionable) in the official IMA CNMNC list of mineral names. Pseudocotunnite presumably is a valid grandfathered species, instable at room temperature. Most probably also siderazot could be a valid grandfathered species.

All the four minerals are included in the book and relevant graphs and statistics, anyway, because, as of today, questionable minerals are implicitly assimilated to the grandfathered species and for this reason recognized as valid by the mineralogical community.

Further studies would be highly desirable to better characterize - or discredit - the above phases.

Troilite, instead, is listed with grandfathered status in the official IMA CNMNC list of mineral names. In our opinion it could be classified as a polytype of pyrrhotite. Troilite, in fact, is stoichiometric FeS, without vacancies in its atomic structure, and because of this it is non-magnetic; pyrrhotite (magnetic) is iron defective Fe_{1-x}S , with x ranging from 0 up to 0.20. Troilite, consequently, might be the hexagonal polytype of pyrrhotite at $T < 122^\circ\text{C}$.

Both troilite and pyrrhotite have "G" (grandfathered) status in the IMA list of mineral names. We quote, here, the IMA CNMNC guidelines (Nickel & Grice, 1998): «Pyrrhotite, Fe_{1-x}S , where x varies between 0 and 0.12, exists in a number of crystallographic forms owing to variations in the degree of order of the Fe vacancies in the S lattice; because of the variable chemical composition, the different types of pyrrhotite can be regarded as polytypoids and are not regarded as separate species». Pyrrhotite (with $x > 0$) is either monoclinic or hexagonal; the most common natural pyrrhotite is monoclinic. In view of the text above, troilite can be expressed as pyrrhotite-2H (with $x = 0$), and thus the name "troilite" would not be necessary. The different forms of pyrrhotite are, of course, not varieties but structural modifications.

Definitions and rules of polytypes and polytypoids.

«(1) Polytypism is defined as "the phenomenon of the existence of an element or compound in two or more layer-like crystal structures that differ in layer stacking sequences. The layers need not be crystallographically identical, but should be similar. Polytypism differs from polymorphism (in the present and strict definition of the latter term) in permitting small differences in chemical composition between structures, not to exceed 0.25 atoms per formula unit of any constituent element. Layer structures that differ from one another by more than this amount are to be called polytypoids rather than polytypes".

(2) "In general, polytypes should not receive individual mineral names. Instead, a set of related polytypes should be designated by a single name followed by a structural symbol suffix that defines the layer stacking differences. A recommended system of structural symbols is described in the report".

(3) "Polytype (and polytypoid: *adding by the authors*) mineral names already in existence that have international acceptance and serve an useful function need not be discarded. Decision on retention of individual names should be the responsibility of the IMA Commission on New Minerals and Mineral Names."»

[Bailey, S.W. (1977): Report of the I.M.A.-I.U.Cr. Joint Committee on Nomenclature. *American Mineralogist*, **62**, 411-415; Bailey, S.W. (1980): Summary of recommendations of AIPEA nomenclature committee on clay minerals. *American Mineralogist*, **65**, 1-7].

1.6. Acknowledgements

This chapter has been the most difficult to write, due to the huge amount of material, bits of information and invaluable support that we have received from several institutions and people throughout the drawing up of the volume. Therefore, it is with a true pleasure that we desire to acknowledge all contributions.

Mineral collectors and photographers, who generously provided their specimens and expertise – several photographs were taken expressly for this book – are not listed below, since they have been credited in the caption of each image. Hereby, we are pleased to express to all of them our warmest thanks for their care and dedication.

A special thank is due to those authors who gave us permission to quote the names of minerals recently approved by the IMA CNMNC, and for providing with unpublished data. The names of the authors appear under the “Reference” section of the relevant species, with the citation “in preparation” or “in press”.

It goes without saying that institutions and people mentioned below did not provide their contribution all at the same level; however, it would be almost impossible, maybe misleading, to sort them in order of priority. The list below (hopefully complete, our apologies for any oversight) is therefore sorted according to an alphabetical order, and includes all those who, in various ways and by means of different acts, gave their contribution to let *Italian Type Minerals* see the light in form we hereby are pleased to present it. The responsibility for any mistakes which may have occurred is exclusively ours.

To all of you, “*grazie di cuore*”.

American Mineralogist: <<http://www.minsocam.org/>>

Canadian Mineralogist: <<http://www.mineralogicalassociation.ca/>>

Contributions to Mineralogy and Petrology: <<http://www.springer.com/>>

Der Aufschluss: <<http://www.vfmg.de/>>

European Journal of Mineralogy: <<http://www.schweizerbart.de/>>

Mineralogical Magazine: <<http://www.minersoc.org/>>

Mineralogical Record: <<http://www.minrec.org/>>

Rivista Mineralogica Italiana: <<http://www.gmlmilano.it/>>

Ava Helen and Linus Pauling Papers, Oregon State University Special Collections: <<http://osulibrary.oregonstate.edu/>>

Fabrizio Adorni, Claudio Albertini, Roberto Allori, Alpimedia Communication snc, Pierluigi (Piero) Ambrino, Ippazio Pasquale Antonazzo, Thomas Armbruster, Gianluca Armellino, Ronald J. Bakker, Giuseppina Balassone, Corrado Balestra, Tiberio Bardi, Alessandra Baretta, Marco Barsanti, Riccardo Basso, Jean Bebien, Fabio Bellatreccia, Elena Belluso, Flaminio Benetti, Anton Beran, Cristian Biagioni, Silvio Bianco, Luca Bindi, Elena Bonaccorsi, Enrico Bonacina, Laura Bonardo, Paola Bonazzi, Antonio Borrelli, Giorgio Bortolozzi, Paolo Bosio, Roberto Bracco, Maria Franca Brigatti, Fabio Brignoli, Piero Brizio, Ernst A.J. Burke, Louis J. Cabri, Valeriano Calderini, Fernando Cámara, Italo Campostrini, Cristina Carbone, Elena Cavallone, Serena Cazzola, Luca Ceccantini, Matteo Chinellato, Christian Chopin, Nikita V. Chukanov, Matteo Ciriotti, Antonio Costa, Alberto Dal Negro, Giancarlo Della Ventura, Francesco Demartin, Vincenzo de Michele, Graziano Del Core, Robert (Bob) T. Downs, Fabio Esposito, Jim Ferraiolo, Massimo Ferrari, Giovanni Ferraris, Giuseppe (Beppe) Finello, Gianni Fraccaro, Ermanno Galli, Mariano Gallo, Antonio Gamboni, Anna Garavelli, Giorgio Garuti, Klaus Glinka, Mauro Goretti, Carlo Maria Gramaccioli, Paolo Grosso, Sandro Gualerci, Alessandro Guastoni, Frédéric Hatert, William (Bill) Henderson, Myriam Julien, Uwe Kolitsch, John F. Lewis, Catherine Leyx, Athos Locatelli, Francisco Longo, Gabriella Lucchetti, Maria Carlotta Malatesta, Gaspere Maletto, Daniele Malferrari, Marzio Mamberti, Marco Marchesini, Barbara Martin, Andrew M. McDonald, Maurilio Meda, Olaf Medenbach, Joan C. Melgarejo, Marcello Mellini, Stefano Merlino, Steffen Möckel, Yves Moëlo, Annibale Mottana, Claudia Napolitano, Fabrizio Nestola, Ernest (Ernie) H. Nickel, David Nieri, Tony Nikischer, Roberta Oberti, Paolo Orlandi, Luisa Ottolini, Ugo Ostan, Adriana & Renato Pagano, Andrea Palenzona, Achille Panunzi, Gian Carlo Parodi, Danilo Pedron, Sergio Pegoraro, Chris Petersen, Federico Pezzotta, Alessio Piccioni, Gian Carlo Piccoli, Pier Giuseppe Prandoni, Domenico Preite, Claudia Principe, Joaquín A. Proenza, Dmitry Yu. Pushcharovsky, Simona Quartieri, Grazia Querio, Andrea Rossellini, Nikolay S. Rudashevsky, Massimo Russo, Sergio Russo, Rita Scarselli, Luciano Secco, Gaetano Sicurella, Alessandro Socci, Chris J. Stanley, Marco Sturla, Rainer Thomas, Fabio Tosato, Wieland Tyrre, Luciano Vaccari, Giovanna Vezzalini, Filippo Vurro, Peter (Pete) A. Williams, Stephan Wolfsried, Federica Zaccarini, Pier Francesco Zanazzi, Michele Zema.

2.1. Catalogue

Adranosite



3.CJ.45

tet, $I4_1/acd$, a 18.118, c 11.320 Å, V 3715.5 Å³, Z 8

Type locality:

La Fossa crater, Vulcano, Lipari, Aeolian Islands, Messina, Sicilia.

Name:

After the Greek name of the ancient god *Adranòs*, father of the Palici, who has characteristics related to natural phenomena (water and fire) and is assimilated to *Hephaistòs* (Vulcanus for the Latins), who had his forges in the bowels of Vulcano Island.

Status:

Approved, IMA 2008-057.

Appearance:

Colourless, white; vitreous; elongated tetragonal prismatic crystals up to 0.30 mm.

Occurrence and distribution:

A sublimation product in an active high-temperature volcanic fumarole. Found only at the type locality associated to aiolosite, alunite, anhydrite, bismuthinite, demicheleite-(Br), demicheleite-(Cl), and panichiite.

Remarks:

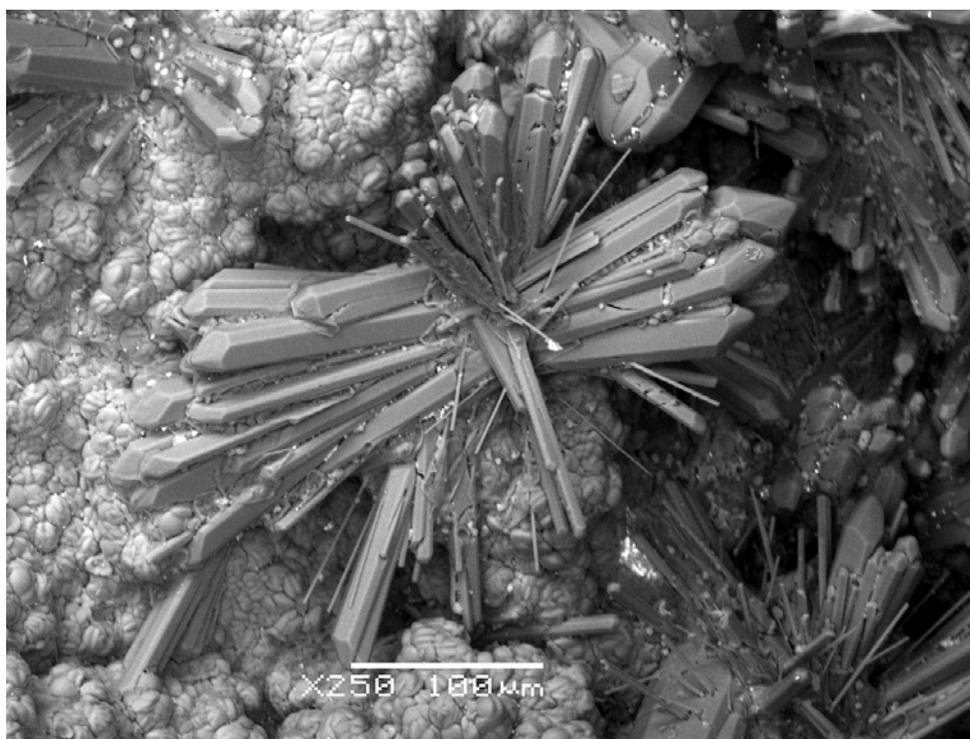
Related to the $(NH_4,K)_4(Fe,Al)_2Na(SO_4)_4Cl(OH)_2$ compound found on the burning coal dump of the Anna mine near Alsdorf, Aachen, North Rhine-Westphalia, Germany. Vulcano was an ancient Sicilian rather than Roman god. He was associated with the volcanic island of Vulcano. He was also called *Adranòs*, the god of Mount Etna, and the father of the Palici or geyser-gods. The Palici were a pair of indigenous Sicilian chthonic deities in Roman mythology, and to a lesser extent in Greek mythology. *Adranòs* was a fire god worshipped by the Sicels, the original inhabitants of the island of Sicily. *Adranus* himself was said to have lived under Mount Etna before having been driven of its bowels out by the Greek god *Hephaestus*, known under the name of Vulcan within the Latin pantheon.

References:

Demartin, F., Gramaccioli, C.M., Campostrini, I.: *in preparation*.



The obverse of a Mamertini's coin showing the face of *Adranòs*



Adranosite from the type locality (I. Campostrini SEM-BSE photo)

Aiolosite



7.BD.20

hex, $P6_3/m$, a 9.626, c 6.880 Å, V 552.1 Å³, Z 2

Type locality:

La Fossa crater, Vulcano, Lipari, Aeolian Islands, Messina, Sicilia.

Name:

After *Aiolòs*, the Greek name of the mythological God of the winds (Latin *Æolius*) from whom the windy Aeolian Archipelago takes its name.



Fountain mask representing Aiolòs

Status:

Approved, IMA 2008-015.

Appearance:

Colourless; vitreous; groups of acicular prismatic hexagonal crystals up to 0.15 mm.

Occurrence and distribution:

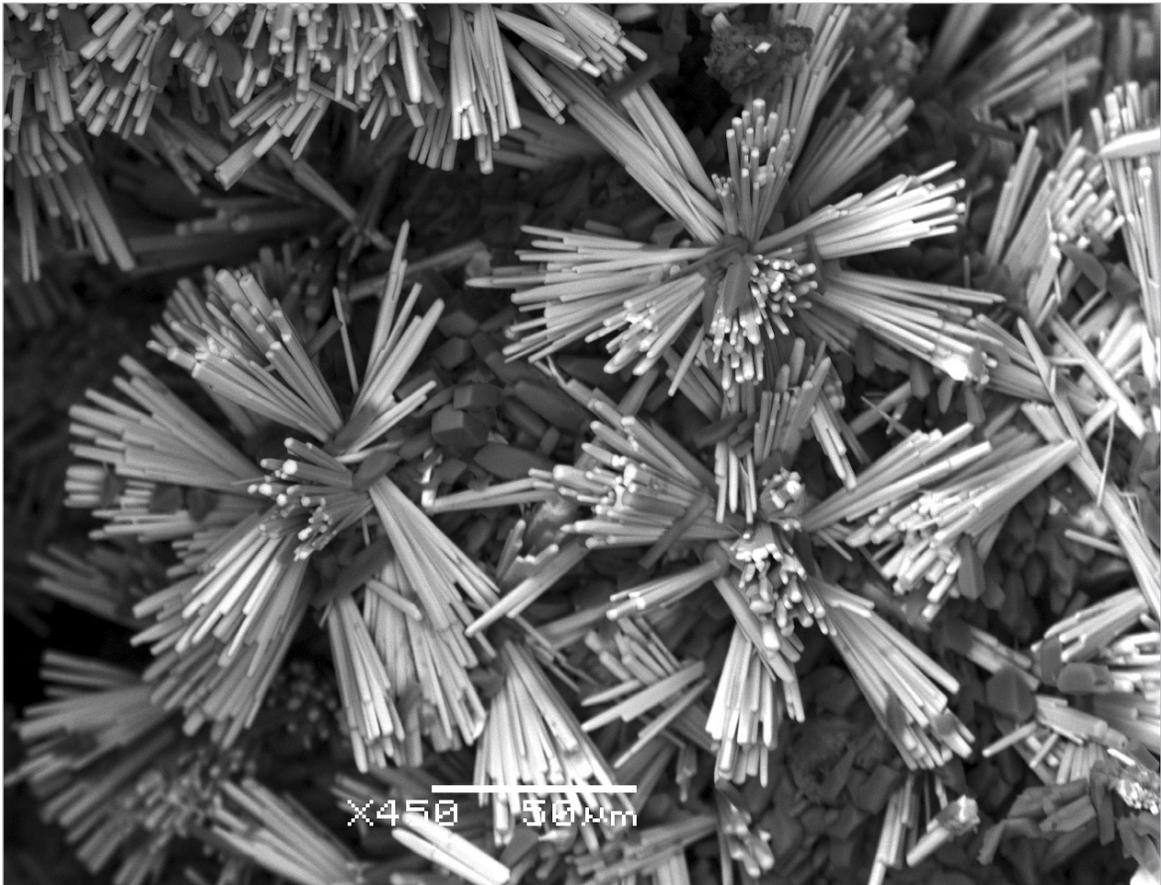
Extremely rare mineral found in an active fumarole.

Remarks:

Aiolosite is isotypic to apatites, homeotypic to cesanite and related to caracolite.

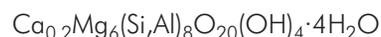
References:

Campostrini, I., Demartin, F., Gramaccioli, C.M.: *in preparation*.



Aiolosite from the type locality
(I. Campostrini SEM photo)

Aliettite



9.EC.60

hex, s.g. unknown, a 5.216, c 24.6 Å, V 579.6 Å³, Z 1

Type locality:

Monte Chiaro, Borgo Val di Taro, Parma, Emilia-Romagna.

Name:

After Andrea Alietti (1923-2000), professor of mineralogy at the University of Modena.

Status:

Redefined, AIPEA Nomenclature Committee 1981.



Andrea Alietti

Appearance:

Colourless, white, pale yellow, green, grey, buff; earthy to dull; translucent microscopic aggregates of crystals with platy-sheet forms.

Occurrence and distribution:

Rare mineral found in serpentinized ophiolite rocks as alteration product and in soils derived therefrom; also in altered dolostones.

Remarks:

An interstratified phyllosilicate (1:1 regularly interstratified talc-saponite); member of the aliettite-corrensite group. Related to brinrobertsite, corrensite, dozyite, hydrobiotite, *karpinskite*, kulkeite, lunijianlaite, rectorite, saliotite, tosudite. Found as pseudomorph of wollastonite (Uzbekistan).

References:

Alietti, A. (1956): Il minerale a strati misti saponite-talco di Monte Chiaro (Val di Taro, Appennino Emiliano). *Rendiconti dell'Accademia Nazionale dei Lincei, Serie VIII*, **21**, 201-217.

Alietti, A. (1956): Diffusione e significato dei minerali a strati misti nelle serpentiniti dell'Appennino parmense. *Periodico di Mineralogia*, **28**, 65-110.

Alietti, A. & Mejsner, J. (1980): Structure of a talc/saponite mixed-layer mineral. *Clays and Clay Minerals*, **28**, 388-390.

Bailey, S.W. (1981): A system of nomenclature for regular interstratifications. *Canadian Mineralogist*, **19**, 651-655.

Brigatti, M.F. & Poppi, L. (1987): Natural and monoionic aliettite: hydration and dehydration states. *Clay Minerals*, **22**, 187-197.



Left: The Monte Chiaro as seen from Borgo Val di Taro (F. Adorni photo)

Right: ophiolitic outcrop on the Western side of the Monte Chiaro (F. Adorni photo)

Allanite-(La)



9.BG.05

mon, $P2_1/m$, a 8.914, b 5.726, c 10.132 Å, β 114.87°, V 469.2 Å³, Z 2

Type locality:

Buca della Vena mine, Ponte Stazzemese, Stazzema, Apuan Alps, Lucca, Toscana.

Name:

For its close relationship with allanite-(Ce), the latter being named after Thomas Allan (1777-1833), Scottish mineralogist. The Levinson suffix is for the dominating REE.



Stazzema
Monte Forato
(pierced mountain)

Status:

Approved, IMA 2003-065.

Appearance:

Black, brown to brownish violet; vitreous to greasy; prismatic elongated crystals up to 2-3 mm in length, somewhat prismatic or tabular crystals with a typically dominant pinacoid against which the crystal is often flattened. The terminations are usually wedge-shaped, more rarely tapered pyramids. Also massive or, more commonly, as embedded grains.

Occurrence and distribution:

Within calcite and barite veins cutting a mineralized ore body. An accessory mineral in some granites and pegmatites, syenites and rarely in schists, gneisses, and metamorphosed limestones. Common.

Remarks:

A sorosilicate member of the epidote group; related to allanite-(Ce), allanite-(Y), androsite-(Ce), androsite-(La), clinozoisite, clinozoisite-(Sr), dissakisite-(Ce), dissakisite-(La), dollaseite-(Ce), epidote, epidote-(Pb), epidote-(Sr), ferriallanite-(Ce), khristovite-(Ce), manganiandrosite-(Ce), manganiandrosite-(La), manganipiemontite-(Sr), mukhinite, piemontite, *tawmawite*, uedaite-(Ce), vanadoandrosite-(Ce). The mineral was known to occur at some localities, and generically referred to as "allanite". After the introduction of the Levinson suffixes, only allanite-(Ce), which is by far more common than allanite-(La), was officially described and recognized as a valid species. The description of the Italian occurrence of allanite-(La) filled the gap in the systematic mineralogy, and allowed the mineral to be included in this compilation. Thomas Allan was a banker and the proprietor-editor of the newspaper Caledonian Mercury. He commissioned the enlargement in Jacobean style of the original tower house of the Lauriston Castle (Edinburgh, Scotland, UK).

References:

- Marble, J.P. (1940): Allanite from Barringer Hill, Llano County, Texas. *American Mineralogist*, **25**, 168-173.
- Pan, Y. & Fleet, M.E. (1991): Vanadian allanite-(Ce) and vanadian allanite-(La) from the Hemlo gold deposit, Ontario, Canada. *Mineralogical Magazine*, **55**, 497-507.
- Ercit, T.S. (2002): The mess that is "allanite". *Canadian Mineralogist*, **40**, 1411-1419.
- Orlandi, P. & Pasero, M. (2006): Allanite-(La) from Buca della Vena mine, Apuan Alps, Italy, an epidote-group mineral. *Canadian Mineralogist*, **44**, 63-68.



Allanite-(La) as black prismatic 1.7 mm crystal in baryte from the type locality (University of Pisa collection, C. Biagioni photo)

Alloriite



9.FB.05

trig, $P3_1c$, a 12.892, c 21.340 Å, V 3071.6 Å³, Z 4

Type locality:

Monte Cavalluccio, Sacrofano, Sacrofano caldera, Campagnano di Roma, Roma, Lazio.

Name:

After Roberto Allori (b. 1933), amateur mineralogist and collector.

Status:

Approved, IMA 2006-020.



Roberto Allori

Appearance:

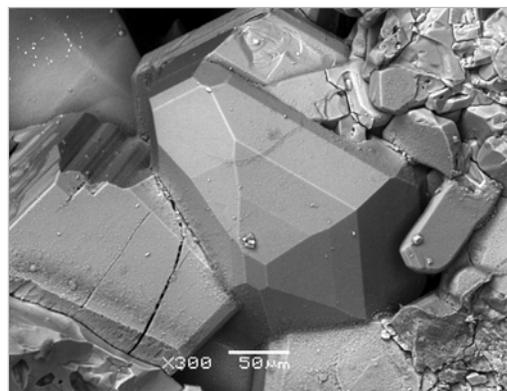
Colourless to very pale lilac; vitreous; minute tabular to stout prismatic micro-hexagonal crystals in vugs associated with sanidine, andradite, "biotite", "apatite".

Occurrence and distribution:

Found only at the type locality in a sanidine ejectum.

Remarks:

A member of the cancrinite group related to afghanite, biachellaite, bystrite, cancrinite, cancrisilite, davyne, fantappièite, farneseite, franzinite, giuseppettite, hydroxycancrinite, kyanoxalite, liottite, marinellite, microsommite, pitiglianoite, quadridavyne, sacrofanite, tounkite, vishnevite. The crystal structure of alloriite is based on the same tetrahedral framework as that of afghanite. It is characterized by the ABA-BACAC stacking sequence and ordering of Si and Al. It is an analogue of afghanite with ...-Na-H₂O-Na-H₂O-... chains located in cancrinite-type channels and substituting for ...Ca-Cl-Ca-Cl... chains, typical for afghanite. Thus alloriite is Na-rich, hydrous (Ca- and Cl-deficient) analogue of afghanite. First found by Roberto Allori.



Alloriite from the type locality (D. Preite collection, I. Campostrini SEM photo)

References:

Chukanov, N.V., Rastsvetaeva, R.K., Pekov, I.V., Zadov, A.E. (2007): Alloriite, $\text{Na}_5\text{K}_{1.5}\text{Ca}(\text{Si}_6\text{Al}_6\text{O}_{24})(\text{SO}_4)(\text{OH})_{0.5}\cdot\text{H}_2\text{O}$, a new mineral of the cancrinite group. *Proceedings of the Russian Mineralogical Society*, **136**, 82-89.

Rastsvetaeva, R.K., Ivanova, A.G., Chukanov, N.V., Verin, I.A. (2007): Crystal structure of alloriite. *Doklady Earth Sciences*, **415**, 815-819.



Nice crystals of alloriite from the type locality. Left: light violet transparent hexagonal 1.2 mm crystals both assembled and accordion-like aggregates in vug of sanidinitic ejectum. Right: bright pale violet hexagonal short prismatic 1.1 mm crystal showing trigonal symmetry standing on the surface of sanidinitic ejectum (R. Allori collection, L. Ceccantini photo)

Aluminocerite-(Ce)



9.AG.20

trig, $R3c$, a 10.581, c 37.932 Å, V 3677.8 Å³, Z 6

Type locality:

Monte Camoscio quarries, Oltrefiume, Baveno, Verbano-Cusio-Ossola, Piemonte.

Name:

For its close chemical relationship with cerite-(Ce), the latter taking its name from its cerium content (the chemical element was named for the asteroid Ceres). The Levinson suffix is for the dominating REE.



Baveno granite deposit

Status:

Approved, IMA 2007-060.

Appearance:

Pink; vitreous; groups of crudely formed pseudo-octahedral microcrystals.

Occurrence and distribution:

In pegmatite veins of the Baveno granite deposit and in a very few other localities.

Remarks:

Related to cerite-(Ce) and cerite-(La), and to the minerals of the whitlockite group. One of the best specimens was found, in 1968, by Piero Tamea; the structure was solved on crystals of this sample. The specimen on which studies were started was found at the Ratti quarry.

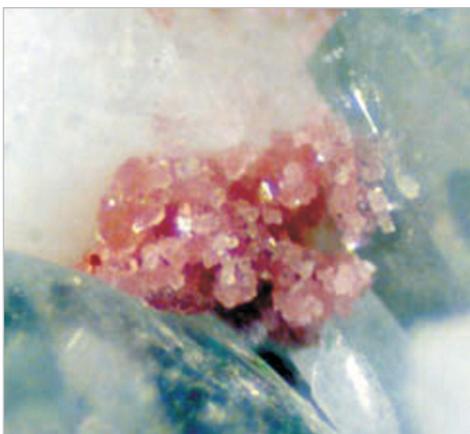
References:

Nestola, F., Guastoni, A., Cámara, F., Secco, L., Dal Negro, A., Pedron, D., Beran, A. (2009): Aluminocerite-(Ce): A new species from Baveno, Italy: Description and crystal-structure determination. *American Mineralogist*, **94**, 487-493.

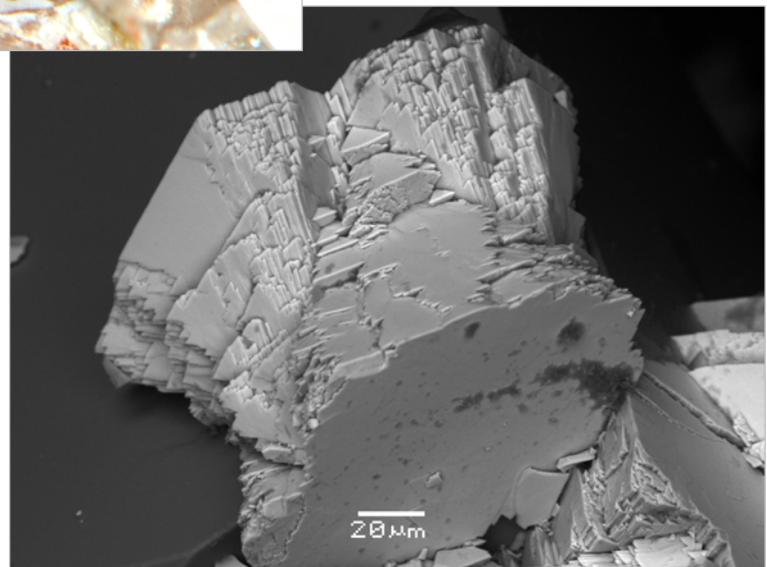


Groups of vitreous pink aluminocerite-(Ce) from the type locality perched on quartz and albite crystals in a vug of the pegmatitic vein of the granite (field 2.5 mm) (P. Tamea collection, P. Ambrino photo)

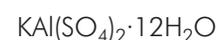
Aluminocerite-(Ce) from the type locality (A. Guastoni SEM photo)



Group of several pink 0.2 mm crystals of aluminocerite-(Ce) from the type locality (S. Varvello collection and photo)



Alum-(K)



7.CC.20

cub, P_63 , a 12.157 Å, V 1796.7 Å³, Z 4

Type locality:

La Solfatara, Phlegrean Fields, Pozzuoli, Napoli, Campania.

Name:

English translation of the Latin name *alumen*, used by Pliny the Elder in his *Historia Naturalis*. Most likely Pliny referred to the hydrated aluminum potassium sulfate.



La Solfatara

Status:

Renamed, IMA 2007-C.

Appearance:

Colourless, white; vitreous; tiny octahedral, which may be strung along fibers, stalactitic, columnar, mealy or granular, massive efflorescences.

Occurrence and distribution:

As fumarolic or solfataric precipitate and formed from argillaceous rocks or coal containing altering pyrite or marcasite. Many world localities.

Remarks:

A member of the alum group; related to alum-Na, lanmuchangite, loncreekite, tschermigite. Also known as potash alum and potassium alum. Alum is one of the oldest and best known substances for hobby crystal growth and even the ancient Romans knew that alum not only crystallizes in octahedrons but also in cubes. Natural deodorant stones are made of alum-(K). It is a pure product made without the addition of chemicals, fragrances, oils or alcohol. Alum is employed in various ways, e.g. as a powerful astringent. It is traditionally the most important of all the ancient mordants and was used as early as 2000 B.C. The most common hardening agent used in a fixing photographic bath (negative black and white process) is alum-(K). Found in caves. The definition of the type locality for alum-(K) is a debated question. This is easily understood, since the mineral has been known for thousands of years. None of the common and updated compilations of minerals give a type locality for it, or at most the type locality is reported as "unknown". As a matter of fact, Pliny the Elder (I Century) cites "alum" in his *Naturalis Historia* (15th chapter of his 35th book), in the frame of the description of the volcanic activity of Vesuvius, although the mineral is not explicitly specified as "potassium alum". By comparing this with the account of "*stupteria*" given by Pedanius Dioscorides (ca. 40 - ca. 90 A.D.) in the 123rd chapter of his 5th book *Περὶ ὑλῆς ἰατρικῆς* (*De Materia Medica* - in the Latin translation), it is obvious that the two are identical. Agricola (XVI Century) in his *De re metallica* provides a detailed description of the extraction and exploitation of "potassium alum" from La Solfatara, Pozzuoli. Vauquelin, who described "potash alum" some two centuries later, at the very beginning of the "modern mineralogy era", did not specify its provenance, and carried out most of his studies on synthetic material. For that reason, following Agricola we suppose and propose to consider alum-(K) an Italian mineral with type locality Pozzuoli.

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Alum-(K) as curls from the type locality (M. Russo collection, I. Campostrini SEM photo)

Alunite

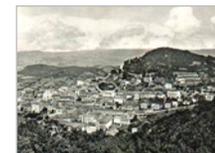


7.BC.10

trig, $R\bar{3}m$, a 6.9741, c 17.1900 Å, V 724.1 Å³, Z 3

Type locality:

Allumiere quarries (open pits and galleries), Allumiere, Tolfa Mounts district, Roma, Lazio
[and Mukacheva (Muzijev), Mukachevo, Transcarpathian Oblast, Ukraine].



Historical picture of Allumiere

Name:

A contraction from aluminilite, an earlier term for the mineral related to its aluminium content (in French language *alun*, after Latin *alumen*).

Status:

Renamed, 1967.

Appearance:

Colourless, white, grey, greyish, yellow, yellowish, yellowish white, yellowish grey, reddish, reddish grey, brownish; vitreous, nacreous, pearly, earthy; prismatic, flattened rhombohedral (a combination of two trigonal pyramids), pseudocubic, tabular, lenticular crystals, aggregates, columnar, fibrous, cryptocrystalline, concretions, films, crusts, botryoidal, granular and masses.

Occurrence and distribution:

Generated by pyrite or solfataric action on aluminous rocks. Many deposits, some of immense size (e.g., Colico Peak porphyry, Colorado).

Remarks:

A member of the alunite group; related to ammonioalunite, ammoniojarosite, argentojarosite, beaverite, dorallcharite, huangite, hydroniumjarosite, jarosite, minamiite, natroalunite, natrojarosite, osarizawaite, plumbojarosite, walthierite (family with kagomé antiferromagnets). It forms series with ammonioalunite, crandallite, jarosite, natroalunite, woodhouseite. First called aluminilite by Jean-Claude Delamétherie in 1707, this name was contracted by François Sulpice Beudant in 1824 to alunite. It is not so well known that Iran is, with China, one of the most important producers of alunite. Found in meteorites and as a possible sulfate present on Mars and on the surface of Ganymede (Jupiter's largest moon). Found in several caves (Carlsbad, Cottonwood, Endless, Lechuguilla, Guadalupe, Virgin, Mboobo Mkulu, etc.). Alunite is frequent in gold deposits. Alunite had in the past, and still has, a high market value. Its use ranges from the fixing of colours on the textile fibres to the tanning; it is employed in medicine and has the property to make fabrics and wood fire-resistant. More recently, it has also been employed for the production of paper and in water purification. Of course alunite is an important source of aluminium.

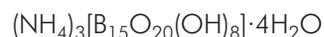
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Colourless 0.5 mm crystal of alunite with a pale lilac hue from the Italian type locality (L. Mattei collection and photo)

Ammonioborite



6.EA.15

mon, $C2/c$, a 25.27, b 9.65, c 11.56 Å, β 94.28°, V 2811.1 Å³, Z 4

Type locality:

Larderello, Val di Cecina, Pomarance, Pisa, Toscana.



Pomarance

Name:

After its chemical composition.

Status:

Grandfathered, 1933.

Appearance:

White, vitreous; parallel and lamellar aggregates of microscopic plates and micrograined and compact masses.

Occurrence and distribution:

In boric acid-rich fumarolic lagoon. Found only at the type locality in a specimen of natural borate.

Remarks:

A neso-pentaborate related(?) to santite and sborgite. At the type locality ammonioborite is formed from boron-rich waters that steam out of volcanic exhalations in the Tuscan boraciferous area; it occurs admixed with larderellite and sassolite.

References:

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Ammonioborite from the type locality (M.E. Ciriotti collection and photo)



Larderello: steampipes of the geothermal power plant (courtesy of ENEL SpA)

Analcime



9.GB.05

cub, $1a3d$, a 13.725 Å, V 2588.3 Å³, Z 16

Type locality:

Isola Lachea, Arcipelago dei Ciclopi, Aci Trezza, Aci Castello, Catania, Sicilia.



Lachea Island

Name:

From the Greek word *analkis* meaning without strength, referring to a weak electrical charge developed on rubbing.

Status:

Approved, Zeolites Subcommittee 1997.

Appearance:

Colourless, white, grey, yellowish, pink, greenish, yellow, reddish, pinkish; vitreous; trapezohedral and cubic crystals, lamellar, grained, compact, earthy and massive aggregates.

Occurrence and distribution:

Typically in basalt and phonolites; also in mafic igneous rocks and authigenic in sandstones and siltstones. Found in several worldwide localities.

Remarks:

Chemically it could be considered a member of the feldspathoid family; however, due to its crystal-chemical features, analcime is included within zeolite minerals in the analcime group. Related to ammonioleucite, leucite, lithosite, pollucite, and wairakite. It forms series with pollucite. Earlier referred to as analcite. A number of different analcimes were described with lower symmetries (tetragonal, orthorhombic, monoclinic, triclinic).

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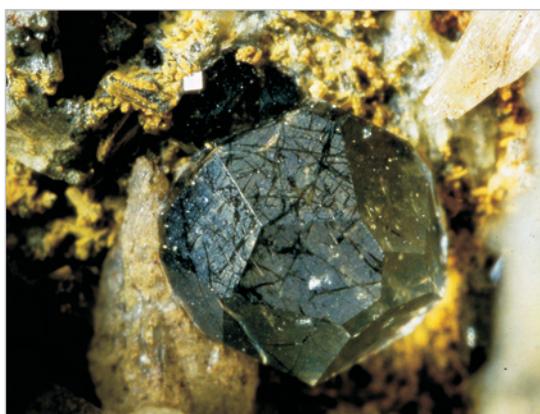
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Analcime from the type locality
Above: crystal with diameter of 2.1 mm
(E. Bonacina collection and photo)



Right: colourless 25 mm large crystal
(G. Sicurella collection and photo)

Anorthite



9.FA.25

tric, $P\bar{1}$, a 8.194, b 12.878, c 14.171 Å, α 93.07°, β 115.07°, γ 91.47°, V 1352.1 Å³, Z 8

Type locality:

Somma-Vesuvio volcanic complex, Napoli, Campania.



Somma Mount

Name:

After the Greek *anorthos* (not straight), in allusion to the triclinic symmetry.

Status:

Grandfathered, 1823.

Appearance:

White, colourless, greyish, reddish, reddish grey, grey, grey white, greyish brown, pinkish, deep blue (tanzanite variety); vitreous to dull (if weathered); prismatic, lamellar, laminar, blocky, tabular crystals with nearly rectangular or square cross-section with slanted dome and pinacoid terminations, sometimes with striated parallel lines on crystal surface; grained and massive; twinning is almost ubiquitous, as in all plagioclases, and crystals can be twinned according to the Albite, Carlsbad, Manebach and Baveno laws.

Occurrence and distribution:

In metamorphosed carbonate rocks, and in some granulite facies metamorphic rocks; rarely in mafic plutonic and volcanic rocks. A widely distributed rock-forming phase.

Remarks:

A tectosilicate member of plagioclase (feldspar) group; related to albite, lingunite, reedmergerite. Polymorph of dmisteinbergite, and svyatoslavite. The space group symmetry of pure anorthite is $P\bar{1}$, but intermediate members along the plagioclase join ($\text{NaAlSi}_3\text{O}_8$ - $\text{CaAl}_2\text{Si}_2\text{O}_8$) may crystallize in $I\bar{1}$ and $C\bar{1}$ space groups, depending on temperature. The solid solution between anorthite and K-feldspar is very limited due to a wide miscibility gap. The solid solution between albite and anorthite is a coupled, charge-balanced substitution CaAl for NaSi (in exchange vector notation $\text{CaAlNa}_{-1}\text{Si}_{+1}$). Anorthite is an essential constituent of many basic igneous rocks, such as gabbro and basalt, and of some meteoric stones (also Lunar and Martian). Most of the lunar crust, often called the *highlands*, consists of rocks that are rich in anorthite. Monticelli & Covelli described anorthite with two other different names: "biotina" and "cristianite" (in honour of the French physicist Jean-Baptiste Biot and of the Prince Christian Frederic of Denmark).



Two habits of anorthite:
the former, from the type locality, in a prismatic 0.9 mm length colourless crystal (V. Airoldi collection, E. Bonacina photo);
the latter as blocky striated creamy-withish 3 mm crystal from Valle Biachella, Sacrofano, Campagnano di Roma, Roma, Lazio, Italy (D. Preite collection, E. Bonacina photo)

References:

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Anorthoclase



9.FA.30

tric, $C\bar{1}$, a 8.252, b 12.936, c 7.139 Å, α 92.11°, β 116.32°, γ 90.22°, V 682.6 Å³, Z 4

Type locality:

Cuddia Mida, Pantelleria, Trapani, Sicilia.

Name:

After the Greek *anorthos* (not straight fracture), in allusion to its lower symmetry with respect to orthoclase (in which the cleavages are almost perpendicular).

Status:

Grandfathered, 1885.

Appearance:

Colourless, white, off-white, yellow, cream, green, greenish, greenish grey, grey, grey pink, pink, brownish, brown, reddish; vitreous (pearly on cleavages); generally it occurs as anhedral to subhedral short prismatic, flattened tabular and rhombic crystals, dense aggregates, phenocrysts, spherulites, small distinct particles dispersed in matrix and masses. As "moonstone" with characteristic sheen (bluish adularescence). Twinning: Baveno, Carlsbad, and Manebach laws.

Occurrence and distribution:

Within andesitic rocks, high-temperature sodic volcanic and hypabyssal rocks. Rather abundant worldwide.

Remarks:

A tectosilicate member of alkali feldspar group: related to buddingtonite, celsian, kokchetavite, kumdykolite, microcline, orthoclase, rubicline, and sanidine. Obviously also related to the members of plagioclase feldspar group. A high temperature variety ($>400^\circ\text{C}$) is monoclinic (disordered): $C2/m$; a 8.35, b 12.98, c 7.16 Å, β 116.1°, Z 4. The anorthoclase name is usually assigned to alkali feldspars having a chemical composition ranging from $\text{Or}_{40}\text{Ab}_{60}$ to $\text{Or}_{10}\text{Ab}_{90} \pm$ up to approximately 20 mole % An (Or, Ab, An = KAlSi_3O_8 , $\text{NaAlSi}_3\text{O}_8$, $\text{CaAl}_2\text{Si}_2\text{O}_8$) and which deviate in some way from monoclinic symmetry tending toward triclinic symmetry. When found in nature, crystals usually do not consist of a single phase but are composed of two or more kinds of K- and Na-rich domains, mostly of submicroscopic size. In addition, they are frequently polysynthetically twinned according to the albite and pericline laws. It is likely that anorthoclase crystals originally grew up as monalbite (monoclinic phase) inverting and unmixing in the course of cooling during geological times. They are typically found in lavas or high-temperature rocks. Anorthoclase is found in meteorites (also Martian) and it is assumed to occur on Martian soil.

References:

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Cuddia Mida: gas emissions and fumaroles at low flux and temperature



Anorthoclase from the type locality as subhedral crystals (field 7 x 5 mm)
(G. Bortolozzi collection and photo)

Antigorite



9.ED.15

mon, *Cm*, *a* 5.424, *b* 9.238, *c* 7.274 Å, β 91.32°, *V* 364.4 Å³, *Z* 2

Type locality:

Passo della Rossa (German: Geisspfad), Alpe Devero, Valle Antigorio (transported glacial blocks), Baceno, Verbano-Cusio-Ossola, Piemonte [and Geisspfad (Italian: Passo della Rossa), Binn, Goms, Wallis (Valais), Switzerland].



Rossa pass and lakes

Name:

After the Antigorio Valley, from where the type specimen was supposed to come.

Status:

Grandfathered, 1840.

Appearance:

White, yellowish, green, green blue, bluish white, bluish grey, grey, brown (colourless to pale green in thin section), brownish, brownish red, black; vitreous, resinous, greasy, nacreous, dull, waxy, earthy; lamellar, bladed, foliated, columnar, fibrous, tabular, laminar, platy (wavy plates, some with rectangular outline due to cleavage), scaly crystals and aggregates, masses and micrograins.

Occurrence and distribution:

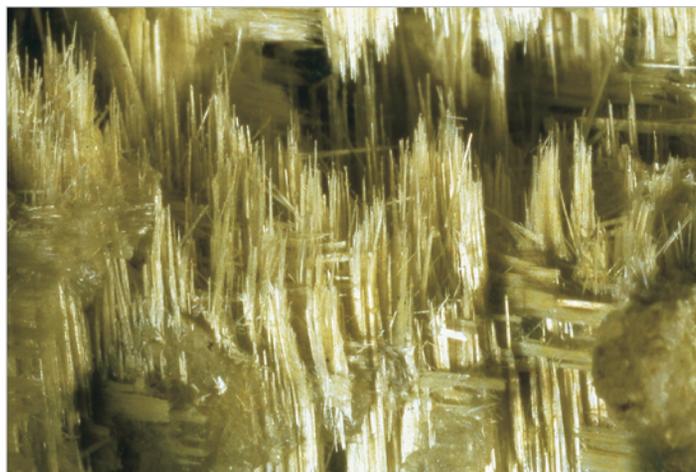
Serpentine minerals commonly result from the hydrothermal or retrograde metamorphism of mafic minerals like olivine, pyroxene or amphibole. High-temperature phase found in uppermost prehnite-pumpellyite to amphibolite facies terrane.

Remarks:

A phyllosilicate member of the serpentine group; related to amesite, berthierine, brindleyite, caryopilite, chrysotile, cronstedtite, fraipontite, greenalite, kellyite, lizardite, manandonaite, népouite, pecoraite. Polymorph of chrysotile and lizardite. As it commonly happens with layer silicates, extensive polytypism is likely to occur, giving rise to cell parameter multiple of the basic thickness of the layer along the stacking direction. The unit cell parameters given above correspond to the basic subcell; several antigorites has been recorded with $c = 43.4 \text{ \AA}$ (six-layer polytype) and many other values as well. Found in meteorites, asteroids, on the Moon and Mars, and also in extrasolar silicate dust. Antigorite has a corrugated *TO*-layer structure, with the tetrahedral layer attached on the concave side of a wave-like octahedral sheet. The "wavelength" of antigorite is variable. It decreases with temperature and, therefore, can be used as a geothermometer for greenschist- to amphibolite-grade serpentinites. The "wavelength", however, is likely to depend also on other parameters such as fluid composition and mineral chemistry. Antigorite artifacts were recovered from Neolithic, Chalcolithic and Bronze Age settlements. Serpentinites of the Geisspfad form a large complex of ultramafic rocks in the south-east of Binnental. They follow the border between Italy and Switzerland for about 5 km and produce the highest mountains between Geisspfad and Cervandone (or Cherbadung).

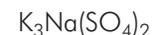
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Fibrous green antigorite from the type locality (field 9 x 6 mm) (A. Barresi collection, E. Bonacina photo)

Aphthitalite



7.AC.35

trig, $P\bar{3}m1$, a 5.680, c 7.309 Å, V 204.2 Å³, Z 1

Type locality:

Somma-Vesuvio volcanic complex, Napoli, Campania.

Name:

After the Greek words *aphthitos* and *alis*, which mean unalterable salt, in allusion to the stability of the mineral in air.

Status:

Grandfathered, 1832.

Appearance:

Colourless to white (rarely pale shades of grey, blue, grey blue, greenish, reddish due to impurities); vitreous to resinous; tabular, pseudo-hexagonal, and prismatic elongated crystals, bladed aggregates, efflorescences, crusts, and masses.



Giotto frescos at the Scrovegni Chapel in Padova

Occurrence and distribution:

Incrustations around volcanic fumaroles and a component of the evaporites. Also in guano deposits.

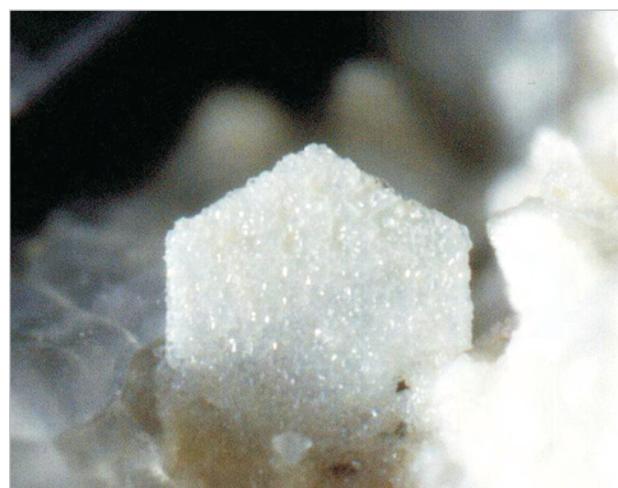
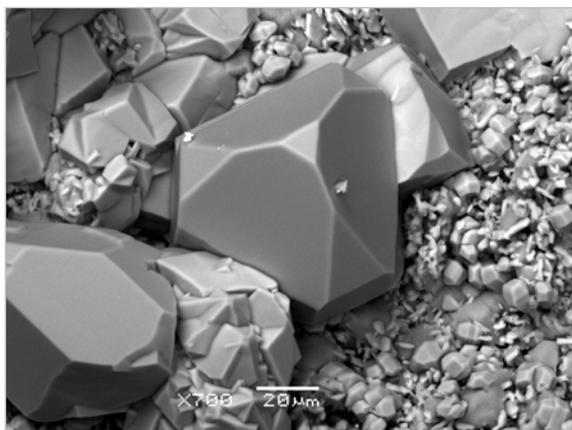
Remarks:

The mineral is often referred to as "glaserite". The chemical composition of natural aphthitalite varies between $\text{K}_3\text{Na}(\text{SO}_4)_2$ and $\text{K}_2\text{Na}_2(\text{SO}_4)_2$. The crystal structures of synthetic compounds with both composition have been refined. It is unclear which composition better matches that of natural aphthitalite. The mineral was observed for the first time in the products of the 1794 eruption by Thomson, who named it "Vesuvian salt" and/or "vegetable alkali"; the name was then changed in "aphthalose" by Beudant (1832). Aphthitalite was found also in the 1848, 1855, 1868, 1870, 1872, 1893, 1906, 1919, 1923, 1933-34 and 1944 Vesuvian fumaroles. Aphthitalite, with thenardite, was identified by XRD during the study on conservation state and cleaning techniques for the Giotto fresco masterpiece in Padoan Scrovegni Chapel.

References:

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Aphthitalite from the type locality
with complex habit
(I. Campostrini SEM photo)



Aphthitalite from the type locality
as glassy whitish pseudo-hexagonal 0.75 mm large crystal
(G. Ghisolfi collection, E. Bonacina photo)