

Université de Liège
Faculté des Sciences
Département de Géologie
Laboratoire de Minéralogie



La CNMNC-IMA et les règles de nomenclature Application aux minéraux de Belgique

Beaufays, le 2 mai 2025
Prof. Frédéric Hatert

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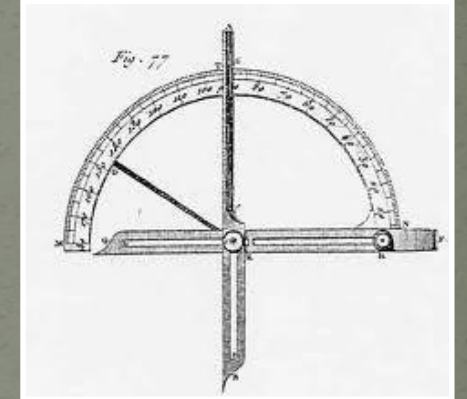
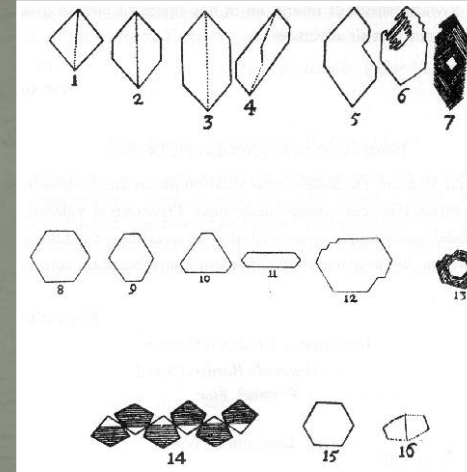
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Loi de constance des angles

Nicolas Sténon (1638-1686)

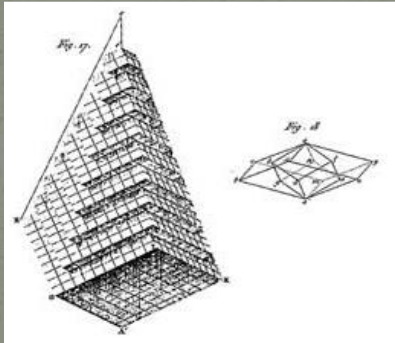


«Peu importe dans quelle mesure les faces d'un cristal peuvent varier dans leur taille ou dans leur forme; l'angle inter-facial reste constant, pourvu que les mesures soient effectuées à la même température ».

A mineral is a natural substance, chemically homogeneous, the surface of which is limited by planar faces. The angles between these faces are constant for the same mineral species.

La molécule intégrante (1871)

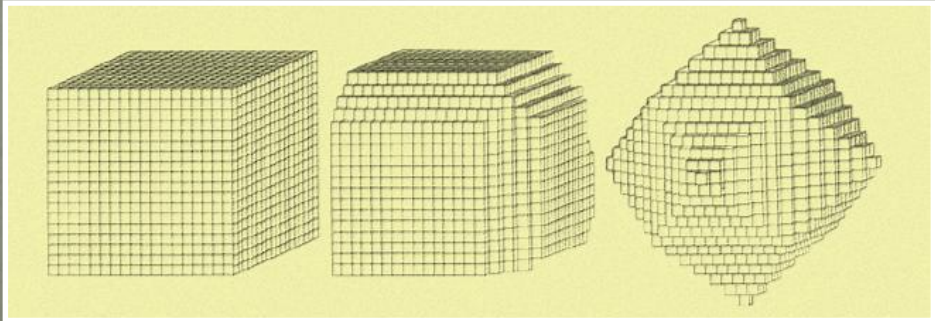
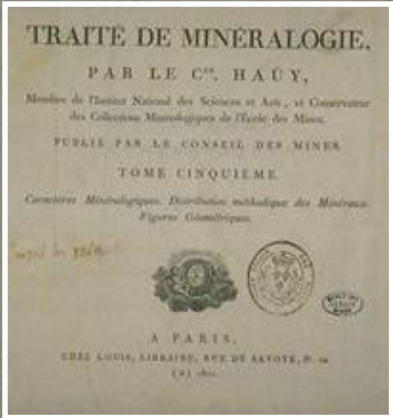
René-Just Haüy (1743-1822)



Le clivage fournit la forme élémentaire de la
« molécule intégrante ».

↓

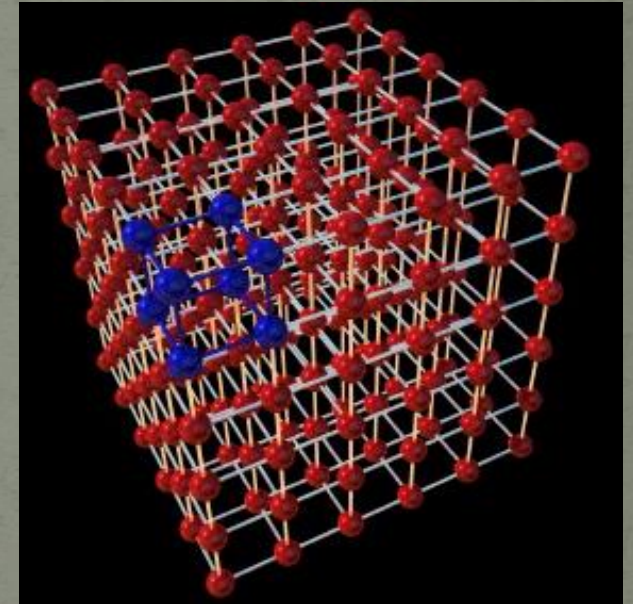
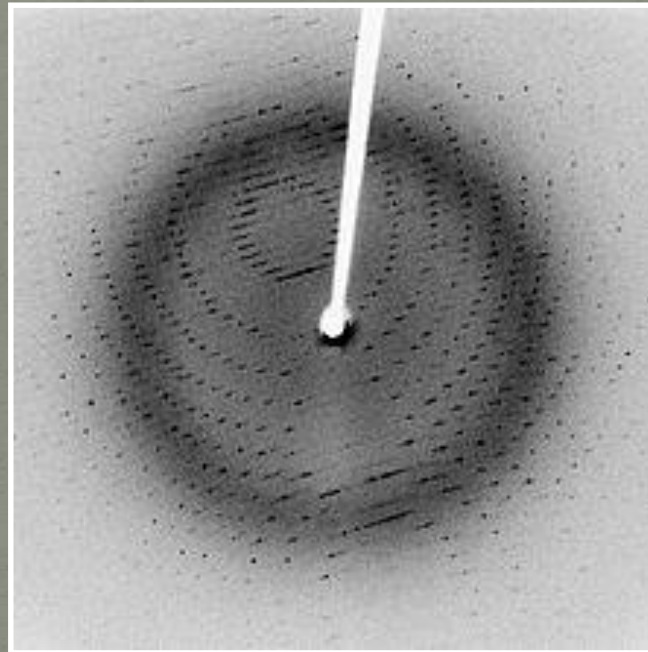
Première théorie descriptive de la structure
interne des cristaux.



Le réseau cristallin

Discovery of X-ray diffraction by
crystals

Max Von Laue (1879-1960)



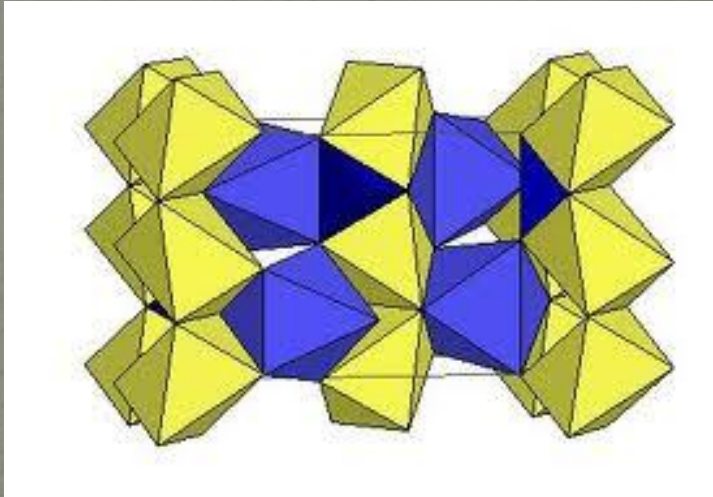
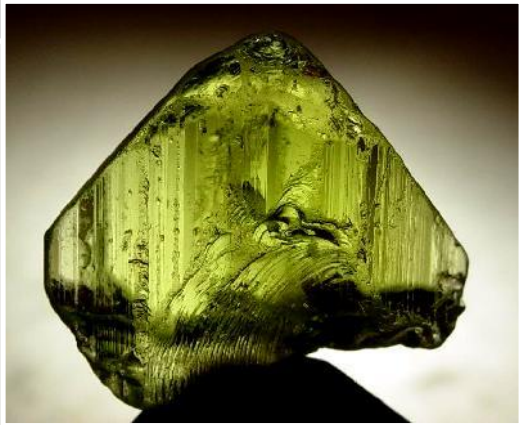
Reticular theory of the crystal

Cristal = maille + motif

Two minerals can present the same crystal structure. However, to consider these minerals as distinct species, at least one atom in the structure must be replaced by an atom of different nature.

Solid solutions:

Fayalite - Forsterite
 Fe_2SiO_4 — Mg_2SiO_4



50 % CNMNC rule

Les noms des minéraux

Couleur

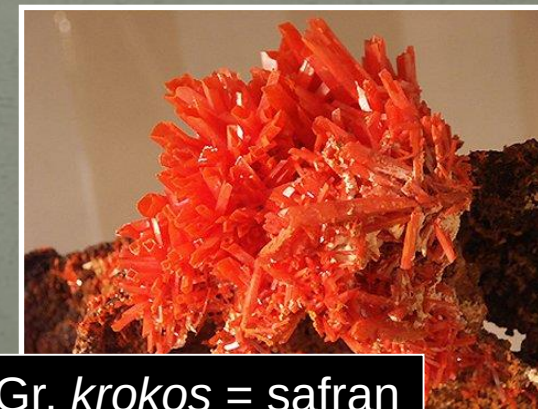
Albite, azurite, chlorite, crocoïte, erythrite, hematite, lazulite, leucite, oripigment, purpurite, rutile



Lat. *albus* = blanche



Gr. *aima* = sang



Gr. *krokos* = safran

Les noms des minéraux

Morphologie

Anatase, axinite, auriacusite, fibroferrite, oursinite, pyromorphite, pyrophyllite, staurolite, tetrahedrite



Gr. *stauros* = croix



Gr. *axine* = hache

Les noms des minéraux

Composition chimique

Anhydrite, arsenopyrite, babefphite, chalcocite, chalcopyrite, cobaltite, cuprite, cavansite, fluorapatite, ruthéniridosmine, sidérite, sodalite, uraninite



CaSO_4



FeAsS



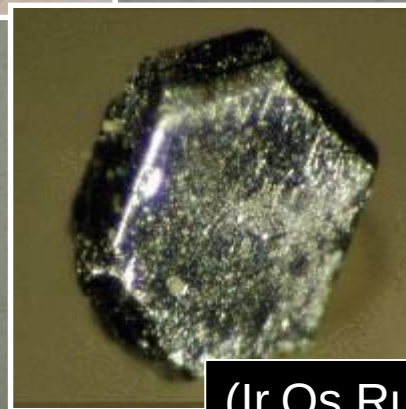
CuFeS_2



Cu_2O



$\text{Ca}(\text{VO})\text{Si}_4\text{O}_{10} \cdot 4\text{H}_2\text{O}$



(Ir,Os,Ru)



Gr. *sideros* = fer

Les noms des minéraux

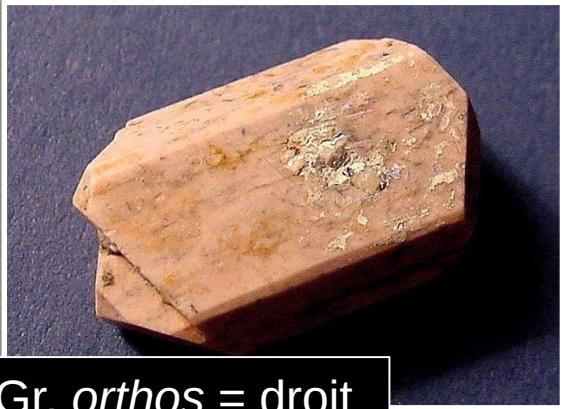
Propriétés physiques

Barite, euclase, orthose, periclase, scorodite



Gr. *barys* = lourd

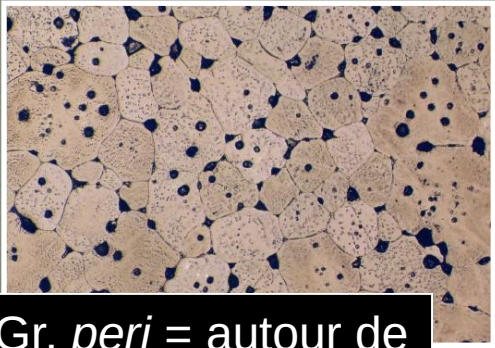
photo: www.irocks.com



Gr. *orthos* = droit



Gr. *eu* = good,
klas = clivage



Gr. *peri* = autour de



Gr. *skorodion* = semblable à l'ail

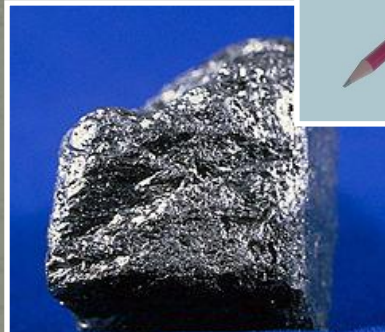
Les noms des minéraux

Utilisation

Fluorite, graphite, muscovite, pharmacolite, pyrite, pyrolusite



Verre de Muscovy



Gr. graphein = écrire



Gr. pyr = feu



Lat. fluere = fluer

Gr. pyr = feu and
louxo = laver



$\text{CaHAsO}_4 \cdot 2\text{H}_2\text{O}$
Gr. pharmaki = poison

Les noms des minéraux

Caractéristiques structurales

Clinoenstatite, clinomimetite, orthoserpierite,
parafransoletite, parahopeite

- **Ortho**: Gr. *orthos* = droit: orthorhombic
- **Clino** = Gr. *klinein* = incliné: monoclinic
- **Para** = Gr. *para* = à côté de: analogies structurales



Les noms des minéraux

Localité-type

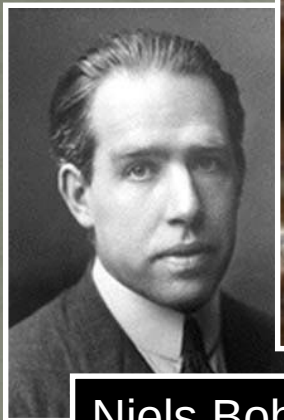
Andalousite, atacamite, brazilianite, ettringite, lakebogaite, lovozérîte, luxembourgite, montebrasite, tyrolite



Les noms des minéraux

En l'honneur de minéralogistes

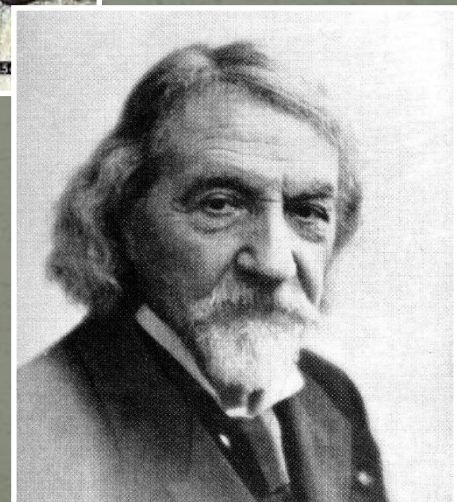
Bobfergusonite, breithauptite, cesarólite, eskolaite, haüyne, hurbutite, mandarinoite, millerite, moissanite, nielsbohrite, sillimanite, wollastonite...



Niels Bohr



Joe Mandarino



Giuseppe Cesàro

La IMA-CNMNC: composition

IMA = International Mineralogical Association



12 Officers, 6 Commissions, 4 Working groups



CNMNC = Commission on New Minerals, Nomenclature and Classification



4 Officers, 38 Members (1 or 2 members per IMA country)

Ferdinando Bosi (Italy): Chairman

Frédéric Hatert (Belgium): 1st Vice-Chair (Nomenclature)

Marco Pasero (Italy): 2nd Vice-Chair (CNMNC mineral list, CNMNC Newsletter)

Stuart Mills (USA): Secretary (Mineral groups)

La IMA-CNMNC: rôles

Roles of the CNMNC

- Evaluation des nouvelles espèces
- Validation des noms de minéraux
- Nomenclature minéralogique
(discréditations, revalidations, redéfinitions, changements de noms, ...)
- Classification des minéraux
(groupes, supergroupes, sous-classes, classes, familles, ...)

Outreach

- CNMNC website
- IMA mineral list
- List of unnamed minerals
- CNMNC Newsletter



Le CNMNC et la Belgique



CNMNC was created in 2006

Following the fusion of the Commission on New Minerals and Mineral Names (CNMMN) with the Commission on Classification of minerals (CCM)

CNMMN was founded in 1959

Chair: Michael Fleischer (USA)

Vice-Chair: Max Hey (UK)

Treasurer: François Permingeat (Toulouse, France)

Belgian mineralogists members of the CNMNC

~ 1962 to 1993: Jules Moreau (Louvain et LLN)

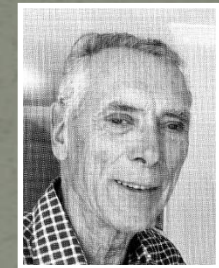
1994 to 2002: Michel Deliens (IRSNB, Bruxelles)

2003 to 2006: Frédéric Hatert (Liège)

2007 to 2012: André-Mathieu Fransolet (Liège)

2012 to 2016: Simon Philippo (Luxembourg)

Since 2016: Fabrice Dal Bo (Liège)



Minerals described before 1959: « Grandfathered »

La « Dominant-constituent rule »

The Canadian Mineralogist
Vol. 46, pp. 717-728 (2008)
DOI: 10.3749/canmin.46.3.717

THE IMA–CNMNC DOMINANT-CONSTITUENT RULE REVISITED AND EXTENDED

FRÉDÉRIC HATERT[§]

Vice-Chairman, Commission on New Minerals, Nomenclature and Classification (CNMNC) of the International Mineralogical Association (IMA), Laboratory of Mineralogy, University of Liège, Bâtiment B-18, B-4000 Liège, Belgium

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Chairman, Commission on New Minerals, Nomenclature and Classification (CNMNC) of the International Mineralogical Association (IMA), Faculty of Earth and Life Sciences, Vrije Universiteit Amsterdam, De Boelelaan 1085, NL-1081 HV, Amsterdam, The Netherlands

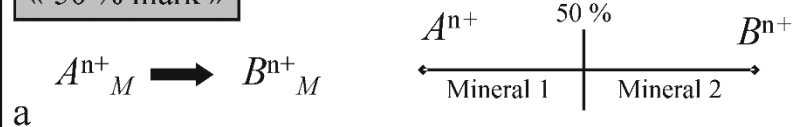


Homovalent substitutions on one crystallographic site

« Constituent »

- Cations
- Anions
- Cationic, anionic, or molecular groups
- Vacancies

« 50 % mark »



Diopside

Hedenbergite



Substitutions homovalentes sur un site

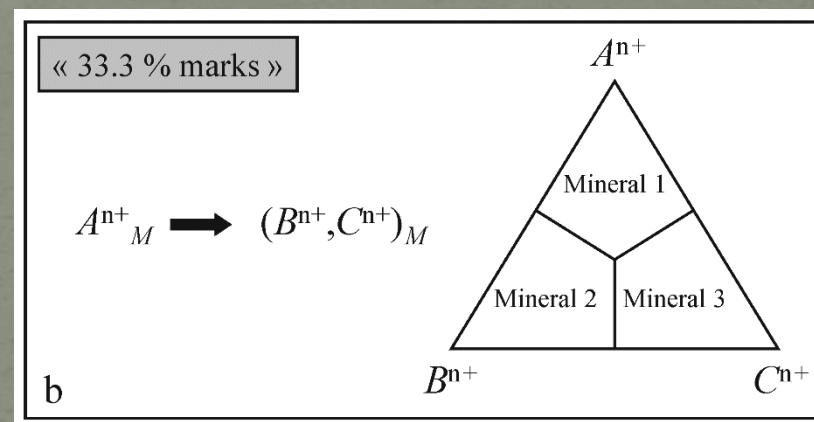
Homovalent substitutions on one site: multiple solid solutions



Preisingerite group

Preisingerite, $\text{Bi}_3(\text{AsO}_4)_2\text{OOH}$
Schumacherite, $\text{Bi}_3(\text{VO}_4)_2\text{OOH}$
Petitjeanite, $\text{Bi}_3(\text{PO}_4)_2\text{OOH}$

Boundary at 33.3 %



Schoenfliesite

Schoenfliesite, $\text{MgSn}(\text{OH})_6$
Natanite, $\text{FeSn}(\text{OH})_6$
Wickmanite, $\text{MnSn}(\text{OH})_6$
Mushistonite, $\text{CuSn}(\text{OH})_6$
Vismirnovite, $\text{ZnSn}(\text{OH})_6$
Burtite, $\text{CaSn}(\text{OH})_6$

Boundary at 16.6 %

Substitutions homovalentes indépendantes

Independant homovalent substitutions on two sites

Columbite group

Fe ²⁺ → Mn ²⁺		A Site	
FeTa ₂ O ₆			MnTa ₂ O ₆
Tantalite-(Fe)			Tantalite-(Mn)
Columbite-(Fe)			Columbite-(Mn)
FeNb ₂ O ₆			MnNb ₂ O ₆
		B Site	
		Ta ⁵⁺ → Nb ⁵⁺	



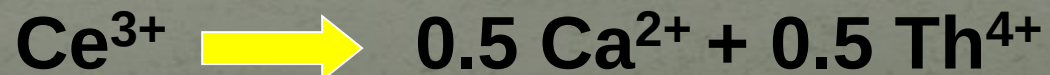
Ferrocolumbite, Crystal Park, El Paso So., Colorado, USA
(from Webmineral.com)

Substitutions hétérovalentes sur un site

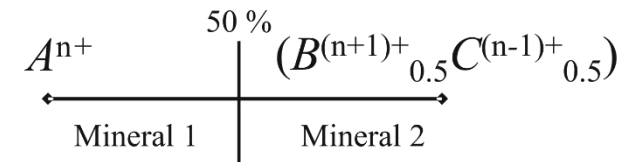
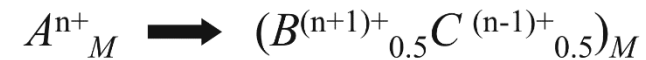
Heterovalent substitutions on one site



Monazite-(Ce)



« 50 % mark »



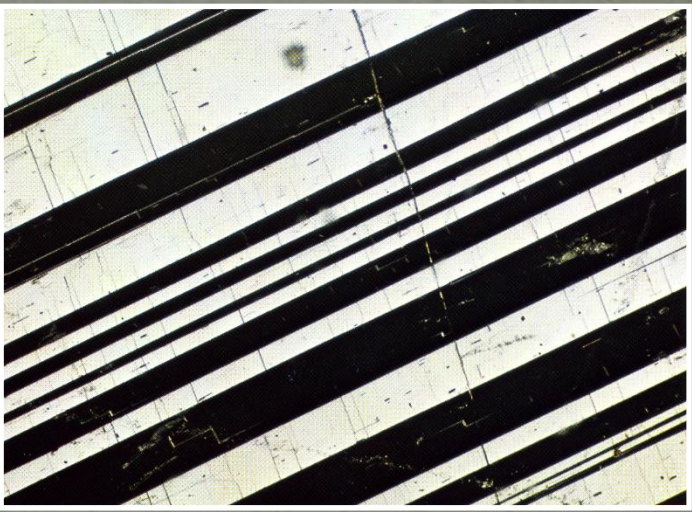
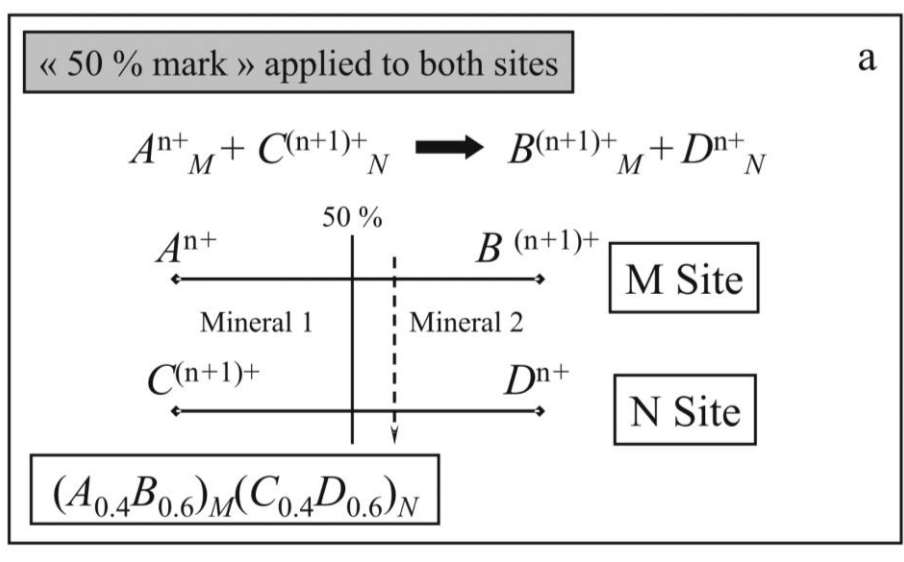
Cheralite

« Valency-imposed double-site occupancy »!

>< 50 % rule!

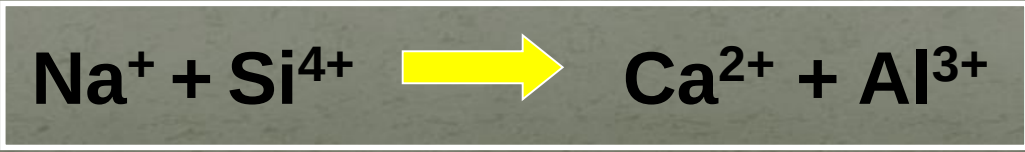
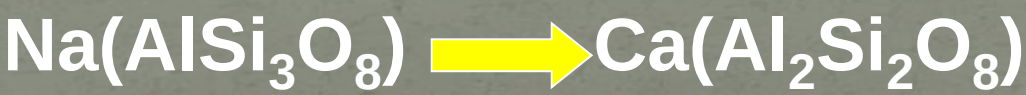
Substitutions hétérovalentes couplées

Coupled heterovalent substitutions on two sites



Albite

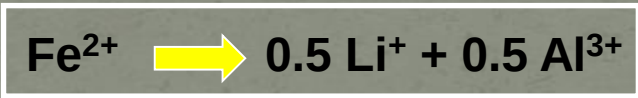
Anorthite



« Valency-imposed double-site occupancy »

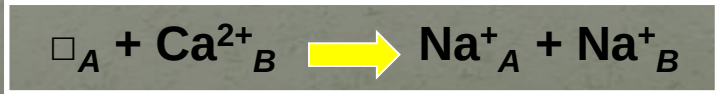
Valency-imposed double-site occupancy

Schorl

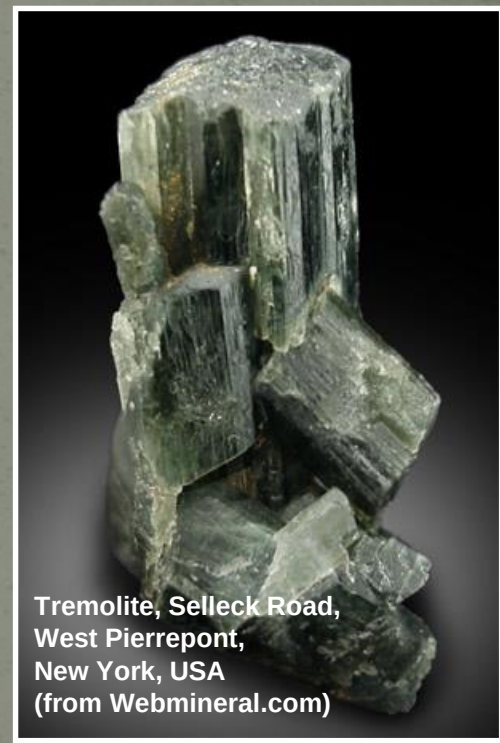


Elbaite

Tremolite



Richterite



Tremolite, Selleck Road,
West Pierrepont,
New York, USA
(from Webmineral.com)

Classification des minéraux



The standardisation of mineral group hierarchies: application to recent nomenclature proposals

STUART J. MILLS^{1,*}, FRÉDÉRIC HATERT², ERNEST H. NICKEL^{3,**} and GIOVANNI FERRARIS⁴

- **Group**: Same crystal structure and chemically similar elements
- **Supergroup**: Two or several groups with essentially the same structure, and constituted by similar chemical elements
- **Sub-class**: Nésosilicates, sorosilicates, inosilicates, cyclosilicates, phyllosilicates, tectosilicates + borates
- **Class**: Elements, sulfides, oxydes, halogenides, carbonates, nitrates, borates, sulfates, phosphates, silicates
- **Family**: Groups or supergroups with structural and/or chemical analogies

Now we have to define and name all groups and supergroups!

Préfixes et suffixes



Préfixes:

- Preferred to facilitate the pronunciation of common names
- Maximum 2 chemical prefixes
- A combination of chemical, structural, or other prefixes is allowed

Examples: Fluorapatite, clinoferroholmquistite, ...

CNMNC guidelines for the use of suffixes and prefixes in mineral nomenclature, and for the preservation of historical names

FRÉDÉRIC HATERT^{1,*}, STUART J. MILLS², MARCO PASERO³ and PETER A. WILLIAMS⁴

Suffixes:

- Maximum 3 chemical suffixes
- With parentheses: framework cations
- Without parentheses: extra-framework cations (zéolites)
- Cations and anions cannot be used together (the anion must be a prefix)

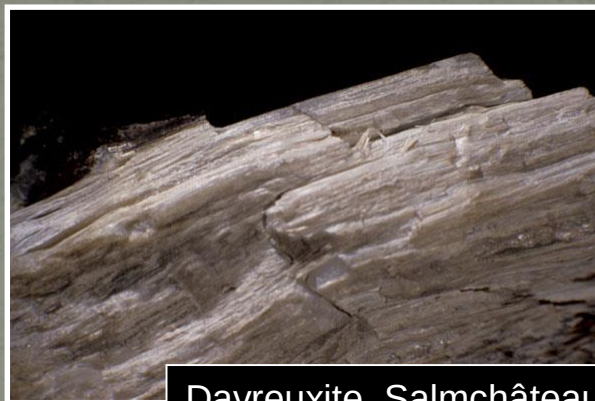
Examples: Jahnsite-(CaMnMn), chabazite-Ca, fluorapophyllite-(K)

Definition	Names	CNMNC	Examples
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Belgique: Minéraux en l'honneur de scientifiques



Davreuxite
 $\text{MnAl}_6\text{Si}_4\text{O}_{17}(\text{OH})_2$



Davreuxite, Salmchâteau

**Charles-Joseph Davreux
 (1800-1863)**
 Chemist, pharmacist, and
 et naturalist from Liège

Delvauxite
 $\text{Ca}(\text{Fe}^{3+})_4(\text{PO}_4)_2(\text{OH})_8 \cdot 4-5\text{H}_2\text{O}$

**Jean-Charles Delvaux de
 Fenffe (1782-1863)**
 Chemist and physicist
 from Liège



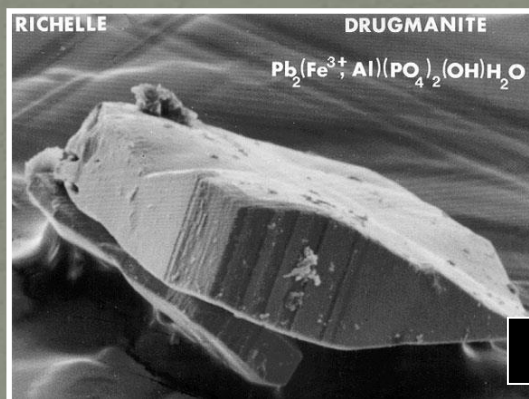
Delvauxite, Beez

Definition	Names	CNMNC	Examples
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Belgique: Minéraux en l'honneur de scientifiques



Drugmanite
 $\text{Pb}_2\text{Fe}^{3+}(\text{PO}_4)(\text{PO}_3\text{OH})(\text{OH})_2$

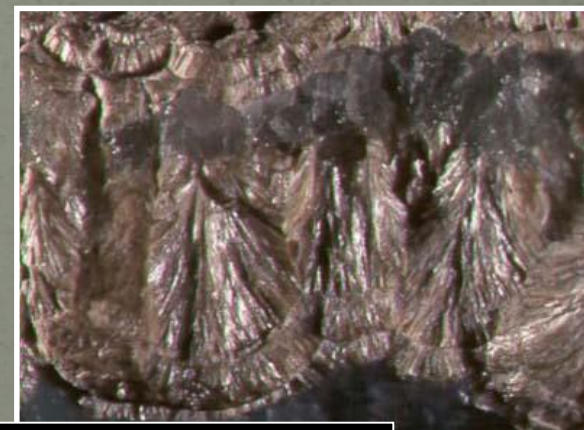


Julien Drugman
(1875-1950)
 Chemist and mineralogist
 from Brussels

Drugmanite, Richelle

Fraipontite
 $(\text{Zn}, \text{Al})_3(\text{Si}, \text{Al})_2\text{O}_5(\text{OH})_4$

Julien Fraipont
(1857-1910)
 Zoologist and
 palaeontologist from Liège



Fraipontite, La Calamine

Definition	Names	CNMNC	Examples
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Belgique: Minéraux en l'honneur de scientifiques

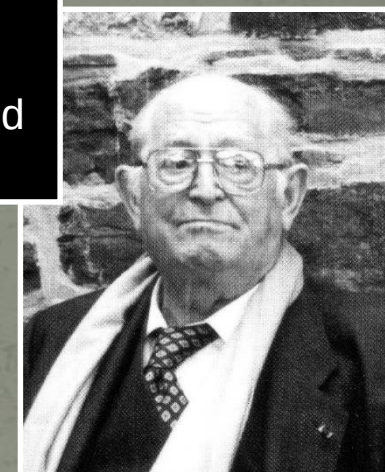


Graulichite-(Ce)
 $(\text{Ce}, \text{La}, \text{Nd}, \text{Ba})(\text{Fe}^{3+}, \text{Al})_3(\text{AsO}_4)_2(\text{OH})_6$



Graulichite-(Ce), Hourt

Jean-Marie Graulich
(1920-2001)
 Geologist from Liège and
 Bruxelles



Halloysite
 $\text{Al}_2\text{Si}_2\text{O}_5(\text{OH})_4 \cdot 2\text{H}_2\text{O}$

Jean-Baptiste d'Omalus
d'Halloy
(1793-1875)
 Geologist from Liège



Halloysite, Beez

Belgique: Minéraux en l'honneur de scientifiques



Hopeite
 $\text{Zn}_3(\text{PO}_4)_2 \cdot 4\text{H}_2\text{O}$

Thomas-Charles Hope
 (1766-1844)
 Chemist from Scotland

Hopeite, La Calamine



Koninckite
 $\text{FePO}_4 \cdot 3\text{H}_2\text{O}$

Laurent-Guillaume de Koninck
 (1809-1887)
 Chemist and mineralogist
 (Leuven, Liège)



Koninckite, Richelle

Definition	Names	CNMNC	Examples
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Belgique: Minéraux en l'honneur de scientifiques



Vantasselite
 $\text{Al}_4(\text{PO}_4)_3(\text{OH})_3 \cdot 9\text{H}_2\text{O}$



Vantasselite, Bihain

René Van Tassel
 (1916-2013)
 Mineralogist from Brussels



Viaeneite
 $(\text{Fe}, \text{Pb})_4\text{S}_8\text{O}$

Willy Viaene
 (1940-2000)
 Mineralogist at KUL



Viaeneite, Engis

Willemite
 Zn_2SiO_4



Willemite, La Calamine

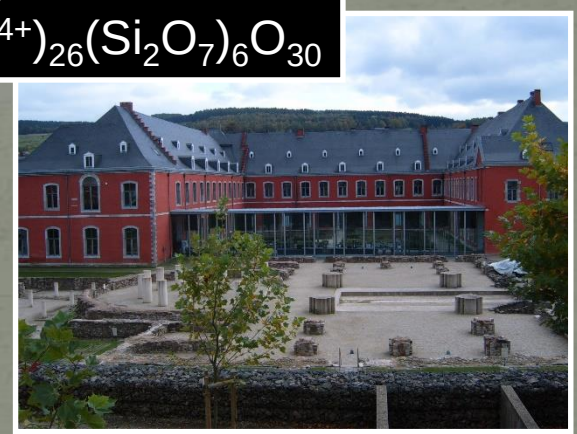


Definition	Names	CNMNC	Examples
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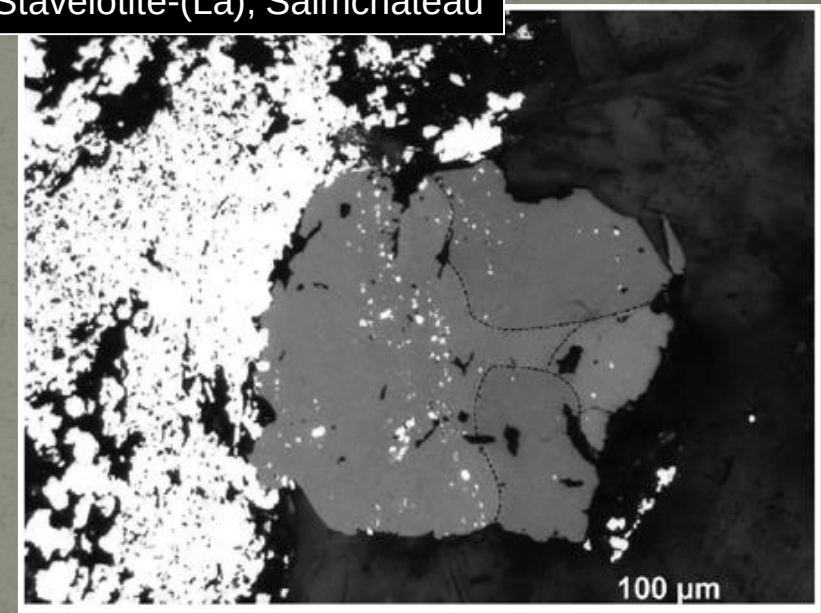


Belgique: Minéraux nommés d'après la localité

Stavelotite-(La)
 $\text{La}_3(\text{Mn}^{2+})_3\text{Cu}^{2+}(\text{Mn}^{3+}, \text{Fe}^{3+}, \text{Mn}^{4+})_{26}(\text{Si}_2\text{O}_7)_6\text{O}_{30}$



Stavelotite-(La), Salmchâteau



Richellite
 $\text{Ca}(\text{Fe}^{3+})_2(\text{PO}_4)_2(\text{OH}, \text{F})_2$



Koninckite on richellite, Richelle

Definition	Names	CNMNC	Examples
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Belgique: Minéraux discrédités

Bastonite



Variety of biotite rich in NH_4^+



« Bastonite », Bastogne

Lohestite



Mixture of kaolinite, pyrophyllite, sercite, and chlorite



Maximilien Lohest
(1857-1926)
Geologist from Liège

Belgique: Minéraux discrédités

Moresnetite



Mixture of hemimorphite and sauconite

Moresnet



Salmite



Mn-bearing chloritoid (ottrélite?)



Vielsalm

Viséite



Mixture of crandallite with other phases



« Viséite », Visé

Definition	Names	CNMNC	Examples
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Belgique: Minéraux revalidés

Destinézite
 $(\text{Fe}^{3+})_2(\text{PO}_4)(\text{SO}_4)(\text{OH}) \cdot 6\text{H}_2\text{O}$

Pierre Destinez
 (?-1911)
 Technician in Mineralogy
 and Palaeontology at
 Liège



Destinézite, Beez

Ottrélite
 $\text{MnAl}_2\text{O}(\text{SiO}_4)(\text{OH})_2$



Ottrélite, Ottré



Chloritoïde, Vielsalm

Belgique: Modifications de noms

Dewalquite (Pisani, 1872)

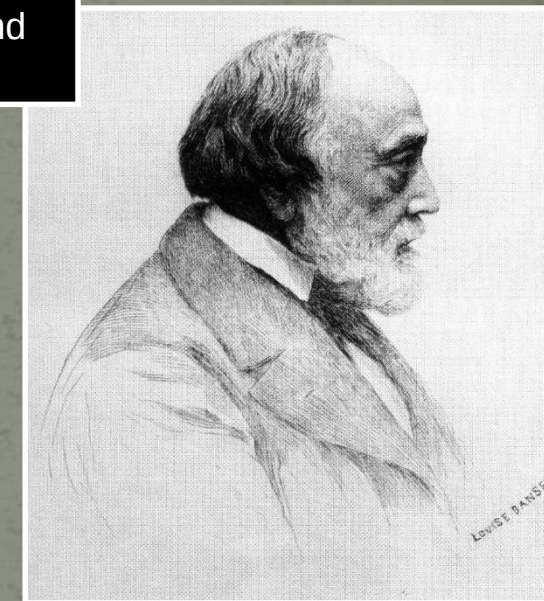


Ardennite (von Lasaulx, 1872)

Gustave Dewalque
(1828-1905)

Mineralogist, geologist and
palaeontologist at Liège

Ardennite, Salmchâteau



Ardennite, Salmchâteau

Ardennite



Ardennite-(As)



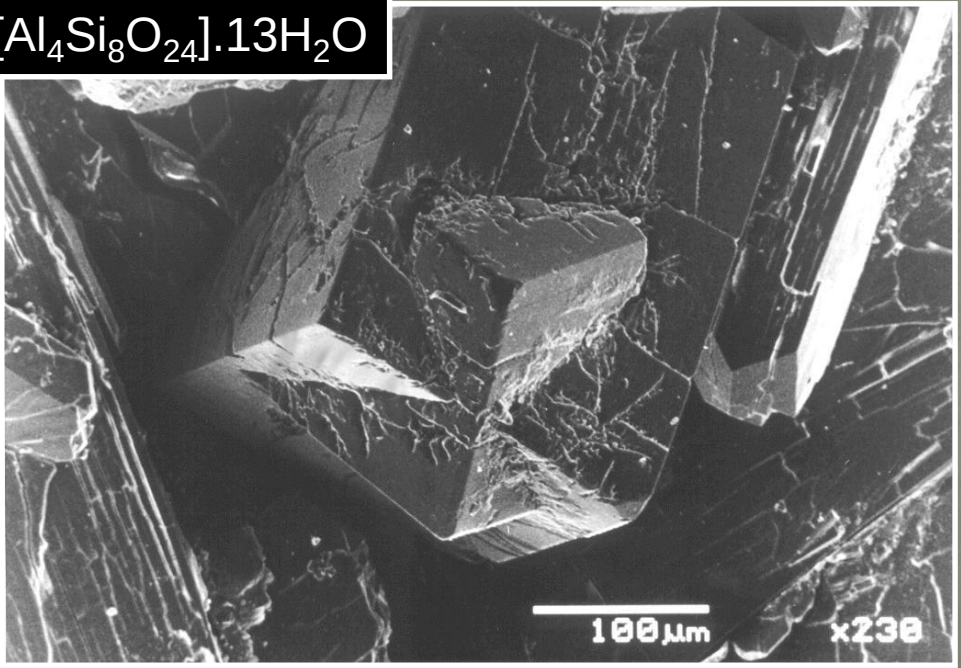
Belgique: Minéraux avec suffixes

GEOLOGICA BELGICA (2005) 8/1-2: 33-42

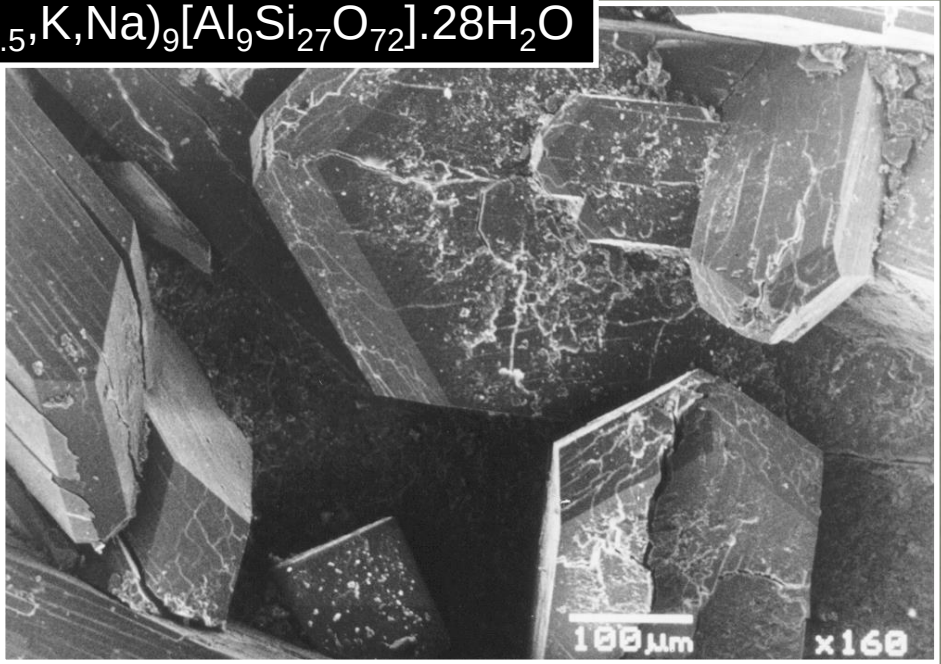
ZEOLITES, PREHNITE, AND PUMPELLYITE FROM BERTRIX, BELGIAN ARDENNES

Frédéric HATERT¹ & Thomas THEYE²

Chabazite-Ca
 $\text{Ca}_2[\text{Al}_4\text{Si}_8\text{O}_{24}]\cdot 13\text{H}_2\text{O}$



Stilbite-Ca
 $(\text{Ca}_{0.5}, \text{K}, \text{Na})_9[\text{Al}_9\text{Si}_{27}\text{O}_{72}]\cdot 28\text{H}_2\text{O}$



Extra-framework cations



Suffix without parentheses

Belgique: Minéraux avec suffixes

Pumpellyite-(Al), a new mineral from Bertrix, Belgian Ardennes

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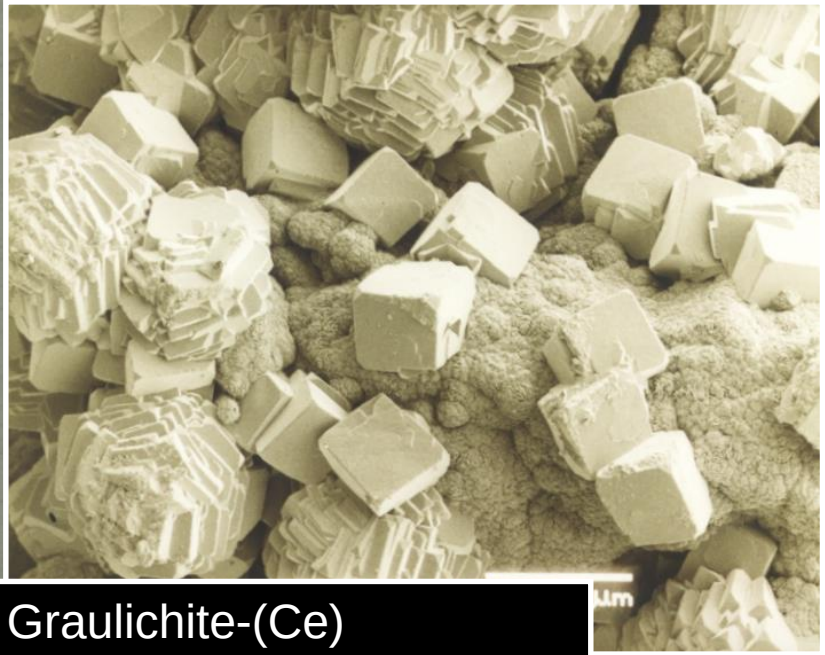
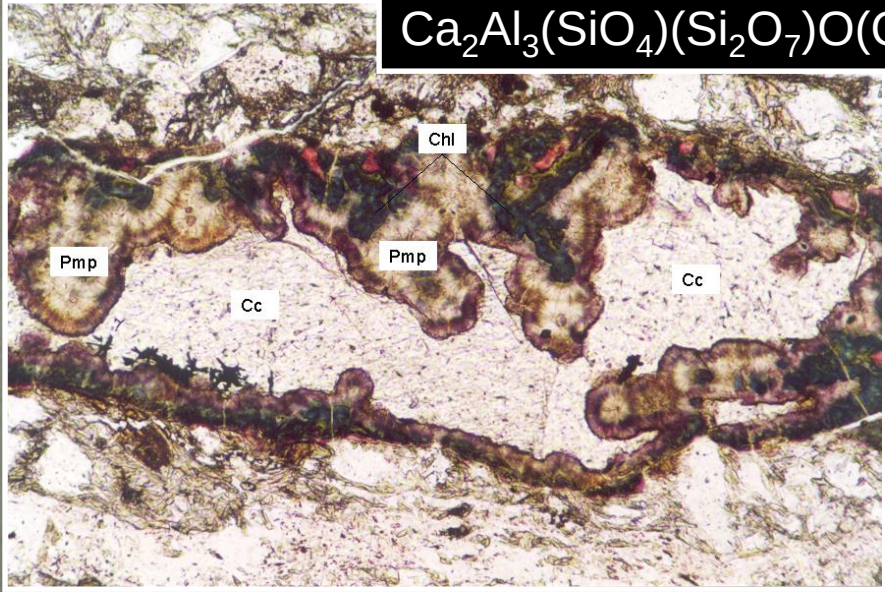
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Framework cations

Suffixes with parentheses

Pumpellyite-(Al)
 $\text{Ca}_2\text{Al}_3(\text{SiO}_4)(\text{Si}_2\text{O}_7)\text{O}(\text{OH})\cdot\text{H}_2\text{O}$



Graulichite-(Ce)
 $(\text{Ce},\text{La},\text{Nd},\text{Ba})(\text{Fe}^{3+},\text{Al})_3(\text{AsO}_4)_2(\text{OH})_6$

Belgique: Minéraux avec suffixes REE

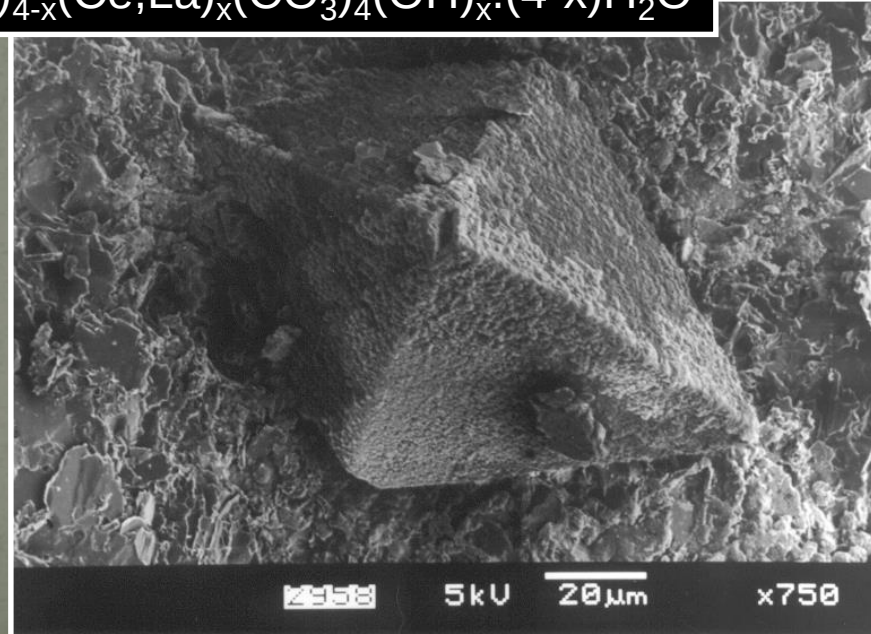
**LES CARBONATES DE TERRES RARES DE BERTRIX,
BELGIQUE**

Frédéric HATERT

REE = Framework cations

 Suffixes with parentheses

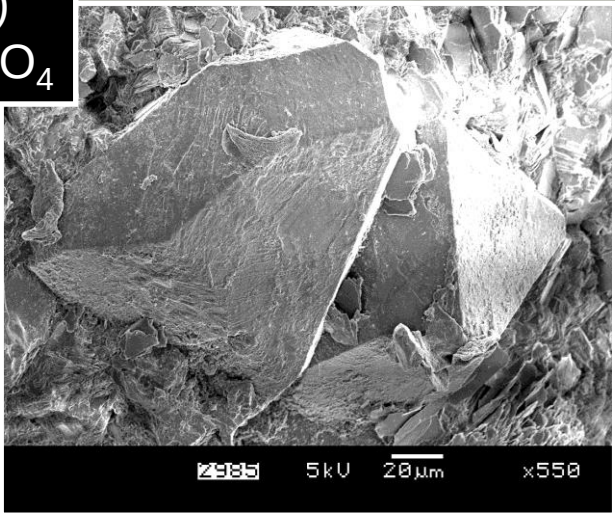
Calcioancylite-(Ce)
 $(\text{Ca}, \text{Sr})_{4-x}(\text{Ce}, \text{La})_x(\text{CO}_3)_4(\text{OH})_x \cdot (4-x)\text{H}_2\text{O}$



Bastnäsité-(Ce)/synchysite-(Ce)
 $(\text{Ce}, \text{La})(\text{CO}_3)\text{F} / \text{Ca}(\text{Ce}, \text{La})(\text{CO}_3)_2\text{F}$

Belgique: Minéraux avec suffixes REE

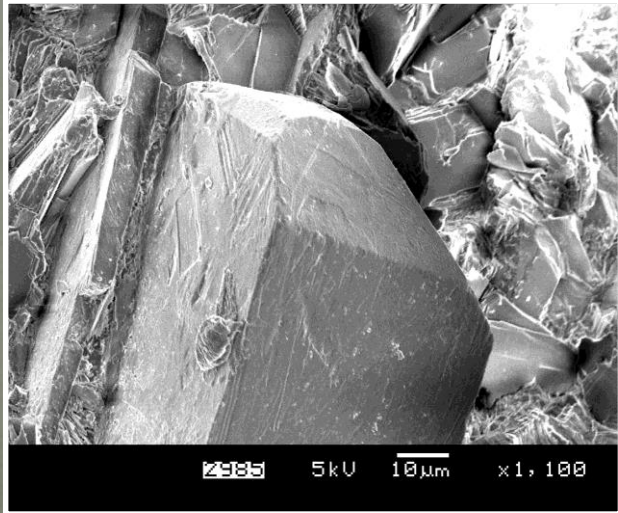
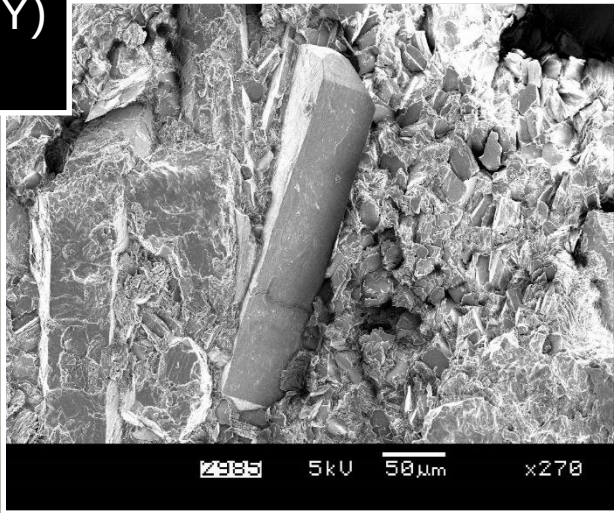
Monazite-(Ce)
(Ce,La,Nd,Th)PO₄



Florencite-(Ce)
CeAl₃(PO₄)₂(OH)₆

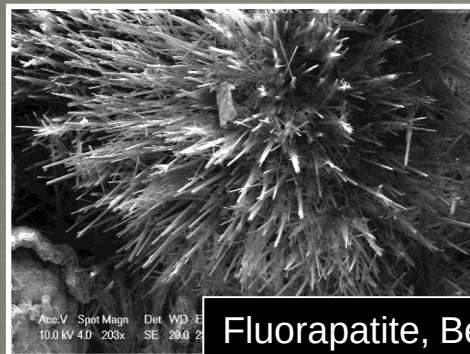
Salmchâteau

Xénotime-(Y)
YPO₄



Definition	Names	CNMNC	Examples
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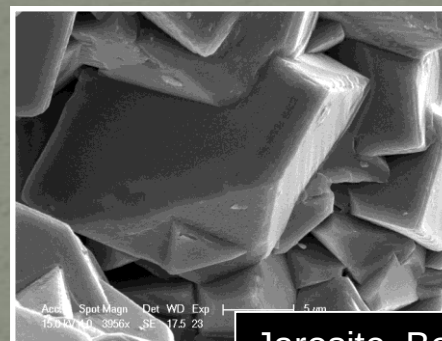
Belgique: Minéraux avec préfixes chimiques



Fluorapatite, Beez

Fluorapatite
 $\text{Ca}_5(\text{PO}_4)_3(\text{F}, \text{OH}, \text{Cl})$

Natrojarosite
 $\text{NaFe}^{3+}_3(\text{SO}_4)_2(\text{OH})_6$



Jarosite, Beez

Ferrimolybdite
 $\text{Fe}^{3+}_2(\text{MoO}_4)_3 \cdot 8\text{H}_2\text{O}$

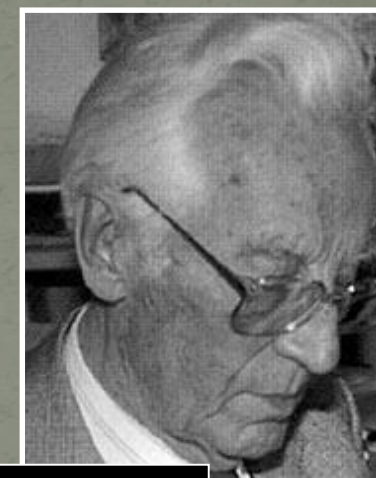


Ferrimolybdite, La Helle

Ferristrunzite
 $\text{Fe}^{3+}\text{Fe}^{2+}_2(\text{PO}_4)_2(\text{OH})_3 \cdot 5\text{H}_2\text{O}$



Ferristrunzite, Blaton



Hugo Strunz

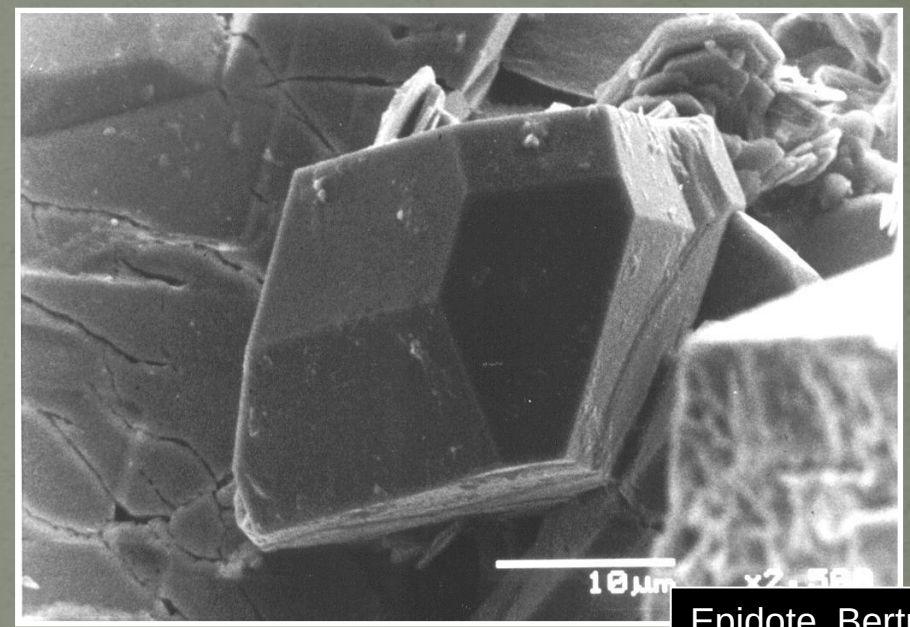
Belgique: Minéraux avec d'autres préfixes

Métatorbernite
 $\text{Cu}^{2+}(\text{UO}_2)_2(\text{PO}_4)_2 \cdot 8\text{H}_2\text{O}$



Metatorbernite, Cahay

Clinozoïzite
 $\text{Ca}_2\text{Al}_3(\text{SiO}_4)_3(\text{OH})$



Epidote, Bertrix

Méta-autunite
 $\text{Ca}(\text{UO}_2)_2(\text{PO}_4)_2 \cdot 2-6\text{H}_2\text{O}$

Tétranatrolite
 $(\text{Na},\text{Ca})_{16}[\text{Al}_{19}\text{Si}_{21}\text{O}_{80}] \cdot 16\text{H}_2\text{O}$

Conclusions

- La CNMNC joue un rôle fondamental dans l'évaluation des nouvelles espèces minérales, dans leur nomenclature, et dans leur classification.
- Les minéralogistes belges sont très actifs dans ces domaines.
- La Belgique est un champ de recherches idéal pour la minéralogie systématique, grâce à la variété d'environnements géologiques et géochimiques qu'on y rencontre.