NEW APATITE NOMENCLATURE

In 2008, with the goal of "tidying up" mineral nomenclature, a scheme for the application of suffixes, hyphens, and diacritical marks was published (Burke 2008). The historical context and full rationale of the nomenclature revision are provided in that paper.

Among the changes implemented in that revision were the renaming of fluorapatite, hydroxylapatite, and chlorapatite to apatite-(CaF), apatite-(CaOH), and apatite-(CaCl), respectively. Nomenclature changes made to these and other minerals with the apatite structure did not completely consider the structural complexities of these minerals. Furthermore, the new nomenclature changes could rationally be extended to other apatite-group minerals, for example, by changing pyromorphite to apatite-(PbCl). In addition, such naming replaces many traditional names given to honor worthy individuals.

For these and other reasons outlined by Pasero et al. (2010), an International Mineralogical Association (IMA) Commission on New Minerals, Nomenclature and Classification (CNMNC) subcommittee was convened to reevaluate the nomenclature of minerals belonging to the "apatite group" and to propose a new and consistent nomenclature for that group. This subcommittee included an international group of scientists, all of whom have worked on the structures and crystal chemistry of apatite-group minerals. Following the recently approved standardization of mineral group hierarchies (Mills et al. 2009), the apatite-group minerals, which have traditionally included phosphates (e.g. fluorapatite), arsenates (e.g. mimetite), and vanadates (e.g. vanadinite), have been expanded to form a "supergroup" that is composed of all minerals with the apatite structure, including silicates (e.g. britholite), silicate-sulfates (e.g. ellestadite), and sulfates (e.g. cesanite). The nomenclature recommendations put forth by this committee for the apatite supergroup have been accepted by the IMA-CNMNC and published in Pasero et al. (2010). This and other nomenclature reports are available on the IMA-CNMNC web page: http://pubsites.uws.edu.au/ima-cnmnc/imareport.htm. One of the main outcomes of this reevaluation is the reestablishment of the historically ubiquitous names fluorapatite, hydroxylapatite, and chlorapatite. The abstract from Pasero et al. (2010) is reproduced here with permission from the *European Journal of Mineralogy*.

Fluorapatite, Panasqueira Mines, Panasqueira, Portugal. COURTESY JEFF SCOVIL PHOTOGRAPH

Burke EAJ (2008) Tidying up mineral names: an IMA-CNMNC scheme for suffixes, hyphens and diacritical marks. Mineralogical Record 39: 131-135

Mills SJ, Hatert F, Nickel EH, Ferraris G (2009) The standardisation of mineral group hierarchies: application to recent nomenclature proposals. European Journal of Mineralogy 21: 1073-1080

Pasero M, Kampf AR, Ferraris C, Pekov IV, Rakovan J, White TJ (2010) Nomenclature of the apatite supergroup minerals. European Journal of Mineralogy 22: 163-179

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ABSTRACT FROM PASERO ET AL. (2010)

The apatite supergroup includes minerals with a generic chemical formula $^{IX}M1_2{}^{VII}M2_3(^{IV}TO_4)_3X$ ($Z = 2$); chemically they can be phosphates, arsenates, vanadates, silicates, and sulphates. The maximum space group symmetry is $P6_3/m$, but several members of the supergroup have a lower symmetry due to cation ordering and deviations from the ideal topology, which may result in an increase of the number of the independent sites. The apatite supergroup can be formally divided into five groups, based on crystal-chemical arguments: apatite group, hedyphane group, belovite group, britholite group, and ellestadite group. The abundance of distinct ions which may be hosted at the key-sites [M = Ca^{2+}, Pb^{2+}, Ba^{2+}, Sr^{2+}, Mn^{2+}, Na^{+}, Ce^{3+}, La^{3+}, Y^{3+}, Bi^{3+}; T = P^{5+}, As^{5+}, V^{5+}, Si^{4+}, S^{6+}, B^{3+}; X = F^{-}, $(OH)^{-}$, Cl^{-}] results in a large number of compositions which may have the status of distinct mineral species. Naming of apatite supergroup minerals in the past has resulted in nomenclature inconsistencies and problems. Therefore an *ad hoc* IMA-CNMNC Subcommittee was established with the aim of rationalizing the nomenclature within the apatite supergroup and making some order among existing and potentially new mineral species. In addition to general recommendations for the handling of chemical (EPMA) data and for the allocation of ions within the various sites, the main recommendations of this subcommittee are the following.

1. **Nomenclature changes to existing minerals** The use of adjectival prefixes for anions is to be preferred instead of modified Levinson suffixes: accordingly, six minerals should be renamed as follows: apatite-(CaF) to *fluorapatite*, apatite-(CaOH) to *hydroxylapatite*, apatite-(CaCl) to *chlorapatite*, ellestadite-(F) to *fluorellestadite*, ellestadite-(OH) to *hydroxylellestadite*, phosphohedyphane-(F) to *fluorphosphohedyphane*. For the apatite group species these changes return the names that have been used in thousands of scientific papers, treatises and museum catalogues over the last 150 years. The new mineral IMA 2008-009, approved without a name, is here named *stronadelphite*. Apatite-(SrOH) is renamed *fluorstrophite*. Deloneite-(Ce) is renamed *deloneite*. The new mineral IMA 2009-005 is approved with the name *fluorbritholite-(Y)*.

2. **Potentially new mineral species** The following end-member compositions are eligible for status as distinct mineral species. The proposed name, if any, is given in parentheses: $Ca_2Pb_3(AsO_4)_3(OH)$ (hydroxylhedyphane); $Ca_2Pb_3(PO_4)_3(OH)$ (hydroxylphosphohedyphane). $Ca_2Sr_3(PO_4)_3F$ (new root name); $Mn_2Ca_3(PO_4)_3Cl$ (new root name); $Pb_5(SiO_4)_{1.5}(SO_4)_{1.5}(OH)$ (hydroxylmattheddleite).

3. **Minerals and mineral names which could be discredited** The mineral ellestadite-(Cl) is not thought to exist and should be discredited; the name melanocerite-(Ce) should be discontinued [= tritomite-(Ce)].

4. **Changes of status from distinct species to polymorphic variants** Fermorite is the monoclinic polymorph of johnbaumite (= johnbaumite-*M*); clinohydroxylapatite is the monoclinic polymorph of hydroxylapatite (= hydroxylapatite-*M*); clinomimetite is the monoclinic polymorph of mimetite (= mimetite-*M*).

5. **Recognition of a new polymorphic variant** A new monoclinic polymorph of apatite is recognized (chlorapatite-*M*).

6. **Changes to end-member formulae** The ideal chemical formula of morelandite is $Ca_2Ba_3(AsO_4)_3Cl$ instead of $Ba_5(AsO_4)_3Cl$; the ideal chemical formula of deloneite is $(Na_{0.5}REE_{0.25}Ca_{0.25})$ $(Ca_{0.75}REE_{0.25})$ $Sr_{1.5}$ $(CaNa_{0.25}REE_{0.25})$ $(PO_4)_3$ $F_{0.5}(OH)_{0.5}$.