

# A new nomenclature for the pyrochlore supergroup: Consequences for the naming of some Norwegian pyrochlore minerals

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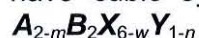
## Introduction

A new nomenclature for the pyrochlore supergroup, approved by the Commission on New Minerals, Nomenclature and Classification (CNMNC) of the International Mineralogical Association (IMA), was recently published by Atencio et al. (2010). It replaces the previously IMA-approved pyrochlore group nomenclature of Hogarth (1977), which is not consistent with the general IMA guidelines for mineral nomenclature (Nickel 1992). The Hogarth classification and nomenclature had, however, a great virtue in that it was simple and easily applied, and resulted in a specific species name for a microprobe-analysed mineral.

The present author has published two recent articles presenting electron-microprobe (EMP) analyses of Norwegian pyrochlore supergroup minerals: plumbopyrochlore and ceriopyrochlore-(Ce) from the Gjerdingen ekerite (Raade 2009) and plumbomicrolite from the Heftejern granitic pegmatite (Raade 2010). The naming of these minerals is consistent with the Hogarth (1977) nomenclature, which was still valid when the articles were written. The purpose of the present contribution is to explore the consequences of the new nomenclature of Atencio et al. (2010) on the naming of these pyrochlore/microlite minerals.

## The new nomenclature

The pyrochlore supergroup minerals have cubic symmetry and conform to the general formula



where **A** is typically a large eight-coordinated cation (Na, Ca, Sr, Sn<sup>2+</sup>, Sb<sup>3+</sup>, Pb, Y, Ce and other REEs, U<sup>4+</sup>, etc.), **B** is a smaller six-coordinated cation (Nb, Ta, Ti, Sb<sup>5+</sup>, W, Sn<sup>4+</sup>, Fe<sup>3+</sup>, Al, Si, etc.), **X** is mainly O, and **Y** is typically OH, F or O, but can also include vacancies and H<sub>2</sub>O. Water can also be incorporated at the A site, and the general formula indicates the possibility of incomplete occupancy of the A, X and Y sites. Consequently, the empirical formulae of pyrochlore minerals should be calculated on the basis of *B* = 2, which was adhered to by Raade (2009, 2010).

In the pyrochlore supergroup nomenclature (Atencio et al. 2010), five groups are recognized, based on the proportions of the *B*-site atoms:

- Pyrochlore group (Nb dominance)
- Microlite group (Ta dominance)
- Betafite group (Ti dominance)
- Roméite group (Sb<sup>5+</sup> dominance)
- Elsmoreite group (W dominance)

Only the first two groups are relevant for the present discussion.

The new mineral names are composed of two prefixes and one root name, identical to the name of the group. The first prefix refers to the dominant anion (of the dominant valence) or to the zero-valent constituents H<sub>2</sub>O or (vacancy) at the Y site.

The resulting five prefixes are

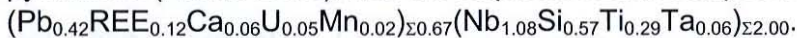
- fluor-
- hydroxy-
- oxy-
- hydro- (H<sub>2</sub>O)
- keno- (vacancy)

The second prefix refers to the dominant cation of the dominant valence (or H<sub>2</sub>O or ) at the A site. As a result of this strict nomenclature, only seven valid mineral species in the pyrochlore supergroup have survived on grounds of their complete descriptions, their new names being: oxycalciopyrochlore, hydroxyrochlore (observe that in this case, 'hydrohydro' is shortened to hydro), hydroxykenomicrolite, oxystannomicrolite, oxystibiomicrolite, hydroxycalcioroméite and hydrokenoelsmoreite. Fluornatromicrolite (IMA 98-018) is approved, but the complete description has not been published yet.

All other current names for minerals in the pyrochlore supergroup are discredited. A number of previously described minerals in the supergroup are possible new species, awaiting formal descriptions after approval of the CNMNC.

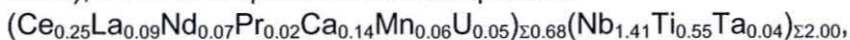
### Application

The pyrochlore group mineral from the Gjerdingen ekerite, classified as plumbopyrochlore (Raade 2009), has the empirical cation composition



No F was detected in the mineral, and the Y-site composition is unknown. In a case like this, the new nomenclature allows the application of a name with the anion prefix suppressed, enclosed by inverted commas: "plumbopyrochlore". However, this is not a species name! The former species plumbopyrochlore is discredited.

Similarly, the Gjerdingen ekerite mineral described as ceriopyrochlore-(Ce) (Raade 2009), with the empirical cation composition



must be renamed "ceriopyrochlore-(Ce)". The former species ceriopyrochlore-(Ce) is discredited.

Based on the 1977 nomenclature, the microlite group minerals from the Heftetjern granitic pegmatite were mainly classified as plumbomicrolite (Raade 2010), with four point analyses corresponding to microlite (Ca-dominated). Applying the new nomenclature, fifteen of the analyses correspond to "calciomicrolite", nine analyses to "plumbomicrolite" and one point is zero-valent-dominated at the A site. The former species microlite and plumbomicrolite are discredited.

### Discussion

The new nomenclature scheme for the pyrochlore supergroup (Atencio et al. 2010) is stringent and logical, and it is intellectually attractive. However, the requirement that the Y-site composition must be known in order to generate a species name, makes it impractical in use, there being five variables to take into consideration for this site. Such a rigorous nomenclature is hardly suited for minerals that often occur in a metamict amorphous state. On the basis of EMP analytical data, it fails in many cases to provide a species name for the mineral. Even in the case of a complete set of analytical data, including determination of H<sub>2</sub>O, it may be difficult to name the mineral in question as a species. This is because the metamictization process involves an uptake of H<sub>2</sub>O that was not present in the pre-metamict mineral. Some pyrochlore supergroup minerals may certainly be named by the chemical composition alone, but many will require a complete structure determination.

It should be noted that the cation composition of "plumbopyrochlore" from Gjerdingen corresponds to a positive charge of 10.70. Assuming that the Y site is completely zero-charge-dominated, the six oxygen atoms of the general formula (denoted with **X**) constitute a negative charge of 12, which must be balanced by the cations. This mismatch is too large to be accounted for by minor and trace elements that are not included in the analyses or by the possibility of minor vacancies at the oxygen sites. In such cases, it is conceivable that hydronium ions ( $\text{H}_3\text{O}^+$ ) may enter the A site, but this is not taken into consideration by Atencio et al. (2010). The cation composition of "ceriopyrochlore-(Ce)" from Gjerdingen has a positive charge of 11.34, which is also below the expected value.

### References

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