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INTRODUCTIONS

This book reviews about 9,300 mineral localities from all over the world, for all valid mineral species (almost 5,000), in the context of their geoenvironment. The main purpose of the book is to describe the chemical and physical properties of all mineral species with an emphasis to their localites and especially the mineral associations in which they occur.

An important progress and many changes in mineralogy during the last decade were registered. They were caused by the fast progress of analytical methods, e.g. by establishing of new analyses of light elements by microprobe and by mass spectroscopy, and by the possibility to study structures of very tiny minerals. Both these facts made possible to describe numerous new mineral species.

Great attention was given to groups of structurally and chemically related minerals. The classic summary on mineral groups is present in the book "Strunz Mineralogical Tables" (Strunz and Nickel, 2001), and most recently in "Fleischer's Glossary of Mineral Species" (Back, 2014).

Numerous nomenclatoric changes during last years have, naturally, some unpleasant practical consequences: numerous specimens of some mineral species in the museums and private mineral collections will loose their correct description, unless being tested by often complex and very expensive analyses (especially in the amphibole and pyrochlore supergroups, where there is often no direct correlation between the old and new names). In the case of light elements, e.g. for tourmalines, it will be difficult to distinguish fluor-elbaite from elbaite, fluor-schorl from schorl etc.

Minerals published already with a complete description have a citation of the original article at the end. In case of minerals approved by IMA but not yet published, we quote their IMA number. Their complete lists can be found at WWW.IMA-MINERALOGY.ORG/MINLIST.HTM, or printed in the Mineralogical Magazine.

Mineral species

Several definitions of "mineral species" have been promulgated but most of them were not generally accepted. According to Strunz and Nickel (2001), a mineral substance is "a naturally occurring solid that has been formed by geochemical and geophysical processes, either on earth or in extraterrestrial bodies". Besides minerals with definite three-dimensional atomic structure, the current definition also permits naturally amorphous phases. Among minerals we find mainly inorganic species – elements, alloys, carbides etc., sulfides and similar compounds, halides, oxides and similar compounds, oxidic compounds with complex anions, and a few organic species.

By far, the largest number of minerals described in our book are considered valid mineral species. They have been submitted to, and accepted by, the Commission on New Minerals and Mineral Names (CNMMN) of the International Mineralogical Association (IMA), or else existed before the CNMMN started its fruitful existence (1959). The principles of criteria for valid mineral species, with a list of discredited mineral names, were published by Nickel and Mandarino (1987). The description of valid species must contain chemical formula, structure (crystal system, crystal group, and unit cell dimensions), and at least some other physical data. A list of valid mineral species is presented in "Fleischer's Glossary of Mineral Species", most recently in the 11th edition by Back (2014), and at WWW.IMA-MINERALOGY.ORG/MINLIST.HTM. There is no problem with the validity of at least 95 % of minerals, thanks to the positive role of the CNMMN in limiting the number of newly described minerals.

The composition of most mineral specimens deviates, however, more or less from the theoretical chemical composition, characteristic for the "end-members" of mineral series. The critical species boundary between two minerals of identical structure and similar chemical formula, distinguished only by substitution of one of the components, is imposed at 50 % of atomic site occupancy. The Sb members of the tennantite group (2.G) will serve as a good example:

tetrahedrite $Cu_{12}[S(SbS_3)_4]$	Ag-rich tetrahedrite $(Cu,Ag)_{12}[S(SbS_3)_4]$
Cu-rich freibergite $(Ag,Cu)_{12}[S(Sb_3)_4]$	freibergite $Ag_{12}[S(SbS_3)_4]$

Remark: both minerals always contain more or less Fe, Zn, and often Hg. Nearly pure freibergite is very rare.

The decision that a new mineral species is established when one of the cations or anions is changed for another one has unfortunate consequences in groups of minerals with very complicated compositions, e.g. the amphibole, mica, tourmaline, pyrochlore, labuntsovite, eudialyte, and several other supergroups: the number of new mineral species may grow as an avalanche, flooding the mineral population with tens or possibly hundreds of names, even when the amount of the substituting component may represent only 1–2 weight % of the whole composition.

The most complicated situation is actually in the pyrochlore supergroup. For example, in the old classification the mineral pyrochlore had a formula $(Ca,Na)_2Nb_2(O,OH,F)_7$ and we had about 30 pyrochlore localities in the first edition of this book. However, the recent classification uses naming according to individual ions of O, OH and F and it makes uncertain, where the pyrochlores from those 30 localities belong. Complete descriptions are missing for many minerals of this redefined group and only 19 of them passed for the IMA approval till summer 2015. For that reason, we keep the old names for minerals where their new name is not clear, and they are marked with an asterix *.

Polytypes are, according to criteria of the CNMMN (Nickel and Mandarino, 1987, p. 1032), not regarded as individual mineral species. Exceptions are a few polytypes with different chemical formulae (e.g. baumhauerite, ferronigerite, etc.).