Nomenclature of the tourmaline-supergroup minerals

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ABSTRACT

A nomenclature for tourmaline-supergroup minerals is based on chemical systematics using the generalized tourmaline structural formula: XY3Z6(T1O6)(BO3)3V,W, where the most common ions (or vacancy) at each site are X = Na+, Ca2+, K+, and vacancy; Y = Fe3+, Mg2+, Mn2+, Al3+, Li+, Fe2+, and Cr3+; Z = Al3+, Fe3+, Mg2+, and Cr3+; T = Si4+, Al3+, and B3+; B = B3+; V = OH− and O2−; and W = OH−, F−, and O2−. Most compositional variability occurs at the X, Y, Z, W, and V sites. Tourmaline species are defined in accordance with the dominant-valence rule such that in a relevant site the dominant ion of the dominant valence state is used for the basis of nomenclature. Tourmaline can be divided into several groups and subgroups. The primary groups are based on occupancy of the X site, which yields alkali, calcic, or X-vacant groups. Because each of these groups involves cations (or vacancy) without a different charge, coupled substitutions are required to relate the compositions of the groups. Within each group, there are several subgroups related by heterovalent coupled substitutions. If there is more than one tourmaline species within a subgroup, they are related by homovalent substitutions. Additionally, the following considerations are made. (1) In tourmaline-supergroup minerals dominated by either OH− or F− at the W site, the OH−-dominant species is considered the reference root composition. (2) For a tourmaline composition that has most of the chemical characteristics of a root composition, but is dominated by other cations or anions at one or more sites, the mineral species is designated by the root name plus prefix modifiers, e.g., fluor-dravite. (3) If there are multiple prefixes, they should be arranged in the order occurring in the structural formula, e.g., “potassium-fluor-dravite.”

Keywords: Tourmaline, mineral chemistry, nomenclature, substitutions, order-disorder

INTRODUCTION

The Subcommittee on Tourmaline Nomenclature (STN) of the International Mineralogical Association’s Commission on New Minerals, Nomenclature and Classification (IMA-CNMNC) has reconsidered the nomenclature of tourmaline-supergroup minerals. This was prompted by the general ambiguity in the assignment of mineral names to specific tourmaline compositions. There are several reasons for this uncertainty (Hawthorne and Henry 1999). (1) Formal descriptions of tourmaline minerals often specify the ideal end-member compositions, but do not specify the limits for the use of the name. (2) Some of the formal descriptions of tourmaline minerals specify the general composition, but do not specify the end-member composition. (3) Tourmaline is commonly incompletely chemically characterized, with critical light elements (H, Li, F, and B) and the oxidation states of transition elements (Fe, Mn) often being undetermined. (4) Site assignments can be equivocal in the absence of crystal-structure refinements. (5) Current graphical representations of tourmaline compositional variations are inadequate to express the actual substitutional nature of tourmaline. These considerations motivated Hawthorne and Henry (1999) and the STN to re-examine and, where necessary, redefine end-members and potential new end-members and species, which led to the development of several compositional diagrams that aid in classification of the tourmaline-supergroup minerals. The proposal for systematic classification of the tourmaline-supergroup mineral-