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QUANTITATIVE ANALYSIS OF METAMORPHIC TOURMALINE

by

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Compositional zoning of tourmaline from several units of the Austroalpine basement (Eastern Alps, Europe) with differing metamorphic history was analysed in order to check the capability of tourmaline to record the metamorphic evolution. The samples were collected from polymetamorphic units which underwent at least two (a Variscan and an eo-Alpine) medium to high grade metamorphic events and from monometamorphic eo-Alpine complexes which were metamorphosed to medium grade only.

The compositional evolution of tourmaline from the polymetamorphic complexes is represented in a sequence of three to four distinct growth zones with a continuous change in composition between the innermost growth zone and the detrital core. X_{Ca} and X_{Mg} increase, X-site vacancies and Al decrease from the inner to the outer growth zones. The compositional polarity of tourmalines in the inner growth zones corresponds to the exchange vector $Na_{-1}Mg_{-1}{}^{X}\square+Al$. Towards the outer ones compositional polarity becomes less prominent, or disappears completely.

Samples from the monometamorphic complexes only exhibit one or two distinct rim zones that are separated from the detrital core by a sharp boundary in colour and a discontinuous change in composition. Towards the outer growth zones X_{Ca} and X_{Mg} increase and Al and X-site vacancies decrease. Compositional polarity mainly reflects the exchange vector $Al_2Ti_{-1}Mg_{-1}$ and decreases in the direction from the detrital core to the rim. Since the polarity of the two poles diminishes towards the rim or disappears at all, an equilibration at amphibolite facies stabilities in the mono- and polymetamorphic units is consistent with conventionally derived PT data. The lack of an abrupt chemical discontinuity between detrital core and the innermost rim in polymetamorphic tourmalines could indicate a reequilibrated pre-Variscan detritus, rimmed by Variscan inner and eo-Alpine metamorphic outer overgrowths.