

ABSTRACT

New electron-microprobe analyses of 'tsavorites' from the Neoproterozoic Metamorphic Mozambique Belt deposits allow the characterization of green grossular according to its trace-element chemistry (V, Cr, Mn). Five chemical types are defined: type 1, vanadian grossular with $V > Cr > Mn$ (in atoms per formula unit); type 2, vanadian grossular with $V > Mn > Cr$; type 3, Mn-bearing vanadian grossular with $Mn > V > Cr$; type 4, Mn-bearing chromian grossular with $Mn > Cr > V$; and type 5, Cr- and Mn-bearing grossular with $Cr > Mn > V$. These types are also characterized by different absorption spectra in the ultraviolet–visible–near infrared. Type 1 tsavorite spectra show a total absorption below 430 nm due to the high vanadium contents. Type 2 tsavorite spectra present the classical absorption bands of V. Types 3 and 4 tsavorite spectra display additional shoulders at 407 and 408 nm due to Mn^{2+} , whereas spectra of Cr-bearing types 4 and 5 tsavorite show the two additional bands of Cr^{3+} at 697 and 701 nm. The different absorption spectra also indicate Fe^{2+} - Ti^{4+} charge transfer. We measured OH^- equivalent to 0.08 to 0.38 wt% eq. H_2O within the structure. Concentrations of vanadium, chromium and manganese are good chemical "fingerprints" for determining the geographic provenance of economic tsavorite from Kenya, Tanzania and Madagascar.