ABSTRACT

Megacrystic (up to 1.5 cm) euhedral to subhedral zircons occur at the Freeman Mine in a zoned syenitic pegmatite near Zirconia, North Carolina. Zircon concentrates obtained from three mine dump sites, a stream draining the dump, and nine weathered pegmatite hand samples were classified as strongly fluorescent, weakly fluorescent or non-fluorescent under shortwave ultraviolet light. Strongly fluorescent zircons in this study are pinkish gray in color, whereas weakly to non-fluorescent samples are dark pale-orange brown and tend to be coated with iron oxides that are mainly goethite with minor hematite. Zircon samples that show areas of internal mottling when viewed with a petrographic microscope, are dark pale orange brown and are not strongly fluorescent or cathodoluminescent. Small grains of magnetite (<0.1mm), very small unidentified transparent minerals (<0.05mm), and fluid inclusions (<0.01mm) are scattered throughout the zircon crystals. X-ray powder diffraction studies indicate that neither population is significantly metamict, since there are no major differences in unit cell dimensions. Average bulk chemical analyses of 0.2 gram samples of un-cleaned concentrates and cleaned concentrates indicate that weakly to non-fluorescent zircons tend to have higher average concentrations of Fe_2O_3, U, Th, Hf and total rare earth elements (REE) plus Y than the strongly fluorescent group. Electron microprobe analyses suggest that average U_2O_3 and HfO_2 values are typically higher in the weakly fluorescent samples. An inverse relationship between higher concentrations of Fe_2O_3, U, U_2O_3, Hf, HfO_2, total REE plus Y and perhaps Th, and lower fluorescence activation suggests that one or more of these trace oxides/elements — most likely Fe_2O_3, or REE — may be quenching fluorescence.