Geochemistry of tourmalines from Archean orogenic gold deposit: proxies for the origin of gold mineralizing fluids?

HENRIK KALLIOMÄKI* TOBIAS FUSSWINKEL
THOMAS WAGNER

Department of Geosciences and Geography,
University of Helsinki, Finland
(*correspondence: henrik.kalliomaki@helsinki.fi)

Natural tourmalines exhibit wide variations in their major and trace element chemistry, reflecting tourmaline stability in diverse igneous, metamorphic and hydrothermal environments and over wide ranges of temperature and pressure. Many Archean greenstone belts host abundant tourmaline in hydrothermal orogenic gold-quartz veins, variably altered metavolcanic and metasedimentary host rocks and in granitic intrusions which may have contributed magmatic fluids to the gold mineralizing systems. This offers great potential for utilizing tourmaline chemistry as proxies for fluid-rock interaction and for the source of fluids in orogenic gold deposits.

We present the major and trace element geochemistry of tourmalines from orogenic gold deposits in the Archean Ilomantsi greenstone belt (Eastern Finland). All tourmalines, including those from gold-quartz veins, altered wall rocks and granitic intrusions, classify as dravite-schorl based on their major element composition. The textural features and trace element characteristics (concentrations of Pb, Zn, Cr, Ni and Ga) show that tourmalines in the gold-quartz veins and altered host rocks have formed in a continuum between fluid- and rock-buffered conditions. The tourmaline trace element data clearly show that multiple pulses of hydrothermal gold-bearing fluids have interacted with different host rock lithologies (e.g. intermediate and mafic volcanics, felsic dikes). The compositional spectrum of tourmalines from the gold mineralization overlaps partly with the composition of granite hosted tourmalines. We conclude that the chemical characteristics of tourmaline are well suited as proxies for fluid-rock reaction, but not as tracers for the distant fluid sources in orogenic gold systems.