ABSTRACT

Chromian spinels record petrogenetic processes in their chemistry. To date, no systematic study of Cr-spinel chemical changes in a polymetamorphic setting has demonstrated a high- to low-grade progression of changes through a facies series. Here, we analyze the retrograde metamorphism of ultramafic rocks, in the Blue Ridge Belt of the southern Appalachian Orogen, that followed a retrograde path from eclogite to low greenschist facies conditions. Over this range of metamorphic grades, the chromian spinels of high olivine, eclogite/upper amphibolite facies rocks (metadunites) that are aluminous, low Ti chromites of moderate magnesium and chrome number, change to iron-enriched, low Al, low Mg number, higher Cr number spinels (chromian magnetites) with approximately one percent TiO_2 in moderate to low olivine rocks of the lower amphibolite facies. Under lower grade greenschist facies conditions in hydrous analogues of the olivine rocks C serpentinites C the spinels are Al, Mg, and Ti deficient end member magnetites. The spinel chemical changes accompany a four stage, retrogressive, hydrous metamorphic path through P,T space. Initial igneous spinel chemistries, perhaps reflected by core chemistries of the highest grade spinels, suggest a suprasubduction zone or subarc petrogenetic setting. Metamorphism of spinel-bearing metaultramafic rocks would require introduction of chromium, if the spinels were to follow a duplicate, but prograde path to higher grade chemistries.