Assessing the Oxidation State of Exhumed Subducted Terranes: A Case Study from the HP/LT New Caledonia Belt

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The oxidation state of subducted oceanic lithosphere is poorly understood and has important implications for the oxidizing capacity of fluids released by dehydration into the overlying mantle wedge. It is unclear whether systematic changes in the abundance of oxidized species of multivalent elements occur with depth as a result of metamorphic reactions, including metasomatic reactions among subducted oceanic crust, sediment, slab-mantle, and/or mantle wedge.

The southwest Pacific island of New Caledonia is well-studied, containing one of the world's largest ophiolite exposures and an Eocene HP/LT belt consisting of low-grade to lawsonite eclogite-facies assemblages. Fluid-rock interaction features such as eclogite-facies veins, metasomatic reaction zones, and "glaucophanite" have provided insight into subduction fluid processes at HP/LT conditions. These same features can offer snapshots of redox processes occurring at depths corresponding to eclogite and blueschist facies conditions, and tectonically juxtaposed ophiolite material provides a setting for comparing this descending plate material with that of the overlying plate.

We obtained bulk and in-situ major and trace element compositions for a suite of blueschist and eclogite-facies rocks to investigate subduction zone redox reactions by documenting compositional variation and modal abundances of Fe^{3+} carriers in these assemblages: epidote, crossite-riebeckite, aegirine-augite, omphacite, chlorite, and accessory oxides. Combined with petrographic analysis to interpret reaction textures, crystallographic sequences, and documentation of zoning in Fe-bearing minerals, these data offer new insight into the redox budget of exhumed HP/LT subduction complexes.