Using Rodingite Dikes to Explore the P-T-t Histories of Subducted Serpentinites

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Rodingites, hydrothermally altered gabbroic dikes within serpentinized peridotites, are a relatively understudied lithology that could record the ambient conditions during formation in oceanic settings, as well as the depths, temperatures and fluid-rock interactions experienced by rodingites and the associated serpentinites during subduction and exhumation. As serpentine can contain up to 15% water, the dehydration of serpentinites can be a significant source of water in subduction systems, and the study of rodingites potentially provides a means of monitoring the release of this fluid. The rodingites studied here, from the Voltri massif in the Ligurian Alps of Italy, record the Alpine subduction cycle and can be compared to unsubducted rodingites in the Apennines to define the recrystallization and chemical change during subduction. The Voltri rodingites consist of grossular-almandine garnet and diopsidic clinopyroxene, and also chlorite and ilmenite. This mineralogy developed during peak metamorphic conditions and is more conducive to constraining the subduction P-T-*t* history (via pseudosection modeling and garnet geochronology) than that of serpentinite. Pseudosection modeling suggests a peak temperature >500ºC; constraining the pressure is more challenging with this mineralogy that primarily changes with temperature and lacks quartz for elastic geobarometry.

Western Alpine rodingite dikes are often cross-cut by grossular-andradite garnetite veins. This study is the first successful attempt to date these veins via Sm-Nd garnet geochronology, with this age being ~34-39 Ma and thus dating a fluid process associated with either peak metamorphism or the early stages of exhumation. This garnet has Nd concentrations of ~20 ppm, potentially providing evidence of local or larger-scale REE mobility. This data will be complemented by garnet geochronology from the main rodingite. Overall, rodingites show strong potential as recorders of subduction and exhumation.