Constraining the temperature conditions of paleo-subduction plate interfaces: Combining petrology and geodynamics

*Sarah Penniston-Dorland[1], Kayleigh Harvey[1], Xin Zhou[2], Ikuko Wada[2], Besim Dragovic[3], Peter E Van Keken[4]

1. University of Maryland College Park, 2. University of Minnesota, 3. University of South Carolina, 4. Carnegie Institution for Science

Pressure-temperature (*P-T*) estimates from exhumed metamorphic rocks are often used to constrain the thermal conditions of paleo-subduction zone plate interfaces. However, the exhumed rock record on average indicates temperatures 200-300˚C warmer than those predicted by geodynamic models for modern subduction zones. To elucidate the difference in the paleo and modern subduction zone thermal structures, we investigate the role of regional tectonics at five selected paleo-subduction localities, including the Franciscan Complex in California, the Raspas Complex in Ecuador, the Rio San Juan Complex in the Dominican Republic, the Sanbagawa Belt in Japan, and the Pam Peninsula in New Caledonia. These terranes were chosen to represent a range of thermal conditions from hot to cold. We develop 2-D coupled kinematic-dynamic models for these localities, using the paleo-subduction parameters, such as convergence velocity and plate age, that are constrained by global plate reconstruction models and regional geological and petrological studies. For comparison with petrology, we supplement existing *P-T* estimates with quartz-in-garnet elastic thermobarometry combined with equilibrium thermodynamics to evaluate the *P-T* history of exhumed rocks from these localities. We compare the model-predicted subduction thermal structures with the *P-T* conditions that are estimated from exhumed rocks in the selected localities and assess the key factors that contributed to the petrologically constrained *P-T* conditions.

