37-6 - EVIDENCE AND TIMING FOR MULTIPLE COOLING MECHANISMS IN A LONG-LIVED SUBDUCTION ZONE FROM THE EASTON METAMORPHIC SUITE IN THE NORTHWEST CASCADES

Friday, May 19, 2023

3:20 PM - 3:40 PM

Whitney Peak Ballroom 1 (The Whitney Peak Hotel)

Abstract

Numerical models of subduction initiation and observations of exhumed subduction complexes indicate that the early stages of subduction are characterized by rapid cooling followed by a prolonged steady thermal state that can last tens of millions of years. Several mechanisms are proposed to drive cooling in subduction zones and include thermal relaxation, exhumation, and underplating, but determining the relative contribution of each mechanism in the history of an exhumed subduction complex can be difficult. The Easton metamorphic suite in the Northwest Cascades of Washington is a Jurassic-Cretaceous subduction complex that records the subduction and accretion of distinct units within a thermally maturing nascent subduction zone. The region preserves an inverted metamorphic sequence with metamorphic temperatures and ages that decrease structurally downward from an early accreted metamorphic sole to younger regionally extensive blueschist facies units. In the metamorphic sole Grt±Cpx amphibolite was metamorphosed at 750-800 C at 1.0 GPa prior to 167 Ma. The amphibolite is underlain by a high temperature Grt-Ab-Gln blueschist that was metamorphosed at ~530 C and 1.0 GPa at 165 Ma. The contact between the units is gradational and the general lack of deformation suggests initial cooling to lower temperatures may have been caused by cooling of the overall subduction zone. Retrograde Lws-Ep-Gln-Ms assemblages suggest that cooling of both the amphibolite and high-grade blueschist units to below 400-500 C was caused by exhumation to 0.7 GPa by 157 Ma. In the regionally extensive blueschist units, Ep-Ab-Chl-Ms±Grt±Lws phyllite was metamorphosed at 430-450 C and 0.7 GPa by 149 Ma. Retrograde fabrics in the phyllite record similar temperatures to peak metamorphic conditions in an underlying Ep-Ab-Gln/Act greenschist/blueschist unit that was accreted and metamorphosed at ≤350 C by ≤140 Ma. The contact between the phyllite and greenschist is marked by a high strain mylonite zone and the combined observations suggest that cooling of the phyllite was driven by underplating of the younger greenschist unit. The observed assemblages and fabrics within the Easton metamorphic suite record cooling as the result of thermal relaxation, underplating, and exhumation at distinctly different times in the subduction history.

Geological Society of America Abstracts with Programs. Vol. 55, No. 4, 2023
doi: 10.1130/abs/2023CD-387367

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