Geophysical Research Abstracts,
Vol. 10, EGU2008-A-02263, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-02263
EGU General Assembly 2008

Migmatite crystallization during extension and collapse of a continental arc-orogenic plateau system

S.M. Gordon (1), D.L. Whitney (1), S. Bowring (2), R.B. Miller (3), N. McLean (2)

(1) Geology & Geophysics, University of Minnesota, Minneapolis USA, (2) Earth, Atmospheric and Planetary Sciences, MIT, Cambridge USA, (3) Geology, San Jose State University, San Jose USA (gordo204@umn.edu)

Arcs contain intrusions derived from melting of the mantle and crust, but the voluminous exposure of migmatite in exhumed continental arcs shows that partially molten crust (migmatite) is also important in the thermal-mechanical evolution of this type of orogen. Although migmatites in many shallowly exhumed arcs record low-pressure – high-temperature metamorphism, more deeply exhumed arcs are comprised of high-pressure migmatites (P $>$ 8-10 kbar) that can be used to understand the role of partially molten crust in the rheology and (re)distribution of heat and material at convergent margins. It is therefore essential to determine the timescale(s) at which partial melting occurred and to link the partial melting history to other crustal-scale processes such as metamorphism and deformation during crustal thickening and exhumation. The North Cascades range, Washington USA, is an excellent locality for such an investigation because it exposes $>$40 km of crustal section, from high-P migmatites and orthogneiss bodies to sedimentary basins. Previous geochronology studies determined that orthogneiss and plutons have crystallization ages ranging from 90-45 Ma, indicating a long history of magmatism during different stages of arc orogenesis. In the present study, we used CA-TIMS (chemical abrasion) methods to analyze a variety of leucosome textural types (e.g. stromatic/discordant; fine-grained/pegmatitic) from three outcrops of the Skagit Gneiss in the high-grade, migmatitic core of the range. All leucosomes exhibit evidence for deformation. The leucosomes yielded ages that range from 68-47 Ma; we interpret these as melt crystallization ages. The youngest leucosome ages (47-45 Ma) coincide with Ar cooling ages and the timing of Eocene exten-

sional basin formation, suggesting rapid and widespread melt (migmatite/pluton) crystallization during exhumation. The Eocene ages are also similar to melt crystallization ages of migmatites, orthogneiss, and plutons exposed hundreds of km to the east in the interior (Omineca) belt of metamorphic core complexes and gneiss domes of the northern North American Cordillera. The similarity in the timing of migmatite/magma crystallization in the two regions is consistent with the idea that the North Cascades and the Omineca belt were once dynamically linked in an orogenic plateau. The rapid upward flow of partially molten crust at the margins of this wide, extending hot orogen marked the end of orogeny.