# Along-strike variation in detrital zircon hafnium isotope compositions from the Chugach-Prince William terrane, Alaska

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The Chugach-Prince William Terrane (CPW) is a Late Cretaceous to Paleocene accretionary complex that spans ~2200 kilometers of the southern coast of Alaska, from Sanak Island in the west to Baranof Island in southeast Alaska. The flysch of the CPW is composed of turbidites that vary from conglomerate, quartzofeldspathic sandstone, volcanic-lithic sandstone and interbedded mudstone. As one of the most outboard terranes in Alaska, understanding the accretion history of the CPW and its subsequent coast-parallel translation should illuminate key elements of the final assembly of the North American Cordillera.

In this study we report 434 integrated U/Pb ages and Hf isotope compositions from four widely separated locations along the arcuate belt of the CPW. Together, the U/Pb ages range from 34 Ma to 2935 Ma with $\varepsilon_{Hf}(t)$ values from +17.3 to -31.2; of the 434 zircons we measured, 230 are Precambrian, and 204 are Phanerozoic. We specifically targeted Precambrian zircons from a much larger detrital zircon U/Pb data set (n>2000, Garver et al., this volume), but also include Hf isotope compositions from important Phanerozoic populations present in all samples from the CPW. Zircons from 10 samples (n=1053) of the Shumagin Formation in the Shumagin Islands (our farthest west sampling area) yield U/Pb age populations with peaks at 74, 88, and 160 Ma with only 17 Precambrian grains (Roe et al., this volume). All but two Phanerozoic zircons from the Shumagin Formation yield positive $\varepsilon_{Hf}(t)$ values consistent with partial melting of a relatively juvenile source region. This is in contrast to similar-aged zircons from the other three sampling areas (from west to east), Kodiak Island, Prince William Sound, and Yakutat, where $\varepsilon_{Hf}(t)$ values range from +11.9 to -26.5 suggesting that Phanerozoic zircons from these areas are crystalizing from melts derived from a heterogeneous source region that includes juvenile and Precambrian crust.

Precambrian zircons from Kodiak and Prince William Sound (PWS) have U/Pb age distributions with major populations at 1810-1870 and 2520-2680 Ma and have $\varepsilon_{Hf}(t)$ from +13.9 to –21.1. This is in contrast to the age distribution from Yakutat with modes at 1380-1450 and 1710-1740 Ma, and $\varepsilon_{Hf}(t)$ from +11.7 to –3.4. Mesoproterozoic and late Paleoproterozoic (<1750 Ma) zircons from Yakutat, Kodiak, and PWS have $\varepsilon_{Hf}(t) > -5$ and all zircons between 1420 and 1750 Ma have positive $\varepsilon_{Hf}(t)$ values suggesting a relatively juvenile source area for the origin of these zircons.

Taken together, the integrated U/Pb and Hf isotope data show that the origin and provenance of detrital zircons from the CPW varies systematically along strike. Phanerozoic U/Pb ages have a strong Coast Mountains batholith signature (Garver et al., this volume) with more juvenile crust in the magmatic source region in the Shumagin

Formation, compared to tectonostratigraphically equivalent rocks in Kodiak, PWS, and Yakutat. The dominance of Mesoproterozoic and Late Paleoproterozoic zircon with slightly negative to positive $\varepsilon_{Hf}$ (t) values in Yakutat appears to correlate well with zircon derived from a southern Laurentia source (i.e. the Mazatzal and Yavapai province) and associated Mesoproterozoic A-type granites.

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## Provenance and thermal history of the Upper Cretaceous Shumagin Formation, Nagai Island, southern Alaska

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The Chugach-Prince William (CPW) composite terrane is a Late Cretaceous to Eocene accretionary complex exposed for ~2200 km in southern Alaska. Principally composed of deep-water turbidites with abundant quartzofeldspathic and volcanic-lithic sandstones, shale, and basaltic rocks including the Resurrection and Knight Island ophiolite complexes, the CPW is also defined by Paleocene age granitic plutons of the Sanak-Baranof Belt that range in age from ~62 Ma on Sanak Island to 48 Ma on Baranof Island in SE Alaska. The eastern extent of the CPW is defined by the Upper Cretaceous Shumagin Formation exposed on Sanak and Shumagin Islands.

New detrital zircon U/Pb dates (n=1053) collected from ten samples of volcanic-lithic and arkosic sandstones from Nagai Island in the Shumagins confirm that the Shumagin Formation is Upper Cretaceous in age. The maximum depositional ages for ten samples are closely clustered and range from 73-77 Ma. The U/Pb zircon age of an interbedded tuff yields and age of 73.7 ± 1.2 Ma, further confirming the Late Cretaceous age of the Shumagin Formation and suggests that the ages of the youngest detrital zircons in most of the samples are close to the depositional age of these rocks. Collectively, samples from the Shumagin Formation have three main populations of zircon ages with modes at 74, 89, and 161 Ma with variation between samples mainly in the relative number of grains making up these populations. Only 17 out of 1053 grains are Precambrian and range from 1445 – 2760 Ma with all but four of the grains between 1750 - 2000 Ma.

The Phanerozoic age populations match well with those from correlative rocks on Kodiak Island, Prince William Sound, and Yakutat suggesting a source region with an active Late Cretaceous arc built on a mostly Mesozoic age meta-plutonic basement (Garver et al., this volume). The Precambrian ages are consistent with the Paleoproterozoic and Archean modes found in correlative units farther east, and the paucity of Precambrian grains in the Shumagin Formation might say something about along strike variations in the meta-plutonic basement of the Late Cretaceous arc source region. Hf isotopic data on U/Pb-dated Phanerozoic grains showof the Shumagin Formation are dominated by positive $\varepsilon_{Hf}$ (t) values showing that the source is juvenile (see Roberts et al., this volume).

Two new U/Pb dates from the Shumagin Batholith, part of the Sanak-Baranof Belt, are 61.7 ± 0.7 Ma and 62.6 ± 0.7 Ma, which we interpret as the crystallization age of these rocks. These dates confirm that the intrusion and crystallization of the Sanak-Baranof Belt, attributed to the passage of a trench-ridge-trench (TRT) triple junction, occurred in the early Paleocene in this part of the CPW. Detrital zircon fission track (ZFT) dates yield cooling ages of 58-54 Ma and appear to show variable amounts of overprinting related to intrusion of the Shumagin Batholith, and slab window heating associated with passage of the TRT triple junction.

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## Geology of the Dawson Range – White Gold district, western Yukon: improved constraints on Yukon Tanana terrane architecture

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The Dawson Range is underlain by the basement rocks of the Yukon-Tanana terrane (YTT), intruded and overlain by locally voluminous late Triassic to Tertiary plutonic and volcanic rocks. The central core of the map area is transacted by the mid-Cretaceous Whitehorse plutonic suite (hbl-granodiorite of the Dawson Range batholith (DRB) phase, and bt-monzogranite of the Coffee Creek granite (CCg) phase) and it masks a pre-mid Cretaceous, fundamental tectonic boundary in intermontane geology. On the northeast side of the DRB, typical YTT rocks are exposed, comprising a thoroughly deformed and metamorphosed pre-Devonian to Permian basement complex. Pre-Devonian quartzite, psammite, marble and amphibolite (Snowcap assemblage; SCA) form the oldest rocks. The SCA is locally in structural contact with amphibolite that is interpreted as the arc-related Devonian to Mississippian Finlayson assemblage. The SCA and Finlayson assemblage are intruded by Permian granites of the Sulphur Creek suite. Early Mississippian Simpson Range plutonic suite is restricted in the map area to the northwest extremity, and is in thrust contact on top of the Snowcap assemblage and Permian intrusions. Occurrences of the Late Triassic Pyroxene Mountain suite occur only in the hanging wall Simpson Range suite rocks, leading us to conclude that the thrust is post late Triassic. On the south side of the CCg, a different thrust of similar scale separates amphibolite facies schist and Permian augen granite from greenschist facies metavolcanic Klondike Schist, indicating that thrusting postdates peak metamorphism. Our work demonstrates that the Permian magmatic portion of YTT is much more widespread than previously known, and extends from the Alaska border in southwest Stewart River map sheet some 180 km to the east-southeast into Carmacks map sheet.

On the southwest side of the DRB, host rocks are dominated by amhibolite facies siliciclastic rocks of the Scottie Creek formation and derived partially melted migmatic paragneiss, that have similar compositional character as the SCA to the northeast. However, these rocks lack Permian intrusions, and are spatially associated with