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U-Pb zircon ages of Neoproterozoic granitoid magmatism on the Arctic coast of Chukotka and Wrangel Island

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The AACM forms the Russian-Alaskan margin of the Arctic Ocean and includes Arctic Alaska, Chukotka, Wrangel Island and the East Siberian Shelf. The AACM is thought to be underlain by Neoproterozoic metamorphic and igneous basement overlain by a Paleozoic and Mesozoic sedimentary cover sequence. This crustal fragment occupies a position today between the North Asian and North American cratons and is a continental mass that separates the modern Pacific and Arctic Oceans. The Angayucham ophiolite belt in Alaska and the South Anyui suture zone in Chukotka are interpreted as remnants of a Late Jurassic to Early Cretaceous collision that amalgamated allochthonous terranes of Pacific margin with the southern margin of the AACM. Subsequent extension, magmatism, metamorphism and deformation during Cretaceous time significantly modified the earlier architecture of the AACM. Many outstanding plate tectonic problems and questions center on the Arctic and the origin and kinematic history of the AACM (e.g., opening of Amerasia Basin, termination of Paleozoic orogenic belts in Eurasia, connections between Siberia and North America through time and the origin of Cordilleran terranes).

New SIMS (SHRIMP-RG and Cameca 1270) U-Pb zircon geochronology results from Wrangel Island and from the Velitkinay massif along the Arctic coast of Chukotka are indicative of Neoproterozoic magmatic episodes at ~710-700 Ma, ~675-670 Ma and ~620-615 Ma in this portion of the AACM (all results 95% conf. concordia ages). On Wrangel Island, granitoid gneiss samples from the Wrangel complex yield 707±4 Ma and 706±5 Ma ages, with inheritance of concordant 1.0-1.1, 1.6 and 1.7 Ga zircon cores. Another granitoid gneiss is dated 620±5 Ma, and contains a 709±5 Ma granitic xenolith. A metavolcanic rock yields an age of 700±4 Ma and a granite clast in an undeformed conglomerate is 672±4 Ma.

Further south in the Velitkinay complex on Chukotka, migmatites and leucogranites are abundant, and are interpreted as evidence of partial melting of basement. A schlieren and enclave rich mid-Cretaceous leucogranite from the interior of the Velitkinay massif contains blocky, euhedral zircons with CL-dark, <5 μm thick rims (rims not analyzed). Of 20 spots analyzed, 11 define an age of 617±5 Ma, and 19 of 20 define a chord with intercepts at 614±10 and 96±160 Ma. U-Pb analyses of sphene yield a crystallization age of 98.3±2.4 Ma. Analyses of zircon cores from a second migmatitic sample yields a slightly older concordia age of 667±9 Ma. The 617 and 667 Ma ages are interpreted as the age of basement igneous rocks that partially melted during Cretaceous magmatism.

These results fall in the established age range of basement magmatism in the AACM (Amato et al., 2009), but are more tightly clustered than ages from Seward Peninsula (870-540 Ma) or Brooks Range (971-~700 Ma). The ~675-670 Ma results overlap the range of previously reported ~660-690 Ma ages from Seward Peninsula, whereas the ~620-615 Ma results are not reported elsewhere in the AACM. These results from Wrangel Island and Chukotka are consistent with an active margin setting along this portion of the AACM and are time-correlative with several other potentially relevant magmatic belts (e.g., pre-Uralian NE Timanides, central Taimyr, Kalak Nappe Complex, Cadomia-Avalonia).