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Title: MAGMATISM, GNEISS DOMES AND XENOLITHS IN THE NORTHERNMOST CORDILLERA: INSIGHTS INTO LITHOSPHERIC-SCALE PROCESSES IN EXTENDED CONTINENTAL CRUST

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Abstract: The geology of Alaska, the Bering Shelf and NE Russia was constructed by arc and marginal basin accretion to Pacific-facing continental margins, culminating with deformation of the pC basement and Paleozoic-Mesozoic cover sequences of this margin during intensified magmatism in the late Jurassic to Early Cretaceous. A protracted series of extensional and magmatic events modified and dispersed this orogenic belt during opening of the Arctic Ocean basin(s). Extension may have been driven by slab rollback which successively dragged fragments of the earlier accretionary collage towards the modern subducting Pacific margin of Alaska.

The Bering Strait and surrounding regions represent an excellent example of stretched and magmatically modified crust. A variety of data from crustal-scale seismic reflection profiles to detailed studies of gneiss domes to the study of deep crustal xenoliths provides unique insight into the lithospheric processes that accompany the extension of continental crust.

The Bering Strait gneiss domes (hot core complexes) represent well-documented cases of crustal-scale flow of rocks at sillimanite to granulite facies conditions, rising rapidly from 12 kb to andalusite-stable conditions during locally extreme crustal thinning at about 90 Ma. Seismic reflection profiling documents 30-35 km thick crust with subhorizontal reflectivity and a sharp Moho beneath the gneiss domes. Mid- to lower crustal reflectivity coincides with the geographic limits of the Cretaceous (120-80 Ma) magmatic belt, suggesting that the locus of regional crustal extension was controlled by the locus of magmatic heating. A younger (75-55 Ma) magmatic belt formed to the south of this belt before subduction and arc magmatism were finally established along the Aleutian trend in the Eocene.

Xenoliths from the deep crust beneath the Cretaceous magmatic belt have a linked history to gneiss dome rocks, yielding Cretaceous magmatic and/or Cretaceous and Paleocene metamorphic ages. Equilibration conditions represent the deeper part of the P-T array represented by gneiss dome rocks and the metamorphic gradients defined (30-50ºC/km) are too hot to be explained by anything other than mantle-derived magmatic heat input to the crust. High-grade rocks in the gneiss domes preserve their earlier (protolith) histories as evidenced by U-Pb zircon geochronology, however xenoliths from the deep crust do not, recording only Cretaceous magmatic and Cretaceous and younger metamorphic growth/equilibration ages.

This unique combined data set for the Bering Shelf region provides compelling evidence for the complete reconstitution/re-equilibration of continental crust from the bottom up during mantle-driven magmatic events accompanied by crustal extension. Given what we know about core complexes and gneiss domes farther south in the Cordillera, it is reasonable to infer similar processes for their genesis and the nature of their underlying lower crust.