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Zircon (U-Th)/He thermochronometry and modeling of Cenozoic exhumation of the West Spitsbergen Fold Belt: a HeFTy task

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The West Spitsbergen Fold Belt (WSFB) is part of a ca. 55 Ma Eurekan deformation zone which trends N-S along the western margin of the Svalbard archipelago and is largely comprised of Meso- to Neoproterozoic metasediments and metavolcanics. (U-Th)/He thermochronometry is being conducted from three different regions within the fold belt to resolve the time-temperature history: Wedel Jarlsberg Land, Prins Karls Forland, and Sorkapp Land. Preliminary data obtained from Wedel Jarlsberg Land (amphibolite facies Eimfjellet Group and greenschist facies Sofiebogen Group) yield zircon (U-Th)/He (ZHe) ages indicative of Late Cretaceous to Early Paleogene cooling. It is apparent from the cooling ages that these Neoproterozoic rocks were >200°C before Eurekan deformation. Despite no clear trend between cooling age and grain size, the zircons exhibit a large range of eU values (51 to 826), viewed as a proxy for radiation damage, corresponding to a Gaussian distribution with age. Preliminary ZHe ages obtained from the Macnairrabbane unit of Prins Karls Forland suggests slightly younger cooling, as young as Late Eocene. HeFTy inversion models suggest the possibility that these rocks were at near-surface conditions through much of the Carboniferous and Permian as part of the Sorkapp-Hornsund High as a consequence of the Late Devonian Svalbardian Event. A moderate-temperature burial or heating event is therefore required to explain the Late Cretaceous /Early Paleogene ZHe cooling ages. With the current data, it is difficult to resolve whether this heating event was the result of pre-Eurekan sedimentation or syn-Eurekan over-thrusting. Nonetheless, the data strongly suggest fast cooling (and exhumation) through the He partial-retention zone during Eurekan tectonism, which may have commenced prior to 55 Ma. Similar thermochronometry results have been produced from Mesozoic rocks of the Sverdrup Basin exposed on Axel Heiberg and Ellesmere Islands of Canada; apatite fission-track and vitrinite reflectance data demonstrate Late Cretaceous through Eocene cooling as a consequence of basin inversion during the Eurekan orogeny. Timing of cooling for both the WSFB and Sverdrup Basin indicate very similar Cenozoic exhumation histories, and allows for the possibility that these separate terranes can be correlated in pre-Eurekan reconstructions.