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Tectonic switching as a Proterozoic crustal growth mechanism during the assembly of Laurentia, Great Lakes Region, North America

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Historically, Paleoproterozoic geology of the Superior and Huron regions (USA & Canada) has been interpreted to represent several rift-to-drift phases of continental break-up and amalgamation during the Wilson orogenic cycle (cf. Ojakangas et al., 2001). New detailed geochronology allows for a re-evaluation of the geologic evolution of the Paleoproterozoic basement that comprises the accretionary belts in the region and which supports a tectonic switching model that can be applied to Laurentide crustal growth. Tectonic switching is the oscillation between extension and compression forces that provides a mechanism for episodic, short-lived orogenic contraction of an otherwise continuously extending upper plate formed by ongoing slab retreat (Collins, 2002). A long-lived convergent margin along southern Laurentia is now well accepted (Karlstom et al., 2001; Holm et al., 2005); but, a hitherto little-recognized feature of this model that has not been addressed is the lithospheric extension and basin development which can be interrupted by intermittent subduction of buoyant oceanic plateaus, as the cyclicity depends on the frequency of plateau arrivals. Unequivocally, Proterozoic convergence with a protracted extension mode in the Great Lakes region of North America generated basins into which continental margin sediments and associated bimodal volcanics were accumulated, which is illustrated by the 1) 2.4-2.2 Ga Huronian Supergroup including mafic and silicic igneous rocks, 2) Marquette Range / Animikie Supergroups and contemporaneous ca. 1.87 Ga magmatic suite of Wisconsin, 3) ca. 1.7 Ga Baraboo Interval quartzites and abundant Yavapai-age magmatism, and 4) 1.5-1.4 Ga Belt Supergroup-related sediments and regional "anorogenic" magmatic suite. Short-lived compression-dominated

forces temporarily interrupted extension, which are now recognized as the 1) ca. 2100 Ma Blezardian orogeny, 2) 1850 Ma Penokean orogeny, and 3) 1650 Ma Mazatzal orogeny. In the case of the Penokean event, a strong contraction mode inverted basins and buried crustal rocks, which became the main source for granites generated during the Yavapai extensional phase when basaltic underplating and consequent melting of the thickened crust occurred, moreover explaining why this is the most prevailing signature of the switching intervals. Granite ascent and emplacement refocuses advective heat in the middle-upper crust, producing temporarily weak crust that is readily deformed. Blezardian and Mazatzal modes involved considerable shortening with only weak thermal perturbations, but nonetheless recognizable. Specifically, our ion microprobe U-Pb monazite and laser probe Ar-Ar muscovite data (e.g., Schneider et al., 2004) illustrate samples that preserve several hundred m.y. of thermal activity. This evolution is consistent with north-directed subduction that retreated to the south, which underwent tectonic switching and progressively converted the extending crust into a series of outboard migrating orogenic belts. The geodynamic evolution of this region is therefore essential for understanding the rate and mechanism by which continents grow over time and how they change from young, weak, and active crust to older, strong, and stable continents.

References:

Collins, W., 2002. Geology, 30, 535-538.

Holm, D.K., Van Schmus, W.R., McNeill, L.C., Boerboom, T., Schweitzer, D., Schneider, D.A., 2005. Geological Society of America Bulletin, 117, in press.

Karlstrom, K., Ahall, K-I, Harlan, S.S., Williams, M.L., McLelland, J., Geissman, J.W., 2001. Precambrian Research, 111, 5-30.

Ojakangas, R., Morey, G., Southwick, D., 2001. Sedimentary Geology, 141-142, 319-341.

Schneider, D.A., Holm, D.K., O'Boyle, C., Hamilton. M., Jercinovic, M., 2004. Gneiss domes and orogeny: GSA Special Paper 380, 339-357.