

## **Episodic crustal growth and its relation to plume-to-plate transition, Wyoming Province, USA**

DARRELL J. HENRY<sup>1</sup>, DAVID W. MOGK<sup>2</sup>, PAUL A. MUELLER<sup>3</sup>

<sup>1</sup> Dept. of Geology and Geophysics, Louisiana State Univ., Baton Rouge, LA, glhenr@lsu.edu

<sup>2</sup> Dept. of Geosciences, Montana State Univ., Bozeman, MT, USA, mogk@montana.edu

<sup>3</sup> Dept. of Geological Sciences, Univ. of Florida, Gainesville, FL, USA, pamueller@ufl.edu

The Beartooth Mountains (Montana/Wyoming, USA) provide a blue print for early crustal genesis in the Wyoming Province. The oldest indication of Hadean and Eoarchean crust (3.5-4.0 Ga) is from detrital zircons preserved in quartzites. Lu-Hf isotopic data from these zircons are most consistent with the earliest magmas being derived from marginally-to-undepleted mantle in a plume-like system. The earliest preserved crust (3.6 Ga) is comprised of trondhjemite-tonalite-granodiorite (TTG) lithologies. By 3.2 Ga, voluminous crust was generated in a modern subduction zone analog. A subsequent time of tectonic quiescence (3.2-2.8 Ga) was coincident with stable-platform sedimentation. Ages and Hf isotopic composition of 3.1-4.0 Ga zircons suggest a transition from plume-to-plate style crustal growth. The resultant crust preserves evidence of active and passive tectonism that culminated in a 2.8 Ga continental arc.

The short, but intense, episode of crustal growth at 2.8 Ga included emplacement of primarily TTG magmas, and was accompanied by tectonic interleaving and medium-to-high grade metamorphism of pre-existing supracrustal, mafic and ultramafic rocks, now preserved as numerous xenolithic pendants. The 2.8 Ga arc (TTG) magmatism was areally extensive ( $>10^6$  km<sup>2</sup>) and accompanied by calc-alkaline granitic rocks, and high-Mg diorites (boninites), similar to modern-style arc magmatism. From west to east at the present level of erosion, 2.8 Ga plutonic and metamorphic rocks represent a continuum of crustal levels (~10-25 km). Magmatic rocks in the westernmost area are dominated by undeformed bulbous, peraluminous, epizonal, quartz-monzonitic plutons that cut metasedimentary rocks with low-P assemblages, e.g., andalusite-staurolite (~580°C, ~3.5 kbar). In contrast, in the easternmost area 2.8 Ga magmatism includes mesozonal plutonic rocks, intruded as sheet-like bodies and preserving a series of meta-dioritic rocks to metaluminous TTG suite rocks. Here, the enclaves/pendants of pre-existing lithologies and aluminous migmatites have peak metamorphic conditions of 750-800°C and 7-8 kbar.