

2003 Seattle Annual Meeting (November 2–5, 2003)

Paper No. 239-13

Presentation Time: 4:30 PM-4:45 PM

CHARACTER AND EVOLUTION OF THE 1.78-1.72 GA BIG SKY OROGENY IN THE TOBACCO ROOT MOUNTAINS, MONTANA

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High-grade metamorphism and intense ductile deformation in Precambrian rocks across the core of the Tobacco Root Mountains result from the 1.78 to 1.72 Ga Big Sky orogeny. Earlier phases of deformation and metamorphism are cryptically recorded, but the dominant characteristics of these Precambrian rocks are Proterozoic, not Archean. The Big Sky orogen marks the northern boundary of the Wyoming Province.

Tobacco Root rocks experienced a clockwise PT path that includes a high-P (> 1.0 GPa and >700°C) phase (M1) at 1.78-1.77 Ga, followed by decompression and heating, then isobaric cooling, leading to re-equilibration (M2) at approximately 700°C and 0.8 GPa at 1.72 Ga, terminated by decompression and quenching at 1.71 Ga. Map and outcrop scale structures are contemporaneous and consistent with a single strain ellipse generated during regional simple shear strain accompanying M1 and largely concluded by M2, in which the generally north-dipping compositional layering and parallel mineral alignment foliation were folded by sheath folds and cylindrical folds with axes dispersed in the foliation plane. A consistent north-northeast trending mineral lineation parallels the axis of symmetry of the sheath folds and the cylindrical fold arrays and indicates the transport direction.

These findings constrain the evolution of the Big Sky Orogen. Regional geologic relationships situate the Tobacco Root Mountains in the hinterland of the orogen. Collision to the north and northeast drove the accretion of a distinctive allochthon of probable ocean-crust origin, associated crustal thickening and simple shear, and M1 in the Tobacco Root Mountains. Isobaric cooling leading to M2 re-equilibration is consistent with Tobacco Root rocks next being carried piggyback on thrust faults that propagated south toward a foreland on the Wyoming Province craton. Post-M2 isothermal decompression and quenching are the result of extension structurally above the Tobacco Root Mountains and indicate the collapse of this very thick orogen.

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