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## Characterization and tectonic evolution of a Mesoproterozoic island arc in the southern Grenville Orogen, Llano uplift, central Texas

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### Abstract

Integrated field and U–Pb geochronologic data document the presence and tectonic evolution of a distinct lithotectonic terrane in the southeastern Llano uplift, here termed the Coal Creek Domain (CCD). The CCD consists of tonalitic and amphibolitic gneisses, foliated gabbroic, tonalitic, and granodioritic intrusions, and the structurally emplaced Coal Creek Serpentinite. The oldest rocks in the CCD consist of tonalitic gneisses with protolith crystallization ages of 1326 Ma and 1301 Ma and pre-1292 Ma amphibolitic gneisses (all ages are U–Pb zircon). They were intruded by dominantly mafic and intermediate with subordinate amounts of felsic low-K plutonic rocks between 1286 Ma and 1275 Ma. High-temperature metamorphism and local anatexis that resulted in the formation of gneisses and migmatites occurred between 1301 Ma and 1286 Ma and is suggested to have occurred at ~1292 Ma. Metamorphism at 1256 Ma resulted in the growth of zircons in mafic rocks. The regional significance of this metamorphic event is unclear but it may be related to dynamothermal metamorphism of the CCD.

The contemporaneous emplacement of low-K gabbro, tonalite, and granodiorite and their spatial association with serpentinite, combined with published geochemical data, strongly suggest that the CCD represents an ensimatic arc. The Coal Creek Serpentinite is interpreted as a fragment of oceanic crust that formed either basement to the arc, or in a related back-arc or intra-arc setting. Combined field, U–Pb geochronologic, isotopic, and geochemical data indicate that the magmatic, metamorphic, and structural history of the CCD differs from that of coeval rocks elsewhere in the Llano uplift.

The boundary between the CCD and deformed and metamorphosed granitic and supracrustal rocks to the north is a zone of intense mylonitization and polyphase deformation. This zone is interpreted as the structural boundary between the arc terrane and units to the north.

*Keywords:* Mesoproterozoic; Grenville; tectonics; U–Pb geochronology; accretion