

SEDIMENTARY PETROLOGY OF THE TEDDY CREEK GROUP, BLACKTAIL MOUNTAINS, MT: IMPLICATIONS FOR PROVENANCE & LANDSCAPE EVOLUTION

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ABSTRACT

A previously undocumented sequence of sedimentary rocks has been identified within SW Montana and informally termed the Teddy Creek Group (TCG). This project focuses on the field relations, mineral compositions, and textures of these rocks to determine their origin and relationship to the regionally extensive Renova Formation.

The TCG consists of a basal pebble-conglomerate with distinctive black chert clasts overlain by sandstones interlayered with white-purple volcanic ash. All lithologies have experienced an episode of post-deposition silicification. Petrographic analysis reveals sandstones are compositionally mature with high abundances of quartz and minor amounts of feldspar and muscovite mica. Most grains and lithic clasts are subrounded-rounded, however monocrystalline quartz grains are subangular-angular. The TCG also preserve cross-bedded laminations indicating a fluvial depositional environment as well as fragments of petrified wood.

In contrast, the Renova Formation consists mainly of tuffaceous sandstones containing abundant muscovite and biotite micas. The presence of the micas is attributed to the unroofing of the Idaho batholith. However, the lack of micas, especially biotite, in the TCG suggests a different source than the Renova Formation.

PROJECT OBJECTIVES

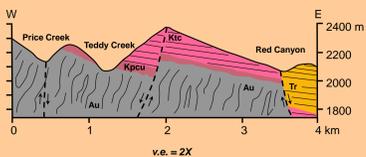
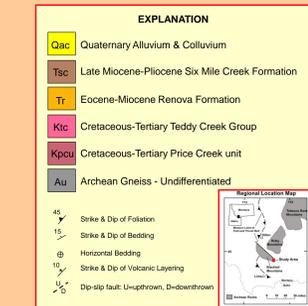
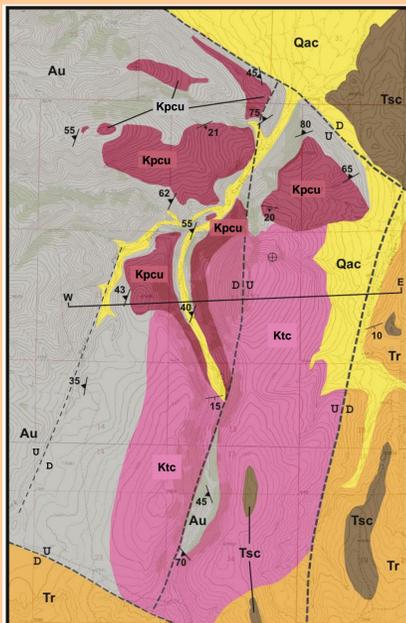
- Document mineralogy & textures within the Teddy Creek Group
- Characterize the transport history that deposited this sediment
- Evaluate field relations between the Teddy Creek Group and the regionally extensive Eocene to Miocene-aged Renova Formation
- Evaluate the tectonic setting of the source area using sandstone composition and discrimination diagram



View of the Blacktail Mountains looking SSE

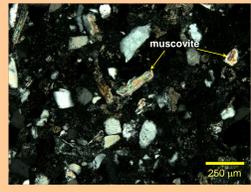
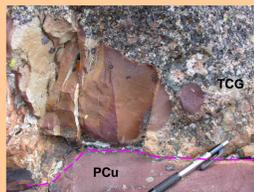
LOCAL GEOLOGIC SETTING

The Teddy Creek Group (TCG) occurs within the Rocky Mountain Basin and Range province of the western U.S. Cordillera. The Blacktail Mountains are one of numerous basement-cored uplifted blocks that occur throughout SW Montana. Basement rocks consist of Archean metamorphic gneisses and Proterozoic mafic intrusions. In the northern portion of the Blacktail Mountains, the basement rocks are overlain by a sequence of Paleozoic and Mesozoic sedimentary rocks. However, in the southern portion of the mountain range, these rocks have been eroded away, and Cenozoic sedimentary rocks unconformably lie on metamorphic basement. The basal unit is a maroon conglomeratic mudstone called the Price Creek unit (PCu). The TCG unconformably overlies the PCu with cobbles of PCu within the basal unit of the TCG.



Geologic map and cross-section of the southern portion of the Blacktail Mountains. Mapping of the Price Creek unit based on work of (1) and (2).

Teddy Creek Group



Characteristics

- Chert pebble conglomerate, quartz sandstone, & volcanic ash
- Cross-bedded in places
- Petrified wood fragments common



Mineralogy & Texture

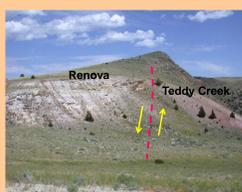
- Immature sandstones, subangular to subrounded clasts
- Minor detrital muscovite mica
- Biotite mica absent
- Silica cemented, well-lithified

Renova Formation



Characteristics

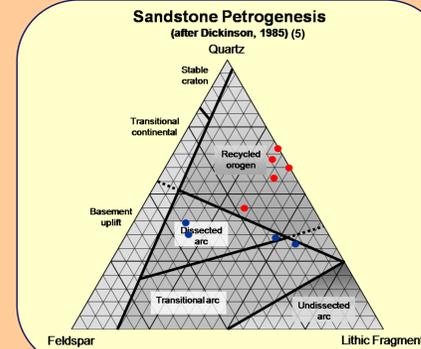
- Predominantly tuffaceous siltstones and quartz-mica sandstones
- Grain size decreases from west to the east
- Mammal fossils (3)



Mineralogy & Texture

- Mature, subrounded to rounded clasts
- Detrital biotite & muscovite mica abundant (3)
- Calcite cemented, poorly-lithified

Tectonic Setting of Source Material



LEGEND
 • Teddy Creek Group
 • Renova Formation data from (4)

Sample #	Quartz	Lithic Fragments	Feldspar	n
PC-28b	43%	33.6%	21.9%	234
PC-25A-03	67.1%	32.9%	0%	240
PC-18A-03	59.4%	39.7%	0.1%	308
PC-5-02	62.7%	32.9%	4.4%	203
PC-6b-02	55.8%	37.4%	6.8%	333

SUMMARY

- Teddy Creek Group sandstones plot within the recycled orogen field implying it was derived from pre-existing sedimentary and/or metasedimentary rocks at a convergent plate margin.
- Renova sandstones plot within the dissected arc field indicative of a volcanic arc source and in agreement with the composition of the Idaho batholith.
- Field relations, mineral compositions, and textures suggest the TCG is distinctive and older than the regionally extensive Renova Formation. Previous workers argue that the Renova sediment was derived from the unroofing of the 80 Ma Idaho batholith into a broad, low-topography basin.
- The origins of the Teddy Creek Group may suggest the existence of high-standing topography in the Late Cretaceous, which may well have persisted into the Miocene.

FUTURE WORK

- $^{40}\text{Ar}/^{39}\text{Ar}$ laser dating of single crystals of muscovite mica to determine the age of the source rocks for the Teddy Creek sandstones.
- Ages will help confirm or refute the relationship between the Teddy Creek Group and the Renova Formation.
- Detrital mica ages may shed new information on the possibility that the modern landscape may have existed prior to 4 million years ago, which many workers speculate.

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- (4) Stroup, Caleb N., Link, Paul K., Janecke, Susanne U., Fanning, C. Mark, Yaxley, Greg M., Beranek, Luke P., 2008, Eocene to Oligocene provenance and drainage in extensional basins of southwest Montana and east-central Idaho: evidence from detrital zircon populations in the Renova Formation and equivalent strata.
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