

2011 TESNAR Mining Workshop Field Trip Guide

Wednesday (September 14) afternoon

Stop 1: Copper Falls Geology and Bad River Geomorphology

Leaders: Tom Fitz and Laurel Woodruff

Bridge over the Bad River

Location: (46.370262, -90.640923)

The bridge is located past the concessions building and marks the trailhead for the Doughboys' Nature Trail.

Upstream of the bridge, there is a large bank of silty sand and some gravel of the Copper Falls Formation. Boulders eroded out of the slope make up the channel and banks of the river. There are a wide variety of lithologies in these boulders, reflecting the diverse bedrock geology of the region.

Rock exposed under the bridge is reddish gray basalt of the Kallander Creek Volcanics. The rock is slightly amygdaloidal and extensively fractured. The amygdules and fractures are filled with calcite stained red with hematite. During the Keweenaw eruptions, these flows were deeply buried by younger lava flows and sedimentary rocks, deep enough to undergo zeolite facies metamorphism. Oxidation of ferromagnesian minerals created abundant hematite that gives the rocks their dark reddish tint. No lava flow contacts are visible in this part of the section, but the lava flows seen from the bridge are tipped to near vertical, dipping steeply to the north.

The bridge, built in the 1930s by the CCC, sits on a foundation constructed with Mellen gabbro. During mining activities in the early 1900s, the Ruggles Mining Company blasted the basalt exposed below the bridge in order to remove a small bedrock ridge to prevent flooding in the mine shafts. This allowed the river to flow directly east before turning north into the gorge; prior to blasting, the river flowed south around a big meander bend.

Brownstone Falls: a Different Perspective

Location: (46.372858, -90.637183)

Past the bridge, along the trail, is another good view of Brownstone Falls from the east side of the confluence.

At this stop, there is another view of Brownstone Falls: to the right, the Tyler Forks River flows in from the northeast, joins the Bad River below the falls, and continues northwest through Devil's Gate. Across the gorge, looking towards Brownstone Falls, an overflow channel can be seen carved into the rock; this abandoned channel funnels water into the Bad River during floods. More mafic and felsic rocks of the Kallander Creek Volcanics are visible—do you see any evidence of a contact?

Stop 2: Palms Formation and Ironwood Iron-formation along Ballou Creek, east end of Mt. Whittlesey

Leaders: Bill Cannon and Laurel Woodruff

Location: (46.31083, -90.57756)

The exposures are in a long road cut along the west side of Lake Road.

Recent road improvement along Lake Road has produced a set of roadcuts along the west side the valley of Ballou Creek that provide a cross section of most of the Palms Formation and part of the lower Ironwood Iron-formation. Starting at the south, at the lower part of the section, a nearly continuous exposure, about 75 m long, of laminated argillite and sandstone illustrates the lower part of the Palms Formation. Proceeding north, up-section, along the outcrop many typical sedimentary structures of the Palms are well exposed. These features have been interpreted to indicate sedimentation on a tidal flat or tidally influenced lagoon. Farther north, a covered interval about 75 m wide is probably underlain by the upper part of the laminated lower Palms Formation and quartzite of the upper Palms Formation. Next, to the north, is a 30 m exposure of the upper part of the Palms Formation quartzite and the Ironwood Iron-formation. The uppermost quartzite is coarse-grained and cross-bedded. The transition to the Ironwood Iron-formation takes place in a 0.5 m interval containing reworked fragments of the Palms surrounded by magnetite. The overlying Ironwood Iron-formation varies from even-bedded magnetite-rich material to irregularly bedded jasper at a scale of a meter or less

Stop 3: Tyler Forks Streamgage and Water Quality Monitoring

Leaders: Brent Olson, Laurel Woodruff, Matt Hudson, and Andrew Lindlof

Location: (46.394722, -90.590000)

Measurements will be demonstrated in and alongside the Tyler Forks River near the USGS gagestation and Bridge on Stricker Road.

The USGS gage station at this site was installed in June of 2011, and has been collecting continuous, updated every 15 min., gage height and discharge data since; both available online (waterdata.usgs.gov).

At this stop, measuring streamflow (Andrew Lindlof), low-level trace element water sampling (Brent Olson), streambed and floodplain sediment sampling (Laurel Woodruff), and temperature monitoring (Matt Hudson) will be demonstrated and discussed. Print outs of the Tyler Forks River at Stricker Road Near Mellen, WI USGS streamgage rating curve will be passed around, along with Flowtracker (streamflow/discharge) data.