# Cambrian stratigraphy at Whitehall, Wisconsin

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## LOCATION

Road cuts north of Whitehall on Trempealeau County Highway "D" and 1.7 mi (2.7 km) north of its juncture with Wisconsin 53 in the SW¼,SW¼,Sec.12,T.22N.,R.8W., Trempealeau County, on the Pleasantville 7½-minute Topographic Quadrangle, 1973) (Fig. 1).

## SIGNIFICANCE

This stop illustrates the contact relationship of the first and second sedimentary cycles in the Cambro-Ordovician rocks of Wisconsin (Ostrom, 1964, 1970). Also, it affords an opportunity to examine and compare three "lithotopes" of the second cycle equivalent to lithotopes of the first cycle, which can be seen at Irvine Park, Mount Simon, and Strum.

## DESCRIPTION

This is an excellent exposure to show the interrelationships of the various Cambrian lithostratigraphic units, beginning with the Eau Claire Formation at the base and extending upward into the Lone Rock Formation (Fig. 2). The section is complete except for about 15 ft (4.5 m) of covered interval midway in the Ironton Member.

Beginning with the sharp and unconformable contact of Galesville on Eau Claire near the base, one can proceed upward through the remainder of the section without evidence of major erosional break.

Regionally, the Eau Claire Formation thins to the east until, in the vicinity of Wisconsin Dells, it is not recognized. North and northwest of the Dells, what is believed to be thin Eau Claire can be seen at Friendship Mound, north of Friendship, and at Sheep Pasture bluff located south of Mauston.

At Friendship Mound there is a 1-ft (0.3 m) bed of fine-grained, silty, iron-oxide–cemented sandstone that separates two thick-bedded, medium-grained, well-sorted sandstone units. The upper of these two units is positively identified as the Galesville Sandstone. At Sheep Pasture Bluff the situation is similar except that the thickness assignable to the separating unit is 7 ft (2 m) and it contains only minor iron oxide. Also at Sheep Pasture Bluff, sandstone clasts occur in the base of the Galesville. A possible interpretation is that the separating unit is the Eau Claire Formation, thinned by pre-Galesville erosion, and that the lower sandstone is the Mount Simon.

A study by Asthana (1969) indicates that the feldspar content of the Mount Simon Sandstone ranges from 3 to 40 percent and averages 18 percent. On the other hand, it is known from numerous analyses of the Galesville Sandstone that it seldom contains more than 1 percent feldspar. Asthana determined that the feldspar content of the sandstone unit below the Eau Claire is higher than that above by a factor of 2 at Sheep Pasture Bluff and of 9 at Friendship Mound. This sharp decrease in feldspar content corresponds to a similar difference between the feldspar content of the Mount Simon and Galesville sandstones elsewhere and is interpreted to indicate that at these exposures the Eau Claire is much reduced in thickness, probably due to post–Eau Claire erosion. Thus, the Eau Claire apparently thins eastward due to pre-Galesville erosion.

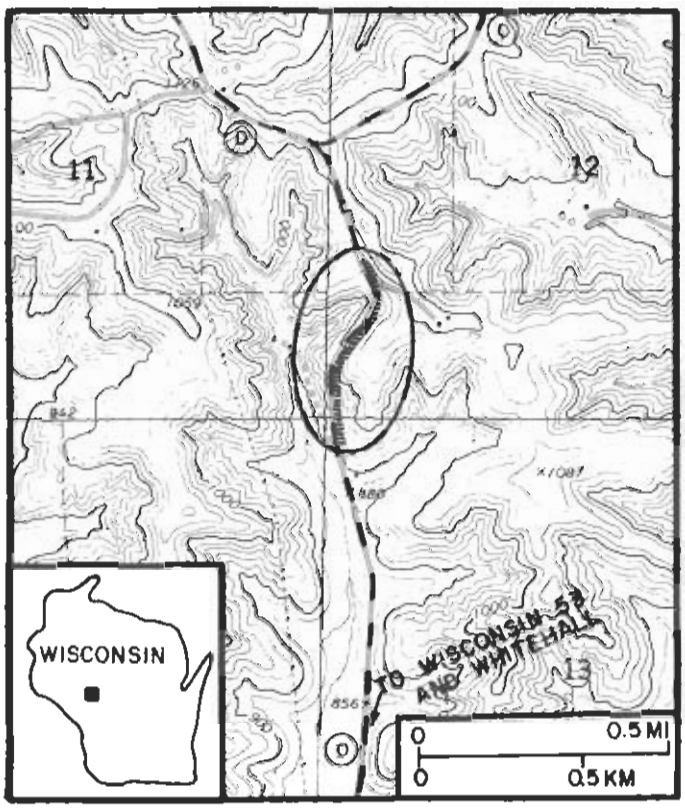



Figure 1. Map showing location of exposures discussed in text.

The Eau Claire–Galesville contact marks the end of one transgressive/regressive sequence and the beginning of the transgressive phase of the subsequent sequence (Ostrom, 1964). The Galesville Sandstone formed during transgression as the result of a process of coalescing of shallow marine near-shore deposits. Rather persistent high-energy conditions are indicated by a noticeable lack of clay, silt, and very fine sand, and the paucity of fossils.

Overlying and transitional with the Galesville is the Ironton Member. The Ironton is interpreted to have formed in an environment located seaward of the beach, where high- and low-energy conditions alternated. Whereas the Galesville is thick bedded, the Ironton is medium bedded and even bedded. Silt and other fine particles are abundant in certain beds. Burrows are common and fossils are present locally. Also, there is commonly

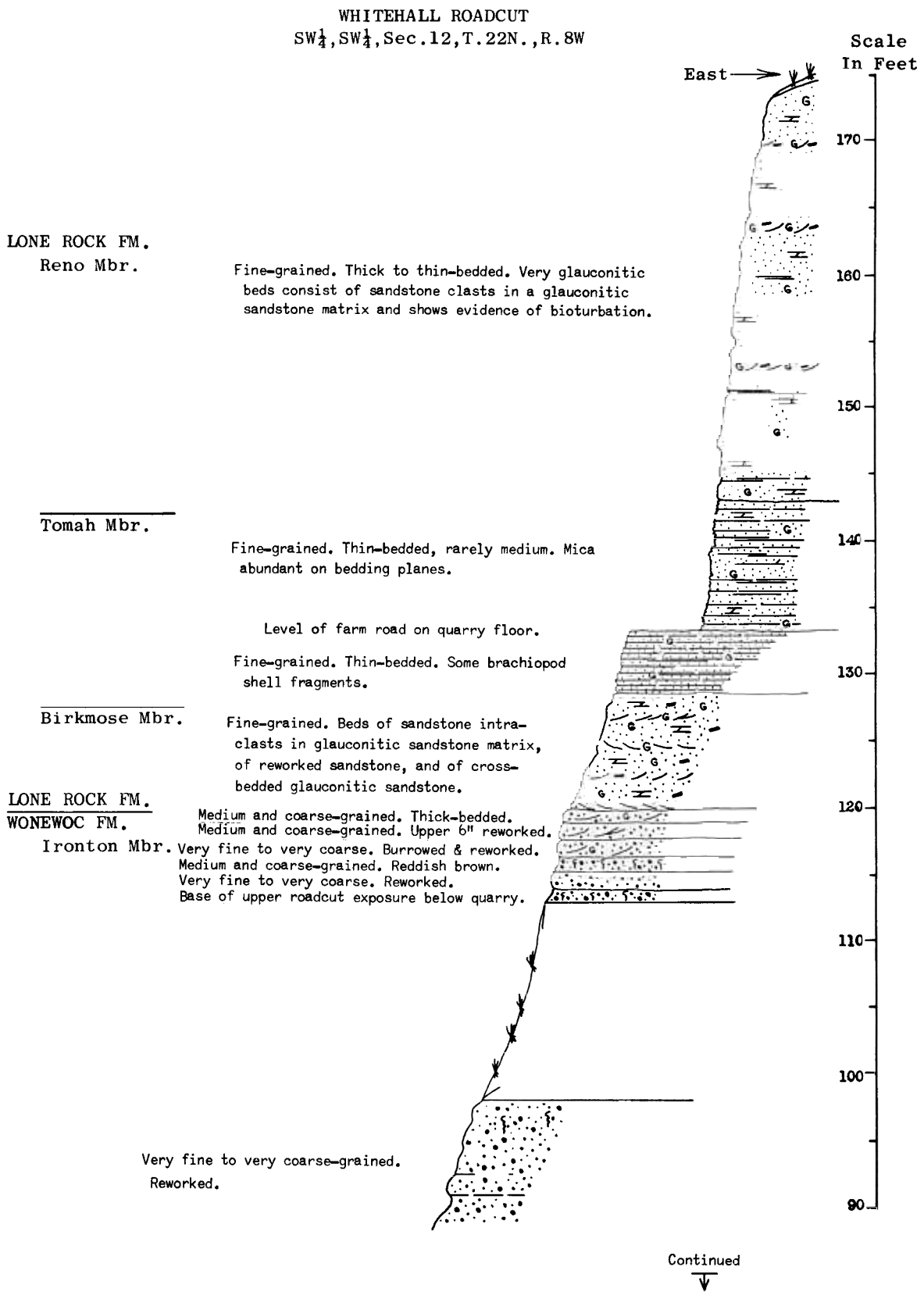
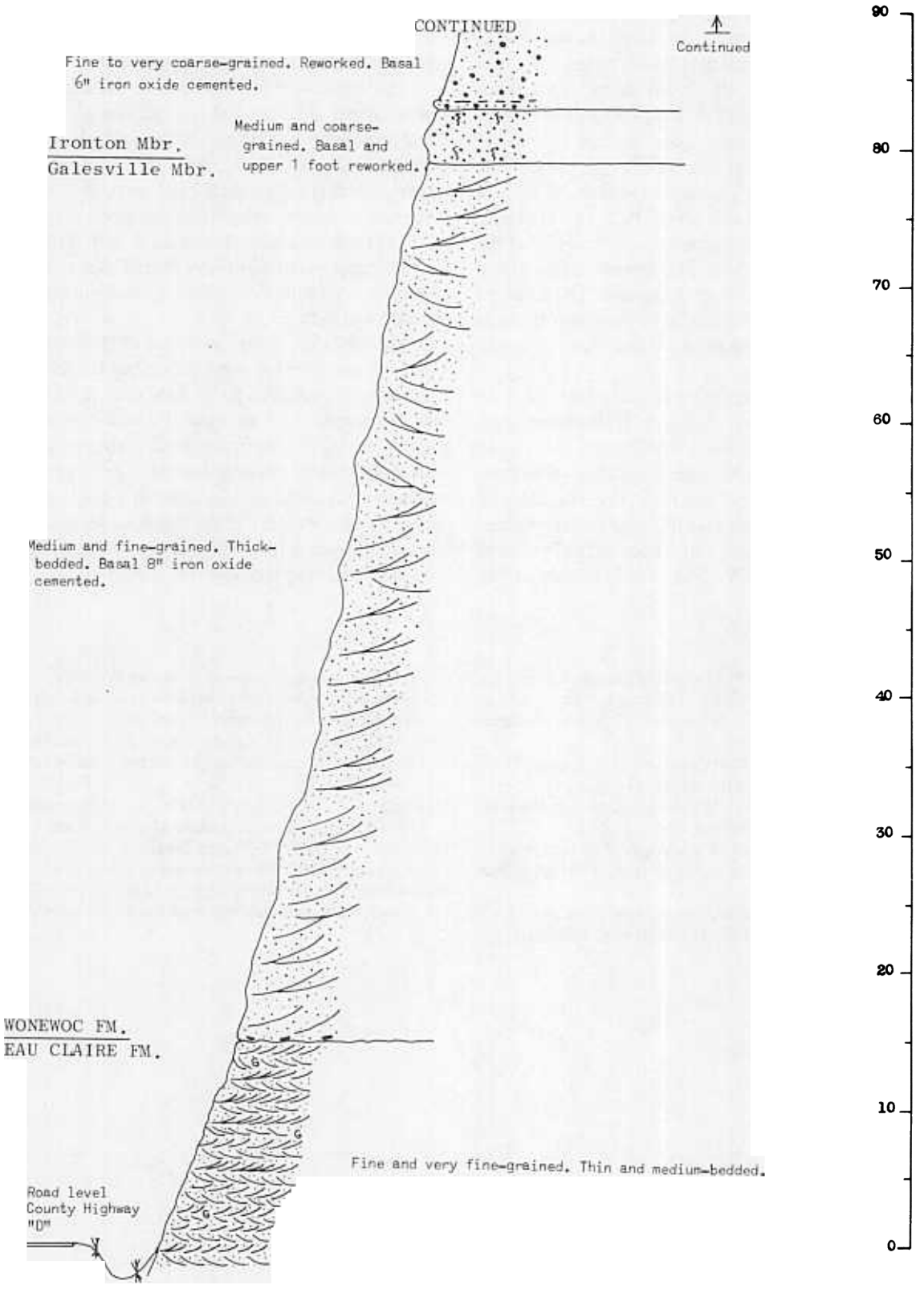



Figure 2. Stratigraphy of Cambrian rocks exposed in SW¼,Sec.12T.22N.,R.8W., Pleasantville 7½-minute Quadrangle (Fig. 1).


CONTINUED
Continued
Fine to very coarse-grained. Reworked. Basal 6" iron oxide cemented.
Ironton Mbr.
Galesville Mbr.
Medium and coarse-grained. Basal and upper 1 foot reworked.
Medium and fine-grained. Thick-bedded. Basal 8" iron oxide cemented.
WONEWOC FM.
EAU CLAIRE FM.
Fine and very fine-grained. Thin and medium-bedded.
Road level
County Highway "D"
90
80
70
60
50
40
30
20
10
0

carbonate cement and glauconite in the upper few feet of the unit. Beds alternate between well-sorted, clean, medium- and coarse-grained, cross-bedded quartzarenite and poorly sorted, reworked and burrowed quartzarenite. Emrich (1966) traced certain of the burrowed beds for as much as 100 mi (160 km) across western Wisconsin, which suggests a broad and flat shelf bottom on which the effects of storm or quiet were widely impressed.

The Ironton Member thins eastward toward the Wisconsin Arch. At Whitehall, the Ironton is about 40 ft (12 m) thick. Traced east and south it thins to disappearance in the bluffs of the Wisconsin River south of Lone Rock. In northeastern Illinois, the Ironton thickens again to a maximum thickness of 150 ft (46 m) (Buschbach, 1964; Emrich, 1966). The Ironton also thickens westward into Minnesota. It is assigned a Franconian age on the basis of fossils.

At Whitehall the Ironton is in sharp contact with the overlying fine-grained glauconitic, shaly and thin-bedded Lone Rock Formation of the Tunnel City Group. The Tunnel City Group consists of two distinct facies in the upper Mississippi valley area, namely a glauconitic facies, the Lone Rock Formation, and a nonglauconite facies, the Mazomanie Formation (Trowbridge and Atwater, 1934; Wanenmacher and others, 1934; Twenhofel and others, 1935; Ericson, 1951; Berg, 1954; Ostrom, 1966, 1970). The Lone Rock facies intertongues with and is laterally and vertically transitional with the Mazomanie facies in the direction of the Wisconsin Arch (Ostrom, 1966).

Abundant burrows and trails in the Lone Rock indicate prolific animal life. Thin bedding and fine particles suggest persistent low-energy conditions. Occasional beds, up to 2 ft (0.6 m) thick and rarely up to 8 ft (2.4 m) thick, of sandstone clasts in a greensand matrix suggest occasional episodes of high energy such as storms. The environment of Lone Rock deposition is interpreted to have been located seaward of that of the Ironton in an area of deeper water and lower overall available energy, as attested to by thin beds, fine sediment, abundant fossils, and lateral persistence of beds.

The similarity of the lower part of the Lone Rock Formation at this site to the lower part of the Eau Claire is believed to be significant. In both cases the upward change is from transitional beds characterized by persistent beds of medium and coarse-grained quartzarenite to fine-grained, shaly glauconitic sandstone with abundant trail markings on bedding surfaces. The two units are interpreted as the manifestation of a single environment repeated by two episodes of transgression separated by a minor regression, which is marked by the Galesville Sandstone and the erosion surface at its base (Ostrom, 1964).

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