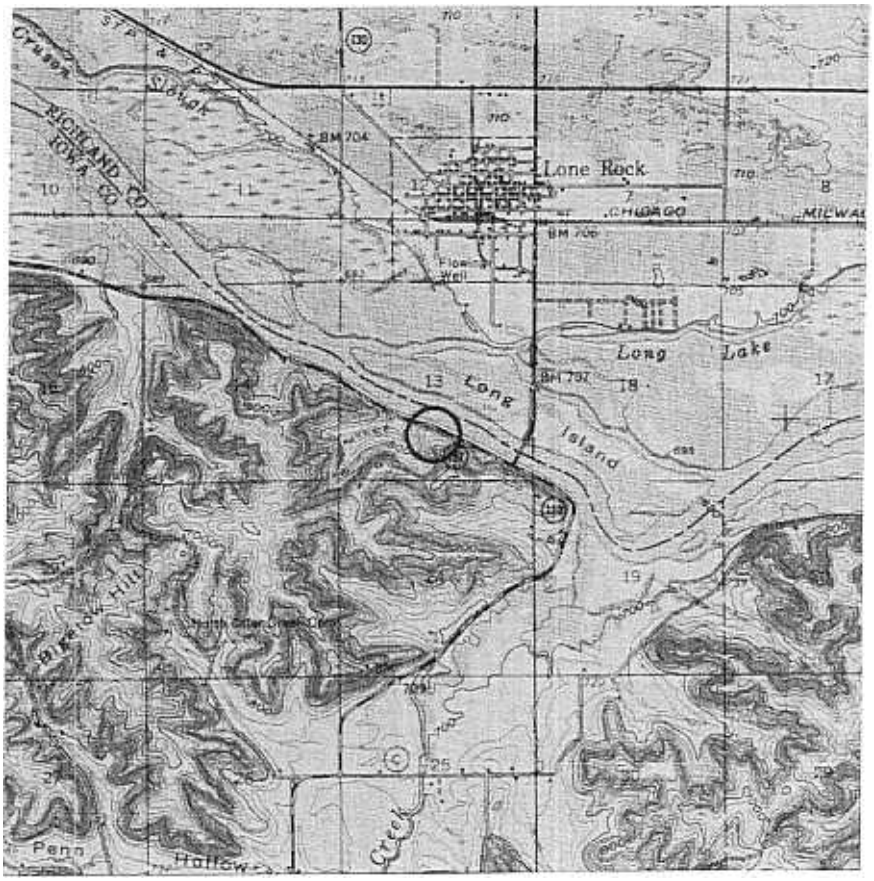
OUTCROP 9

Title: Lone Rock

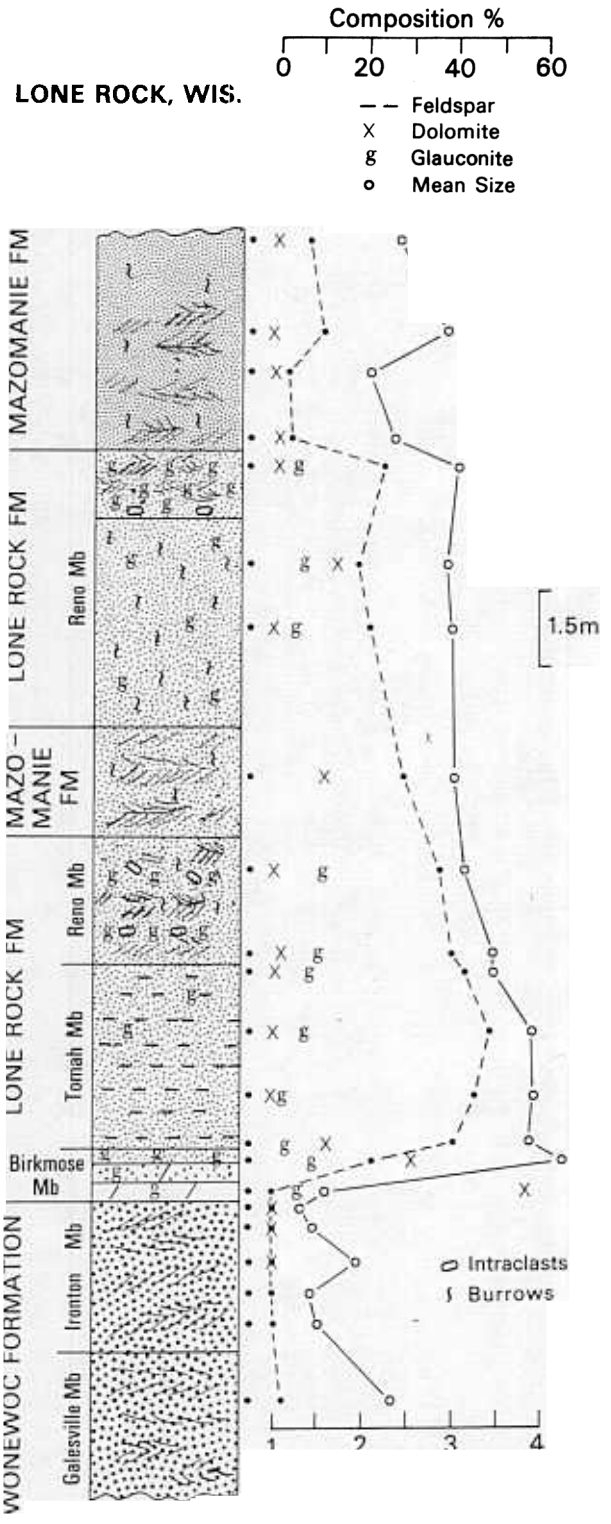
Location: Road Cut on Wisconsin Highway 133, south side of Wisconsin River, 3.2Km south of Lone Rock, Wisconsin in the NW¼, SW¼, SE¼, Sec. 13, T.8N., R.2E., Iowa County (Spring Green 15-minute topographic quadrangle, 1960).



Author: I. E. Odom

Description: This outcrop is an excellent representation of the lithic and sedimentologic characteristics and of the stratigraphic relations of the Lone Rock, Mazomanie, and Wonewoc Formations adjacent to the Wisconsin Arch. Ostrom (1966) chose this outcrop for the type section of the Lone Rock Formation (part of the Tunnel City Group), and except for the Birkmose Member it is a good example of the lithic characteristics of the formation.

The lower 6 meters of the road cut and the bluff down to river level are composed of medium to fine-grained, quartzose, well and moderately well-sorted Galesville and possibly the Ironton Sandstones of the Wonewoc Formation. Generally, the Ironton Sandstone is slightly coarser than the Galesville, and it often contains thin beds that are poorly sorted. These lithic characteristics are not too evident at this outcrop, thus the Ironton may actually be


LONE ROCK, WIS.
Composition %
0
20
40
60
Feldspar
Dolomite
Glauconite
Mean Size
MAZOMANIE FM
LONE ROCK FM
Reno Mb
MAZO-MANIE FM
LONE ROCK FM
Reno Mb
Tomah Mb
Birkmose Mb
WONEWOC FORMATION
Ironton Mb
Galesville Mb
1.5m
Intraclasts
Burrows
1
2
3
4

absent (Ostrom, 1966).

The Birkmose Member of the Lone Rock Formation is thin and contains appreciable reddish dolostone and flat pebble conglomerate throughout this area of Wisconsin. Toward the west, it thickens and more dolomitic and glauconitic sandstones are present (Fig. 35). The very fine-grained sandstones with shale interbeds that succeed the glauconitic sandstone at the top of the Birkmose are assigned to the Tomah Member. This lithology is typical of the Tomah over thousands of square miles in western Wisconsin and eastern Minnesota. As shown in Figure 35, the Tomah thickens west of the Mississippi River, and in southern Minnesota and north central Iowa it composes the entire Lone Rock Formation above the Birkmose Member.

The Tomah Sandstones almost always contain more than 35% K-feldspar, unless they are very dolomitic, and some coarse siltstone beds locally contain 70% feldspar. This high feldspar content is related to the Tomah's exceedingly fine grain size, good sorting, and very leptokurtic kurtosis. The Tomah contains Cruziana and possibly Zoophycos trace fossil assemblages. (Note to petrology instructors -- A suite of thin sections from this outcrop is ideal for use in sedimentary petrology classes to show the strong relationship of feldspar content to grain size that is typical of all Cambrian sandstones in the Upper Mississippi Valley as well as the nature of feldspar overgrowths, the effects of environments on mineralogical sorting, and the principle that mineralogical maturity is not always related to the mineralogy of the source rocks).

The Tomah Member is usually transitional through approximately 1 meter with the overlying Reno Member. The Reno Sandstone is slightly coarser than the Tomah, usually cross-stratified, and very glauconitic. It too contains appreciable feldspar. The enrichment of glauconite in thin bands is related to reworking by currents; the glauconite bands are analogous to heavy mineral concentrations. Note that intraclasts frequently occur near the base as well as within the highly glauconitic beds, and that scour marks occur in the top of the underlying beds. The Reno Member as well as the Mazomanie Formation contains trough and some wedge and tabular-shaped cross sets. Numerous other bed forms and biogenic marks, especially burrows and trails, (Skolithos and Cruziana assemblages) are also present.

The upper part of the Lone Rock section shows the repetition of the glauconitic Reno Member with the sparingly glauconitic Mazomanie Formation. The lower portion of the upper Reno tongue is composed of the rock type that Berg (1954) and others called "wormstone" (see p. 92 for description). Note that the lower tongue of the Mazomanie Formation is very fine-grained and feldspathic, whereas the upper tongue contains both quartzose and feldspathic sandstones. Quartzose Mazomanie Sandstone does not extend westward far beyond this outcrop, however, feldspathic Mazomanie Sandstone is present westward to beyond Richland Center, Wisconsin. The regional facies relations of the Lone Rock and Mazomanie Formations are shown in Figures 35 and 36 and are discussed in the paper by Odom (this guidebook).

Interpretations: Quite different interpretations of the depositional environments of the formations (Tunnel City Group) present here are presented by Odom (this guidebook) and by Byers (this guidebook). Readers are referred to these

papers, however, I advise against the suggestion made by Byers that before you ponder the depositional environments you don special "eyeglasses" for the purpose of making "glauconite" invisible (see Fig. 36).

It is suggested that the origin of the massive, argillaceous "wormstone" beds in the Reno Member (beds of this nature are more numerous and thicker farther west) is related in part to bioturbation and in part to soft sediment deformation (see paper by Odom, this guidebook). This opinion is based largely on the presence of ramdomly oriented clasts that are always present. What other sedimentological processes might form this type of structure? The possibility that the "wormstones" represent tidal channel deposits has been considered, but this origin appears to be ruled out because individual beds often can be traced for many miles.

During investigations of the mineralogical and chemical nature of glauconite in the Cambrian of this area, considerable effort was made to identify the environment where the pellets initially formed. The author has hypothesized (Odom, 1976) that the pellets initially formed in the "wormstones" beds and were subsequently widely distributed in the cross-stratified sandstones by currents that reworked the "wormstones". This major evidences supporting this view are the frequent heavy concentrations of glauconite in sandstones immediately above the wormstones and the presence of scour and cut-and-fill structures in the top of the "wormstone" beds.