

---

PRELIMINARY REPORT ON THE PRECAMBRIAN GEOLOGY  
OF THE ATHELSTANE AREA, NORTHEASTERN WISCONSIN<sup>1</sup>

J. ALLAN CAIN AND WALTER A. BECKMAN, JR.

*Department of Geology, Western Reserve University, Cleveland, Ohio and  
The Evanston Exploration Corporation, Evanston, Illinois*

In a recent issue of this Journal, the general geology of part of northeastern Wisconsin was reviewed (Cain, 1963). It was pointed out that, while a large part of the Precambrian granitic and metamorphic complex has been differentiated into mappable units, an area of some 200 square miles in the central part of the region remained unmapped (Cain, 1963, fig. 2).

Field work completed during the summer of 1962 has provided preliminary information on this area. A detailed description of the petrography, structural petrology, and petrogenesis of the rocks will not be completed until the authors and Dr. J. J. Mancuso have synthesized the results of their several investigations in northeastern Wisconsin. In the interim, it seems appropriate, in view of the previous gap in basic mapping and the problem of correlation between the High Falls Granite (Mancuso, 1960) and Amberg Granite (Cain, 1961), that the new results be made available as a preliminary report.

DESCRIPTION OF THE AREA

Figure 1 indicates that outcrops are quite abundant but not uniformly distributed throughout the area. The southeastern and northwestern parts, particularly, are blanketed by thick glacial deposits so that only rarely is bedrock exposed.

Only two major units are distinguished within the area: the Quinnesec Formation and the younger Amberg Granite (fig. 1).

*Quinnesec Formation*

This unit forms the northern limit of the Amberg mass, is the oldest unit recognized in northeastern Wisconsin, and is presumed to be equivalent to the Waupee

---

<sup>1</sup>Contribution No. 10, Department of Geology, Western Reserve University.

Volcanics described by Mancuso (1960). In addition to the main belt of Quinnesec Formation, small areas occur within the granite mass near Amberg and Middle Inlet.

Rocks of the formation are typically "greenstones," including pyroclastics, sediments, and lava flows. The northern strip of Quinnesec Formation consists of metabasalt at the extreme west, metarhyolite in the central part, and metabasalt with local amphibole schist (presumably meta-sediments and pyroclastics) in the eastern part.

In the northern exposures (fig. 1), rhyolite occurs closer to the granite than any other rock type in the formation, but no actual contacts were observed. The rhyolite is strongly sheared, both macroscopically and microscopically, and pheno-

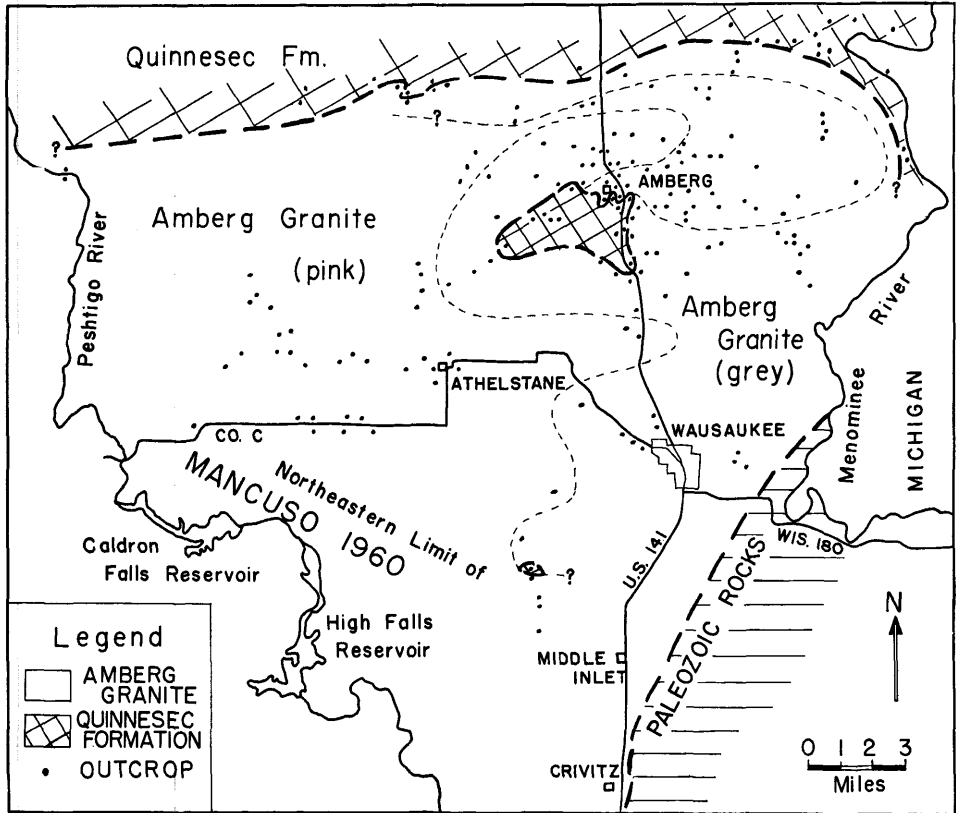


FIGURE 1. Precambrian geology of the Athelstane area.

crysts of quartz and feldspar show well-developed mortar structure. In addition, veinlets and porphyroblasts of potash feldspar are common close to the granite. It seems clear that the rhyolite has been affected by the emplacement of the granite and is older than the Amberg mass. The extent of this rhyolite unit and the rocks immediately north of it were described by Wadsworth (1962).

The small mass of Quinnesec Formation near Amberg consists mainly of metabasalt with a few outcrops of amphibole schist at the eastern margin (U. S. Highway 141). In the northeastern part of this remnant, the greenstone shows sharp, linear contacts with granite, and mineralogical changes are minor. Northwest of Middle Inlet, at an abandoned molybdenum mine, a small wedge of

schistose greenstone is present in the granite, but no other outcrops of Quinnesec Formation were found in that area.

Apart from the very local rhyolite unit, the Quinnesec Formation in the present area is essentially as described by Prinz (1958) and Cain (1961) from exposures to the north.

### *Amberg Granite*

Although this is mapped as one unit, figure 1 shows that varieties characterized by grey feldspars and pink feldspars, respectively, are present in definite geographical areas. Most of the Amberg mass is characterized by pink, or flesh colored, Carlsbad-twinned potash feldspar, plagioclase, quartz, biotite, and hornblende in hypidiomorphic-granular texture. Microcline-perthite is the typical potash feldspar and often contains subhedral plagioclase and biotite. Plagioclase is sodic andesine which is rarely twinned and shows alteration to sericite flakes. Commonly, small plagioclase laths enclose microcline crystals in a rapakivi-like texture. Quartz grains are usually surrounded by a fine-grained aggregate of quartz suggestive of mortar structure. Biotite and hornblende are present as ragged grains showing alteration to iron oxides.

Typically, the grey variety is finer-grained and contains more mafic minerals than the pink one. Further, it commonly contains schlieren, small angular xenoliths of Quinnesec Formation, biotite gneiss and quartz diorite, and exhibits gneissic structure. The gneissic rock is restricted to the margins of the granite mass and, farther from the contacts, is intruded by the pink variety. While much of the gneissic grey granite is merely a border phase of the main Amberg mass, it is very likely that a more complicated picture will emerge after detailed study. For example, it is conceivable that one or both of the gneissic units mapped as Macauley Granite (Mancuso, 1960) and biotite gneiss (Cain, 1961) to the south and north, respectively, are present in this area. Also, several quarries near Amberg are situated in a grey granite which has hypidiomorphic-granular texture.

Buckley (1898: 142-155) described the granites from three large quarries at Amberg and one at Athelstane. He separated the granites into fine-grained grey and coarse-grained red types at Amberg, and a coarse-grained grey variety at Athelstane. We believe that pink seems a more appropriate term than red, while the "grey" granite at Athelstane is perhaps better described as flesh colored (Buckley, 1898, plate 20) and is included in the pink variety (fig. 1).

The pink granite exhibits obvious variations in grain size, color, and biotite/hornblende ratio, and it is hoped that an areal variability study (now in progress) will provide significant information on the composition of this extensive unit. A new isotope geochemistry laboratory at Western Reserve University (under Dr. P. O. Banks) will, it is hoped, shortly provide the geochronologic information essential to the elucidation of the geologic history of the area.

### CONCLUSIONS

The generally unaltered and undeformed appearance of the main Amberg mass suggests (in the absence of conclusive field relationships or radiometric dates) that the unit is younger than other granitic units to the north (Cain, 1961). As yet, the relative ages of the several grey and pink varieties of Amberg Granite have not been established completely. Since outcrops of pink granite can be traced from the High Falls reservoir to Amberg (fig. 1), it seems clear that the Amberg Granite and High Falls Granite are part of the same mass. Similar pink rapakivi granites, in which mortar structure is apparently ubiquitous, have been mapped by the authors along the Wolf River, 30 miles southwest of the present area, and, farther west near Wausau, by Weidman (1907) and others. Detailed petrologic and geochronologic work will be necessary, however, before these

widely-separated exposures can be assigned to a "Wisconsin batholith" (Van Hise and Leith, 1911: 344).

## REFERENCES

- Buckley, E. R.** 1898. On the building and ornamental stones of Wisconsin. Wis. Geol. and Nat. Hist. Surv. Bull. 4. 544 p.
- Cain, J. A.** 1961. Geology of the Pembine area, Marinette Co., Wisconsin. Wis. Geol. and Nat. Hist. Surv. open-file rept. 105 p.
- . 1963. Some problems of the Precambrian geology of northeastern Wisconsin: A review. Ohio J. Sci. 63(1): 7-14.
- Mancuso, J. J.** 1960. The stratigraphy and structure of the McCaslin District, Wisconsin. Ph.D. Thesis, Michigan State University.
- Prinz, W.** 1958. The geology of part of the Menominee District, Michigan and Wisconsin. Ph.D. Thesis, Yale University.
- Van Hise, C. R., and C. K. Leith.** 1911. The geology of the Lake Superior Region. U. S. Geol. Survey Mon. 52. 641 p.
- Wadsworth, W. B.** 1962. Petrogenesis of a quartz diorite pluton near Pembine, Wisconsin. M. S. Thesis, Northwestern University.
- Weidman, S.** 1907. The geology of north central Wisconsin. Wis. Geol. Nat. Hist. Surv. Bull. 15(4). 697 p.
-