

# NEW EVIDENCE ON THE CAMBRIAN CONTACT AT HOPPIN HILL, NORTH ATTLEBORO, MASSACHUSETTS

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**ABSTRACT.** A re-examination of Hoppin Hill, North Attleboro, Massachusetts, yielded an actual exposure of the sedimentary contact between the white, basal quartzite of the lower Cambrian formation and the coarse, pink granite of the Dedham granodiorite, thus substantiating the interpretation put forth by M. P. Billings in 1929. So far as can be determined, no exposure of the contact itself has been observed previously.

## INTRODUCTION

THE writer became concerned with the problem of the age of the Dedham granodiorite when mapping the Medfield and Holliston, Massachusetts, quadrangles for a Ph.D. thesis. These quadrangles have no fossiliferous rocks and yield only the evidence that the Dedham is pre-Mattapan volcanics (Devonian?) and post-Marlboro formation (probably pre-Cambrian). The writer is very grateful to Professor M. P. Billings for helpful discussion of the problem and for making available a student field report of the Hoppin Hill area.

Hoppin Hill, in North Attleboro, eleven miles south of the Medfield quadrangle, is a granite knob with fossiliferous Lower Cambrian slates cropping out on the east side and it is completely surrounded by Carboniferous sediments of the Narragansett Basin. For fifty years this locality, the most important locality in the dating of the Dedham granodiorite, has been a source of geological argument.

## PREVIOUS WORK

Shaler, Woodworth and Foerste (1899, plate 27) gave a sketch map of the east side of the hill and described in detail the fossil localities. They were uncertain about the age relations because the actual contacts were not exposed. They state (p. 390) that "the Cambrian strata apparently follow the general trend of the eastern margin of the granite hill" and (p. 391) that "the temptation is very strong to consider the quartzite and the associated green shales as forming the lowest beds of the series." However, under general features (p. 8) they state "on top of this formation (Lower Cambrian) and

the granites which have broken through it, come the Carboniferous beds."

C. H. Warren and S. Powers (1914, pp. 459-460) interpreted the structure as an intrusive contact of granite against the lower Cambrian slates, thus indicating a post-Cambrian age of the granite.

B. K. Emerson (1917, p. 37) accepted Warren and Powers' conclusion that the granite is younger than the Hoppin slate. He stated that "the base of the Cambrian strata is not exposed in the district and their thickness is unknown, but is probably not less than 600 feet."

M. P. Billings (1929, p. 103) assigned the Dedham-Salem group to the pre-Cambrian because — "at Hoppin Hill, North Attleboro, the fossiliferous Lower Cambrian slates rest unconformably on eroded granodiorite. A basal quartzite about ten feet thick intervenes between the slates and the granodiorite."

C. R. Williams, as a student under Dr. Kirk Bryan and Dr. Marland Billings at Harvard University, made a field study of the Hoppin Hill area when the reservoir was particularly low in 1930. He measured the thickness of the Cambrian strata as 340 feet, including 15 feet of white quartzite at the base (1931, manuscript report loaned by Professor Billings).

L. La Forge (1932, p. 22) stated that "the Dedham granodiorite is almost surely younger than the Cambrian rocks of the region, and the gabbro or norite of Nahant, which is here included in the group, is certainly post-Cambrian." He gave the age as probably early Paleozoic.

#### PRESENT WORK

In February 1949, when the writer visited Hoppin Hill, the reservoir covered much of the fossiliferous red slate and limestone north of Hoppin Hill Avenue, and reached directly

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#### PLATE 1

Fig. 1. Steep ledge of coarse granite at right; white quartzite in left center resting against the granite.

Fig. 2. Close view down into excavation along the contact. Granite on right and quartzite dipping away steeply to left. Strike  $N37^{\circ}E$ , dip  $78^{\circ}SE$ .

Fig. 3. Steep ledge of granite on left, quartzite in center foreground. Topographic shelf, developed on the quartzite, shows in right half of picture.

(3 photos from locality 1, marked in Fig. 1)



FIGURE 1



FIGURE 2



FIGURE 3

to the granite on the steep lower east side of the hill. At least two outcrops of the fossiliferous strata can still be seen north of the reservoir, one on the south side of the railroad and one in the meadow close to the north side of the railroad embankment (marked f in fig. 1).

The writer turned attention from the fossiliferous strata to the basal quartzite noted by Billings (1929, p. 103). A greenish white quartzite can be seen at the water's edge on the west side of the reservoir about 50 yards south of Hoppin Hill Avenue (fig. 1, locality 2). At the south end of the hill is an elongate, rocky knoll of elevation 250 feet (fig. 1, locality 1). At approximately the 230 foot contour on the southeast side of the knoll is a shelf or shoulder, 10 to 25 feet wide and about 100 yards long. The shelf has a long continuous outcrop of hard, white quartzite dipping away from the granite that forms the top of the knoll and dipping toward the red shale. The granite is coarse-grained, pink and white, with milky quartz standing a quarter inch above the pitted pink feldspar on the weathered surface.

At one spot the quartzite and granite were only one foot apart and in several places less than ten feet apart. Excavating a few inches of soil at the spot where the granite and quartzite were closest revealed the actual contact in somewhat crumbly rock at the bottom of a trench ten inches deep and four inches wide at the bottom. The granite maintains its coarse grain (several millimeters) directly to the contact. At the contact the feldspar is kaolinized and bleached to a light buff color and a little chlorite and epidote are present. In the bottom few inches of quartzite are some grains as large as two millimeters, whereas higher up the grains are mostly less than one half millimeter. No indication of shearing or slipping occurs on the contact. Thus, the sedimentary contact of basal white quartzite against the granite is definitely proved and the possibility of a fault contact or intrusive contact is clearly eliminated. The strike and dip of the contact is N37°E, 78°SE. Plate 1, figs. 1, 2 and 3, show the ledge of granite, the small excavation along the contact, and the quartzite resting unconformably on the granite (fig. 1, locality 1). To the writer there is no longer any doubt of the pre-Cambrian age of this granite.

To try to reconcile Warren and Powers' (1914, pp. 459-

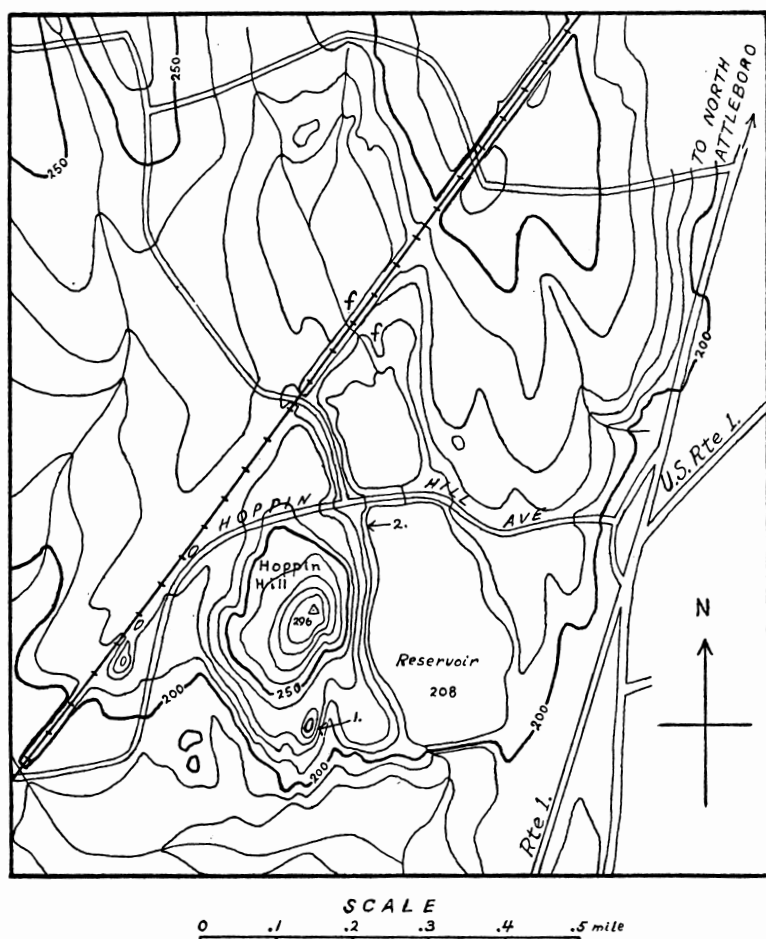


Fig. 1. Map of Hoppin Hill, North Attleboro, Massachusetts, enlarged from U. S. G. S. Attleboro quadrangle. Locality 1 marks the exposure of the sedimentary contact,  $N37^{\circ}E$ ,  $78^{\circ}SE$ . Locality 2 has quartzite dipping eastward. Fossiliferous Cambrian outcrops are indicated by f.

460) opposing view, it may be noted that they described only the outcrops north of Hoppin Hill Avenue. Those outcrops consist chiefly of red shaly limestones, so susceptible to deformation that slaty cleavage is more prominent in them than bedding. The few outcrops still above the reservoir do

not reveal enough indication of bedding to warrant the statement that they strike toward and dip into the granite.

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