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HAMILTON MOUNDS IN ADAMS COUNTY, WISCONSIN

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Hamilton Mounds are ridges of an exhumed Huronian quartzite monadnock entirely surrounded by Upper Cambrian sandstone. The fact that these mounds are quartzite rather than sandstone, though known to local people, did not come to the attention of the Geological Survey until 1929. The mounds are in a sparsely settled area in the northeastern part of Adams County, and had probably not been investigated by a geologist until they were called to the attention of the senior author by the County Highway Commissioner. Road surfacing material was produced by crushing the broken-up quartzite on the end of one of the mounds. In 1931 the junior author made a topographic map of the mounds and mapped the outcrops. Hamilton Mounds are situated in the Central Plain near the western edge of Wisconsin outwash, and either in Glacial Lake Wisconsin or near its eastern margin. They are located in section 31, T.20, R.7E. and section 36, T.20, R.6E.

The mounds rise to a maximum height of 160 feet above the exceedingly level Central Plain, the general level of which is about 1000 feet above sea level. Necedah Mound, some 20 miles to the southwest, is the nearest outcrop of quartzite. Steep-sided buttes of Cambrian sandstone break the monotony of the plain. The mounds were not glaciated. Outwash from the Wisconsin ice extends nearly to the northeastern mound. The nearest known occurrence of Glacial Lake Wisconsin clay is about 4 miles to the southwest. Surrounding the mounds the soil of the plain is loose sand produced by the weathering of sandstone. In many places the quartzite talus and ledge are covered by a thin

veneer of loose sand. At elevation 1050 in the NW of the SW¼ of section 31, T.20, R.7E., a test pit exposed sandy gravel overlain by 1 foot of wind blown sand. The gravel consists largely of sub-angular quartzite pebbles. There are a few small pebbles of granite, rhyolite, and chert. The erratics suggest that the mounds were surrounded by the waters of Glacial Lake Wisconsin, and that the erratics were ice-rafted. There is a terrace surrounding the mounds. This may have been developed in part by Glacial Lake Wisconsin. It appears more likely, however, that this is a Cambrian feature.

There are eleven distinct quartzite mounds which coalesce at their base in a slight elevation about one square mile in area. Four mounds in the northeast trend northeast-southwest. All the others trend more nearly east-west. Viewed from the south the mounds appear to have long, gentle slopes, and fairly level tops. From the west the mounds are shown to be narrow, sharp ridges separated by fairly definite valleys.

With the exception of one small exposure of Cambrian sandstone lying unconformably upon the quartzite, all rock exposures are massive, vitreous, well-jointed quartzite varying in color from pinkish-gray to greenish-gray. The minimum thickness of the quartzite is 160 feet. Thin sections show the composition of the quartzite to be 85 to 90% quartz, 13 to 15% sericite, and 0-2% hematite. The quartz is entirely recrystallized and shows strain shadows. Heavy mineral separations were made from the samples corresponding in location to the samples used in thin sections. Well rounded, slightly elongated chatter marked zircons were found in each of the eight separations. Only six grains of garnet, rough and irregular in shape, were found. One long, narrow grain of tourmaline, with well rounded edges, was noted.

In three places the quartzite is brecciated. Angular fragments of quartzite appear floating in white vein quartz. In a few cases the walls of openings

are covered with well developed quartz crystals. The road material excavation has special interest. Here the quartzite loses its hard, massive character and becomes a mass of rubble which yields considerable amounts of kaolin on weathering. At one point in the excavation a deposit of pure kaolin fifteen by fifteen feet in area and two feet in depth was found, and the surrounding quartzite has taken on a white coating of the material even though the rock is still quite solid. On the southern edge of the pit at the head of the road coming in from the east, the kaolin-bearing quartzite becomes noticeably more weathered and is found in more rounded pieces rather than as the usual angular rubble.

A series of thin sections taken from this more altered material and the kaolin-bearing quartzite show a transition from fairly fresh feldspar through sericite to kaolin. Because of the freshness of the orthoclase and albite present and the unstained condition of some of the quartz associated with them, it would seem that this part of the quartzite has been affected by the intrusion of pegmatitic juices which brought in the fresh feldspars and quartz and at the same time partly altered the feldspars to sericite by hydrothermal action. The hydrothermal alteration probably hastened the weathering of this portion of the quartzite as compared to the rest of the area since outside of the small altered area sericite is present in a rather fresh state.

The only rock exposures of the area are found on the tops of the hills and in the road material excavation where the loose surface rubble has been largely removed. Bedding has been masked to a great extent, but is found in enough places, along with cross-bedding, to make the determination of tops of beds and dip and strike possible. Ripple marks are rare and unsatisfactory as structural criteria because of their indefiniteness. Gradation of grain in beds has been entirely obliterated by recrystallization. Flow cleavage

is absent and fracture cleavage is present only in a few places. The structures are based almost entirely on data derived from bedding and cross-bedding. That the markings in the rock which are taken for bedding are true bedding and not the result of iron staining is shown by the continuity of their strike and dip within one outcrop and in adjacent outcrops, by the differential weathering of the bands on exposed surfaces, and by the almost diagrammatic development of cross-bedding.

The rocks of the exposures are rather closely jointed. A set of joints trending east-west is universal. The dips of these joints vary from place to place with the dip of the bedding, the latter striking in the same general direction as the joints. It would appear, then, that these joints are true bedding joints. Movement has occurred along these bedding joints on the hill at the forty corner just north of the center of section 36, T.20, R.6E. and in the road material excavation as shown by the development of thin chloritic and sericitic layers along the joint surfaces. It is impossible to determine the direction of movement because of the small amount of schistose material present.

The general strike throughout the area is N75°W. Dips on the long chain of five hills running east-west through the area indicate that the hills are on the north limb and near or on the crest of an anticline. At the western end of the chain the dips are steep and to the north. At the extreme east end of this hill dips are lower and to the north. Cross-bedding shows that the beds are right side up in all cases. The high hill in the southwest corner of the southwest forty of the northwest quarter of section 31 shows a strike of N75°-80°E. with a dip of 40° to 45° to the north and the tops of the beds to the north.

A second chain of hills, three in number and south of the chain just described, also has steep dips to the north in the western portion, with the

tops of the beds to the north. The whole set up of these two chains of hills indicates that both the trough of a syncline and the crest of an anticline lie in the valley between them. A minor anticline whose axis is parallel to the area of the two larger folds is found in the northwest portion of the area.

A feature of interest is the displacement suggested by the position of the two high hills on either side of the township line in the center of the map. No direct evidence of faulting has been found. The slopes of the hills are covered with talus and sand and are overgrown with scrub oak. A comparison of strikes and dips on the two hills seems to agree fairly well. Those on the west are N50° to 60°E. with dips to the northwest. Those on the east hill are N75° to 85°E. with dips to the north. If such a fault exists it would probably strike a little east of north and the hills east of it have moved south relative to those west of it. A horizontal displacement of six hundred feet is suggested on the map.

Hamilton Mounds are small ridges of Huronian quartzite which have been exposed by the removal of the overlying Upper Cambrian sediments. The quartzite has been intensely folded and dynamically metamorphosed with the production of sericite. The axes of the folds strike N75°W. and probably pitch to the east. Local brecciation and possible intrusion of pegmatitic and aplitic juices occurred with and after the folding producing resistant well cemented breccias and hydrothermally altered, easily weathered areas. A possible fault occurring after the folding is indicated by the displacement of the two main ranges of hills.