ICE FLOW IN THE VICINITY OF THE MANETTO HILLS, DIX HILLS AND HALF HOLLOW HILLS IN CENTRAL LONG ISLAND, NY

PowerPoint Presentation

Herbert C. Mills
33 Beacon Drive
Port Washington, NY 11050

Introduction

The Manetto Hills, Dix Hills and Half Hollow Hills (MDH Hills) straddle the Nassau/Suffolk County line in central Long Island. They form some of the highest elevations on Long Island including Jayne's Hill (located in West Hills County Park in South Huntington), the highest point on the island at 400 feet above MSL. The north/south trending MDH Hills are topographic anomalies when compared to the east/west trending end moraines that dominate Long Island's topography from Brooklyn to the "Twin Forks". This is clearly evident on a digital elevation map of the island where the northern ends of the MDH Hills are seen merging with the Ronkonkoma Moraine while the central and southern portions extend several miles to the south.

Previous Work

The origin of the MDH Hills has not received much attention since Fuller first described them in 1914 as eroded remnants of terraces comprised of Manetto Gravel (a coarse quartz gravel of undetermined age) overlying Cretaceous sands and clays. However, Fuller does not mention the presence of a thin till south of the Ronkonkoma Moraine. In discussing this area, Isbister (1966) stated that "The Ronkonkoma ice sheet overrode its terminal moraine at least for a short distance and then retreated to the north, depositing a mantle of ground moraine in its wake." In 1996, Sirkin took a very different approach and described the MDH Hills as interlobate moraines that were deposited between the southeastern face of the Hudson Lobe and the southwestern face of the Connecticut Lobe as the ice front retreated to the north from the Ronkonkoma still- stand. He attributed the stratified drift south of the Ronkonkoma moraine that drapes the MDH Hills to the deposition of kame deltas in pro-glacial lakes ponded against the ice-front. However, this does not adequately explain how these lakes were confined to the south, east and west, nor the presence of a widespread, thin till miles south of the main ice front. Since there is no consensus on the origin of the MDH Hills, the present study (based on field notes taken in 1985 and follow-up visits in 2012-13) seeks to determine what mode of origin is best supported by field studies and well records.

Description

Numerous well- logs plus outcrops in sand mines and road cuts show that the MDH Hills, and the Wheatley Hills to the west in Old Westbury, all are underlain by Cretaceous sediments that, in these areas, vary in elevation from 100 to over 200 feet above mean sea level. The frigid, periglacial environment near the margin of the Laurentide ice sheet would have formed a deep permafrost in these otherwise unconsolidated sediments. The frozen hills would have tended to impede the advancing margin of a glacier that was reaching its southern limit due to warmer

temperatures in the lower latitudes. As advance and melting reached equilibrium, the ice margin established a stationary front banked up against the northern slopes of the MDH Hills. This stationary front remained at, or near, this position for an extended period of time (hundreds of years ?) based on the extensive accumulation of stratified drift that makes up the Ronkonkoma terminal moraine. Sand and gravel, in the form of large, coalescing kames, was deposited along the Ronkonkoma ice margin as well as on the broad outwash plain south of the moraine. Discontinuous patches of till are found in the moraine and boulders occur on the surface, but they are smaller and much less abundant than those found on the Harbor Hill end and ground moraine on Long Island's north shore.

South of the Ronkonkoma terminal moraine, a discontinuous thin till layer is observed at or near the surface of the MDH Hills as far south as Farmingdale on the eastern fringe of Bethpage State Park. Outcrops of till are scattered along road cuts, recharge basins, and old excavations and are generally quite unimpressive. Many outcrops described in field notes from 1985 have been obscured by development. The till is usually between one and three feet thick and the composition varies from silty-sand to sandy-gravel with a scattered assortment of cobbles. The largest clasts are about 16 inches in their longest dimension but cobbles larger than 12 inches are rare. This contrasts with the boulders, up to 5-6 feet in length that are found on the surface of the Ronkonkoma moraine. The lithology of the till stones is quite varied and includes felsic and mafic gneisses and schists as well as Cretaceous ironstones and the ubiquitous (on Long Island) "puddingstone" conglomerate.

Explanation

So what glacial process most likely resulted in the deposition of the thin, loosely compacted till and associated stratified drift that is found draped over the MDH Hills south of the moraine? To find an answer we can look at present glacial margins in Iceland and Greenland. South-central Iceland is covered by Vatnajokull, a small ice-cap glacier that varies in thickness from 420 to over 1000 meters (1400 – 3300 feet). It is a remnant of an ice sheet that covered all of Iceland during the last Ice Age. The glacier is situated on a plateau that is separated from the coast to the south by a broad outwash plain, referred to in Iceland as the "sandar". At several locations, outlet and piedmont glaciers (tens of meters in thickness), fed by Vatnajokull, transport unsorted rock debris and copious amounts of stratified sand and gravel beyond the margin of the main ice field onto the outwash plain. In Greenland, especially along the southern and southeastern coasts, many outlet glaciers extend beyond the margins of the main ice-sheet. Unlike in Iceland, they behave more like typical valley glaciers as they scour the bedrock creating fiords at their downstream margins. Although, the long, continuous, lobate end moraines on Long Island indicate that they formed along relatively stable ice margins, it is likely that thinner outlet glaciers occasionally spilled over, or through, the main ice front. This pattern could explain the thin till and outwash covering the MDH Hills as well as other reports of thin tills with cobbles and small boulders south of the Ronkonkoma Moraine in East Moriches, North Bellport, Central Islip and North Amityville (King, et.al., 2003). None of these locations, based on their descriptions, would have required a major incursion of the main glacier. In fact, the lack of substantial lodgement or meltout tills, regional continuity of till units, or recognizable glacial landforms strongly suggests that the tills were deposited during localized expansion of relatively thin, low energy, outlet or piedmont glaciers .

Conclusions

1. The MDH Hills owe their topographic expression due primarily to the elevated core of Cretaceous sediments that underlie each group of hills.

2. The relative position of the MDH Hills, the Ronkonkoma Moraine and the southern outwash plain does not support the "interlobate moraines" interpretation for MDH Hills. This interpretation would have required the main ice front to advance several miles further south before retreating to the Ronkonkoma Moraine stationary positi.
+0
+++……
……
……
……
……
……
……
……
……
……..0on;0 field evidence for such an advance by the main ice sheet is lacking.

3. The author agrees with Isbister (1966) that during the Wisconsinan maximum the advancing ice front overrode the Ronkonkoma Moraine to some extent leaving behind deposits of outwash and thin surface till.

4. Models for this type of "spillover" ice beyond the margins of continental ice sheets can be found today as ice-tongues and piedmont glaciers in Iceland, Greenland, and the Taylor Dry Valley in Antarctica.

5. A lab model to simulate the partial overriding of an end moraine was designed to help visualize of how this process might look. *(PowerPoint)*

Acknowledgments

Thanks to Allan Lindberg for his assistance with the fieldwork in 2012 and 2013, and to Lois Lindberg for preparing the "slime" for the modeling experiment on ice-flow.

References

Fuller, M. L., 1914, The geology of Long Island, New York: Geol. Survey Prof. Paper 83, 231 p.

Isbister, J., 1966, Geology and hydrology of northeastern Nassau County, Long Island, New York: U.S. Geol. Survey Water-Supply Paper 1825, 89 p.

King, C., Mion, L., Pacholik, W., Hanson, G. N., 2003, Evidence of till south of the Ronkonkoma moraine, Tenth Conference on Geology of Long Island and Metropolitan New York: SUNY Stony Brook.

Munzer, U., 1991, Iceland - A Dynamic Country, Brannenberg, Germany, 211 p.

Sirkin, L. A., 1996, Western Long Island Geology, Book and Tackle Shop, Watch Hill, R.I., 179 p.