POSSIBLE GLACIOTECTONIC SOURCE FOR COARSE OUTWASH, COLD SPRING HARBOR, NY

PowerPoint

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Introduction

This is a follow-up report to my presentation at the 20th Annual Long Island Geologist Conference, April 13, 2013. ["An extraordinary deposit of very coarse stratified drift, Cold Spring Harbor, NY"]. That report includes the site location, a description of the strata, and some ideas on how this unusual coarse layer of stratified drift might have been deposited on the proximal slope of the Harbor Hill Moraine in Cold Spring Harbor.

This year, I am proposing a possible source for the well-rounded stones and a two-stage transport mechanism for emplacement in their present location. The scenario proposed here is based on known glaciotectonic processes found on an adjacent north shore peninsula and the reasonable elimination of other possibilities.

Source of material

A stratified drift (outwash) sequence located on the proximal slope of the Harbor Hill Moraine in Cold Spring Harbor includes a coarse clastic stratum consisting of well-rounded, cobbles, pebbles and small boulders composed primarily of quartz and quartzite. In a surface till just above the cobble layer, metamorphic and igneous erratics, representative of mainland bedrock, are abundant but quartzite and quartz are uncommon. Also, the majority of the till stones are not well-rounded. From this, it can be inferred that the cobbles and boulders in the till have a different source than those in the stratified drift. The crystalline bedrock of the Manhattan Prong and SW Connecticut is a likely source for the till, while the Long Island Sound Valley is a more probable source for the stones in the outwash. The high degree of rounding and short distance (4-5 miles) of glacial transport suggests that these stones were already rounded before they were re-deposited as stratified drift.

Accounts of the Cretaceous sediments and topography in northern Nassau County are found in Suter et.al. (1949), Swarzenski (1963), and Isbister (1966). Deep channels in the Long Island Sound Valley, located adjacent to the present shoreline in western L.I, have been described by Stone, et.al. in "Quaternary Geologic Map of Connecticut and Long Island Sound Basin" (2005). These channels provide a plausible source for the cobble layer at Cold Spring Harbor and, perhaps, another coarse stratified unit at a similar elevation (about 200 feet above MSL) at the southern end of Hempstead Harbor [per. communication. S. Englebright, 2013].

The earliest river channel sediments probably originated from the erosion of Cretaceous sediments during the Tertiary Period when the L.I. Sound Valley was formed. These deposits

were rounded during this long fluvial episode, and perhaps again during periodic major glacial stages when sea level was low enough to drain the sea water from the L.I. Sound Valley. However, an original pre-Cretaceous bedrock source of the abundant quartzite is still undetermined. (Poughquag Formation in NY or Cheshire Quartzite in NE CT are possibilities).

Another association of coarse quartz clasts with Cretaceous beds is found in the old sand mines in Port Washington, NY. Cobble-size ventifacts of crystalline quartz and quartzite are found on the surface of the Cretaceous beds where they have been exposed by mining and erosion of the overlying glacial deposits. It is inferred that katabatic winds near the glacial margin shaped these stones during one or more glacial episodes. The absence of ventifacts of other compositions (except occasional Cretaceous ironstone) suggests they were not brought to Long Island via ice-transport from a mainland source, but rather originated in Cretaceous strata in the vicinity of Long Island Sound and the north shore.

The bluish metallic stain found on the surface of many of the CSH cobbles appears to be a mix of manganese and iron oxides. This coating is rarely observed on stones in glacial drift deposits on Long Island, but is sometimes found on the interior of Cretaceous concretions. Its presence in this stratum might be related to the genesis of the cobbles in iron oxide-rich Cretaceous beds.

Glacial tectonics

During the Woodfordian maximum on L.I., an advancing ice-front detached and thrust-faulted several large, intact masses of frozen Cretaceous sediments from a north-facing cuesta on the Port Washington peninsula (Mills & Wells, 1974). Pre-existing (Illinoian?) glacial drift was also deformed by folding and faulting due to the plowing force of the overriding Cretaceous masses. In addition, C-14 dated, mid-Wisconsinan interstadial marine units consisting of clay, peat and oyster shells, were described from Port Washington by Sirkin (1980). These beds were sheared from deposits in a pre-Woodfordian Long Island Sound and carried about 5 miles south before lodging some 200 feet above MSL about 2 miles north of the Harbor Hill Moraine. Deep permafrost conditions must have existed during this powerful Woodfordian surge in order to move these huge, intact masses of frozen sediments.

This documented occurrence of the transport of large blocks of frozen sediments by thrust-faulting caused by advancing ice strongly suggests that this high-energy process also could have removed permafrost masses of coarse river sediments from the Sound Valley. Thrust-faulting of the frozen stream bed sediments not only served as the mechanism for removing the river sediments from the valley, but it also raised their elevation by a “ramping-up” process that pushed the permafrost slabs up and over the frozen cuesta of Cretaceous beds.

The cobble-laden beds then were incorporated into the basal zone of the glacier where melting of the permafrost made them available for re-deposition as well-rounded , stratified drift on the proximal slope of the Harbor Hill Moraine.

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