High-resolution 2-D CHIRP sub-bottom study reveals buried paleo-channels in Long Island Sound

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Long Island Sound is a generally east-west trending tidal estuary framed by Connecticut coastline to the north and by Long Island, New York (Lewis and DiGiacomo-Cohen, 2000). The embayment narrows at both ends as it meets the Atlantic Ocean in the east and as it connects with the East River in the west (Knebel and Poppe, 2000). Over the last 21,000 years, the geologic configuration of this body of water has been shaped by ice advance and retreat, glacial lake formation and drainage, and subsequent marine transgression, which have contributed to the development of a complex system of partially buried paleo-channels that extends throughout the Sound. In an effort to build on previous geophysical studies of this region, a high-resolution 2-D CHIRP sub-bottom survey was conducted in a study area located between Bridgeport, CT, and Port Jefferson, NY, in west-central Long Island Sound. Resultant sub-bottom profiles were initially analyzed with computer software Kingdom of Seismic Micro-Technology, Inc., and the channel reflector was manually digitized. GIS software (ArcMap, version 10.1) was then used to interpolate the manual digitization of the channel surface, which generated a detailed reconstruction of the paleo-channel system in the study area. Results indicated at least five previously unidentified buried paleo-channels, which measured anywhere between 100-400 m across and were typically buried beneath 6-12 m of postglacial sediments. Several of the uncovered channels appeared to connect the deep east-west depression just north of the sub-aerial Stratford Shoal to the main east-west conduit to the south of the shoal, suggesting a new dimension to the channel system and flow pattern. Channels were carved into varved laminations of glaciolacustrine clay, which were likely deposited when glacial Lake Connecticut occupied the basin nearly 17,000 years ago. Our study showed that 2-D CHIRP survey was an effective tool for identifying subtle sub-bottom features, and our results provided a detailed look at the path of glacial drainage and marine transgression through the partially buried paleo-channel system of Long Island Sound.