FIGURE 1-16. Boston and the lower Charles River estuary showing marshes in 1775.

FIGURE 2-29. Fault slice of Late Triassic redbeds, the Middleton Basin, in the Bloody Bluff Fault Zone, bordering dark Late Proterozoic volcanic rock mined in the SanVal Quarry, Middleton.

FIGURE 3-13. Pebbly mudstone slump deposit, which has been called the "Squantum Tillite," in the Cambridge Argillite at Squaw Head, Squantum, Quincy.

FIGURE 3-14. Mattapan rhyolite found at the Tileston School, Mattapan Square, Dorchester.

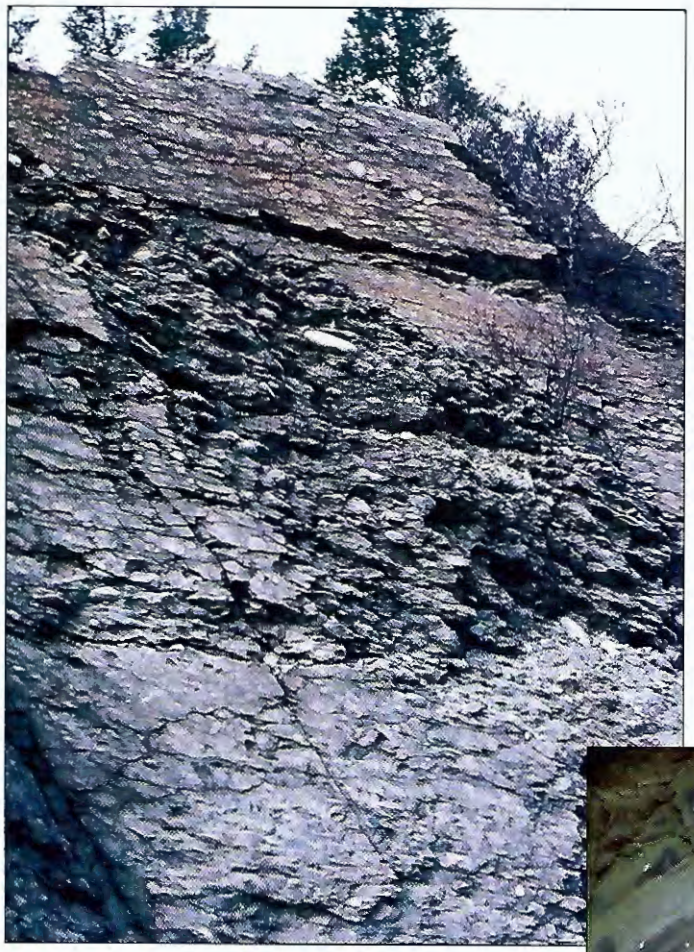


FIGURE 3-15. Roxbury Conglomerate at Route 128 (Interstate 95), south of Route 9, Newton.

FIGURE 3-17. Cambridge Argillite at the Somerville Quarry, Somerville.

FIGURE 3-18. Thin-bedded, laminated Cambridge Argillite on Grape Island.

FIGURE 3-19. Thin-bedded Cambridge Argillite capped by gently dipping diabase dike at Little Brewster Island.

FIGURE 3-20. Slump deposit of conglomerate with tuff block and Cambridge Argillite at Squaw Head, Squantum, Quincy.

FIGURE 3-21. Thin-bedded, laminated Cambridge Argillite with slump folds at Rainsford Island.

FIGURE 3-22. Contorted laminated mudstone bed slump in sandstone of the Cambridge Argillite at Squaw Head, Squantum, Quincy.

FIGURE 3-23. Siltstone and mudstone of the Lower Cambrian Weymouth Formation at Brewster Road in Quincy.

FIGURE 3-24. Argillaceous beds with brown cherty layers, Lower Cambrian Weymouth Formation at East Point in Nahant.

FIGURE 3-26. Ordovician siliceous sandstone and siltstone clasts in Pennsylvanian conglomerate at Sachuest Beach in Middletown, Rhode Island.

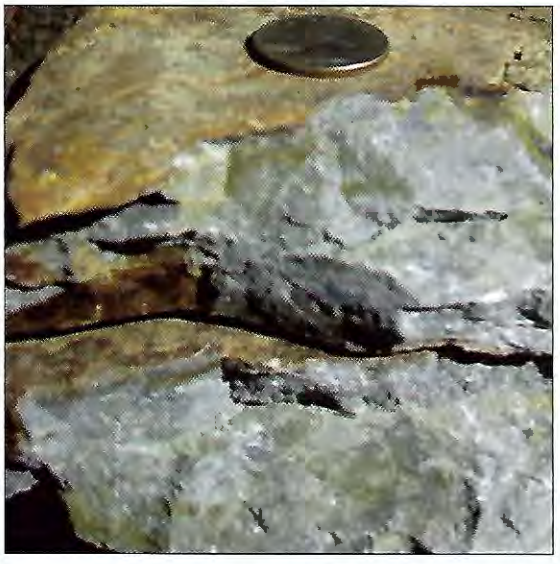


FIGURE 3-25. Middle Cambrian Braintree Argillite, slightly metamorphosed by Quincy Granite at Hallum Street in Milton.

FIGURE 3-28. Ash flow tuff of the Chickatawbut Road Flow Member of the Blue Hills Rhyolite at Blue Hills.

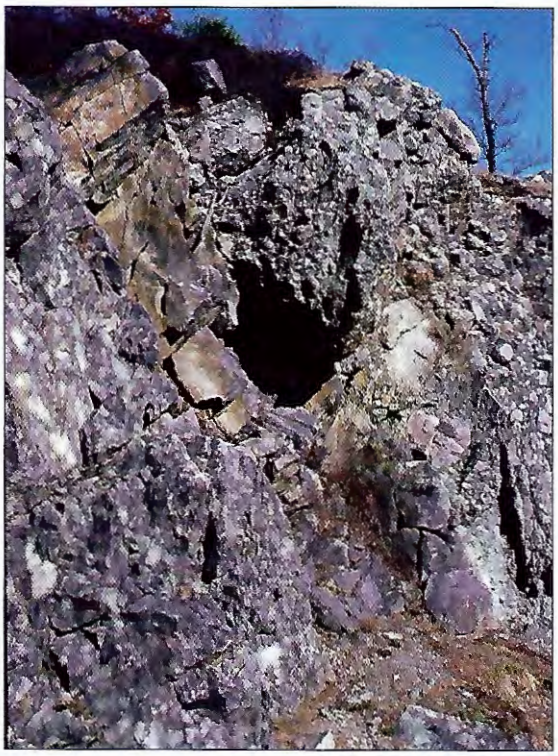


FIGURE 3-30. Pondville Conglomerate, upper right, overlying Blue Hills Rhyolite volcanic rock, left side, along an irregular contact in the Norfolk Basin on the north side of Route 128 in Milton.

FIGURE 3-31. A close-up view of Pondville Conglomerate just above lower contact, at Routes 128 and 28 in Quincy.

FIGURE 3-32. Red sandstone beds of the Wamsutta Formation, southbound lane of Route 24 just south of Route 128 in Randolph.

FIGURE 3-33. Amygdaloidal basalt of the Brighton Basalt (Melaphyre) at Wiltshire and Chestnut Hill streets in Brighton.

FIGURE 3-35. Nahant Gabbro cut by a nearly contemporaneous diabase dike that is offset at East Point in Nahant.

FIGURE 3-36. Nahant Gabbro, sheared with drag folds.

FIGURE 3-37. Quincy Granite closeup at the Granite Rail Quarry in Quincy.

FIGURE 3-39. Blue Hills Granite Porphyry at Blue Hills.

FIGURE 3-40. Curved greenstone dike cutting the Cambridge Argillite (on the right) at the southeast end of Calf Island.

FIGURE 3-41. Greenstone dike cutting Late Proterozoic Dedham Granodiorite on Route 128, near Exit 16, west of route 109 in Dedham.

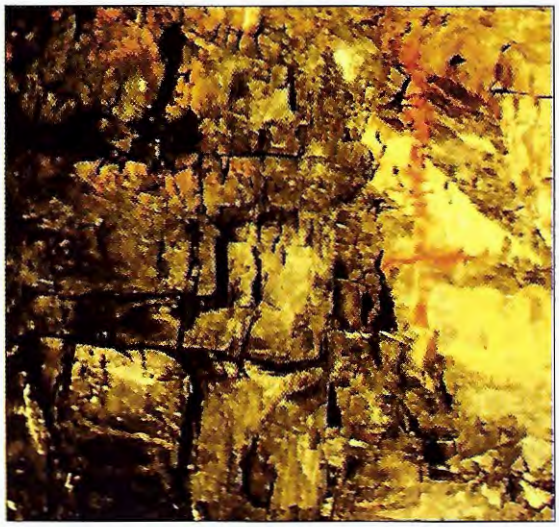


FIGURE 3-47. North-trending diabase dike with columnar jointing and with fault gouge along its border at the Wellesley Extension Intercept Tunnel in Dedham.

FIGURE 3-44. Gabbro dike from Porter Square Subway Station in Cambridge with fragment of granite. (Photo courtesy of Allen Hathaway.)

FIGURE 3-49. Kaolinized Roxbury Conglomerate at Blue Hill Avenue at Franklin Field in Dorchester.

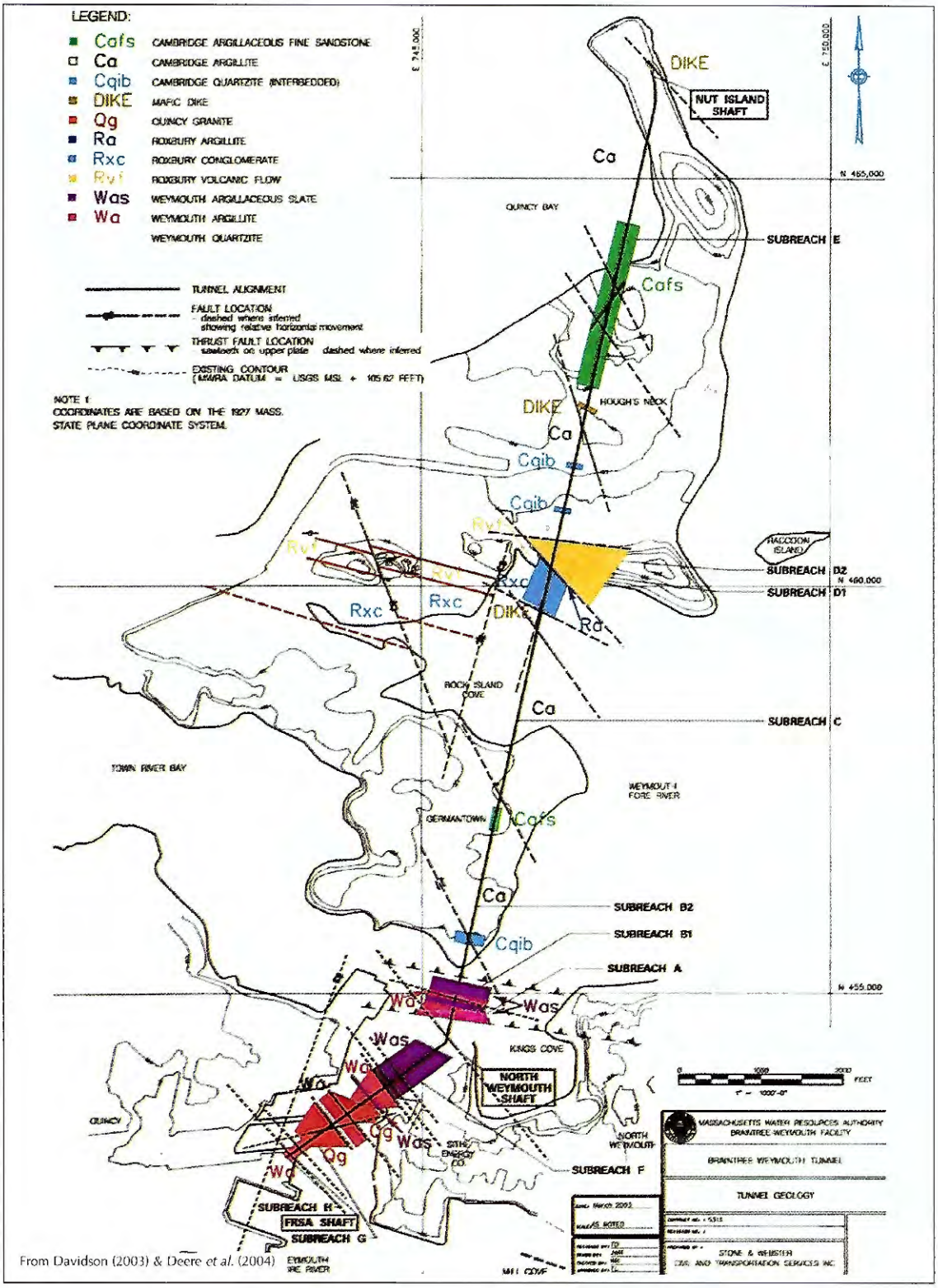


FIGURE 3-55. Geologic map of the Braintree-Weymouth Tunnel from Hough's Neck to Nut Island, Hingham.

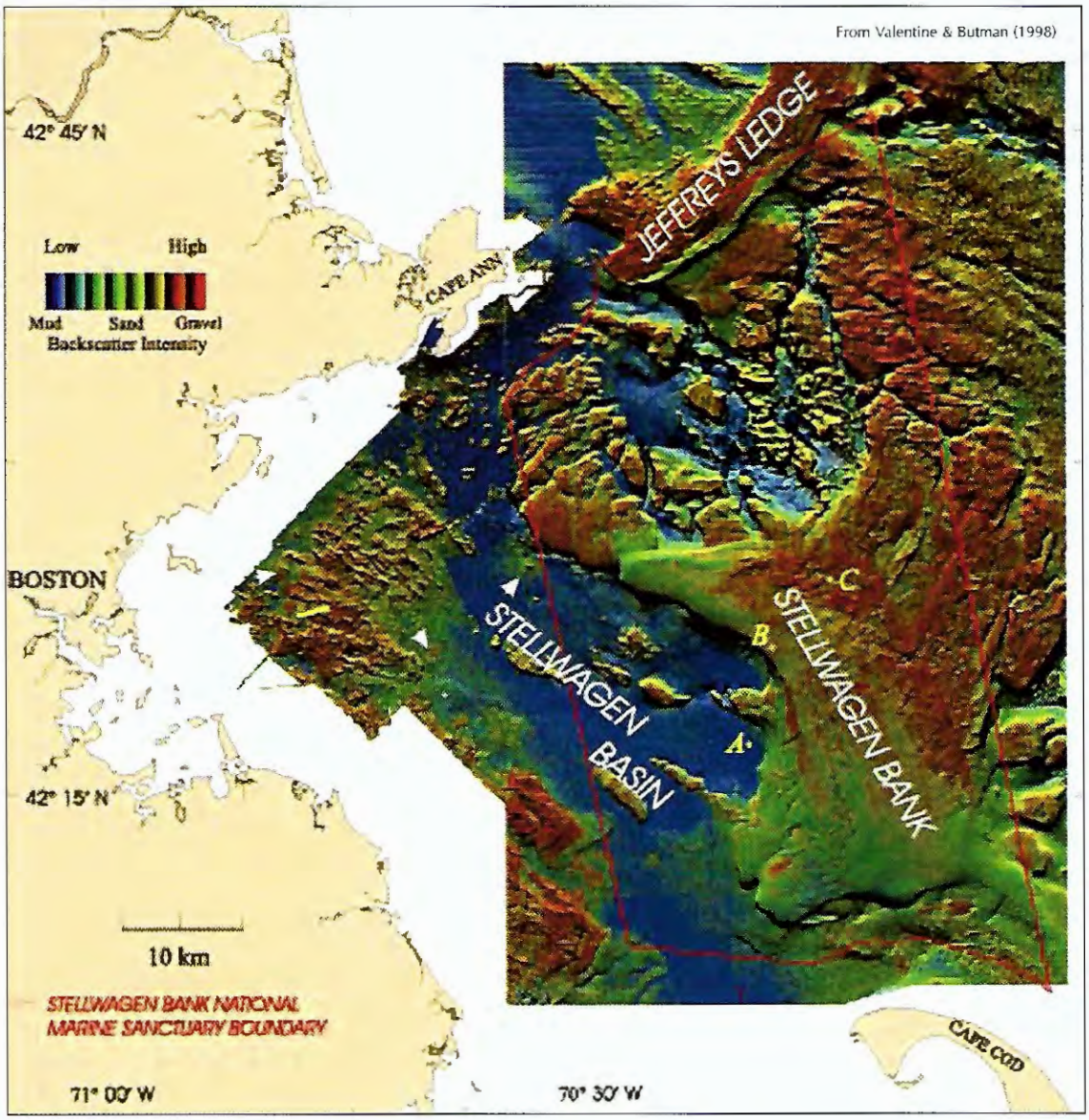


FIGURE 3-72. Sea floor topography from Massachusetts Bay to Stellwagen Bank.

FIGURE 3-77. Typical till at Great Brewster Island.

FIGURE 3-78. Great Brewster Island showing rougher and gullied lower till overlain by smoother upper till.

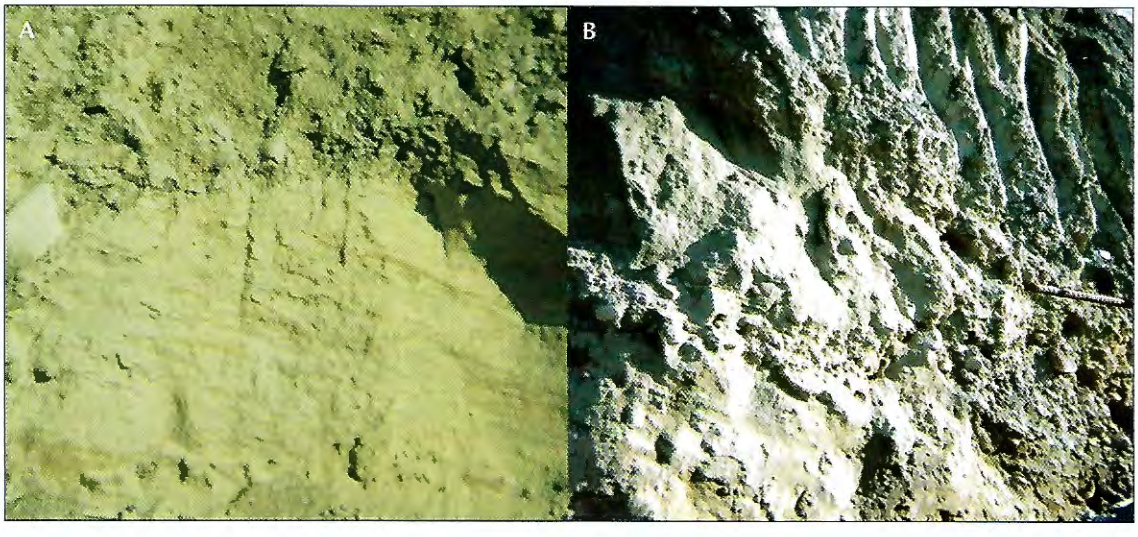


FIGURE 3-80. Photos of deltaic sand and gravel north of Beacon Hill, looking south at the face against Cambridge Street during the excavation for the Holiday Inn showing: (A) partly faulted stratified sand and gravel, and (B) tilted stratified sand and gravel, unconformably overlain by till.

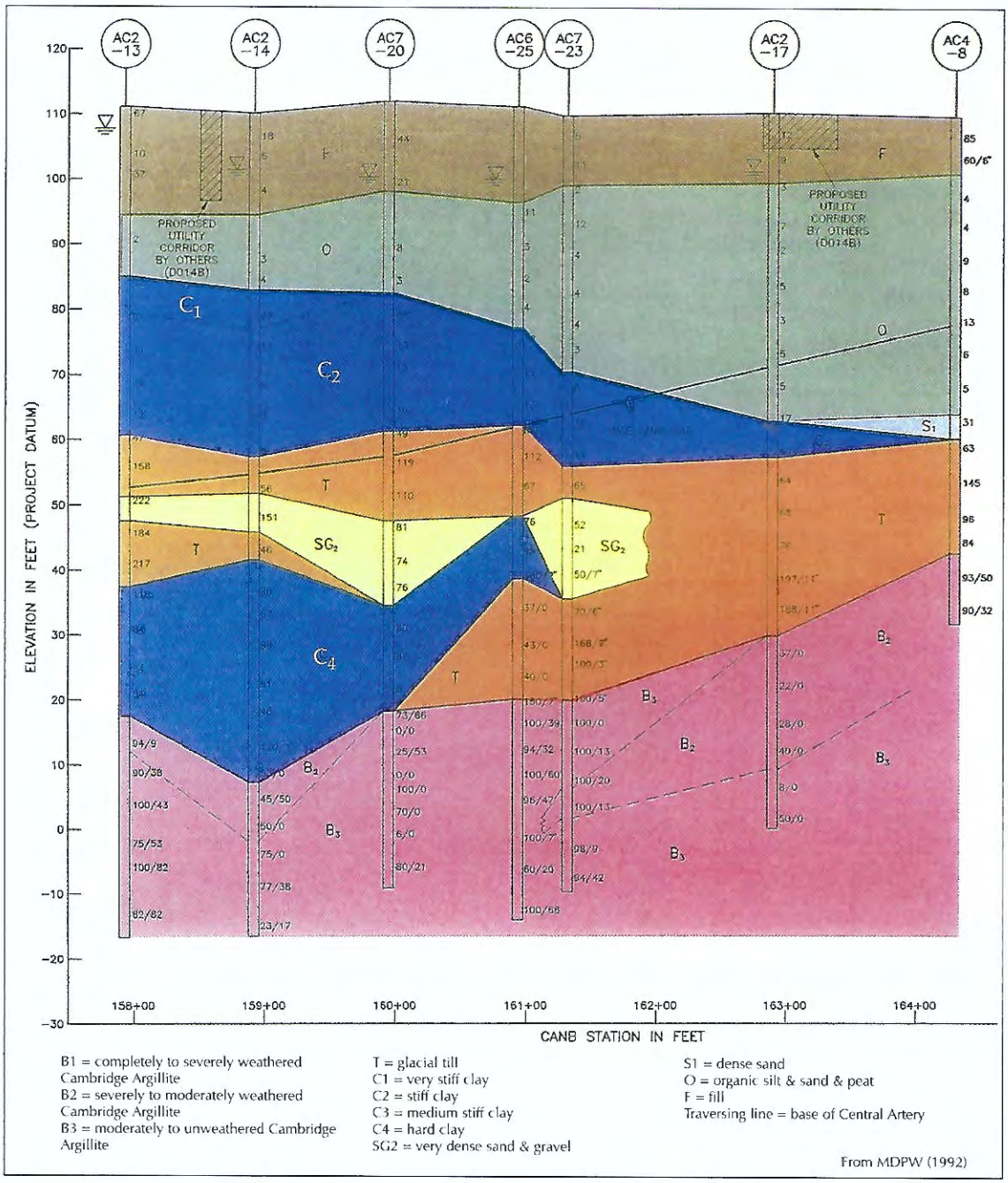


FIGURE 3-82. Geologic cross-section (from the southwest) along the Central Artery Tunnel between Valenti Way and Causeway Street (east slurry wall, stations 158+00 to 164+00) showing an apparent clay and sand filling of a channel cut through the lower till and later covered by upper till and partially thrusted between the upper and lower tills, which here are undifferentiated.

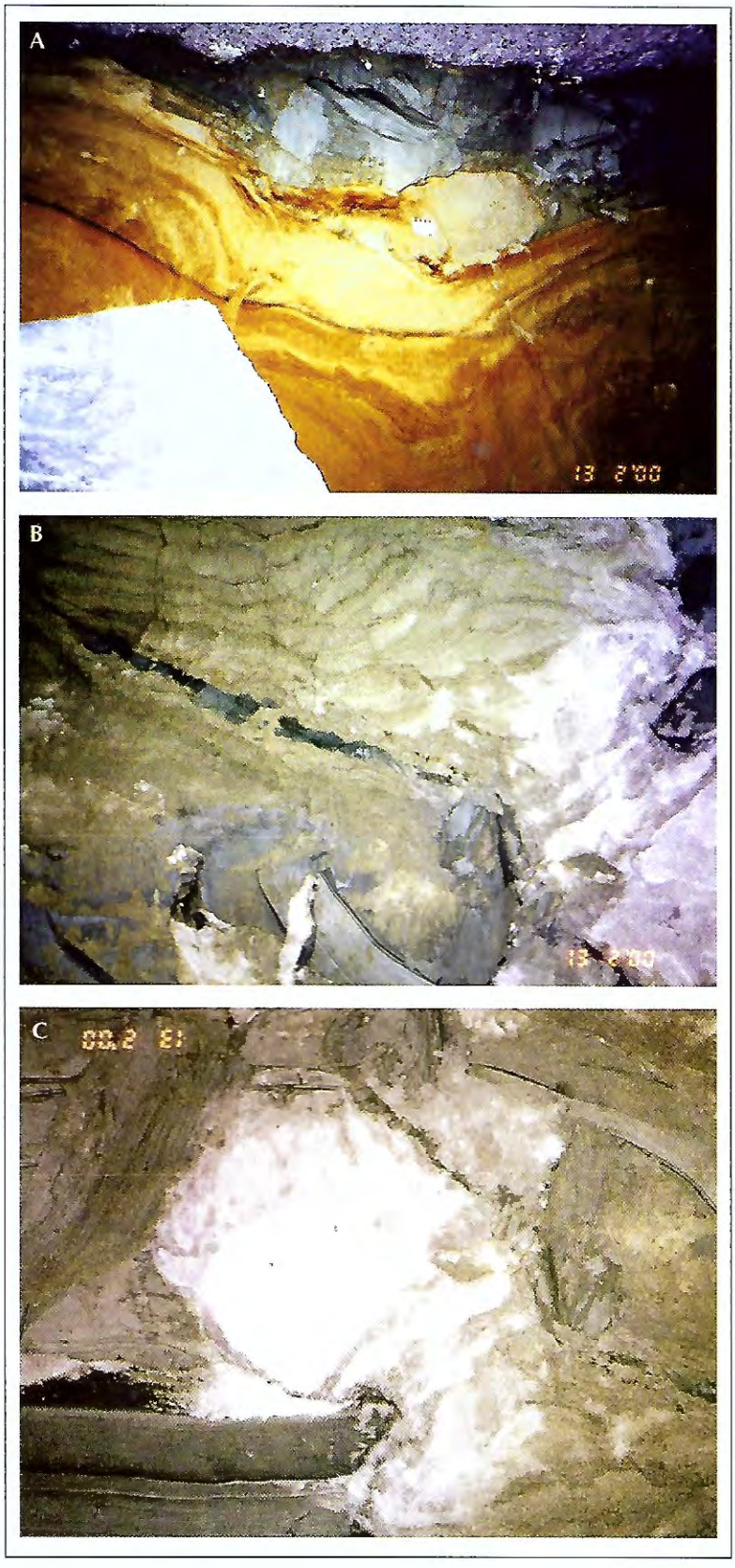


FIGURE 3-84. Excavation for garage at Millennium Place, Tremont and Boylston streets, on the southeast corner of Boston Common in 2000, showing (A) banded blue clay on lower left complexly faulted against blocks of stratified sand, (B) graded-bedded fine-grained sand on upper right thrust over sand with clay seams along small thrusts on lower left (which also shows teeth marks of the backhoe in the lower part of the photo), and (C) banded orange and buff stratified sand with brecciated blue clay above.

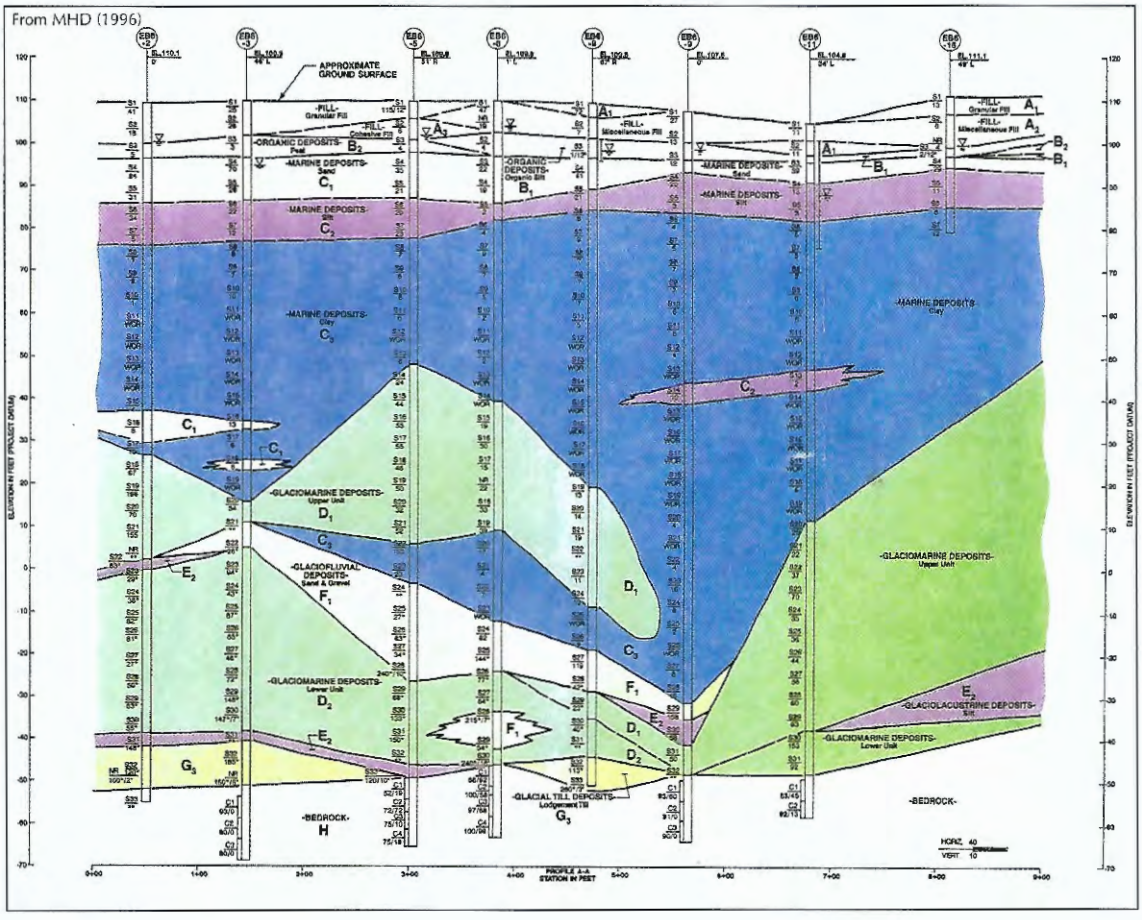


FIGURE 3-92. Variations of the glaciomarine deposit in section (north view) along the Central Artery/Tunnel Project, beneath Airport Access Road off the northwest corner of Logan Airport and west of MBTA Airport Station. Similar redeposited glaciomarine sediment (D_1) is also in the lower marine clay (C_3) in a channel above the lower outwash (F_1).

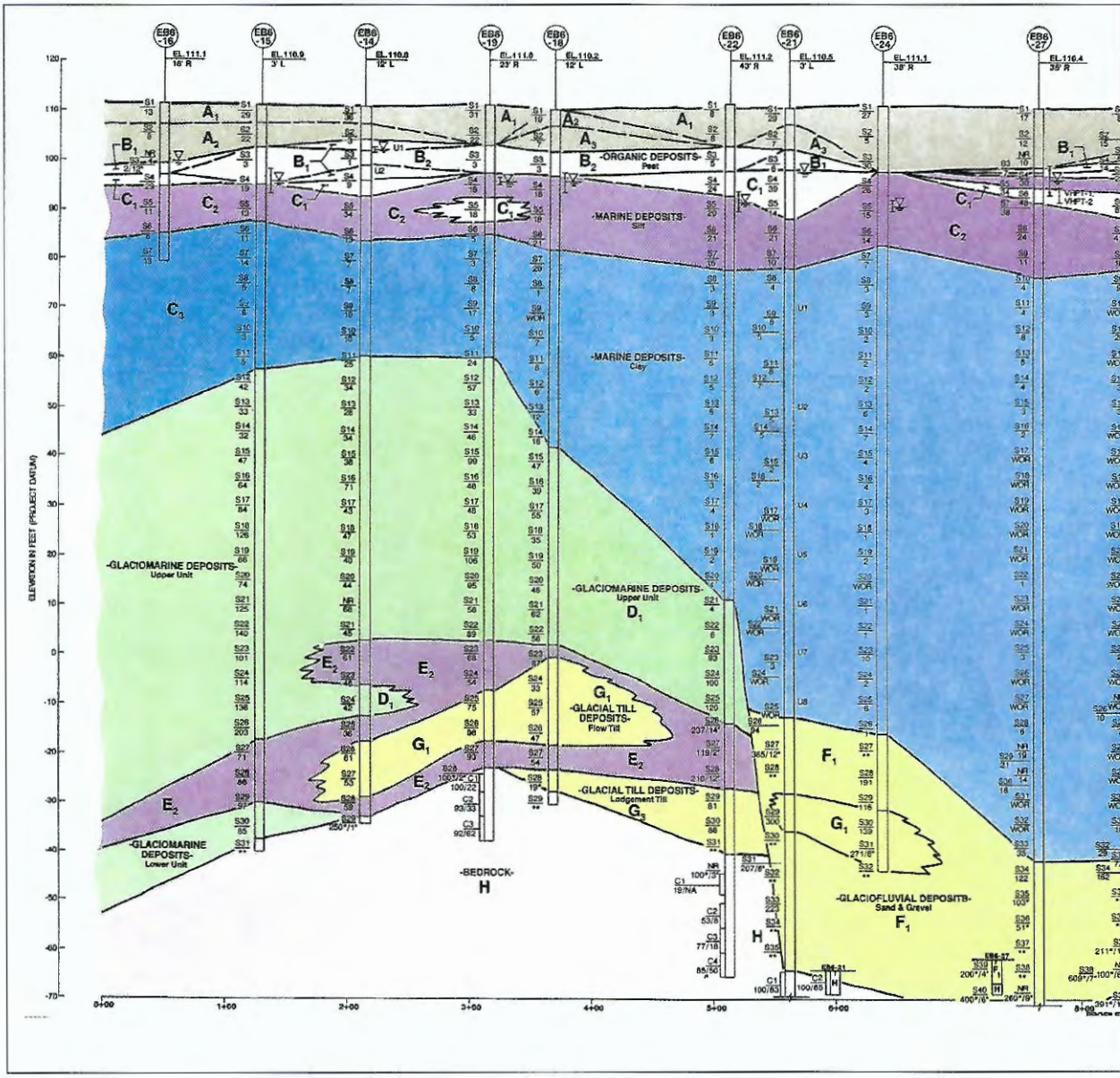
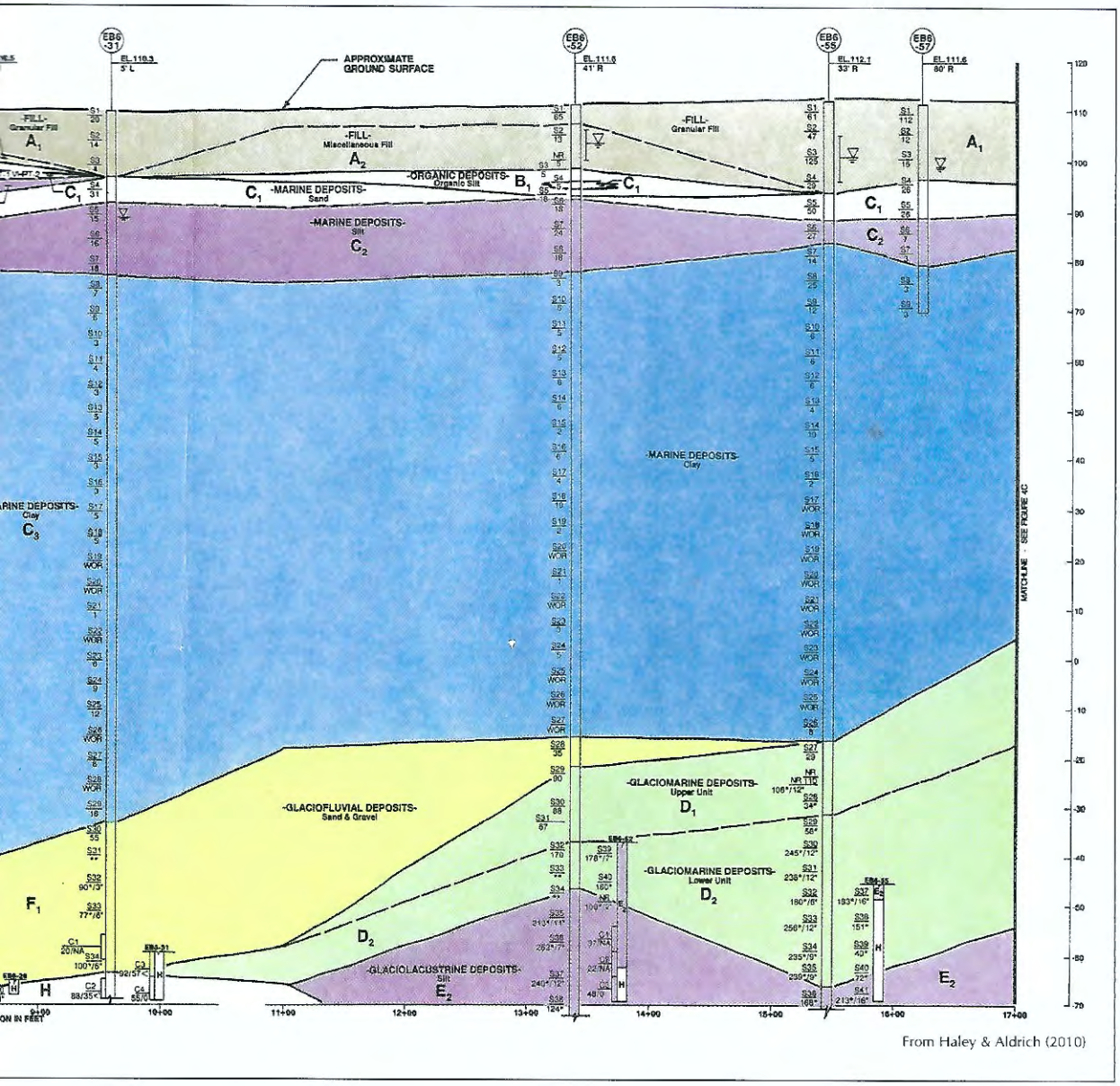


FIGURE 3-93. Section from the Central Artery/Tunnel Project beneath Route 1 adjacent to MBTA Airport Station showing complex facies relations within the glaciomarine deposits resting on lower



From Haley & Aldrich (2010)

till and bedrock that are cut by a deep channel with lower outwash and marine clay fill, view northwest. The units labeled glaciolacustrine silt and enclosed till are facies of the glaciomarine deposit.

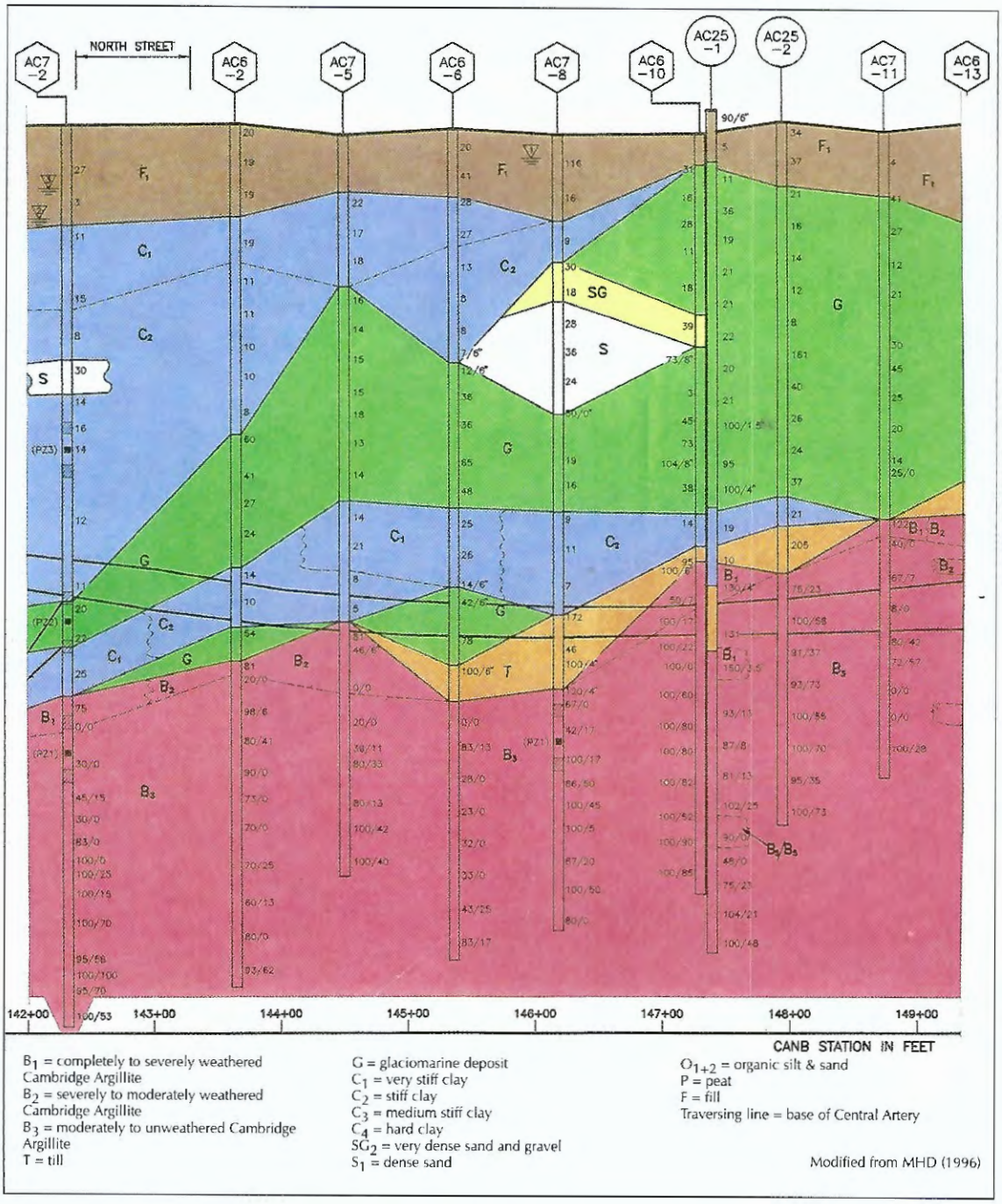


FIGURE 3-94. Section along the Central Artery between North Street and North Washington Street (west tunnel wall; stations 142+00 to 150+00) showing glaciomarine deposit interbedded with and overlain by marine clay above thin till, which are undifferentiated; view southwest.

FIGURE 3-96. Gray marine clay under the shovel, covered by reddish-brown organic silty sand in the foreground. (Photo courtesy of Bradford Miller.)

FIGURE 3-97. Marine clay rubble in excavation, including large boulders. (Photo courtesy of Bradford Miller.)

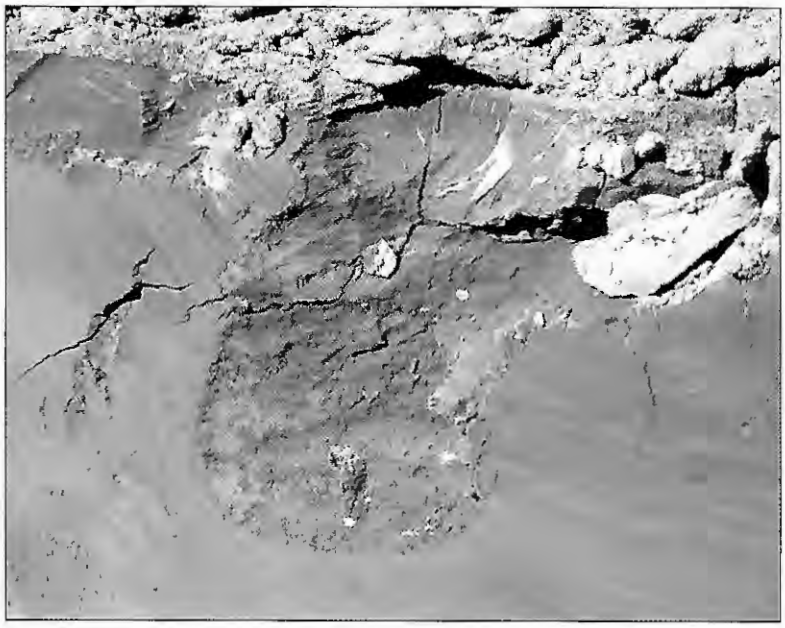


FIGURE 3-107. Reworked clay over the weathered top of marine clay. (Photo courtesy of Bradford Miller.)

FIGURE 5-5. Aerial view of Boston view on May 18, 2012. (Courtesy of lesvants.com.)

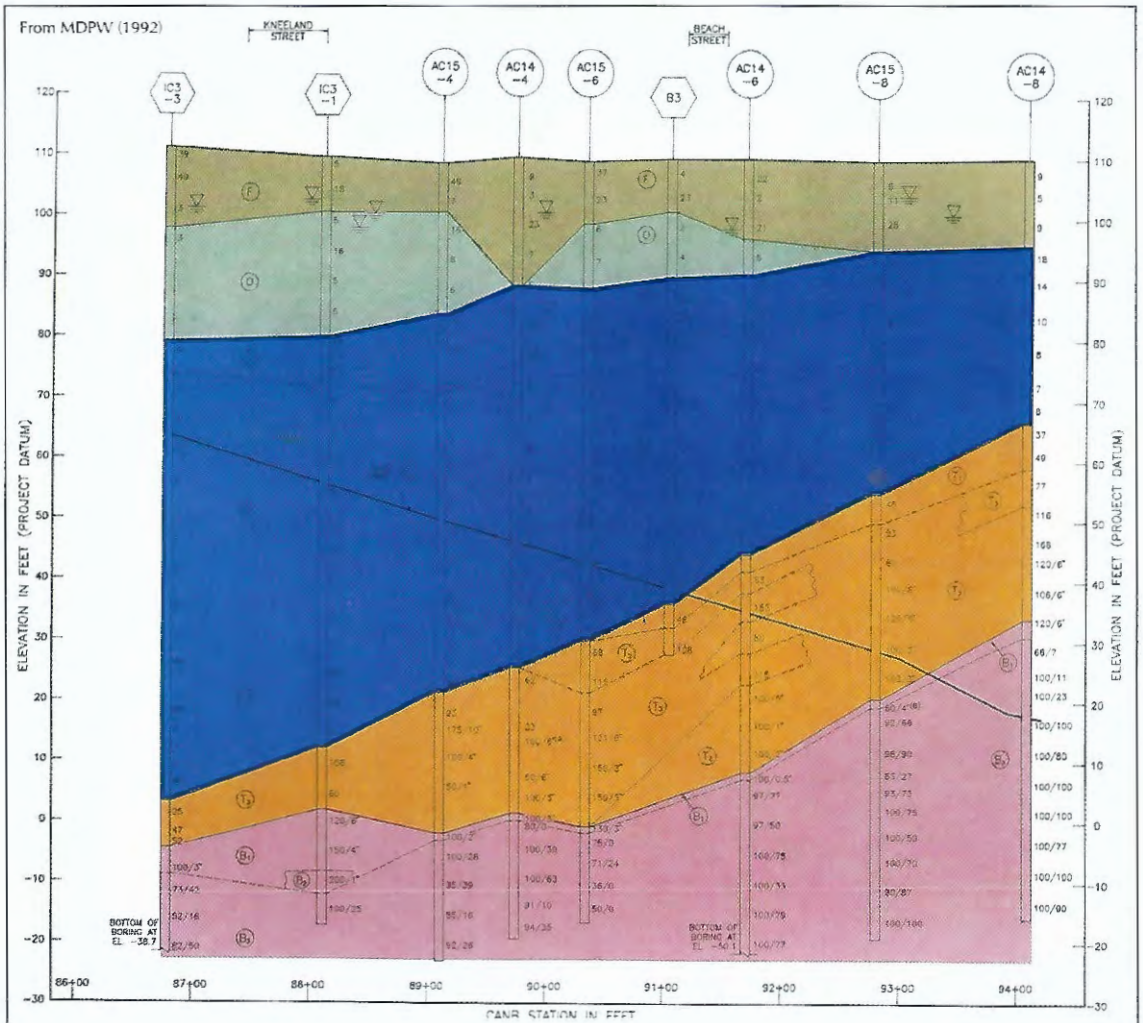


FIGURE 6-27. Section along the Central Artery west of South Station (middle slurry wall between stations 87+00 and 94+00) showing the marine clay overlapping the south side of the Fort Hill drumlin (view west).

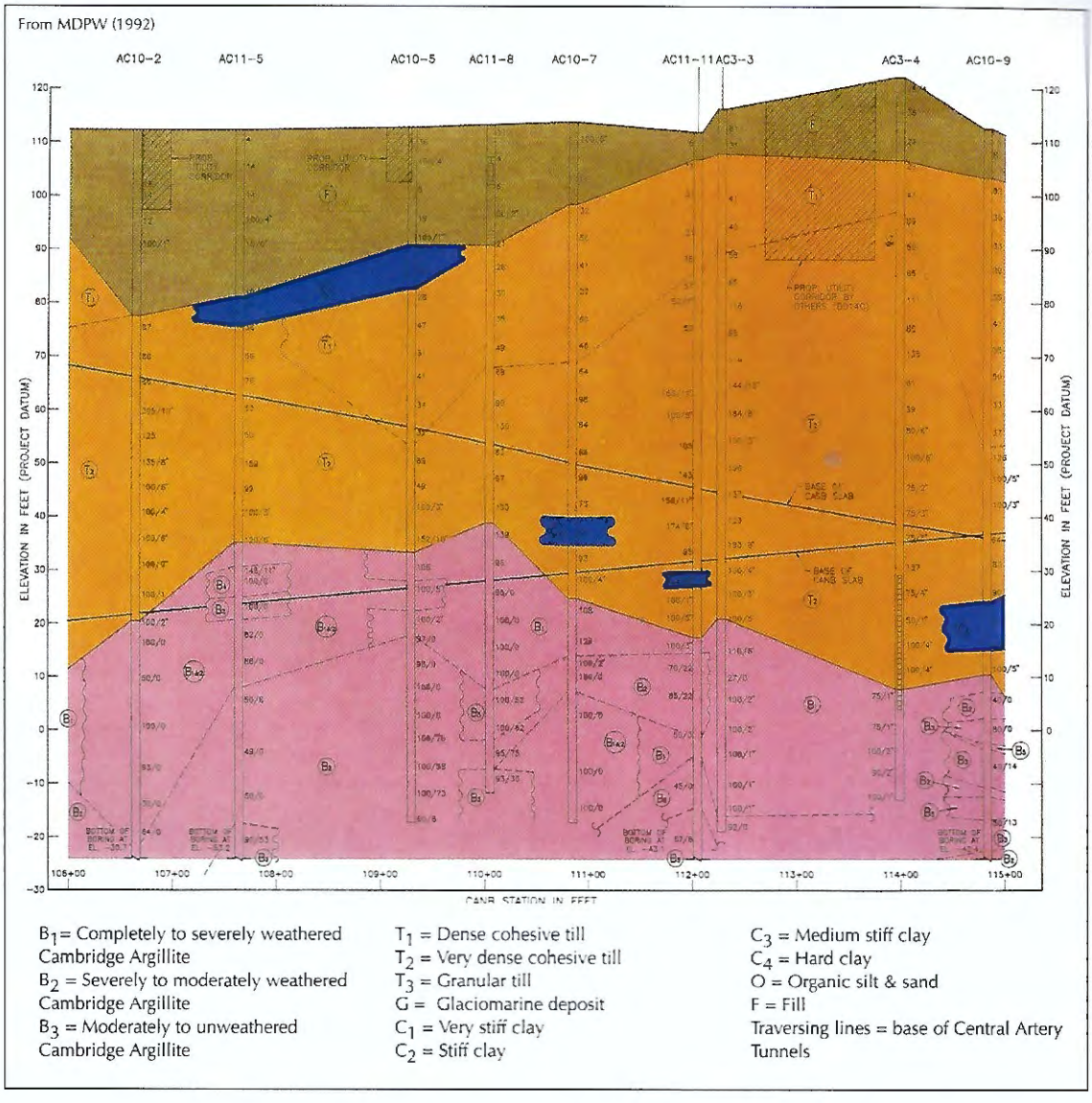


FIGURE 6-28. Section along the Central Artery Tunnel from Congress Street to Fleet Center near the Charles River, middle slurry wall between Stations 106+00 and 115+00 (view west to southwest).

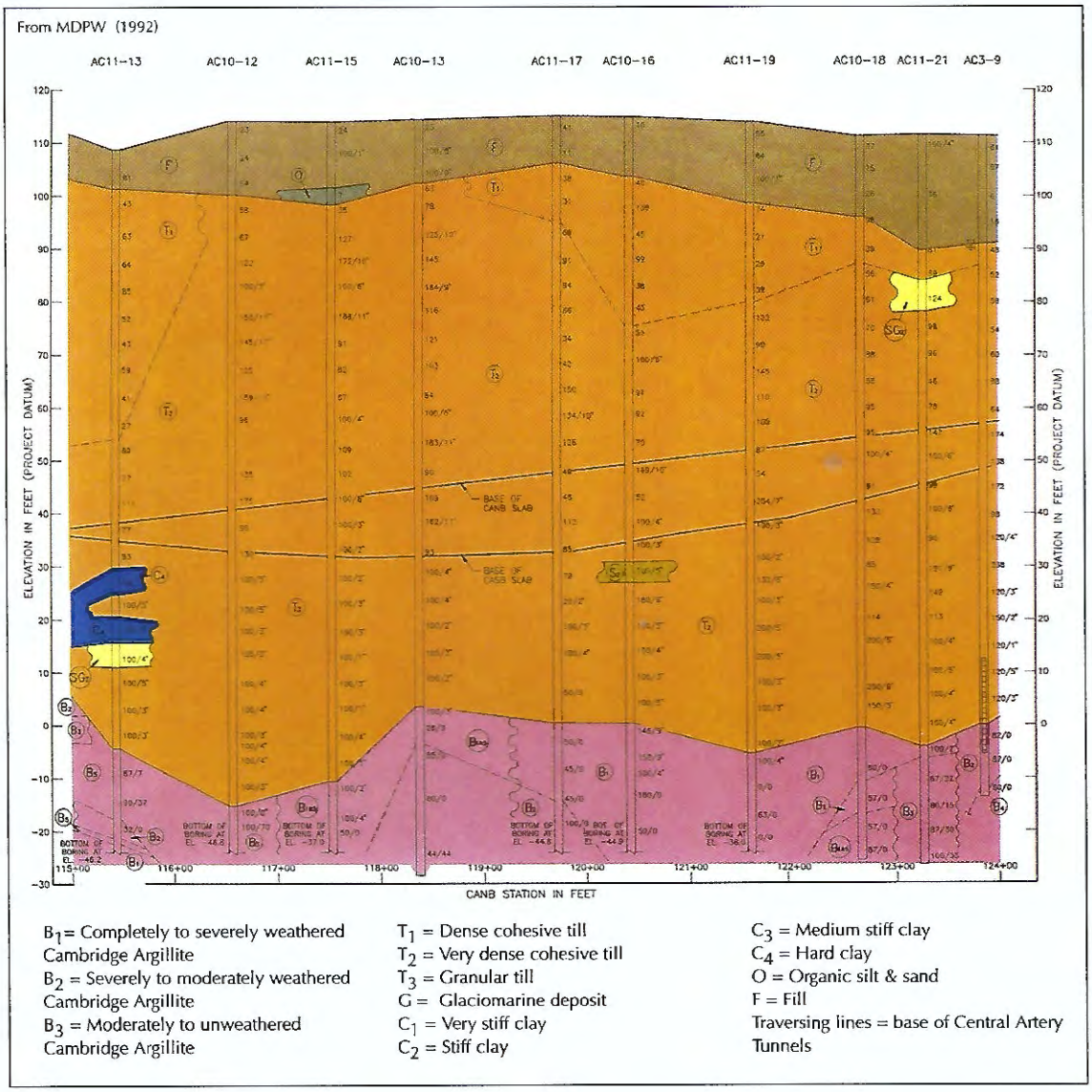


FIGURE 6-29. Section along the Central Artery Tunnel from Congress Street to Fleet Center near the Charles River, middle slurry wall between Stations 115+00 and 124+00 (view west to southwest).

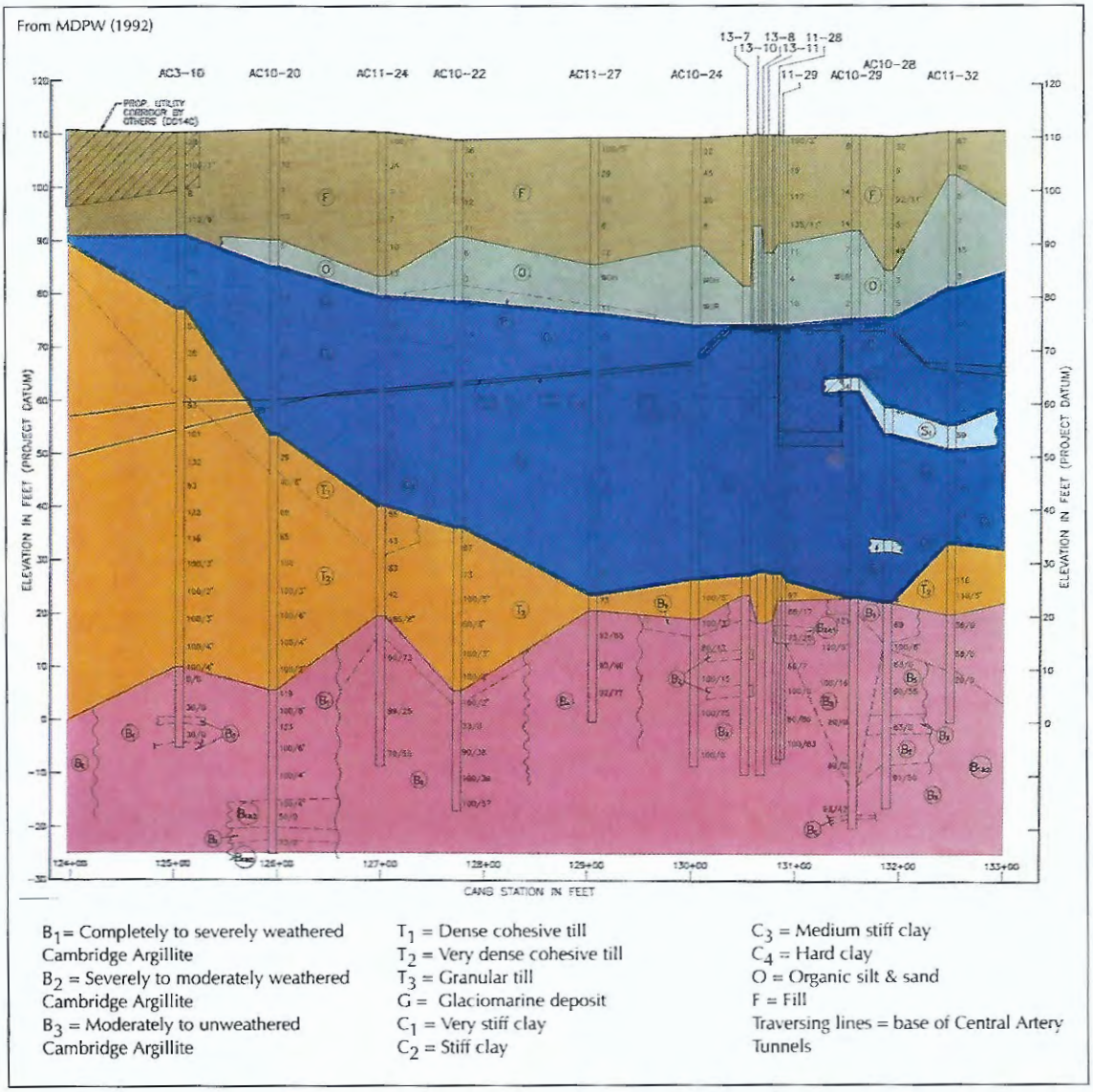


FIGURE 6-30. Section along the Central Artery Tunnel from Congress Street to Fleet Center near the Charles River, middle slurry wall between Stations 124+00 and 133+00 (view west to southwest).

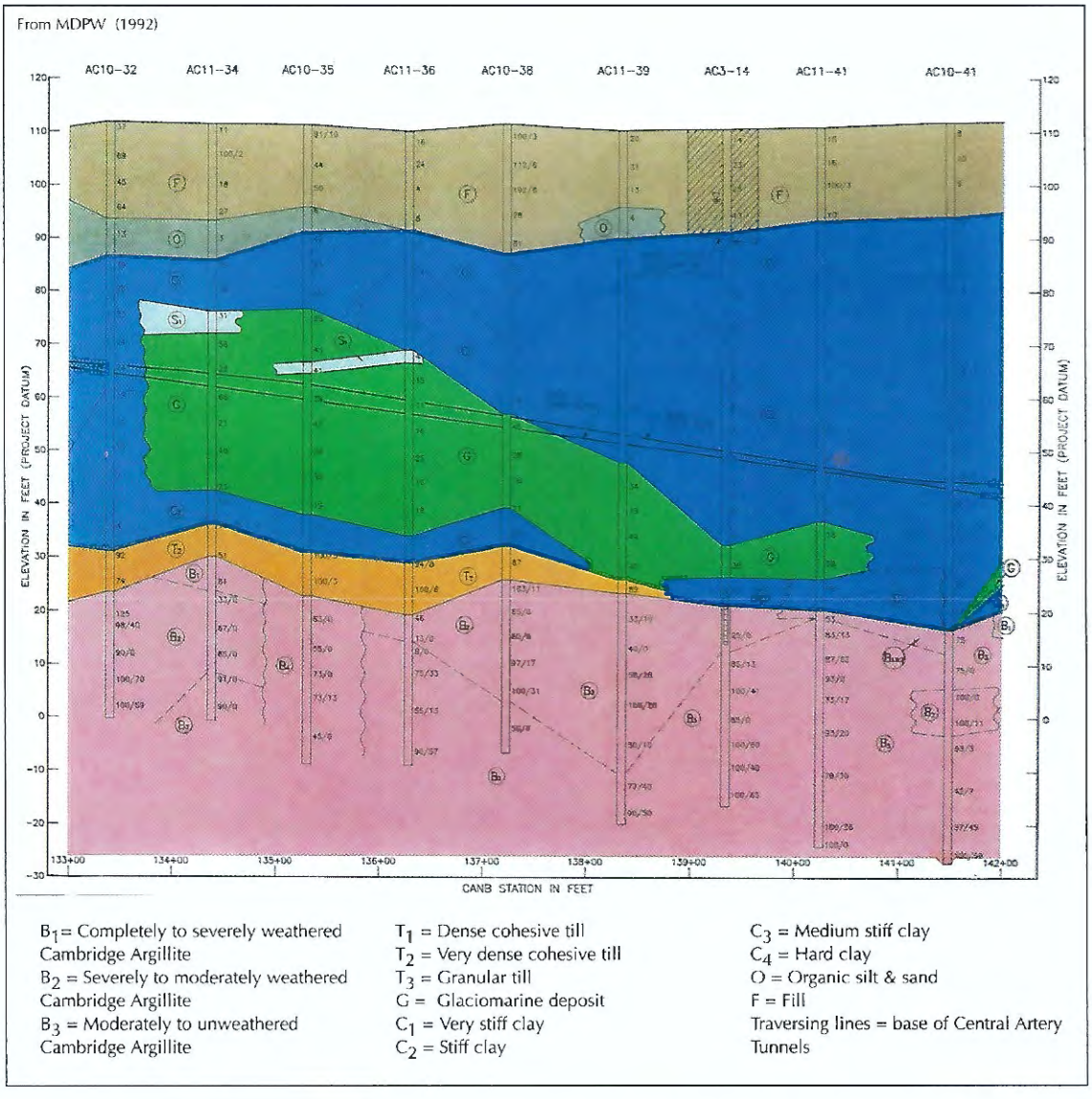
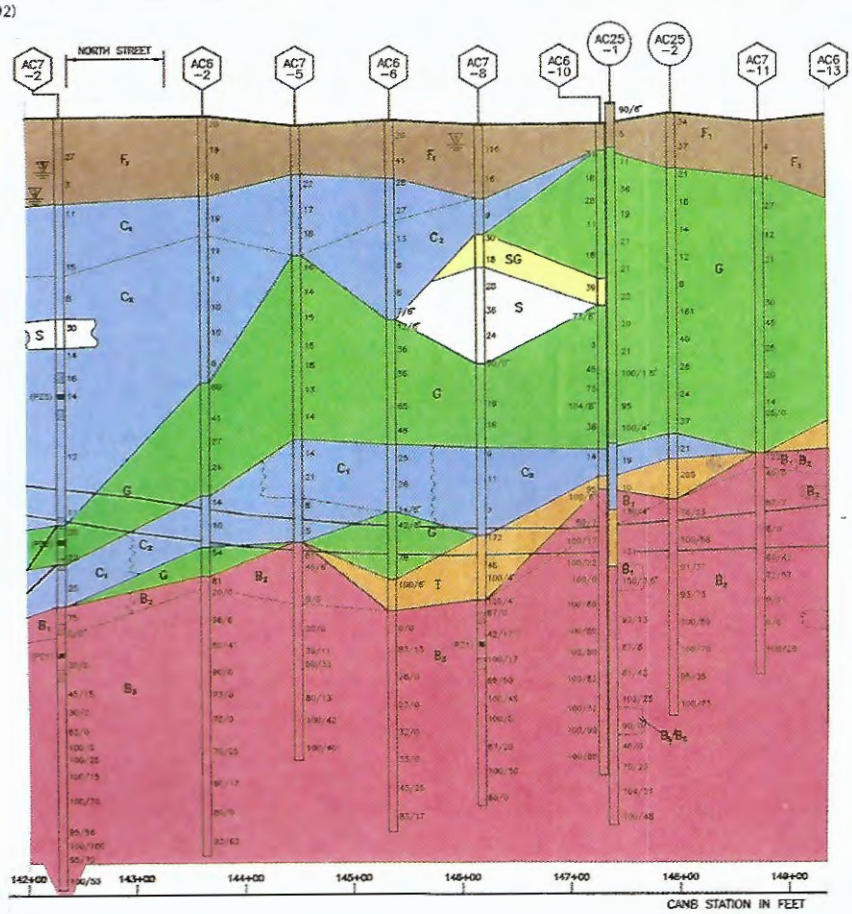


FIGURE 6-31. Section along the Central Artery Tunnel from Congress Street to Fleet Center near the Charles River, middle slurry wall between Stations 133+00 and 142+00 (view west to southwest).

From MDPW (1992)



B_1= Completely to severely weathered Cambridge Argillite
B_2 = Severely to moderately weathered Cambridge Argillite
B_3 = Moderately to unweathered Cambridge Argillite
T_1 = Dense cohesive till
T_2 = Very dense cohesive till
T_3 = Granular till
G = Glaciomarine deposit
C_1 = Very stiff clay
C_2 = Stiff clay
C_3 = Medium stiff clay
C_4 = Hard clay
O = Organic silt & sand
F = Fill
Traversing lines = base of Central Artery Tunnels

FIGURE 6-32. Section along the Central Artery Tunnel from Congress Street to Fleet Center near the Charles River, middle slurry wall between Stations 142+00 and 150+00 (view west to southwest).

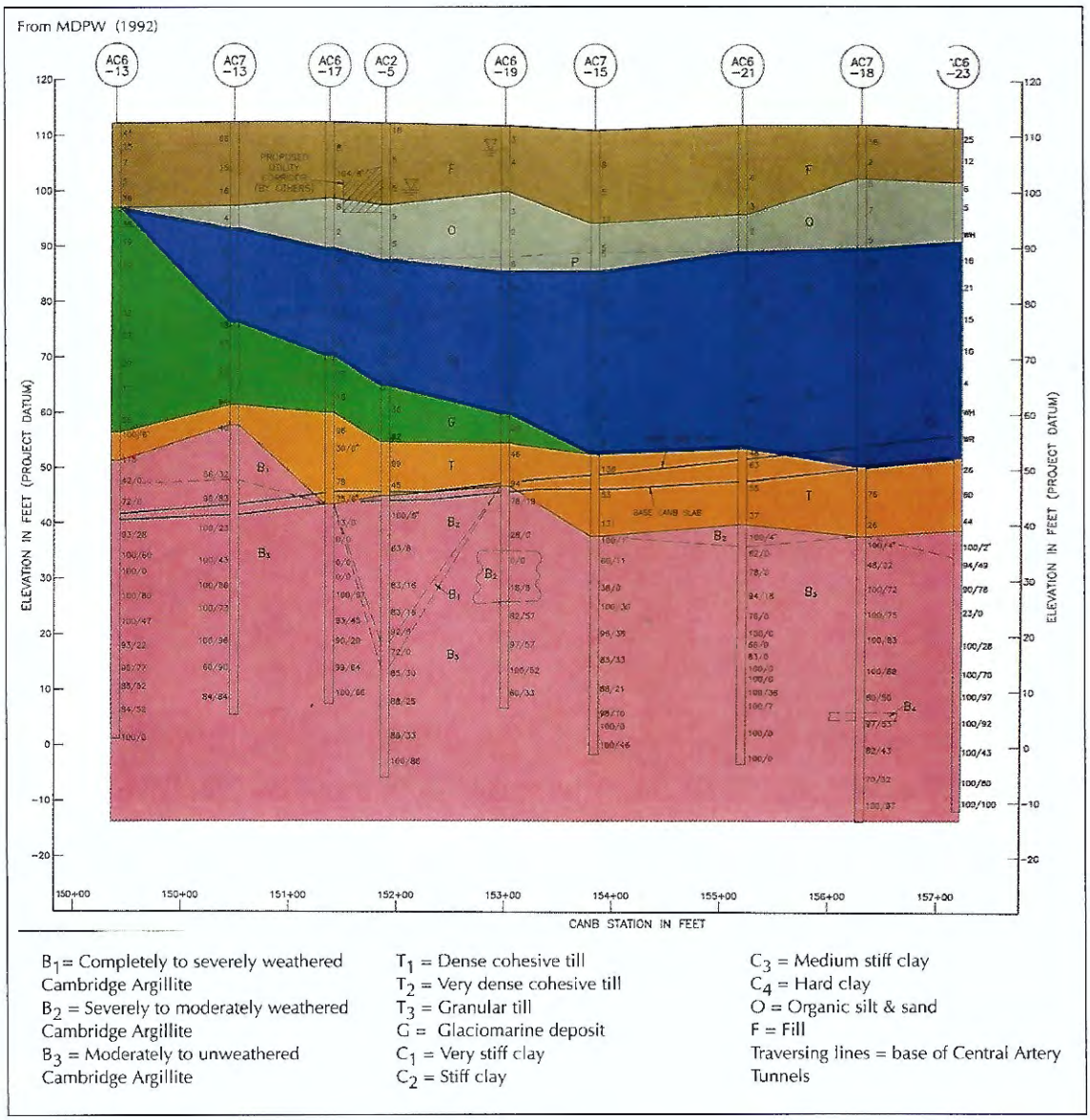


FIGURE 6-33. Section along the Central Artery Tunnel from Congress Street to Fleet Center near the Charles River, middle slurry wall between Stations 150+00 and 157+00 (view west to southwest).

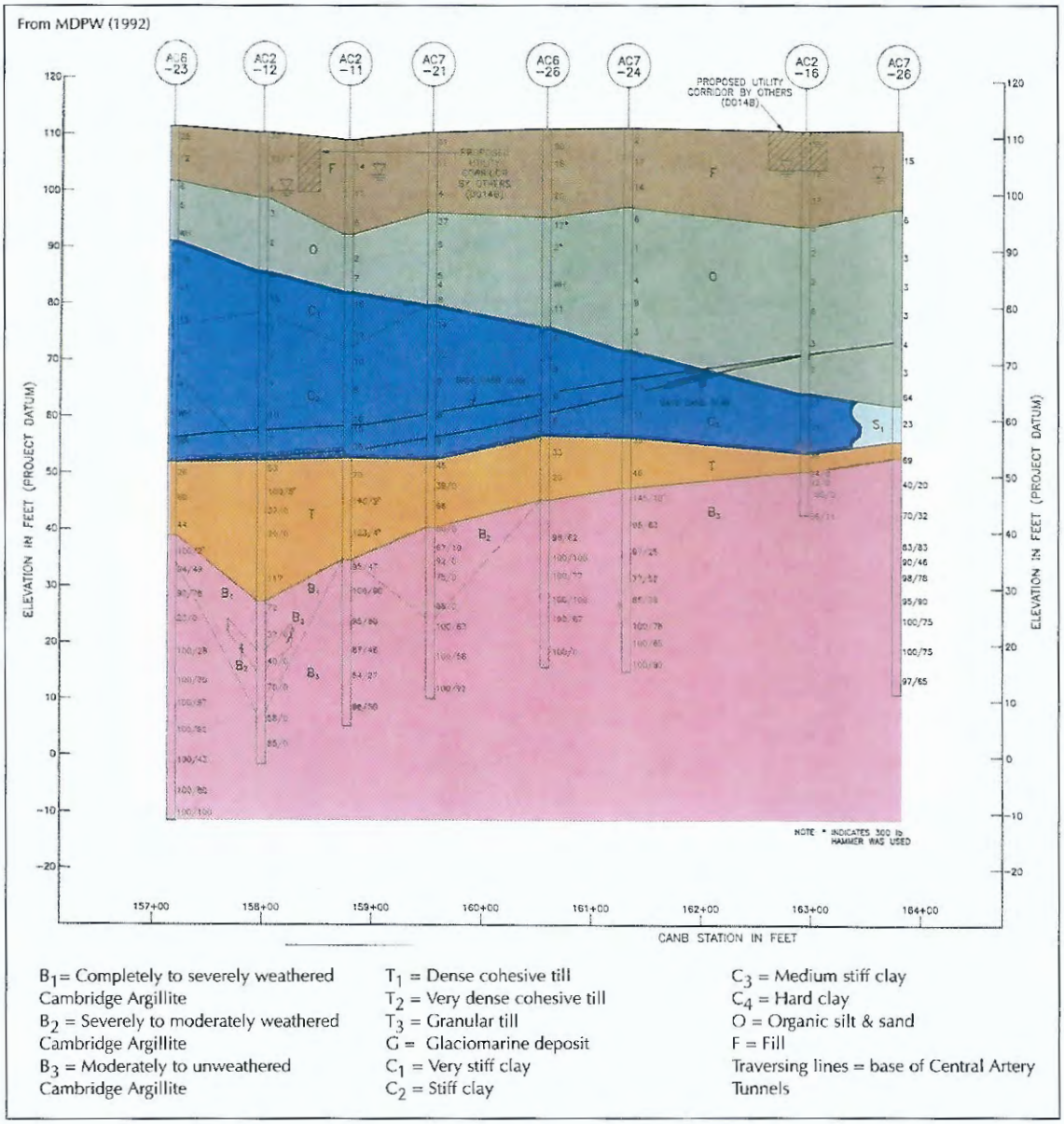
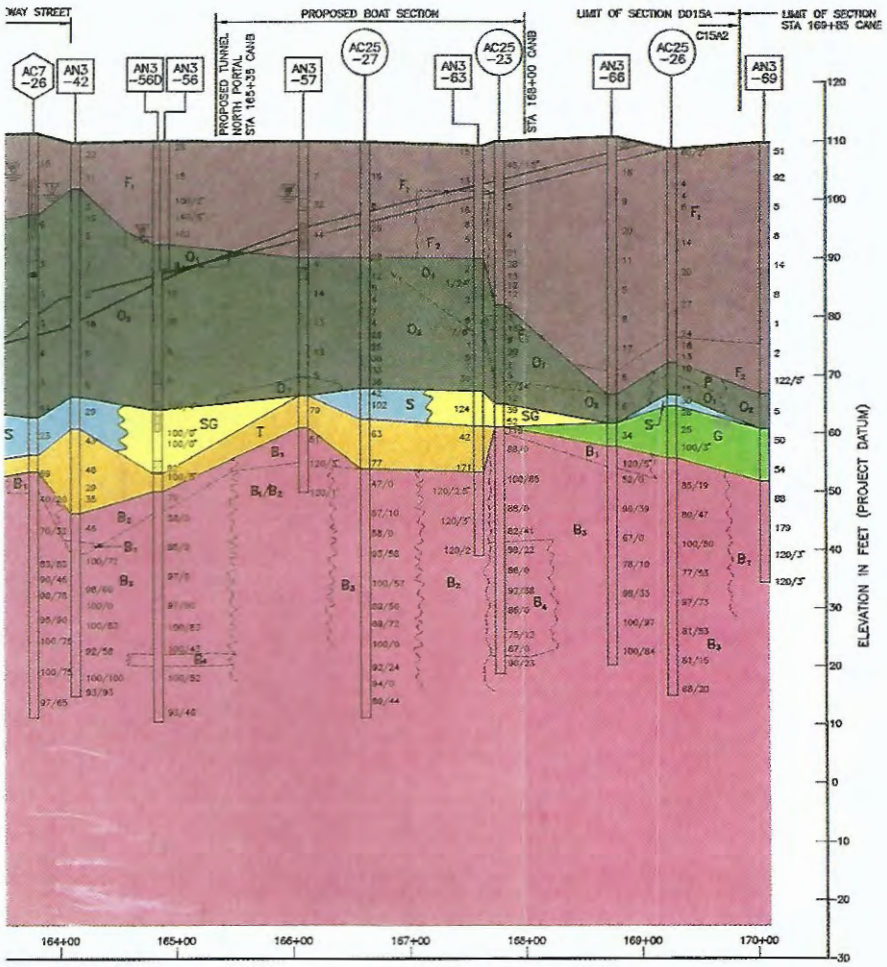


FIGURE 6-34. Section along the Central Artery Tunnel from Congress Street to Fleet Center near the Charles River, middle slurry wall between Stations 157+00 and 164+00 (view west to southwest).

From MDPW (1992)



B_1 = Completely to severely weathered Cambridge Argillite
B_2 = Severely to moderately weathered Cambridge Argillite
B_3 = Moderately to unweathered Cambridge Argillite
T_1 = Dense cohesive till
T_2 = Very dense cohesive till
T_3 = Granular till
G = Glaciomarine deposit
C_1 = Very stiff clay
C_2 = Stiff clay
C_3 = Medium stiff clay
C_4 = Hard clay
O = Organic silt & sand
F = Fill
Traversing lines = base of Central Artery Tunnels

FIGURE 6-35. Section along the Central Artery Tunnel from Congress Street to Fleet Center near the Charles River, middle slurry wall between Stations 164+00 and 170+00 (view west to southwest).

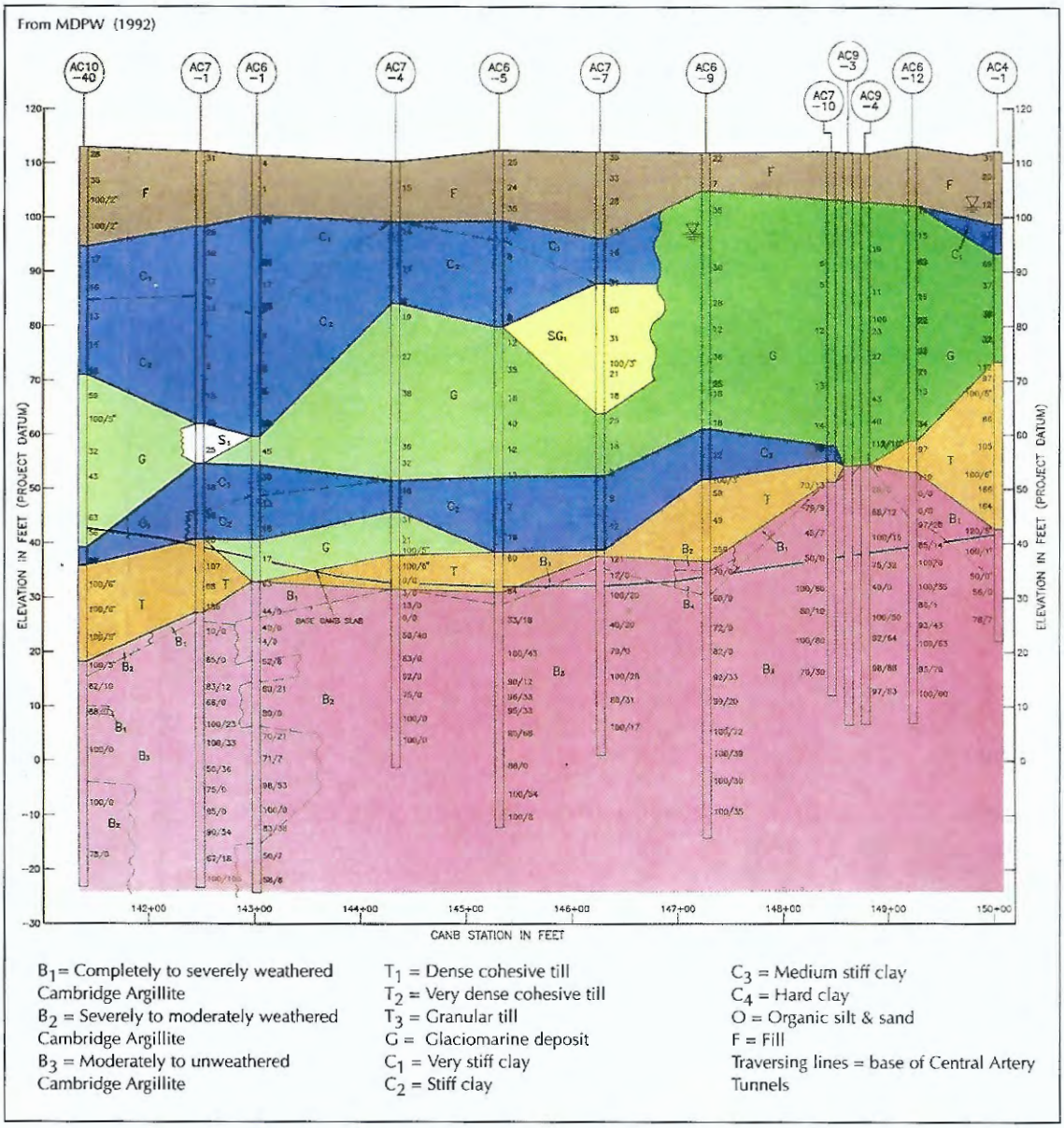


FIGURE 6-36. Section along the Central Artery Tunnel between North and Cross streets (east slurry wall Stations 142+00 to 150+00) showing the lower outwash sand and the gravel filling channel in the glaciomarine deposit and both covered by marine clay.