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| 15. Supplementary Notes   |                                  | 13. Type of Report & Period Covered                   |  |
| 16. Abstract (Limit: 200 words)<br>Five soil profiles in the Boston Basin area were developed for use in the seismic analysis of buildings in Eastern metropolitan areas. The soil survey comprised collecting and analyzing the extensive data that is available for the M.I.T. campus, and the numerous projects in which M.I.T. personnel have been engaged. The profiles are somewhat similar, being differentiated mainly by the thickness of clay layers. Generally, they start from bedrock and work up through glacial till, outwash sands and gravel, clay (less than 60 feet to a maximum of about 180 feet), outwash sands and gravels, peat and/or organic silt, and heterogeneous man-placed fills. Additional subsurface data was obtained from the Boston Society of Civil Engineers which located these profiles and indicated that they were representative of the area. The profiles were confirmed and refined by geologists and consulting engineers. Each profile is shown together with a typical profile for the Boston Bay area and maps locating the profiles. A bibliography is included. |                                  | 14.   |  |
| 17. Document Analysis a. Descriptors<br>Soils Buildings<br>Seismic surveys Geology<br>Earthquakes Soil profiles<br>Earthquake resistant structures<br>b. Identifiers/Open-Ended Terms<br>Boston Basin<br>Seismic building protection<br>c. COSATI Field/Group   |                                  |   |  |
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Statements such as: "The basic set of spectra (response spectra resulting from an earthquake loading) which presumably would apply for rock and/or very firm soil, must be modified so as to apply to the description of local soil conditions..." and "local soil conditions will affect both the motions which occur at the base of the building and also the way in which the building responds to these motions," taken from Internal Study Report No. 1 for Optimum Seismic Protection for New Building Construction in Eastern Metropolitan Areas by R.V. Whitman indicate the scope of the problem at hand. That is, for seismic analysis of buildings in Eastern Metropolitan areas (i.e. Boston) we must determine the types of profiles upon which these buildings will be founded. Therefore, considering the area surrounding the Boston Basin east of Route 128, the initial problem is to develop a few typical profiles keeping in mind the fact that we are interested in dynamic analyses and as such, do not need precise knowledge of subsurface conditions. For example, a six-inch sand layer between two shallow clay layers would certainly be important for consolidation problems; but for developing response spectra, the effect of this layer of sand would be negligible.

The soil survey was initiated by collecting and analyzing the extensive data that is available for the M.I.T. campus. Another source was the numerous projects that M.I.T. personnel

have been involved in: for example, Interstate 95 in Saugus, Green Shoe Factory in the South Boston area, and the University of Massachusetts site at Columbia Point. This starting point gave a good picture of the types of profiles which are to be expected in the Boston Basin area. A later interview with Clifford Kaye of the United States Geological Survey in Boston generally confirmed these data.

The profiles are somewhat similar and are differentiated mainly by the thickness of the clay layers. They are, in general, starting from bedrock (which is the Cambridge argillite in the Basin area) and working up: bedrock, glacial till, outwash sands and gravels, clay (less than 60 feet to a maximum of about 180 feet), outwash sands and gravels, peat and/or organic silt, and heterogeneous man-placed fills. This general scheme is shown in Figure 1.

Discussion with other members of the Soils Division working on the project yielded five typical profiles of which three were clay profiles of the type in Figure 1 with only the thickness of clay varying:

Case III - Up to 60 feet of clay

Case IV - 60 to 120 feet of clay

Case V - 120 to 180 feet of clay

Case I was to be up to 30 feet of fill or silt on firm soil (i.e. till) or rock and Case II was Case I located above 10 to 30 feet of outwash sands and gravels on rock.

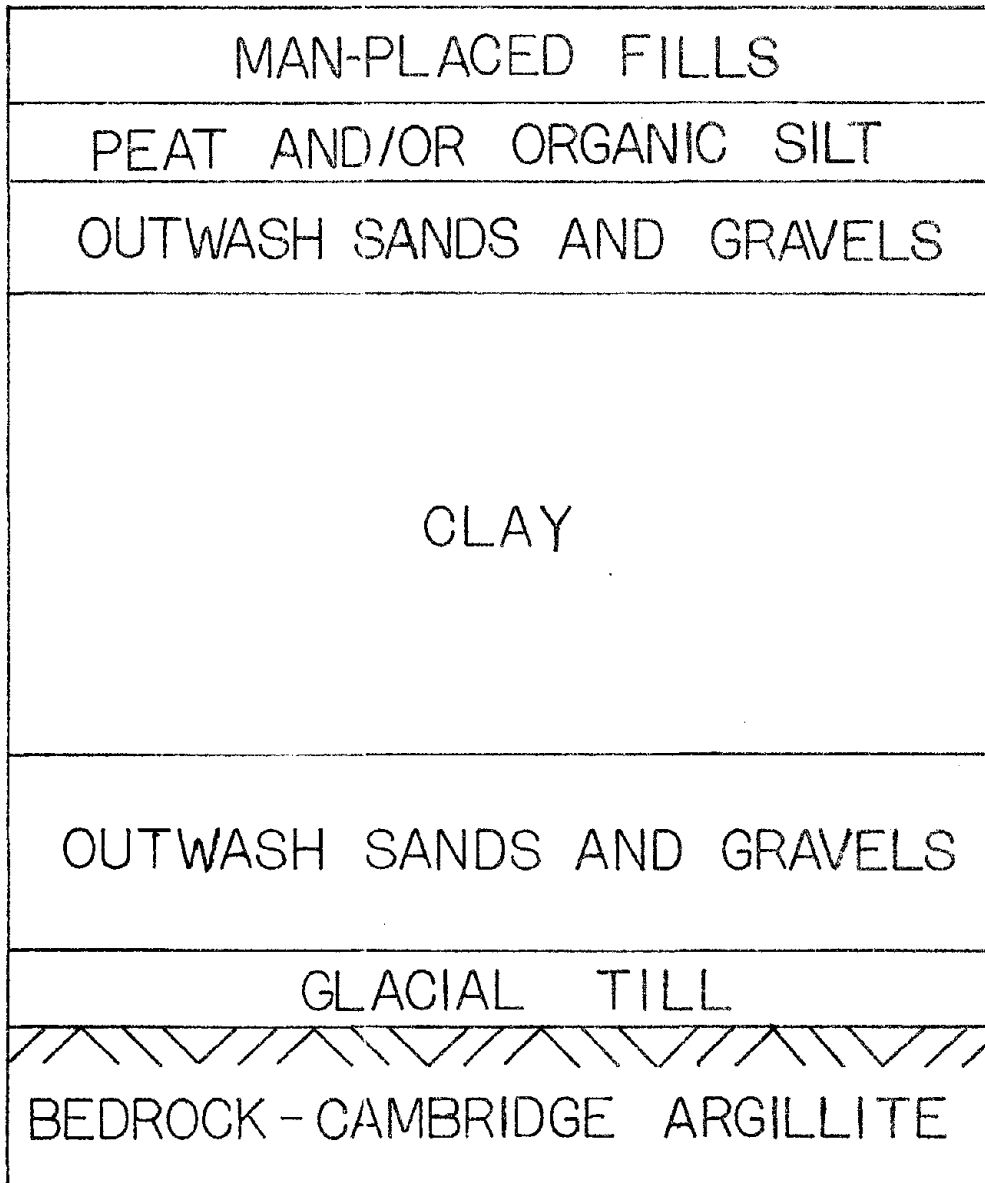
These profiles were then located on a U.S.G.S. Boston

and vicinity topographic map. Additional subsurface data was obtained from the 1961 Boston Society of Civil Engineers collection of boring data in the Boston area. This map not only located these profiles but also showed that a good portion of the area could be described by these profiles indicating that they were representative of the area.

As a final precaution these typical profiles were presented to two geologists familiar with the area--Professor Ronald Hirschfeld of M.I.T. and Mr. Donald Reed of Haley & Aldrich, Inc. Consulting Soil Engineers. They both concurred with the clay profiles, Cases III, IV, and V, but had suggestions for Cases I and II. These alterations are included on the profiles as they appear in the appendix. Note the change in Case I from up to 30 feet of heterogeneous fill including peat or organic silt above firm soil (till) or rock to up to 30 feet of outwash sands and gravels. This was suggested by Mr. Reed, who also pointed out that for the area in question (the area east of Route 128), this would be the predominant profile type. Case II, the next most common profile, had the organic silt changed to peat above 30 to 50 feet of outwash sands and gravels. These changes did not affect the map because the original Cases I and II which had been located on the map were profiles deficient of clay and actually did conform to the new Cases I and II.

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TYPICAL PROFILE FOR BOSTON BASIN AREA

FIGURE 1

# CASE I

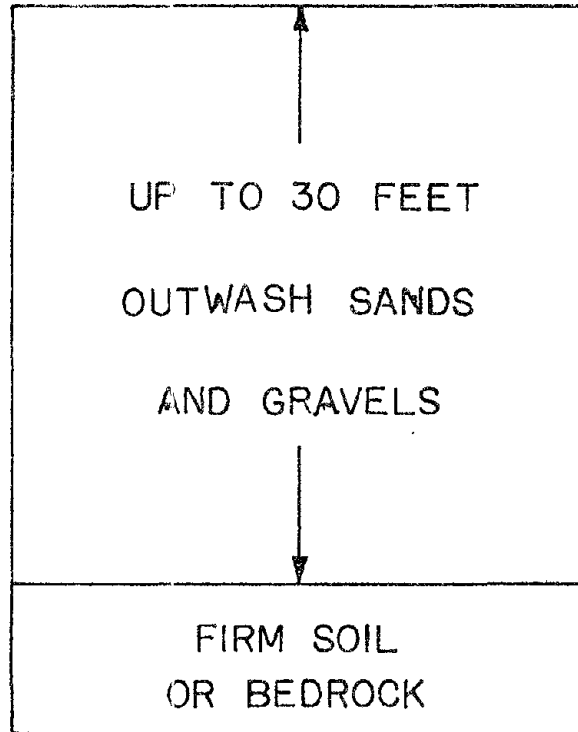


FIGURE 2



# CASE II

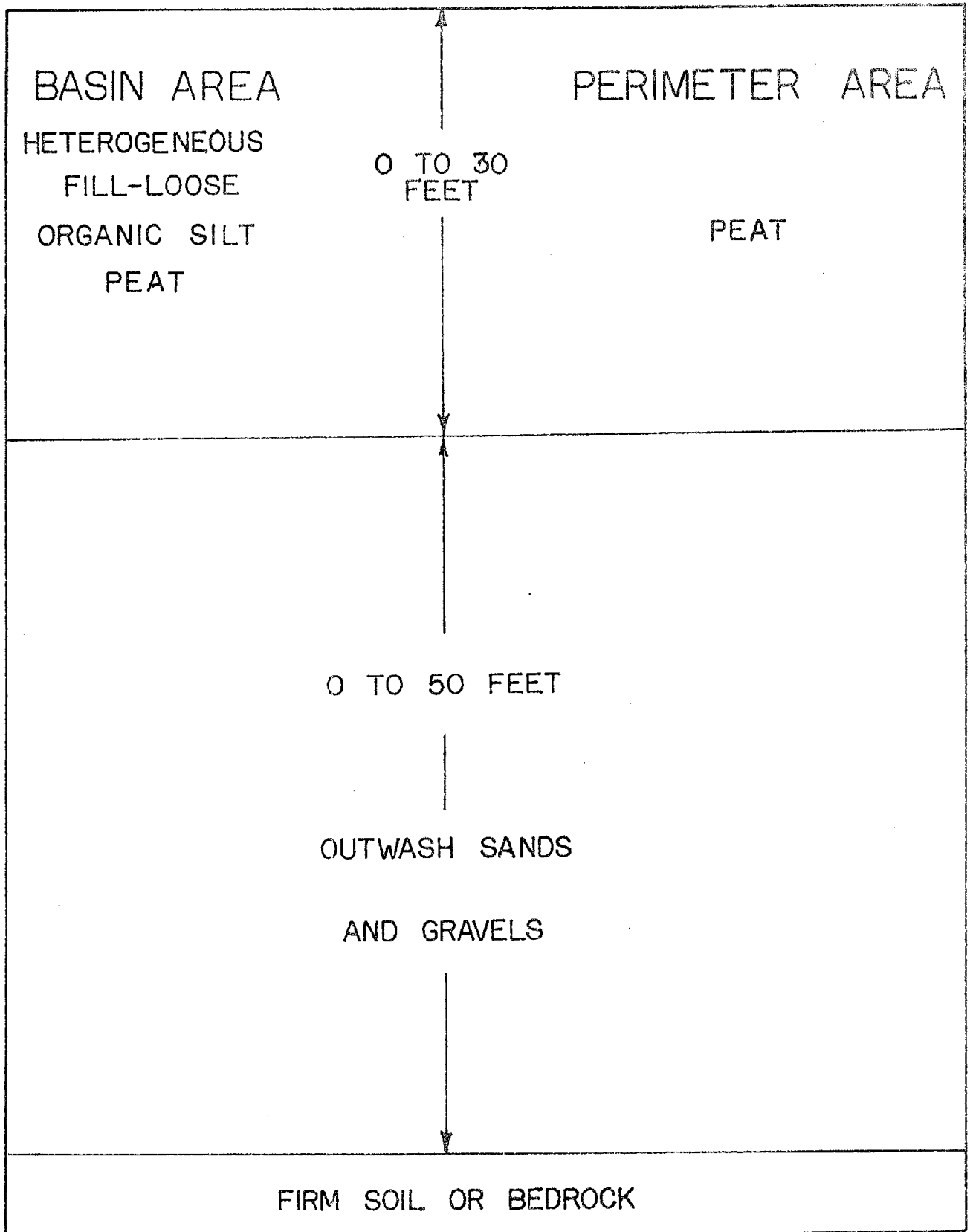


FIGURE 3

# CASE III

UP TO 30 FEET  
FILL OR ORGANIC SILT

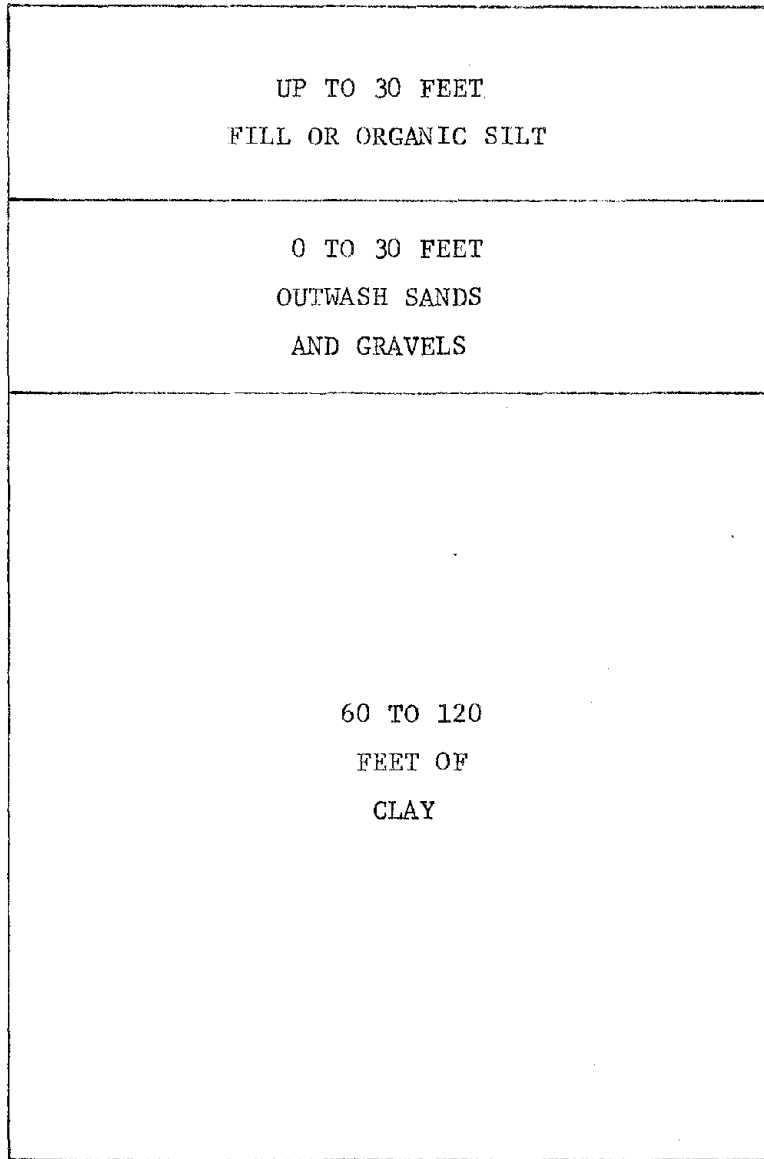
0 TO 30 FEET  
OUTWASH SANDS  
AND GRAVELS

UP TO  
60 FEET  
CLAY

BEDROCK

FIGURE 4

# CASE IV



BEDROCK

FIGURE 5

# CASE V

UP TO 30 FEET  
FILL OR ORGANIC SILT

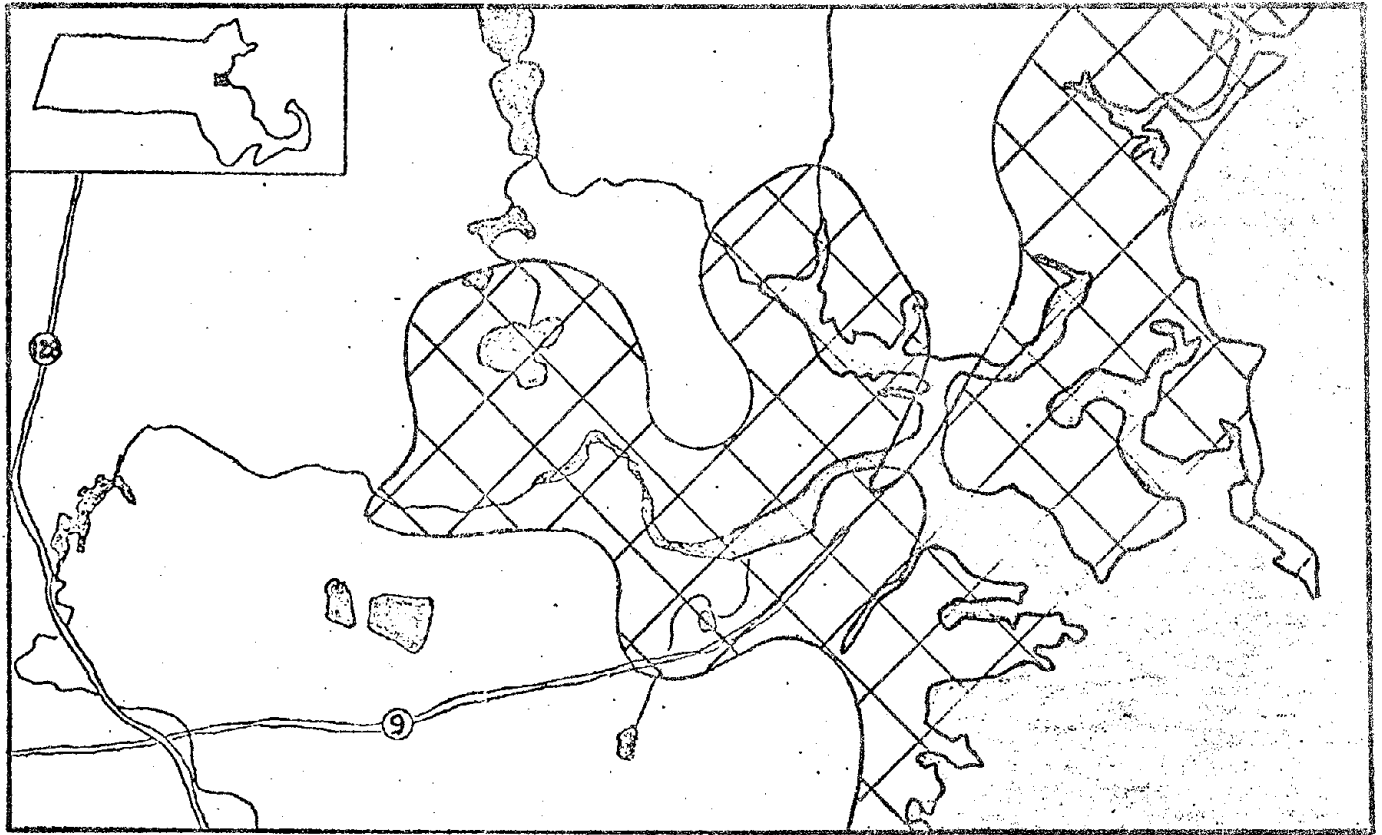
0 TO 30 FEET  
OUTWASH SANDS  
AND GRAVELS

120 TO 180  
FEET  
CLAY

BEDROCK

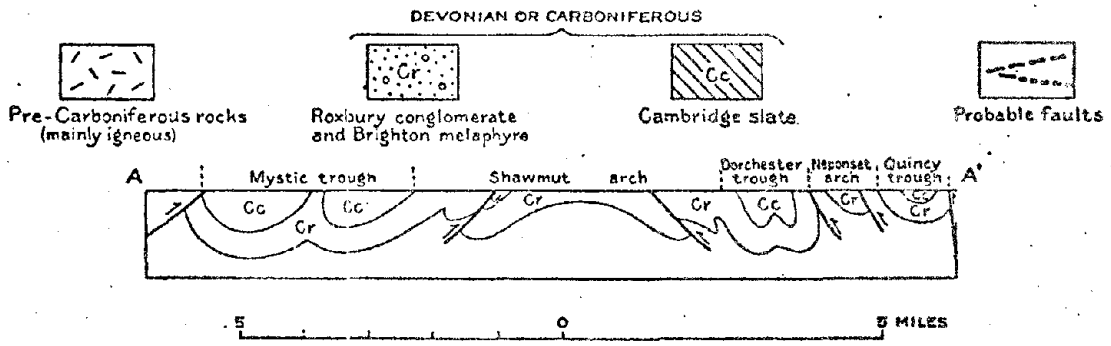
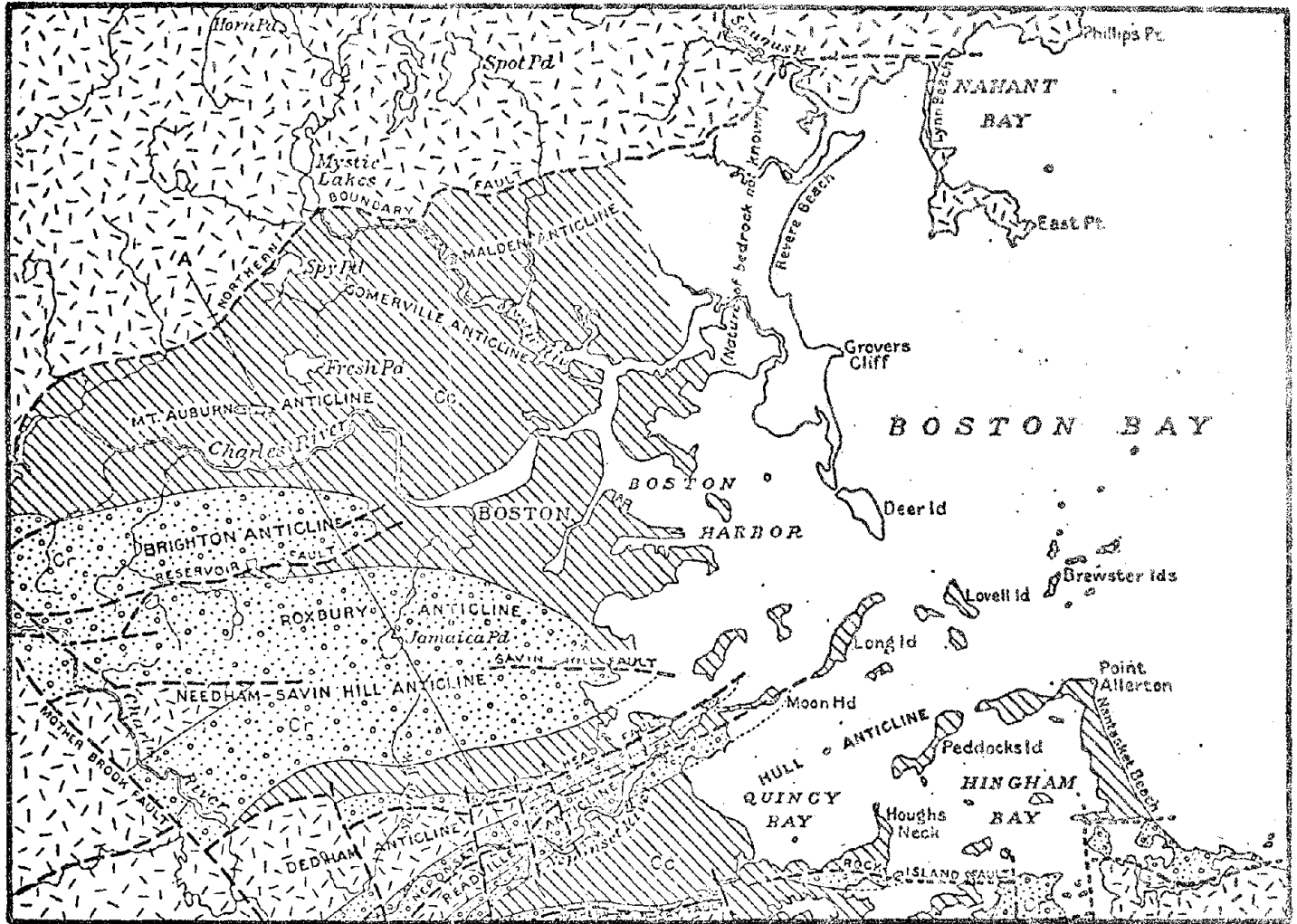
FIGURE 6

# GENERAL LOCATION OF PROFILES



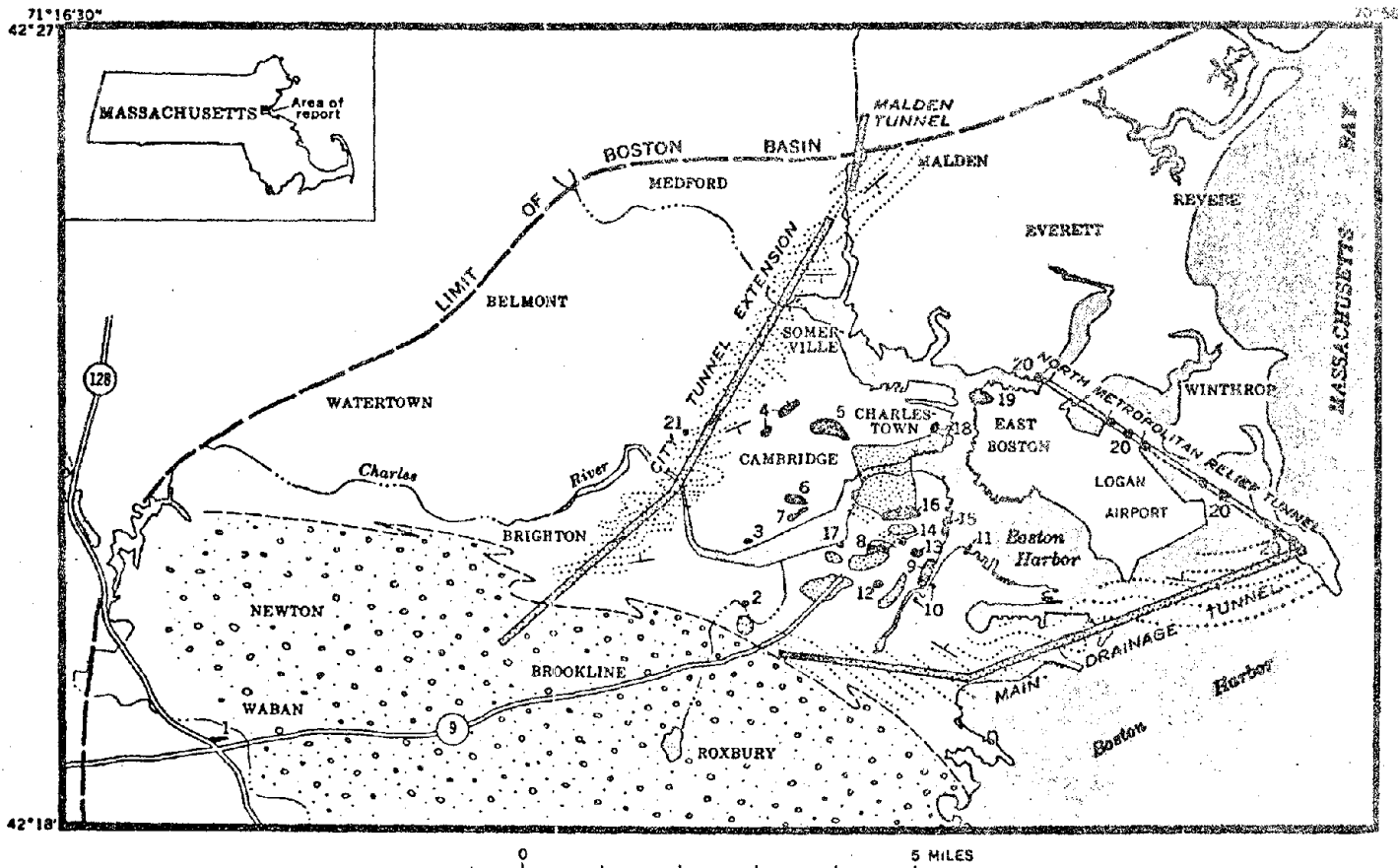
THE CLAY PROFILES (CASES III, IV, AND V) ARE FOUND IN THE CROSS-HATCHED AREA. EXPOSED BEDROCK OR TILL AND CASE I AND II PROFILES ARE FOUND ELSEWHERE IN THE BOSTON BASIN AREA.

(SEE FIGURES 2 THROUGH 6 FOR DEFINITION OF CASES I-V.)









TAKEN FROM U.S. GEOLOGICAL SURVEY - BULLETIN 839

GENERALIZED GEOLOGIC MAP AND SECTION OF BOSTON BASIN



EXPLANATION

|                  |   |                           |  |  |
|------------------|---|---------------------------|--|--|
| Boston Bay Group | <br>Argillite and sandstone; minor conglomerate and volcanic rocks<br><i>Dotted lines are strike trends based on tunnel data</i> | DEVONIAN OR CARBONIFEROUS | <br>Approximate contact between dominantly conglomeratic rocks and fine-grained rocks | <br>Known kaolinization<br><i>Number explained in caption</i>   |
|                  | <br>Conglomerate, minor argillite, and volcanic rocks  |                           | <br>Strike and direction of dip of beds   | <br>Known unaltered rock<br><i>Shown only for downtown Boston, adjoining Charlestown, and tunnels</i> |

TAKEN FROM U.S. GEOLOGICAL SURVEY PROF. PAPER 575-C BY CLIFFORD A. KAYE

AREAS OF KNOWN BEDROCK KAOLINIZATION AROUND BOSTON

List of Internal Study Reports

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2. E. H. Vanmarcke and R. V. Whitman, "Background for Preliminary Expected Future Loss Computations," October, 1971.
3. P. J. Trudeau, "Identification of Typical Soil Profiles in the Boston Basin Area," November, 1971.