NATURAL SOIL DEPOSITS

Soils are produced by *weathering* of rock.

Weathering is the physical or chemical breakdown of rock.

**Physical Processes:**
- Unloading
- Frost Action
- Organism Growth
- Crystal Growth
- Abrasion

**Chemical Processes:**
- Oxidation
- Hydration
- Hydrolysis
- Carbonation
- Solution

after FM 5-410 Military Soils Engineering
ROCK-SOIL RELATIONSHIPS

- **Igneous Rocks**
  - Granite > silty sands
  - Basalts > clayey soils

- **Sedimentary rocks**
  - Shales > clays and silts
  - Sandstones > sandy soil
  - Limestone > coarse or fine grained soils

- **Metamorphic rocks**
  - Gneiss > silty sands
  - Slate > clayey soils
  - Marble > fine grained soils
  - Quartzite > coarse grained soils
SOIL FORMATION METHODS

Two Main Groups:

**Residual Soils**

Rock material weathered in place via mechanical and chemical processes (chemical usually dominant factor).

As a result of this process, and because the rock material may have an assorted mineral structure, the upper layers of soils are usually fine-grained and relatively impervious to water.

**Example:** Piedmont (Eastern US).

**Transported Soils**

Soils transported from place of origin via three main processes:

1. Water
2. Glacial
3. Air

Most soils are transported soils.

**Example:** Cape Cod.
RESIDUAL SOILS
TYPICAL WEATHERING PROFILES

(a) Mudstone, Shale, and Slate
(b) Gneiss and Schist
(c) Granite to Gabbro;

RESIDUAL SOILS
TYPICAL WEATHERING PROFILES

Figure 3-2. from NHI-06-088 (after Deere and Patton, 1971).
RESIDUAL SOILS – PIEDMONT PROVINCE

Covers ~1/3 of SC and NC.

Eastern Border of Province called Fall Line

“Georgia Red Clay” – Residual Soil

TRANSPORTED SOIL DEFINITIONS

Glacial Soils: formed by transportation and deposition of glaciers.

Alluvial Soils: transported by running water and deposited along streams.

Lacustrine Soils: formed by deposition in quiet lakes.

Marine Soils: formed by deposition in seas/oceans.

Aeolian Soils: transported and deposited by the wind.

Colluvial Soils: formed by movement of soil from its original place by gravity (e.g. landslides).

TRANSPORTED SOILS

Meander and Erosion along Rivers

Meander Development & Cutoff

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TRANSPORTED SOILS

Oxbow Lake Deposits

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TRANSPORTED SOILS

Oxbow Lake Example
Northampton, MA
TRANSPORTED SOILS

Major Floodplain Features

- Alluvial Terrace
- Point Bar
- Oxbow Lake
- Natural Levees
- Backswamp
- Alluvial Fans

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NEW ENGLAND GEOLOGY

**Figure 46** - Approximate maximum extent of major ice sheets in North America during the Great Ice Age. Ice caps and glaciers in the mountains of the Western United States are not shown. Dashed line is approximate coastline during full-glacial development (From Matsch, 1975).

**Figure 2** - Adapted from Strahler, 1966. A) Map of moraines (solid black) and outwash plains (shaded) of Southeastern New England. B) Ice flow map for Southeastern New England. Dashed lines show positions of ice standstill. C) Block diagram showing subglacial erosion and deposition of glacial till. D) Block diagram showing north-south belt of glacial deposits running through Cape Cod and Nantucket Island. Rear of diagram shows current exposure of this belt above sea level. E-F) Block diagrams showing creation of kettle holes and outwash plains at the stagnant margin of an ice sheet.
Figure 1. Paleozoic Terranes of Southeastern New England

Base map by Peter Gromet. Geology after works by P. Gromet and O. Horne, D. Murray, N. Hamizada and E. Bettez. Please see NEIGC field guides for more detailed information.
Figure 50 – Location map of Lake Hitchcock. Lake Upham formed after Hitchcock drained (From Ashley, 1972)
NEW ENGLAND GEOLOGY

The Bedrock of Massachusetts

The Office of the Massachusetts State Geologist
and the Department of Geosciences at U-Mass, Amherst

Rock types in Massachusetts
- Sedimentary Rocks
- Calcareous Schists
- Marble
- Granite
- Mafic Rocks
- Metamorphic Rocks
- Sediments

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Map based on USGS Open-File Report 03-225

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NEW ENGLAND GEOLOGY

Surficial Geologic Map of the Ashby-Lowell-Sterling-Billerica 11-Quadrangle Area
(Stone and Stone, 2007)
2009 GEOLOGIC TIME SCALE

CENOZOIC

MESOZOIC

PALEOZOIC

PRECAMBRIAN

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