

# GEOG203 – Environmental Systems

## Soils & Biogeochemistry *Soil Formation and Classification* *Lecture #5 – October 18<sup>th</sup> 2006*

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### Soil-forming factors - Jenny

**Climate** (temperature, precipitation).

**Parent material** (sediment type and mineralogy, ease of weathering etc.).

**Organisms** (e.g. deciduous vs. coniferous forest; grassland vs. forest, micro- vs. macro-organisms).

**Topography** – controls water regime (wet vs dry) and rates of soil erosion).

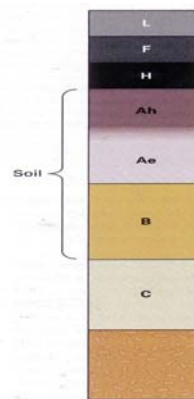
**Time** – older soils more strongly developed than young soils.

$$\text{Soil} = f(\text{cl, pm, o, top, time})$$

### Soil = f(cl, pm, o, top, time)

If we keep four variables constant and vary only one, then the effect of that variable can be examined:

- S=f(cl, pm, o, top, time) **climofunction**
- S=f(cl, pm, o, top, time) **lithofunction**
- S=f(cl, pm, o, top, time) **biofunction**
- S=f(cl, pm, o, top, time) **topofunction**
- S=f(cl, pm, o, top, time) **chronofunction**



The **Surface litter** is the freshly fallen leaves and organic debris and partially decomposed organic matter

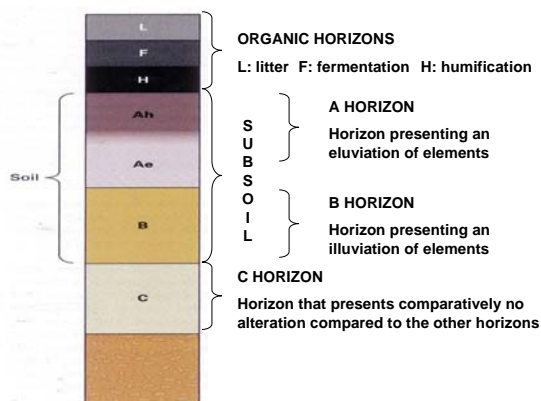
The **Topsoil** is the partially decomposed organic matter (humus), plant roots, living organisms and some inorganic minerals

The **zone of leaching (eluviation)** is the area through which dissolved and suspended material move downward

The **Subsoil** generally present unique colors and often an accumulation (**illuviation**) of material (Al, Fe, OM, clay) leached from the above layers

The **Parent material** is the partially broken down inorganic material

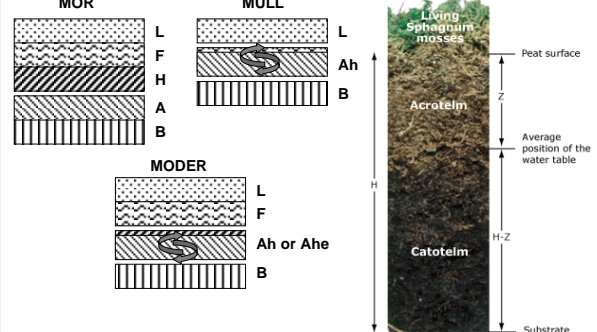
The **bedrock** is the impermeable layer of rocks except for fractures.



### Organic matter in soils

On the surface of mineral soils...

In organic soils...



## Type of soil in the Canadian Soil Classification

A **Brunisol** have sufficient development to exclude them from the regosol, but they lack the degree or kind of horizon development specified of other orders.

The general concept of the **Chernozem** is that of well to imperfectly drained soils having surface horizon darkened by the accumulation of organic matter from the decomposition of vegetation representative of grassland communities or of grassland-forest communities.

**Cryosol** occupy much of the northern third of Canada where permafrost exist close to the surface of both mineral and organic deposits.



## Type of soil in the Canadian Soil Classification

**Gleysol** is defined on the basis of color and mottling, which are considered to indicate the influence of periodic or sustained reducing conditions during their genesis.

**Luvisol** generally have light-colored, eluvial horizons and have illuvial B horizons in which silicate clay has accumulated.

**Organic soil** is composed largely of organic materials



## Type of soil in the Canadian Soil Classification

**Podzol** have B horizons in which the dominant accumulation product is amorphous material composed mainly of humified organic matter combined in varying degrees with Al and Fe

**Regosol** presents weak degree of development (no B horizon)

**Solonetz** have B horizon that is very hard when dry and swell to a sticky mass of very low permeability when wet

**Vertisol** occurs in heavy textured materials (>60% clay of which at least half is smectite) and have shrink-swell characteristics diagnostic of the vertisol order



## Canadian Soil Orders

- **Brunisolic**: Bm horizon, weathering. *inceptisol*
- **Cryosolic**: permafrost. *gelisol*
- **Chernozemic**: thick surface A horizon. *mollisol*
- **Gleysolic**: Bg horizon.
- **Luvisol**: Bt horizon, translocation of clay. *Ultisol or alfisol SB*
- **Organic**: > 30 cm of O horizon. *histosol*
- **Podzolic**: Bf/Bh horizon with translocation of Fe, Al & o.m. *spodosol*
- **Regosolic**: absence of profile development. *entisol*
- **Solonetzic**: Na-rich subsurface.

## Simonson

- 4 main processes:
  - Inputs
  - Outputs
  - Transfers
  - Transformations

Soil order are the result of the balance between the 4 processes

