

Soil Science and Soil Physics

Lecture 12

Soil Types

Detailed

Taxonomy according to FAO/UNESCO



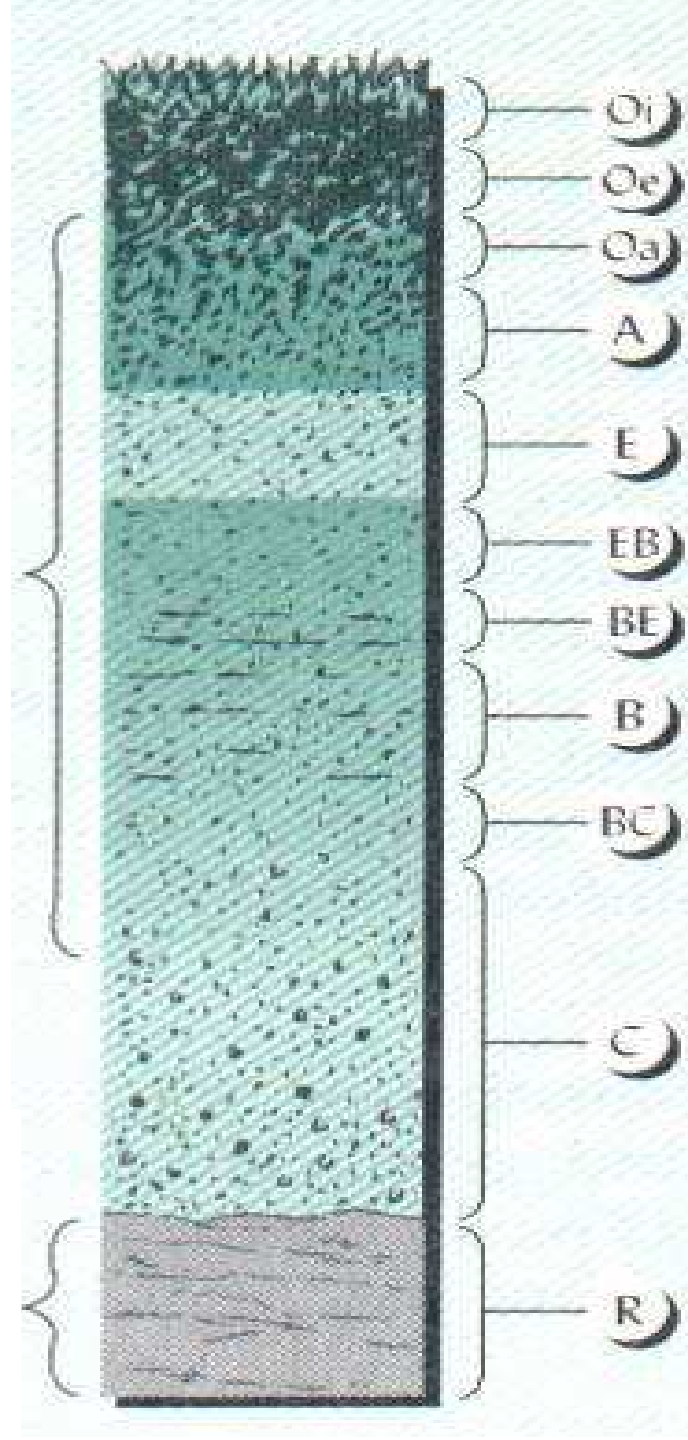
Basic soil horizons

- **O** Plant litter at various levels of decomposition and humus - **O**rganic matter)
 - **A** Topsoil – dark horizon usually rich in humus
 - **E** Eluviation horizon or albic horizon (**E**luviation), light color
 - **B** Horizons that formed below an A, E, O or H
 - **C** Little affected by pedogenetic processes,
-
- **R** Hard bedrock underlying the soil.
(**R**ock)

Transitions between horizons

bedrock

Solum



Indexes

B Subsurface horizons

- **t** clay accumulation (**t**erra cotta)
- **g** gley processes (water saturated soils)
- **k** carbonate accumulation (dry soils)
- **S** **s**esquioxides accumulation (iron, aluminum...)
- **h** humus accumulation (org. matter)
- **O** residual **o**xides – red color (tropical soils)
- **v** alteration relative to underlying horizon

more indexes....

- **C** horizons
 - r highly weathered “saprolite”
 - Ca carbonates
- Rules for index usage
 - No more than 2 indexes

Examples:

Btg, Cr, Bv, Ap, . . .

other indexes

B subsurface horizon

- m marmored

S salic

M soil sediment as substrate

D rock is not soil substrate

T peat

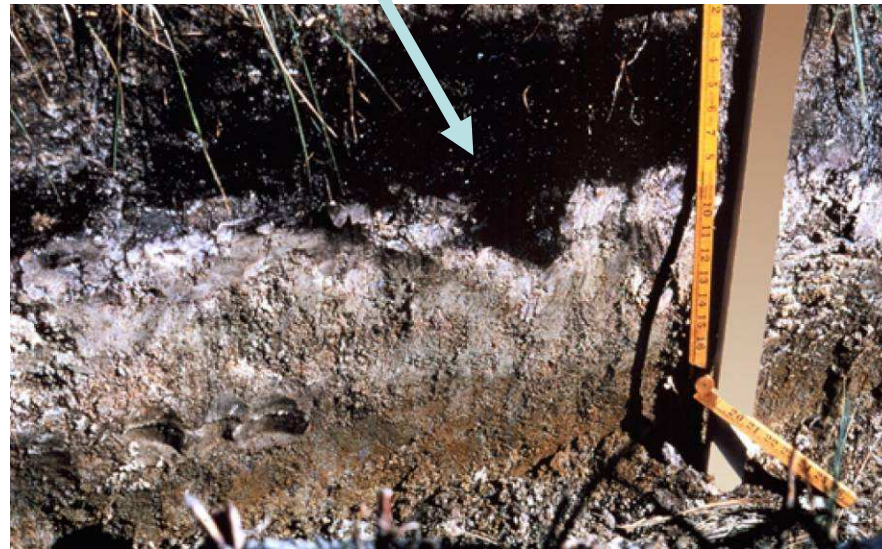
Diagnostic horizons

- **Surface organic horizons:** > 12-18% organic carbon (OC) (weight), > 20-30% organic matter (OM)
- **Organomineral surface horizons (epipedons):** accumulation of organic matter < 20-30%, undecayed OM <5%
- **Subsurface:** under the zone of biogenic accumulation if OM, only illuviated (flushed) from surface horizons

Surface organic horizons

Forest soils

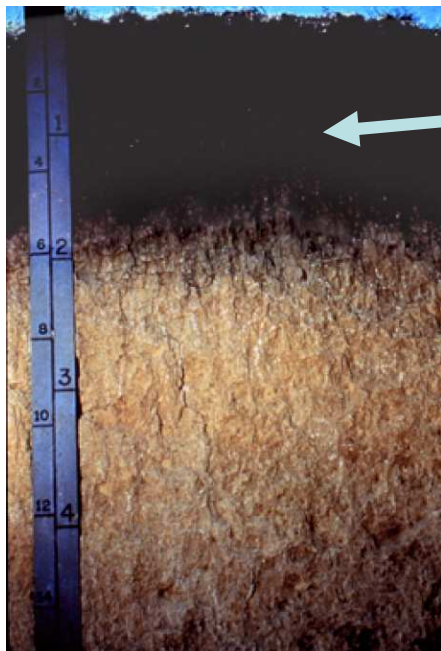
Litter, fermented horizon, humified horizon



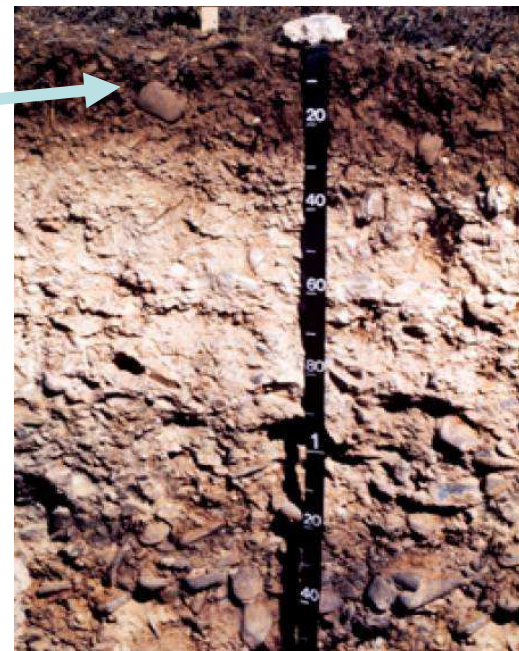
Organomineral surface horizons

Ai - initial : young, shallow, light colored on silicates and carbonates

Ac, Am, - molic : depth > 0,1 m, if arable soils > 0,25 m, dark colored, saturated sorption complex)

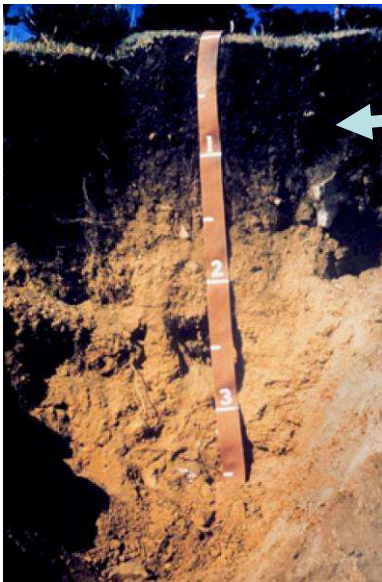


molic
horizon



Organomineral surface horizons

Au - umbric - > 0.1 m (if arable >0.25m), dark, unsaturated sorption complex



Umbric horizon

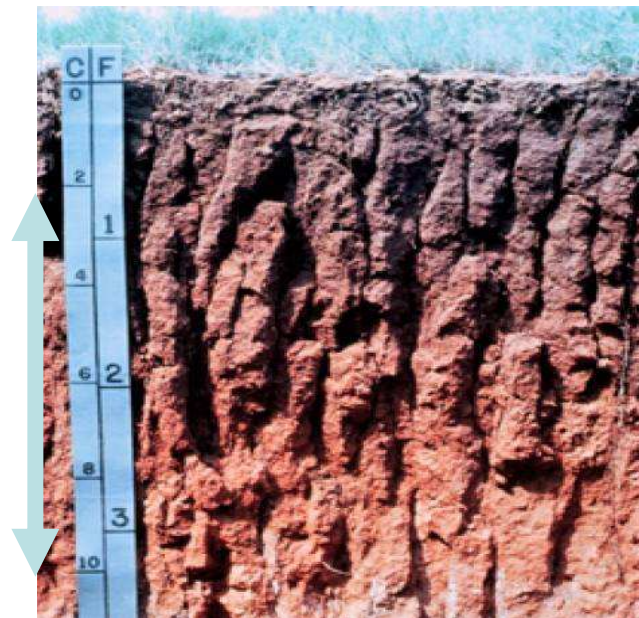
Ap - arable: cultivated by agric. practices

Subsurface horizons:

Bt - luvic, (argillic) : clay enriched horizons with illuvial colloidal coatings. Polyedric or prismatic structure

Special cases **Bn – natric** = high Na, alkalic pH

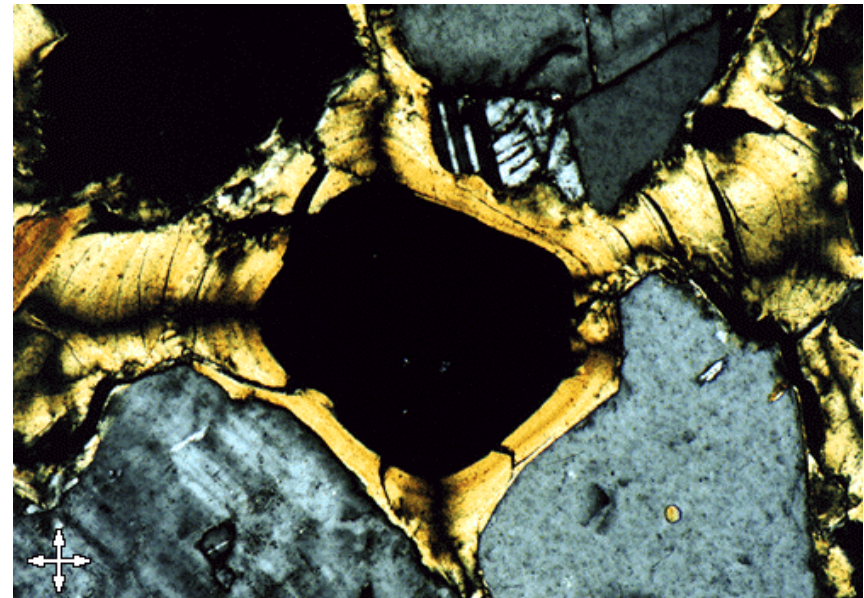
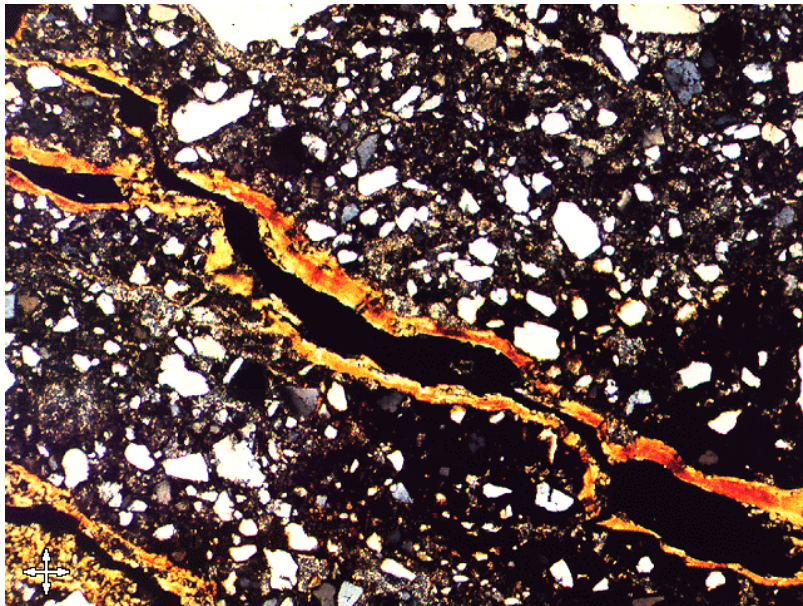
Btg –gleyed rusted or light pattern of soil matrix, but brown prevails



Luvic Bt

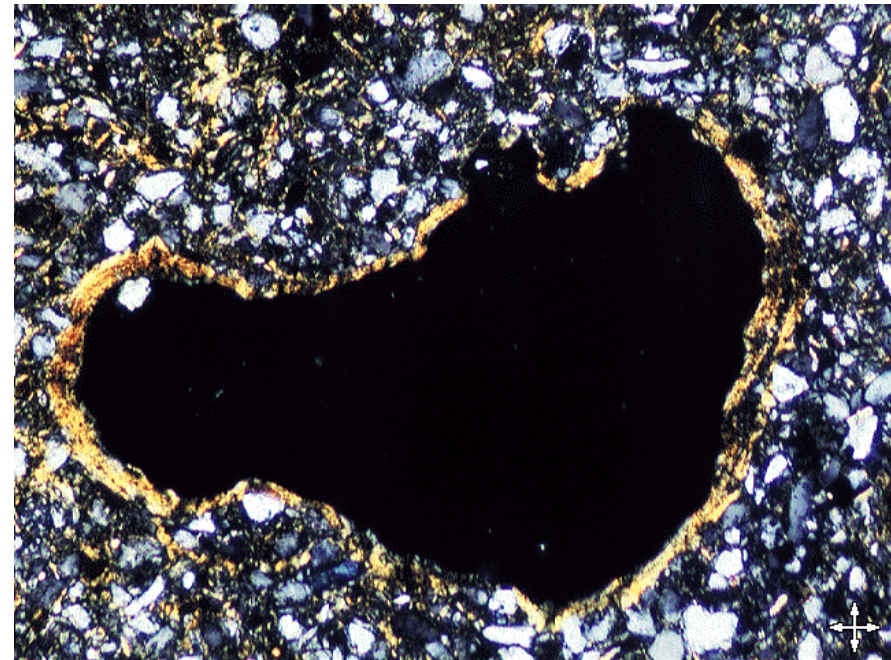
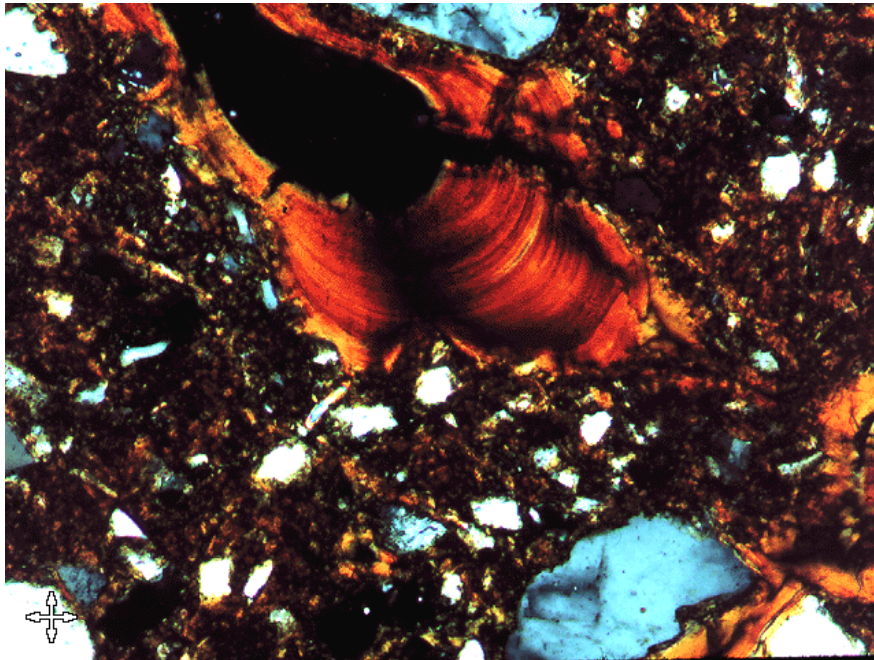
Luvic horizons – clay coatings

Luvic, (argilic) horizons – microscopic images



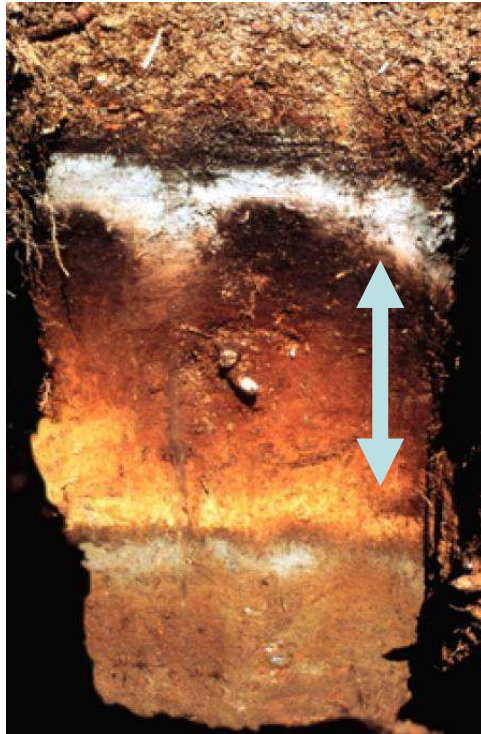
Luvic horizons – clay coatings

Luvic, (argilic) horizons – microscopic images



Subsurface horizons:

Bs - spodic, (sesquioxidic): accumulation of translocated simple organic compounds, aluminium or iron (**Bs, Bhs, Bh**).
Result of podzolization, peptization of organic matter, release of metals and migration with water and deposition



Spodic Bs horizon

Subsurface horizons:

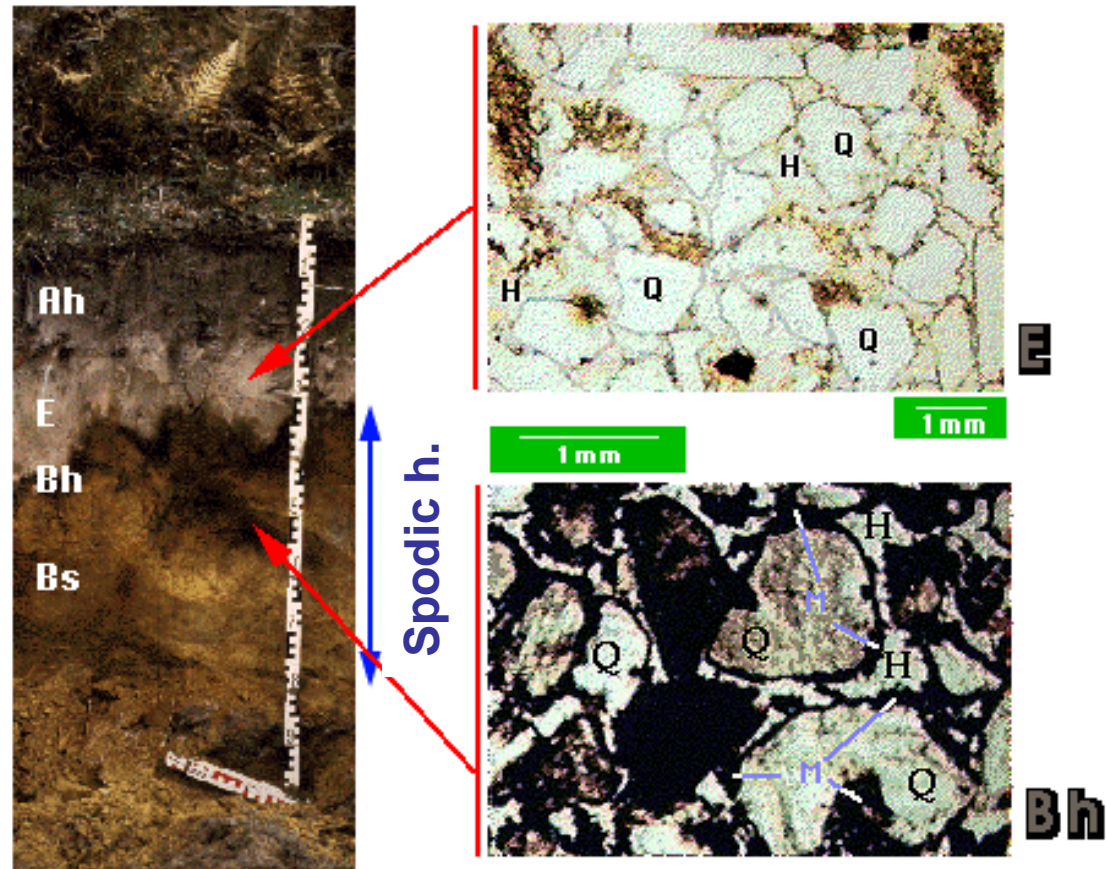
E - Albic: below Organic horizon or A-horizon
Light color, poor in organic or mineral colloids, sesquioxides or salts.
Lacking coatings, low sorption capacity



Albic horizon

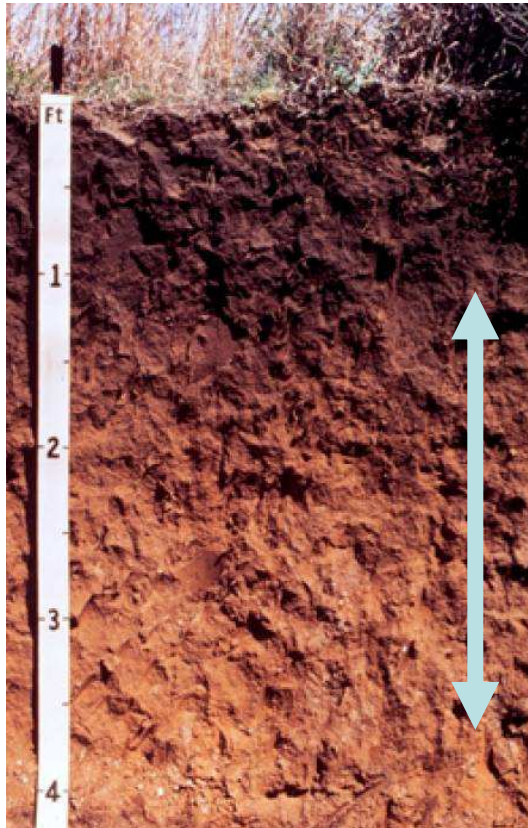
Subsurface horizons:

Albic E and Spodic Bs horizons - microphotography

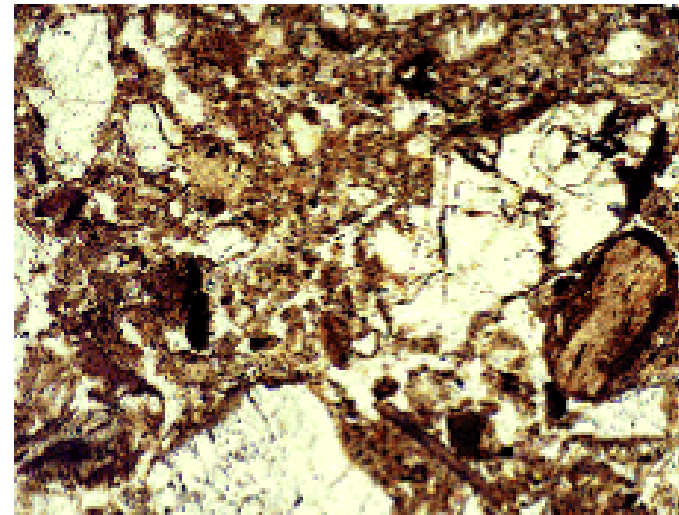


Subsurface horizons:

Bv – cambic brown : characteristic by alteration without illuviation (transport from E to B horizon) of colloids
elements Fe, Mn, Al are released – brown color



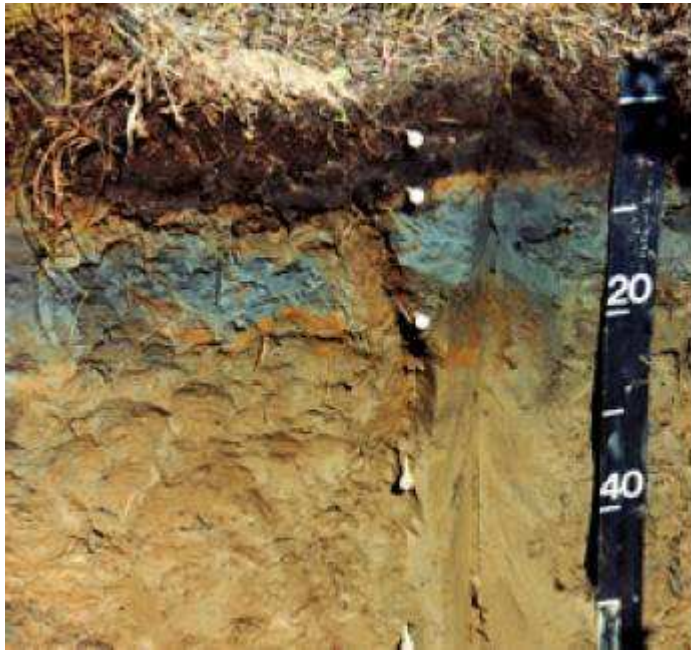
Cambic horizon Bv



microfotography 1mm

Subsurface horizons

- **gleyic – reduced in permanently saturated areas – Fe is reduced blue color (bits of rust – Fe oxidized in root zone, earthworm holes)**



Subsurface horizons

- **andic** – volcanic : lava, ash, obsidian



Subsurface horizons

- accumulation of salts



natric Bn high Na content



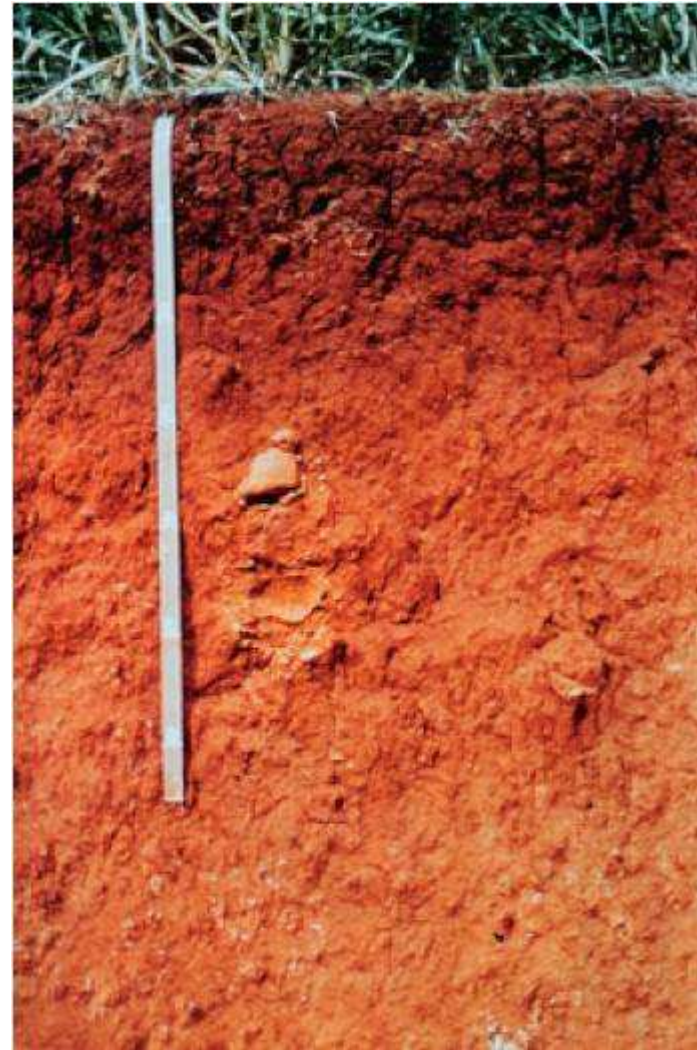
salic – precipitated salts

Subsurface horizons

Ferric

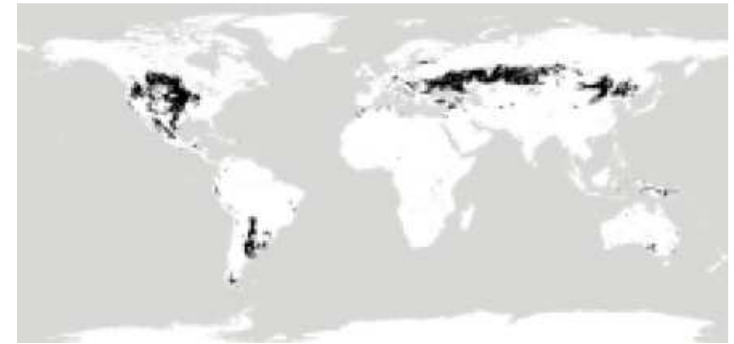
**horizons of accumulation of
reoxidized Fe and Mn
silicate minerals dissolved and
flushed out from the soil profile**

- in tropics



Selected Soil Types

Chernozem (means black soil)



Ap

Dark, crumbly structure

A

Dark silty compact

A/Cca

mixed colors, slightly carbonic, polyedric, compact

Cca

eolic substrate of carbonic origin

Chernozem



Chernozem

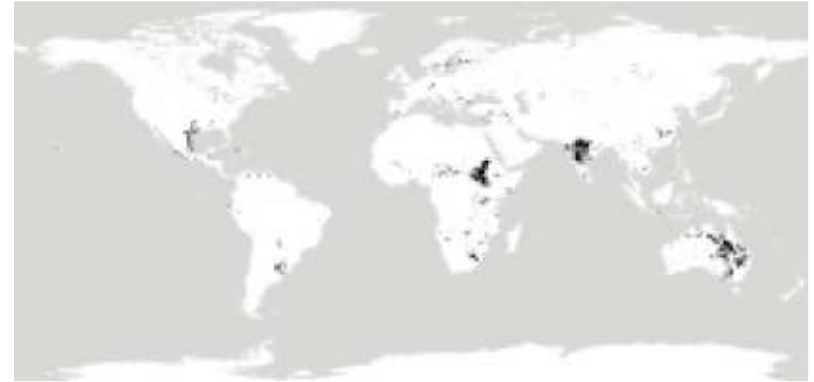


<http://web.utk.edu/~ammonst/research.html>

Chernozem



Vertisol (vertical genesis)



Ap

Dark colored compact

A

Dark prismatic

A/C

Dark/grey clayey, rough prismatic, very compact, straight or tilted cracks

Cca

yellow clay with carbonates, very compact

C

yellow clay

Luvisol



Ap brown grey – crumbly, compact

E light eluviated

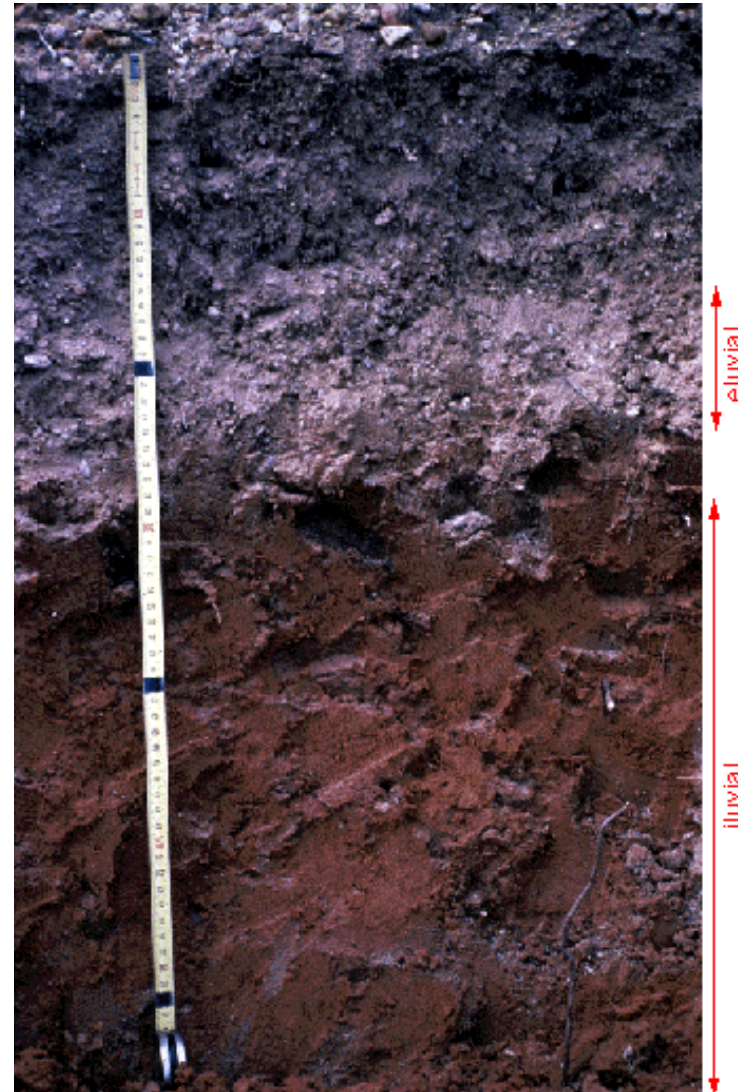
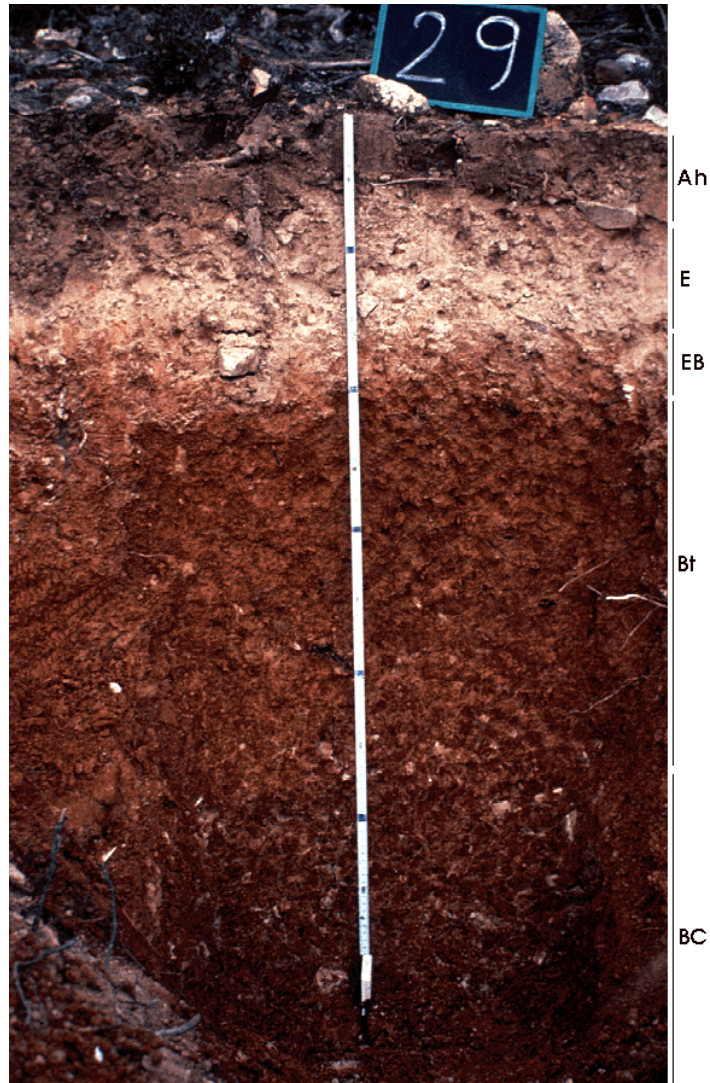
E+B eluviated / illuviated

Bt illuviated colloids

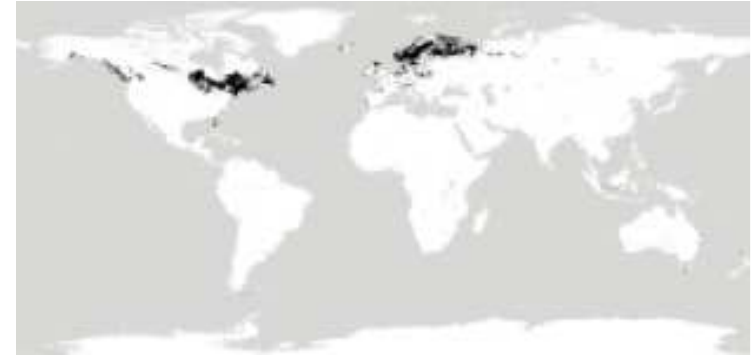
B/C light brown, prismatic

C yellowbrown clayey/silty

Luvisol

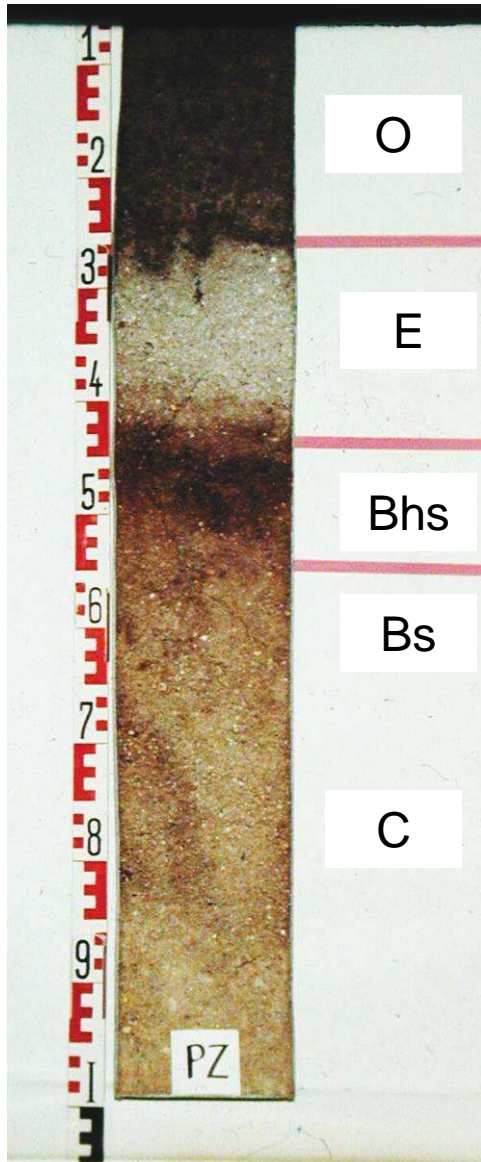


Podzol



- A** dark brown (typically forest soil)
eluviated
- E**
- Bsh** illuviated humus and sesquioxides
- Bs** illuviated sesquioxides
- B/C** soil - weathered bedrock
- C** weathered substrate

Podzols

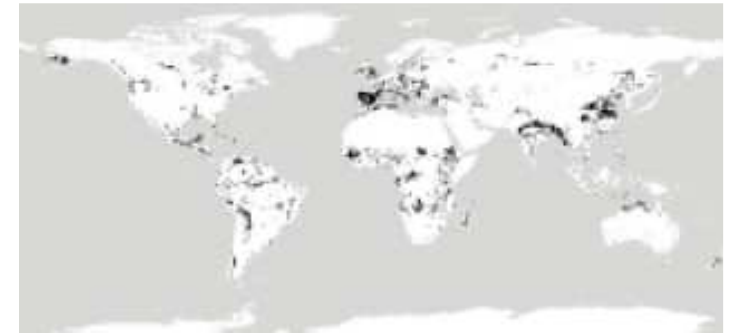


Vališ, 1972



<http://edafologia.ugr.es/>

Cambisol



Ap sandy loam crumbly

Bv weathered substrate with no translocation

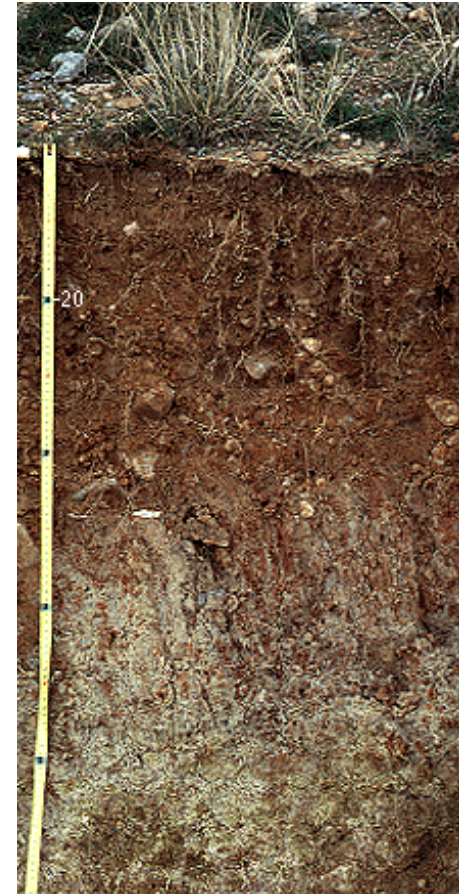
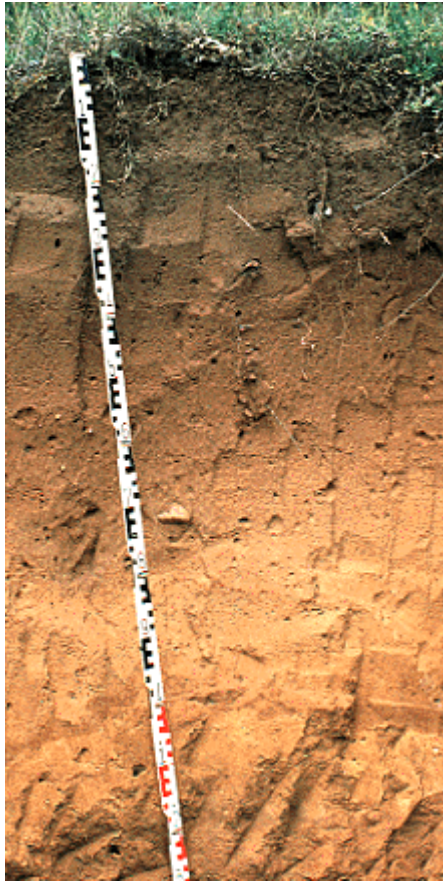
B/C soil - weathered bedrock

C slightly weathered bedrock

Cambisols



Cambisols



Gley



AG

polyedric structure

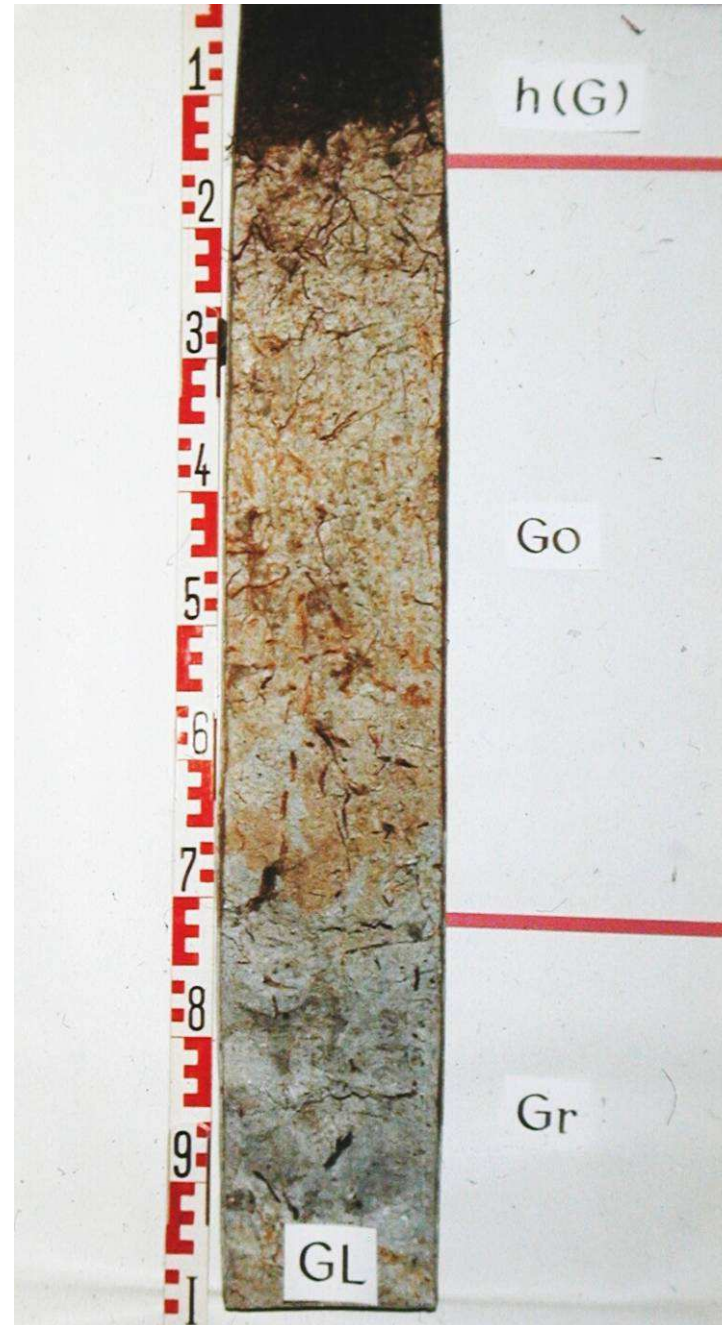
Gor

blue grey, redox

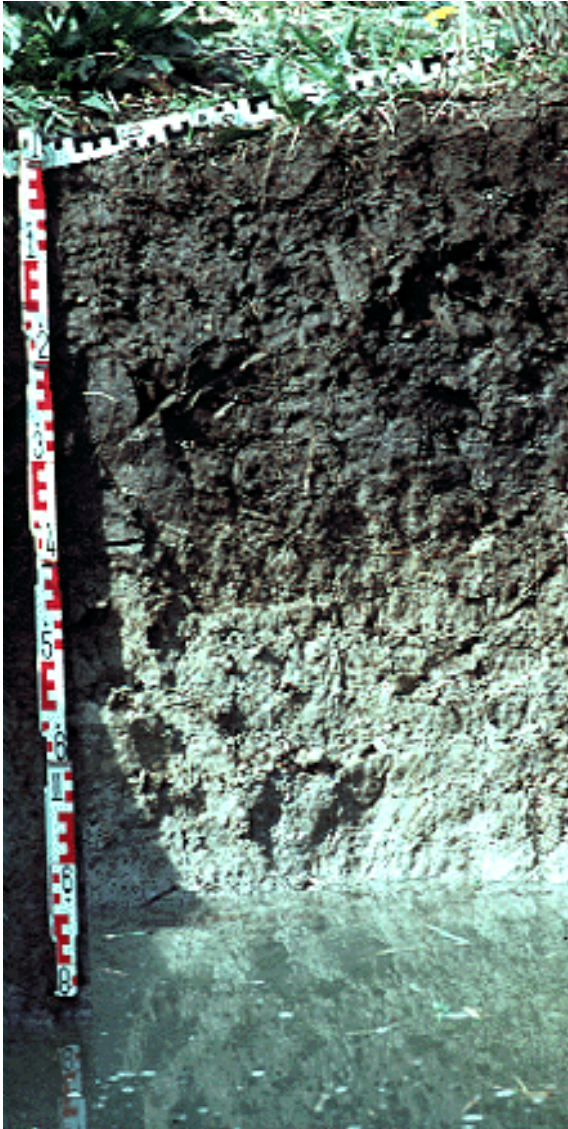
Gr

blue grey, reduced only

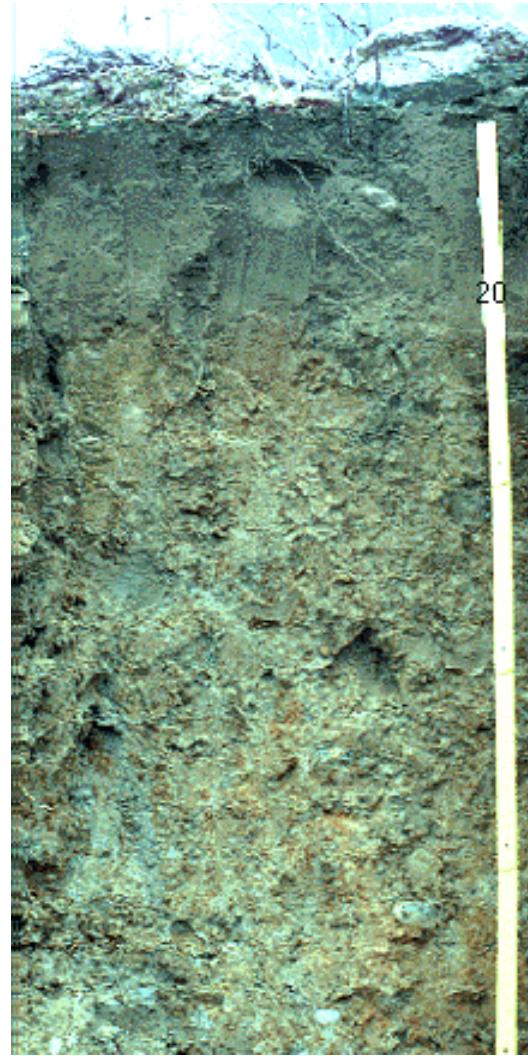
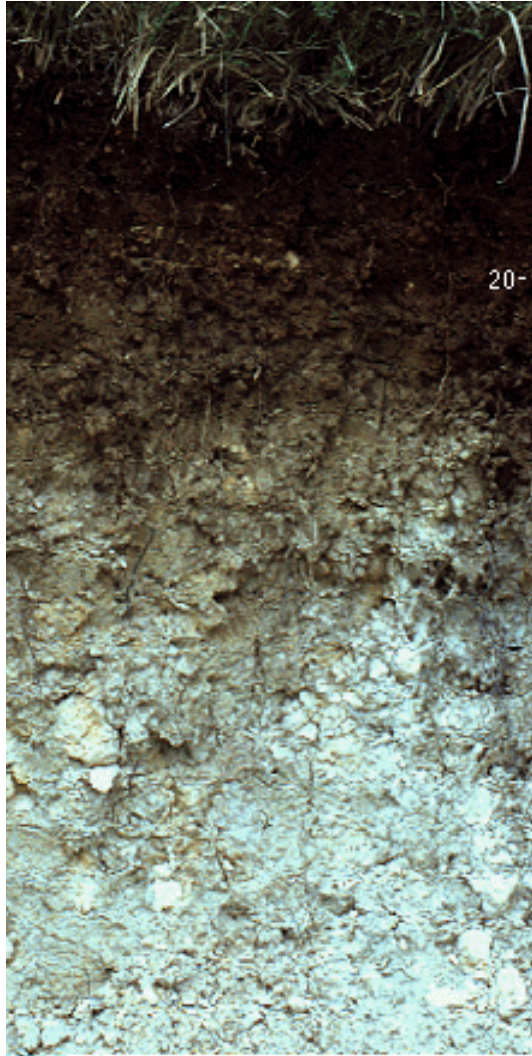
Gley



Gley



Gley



Solonchak – precipitated salts



Solonchak



Solonetz



A

E

Bn

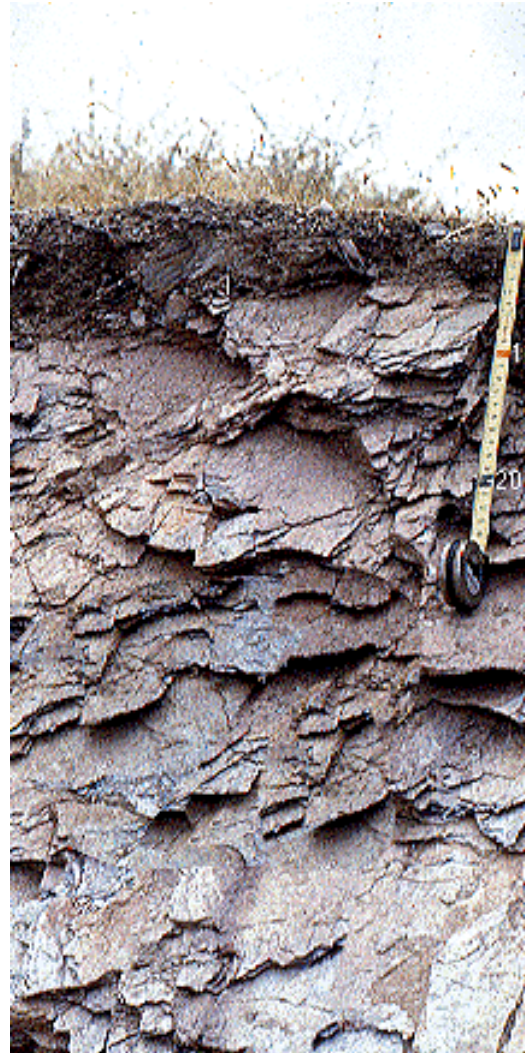
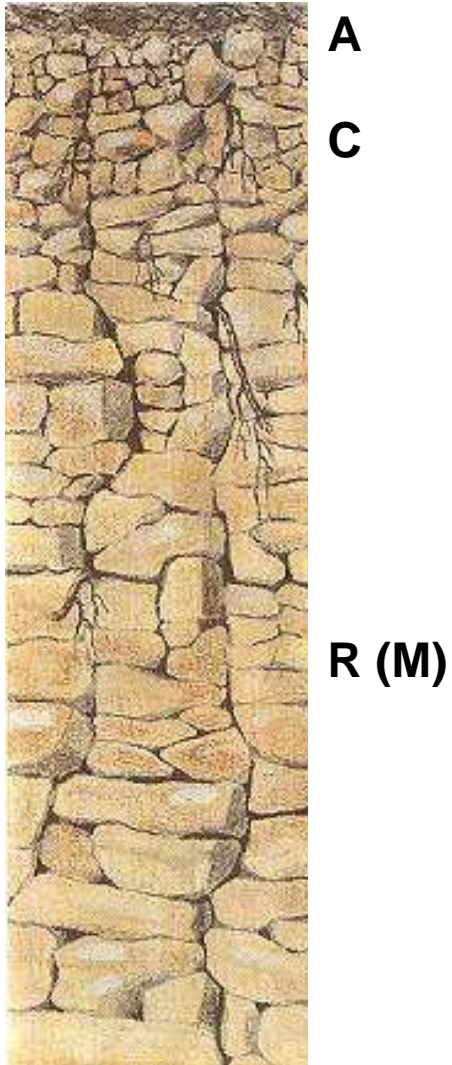
B/C

Cca

natric horizon

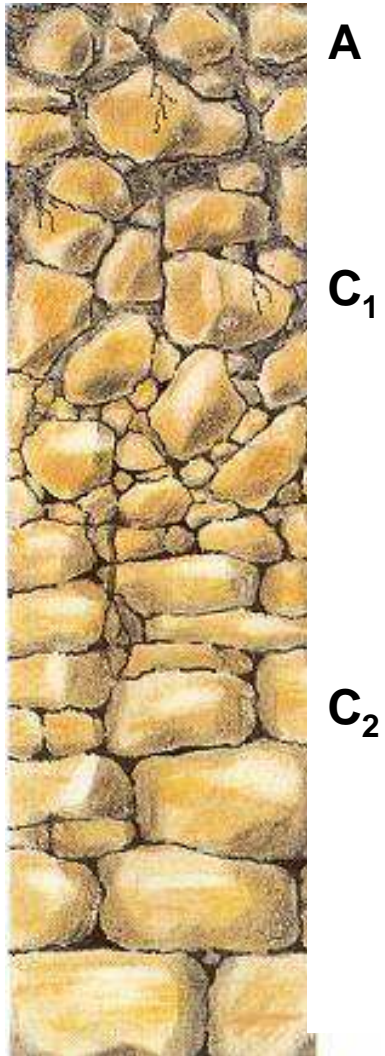


Lithosols – stony initial soils



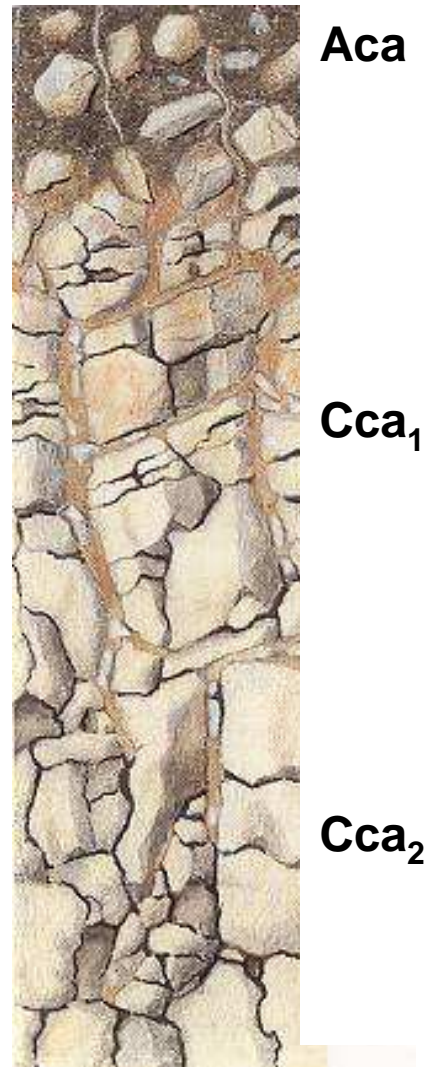
Ranker (lithosols)

more humus



Rendzina (lithosols)

stony soil on carbonates



Rendzina



Fluvisols – “water transported substrate”



Ap

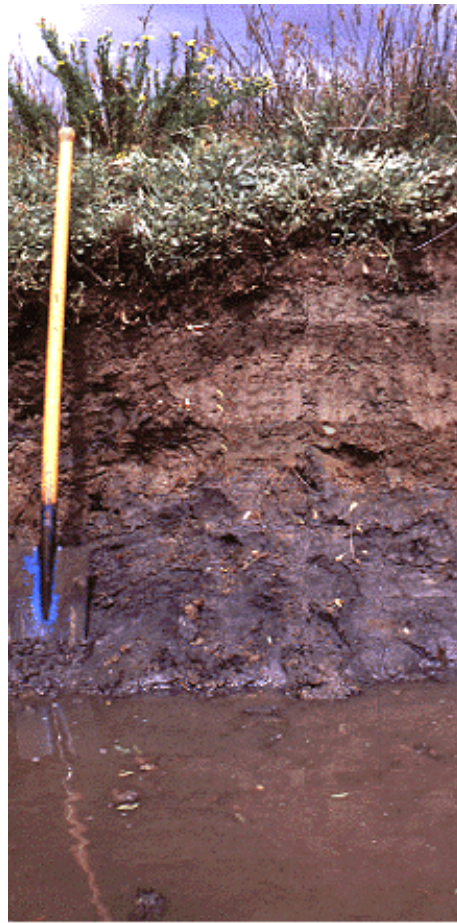
A/C

C

CG

multiple layering acc. to the river functioning

Fluvisols



Organosols – Histosols (peat)



T₁

**lowlands
more mineralized**

T₂

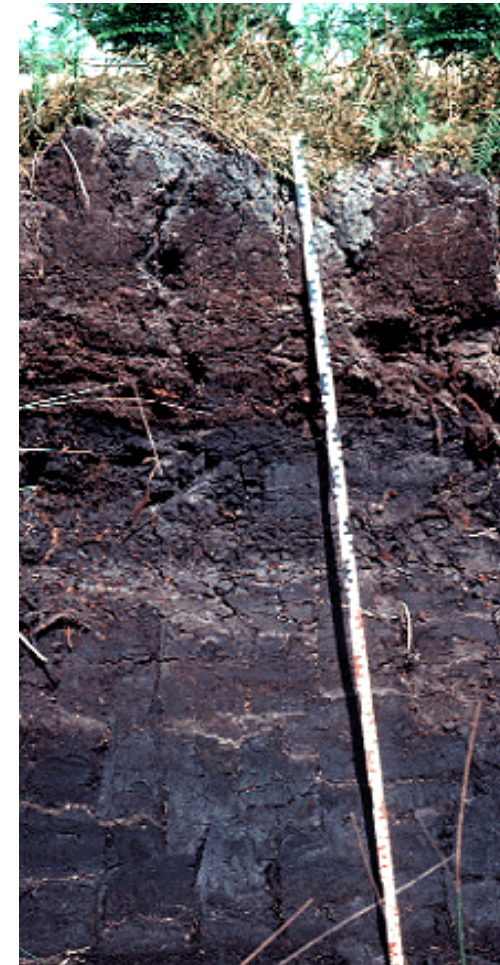
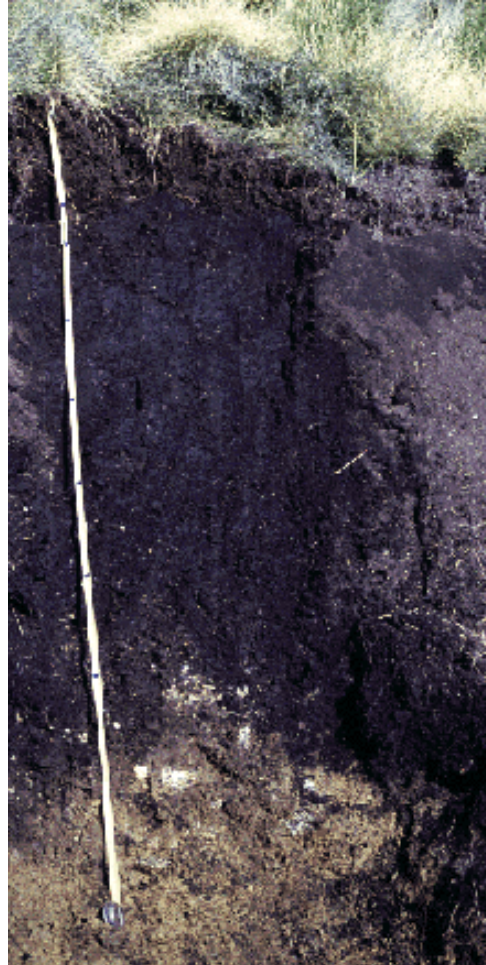


T₁

**mountains
less mineralized**

T₂

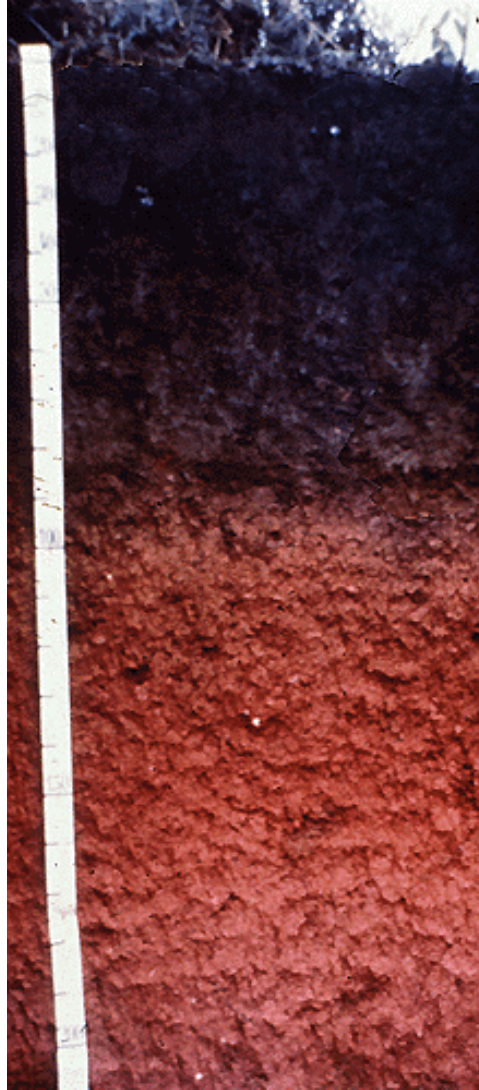
Organosols – Histosols (peat)



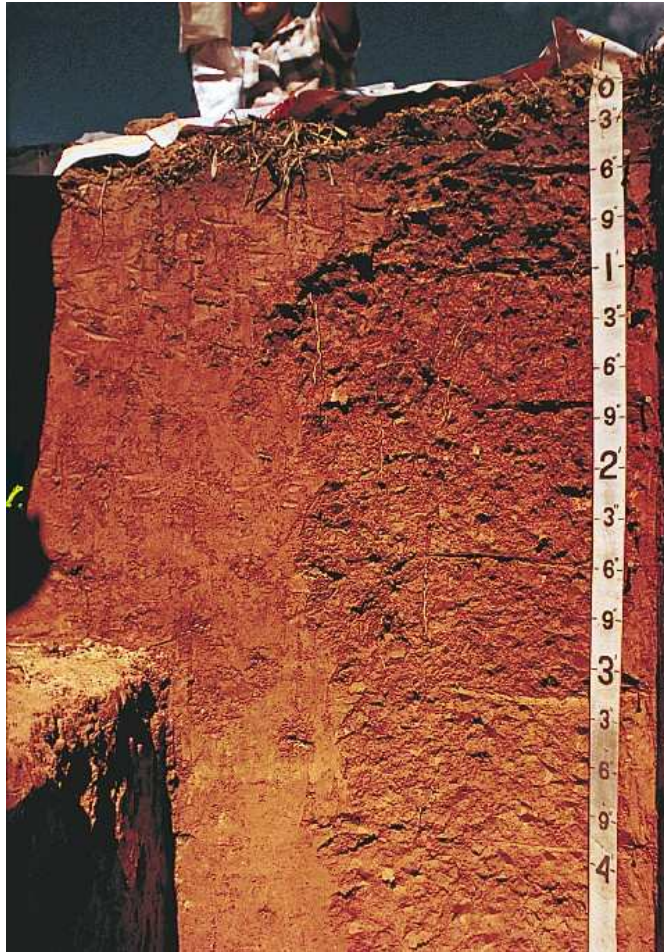
Andosol – volcanic soils



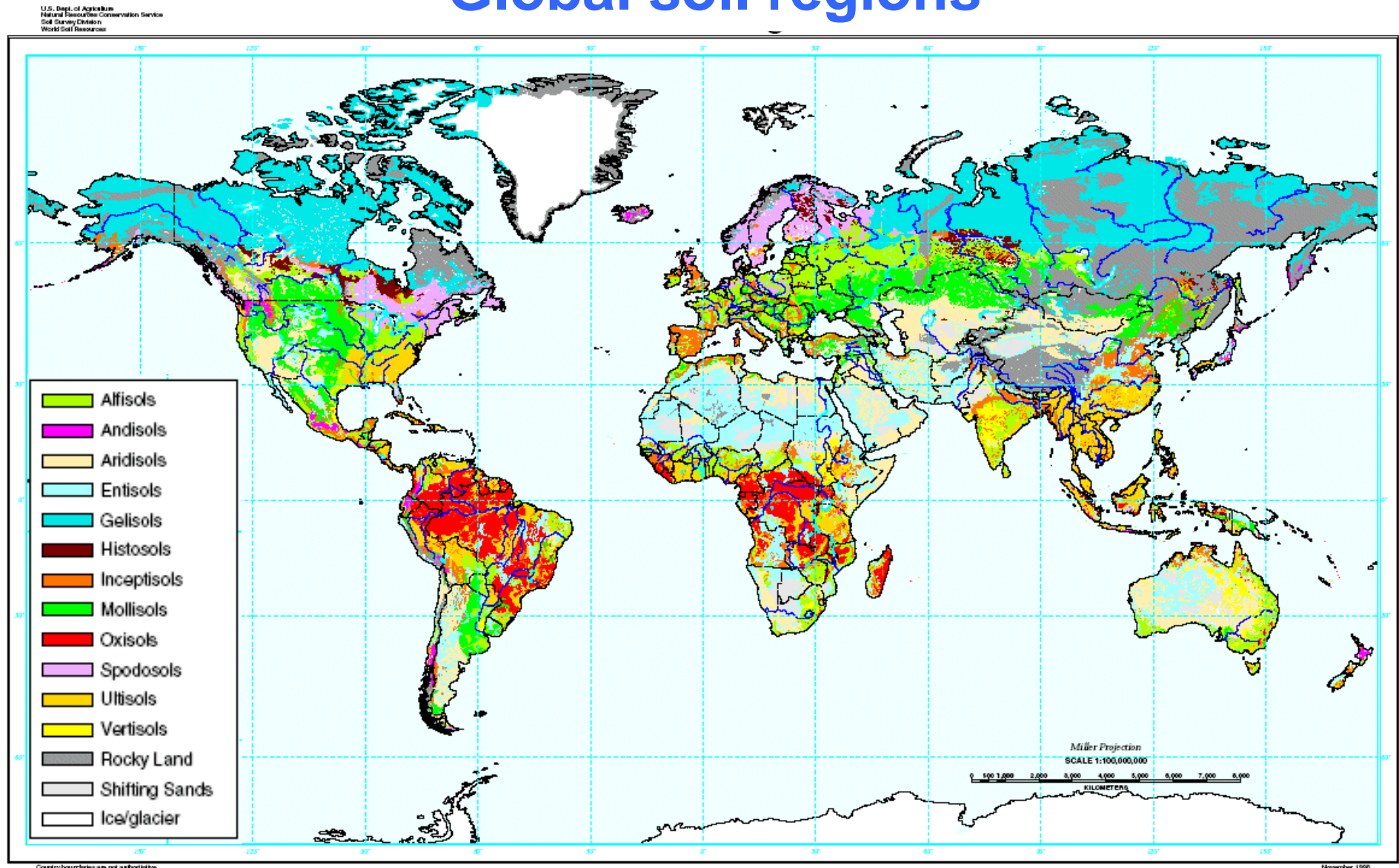
Ferrasols – Oxisols (tropics)



Ferrasols - Oxisols

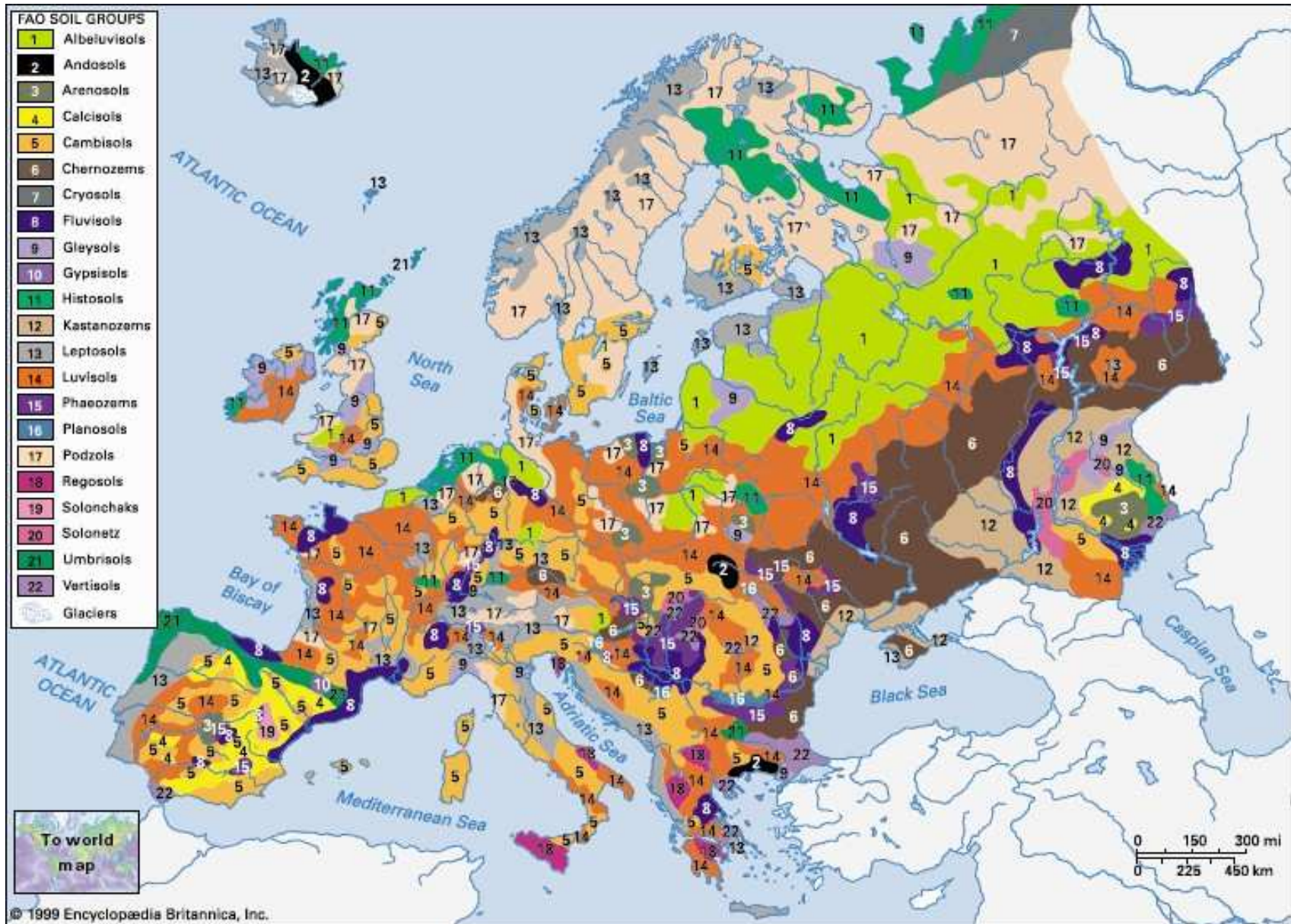


Global soil regions



US – according to Soil Taxonomy USDA

European soil regions



Literature

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