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## **ASAC 1101 : FUNDAMENTALS OF SOIL SCIENCE (2+1)**

**Level : B.Sc (Ag), I semester**

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### **Topic**

**Soil classification – Early system of soil  
classification – Diagnostic horizons –Soil  
moisture and temperature regimes**

## CONCEPTS COVERED

### Concepts Covered:

- Test 1 Why classification is needed
- Test 2 Development of classification system
- Test 3 Different classes
- Test 4 Description of the classes

# **Why need Soil Classification and Taxonomy?**

- **Classification allows scientist to accurately identify individual soil wherever they are.**
- **Taxonomy provides basic understanding about the components of different soils which is necessary for effective decision-making about conservation and sustainable use.**

# Purpose of Soil Classification

1. Organize our knowledge.
2. Remember properties of the objects.
3. Bring out and understand relationships among individuals and classes of the population.
4. Learn new relationships among the group.
5. Establish groups of the objects in a manner useful for practical and applied purposes.

# Historical developments in Soil Classification

- **Early System of Classification:**

1. **Economic Classification**
2. **Physical Classification**
3. **Chemical Classification**
4. **Geological Classification**
5. **Physiographic Classification**

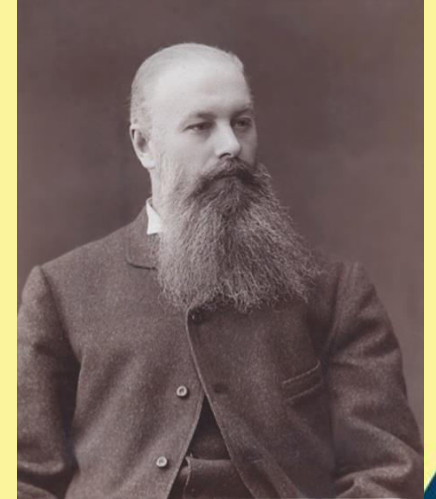
# Modern system of soil classification

The first classification was proposed by Dokuchaev (1870): Soil is a natural body

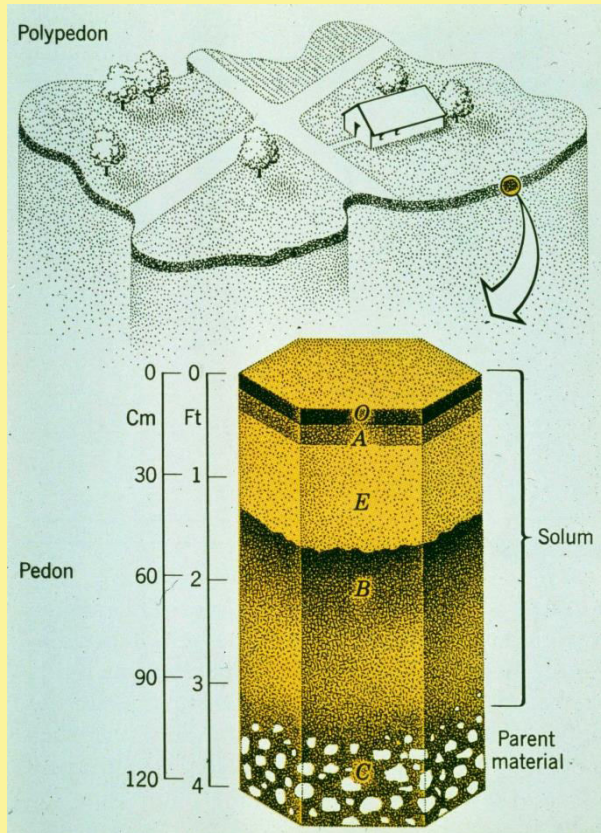
Divided the soil into **three** categories

1. Normal (*Zonal*): Formation influenced by climate and vegetation
2. Transitional (*Intrazonal*): more developed than Azonal. Formation controlled by local factors like **parent material** and **topography**
3. Abnormal (*Azonal*) : poorly developed

This approach was based on the principle of **soil genesis**, role of **vegetation** and **climate**.



# Pedon and Polypedon

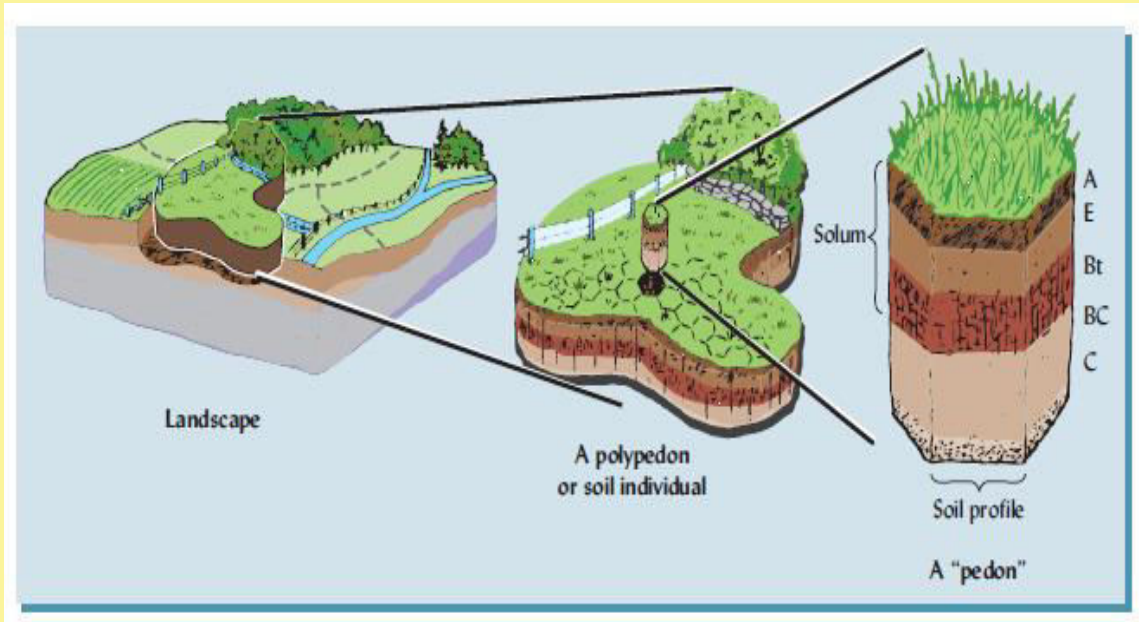


**Basic unit of soil classification**

**Smallest sampling unit that displays the full range of properties characteristic of a particular soil**

**Pedons occupy from about 1 to 10 m<sup>2</sup> of land area**

# Pedon and Polypedon



A soil unit in a landscape usually consists of a group of very similar pedons: **Polypedon**

Sufficient size to be recognized as a landscape component termed a **soil individual**



# Marbut's Morphogenetic System:

- Both soil morphology and soil genesis
- Introduced the concept of “Great Soil Group”.
- Classification based on their own intrinsic properties.
- The highest category was divided into two classes
  1. Pedalfers- Aluminium and Iron accumulation (highly leached soil)
  2. Pedocals- Calcium carbonate accumulation (soils of arid and semiarid)

But this system was based on assumed soil genesis which could not find places for most of the soil.



# Baldwin and Associated Genetic System:

- They emphasized the Marbut's system and returned to the zonality concept.
- They gave emphasis on soil as a three dimensional body.
- They introduced the concept of “Soil Family” between the Great Soil Group and Soil Series.
- The concept of “Great Soil Group” was revised.

But still this system was also not completely based on soil measurable properties.

## **Three ORDERS in this system:**

### **1. Zonal or “normal” soils**

- climate inputs dominate a soil’s genesis**
- soil is in equilibrium with the climate/veg**

### **2. Intrazonal soils (local conditions: topography and/or parent material)**

- salts, wetness or limestone bedrock  
overwhelm the soil’s genesis**

### **3. Azonal soils**

- too young, dry or sandy to have developed  
into Zonal soils**

# Zonal soils – examples

- Podzols – cool climates, coniferous forest
- Brunizems – tallgrass prairies
- Sierozems – desert soils
- Laterite soils – red tropical soils



<http://geo.msu.edu/extra/schaetzi/07%20-%20soil%20classification%20and%20mapping.ppt>

# Intrazonal soils – examples

- Rendzinas – shallow to limestone bedrock
- Gley soils – wet soils
- Peat soils



<http://geo.msu.edu/extra/schaetzl/07%20-%20soil%20classification%20and%20mapping.ppt>

# Azonal soils – examples

- Dry, sandy soils
- Shallow-to-bedrock soils
- Alluvial soils (young parent materials)



<http://geo.msu.edu/extra/schaetzi/07%20-%20soil%20classification%20and%20mapping.ppt>

# Major limitations of the genetic systems

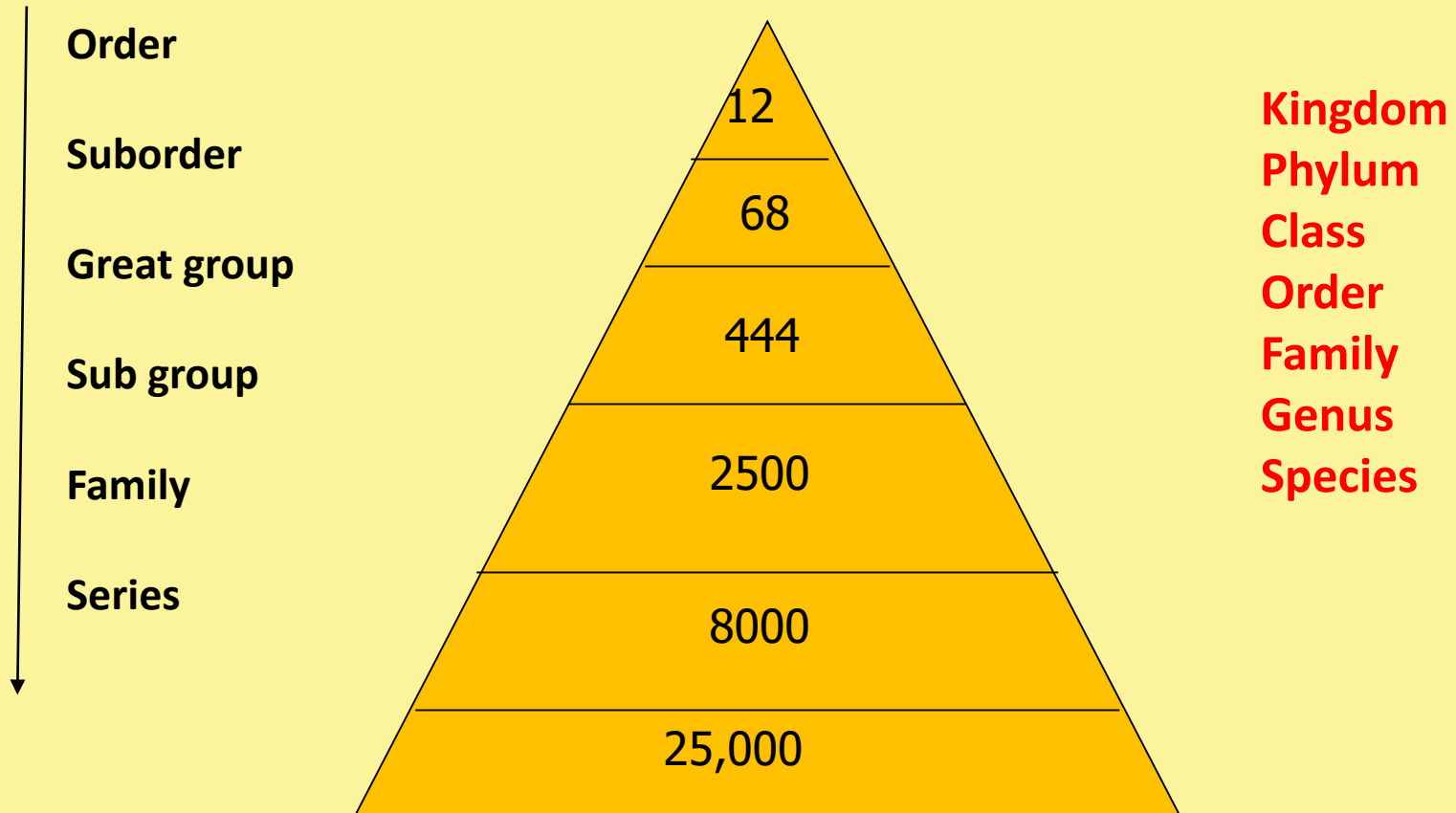
- The two highest categories were defined in genetic terms not on soil properties.
- The Great Soil Group concept were qualitative.
- In definitions, more emphasis was given on properties of virgin soils which got modified by use.
- The nomenclature was evolved from many languages and it was difficult to name the intergrades.

# **Soil Taxonomy (Comprehensive System of Soil Classification)**

- **System based on the measured or observed soil properties.**
- **Surface and subsurface diagnostic horizons.**
- **Moisture and temperature regime.**
- **Color, texture, structure.**
- **Organic matter, clay, iron, aluminium oxides, silicate clays, salts, pH, base saturation.**
- **Soil depth.**



# Soil Taxonomy hierarchy



# Features of Soil Taxonomy

- Soil classes were defined in terms of present soil properties.
- All such properties were considered which affect soil genesis or the outcome of soil genesis.
- The nomenclatures were made using Greek and Latin words.
- A new category, “Subgroup”, was added to define the central concept of great groups.
- This system is easy to remember.

# Diagnostic horizons

**Surface**

**Subsurface**



# Diagnostic surface horizons

## Epipedons

Mollic

Umbric

Ochric

Folistic

Histic

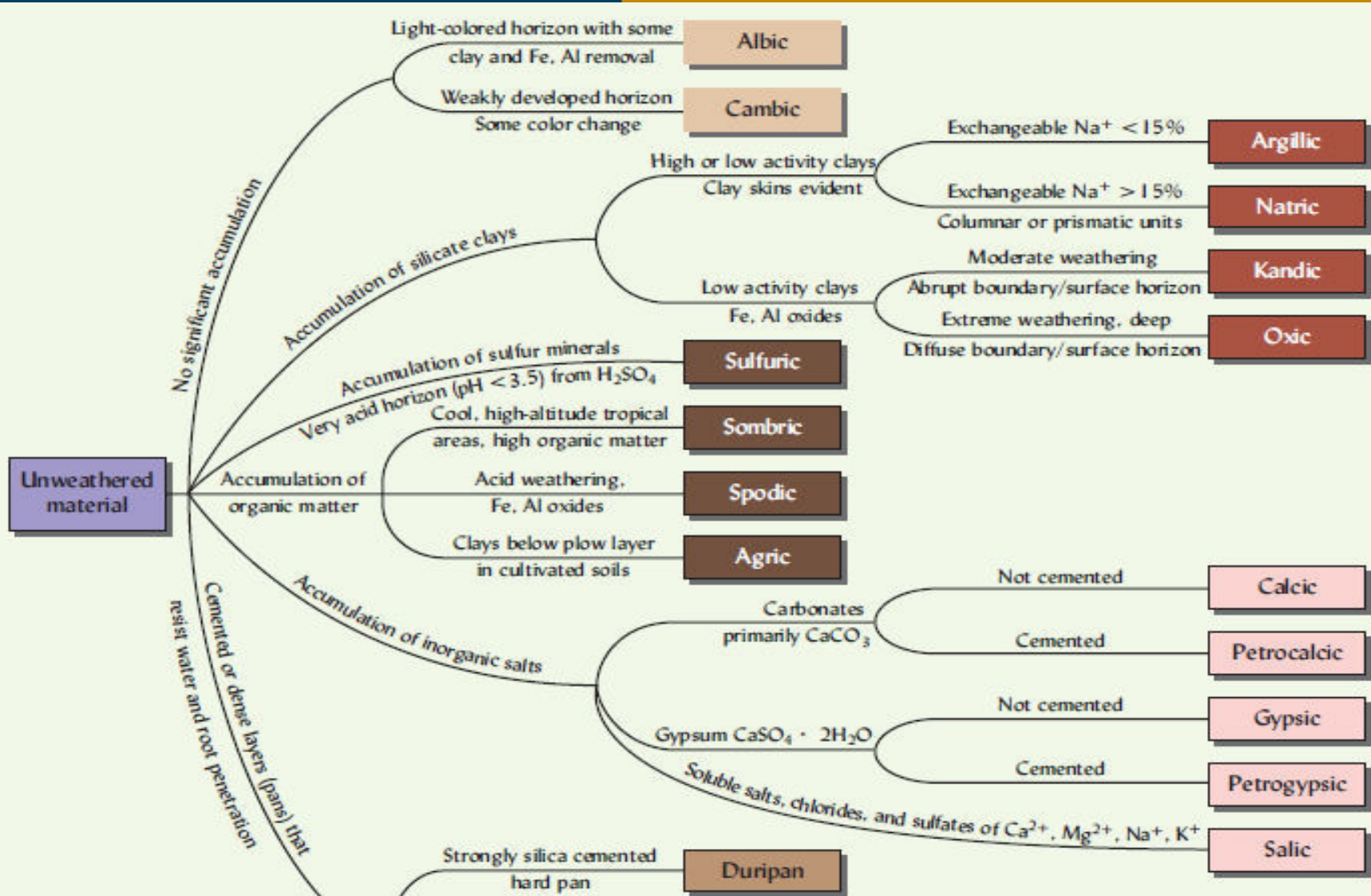
Melanic

Plaggen

Anthropic

# Diagnostic subsurface horizons / Endopedons

1. Agric
2. **Albic**
3. Anhydritic
4. **Argillic (Bt)**
5. Calcic
6. Cambic
7. Duripan
8. Fragipan
9. Glossic
10. Gypsic
11. **Kandic**
12. Natric
13. **Oxic**
14. Petrocalcic
15. Petrogypsic
16. Placic
17. Salic
18. Sombric
19. **Spodic**
20. Sulfuric



# Soil Moisture Regimes (SMRs)

- 1. Aquic:** Soil is saturated with water for sufficient periods of time for evidence of poor aeration (gleying and mottling) to occur.
- 2. Udic:** Soil moisture is sufficiently high year-round in most years to meet plant needs. An extremely wet moisture regime with excess moisture for leaching throughout the year is termed perudic.
- 3. Ustic:** Soil moisture is intermediate between Udic and Aridic
- 4. Aridic:** The soil is dry for at least half of the growing season and moist for less than 90 consecutive days.
- 5. Xeric:** This SMR is found in typical Mediterranean-type climates, with cool, moist winters and warm, dry summers.

# Soil Temperature Regimes

- These regimes are based on mean annual soil temperature, mean summer temperature, and the difference between mean summer and winter temperatures, all at 50 cm depth.

Soil Temperature Regimes		
(At 50 cm depth) Mean annual temperature, °C	>6°C difference between summer and winter	<6°C difference summer and winter
<-10	Hypergelic	-
-4 to -10	Pergelic	-
+1 to -4	Subgelic	-
<+8	Cryic (cold summer)	-
<+8	Frigid (warm summer)	Isofrigid
+8 to +15	Mesic	Isomesic