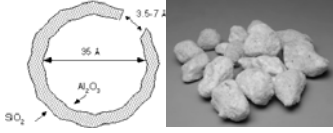


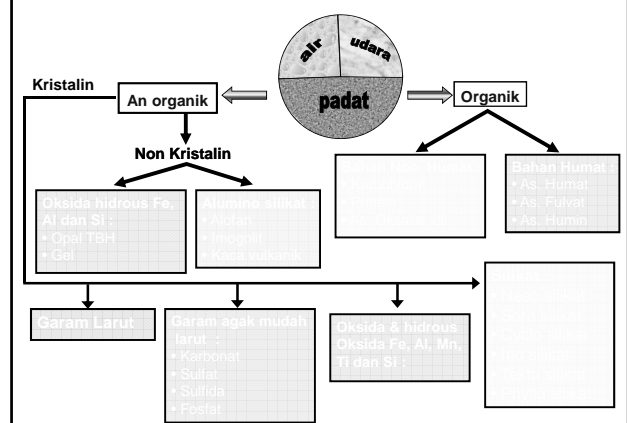
## Mineralogi Lempung



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## KOMPONEN TANAH



## Non silicate Clays

- ☐ Amorphous clays
  - A = without
  - morphous = shape
  - Small structures, from mineral source
  - Very difficult to identify a "typical" structure

## Non crystalline Silicate Clays

- **Not** organized into crystalline sheets
- Both + and – charges; can adsorb anions such as phosphate
- High water-holding capacity
- Malleable when wet, but not sticky
- Often form in volcanic soils (especially in Andisols)
- *Eg. allophane and imogolite*

- Have many fine pores so specific surface is wide (500 m<sup>2</sup>/g)
- More weak stability than crystalline but higher reactivity

## Allophane and Imogolite

- Mixtures of silica and alumina that are poorly crystalline to microcrystalline
- Allophane:  $Al_2O_3 \cdot (SiO_4)_{1-2} \cdot 2.5-3H_2O$
- Imogolite:  $Al_2SiO_3(OH)_4$
- Common in young volcanic (andic) materials
  - Insufficient weathering
  - High soluble silica concentrations
- pH dependent charge
- Exchange capacity
  - CEC: 10 to 40 cmolc kg<sup>-1</sup> at pH 7
  - AEC: 5 to 30 cmolc kg<sup>-1</sup> at pH 4



## Allophane

- ▣ Berasal dari bahan abu vulkanik
- ▣ Alofan berongga, berbentuk bola dengan diameter luar 3,5-5 nm dan tebal dinding 0,7-1 nm
- ▣ Luas permukaan antara 500-1.100 m<sup>2</sup>/g, diukur dengan serapan *ethylene glycol monoethyl ether* (EGME)
- ▣ BV < 0,8 Mg/m<sup>3</sup>
- ▣ Mempunyai kapasitas menahan air dan permeabilitas (tinggi )

## Imogolite

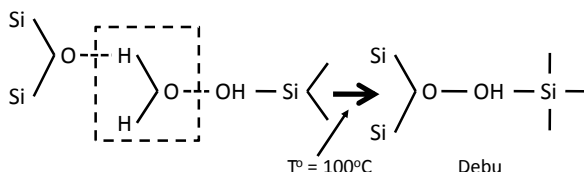
- ▣ Pelapukan lanjut dari alofan yang biasanya ditemukan pada tanah vulkan dari abu gelas (*glassy ash*) dan berasosiasi dengan alofan
- ▣ Dengan mikroskop elektro terlihat berbentuk pipa (*tubular*)
- ▣ Diameter dinding 1 nm (dalam) dan 2 nm (luar)
- ▣ Luas permukaan antara 900-1.100 m<sup>2</sup>/g diukur dengan serapan *ethylene glycol monoethyl ether* (EGME)

- Tanah yang mengandung alofan dan imogolit mempunyai serapan kation dan anion yang tergantung pH tanah
  - ✓ Kation biasanya diserap pada pH tinggi
  - ✓ Anion biasanya diserap pada pH rendah
- Karena struktur tidak sempurna → Al dalam bentuk Al(OH)<sub>2</sub> atau Fe keluar → ion tersebut sangat aktif menyerap anion
- Karena porous → permukaannya luas → air diikat kuat dalam jumlah besar

## pH Dependent Charge of Allophan

pH	Net Charge (meq/100g)	CEC (meq/100g)	AEC (meq/100g)
4	+40	-4	+44
5	+5	-12	+17
6	-10	-20	+10
7	-30	-35	+5
8	-60	-60	0

## Kenapa mineral amorf bersifat irreversible?



## Afinitas (kemampuan mengikat/menjerap anion) oleh alofan & imogolit, yaitu:

- NO<sub>3</sub><sup>-</sup>, Cl
  - sangat lemah sehingga mudah terlindi
- SO<sub>4</sub><sup>2-</sup>
  - afinitas sedang terhadap jerapan
- PO<sub>4</sub><sup>3-</sup>
  - afinitas kuat sehingga bisa menjerap > 85%
- F
  - sangat kuat sehingga dapat merusak bahan alofan/imogolit
  - digunakan untuk selidik lapangan mengenai kandungan alofan

pH NaF > 11 alofan tinggi  
 10 – 11 alofan sedang  
 < 10 alofan rendah

Struktur amorf jika makin rapuh →  
 mempermudah F merusaknya, jika kuat (kristalin)  
 maka F sulit merusaknya



### Iron and aluminium oxides

- **Found in highly weathered soils of warm, humid regions** (eg. oxisols)
- Consist of Fe and Al atoms connected to oxygen atoms or hydroxyl groups
- Some form crystalline sheets (eg. *gibbsite* and *goethite*), but often amorphous
- Low plasticity and stickiness

## Sesquioxides - Al and Fe Oxides

- As weathering continues:
  - Base cations and  $\text{H}_4\text{SiO}_4$  are leached
  - Soils become acidic, further enhancing weathering processes
- After extensive weathering
  - Low solubility (stable minerals) sesquioxides
  - Resistant primary oxides and silicates

- Sesquioxides
  - **Gibbsite** [ $\text{Al}(\text{OH})_3$ ]: *ubiquitous in soils*, particularly those that are highly weathered (Oxisols & Ultisols) and in Al-rich soils (Andisols)
  - **Goethite** [ $\text{FeOOH}$ ]: *the most common hydrous Fe oxide* (found in all soils), particularly in cool, moist climates
  - **Hematite** [ $\text{Fe}_2\text{O}_3$ ]: *found in almost all soils*, favored in warm, dry climates and in the tropics and subtropics