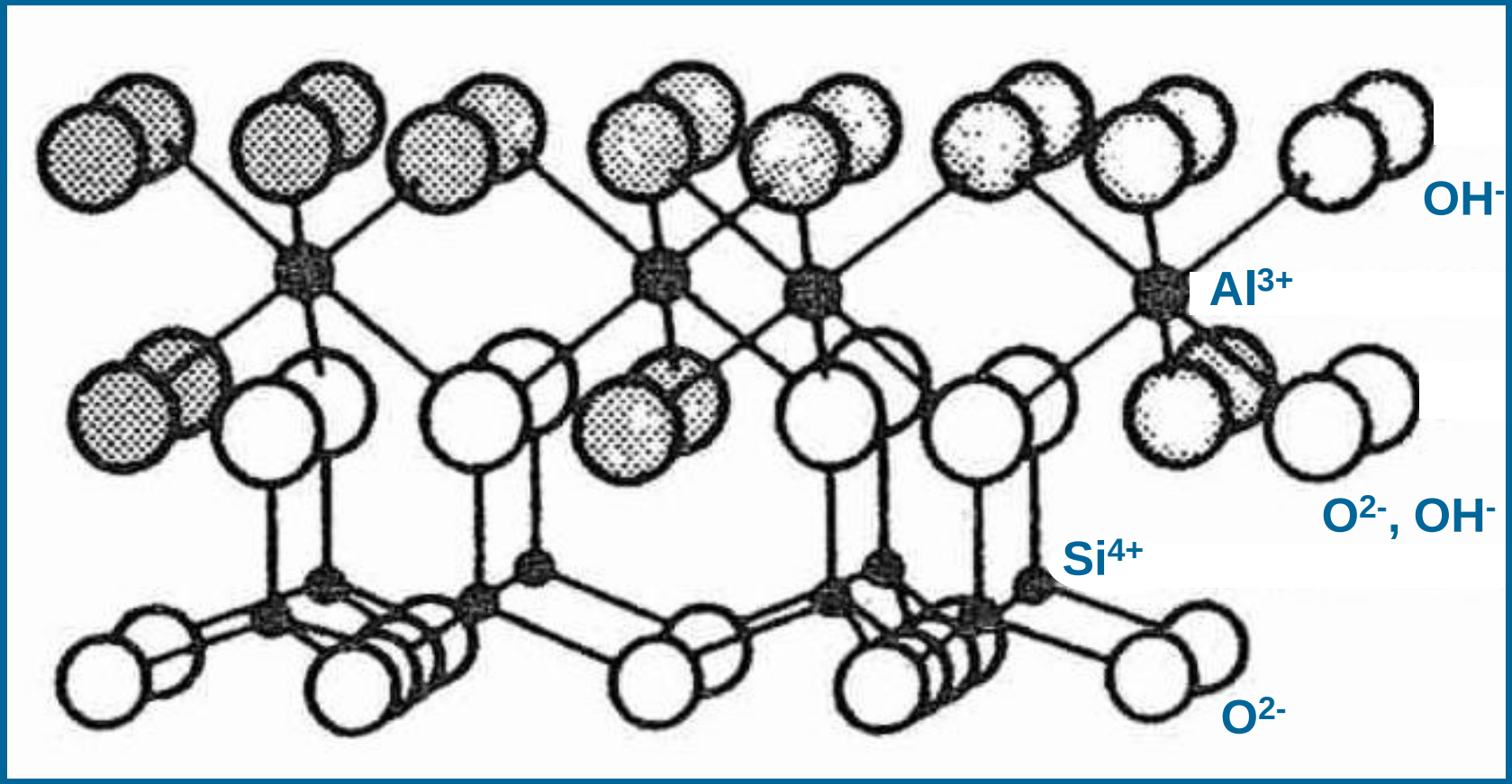
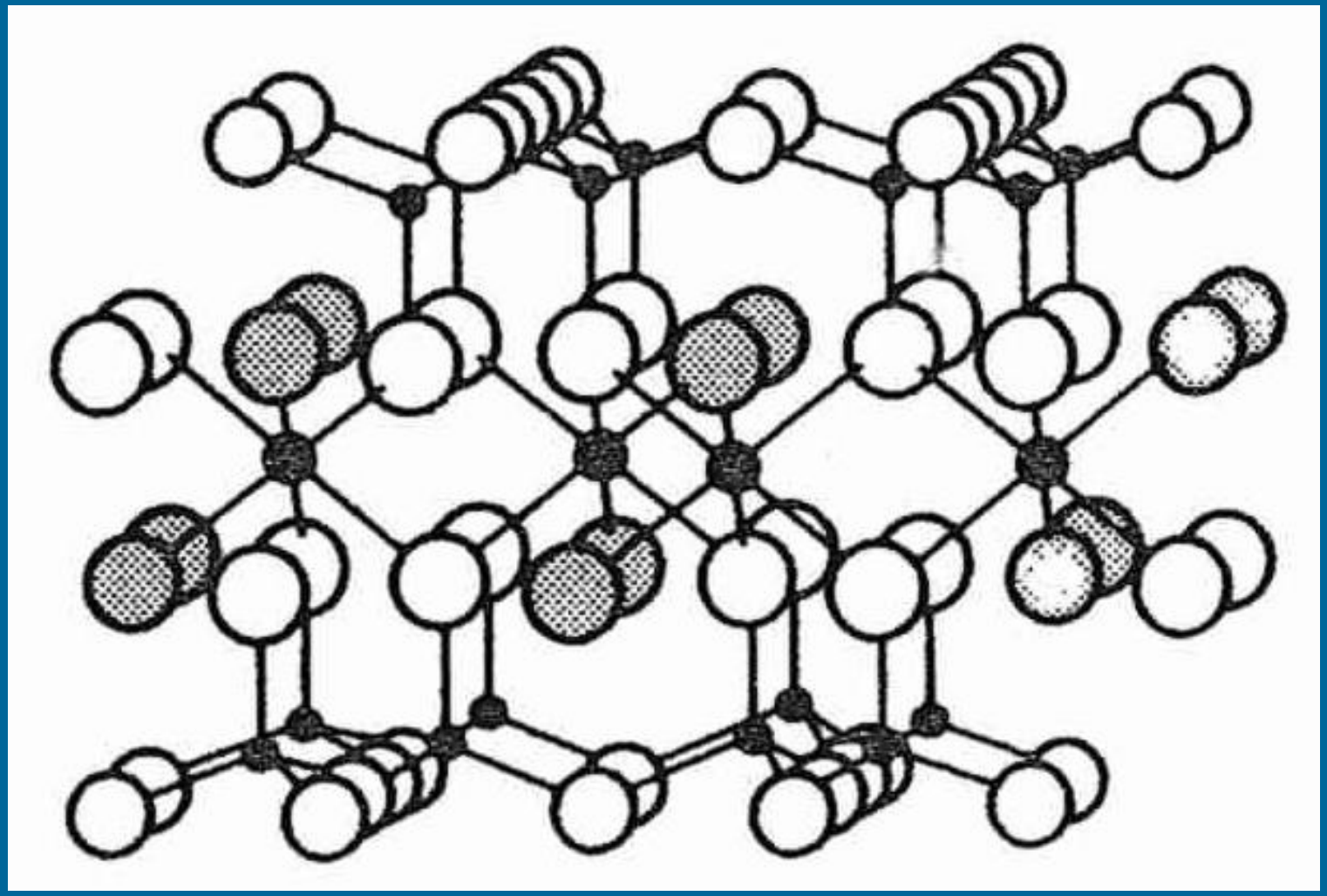
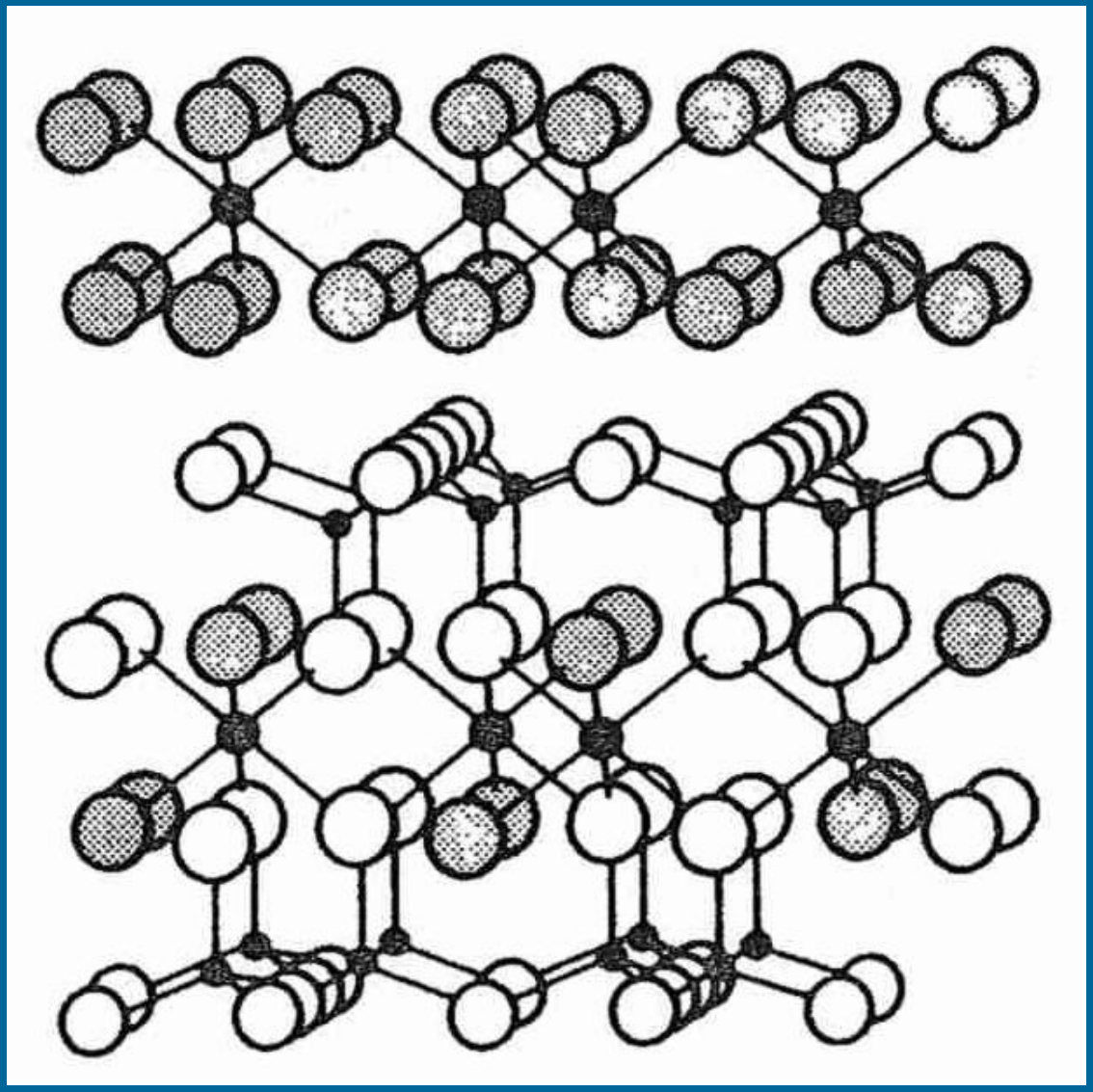
Clay minerals (phyllosilicates) 1:1



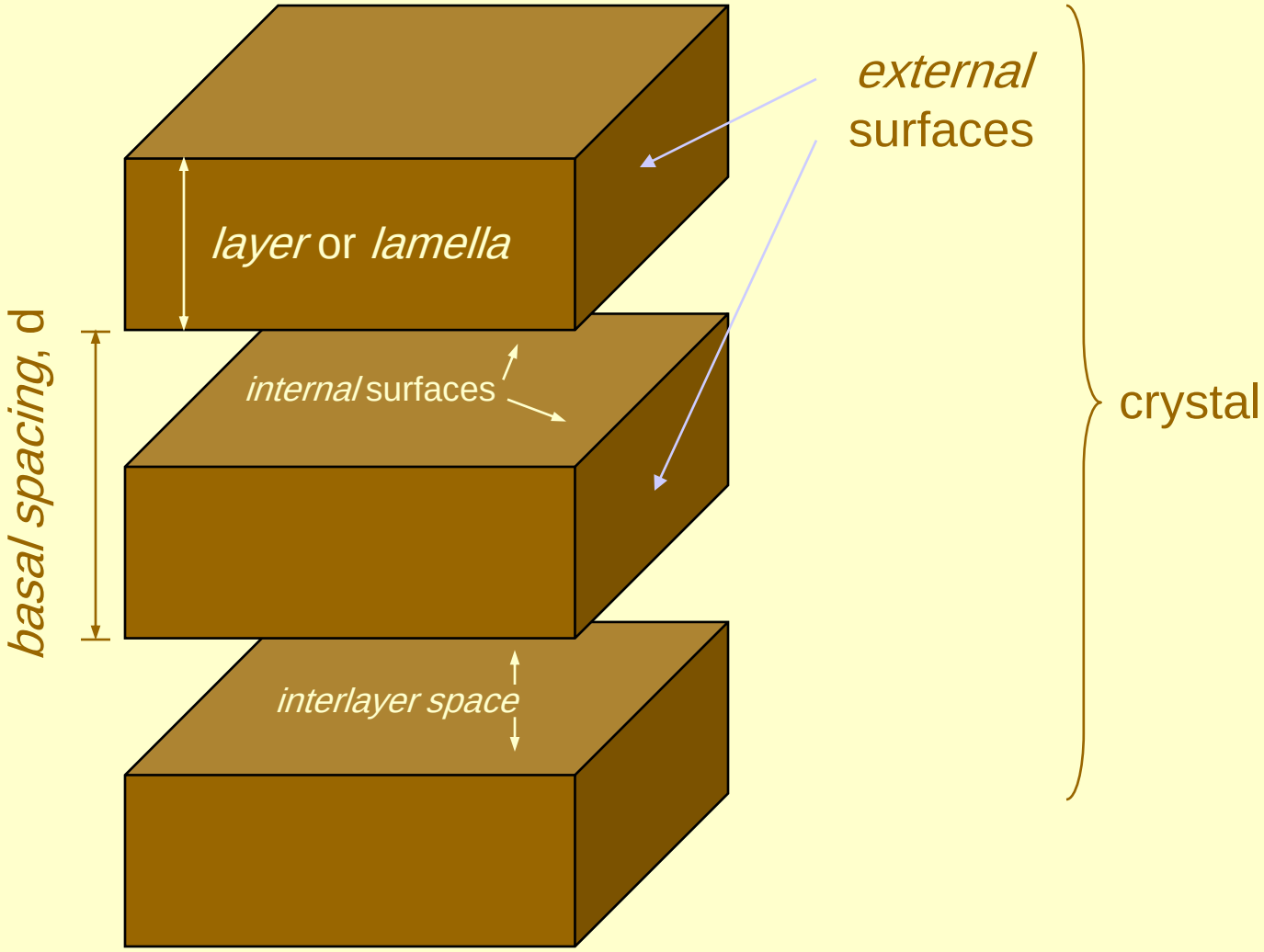
Clay minerals (phyllosilicates) 2:1



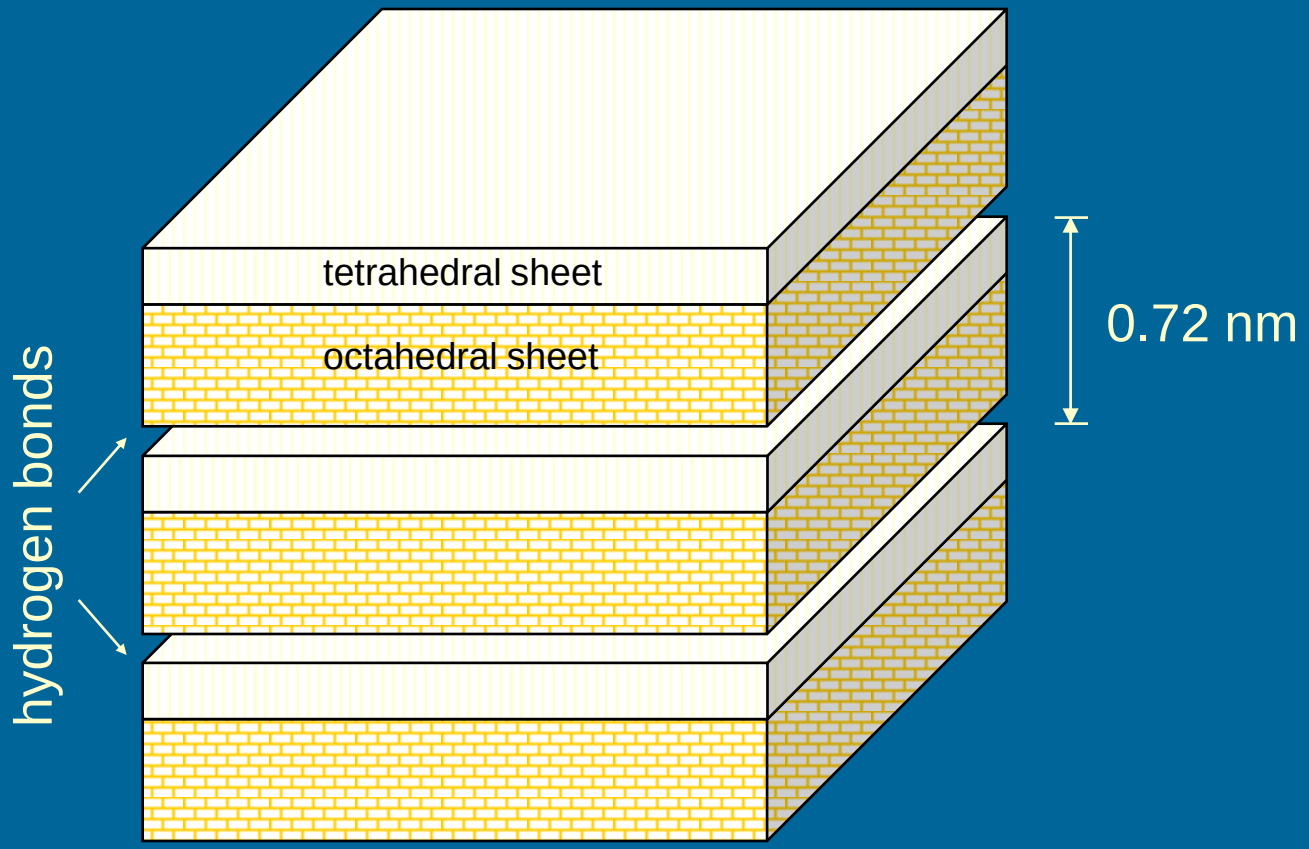
Clay minerals (phyllosilicates) 2:1:1



Structure of a clay mineral crystal

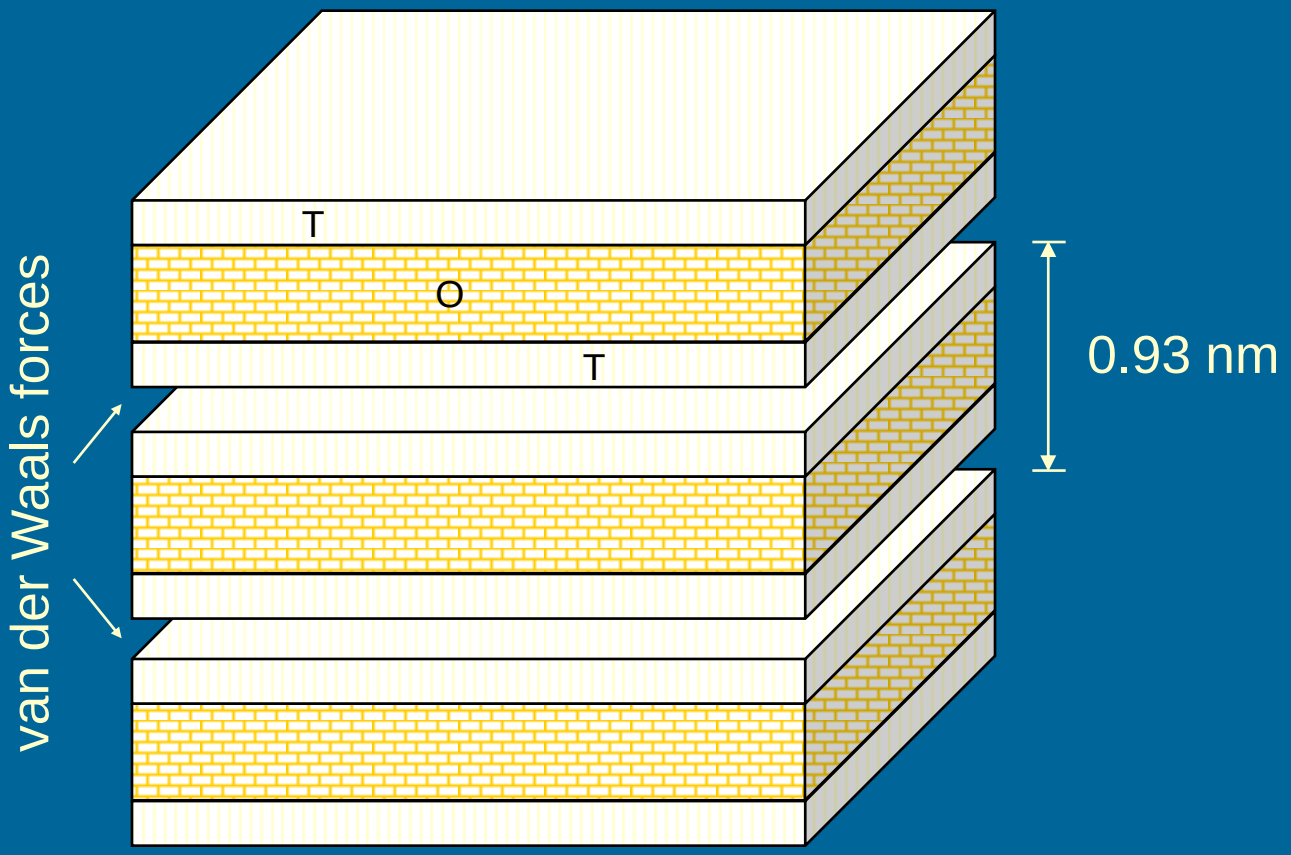


Clay mineral 1:1 (crystal)



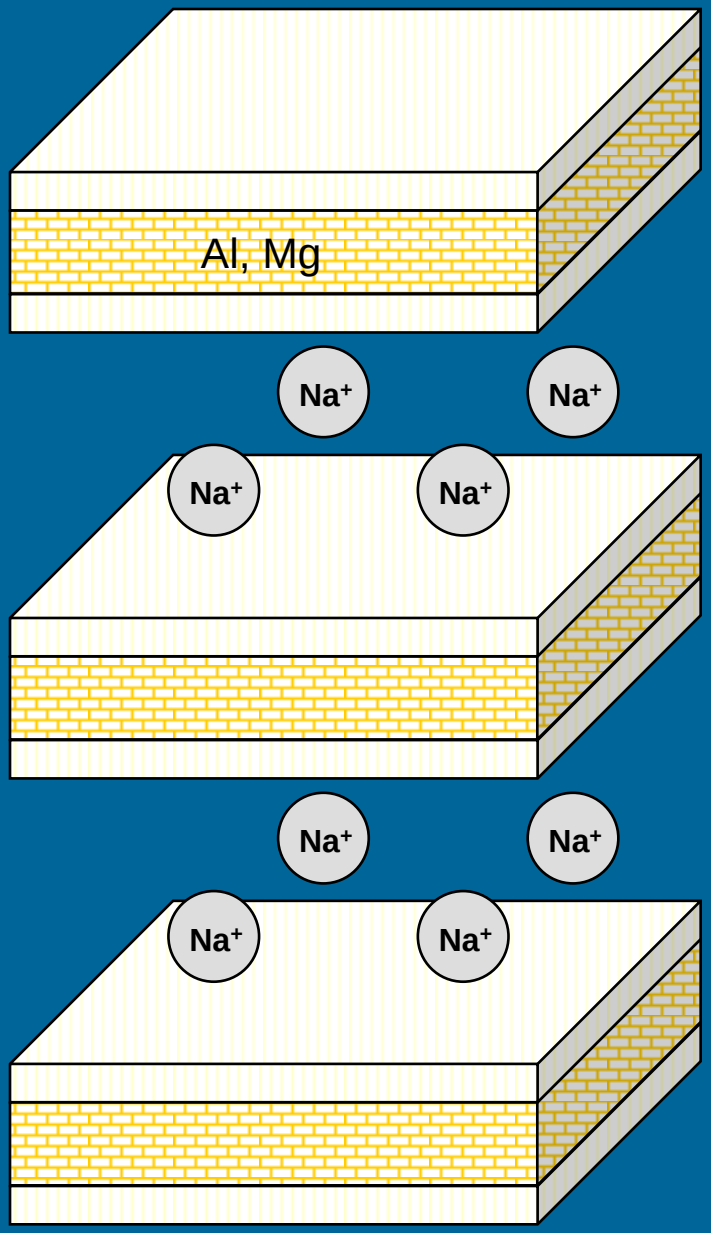
caolinite

Clay mineral 2:1 (crystal)



pyrophillite, talc

Clay mineral 2:1 (crystal)

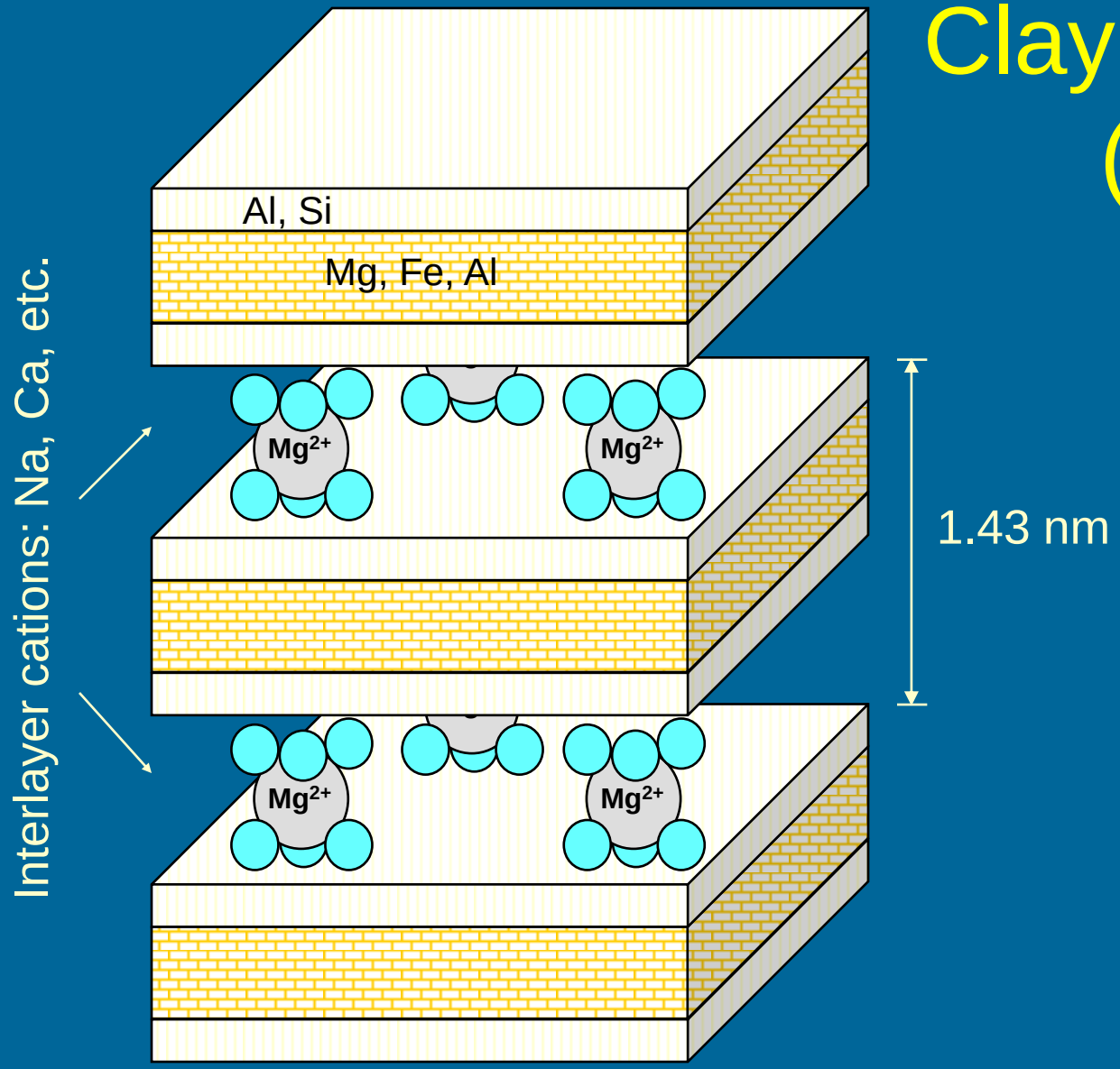


Interlayer cations: Na, Ca, etc.

basal spacing (d), variable: 1.0 – 4.0 nm

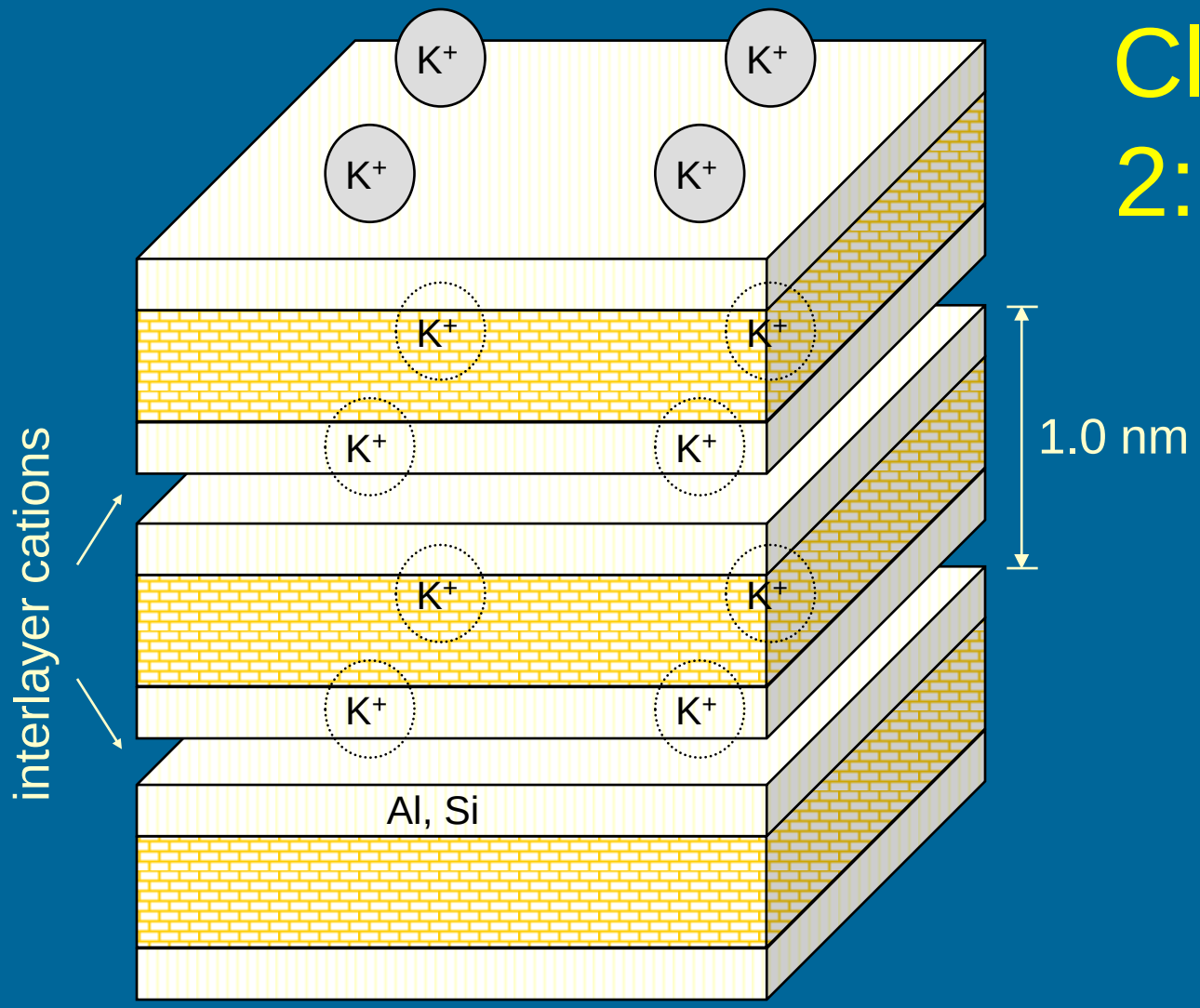
smectite (montmorillonite)

Clay mineral 2:1 (crystal)



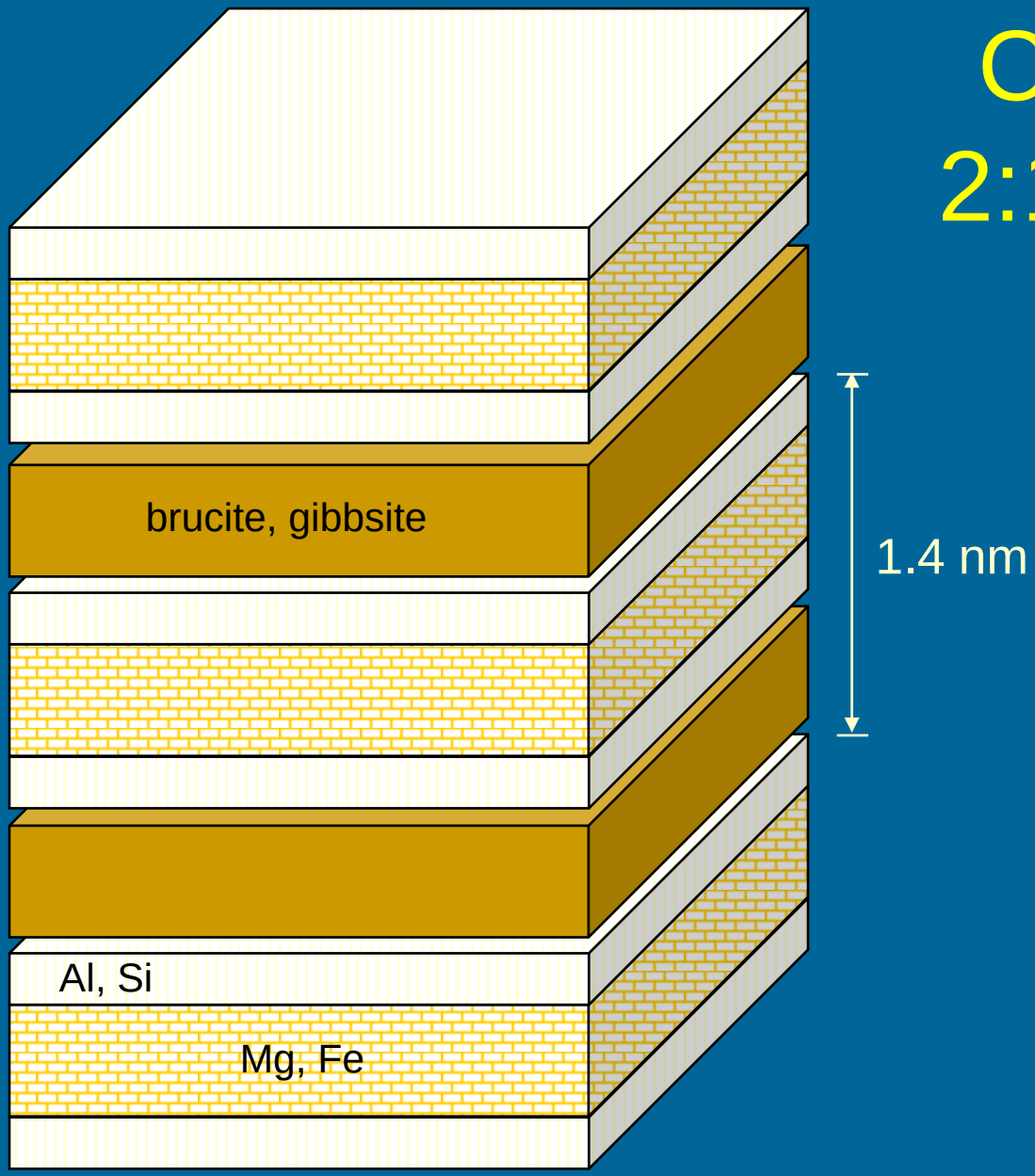
vermiculite

Clay mineral 2:1 (crystal)

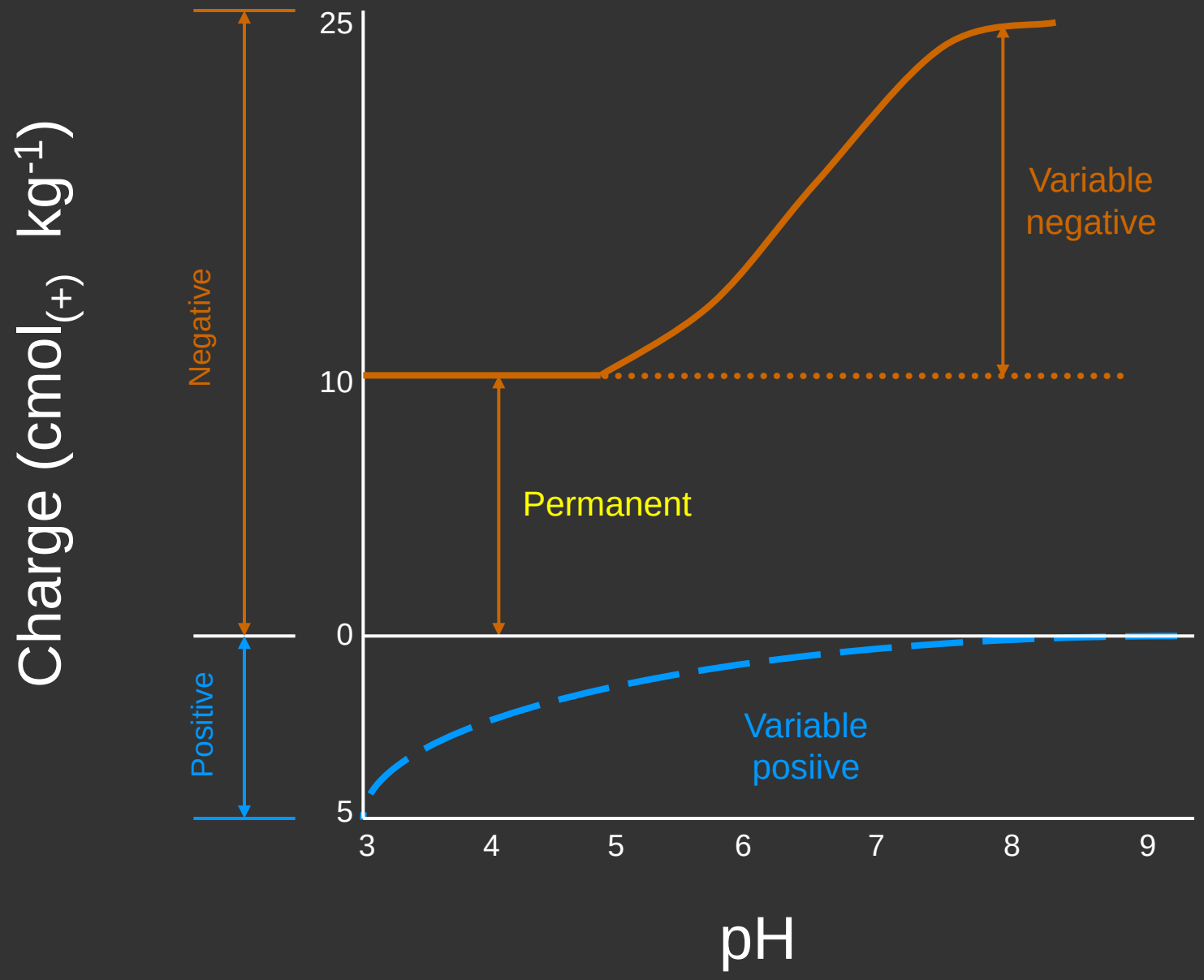


mica (muscovite)

Clay mineral 2:1:1 (crystal)



chlorite

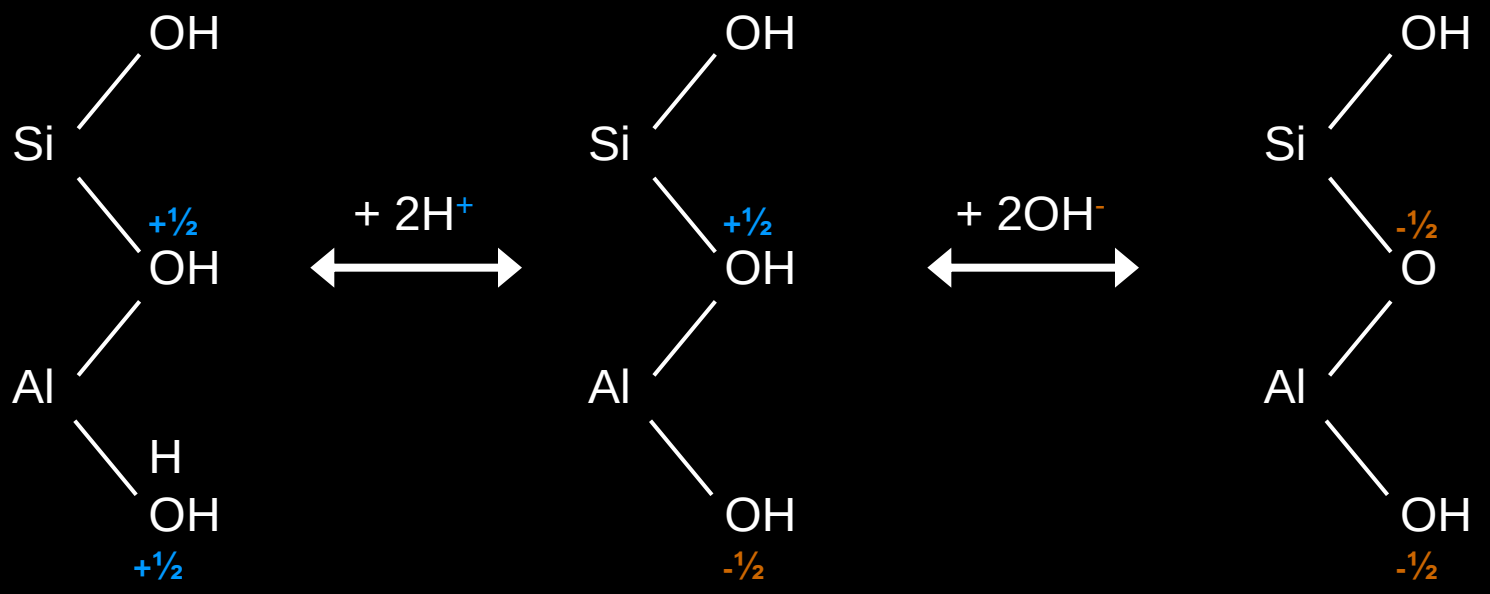

Charge (cmol(+) kg-1)
Negative
Positive
25
10
0
5
3
4
5
6
7
8
9
pH
Variable
negative
Permanent
Variable
posiive

Variable Charge and pH

Acid condition

Neutral condition

Alkaline condition



$pK_a = 5.0$

$Al(OH_2)^{+1}$

$pK_a = 7.0$

$(Al\text{-}OH\text{-}Si)^{+1/2}$

$pK_a = 9.5$

Si-OH