
profundal

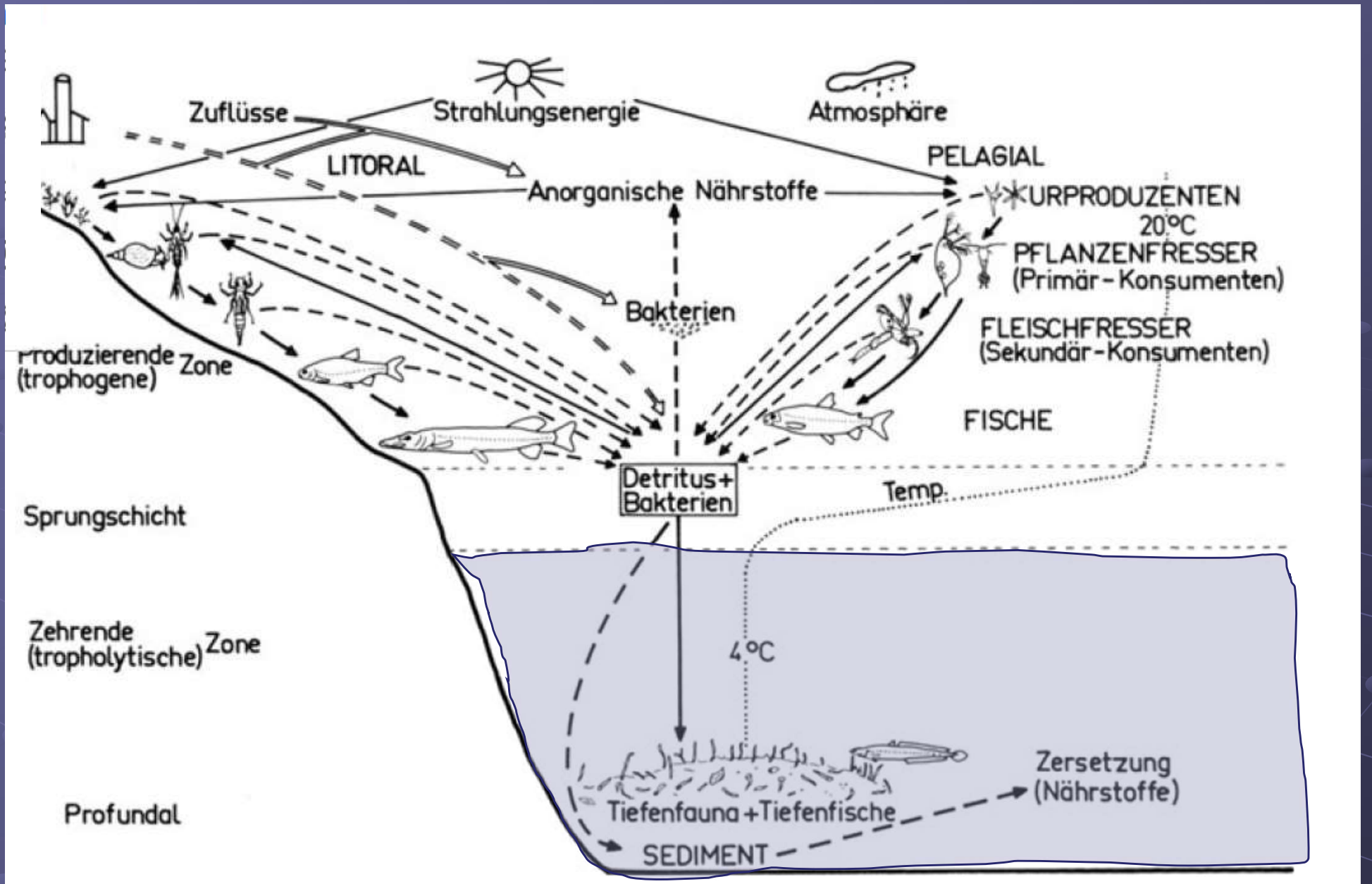
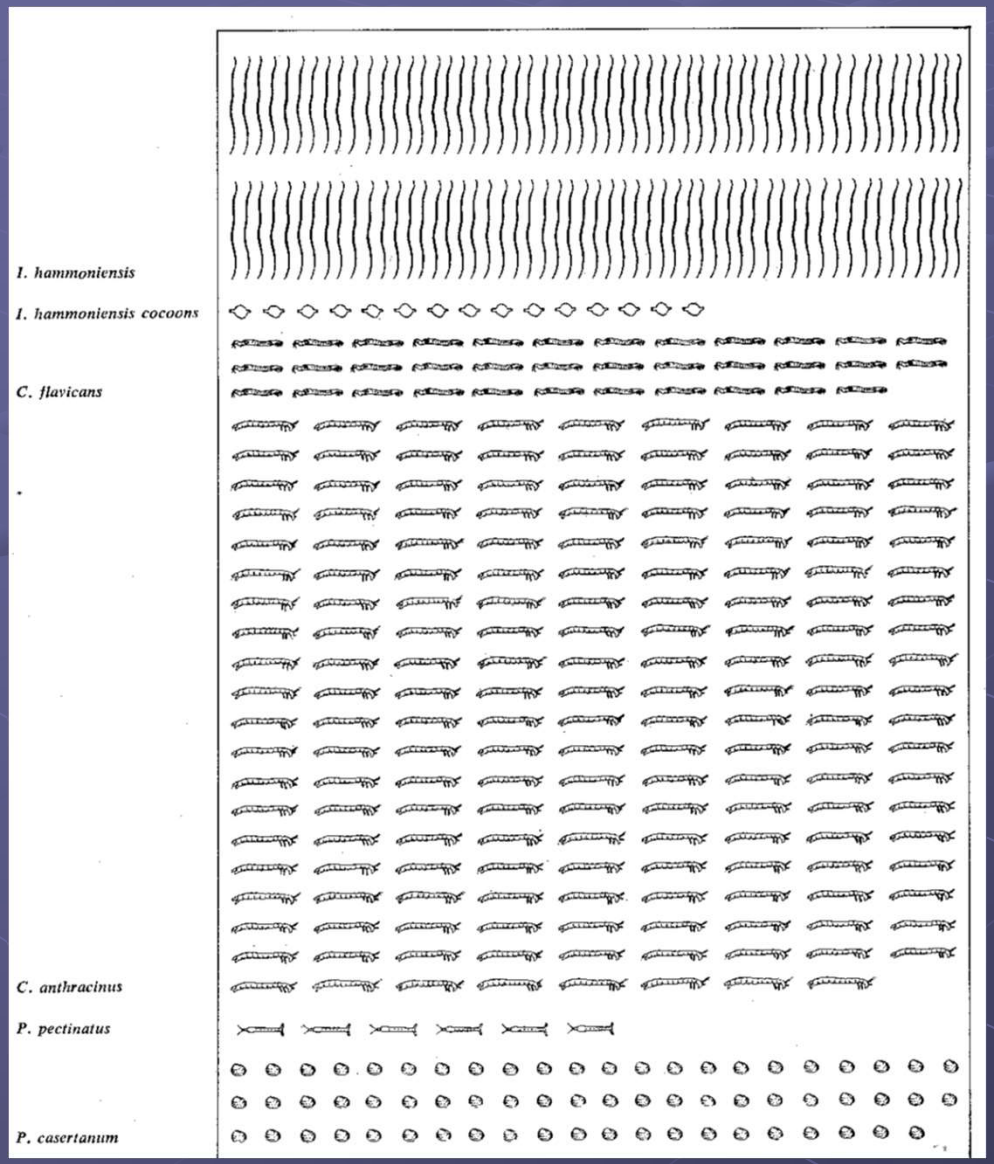


Fig. 1. Schema des Stoffhaushaltes in einem See

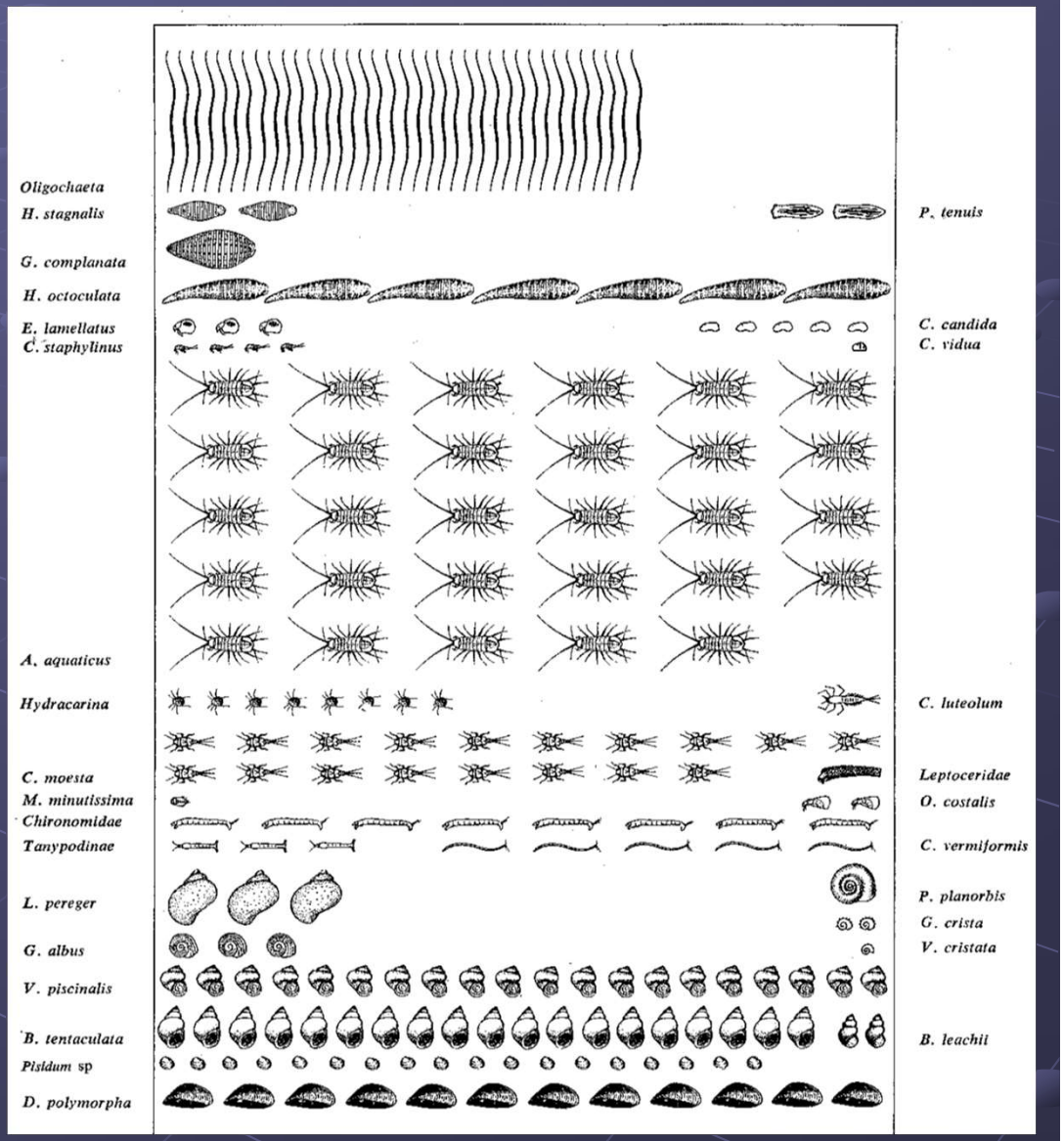
Esromsee

JONASSON 1972

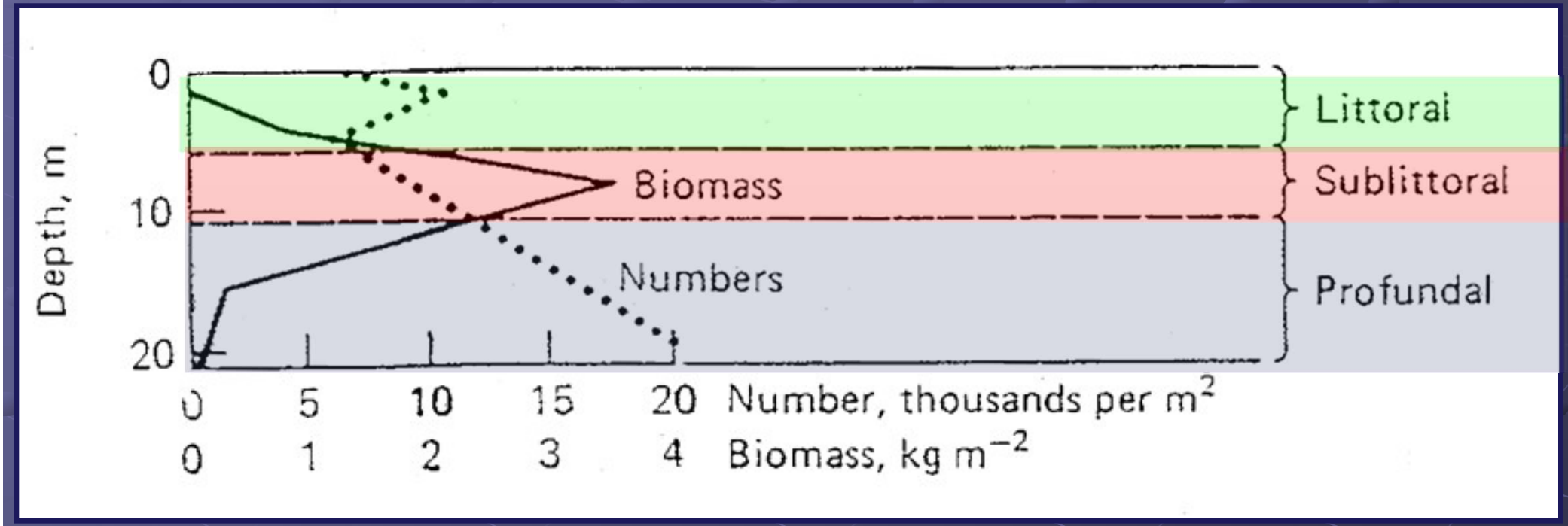
profundal



littoral



Esromsee: biomass numbers



Esromsee: feeding types

n=number/area, G= weight.

%	herbivores		filter feeders		detritivores		carnivores	
	n	G	n	G	n	G	n	G
littoral	30	40	26	46	32	7	13	7
sublittoral	0	0	63	99	30	1	7	1
profundal	0	0	20	16	70	72	10	12

Ecological factors in profundal

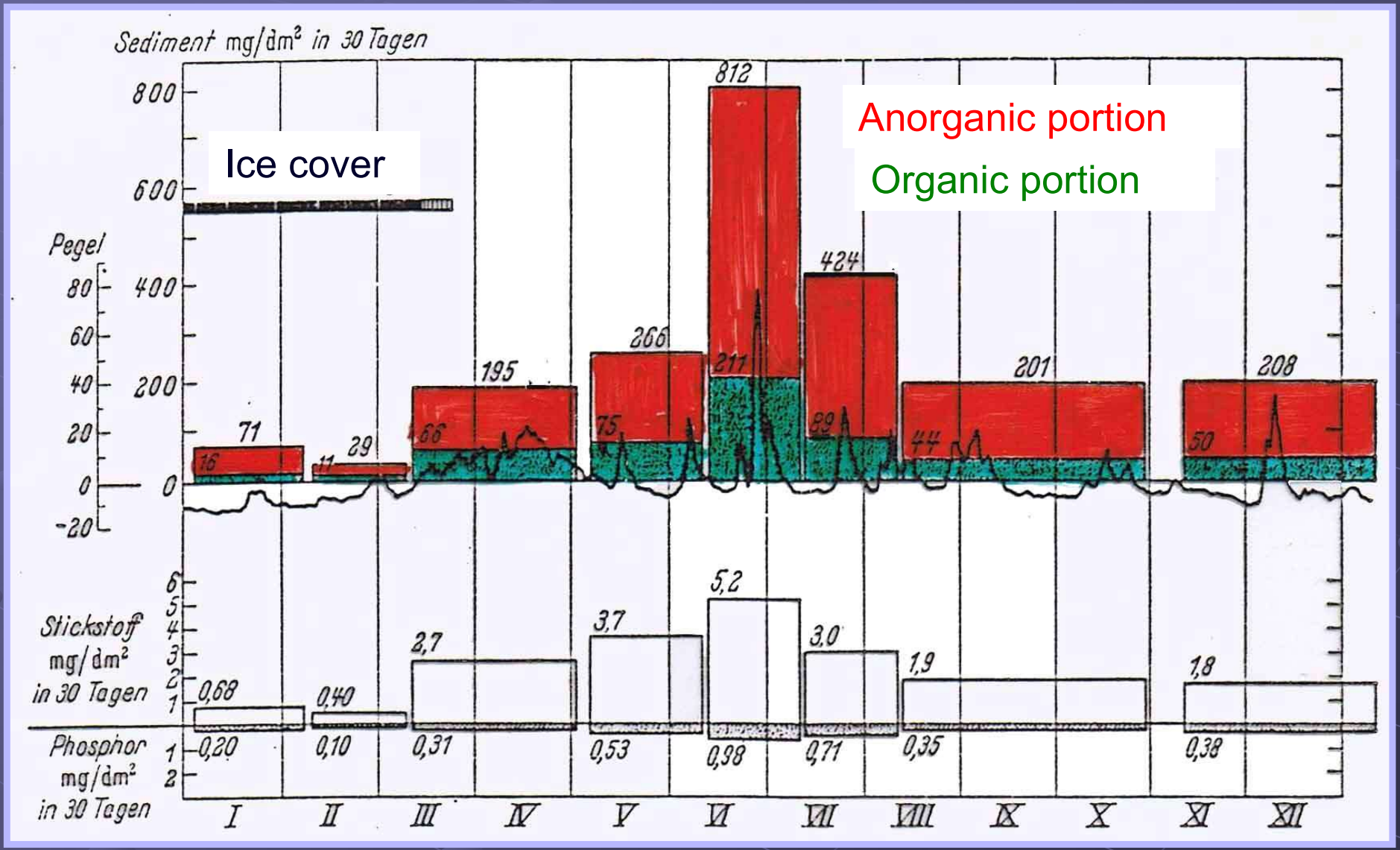
less than 1% of surface light

tropholytic zone ->
consumer (detritivores/carnivores)

- Sediment
  a. **allochthonous**

autochthonous

Seasonal sedimentation rate (mg/dm² in 30 days) and water level in Lunzer Untersee in 1934 according to BERGER.



Ecological factors in profundal

- less than 1% of surface light **tropholytic zone -> consumer**

- sediment
  a. allochthonous

autochthonous

- Biogenic calcium carbonate
- iron: formation of limonite and iron sulfide
- silicic acid

Ecological factors in profundal

- less than 1% of surface light — tropholytic zone
  - sediment
    a. allochthonous — autochthonous

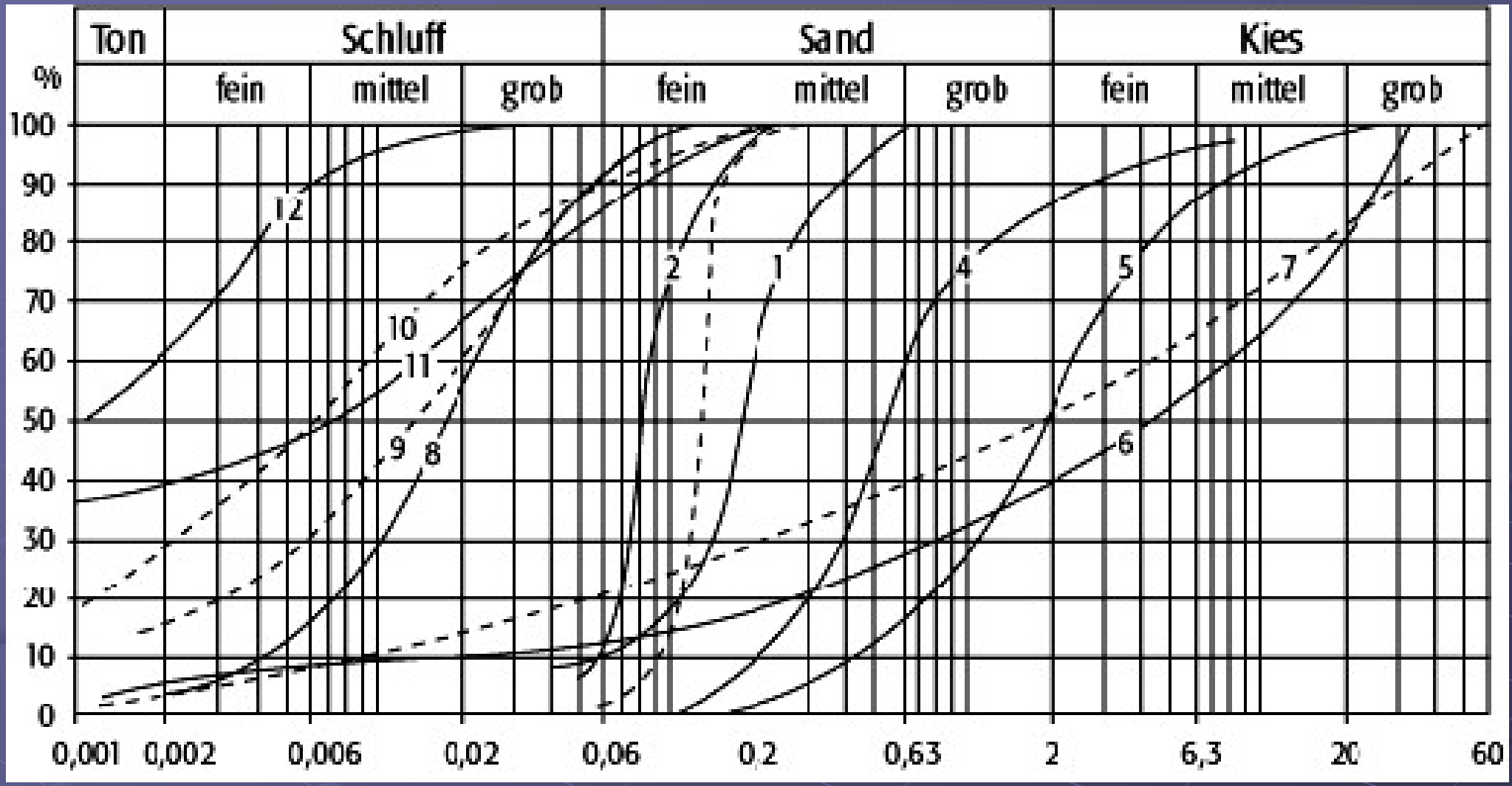
    b. Grain size:

Grain size (mm) according to Udden & Wenthworth - scale, DIN 4022

[µm]	Φ	①	DIN 4022		[mm]
		Cobble	Steine		
63.000	-6				63
32.000	-5	Gravel	Kies	grob	
16.000	-4				20
8000	-3			mittel	
4000	-2				6,3
2000	-1			fein	
1000	0	Sand	Sand		2
500	1			grob	
250	2				0,63
125	3			mittel	
63	4				0,2
32	5			fein	
16	6	Silt	Schluff (Silt)		0,063
8	7			grob	
4	8				0,02
2	9			mittel	
					0,0063
				fein	
		Clay	Ton		0,002

① Udden & Wenthworth mod. nach Doeglas

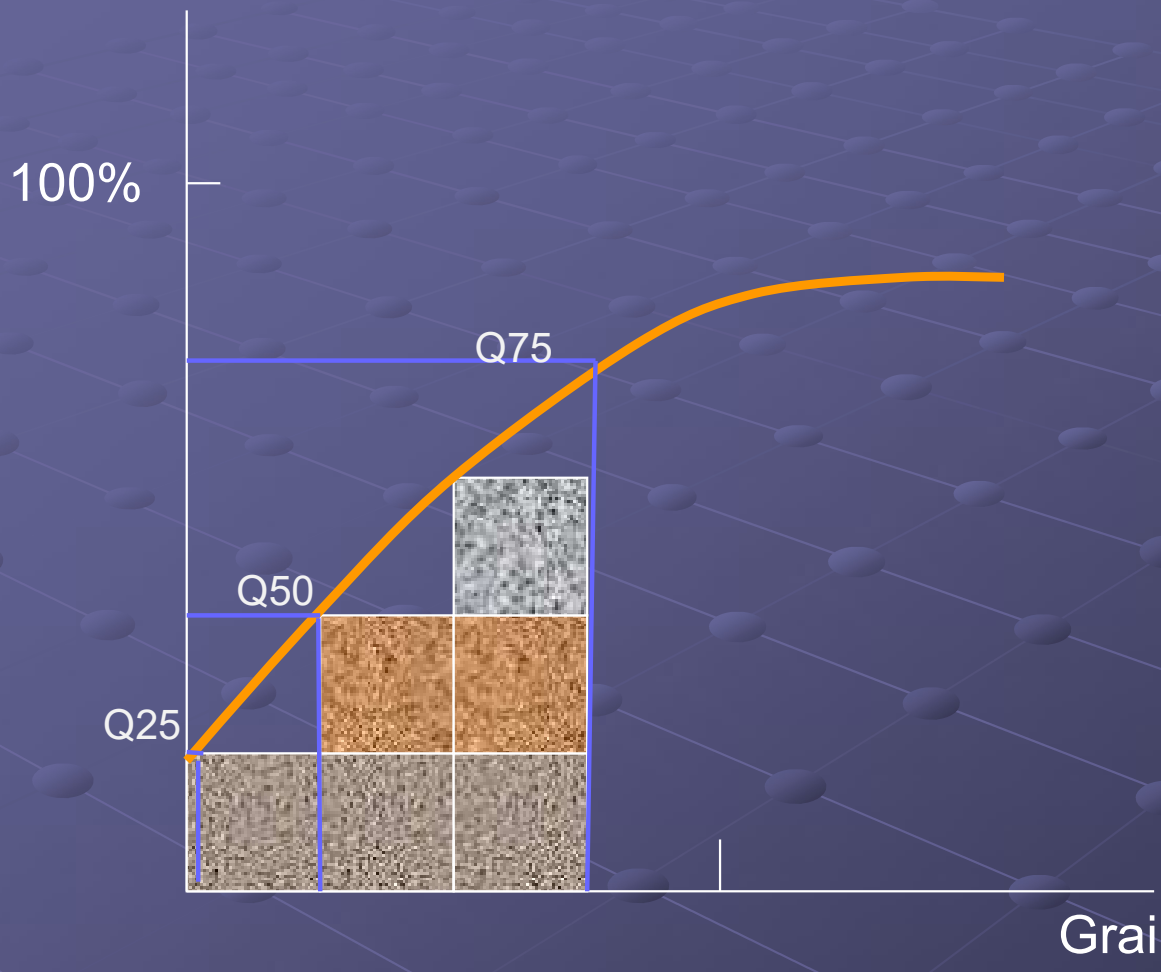
Φ = Phi-Grad = $-\log_2(d/d_0)$; d = Durchmesser, d_0 = 1 mm Einheitsdurchmesser

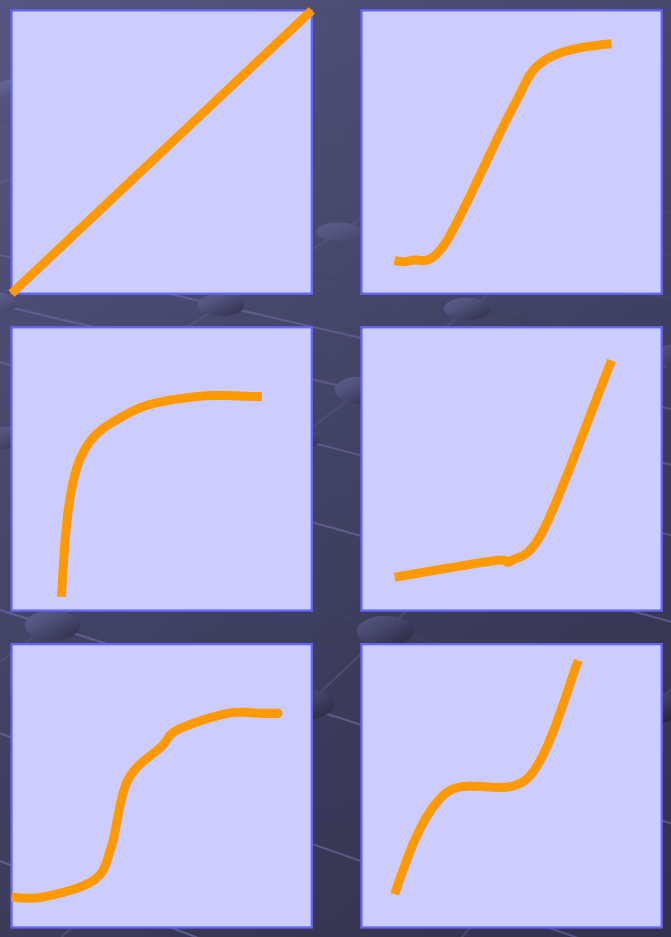


Arithmetische Skala der Korngrößeneinteilung als logarithmische Transformation der Udden-Wentworth-Skala:

$$\Phi = - \log_2 D$$

Cumulative graphs as characteristics for sediment grain size composition





Ecological factors in profundal

- less than 1% of surface light — **tropholytic zone -> consumer**

- sediment
  a. **allochthonous** — **autochthonous**
  b. Grain size
  c. Organic components:

Dy: humus colloids (little decomposed plant remains) + Ca (-> dystrophic lakes)

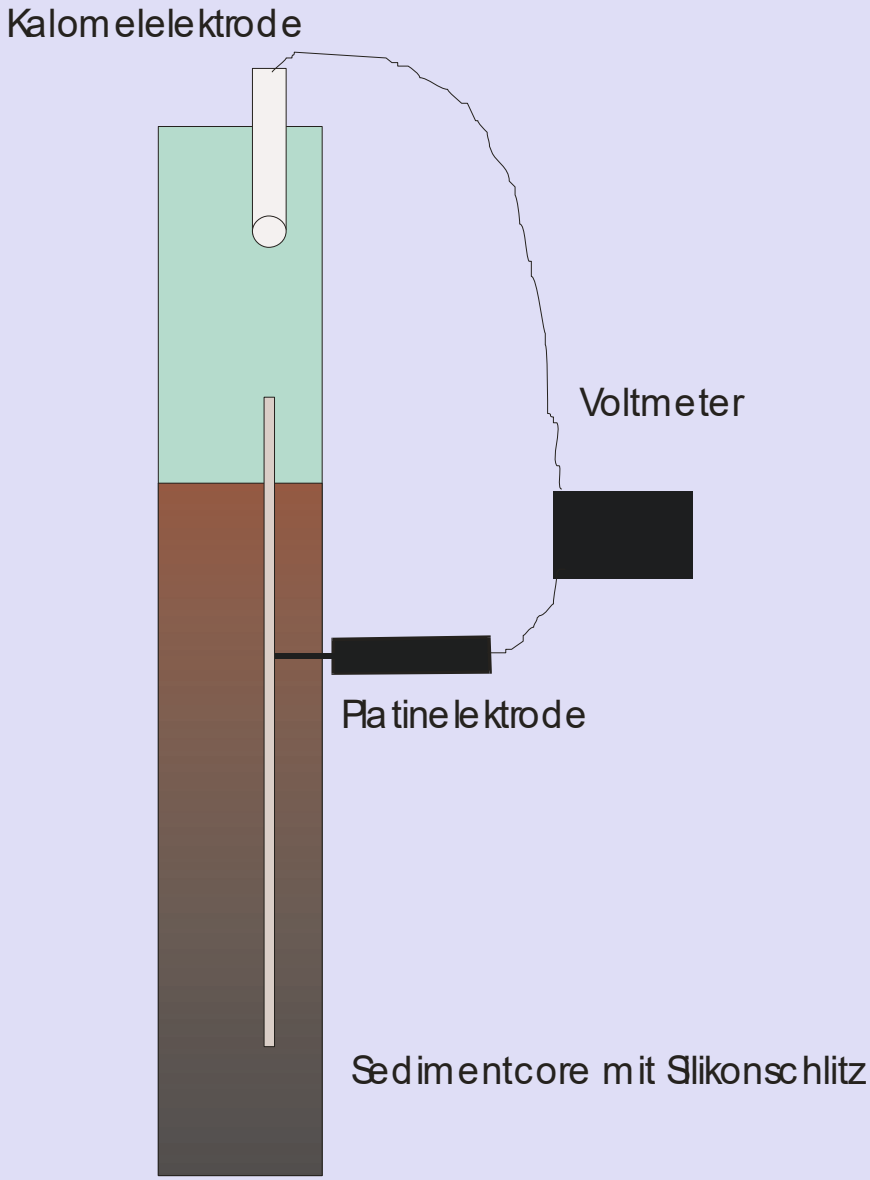
Gyttja: anorganic and organic components, in oligotrophic and eutrophic lakes

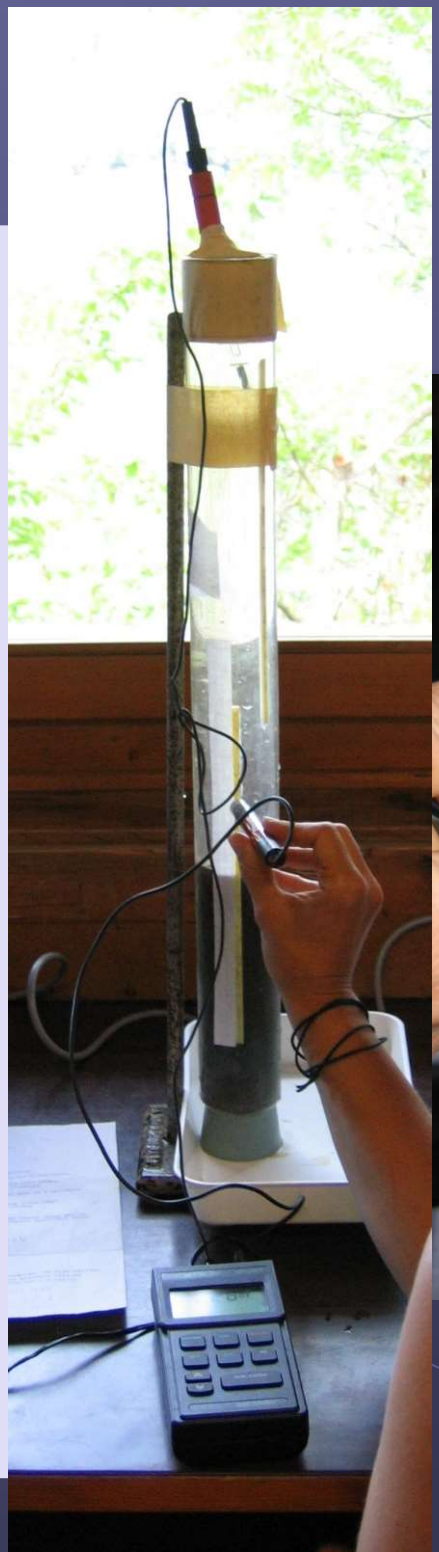
Sapropel: anaerobic sludge, contains iron, sulfide

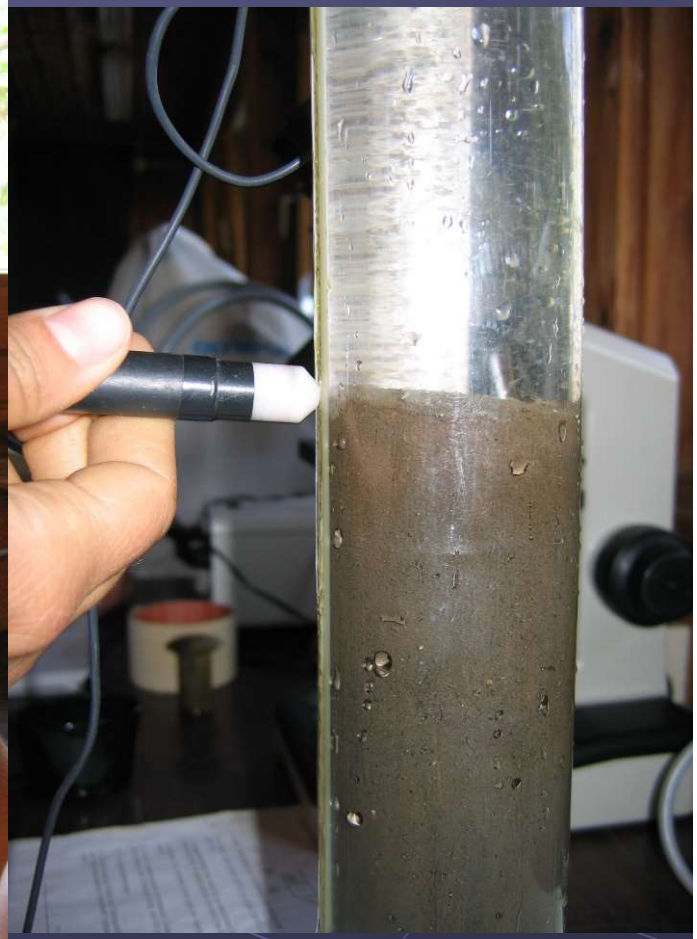
Ecological factors in profundal

- less than 1% of surface light — tropholytic zone -> consumer
- sediment
  a. allochthonous — autochthonous
  b. Grain size
  c. Organic components:
- redox potential E_7

Measuring the redox potential





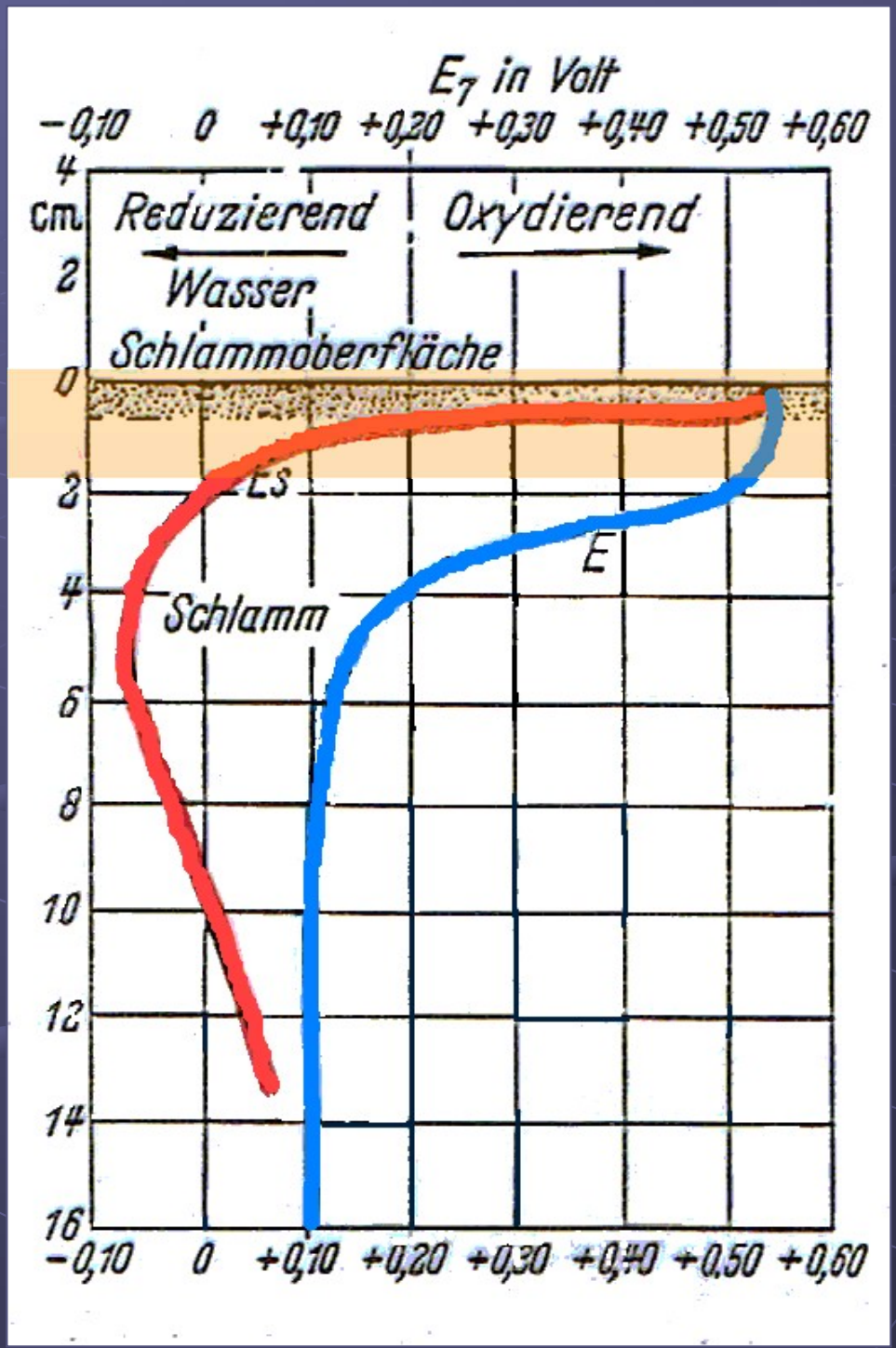


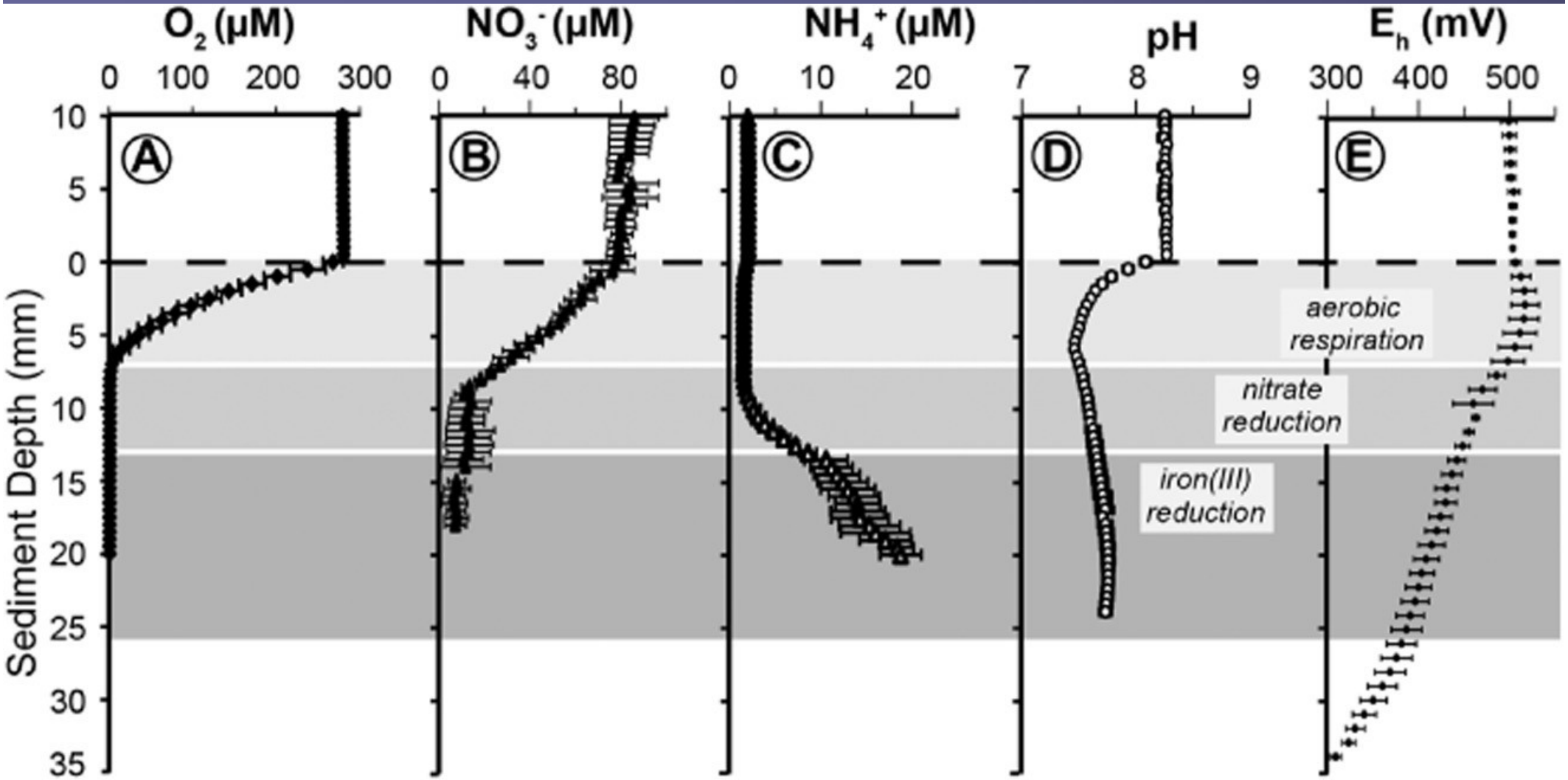
The higher the redox potential the higher the O_2-concentration

Redox pairs	E7 (Volt)	corresponding O_2 (mgl^{-1}) concentration
NO^-_3 to NO^-_2	0.45 - 0.40	4.0
NO^-_2 to NH_3	0.40 - 0.35	0.4
Fe^{+++} to Fe^{++}	0.30 - 0.20	0.1
SO_4^{--} to S^{--}	0.10 - 0.06	0.0

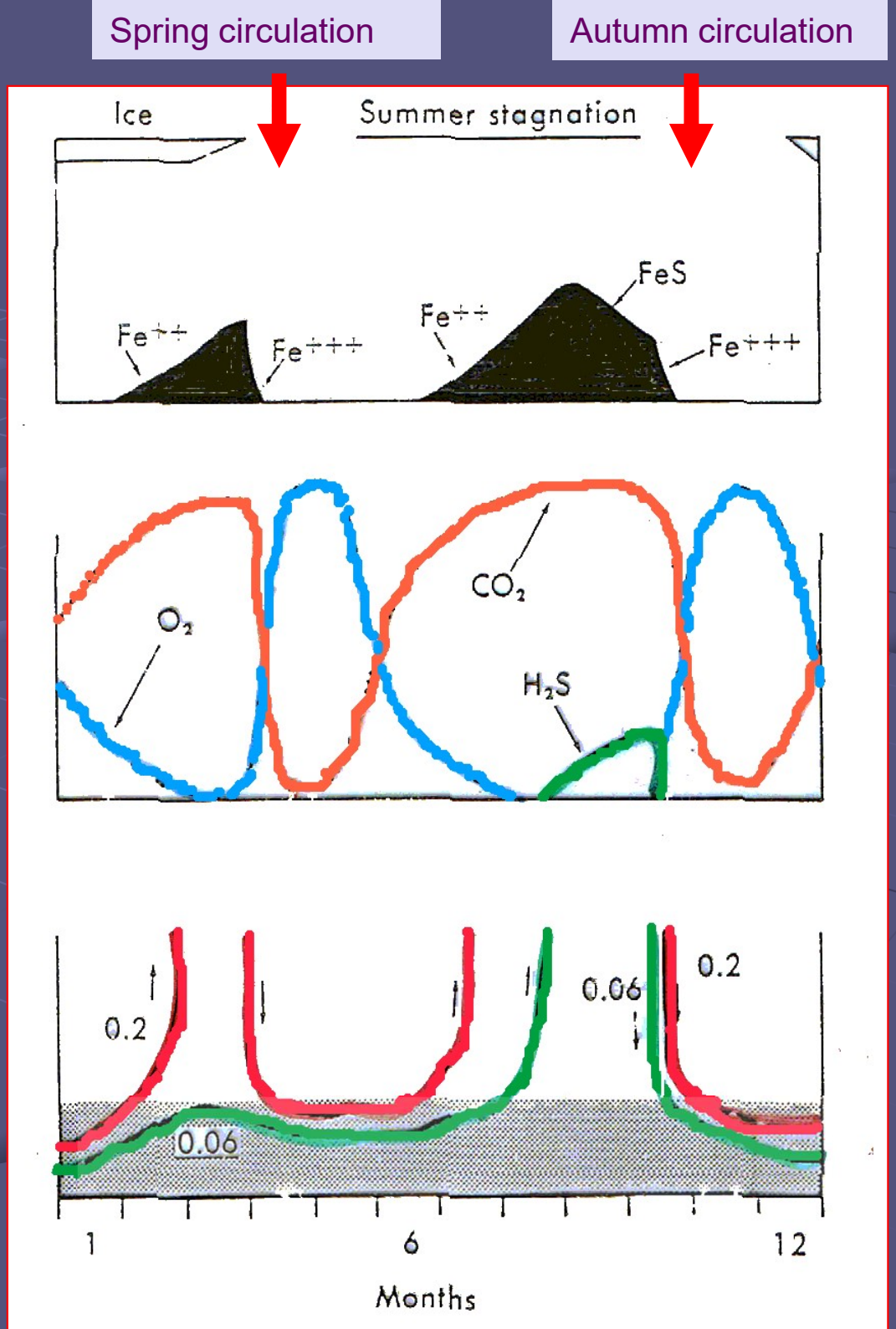
Winter stratification of the redox potential in the sediment of two North English lakes: oligotrophic (Ennerdale Water), eutrophic (Esthwaite Water)

Discontinuity layer




O2 (µM)
0 100 200 300
NO3- (µM)
0 40 80
NH4+ (µM)
0 10 20
pH
7 8 9
Eh (mV)
300 400 500
A
B
C
D
E
Sediment Depth (mm)
10 5 0 5 10 15 20 25 30 35
aerobic respiration
nitrate reduction
iron(III) reduction

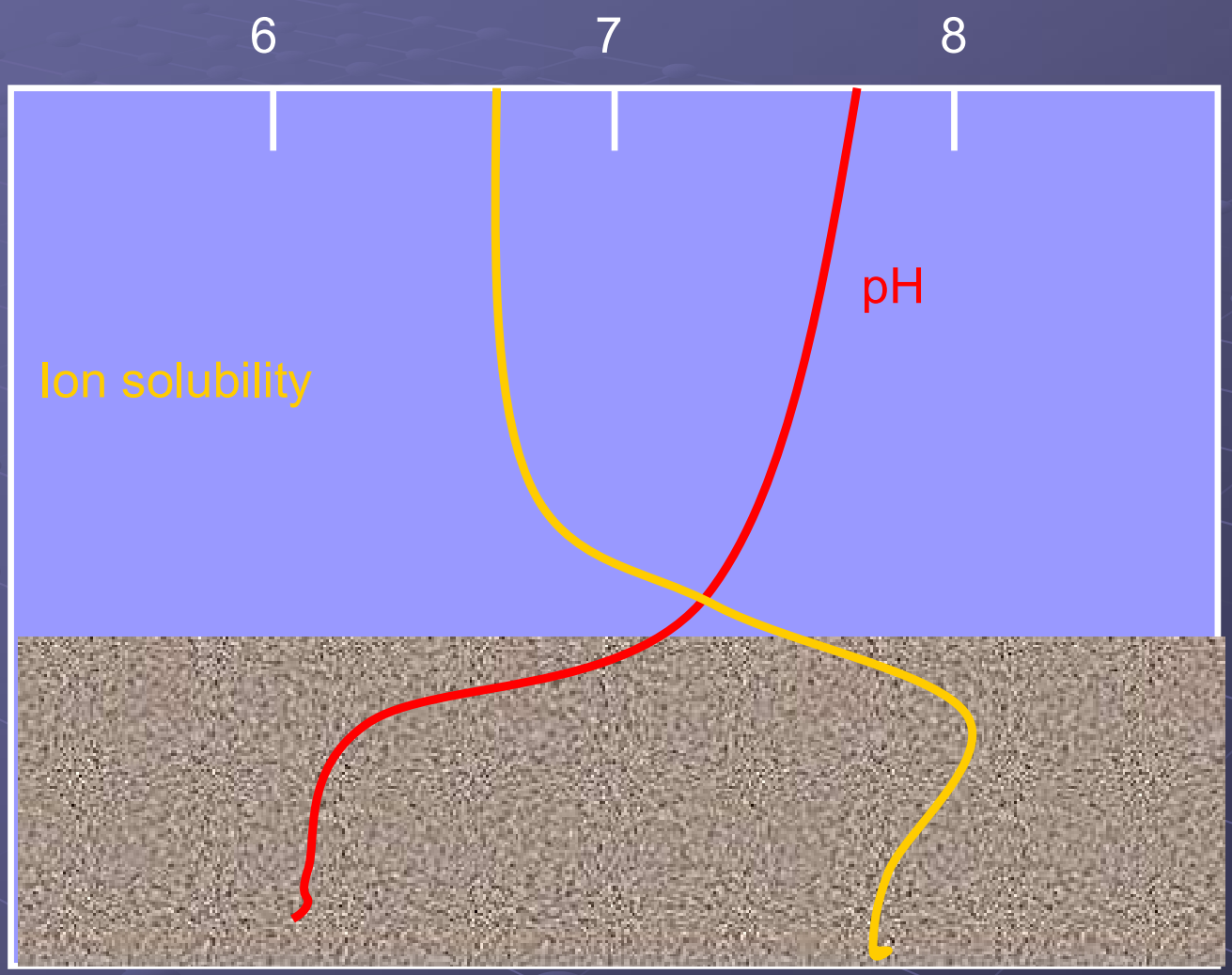
Dimictic eutrophic lake



Ecological factors in profundal

- less than 1% of surface light — tropholytic zone
- sediment
  a. allochthonous — autochthonous
  b. Grain size
  c. Organic components:
- redox potential E_7
- pH, ion solubility

pH, ion solubility (phosphate, nitrate, nitrite)



Ecological factors in profundal

- less than 1% of surface light — **tropholytic zone**
- sediment
  a. **allochthonous** — **autochthonous**
  b. Grain size
  c. Organic components:
- redox potential E_7
- pH, dissolubility of ions
- oxygen contents — **Adaptation to hypoxic conditions:** hemoglobin in Chironomidae

  Anoxibiosis – switch to anaerobic respiration

Ecological factors in profundal

- less than 1% of surface light — tropholytic zone
- sediment
  a. allochthonous — autochthonous
  b. Grain size
  c. Organic components:
- redox potential E_7
- pH, dissolubility of ions
- oxygen contents
- low temperatures — cold stenotherm forms
  eurytherm forms
  glacial relicts: *Cytherissa lacustris*
  Limnocythere st. Patricii

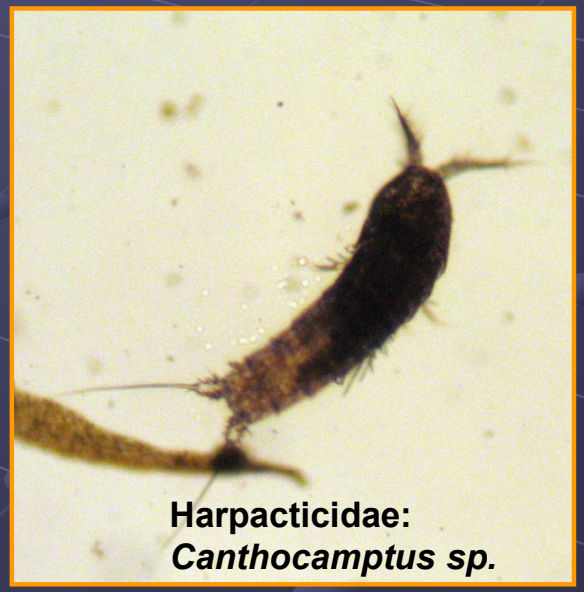
FAUNA

Size classification

Macrobenthos > 600µm: Oligochaeta, Chironomidae, Sphaeriidae, Turbellaria

Meiobenthos 60-600µm: Ostracoda, Harpacticidae


Ostracoda


Harpacticidae:
Canthocamptus sp.

Microbenthos < 60µm: protozoa, bacteria, fungi

FAUNA

Lifestyle classification

epibenthic

Heliozoa

Hydrozoa

Turbellaria

Gastropoda

Ostracoda

Harpacticidae

Bryozoa

Megaloptera

endobenthic

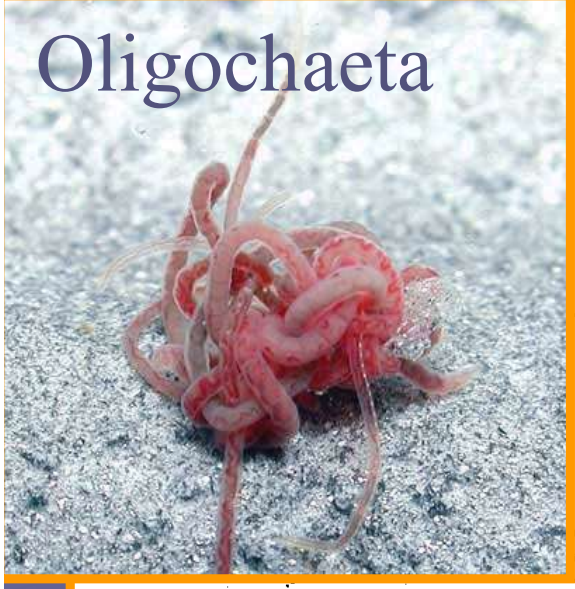
Turbellaria

Nematoda

Sphaeriidae *(Pisidium spp.)*

Oligochaeta

Chironomidae



aus McCALL & TEVESZ 1982

UC

CHR

AMP

TO

CHR

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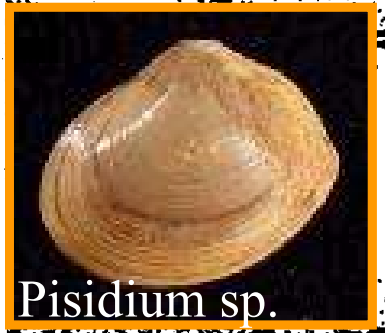
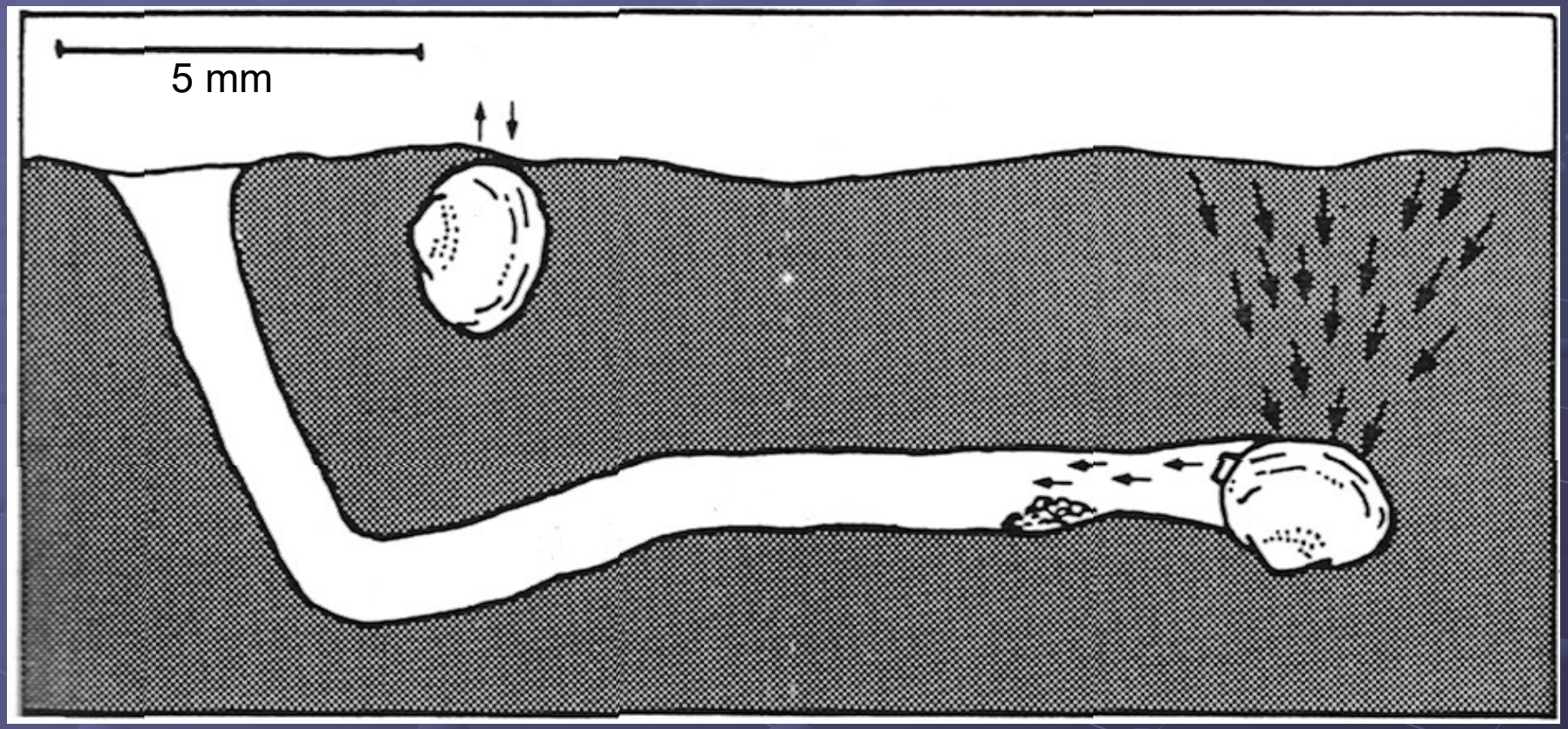


Bioturbation of lake sediment

Life position of *Pisidium* (right) and *Sphaerium* (left)

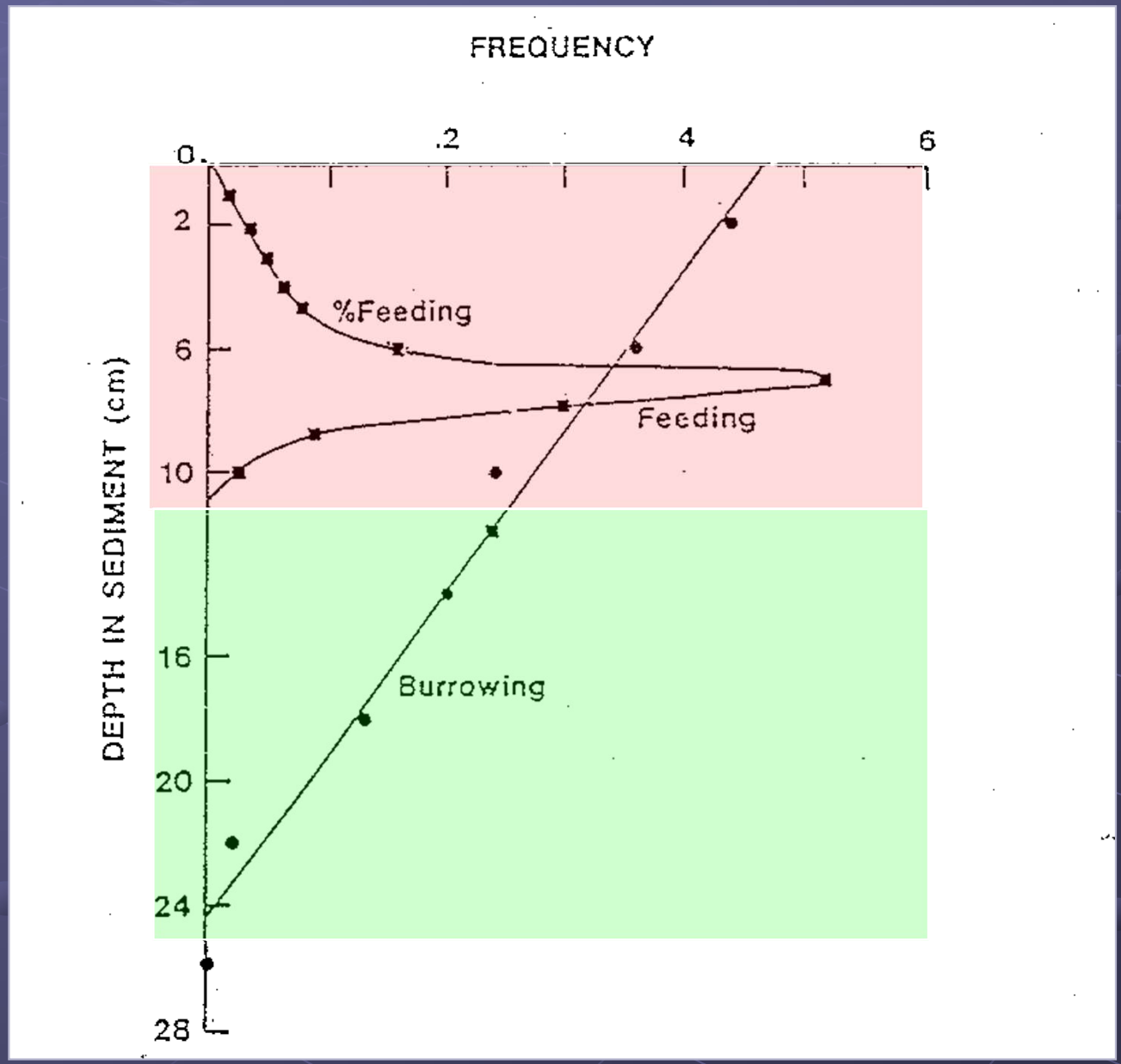


from McCALL & TEVESZ 1982,
adapted from MEIER-BROOK (1969)

Oligochaeta

hatching Oligochaeta-cocoon

Depth distribution of tubificid worms in a laboratory experiment



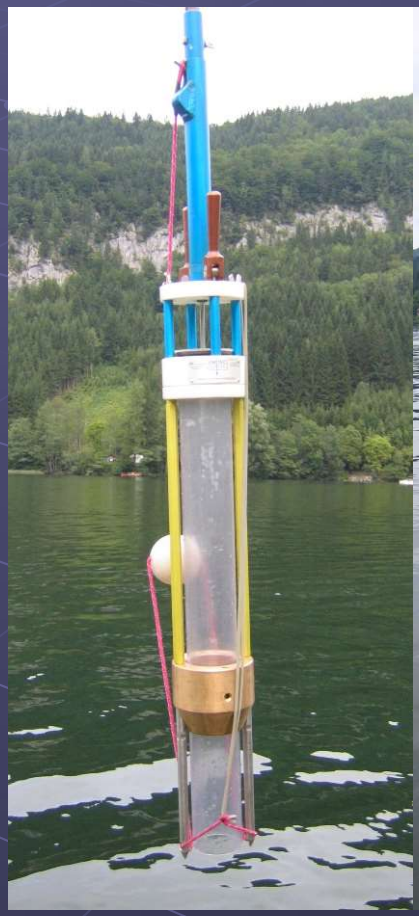
Qualitative sampling methods

Dredge

Quantitative sampling methods

Ekman-Grab

Petersen Grab



Kajak-Brinkhurst Corer
improved by Niederreiter

Depth distribution of organisms in a core: cutting the sample

Depth distribution of organisms in a core:

measuring the redox potential