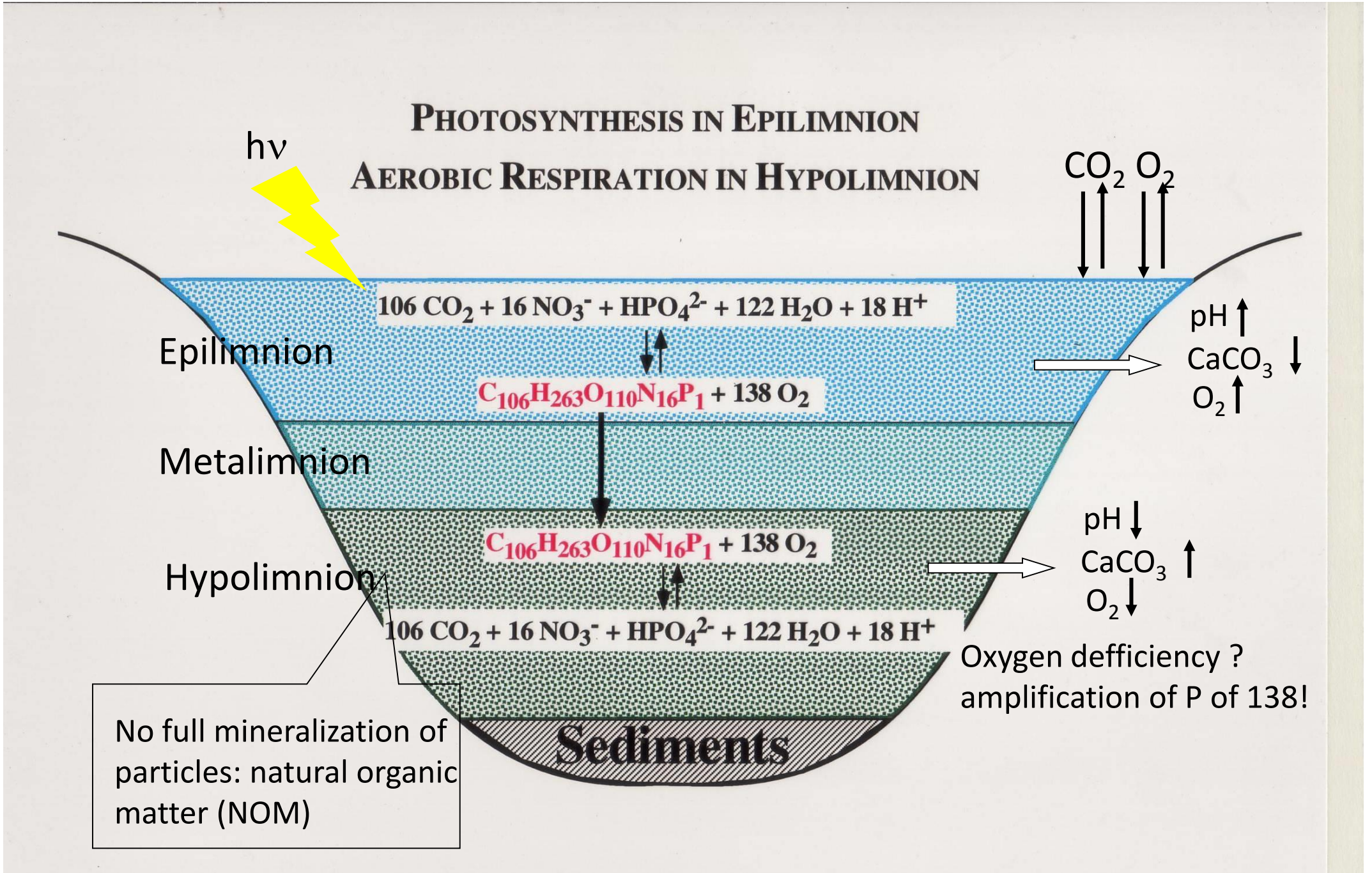
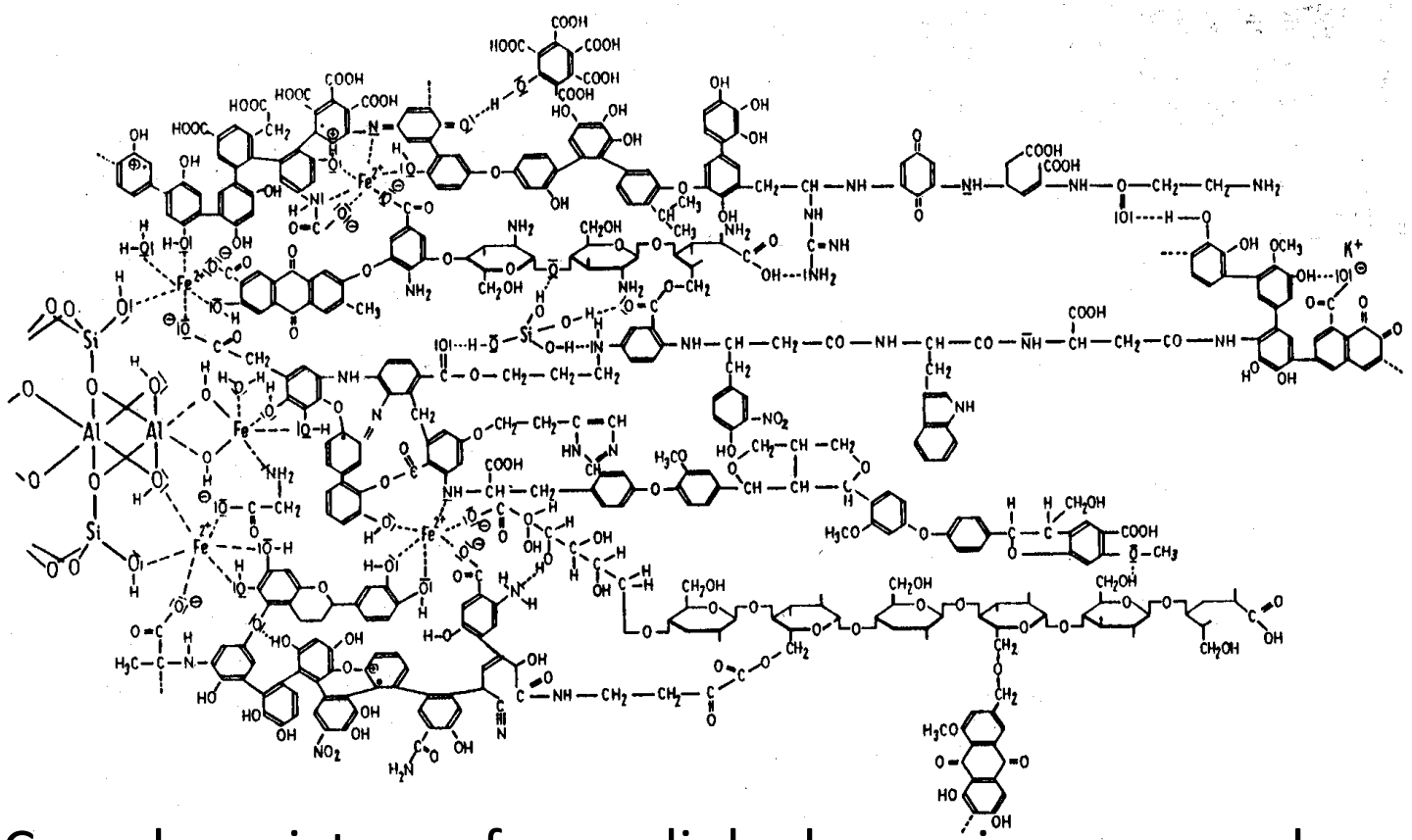
Redox processes in lakes


PHOTOSYNTHESIS IN EPILIMNION
AEROBIC RESPIRATION IN HYPOLIMNION
hν
CO2 O2
106 CO2 + 16 NO3- + HPO4 2- + 122 H2O + 18 H+
Epilimnion
C106H263O110N16P1 + 138 O2
Metalimnion
C106H263O110N16P1 + 138 O2
Hypolimnion
106 CO2 + 16 NO3- + HPO4 2- + 122 H2O + 18 H+
Sediments
pH ↑
CaCO3 ↓
O2 ↑
pH ↓
CaCO3 ↑
O2 ↓
Oxygen defficiency ?
amplification of P of 138!
No full mineralization of particles: natural organic matter (NOM)

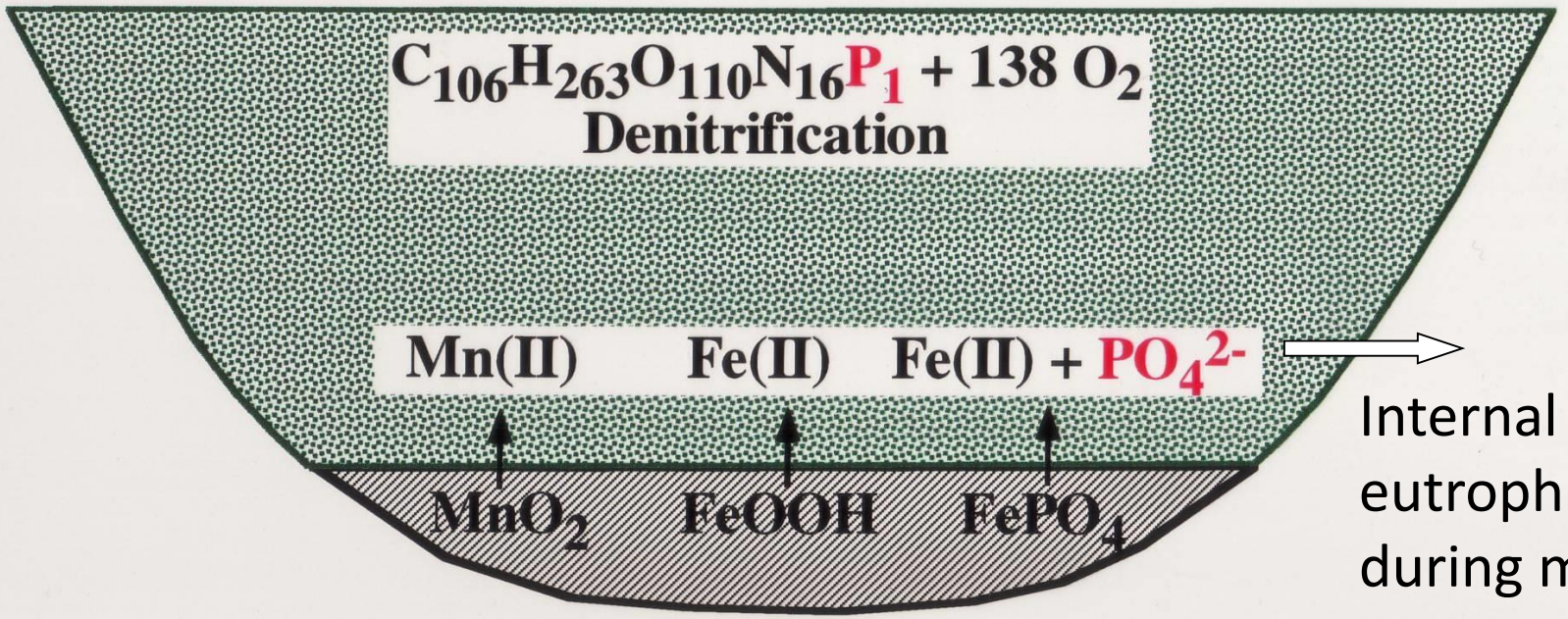
Natural organic matter (NOM)



- Complex mixture of cross-linked organic compounds
- Degradation products/metabolic products of algae/bacteria
- Many different chemical functions
- Highly relevant for water treatment

Pc

PROCESSES IN THE HYPOLIMNION AND AT THE SEDIMENT-WATER INTERFACE



Internal eutrophication during mixing

Role of phosphate

- Minimum element for algal growth
- Oxygen consumption in the hypolimnion
- Amplification by P ~ 138!
- Dissolution of Fe and Mn from sediments
- Dissolution of P from sediments
- Internal eutrophication

Measures to restore lakes - external

- No discharge of wastewater (sewer system out of lake basin)
- Phosphate elimination in wastewater treatment plants (CH since 1971 in law)
- Ban of phosphate in textile washing detergents (CH 1986)
- Adapted use of mineral fertilizers