

Figure 7.6 A schematic diagram showing the position of wetlands in relation to upland and aquatic ecosystems and the biogeochemical linkages between these landscape components. From Mitsch and Gosselink (1986).

A photograph of a river flowing through a forest. The river is in the foreground, with water reflecting the sky and surrounding trees. The banks are rocky and covered with green vegetation. The background shows a dense forest of tall trees under a clear blue sky. The word "Rzeki" is overlaid in white text in the center of the image.

Rzeki

Rzeki

Biogeny w strumieniu

- rozpuszczone (jony)

- w formie nierozpuszczonej

Biogeny w strumieniu

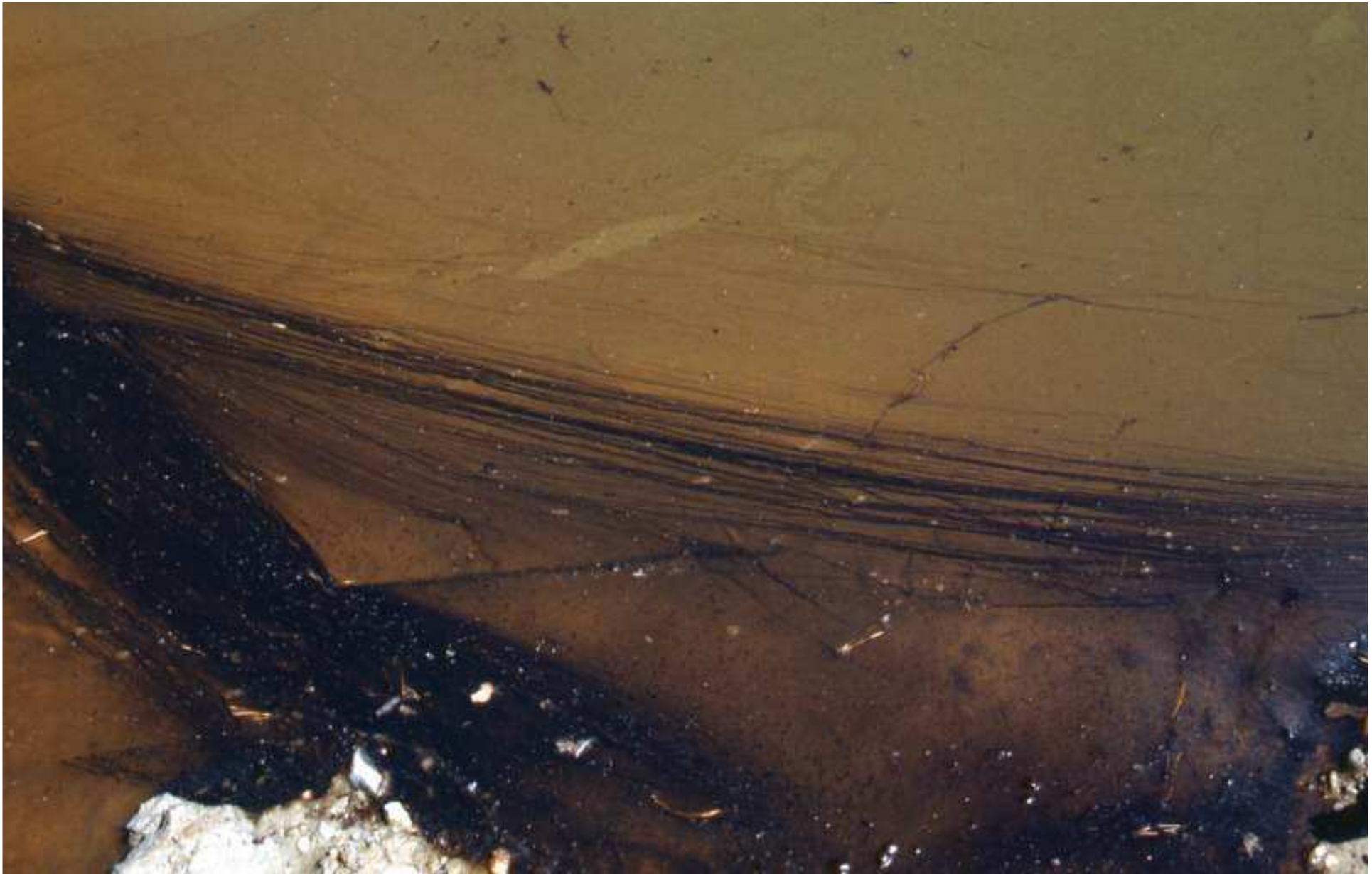
- rozpuszczone (jony)

- z opadów deszczu
 - wymywania z gleby
 - z ściółki
 - z wietrzenia chemicznego

- w formie nierozpuszczonej

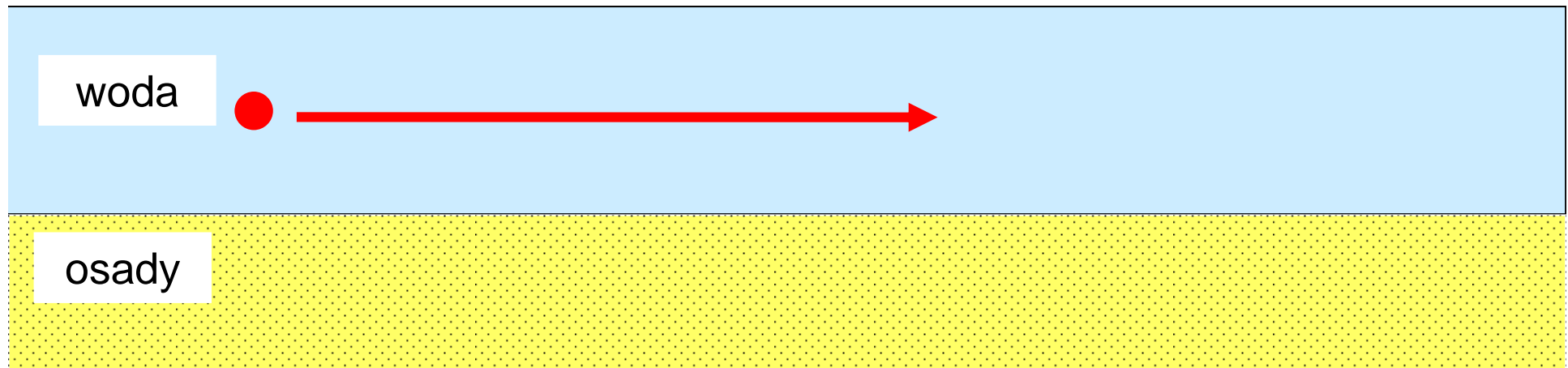
- produkt wietrzenia fizycznego

Rzeki



Rzeki

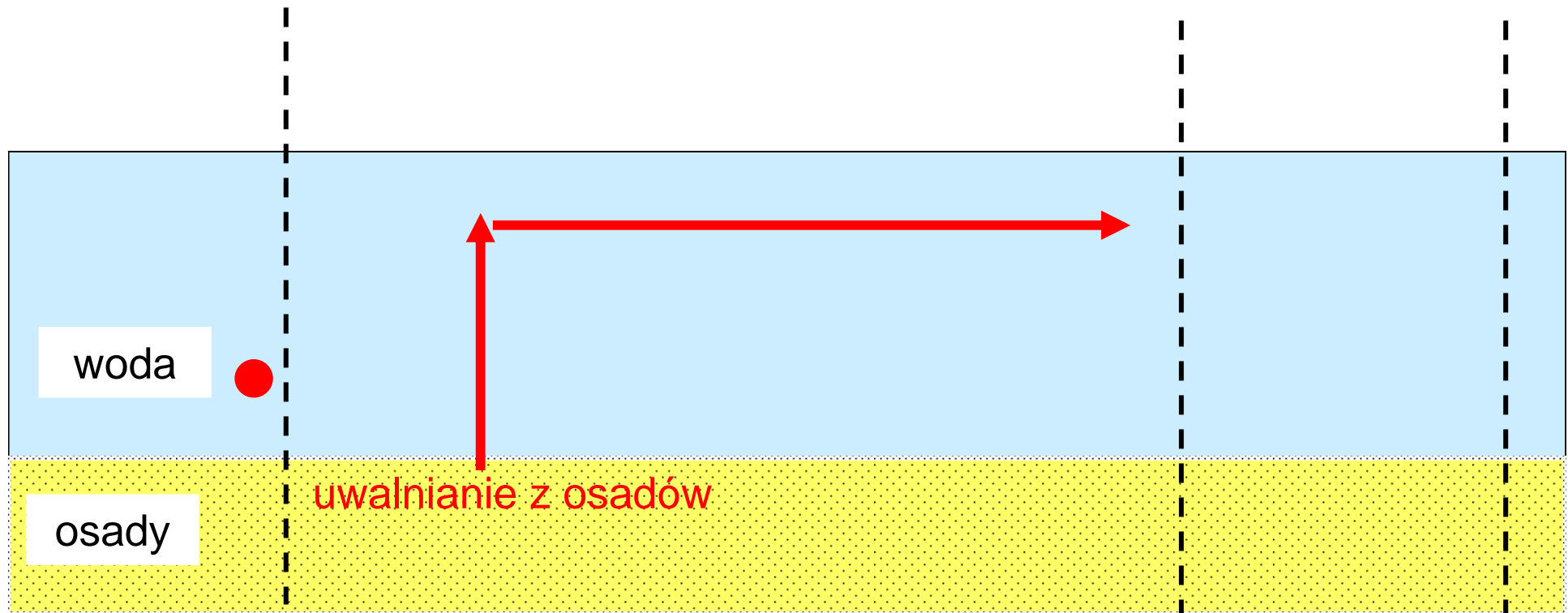
strumień



Przemieszczanie się biogenów w strumieniu

Rzeki

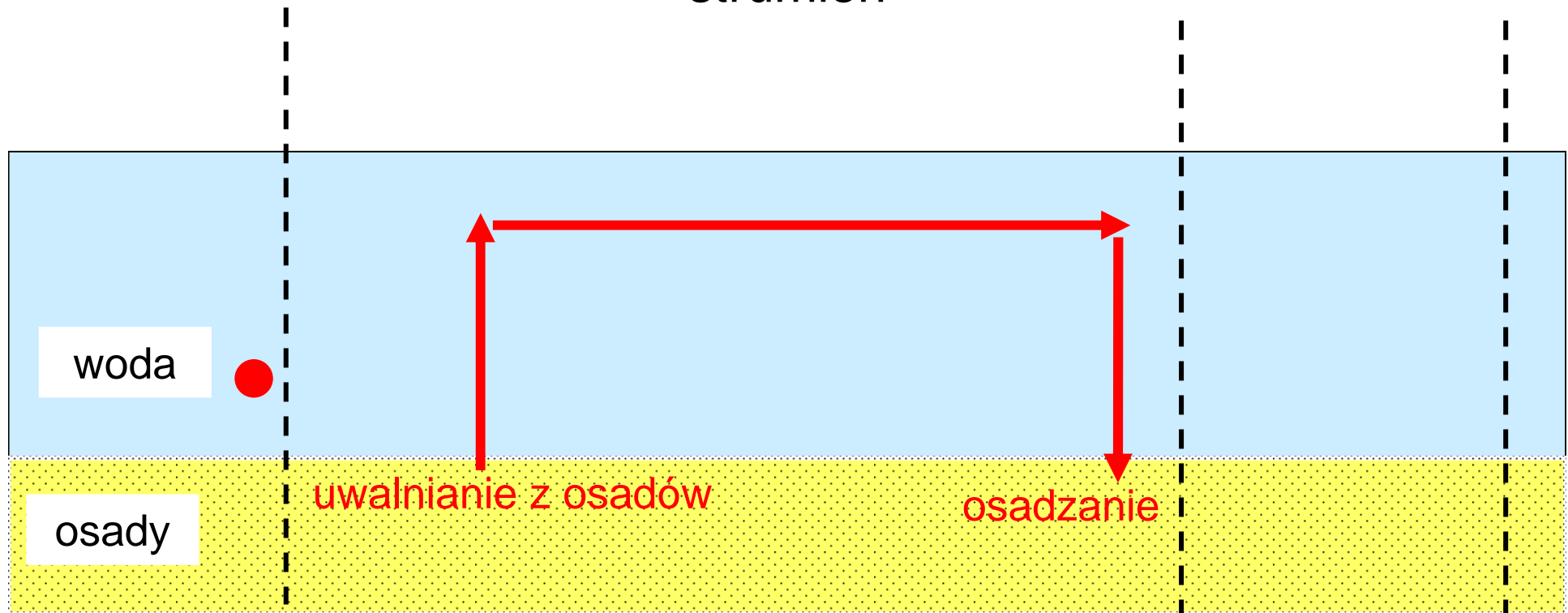
strumień



Przemieszczanie się biogenów w strumieniu

Rzeki

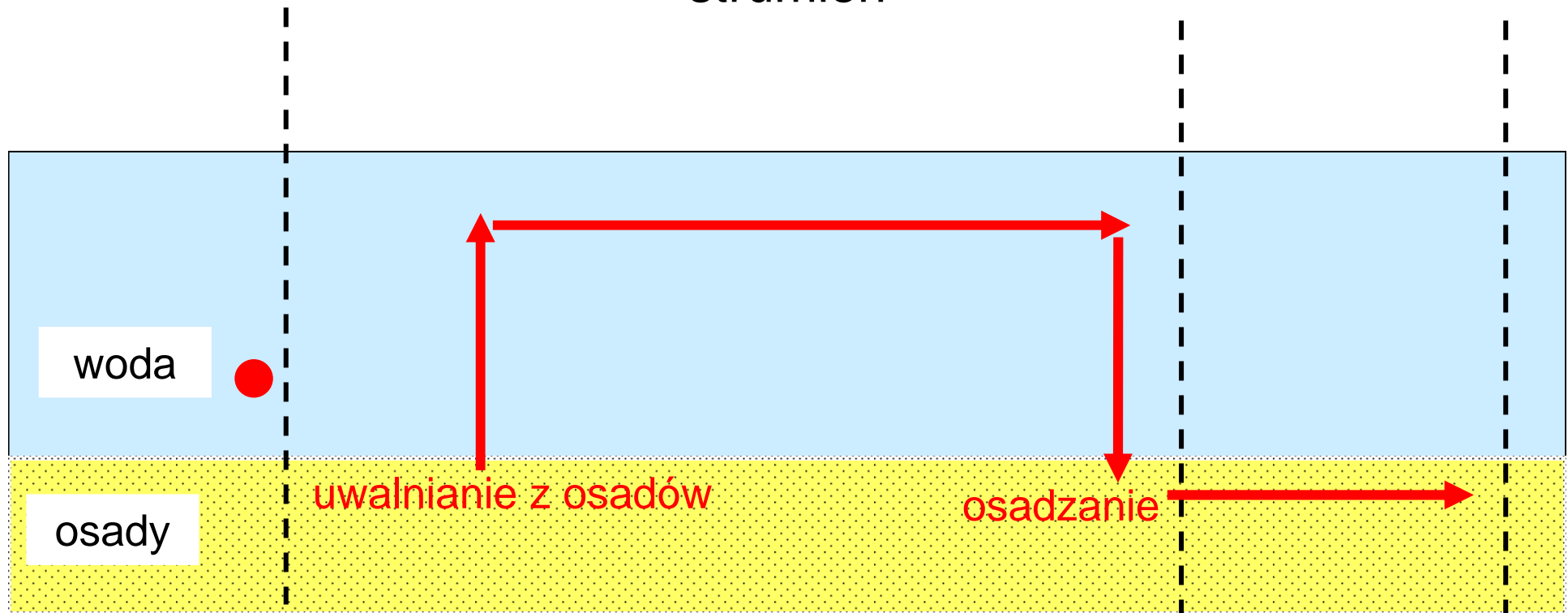
strumień



Przemieszczanie się biogenów w strumieniu

Rzeki

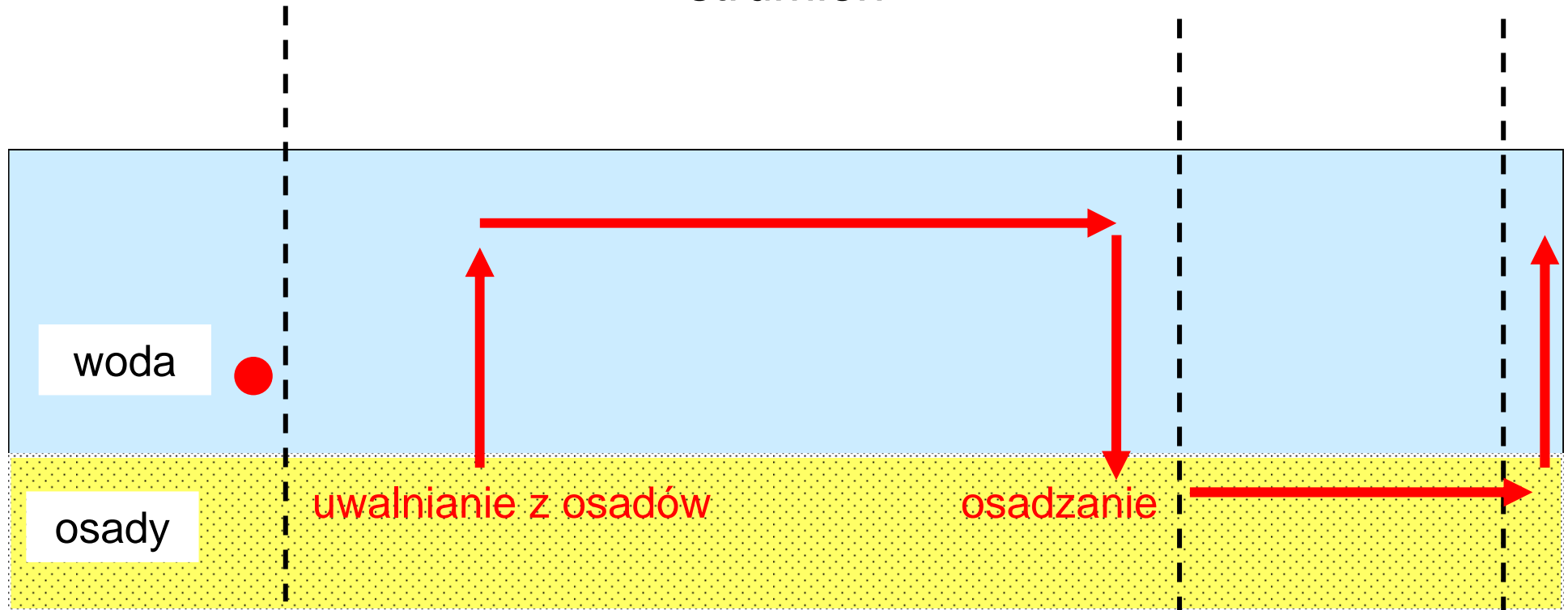
strumień



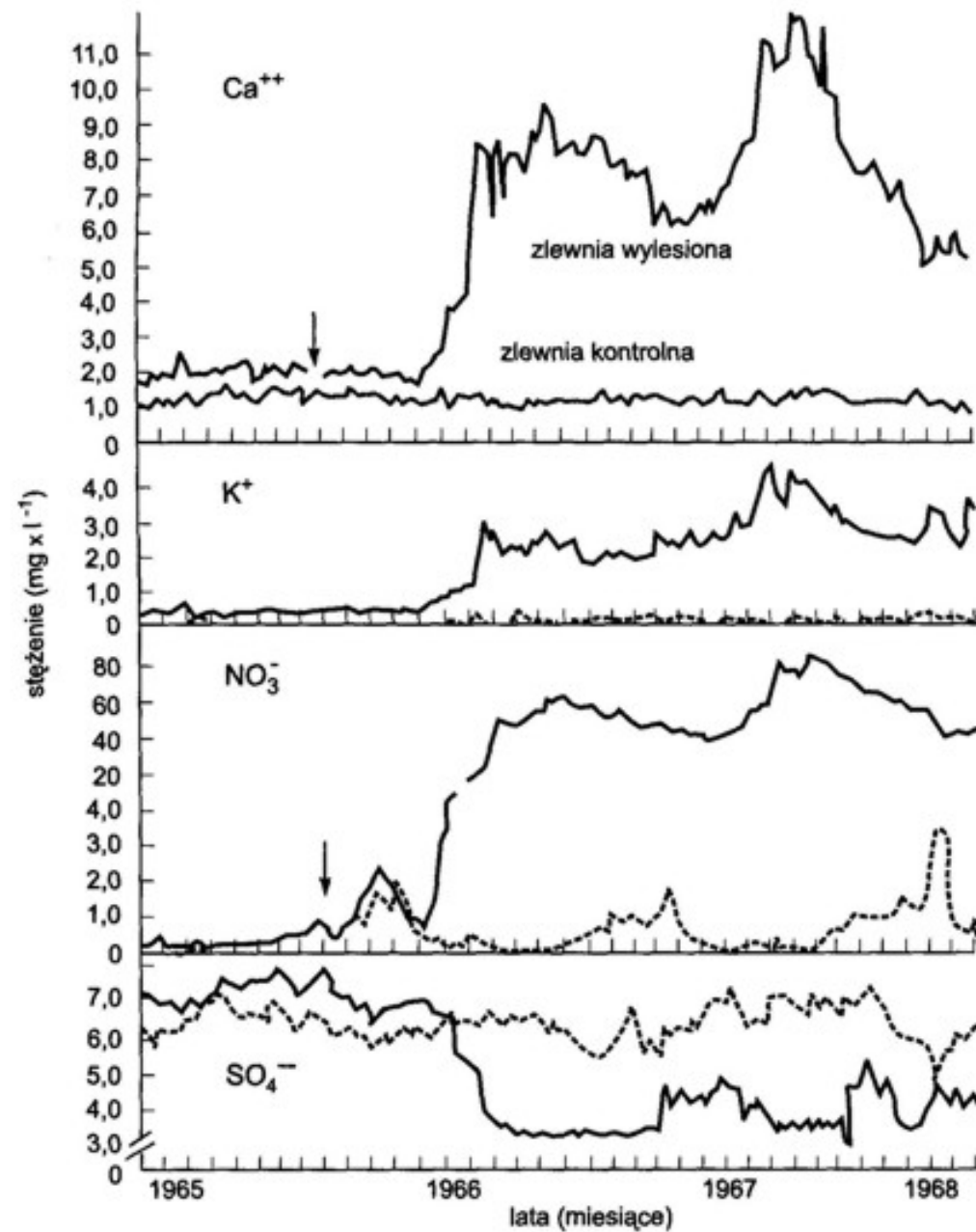
Przemieszczanie się biogenów w strumieniu

Rzeki

strumień



Przemieszczanie się biogenów w strumieniu



Ryc. 9.19. Eksport rozpuszczonych pierwiastków odżywczych (wapń, potas, azotan i siarczan) z jednej ze zlewni w Hubbard Brook po eksperymentalnym wycięciu lasu (wg Bormana i Likensa, 1979)

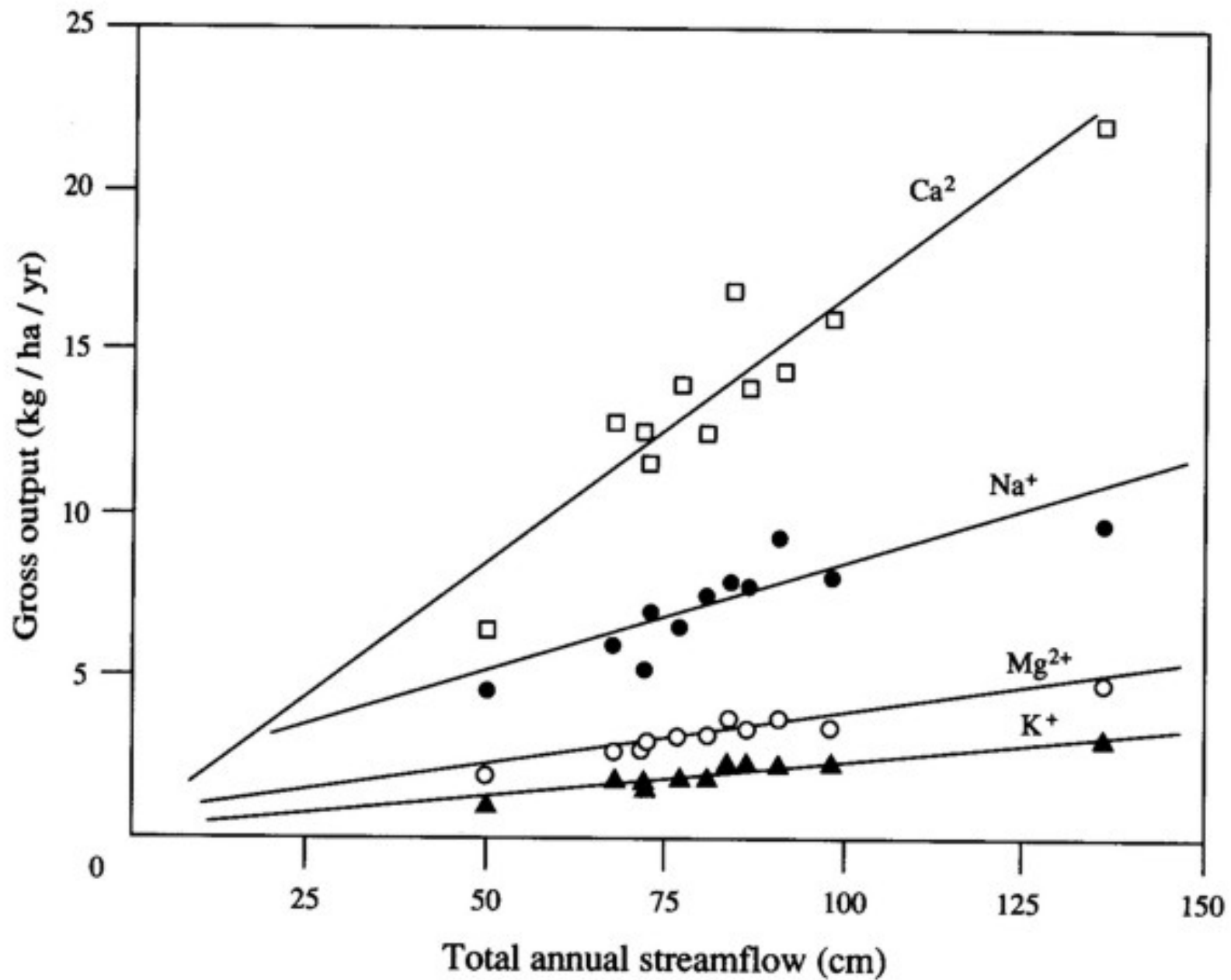


Figure 8.5 Annual stream-water loss of major cations as a function of annual stream discharge in the Hubbard Brook Forest, New Hampshire. From Likens et al. (1977).

Rzeki

Skład chemiczny wody wybranych rzek

	Mackenzie	Orinoko	Rio Grande
Jony główne			
Ca ²⁺	0,82	0,08	2,72
Mg ²⁺	0,43	0,04	0,99
Na ⁺	0,30	0,06	5,10
K ⁺	0,02	0,02	0,17
Cl ⁻	0,25	0,08	4,28
SO ₄ ²⁻	0,38	0,03	2,48
HCO ₃ ⁻	1,82	0,18	3,00
SiO ₂	0,05	0,19	0,50

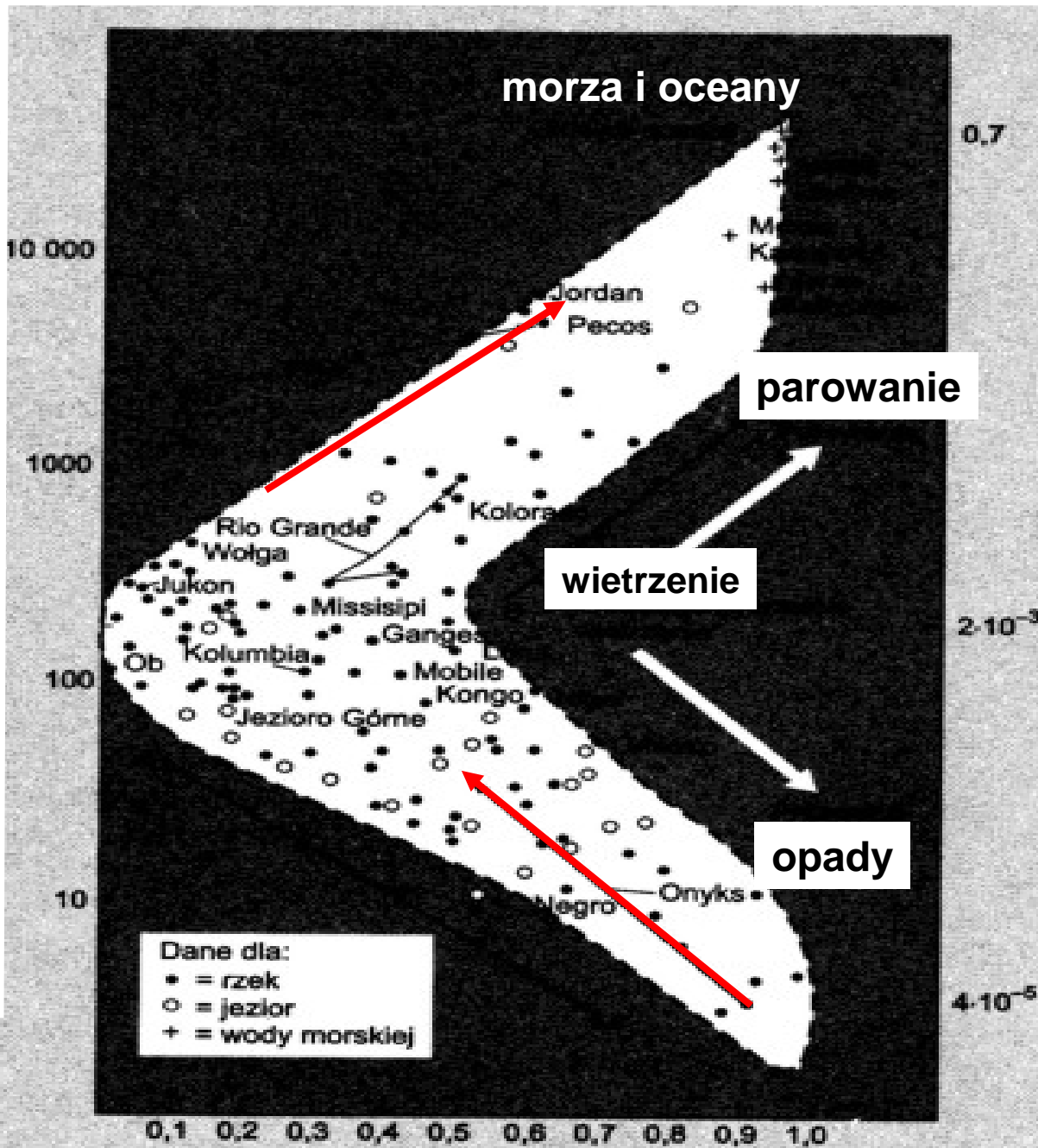
Rzeki

Pochodzenie jonów w rzekach:

Wietrzenie: Ca^{2+} , Mg^{2+} , K^{+}

Aerozole morskie: Na^{+} , Cl^{-} , SO_4^{2-}

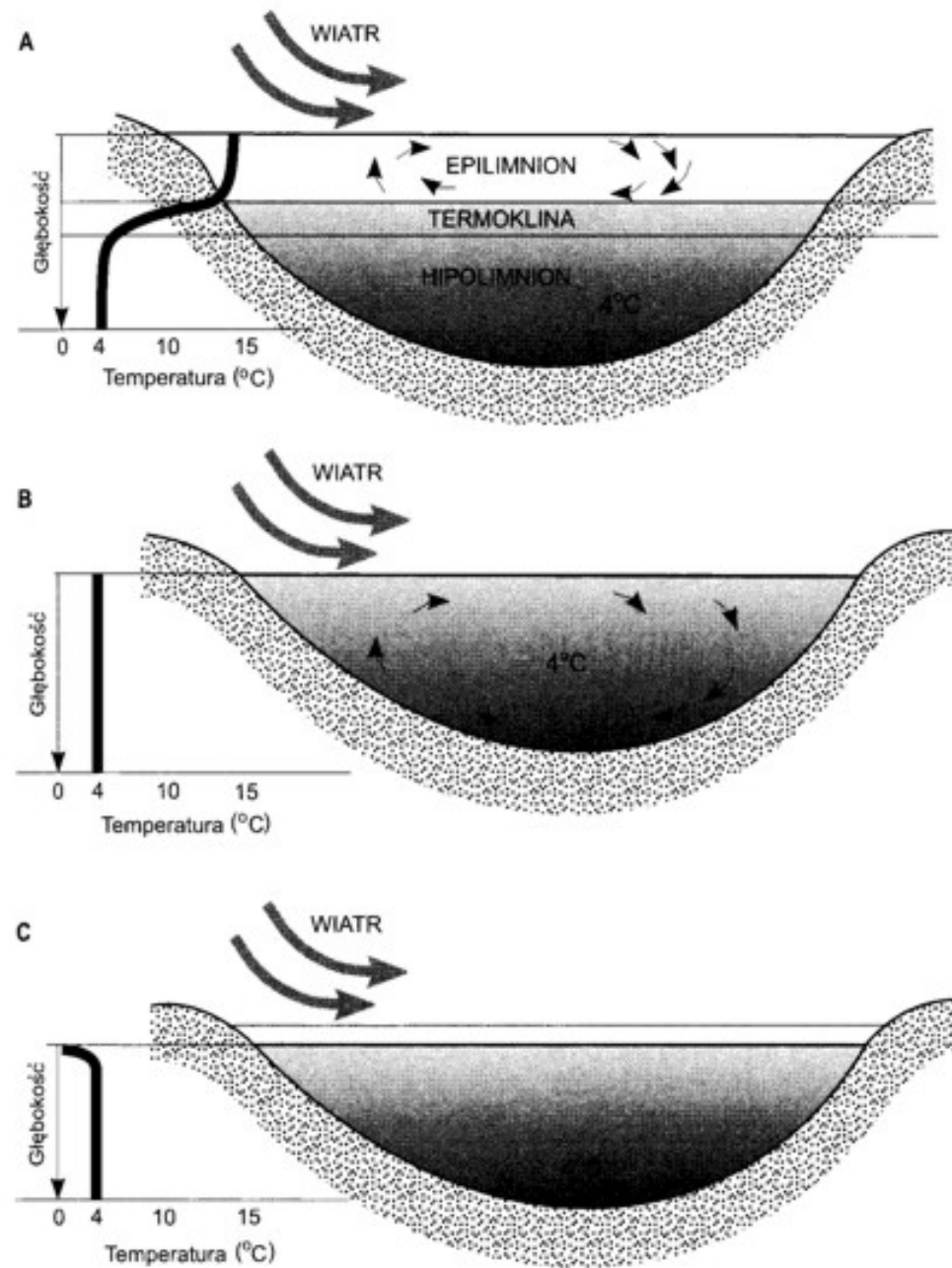
Calkowite stężenia rozpuszczalnych soli (mg/dm³)



Siła jonowa (mol/dm³)

Stosunek masy Cl/(Cl + HCO₃) lub Na/(Na + Ca)

Jezióra



Ryc. 9.3. Stratyfikacja termiczna jeziora umiarkowanej strefy klimatycznej. A — latem; B — wiosną i jesienią (brak stratyfikacji); C — zimą

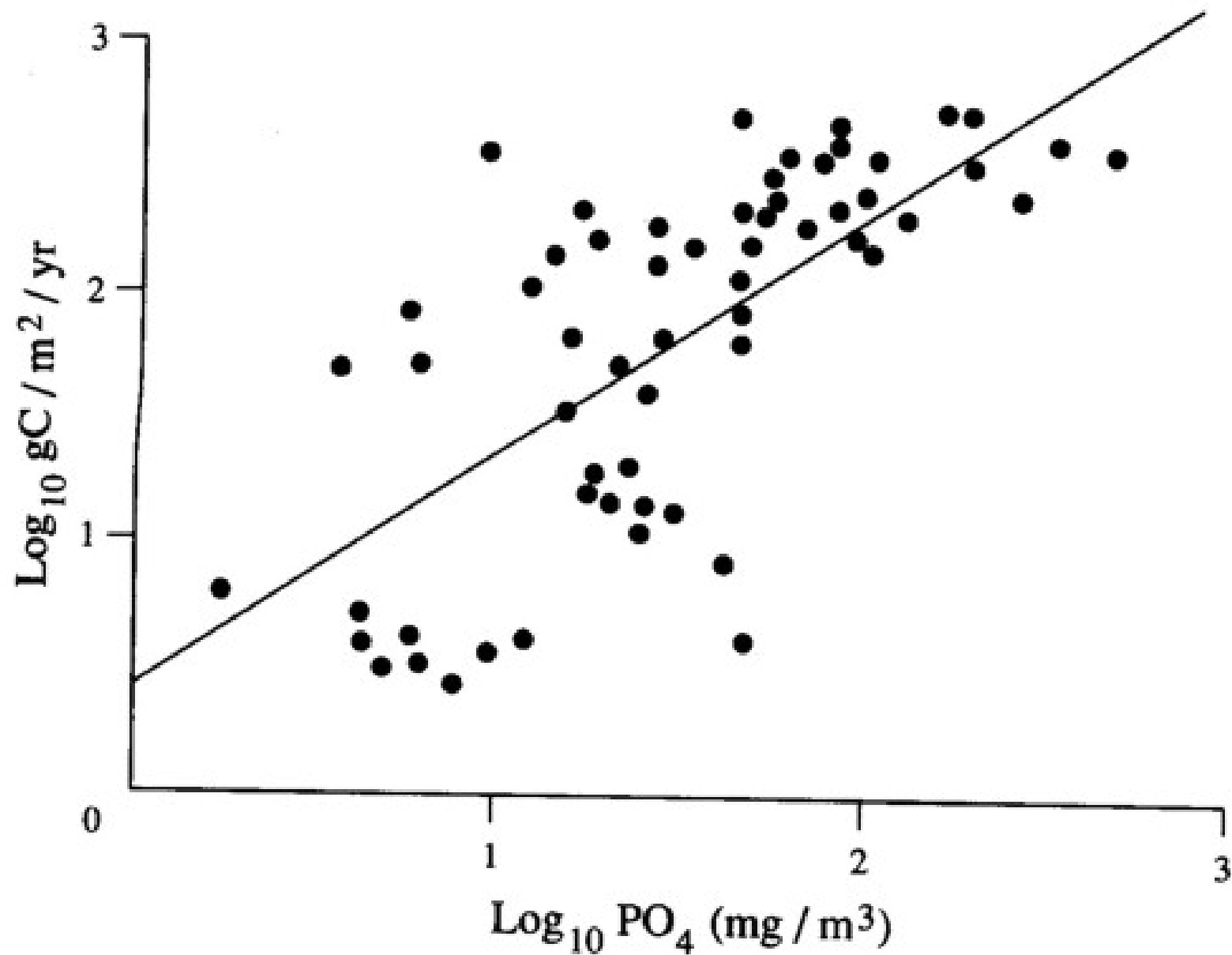
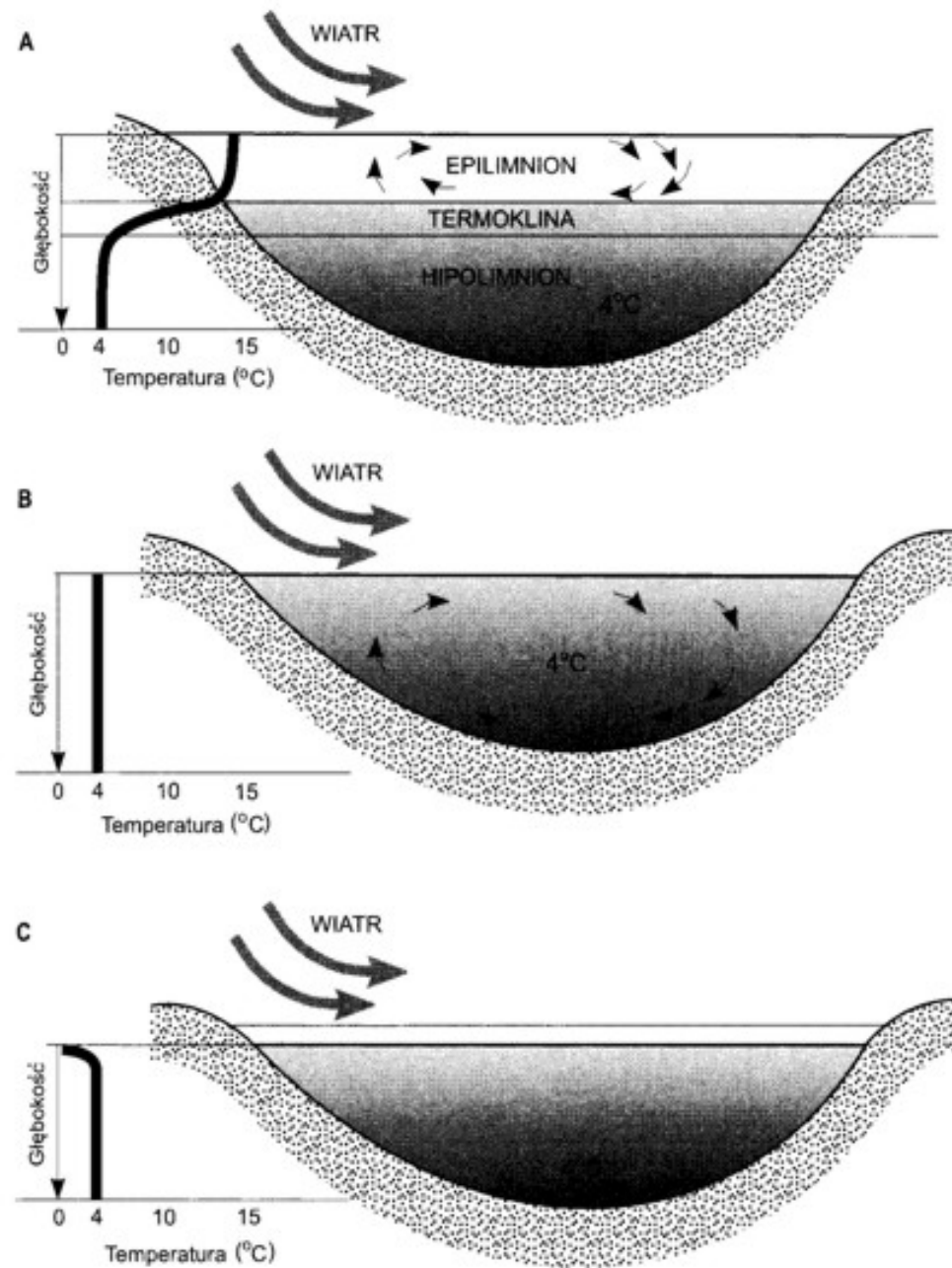
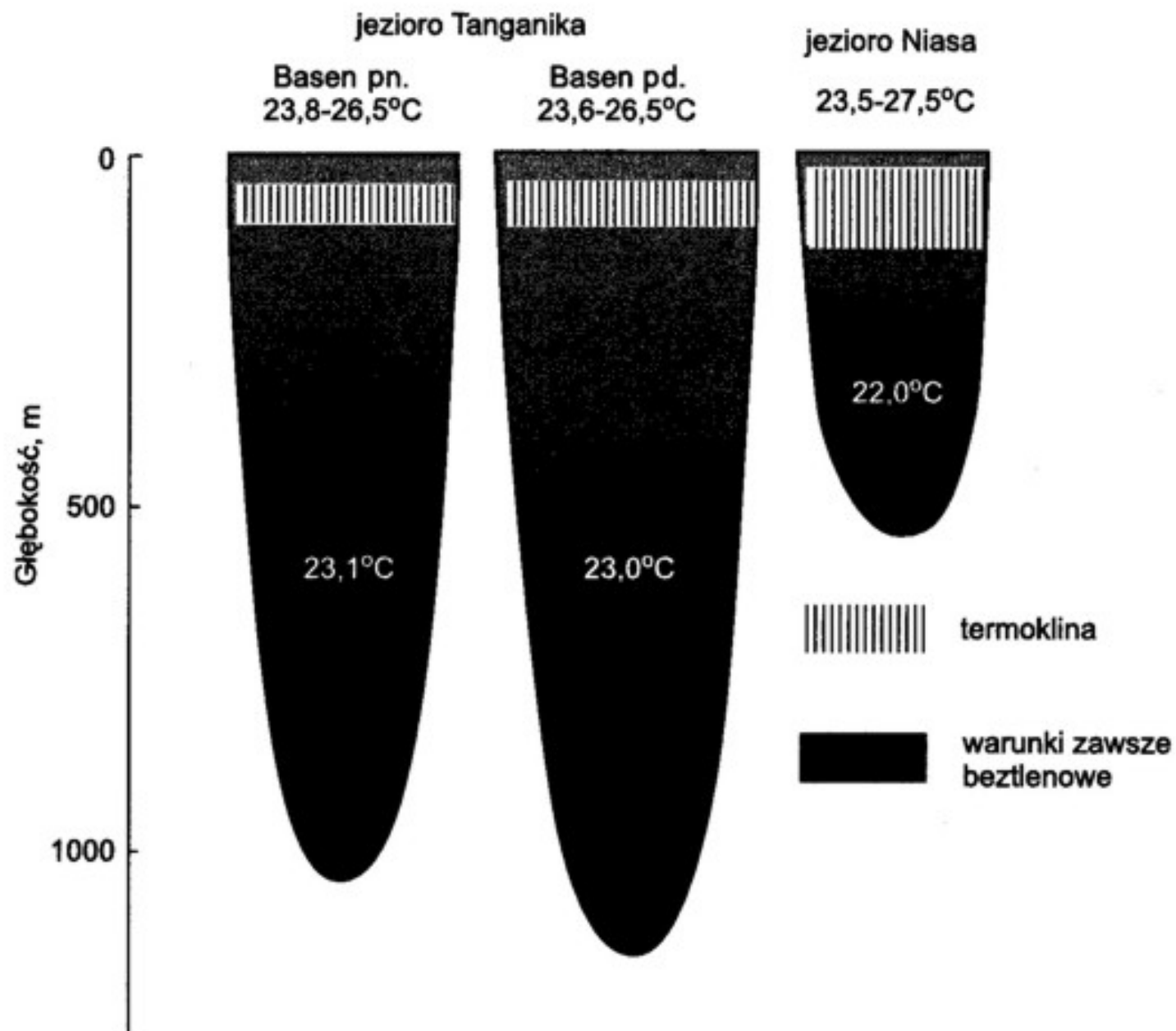


Figure 7.8 Relationship between net primary production and the phosphorus concentration in lakes of the world. From Schindler (1978).





Ryc. 9.3. Stratyfikacja termiczna jeziora umiarkowanej strefy klimatycznej. A — latem; B — wiosną i jesienią (brak stratyfikacji); C — zimą

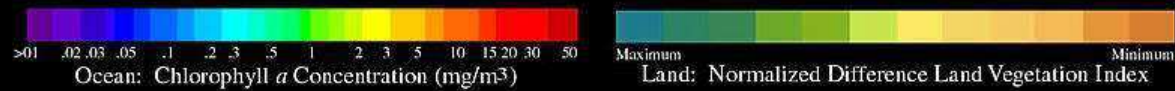
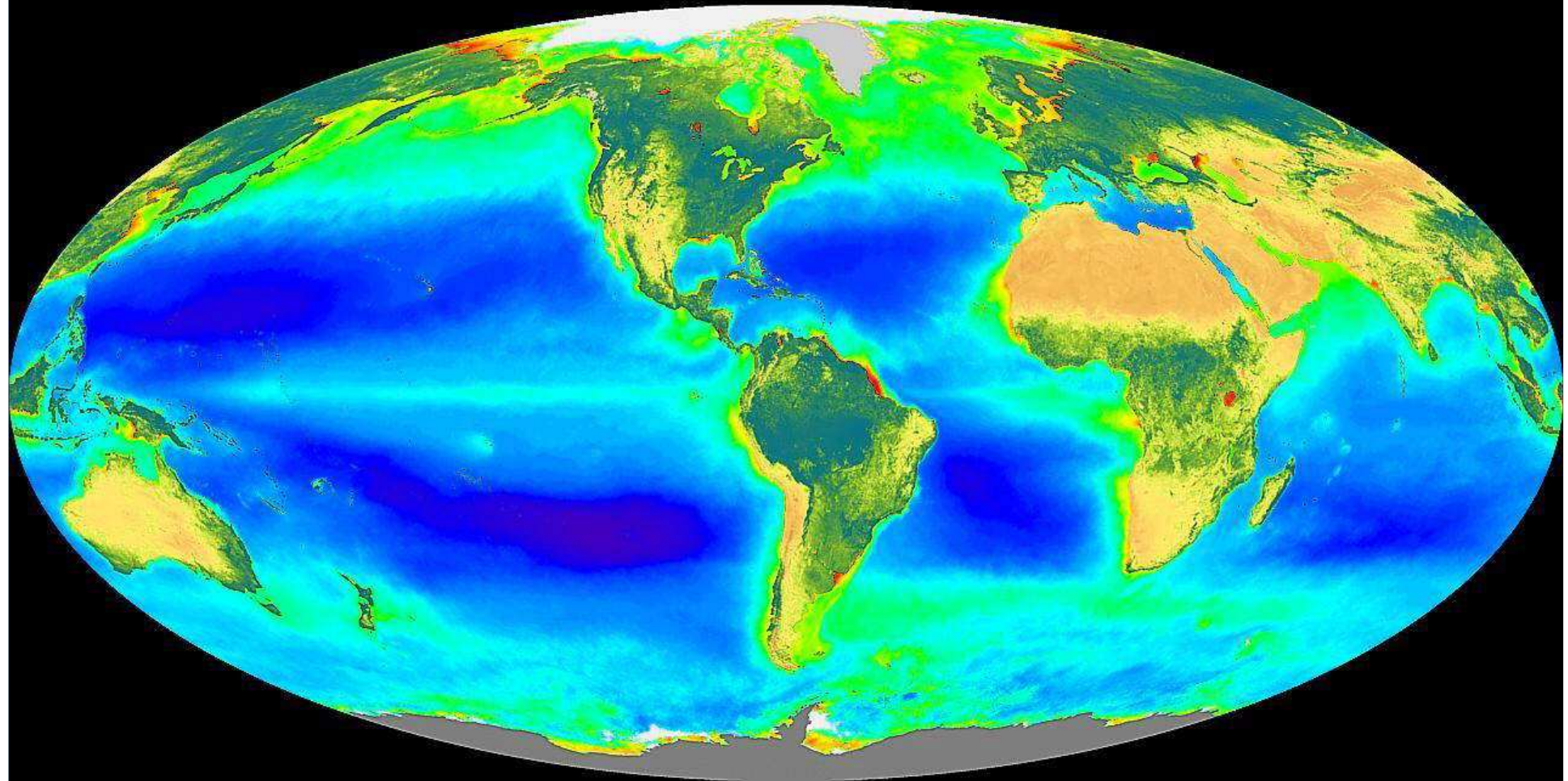


Ryc. 9.5. Stratyfikacja termiczna wielkich jezior afrykańskich (wg Beauchampa, 1964)

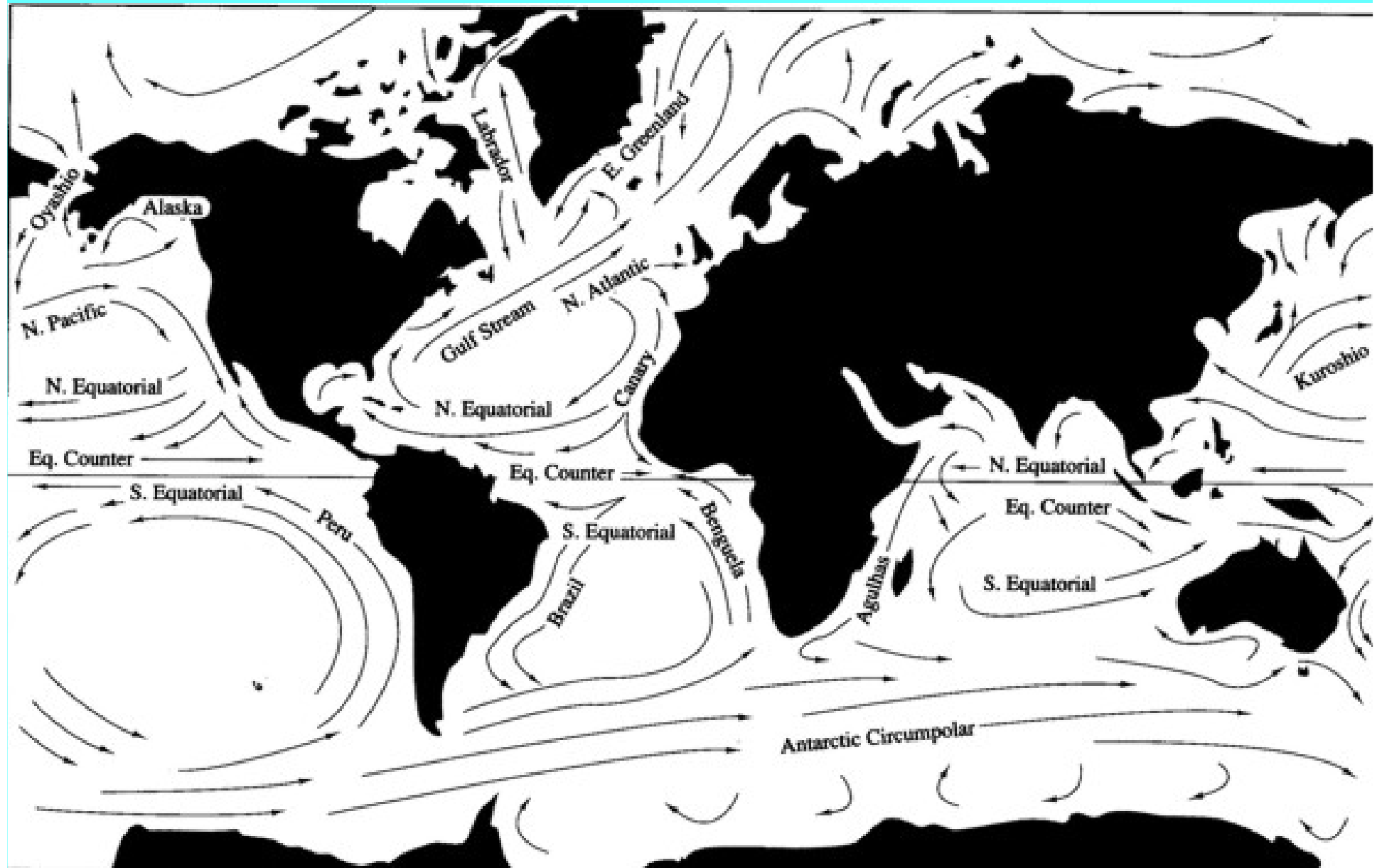
A photograph of a sunset over the ocean. The sun is a bright yellow orb in the upper center, casting a shimmering path of light across the dark blue water. The sky transitions from a deep orange near the horizon to a darker purple at the top. The word "OCEANY" is written in a bold, white, sans-serif font across the middle of the image.

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SeaWiFS Global Biosphere September 1997 – August 2000
Three Year Anniversary



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Stężenie jonów ($\text{mmol} \cdot \text{dm}^3$) w wodzie słodkiej i morskiej

Jony główne	woda rzeczna	woda morska
Na^+	0,23	470
Mg^{2+}	0,14	53
K^+	0,03	10
Ca^{2+}	0,33	10
HCO_3^-	0,85	2
SO_4^{2-}	0,09	28
Cl^-	0,16	550
Si	0,16	0,1

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Źródła
biogenów

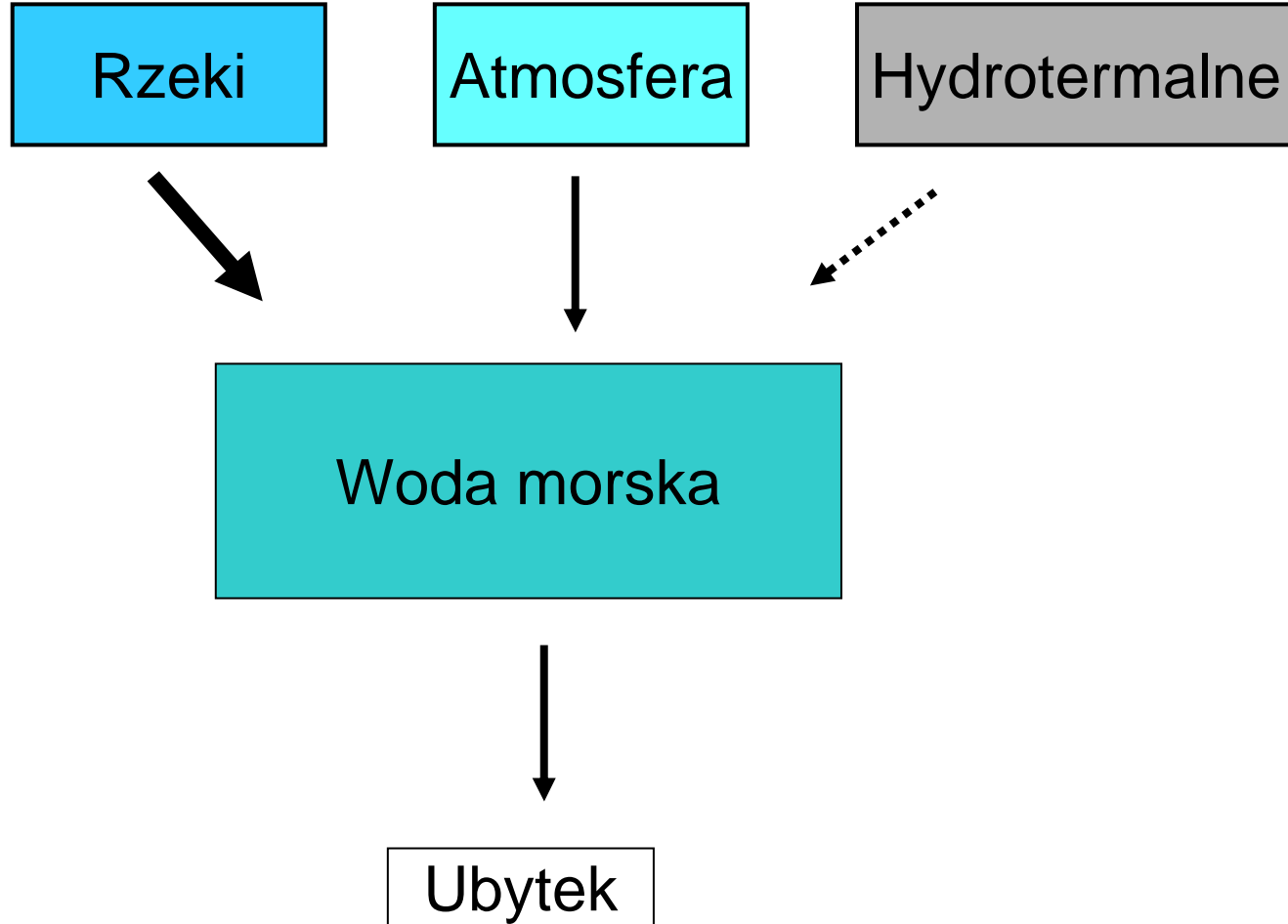
Rzeki

Atmosfera

Hydrotermalne

Woda morską

Ubytek



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Tworzenie osadów

osady węgla wapnia

- abiotyczne
- biotyczne

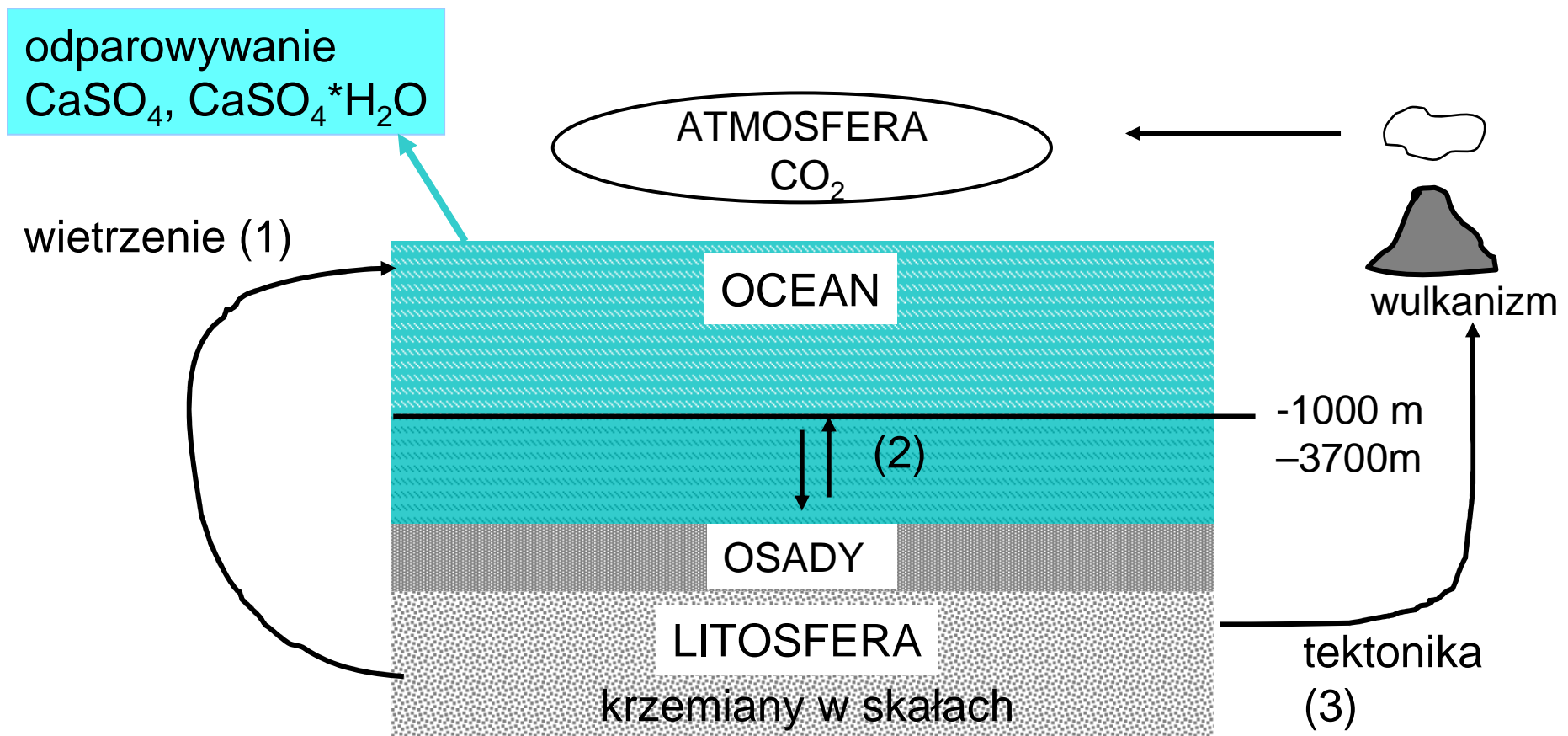
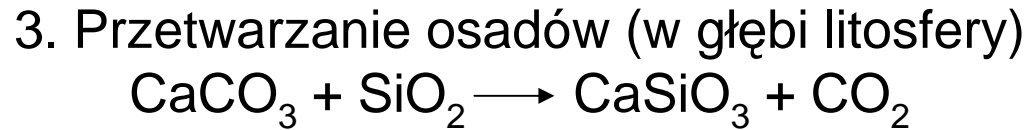
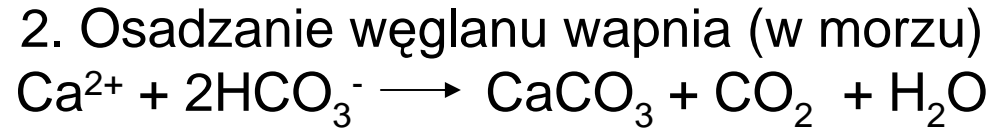
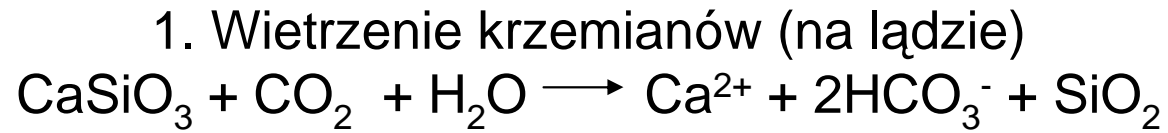
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Tworzenie osadów

osady węgla wapnia

- abiotyczne
- biotyczne

osady krzemionki (okrzemki, promienice)



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Tworzenie osadów

osady węglańu wapnia

- abiotyczne
- biotyczne

osady krzemionki (okrzemki, promienice)

Ewapority

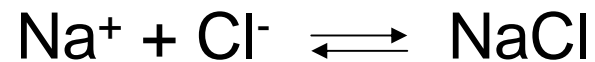
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Ewaporyty

Odparowanie 47% wody



Odparowanie 90% wody



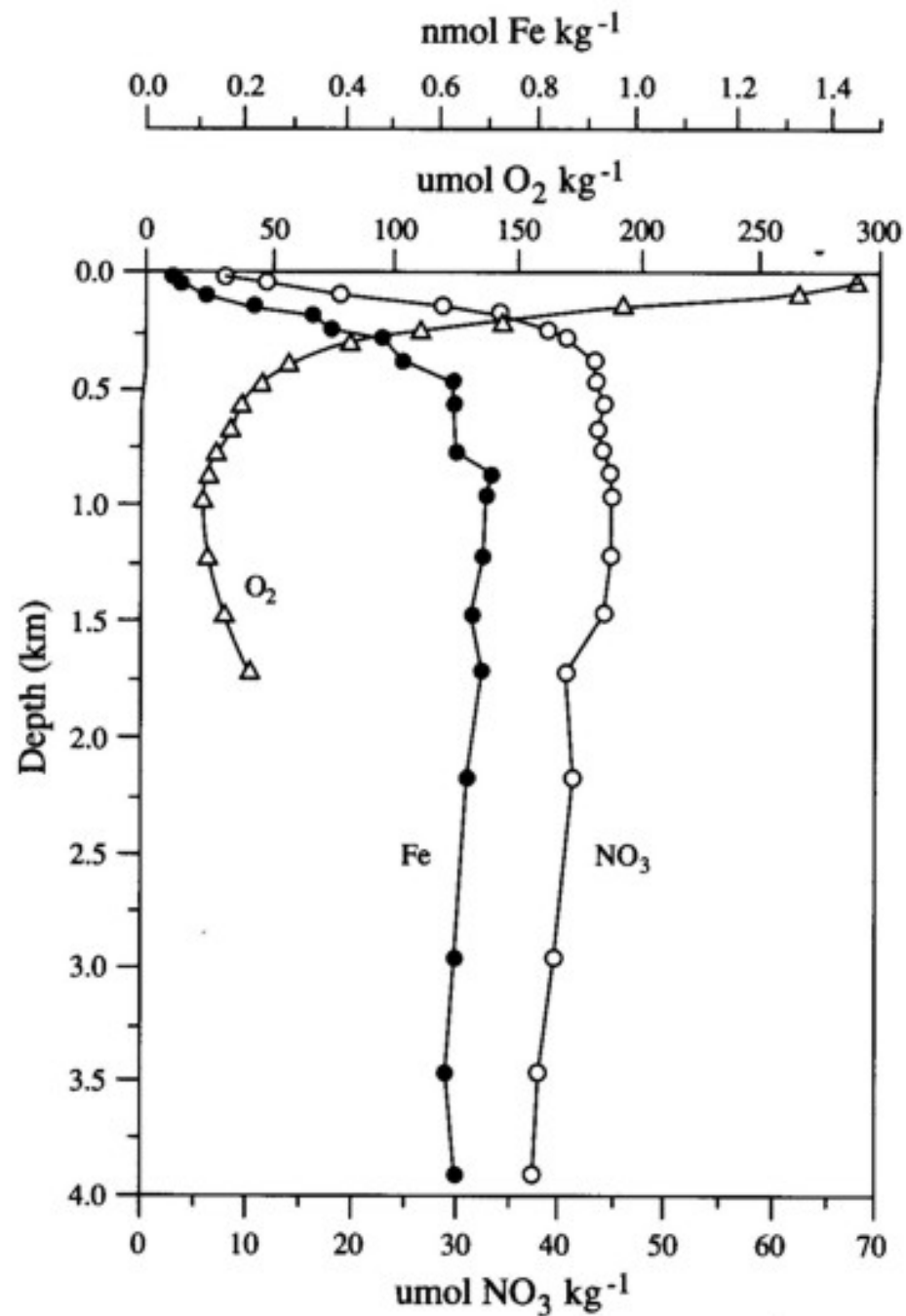


Figure 9.13 Vertical distribution of Fe, NO₃, and O₂ in the central North Pacific Ocean. From Martin et al. (1989).

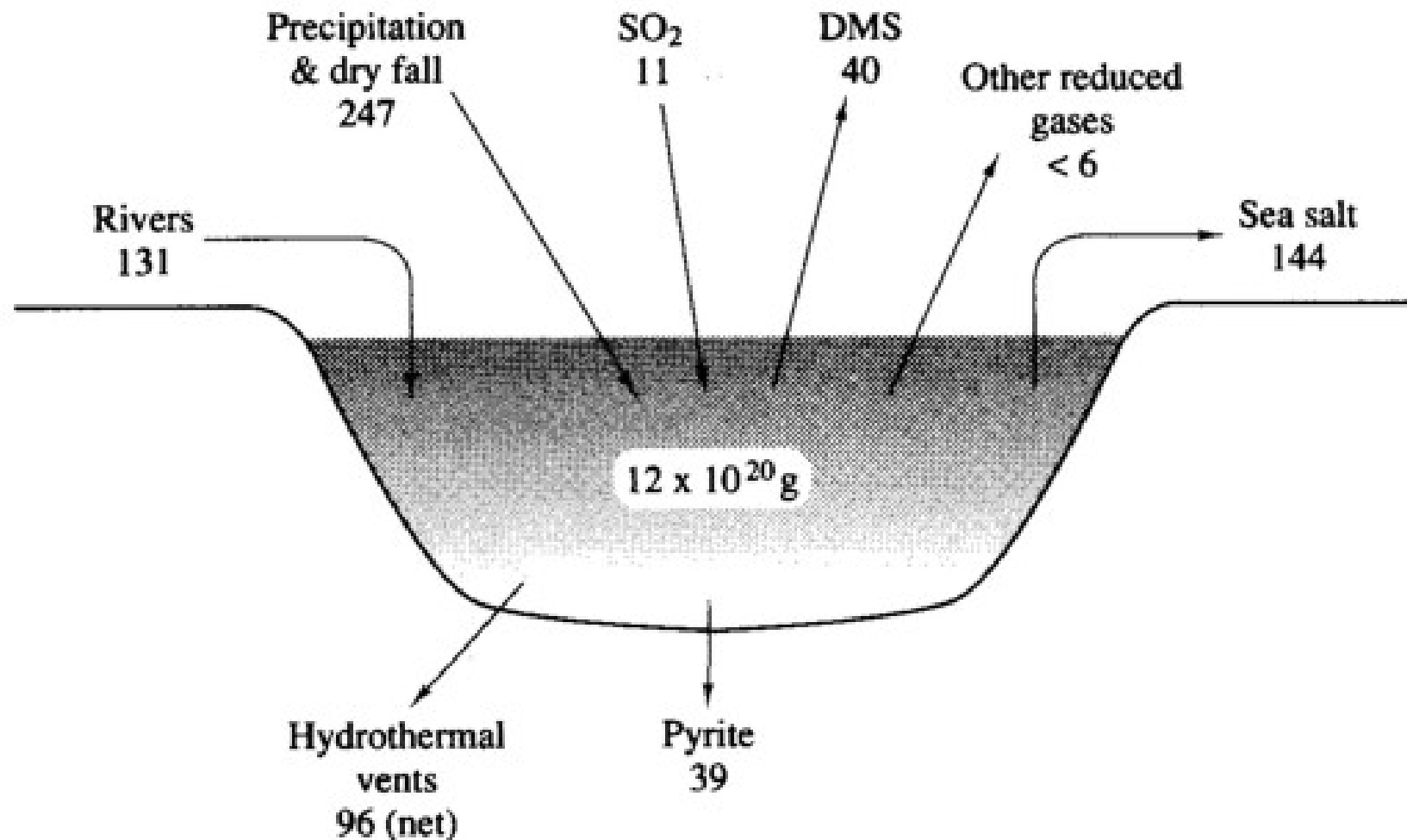


Figure 9.14 Sulfur budget for the world's oceans. All values given in 10^{12} g S/yr. River flux is from Husar and Husar (1985), gaseous outputs from Toon et al. (1987), hydrothermal flux from Jannasch (1989), and pyrite from Berner (1982). All other fluxes are from Brimblecombe et al. (1989). As a result of pollution, the present-day river flux may be $>200 \times 10^{12}$ g S/yr. (See also Fig. 13.1).

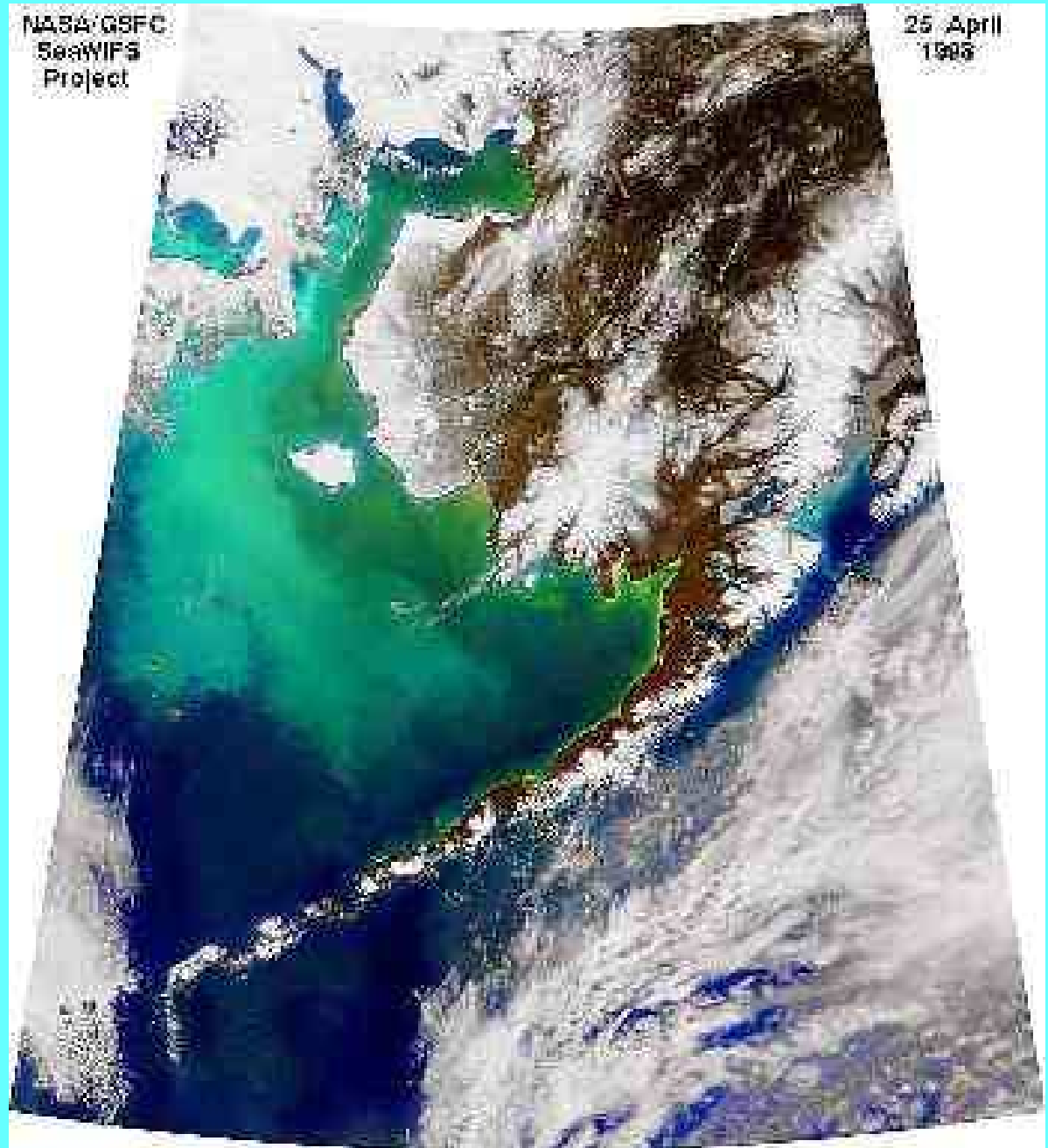


**CHMURY SIARKOWODORU
WYDZIELANEGO PRZEZ
GŁĘBINOWE BAKTERIE ANAEROBOWE
(24.04.2002, PÓŁNOCNA NAMIBIA)**

NASA/
MODIS

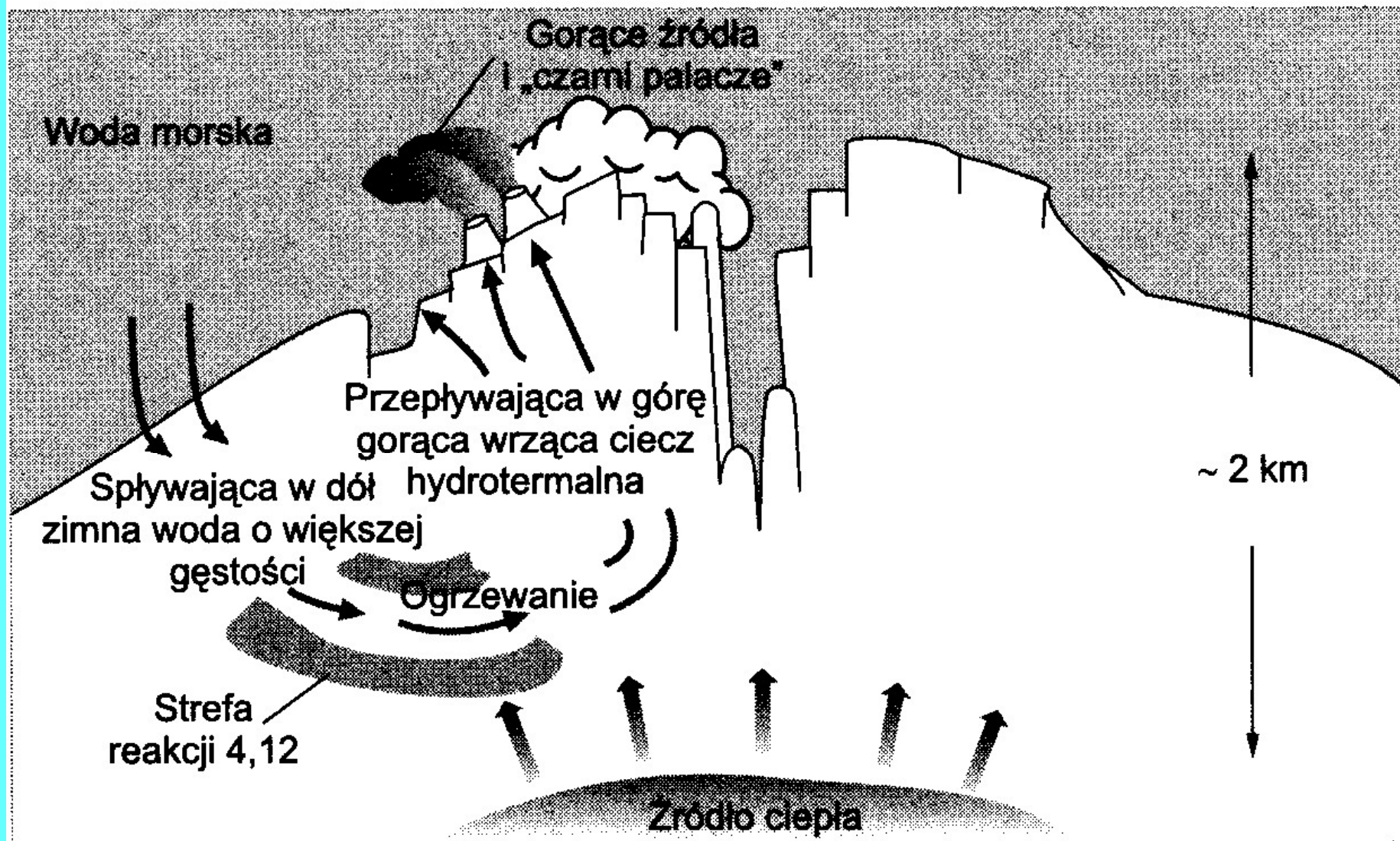


Emiliana Huxleyi.



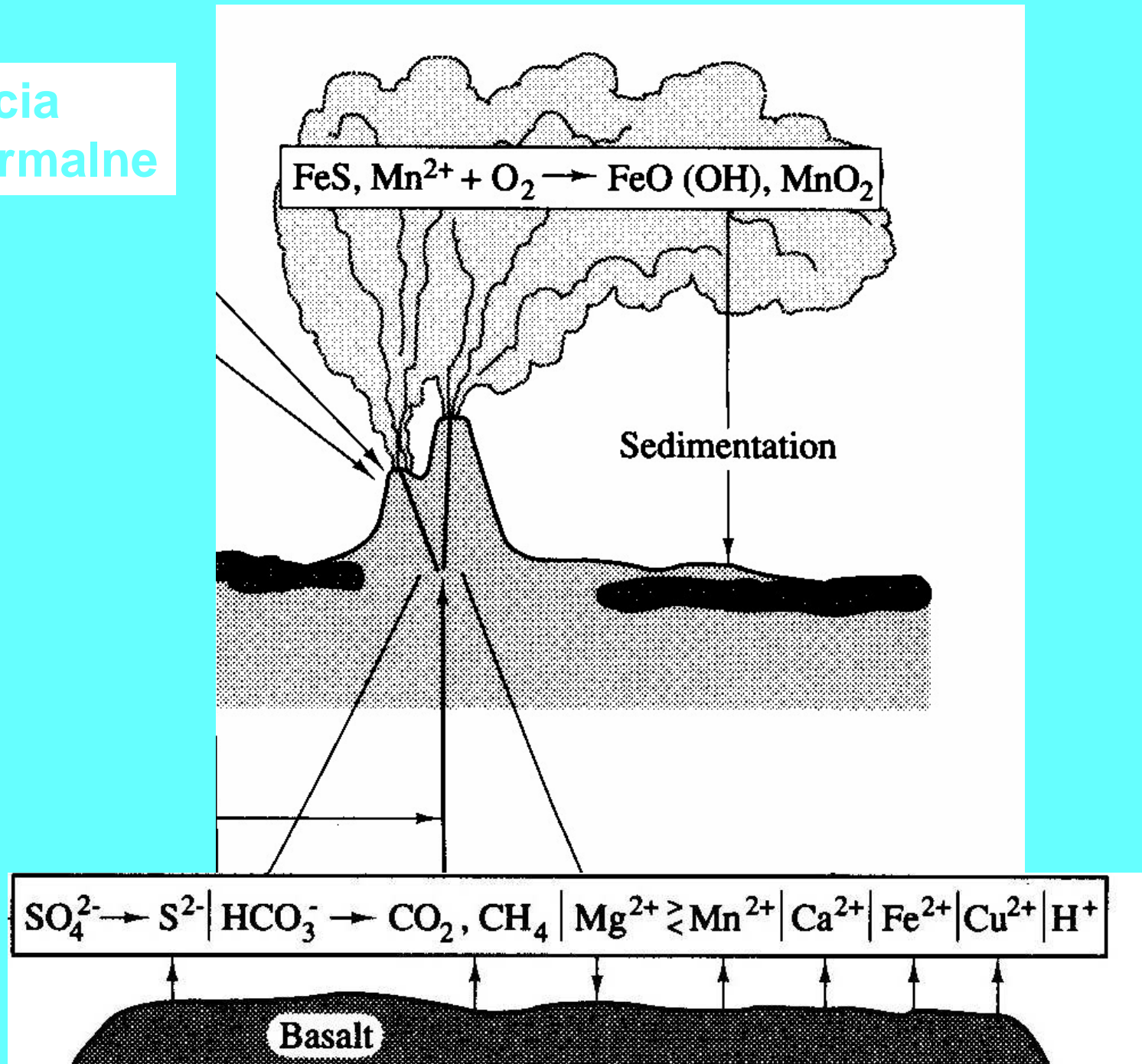
Ujścia hydrotermalne

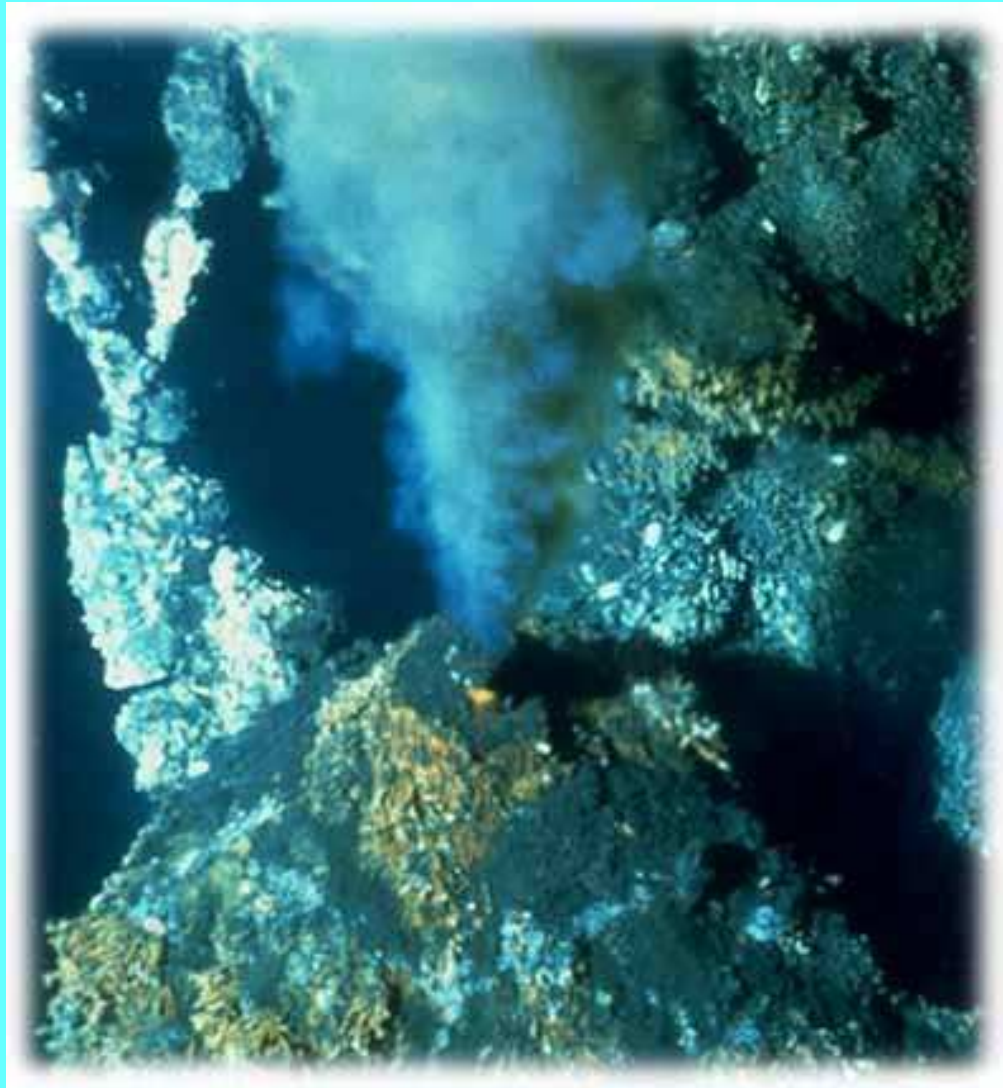
Ujścia hydrotermalne



Rys. 2. Konwekcja hydrotermalna w pobliżu grzbietów śródoceanicznych

Ujścia hydrotermalne

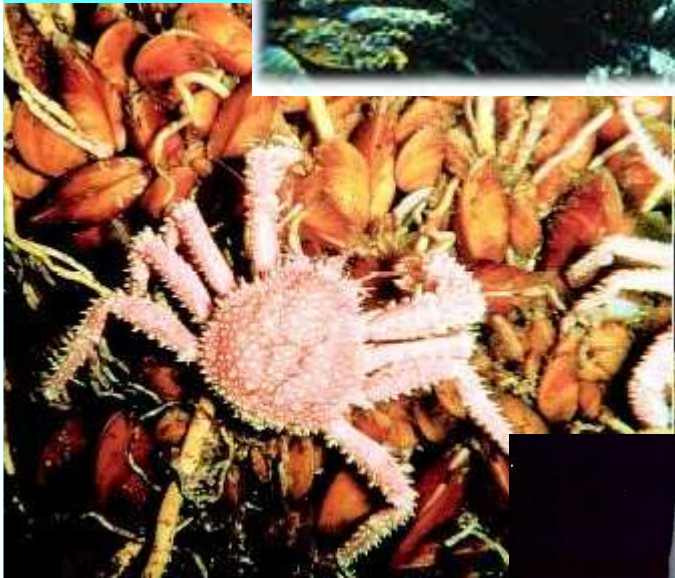




Ujścia hydrotermalne

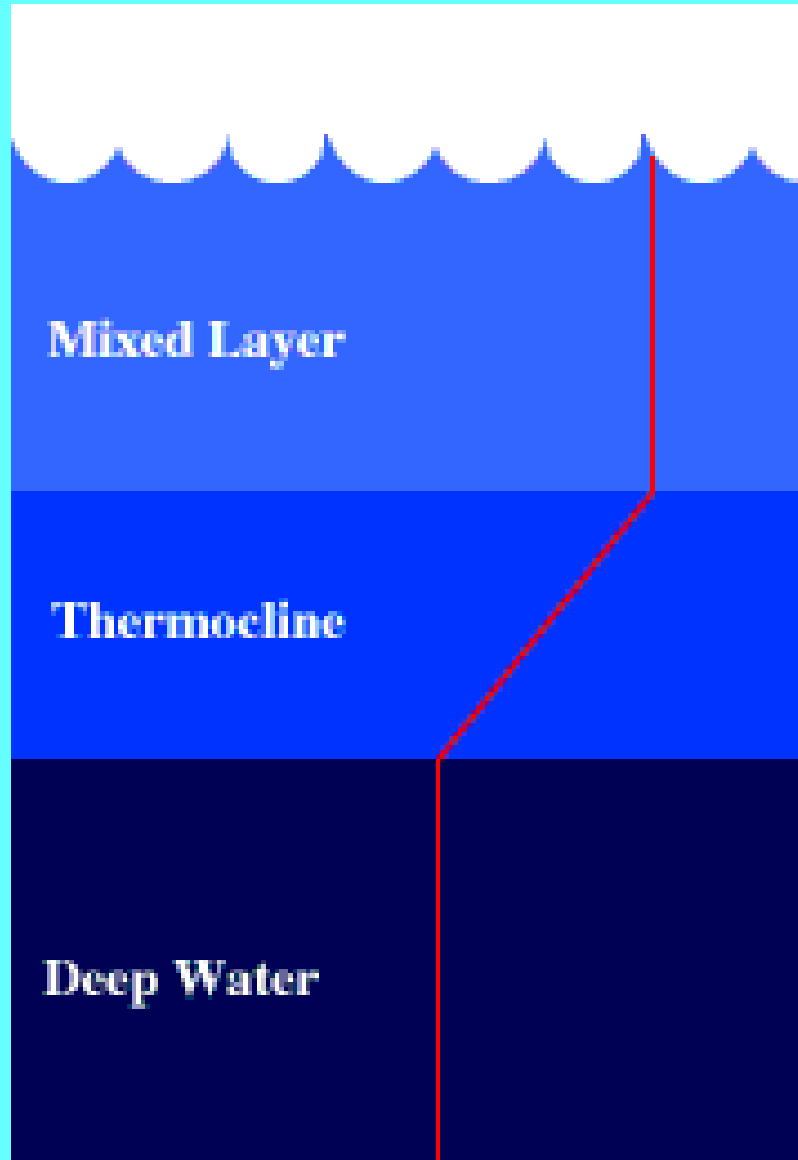


Komin hydrotermalny na dnie Rowu Kajmańskiego



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El Niño

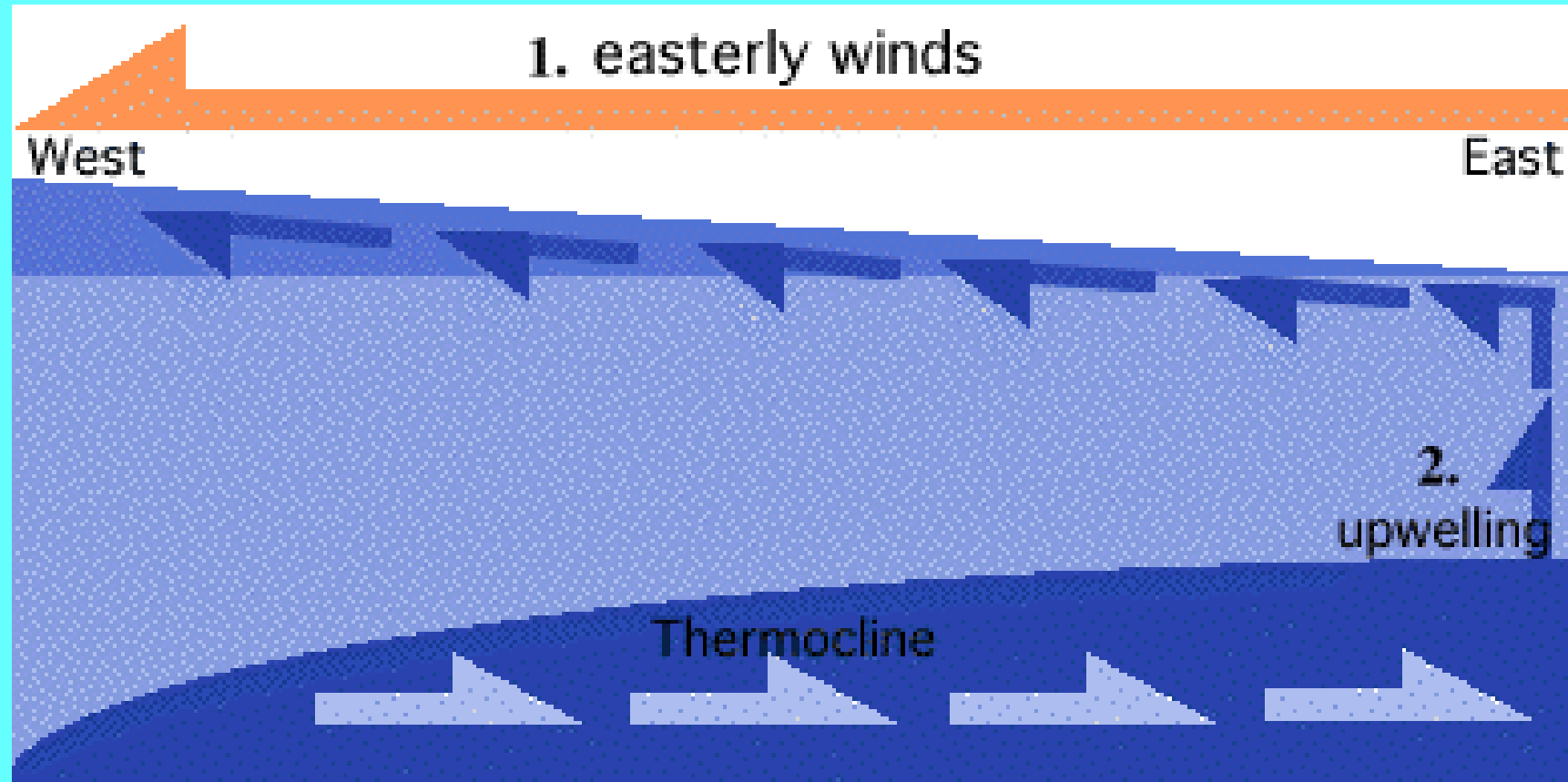


Temperature



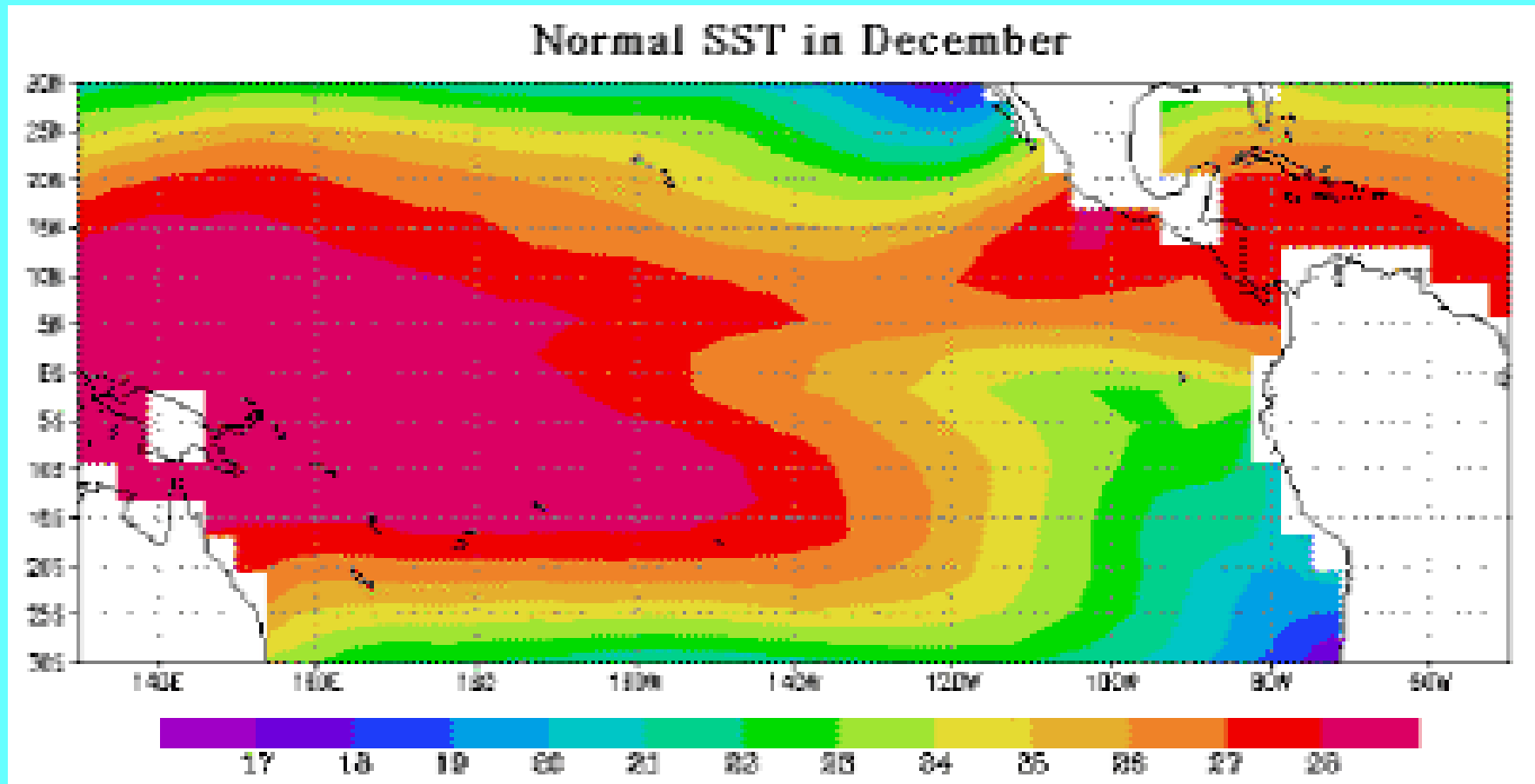
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El Niño



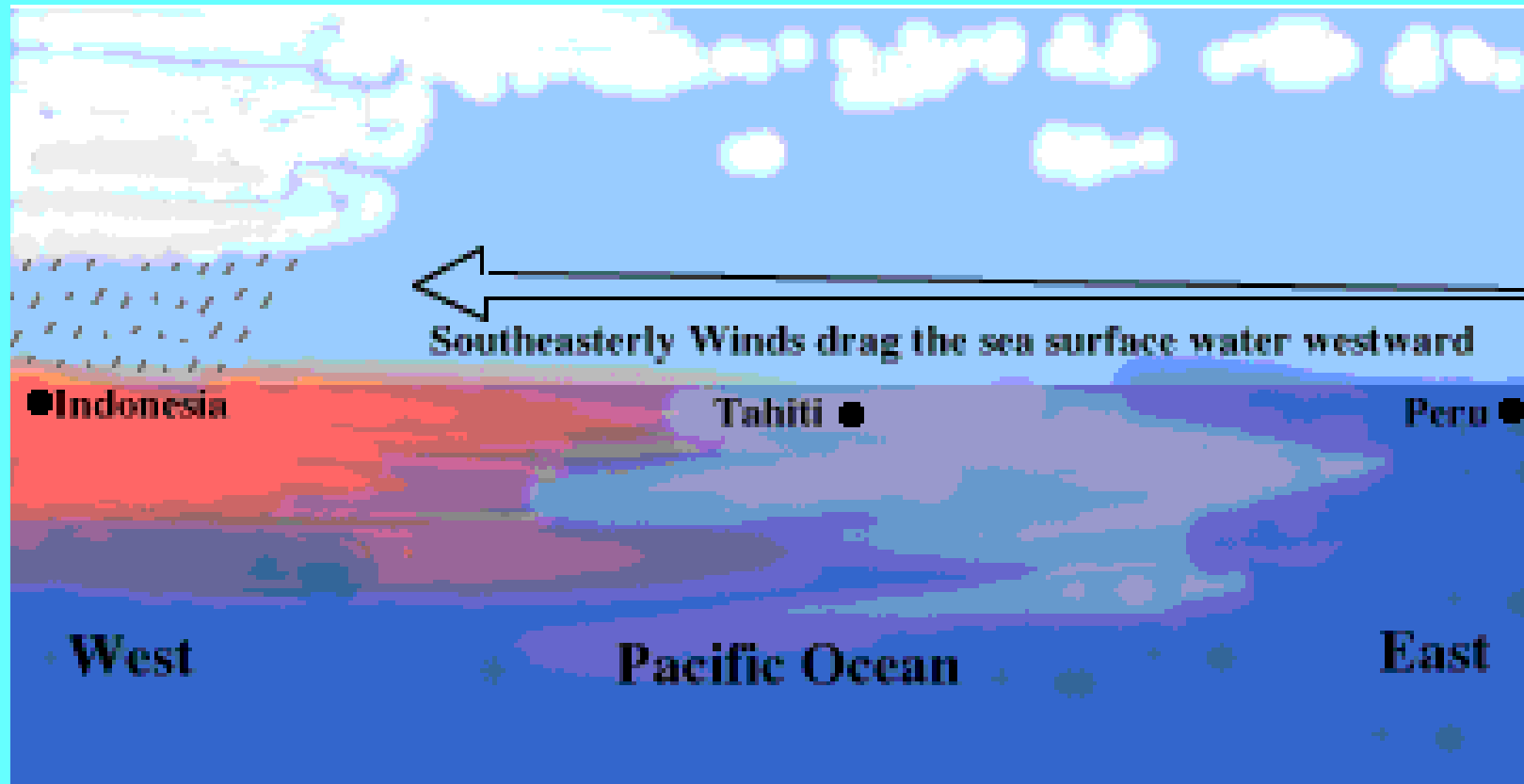
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El Niño



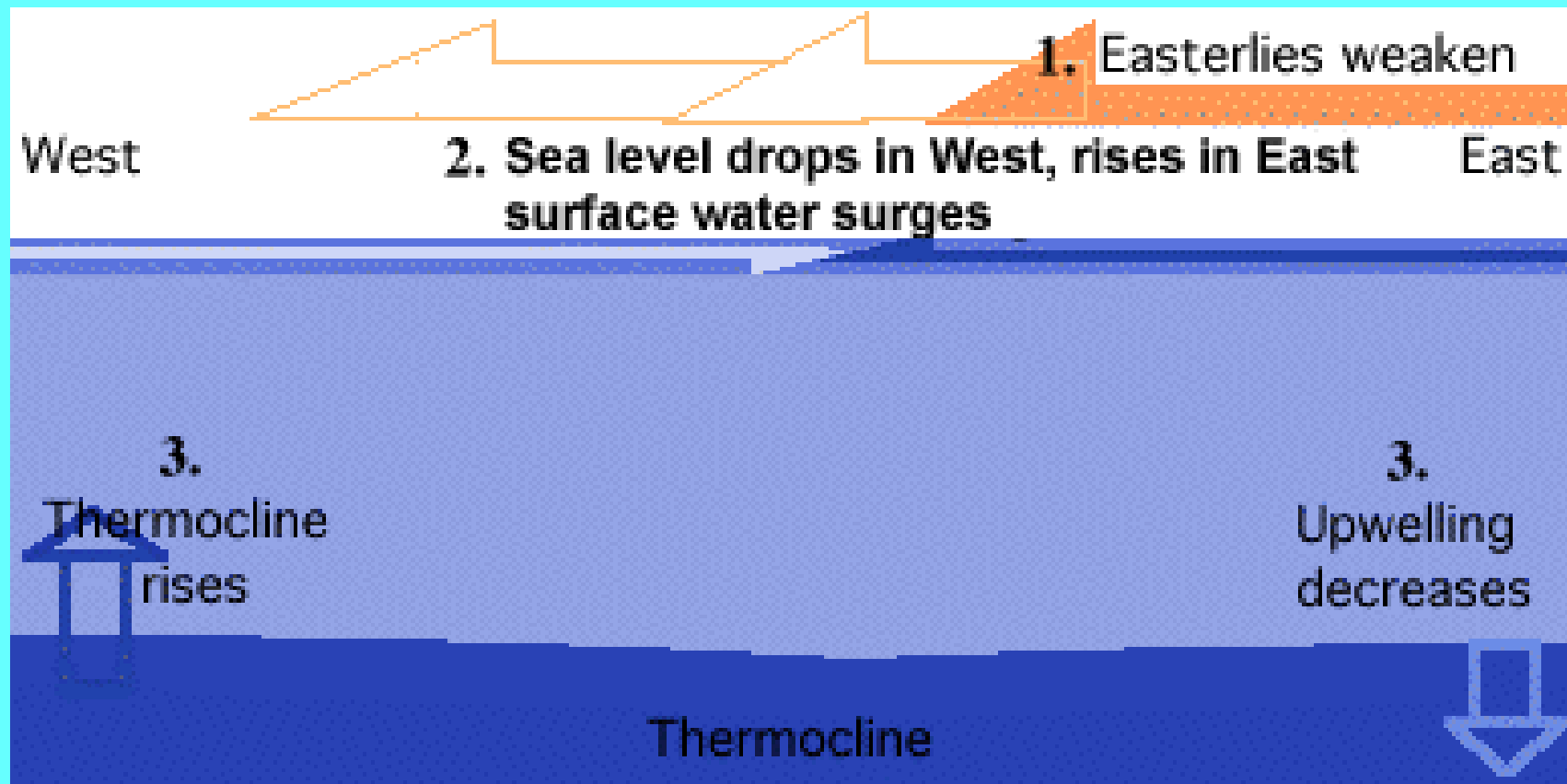
OCEANY

El Niño



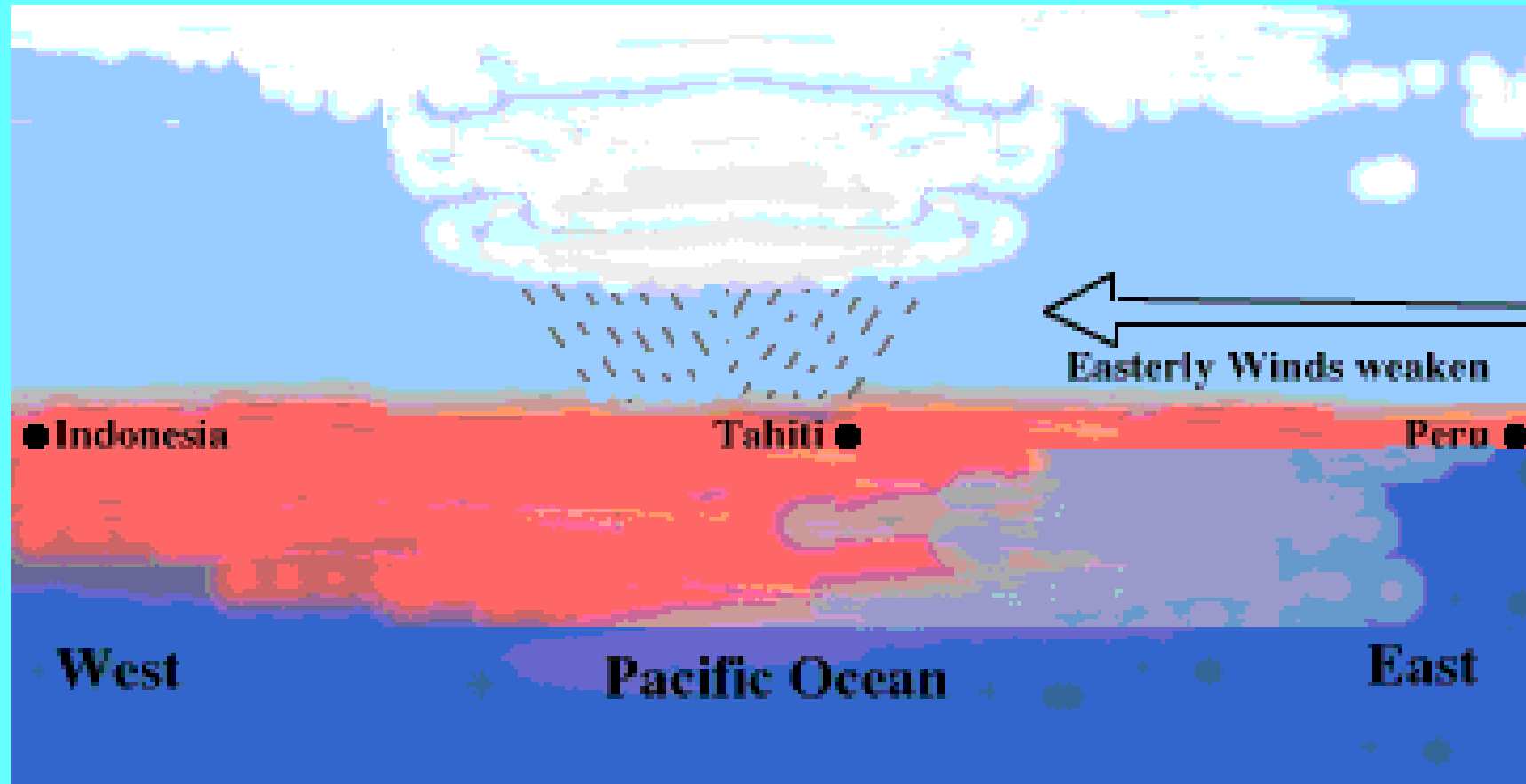
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El Niño



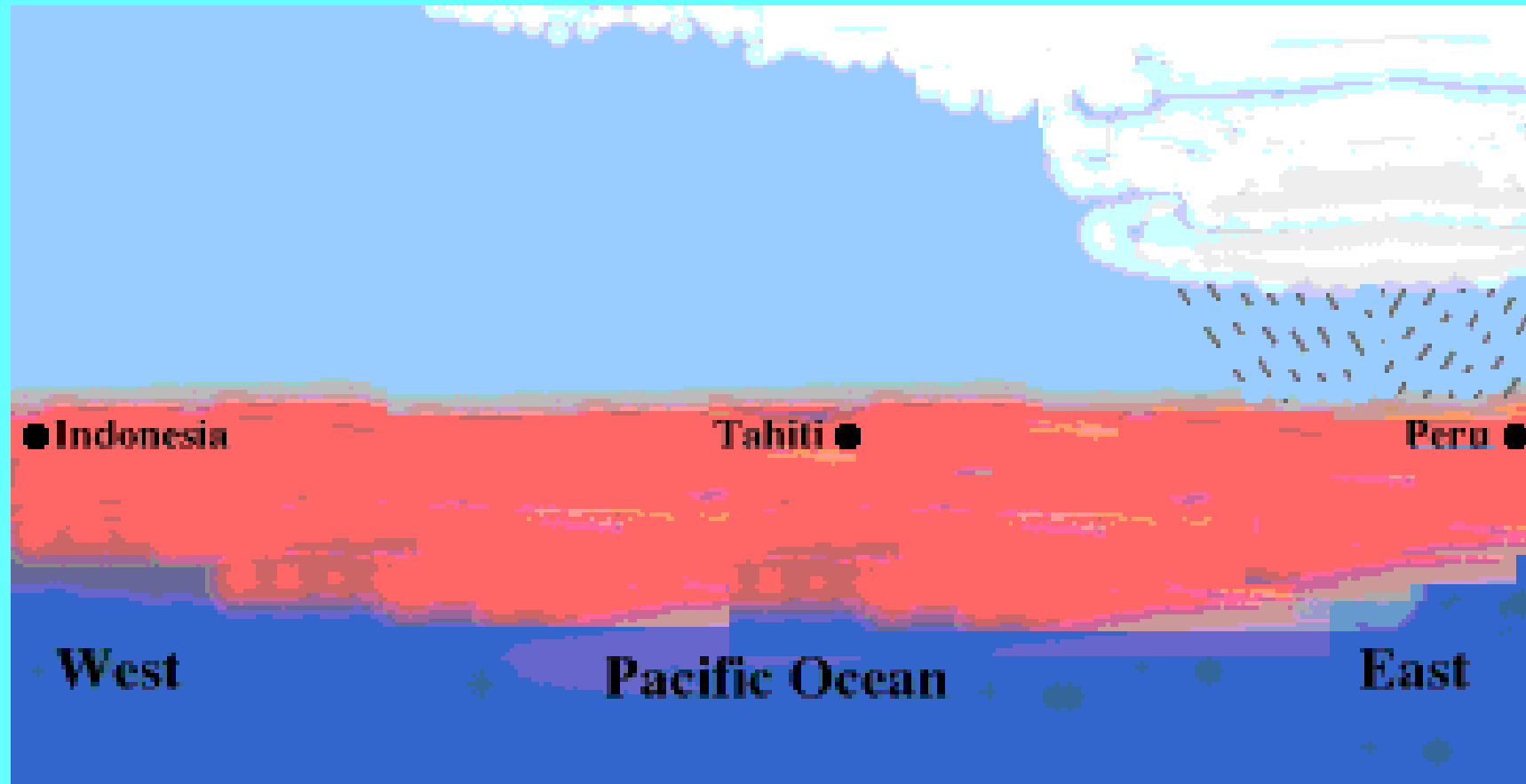
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El Niño



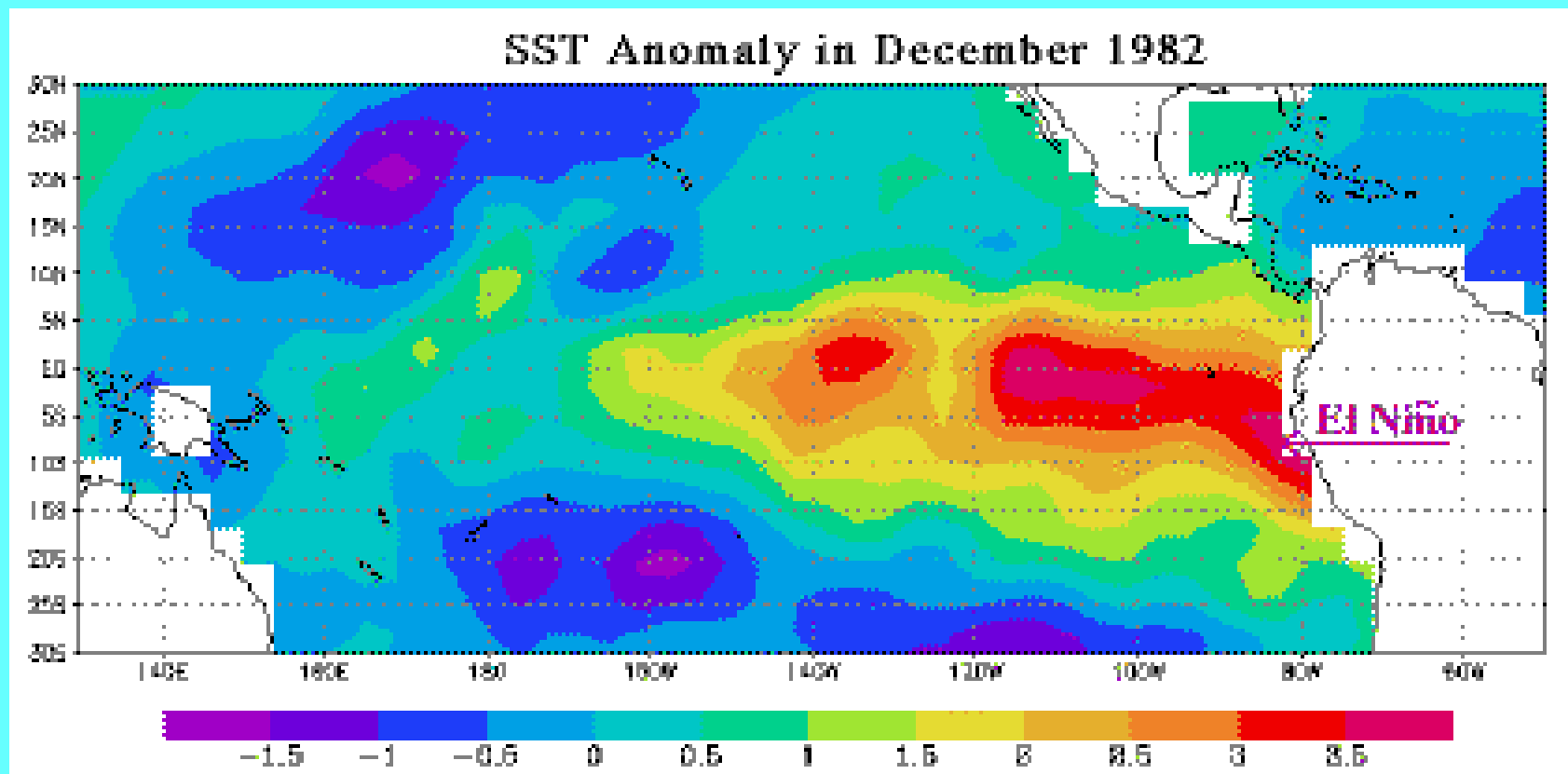
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El Niño

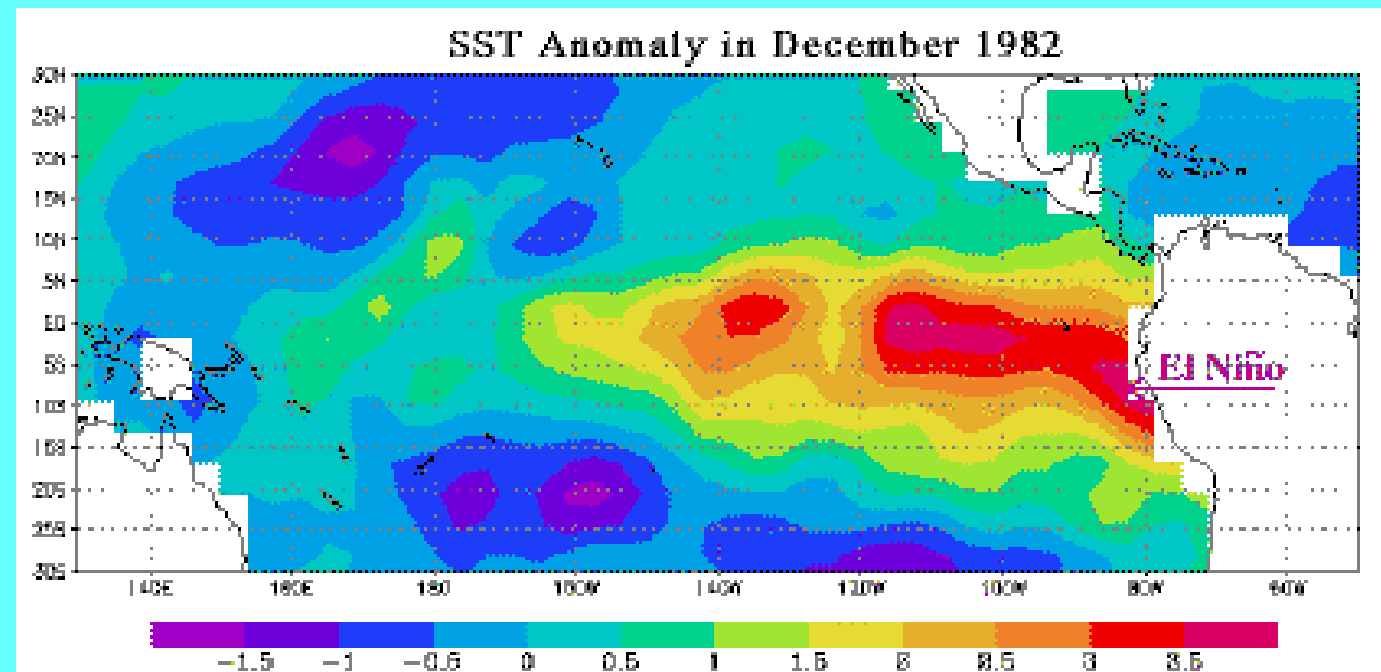
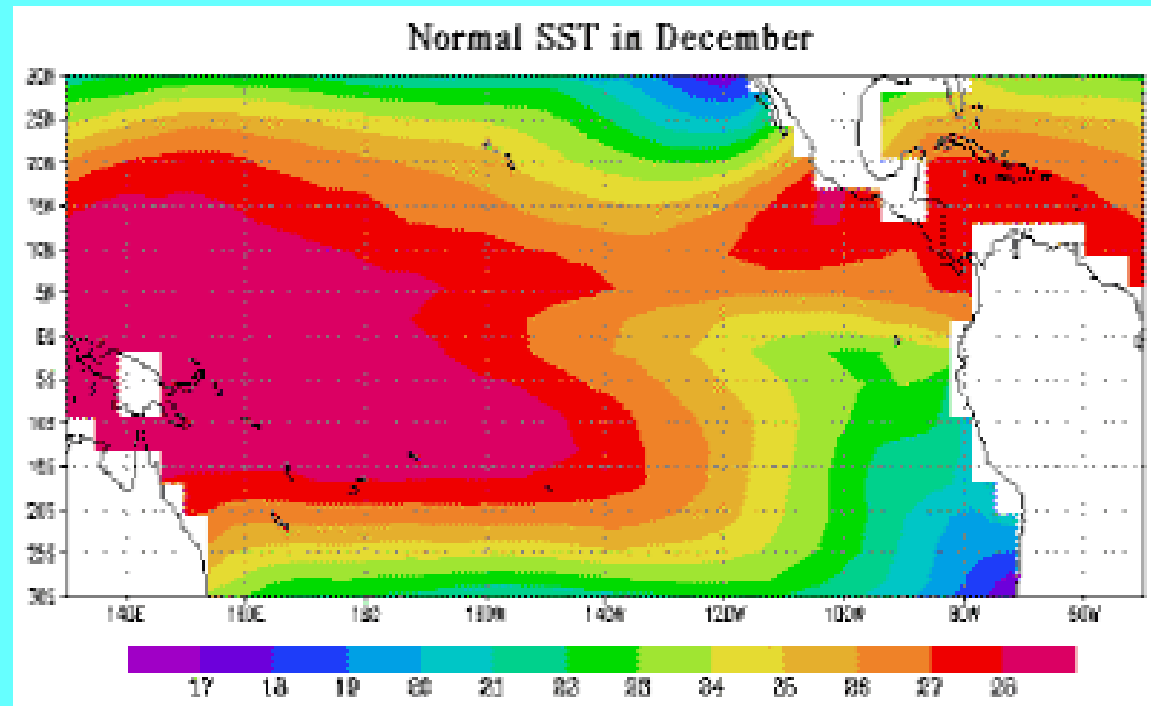


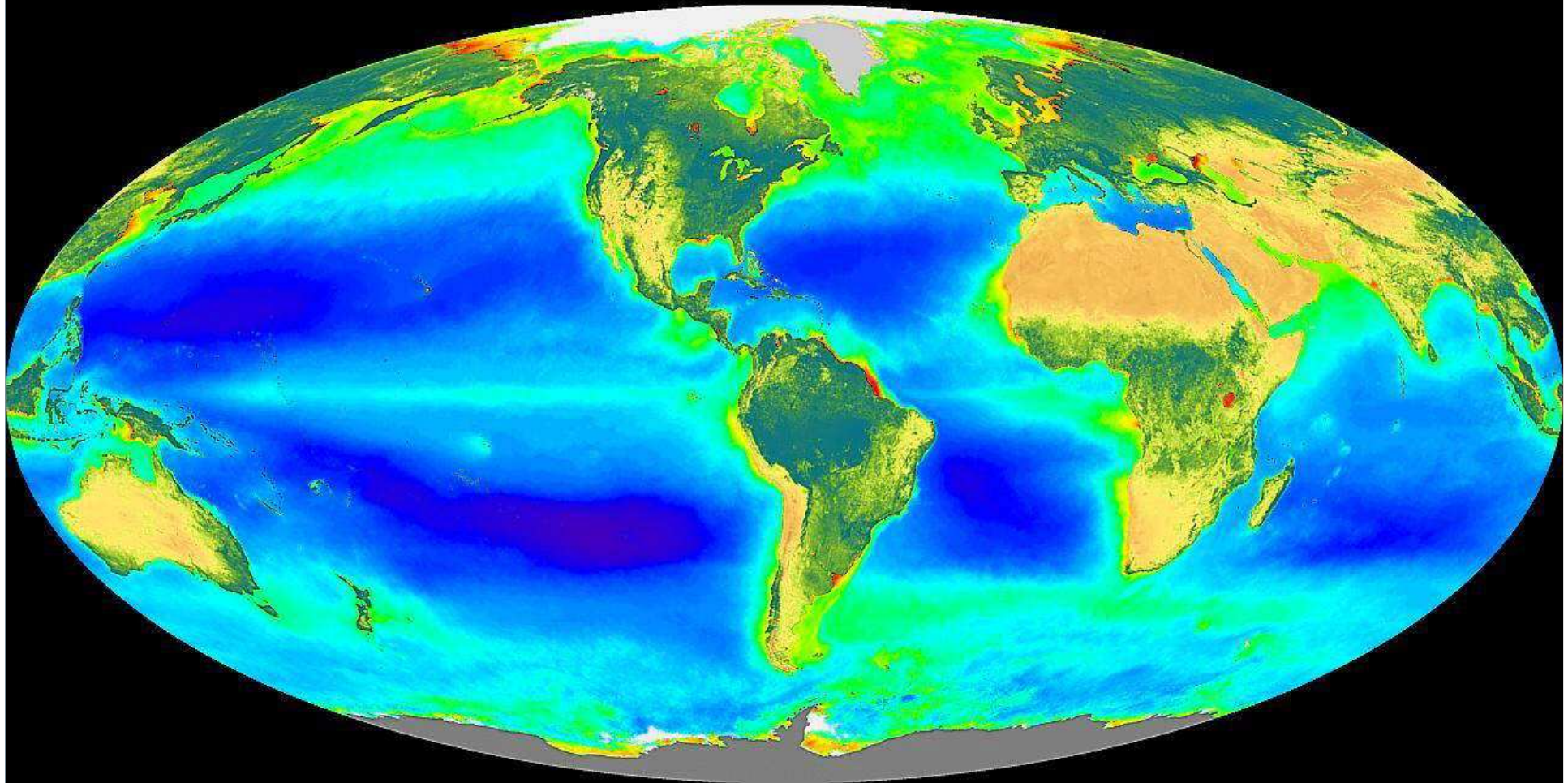
OCEANY

El Niño



El Niño





>01 .02 .03 .05 .1 .2 .3 .5 1 2 3 5 10 15 20 30 50
Ocean: Chlorophyll a Concentration (mg/m^3)

Maximum Minimum
Land: Normalized Difference Land Vegetation Index

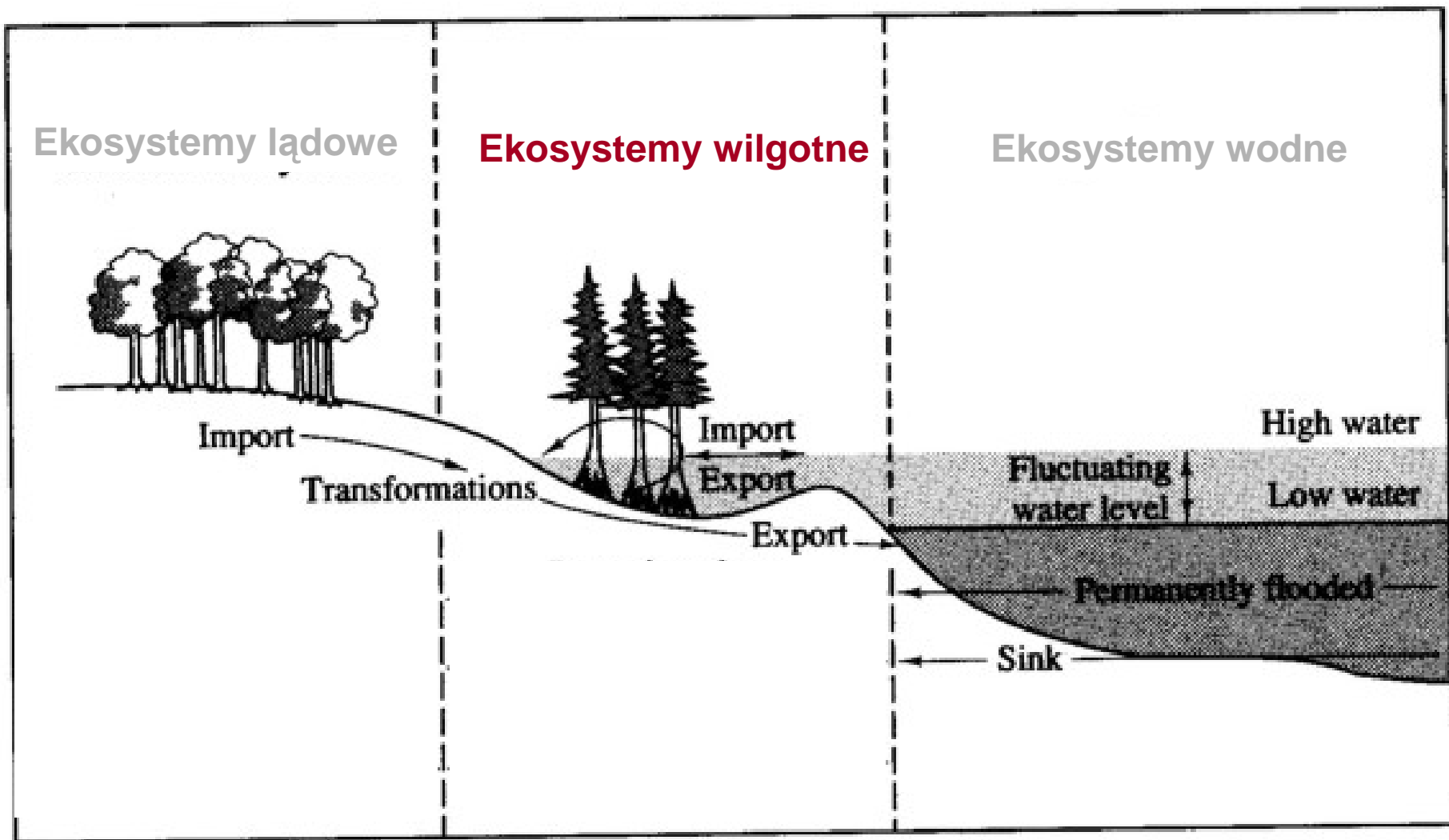
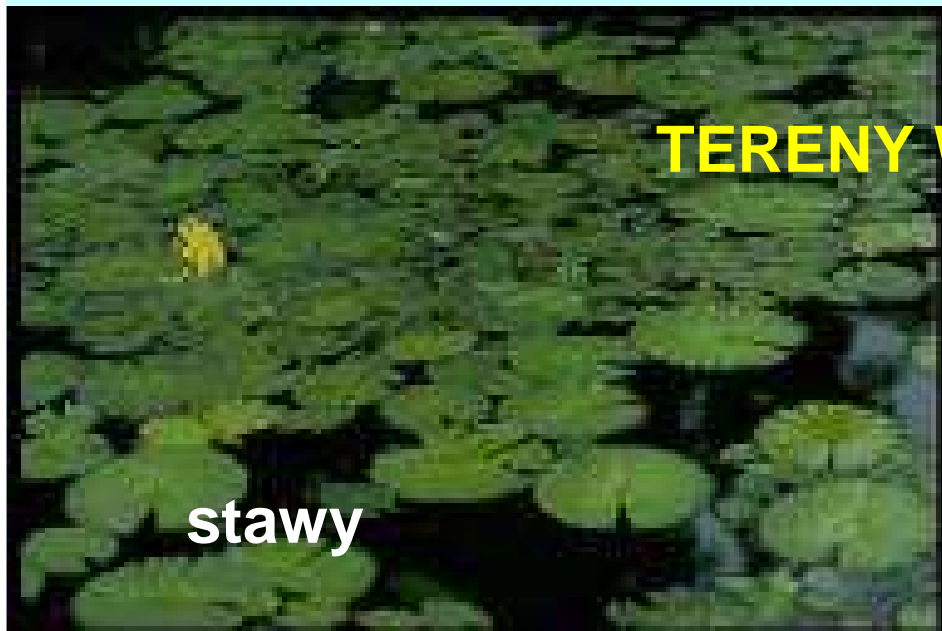


Figure 7.6 A schematic diagram showing the position of wetlands in relation to upland and aquatic ecosystems and the biogeochemical linkages between these landscape components. From Mitsch and Gosselink (1986).

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stawy



bagna

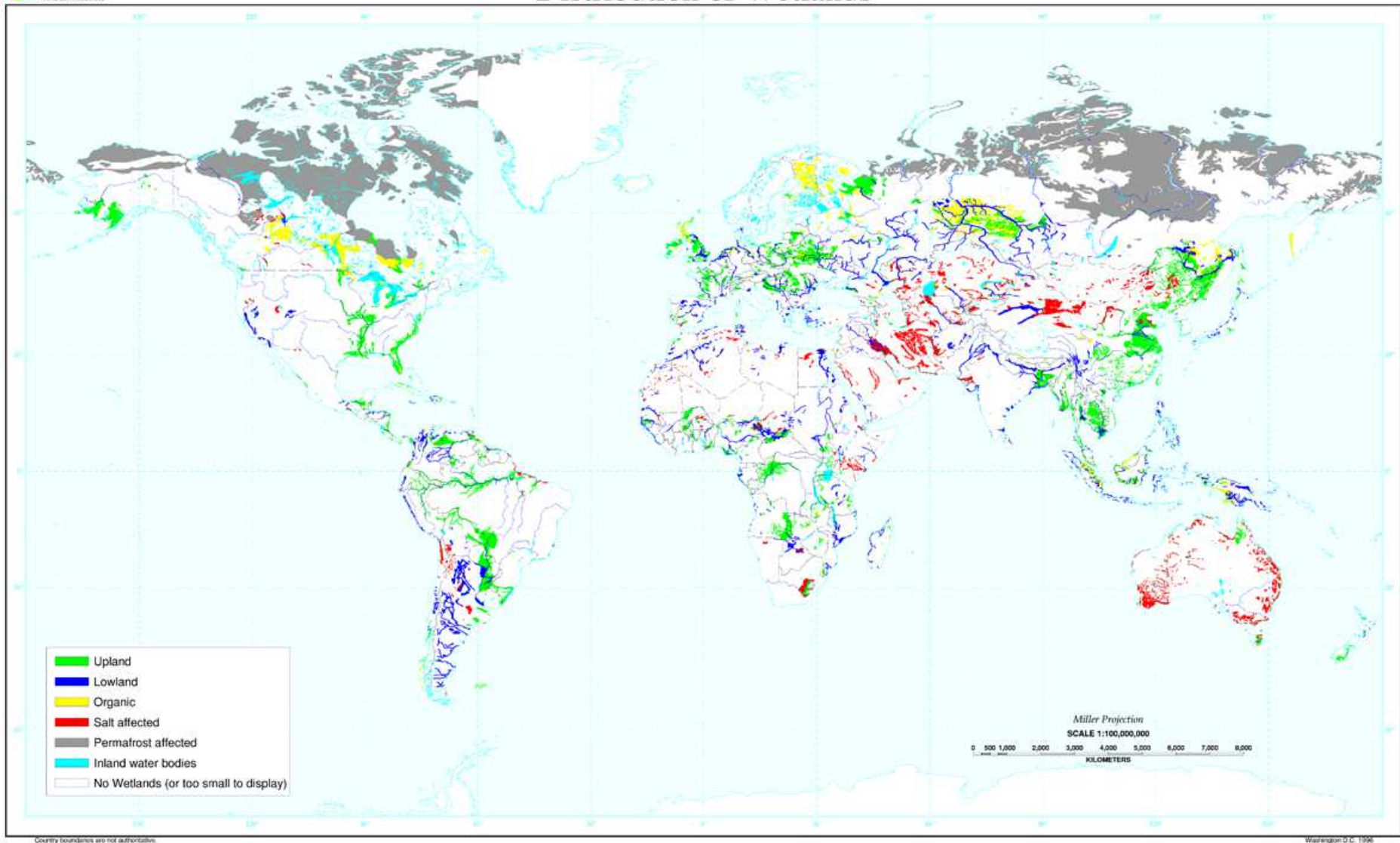


moczary



torfowiska

Distribution of Wetlands



TERENY WILGOTNE

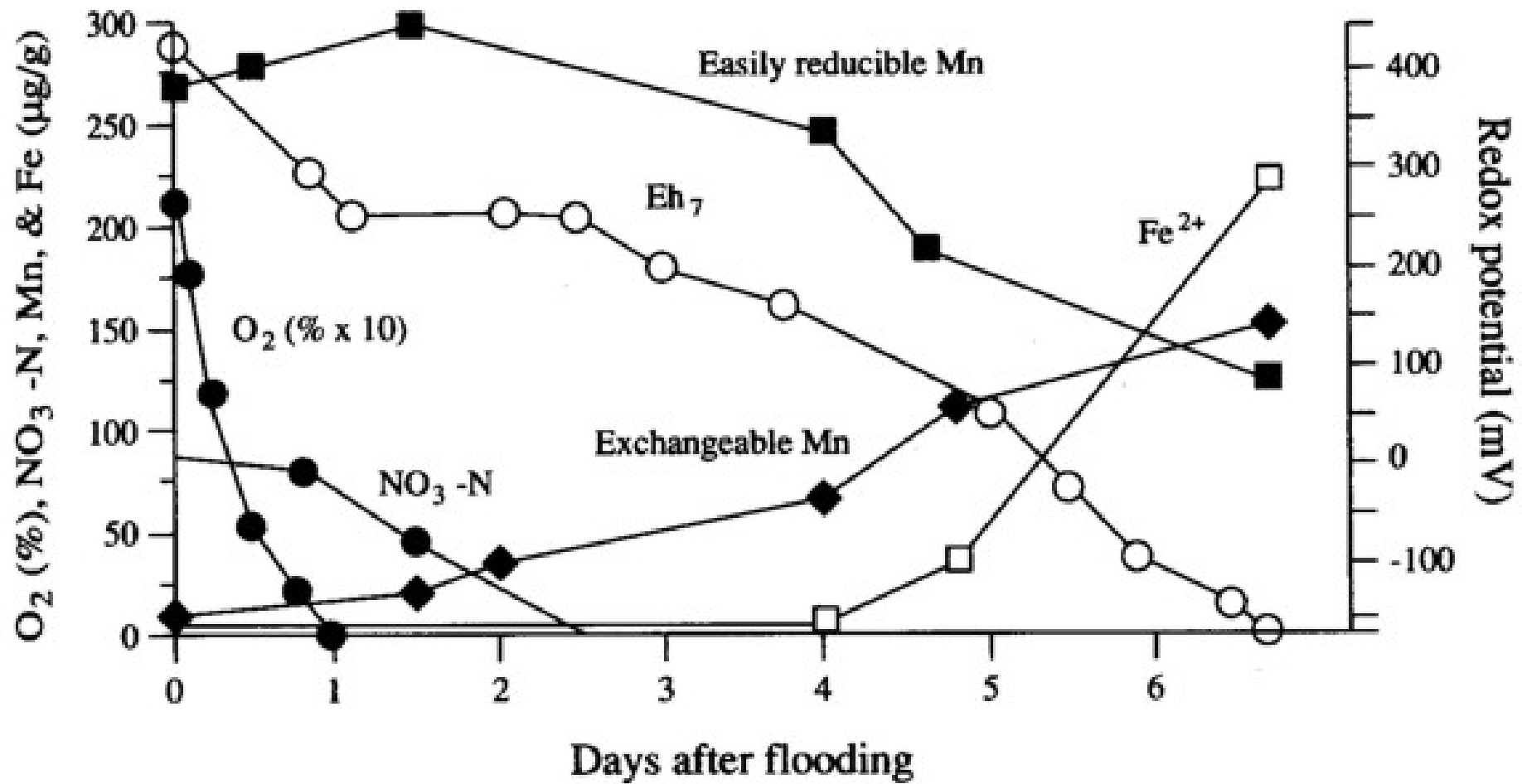


Figure 7.4 Changes in the chemical composition of the waters overlying a flooded soil as a function of time after flooding. Note that the reduction of iron does not begin until fully anaerobic conditions are achieved. Redox potential is expressed at pH 7, that is, E_{h7} . From Turner and Patrick (1968).

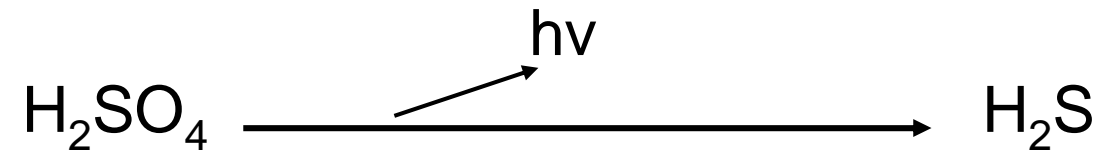
Table 7.1 Thermodynamic Sequence for Reduction of Inorganic Substances at pH 7.0^a

Reaction	E_h
Disappearance of O ₂ $O_2 + 4H^+ + 4e \rightleftharpoons 2H_2O$	0.816 V
Disappearance of NO ₃ ⁻ $NO_3^- + 2H^+ + 2e \rightleftharpoons NO_2^- + H_2O$	0.421 V
Formation of Mn ²⁺ $MnO_2 + 4H^+ + 2e^- \rightleftharpoons Mn^{2+} + 2H_2O$	0.396 V
Reduction of Fe ³⁺ to Fe ²⁺ $Fe(OH)_3 + 3H^+ + e^- \rightleftharpoons Fe^{2+} + 3H_2O$	-0.182 V
<u>Formation of H₂S</u> $SO_4^{2-} + 10H^+ + 8e^- \rightleftharpoons H_2S + 4H_2O$	<u>-0.215 V</u>

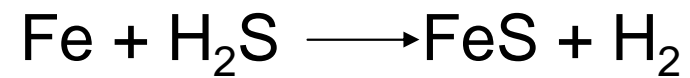
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SIARKA JAKO AKCEPTOR ELEKTRONÓW

Bakterie beztlenowe (*Desulfovibrio*, *Desulfomonas*)



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Tworzenie:

DMS $(\text{CH}_3)_2\text{S}$

DMDS $(\text{CH}_3)_2\text{S}_2$

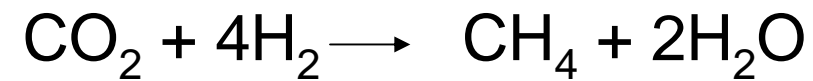
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Reduction of Fe ³⁺ to Fe ²⁺ $Fe(OH)_3 + 3H^+ + e^- \rightleftharpoons Fe^{2+} + 3H_2O$	-0.182 V
Formation of H ₂ S $SO_4^{2-} + 10H^+ + 8e^- \rightleftharpoons H_2S + 4H_2O$	-0.215 V
<u>Formation of CH₄</u> <u>$CO_2 + 8H^+ + 8e^- \rightleftharpoons CH_4 + 2H_2O$</u>	<u>-0.244 V</u>

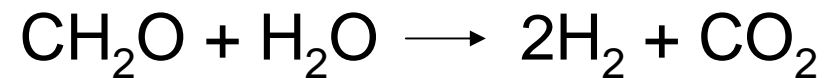
^a From Stevenson (1986).

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METANOGENEZA



wodór - produkt fermentacji:



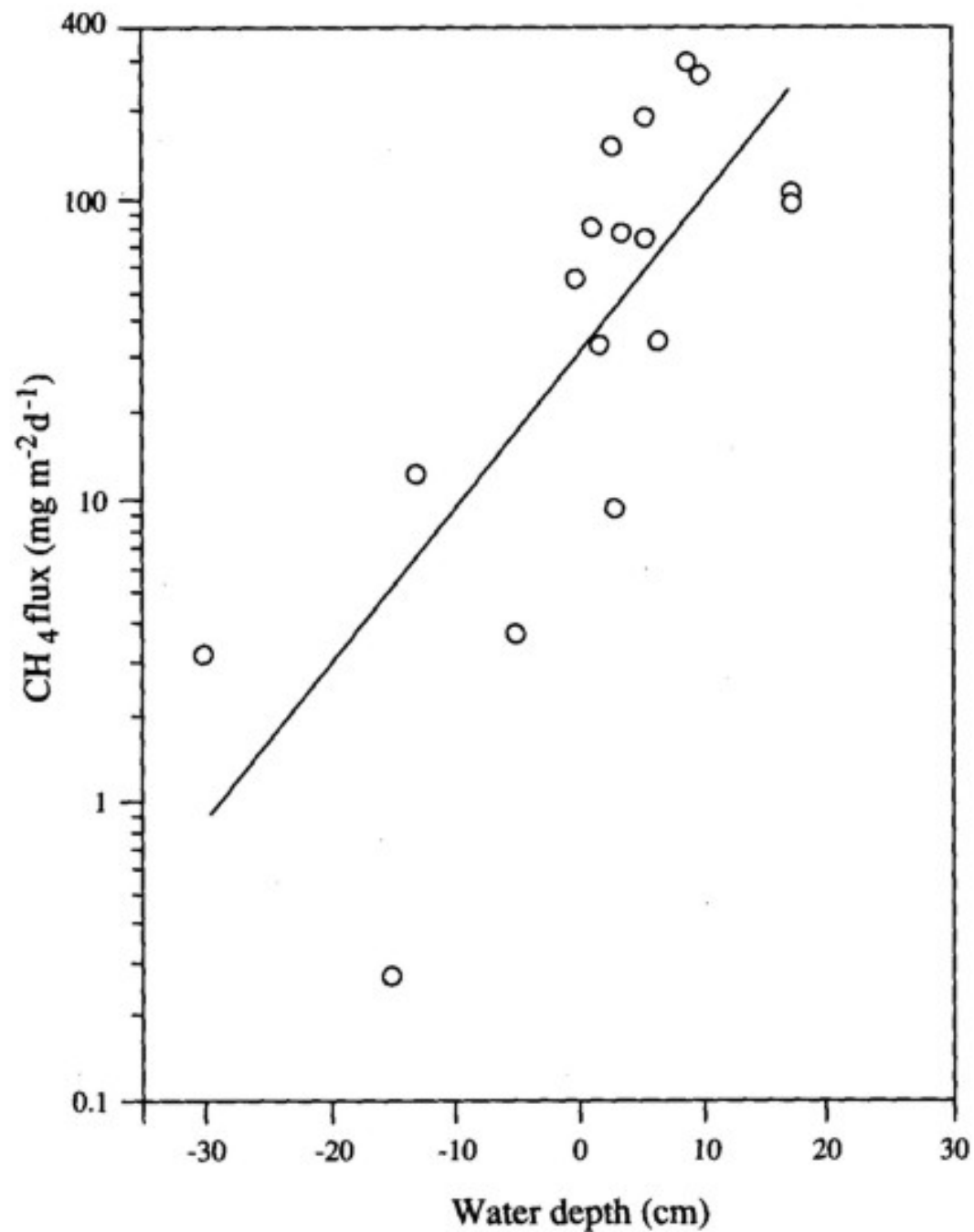


Figure 7.5 Surface methane flux versus water depth for bog, fen, and marsh sites in

TERENY WILGOTNE

Estuaria
ESTUARIA



TERENY WILGOTNE



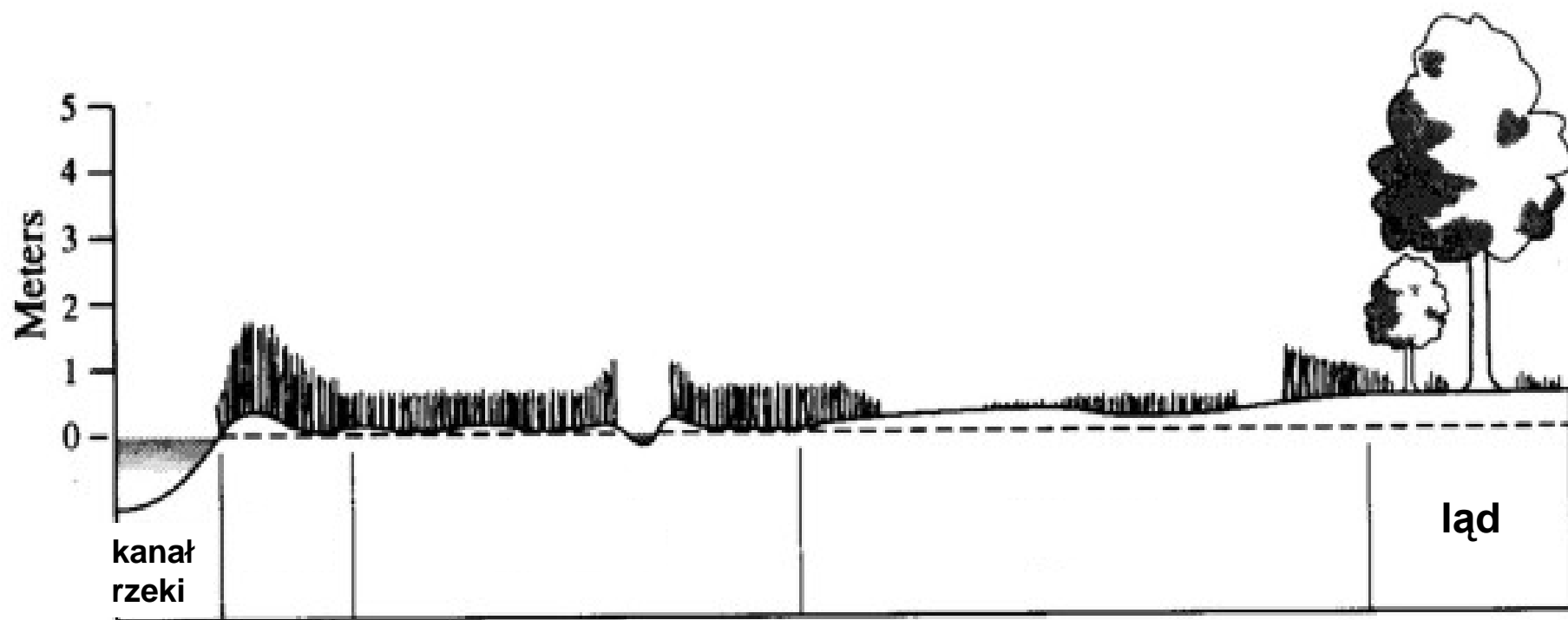


Figure 8.9 Schematic cross section through a salt marsh, showing the relationship between various components of the salt-marsh ecosystem and the open waters of the estuary. From Wiegert et al. (1981).

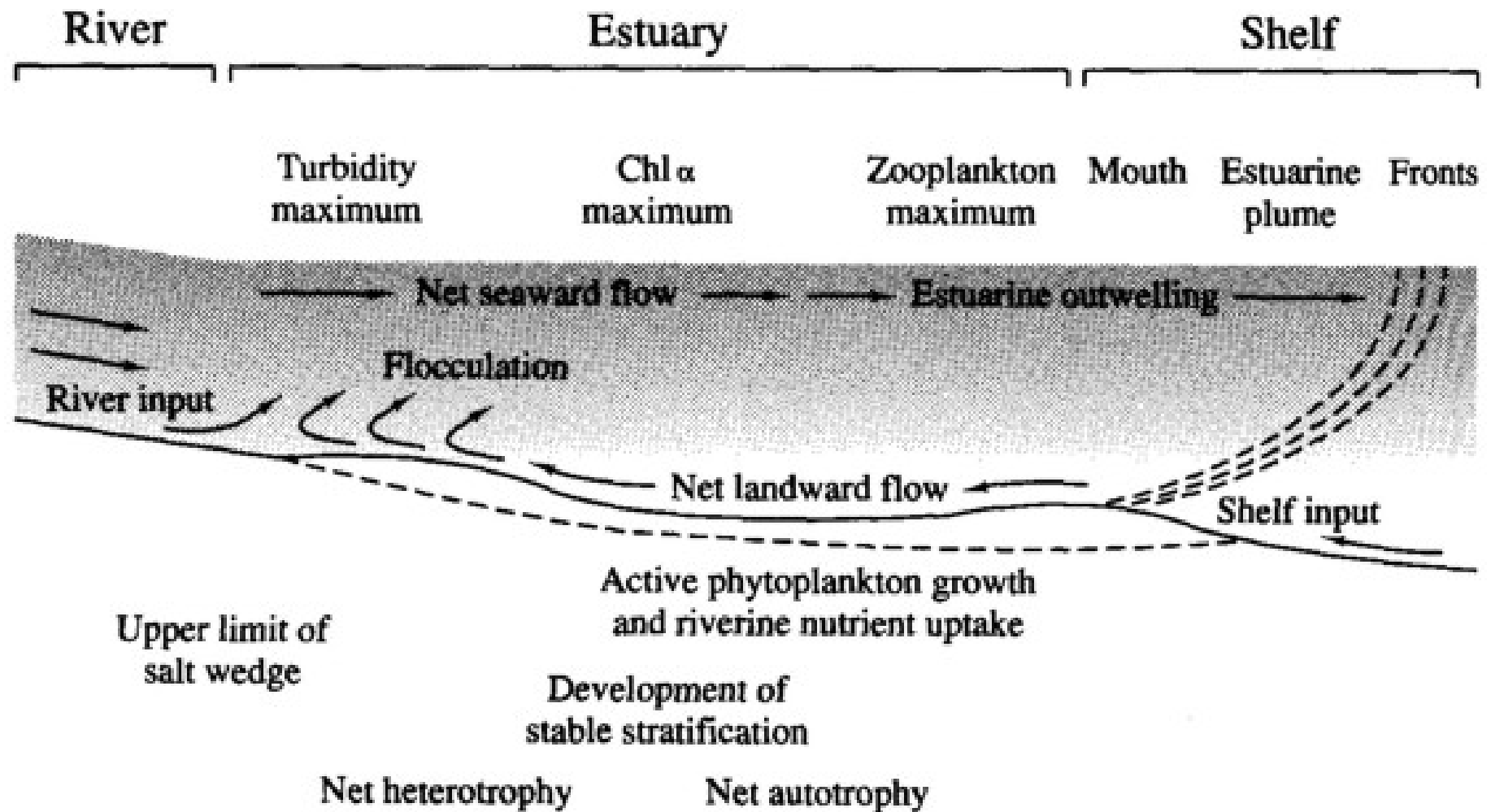


Figure 8.13 Conceptual model of the chemical and biological structure in estuaries. As the suspended load settles from the entering river waters and nutrients are made available, phytoplankton production increases, fueling an increase in zooplankton production and higher trophic levels. From Fisher et al. (1988).

Table 7.1 Thermodynamic Sequence for Reduction of Inorganic Substances at pH 7.0^a

Reaction	E_h
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Formation of H ₂ S $SO_4^{2-} + 10H^+ + 8e^- \rightleftharpoons H_2S + 4H_2O$	-0.215 V
Formation of CH ₄ $CO_2 + 8H^+ + 8e^- \rightleftharpoons CH_4 + 2H_2O$	-0.244 V

^a From Stevenson (1986).

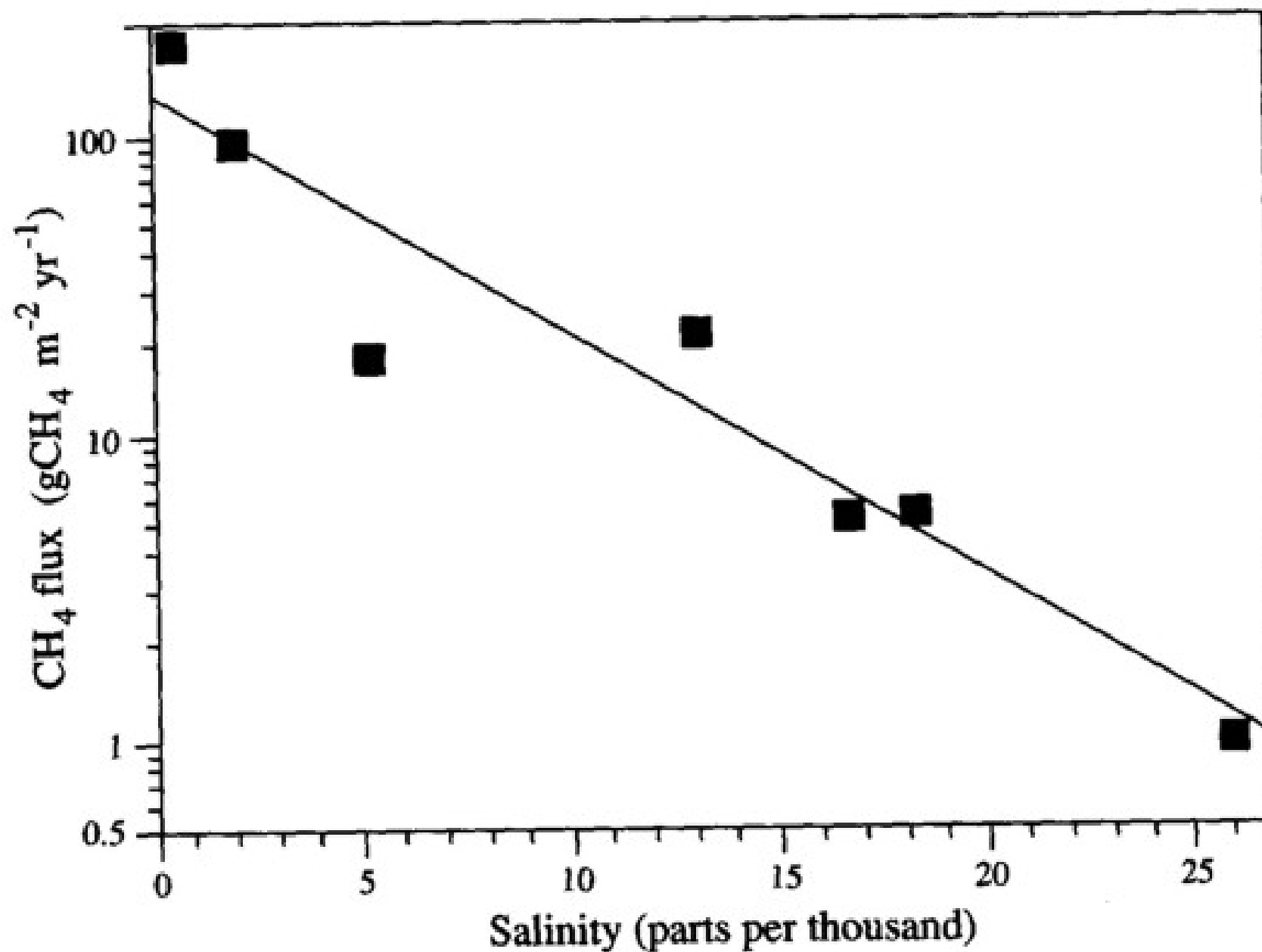


Figure 8.11 Annual methane lost from salt marsh soils as a function of salinity. From Bartlett et al. (1987).

Akumulacja materii organicznej w glebach i ściółki
w różnych biomach (Schlesinger, 1991)

Biom	materia organiczna w glebach (kg C/m ²)	depozyty ściółki (mt C *10 ⁹)
Tundra	21,6	4,0
Tajga	14,9	24,0
Las strefy umiarkowanej	11,8	14,5
Step	19,2	1,8
Pustynia	5,6	0,2
Sawanna	3,7	1,5
Puszcza tropikalna	10,4	3,6
Tereny wilgotne	68,6	2,5