TOWARD THE FUTURE

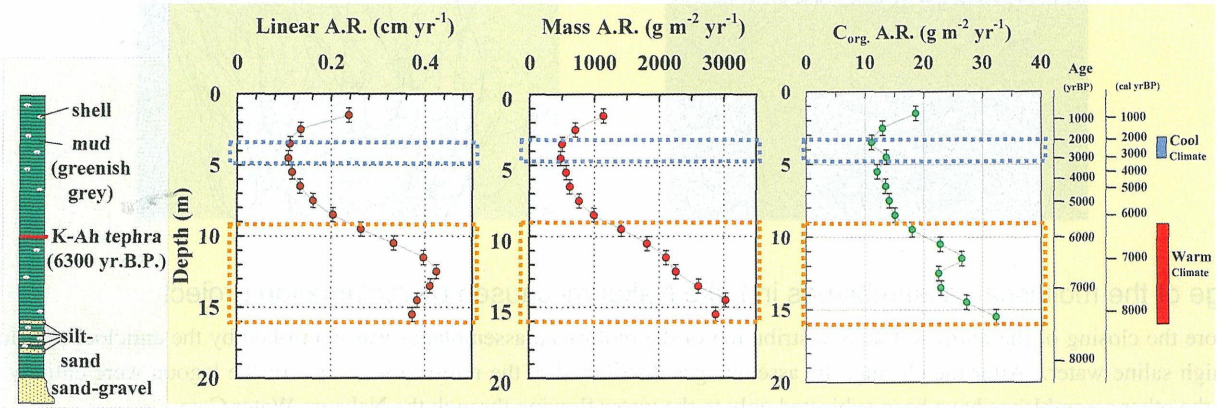
Sea-level rise due to global warming has great impact on coastal zones, especially on coastal lagoon areas. Inundation and displacement of lowlands and wetlands, increase in salinity of coastal lagoons, salt water intrusion into freshwater aquifers, etc. are predicted. Geochemical study on sediment core and observation system of halocline behaviour at Lake Nakaumi are introduced.

Depositional environment during the Holocene climatic optimum and projections of the environment in future global warming

Based on analyses of a sediment core NU9007 (central portion of Lake Nakaumi) for organic carbon accumulation rate (C_{org}.A.R.), organic nitrogen accumulation rate, sedimentation rate (S.R.), total mass accumulation rate (mass A.R.), ^{14}C dating, C_{org}. ·S contents and stable carbon·oxygen isotopes ratio, the following characteristics of the depositional environment during the Holocene climatic optimum have been established. The results will offer basic informations for projections of lagoonal environments in future global warming.

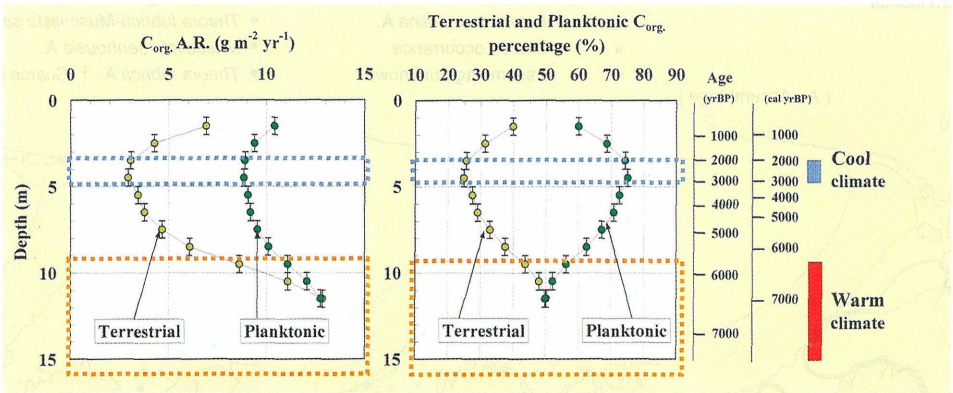
(1) Precipitation

Considering S.R. (Linear A.R.) and mass A.R. changes, precipitation appears to have increased during the Holocene climatic optimum in Lake Nakaumi. The S.R. was significantly higher (range 0.20 - 0.42 cm yr^{-1}) in the 7,500 - 5,500 yr B.P interval (warm climate) than in the 2,000 - 3,000 yr BP (cool climate; 0.11 cm yr^{-1}). Mass A.R. was also high during 7,200 - 6,000 yr B.P. at about 1,000-3,000 g m^{-2} yr^{-1}, and decreased to about 500 g m^{-2} yr^{-1} at 3,000-2,000 yr BP. These characteristics are representative of Nakaumi-Shinji lagoonal area. Precipitation in the lagoonal area possibly increase in future global warming.



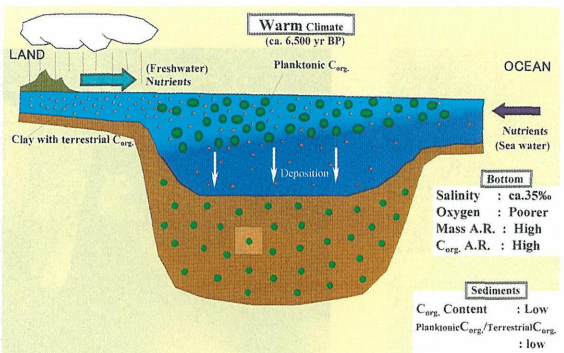
(2) Primary production

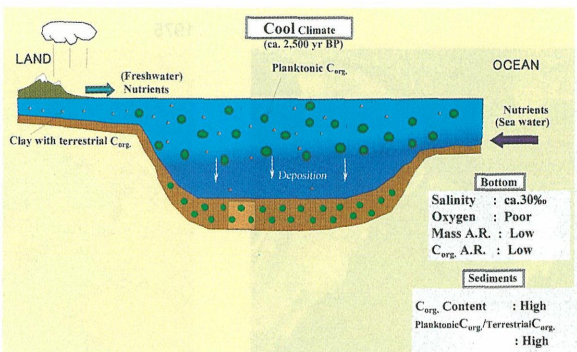
From the results of the relationships between C_{org}.A.R. and mass A.R., and between C_{org}. contents and mass A.R., the terrestrial C_{org}. content of clayish sediment is approximately constant at 0.61 %, and the relationship between planktonic C_{org}.A.R. and mass A.R. is expressed by the equation: planktonic C_{org}.A.R. (g m^{-2} yr^{-1}) = 0.0024 mass A.R. + 7.70. According to this relationship, the planktonic C_{org}.A.R. was relatively high (about 11 - 13 g m^{-2} yr^{-1}) in the warm climate of 7,200 - 5,500 yr BP, and decreased to about 9 g m^{-2} yr^{-1} in the cool climate of 3,000-2,000 yr BP. Primary production was thus at most 1.4 times higher in the warm climate during the Holocene than in the cool climate. During the warm climate interval, the river runoff would increase due to large precipitation and carry abundant nutrient salts (mainly nitrogen and phosphorous) for high primary production.



(3) Schematics of the depositional environment in Lake Nakaumi

During warm climate, river runoff increase and carry abundant terrestrial C_{org}. with fine clastics and nutrient salts. Planktonic C_{org}. contents of the sediments are diluted by the clastics to low levels, although primary productivity is high. The proportion of terrestrial C_{org}. to planktonic C_{org}. in sediments is high. Lake bottom is poorer in oxygen by high primary production.

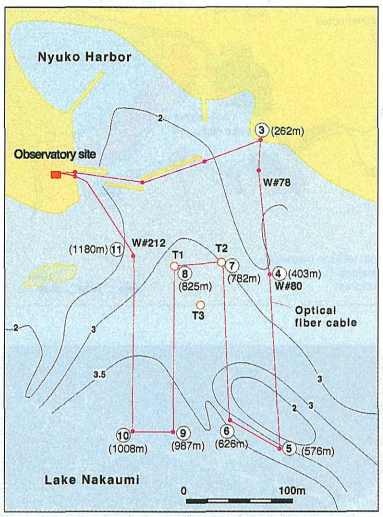


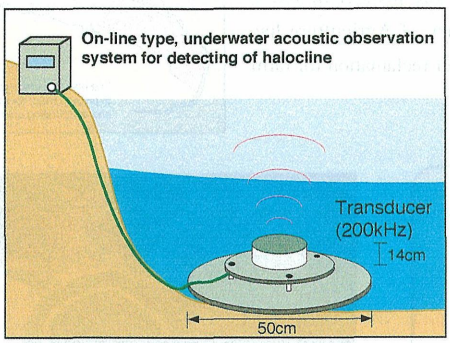


Development of a long-term observation system for the study of Halocline behaviour in brackish lakes and estuaries

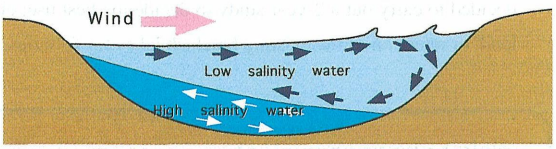
Brackish lakes are characterized by the existence of halocline. If heavy more saline water lie constantly in lower part in lakes in summer season, it become oxygen-free to dissolve P from bottom sediment, causing water pollution. It is important to know the behaviour of halocline.

The system consists of an acoustic observation system and a lake bottom thermometry system using an optical fiber distributed sensor. The acoustic observation system measures acoustic reflection caused by the rapid change of acoustic impedance at the boundary of the halocline in water. The lake bottom thermometry system detects movement of the lower part of the lake water by means of temperature change. Long-term observations using this system were successfully carried out in Lake Nakaumi.

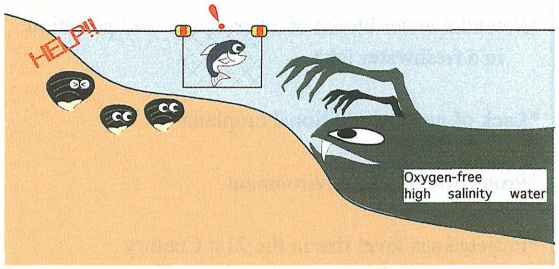




Halocline behaviour by wind

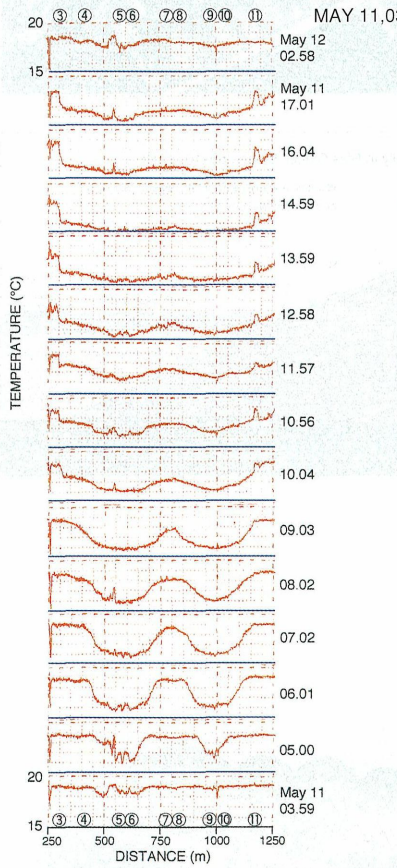


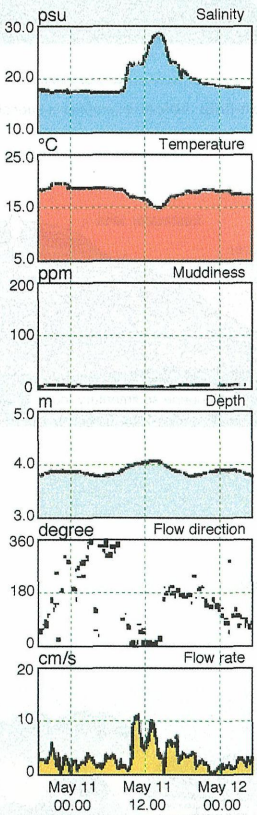
Invasion of stagnated oxygen-free high saline water to shelf area to damage fish-farm



The observation at the margin of Lake Nakaumi (Nyuko harbor, Daikon-jima Island)

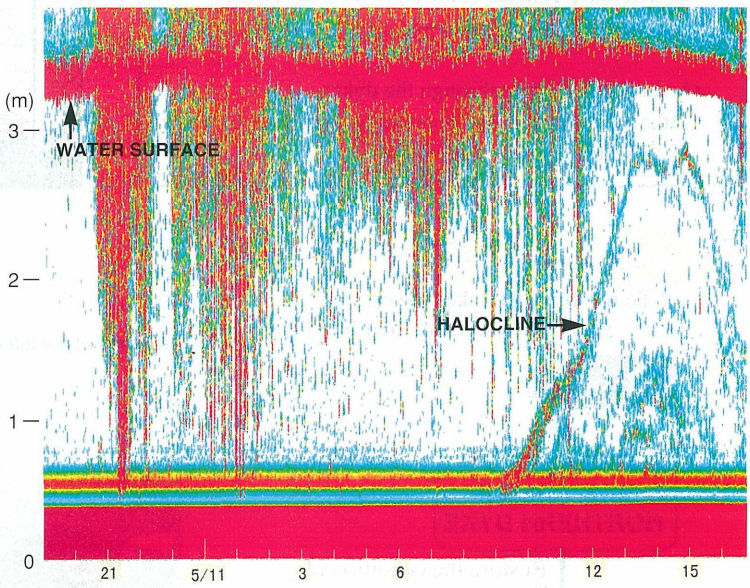
DISTRIBUTED TEMPERATURE ON LAKE BOTTOM
MAY 11,03-MAY 12,02.58





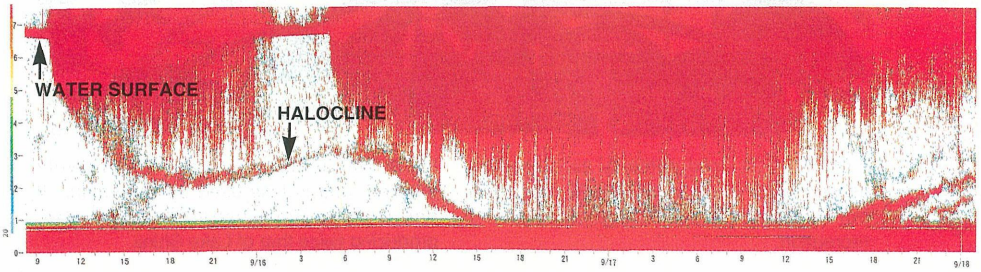
The time series data of the lake bottom water at T-3

The time series acoustic profile at T-3, May 10-11, 1995, showing the invasion of high salinity water after strong wind(＞12cm/s)



The observation at the center of Lake Nakaumi, September 15-17, 1995

The time series acoustic profile at the center of Lake Nakaumi, Sept.15-17, 1995. Strong windy days were caused by Typhoon No.12. The halocline was moved by strong wind (max.15.7cm/s) , approaching to the lake bottom.



Weather chart at the time of Typhoon No.12 (21:00, sept. 16,1995)