1. *Global Correlation on the Palaeoclimatic Change between Lake Biwa Sedimentary Evidence and other Marine and Terrestrial Records*[*)]

By Norio FUJI
Department of Earth Sciences, Faculty of Education,
Kanazawa University

(Communicated by Teiichi KOBAYASHI, M. J. A., Jan. 13, 1986)

In the stratigraphic subdivision through the geologic column, three principal categories have been recognized by the International Subcommission on Stratigraphic Classification. They are lithostratigraphy, biostratigraphy, and chronostratigraphy. However, as the Quaternary period possesses special and unique features, two further categories such as morphostratigraphy and climatostratigraphy have been employed.

In deep-seas throughout the globe, long sequences of relatively undisturbed sediments are preserved that frequently extend back to Plio-Pleistocene boundary. Within these sediments, the microfauna contains a record of changing oxygen isotope ratios that not only provide evidence for the past glacial and interglacial oscillations but also from the basis for stratigraphic subdivision and long distance correlation. Sediments from deep-seas hold a number of advantages over terrestrial sequences from the point of view of stratigraphic subdivision and correlation throughout the world. These advantages are: (1) More commonly continuous and relatively undisturbed, (2) use of a common technique such as oxygen isotope analysis, (3) dating and correlation by the independent method of palaeomagnetic stratigraphy.

However, if terrestrial sequences provide the following certain characteristic feature, correlation between the marine and terrestrial successions can be established: (1) Getting of a lengthy stratigraphic record, (2) clear and unequivocal evidence of climatic change, (3) continuous record, and (4) dating and correlation by the independent method of Palaeomagnetic stratigraphy and/or radioactivity etc.

The most impressive and important example of lake sediment sequences as one of standards for the world-wide correlation of terrestrial record is the record from Lake Biwa, Japan. Lacustrine sediments obtained from Lake Biwa accepts the above-mentioned four indispensable conditions. In addition, although sediments of both cold and warm ages are complete within sediments from the deep-seas, we cannot evaluate changes in climate over short ages because of the extremely small rate of sedimentation in the deep-seas (Fuji, 1983, 1984; Horie, 1984).

In this article, the writer shows a tentative palaeoclimatic curve based upon pollen analyses from samples of the 200-meter and the upper part of a 1,400-meter cores obtained from Lake Biwa, and also compares tentatively the palaeoclimatic change from Lake Biwa with the oxygen isotope stratigraphy from the

*) Contribution from the Department of Earth Sciences, Kanazawa University, no. 121.

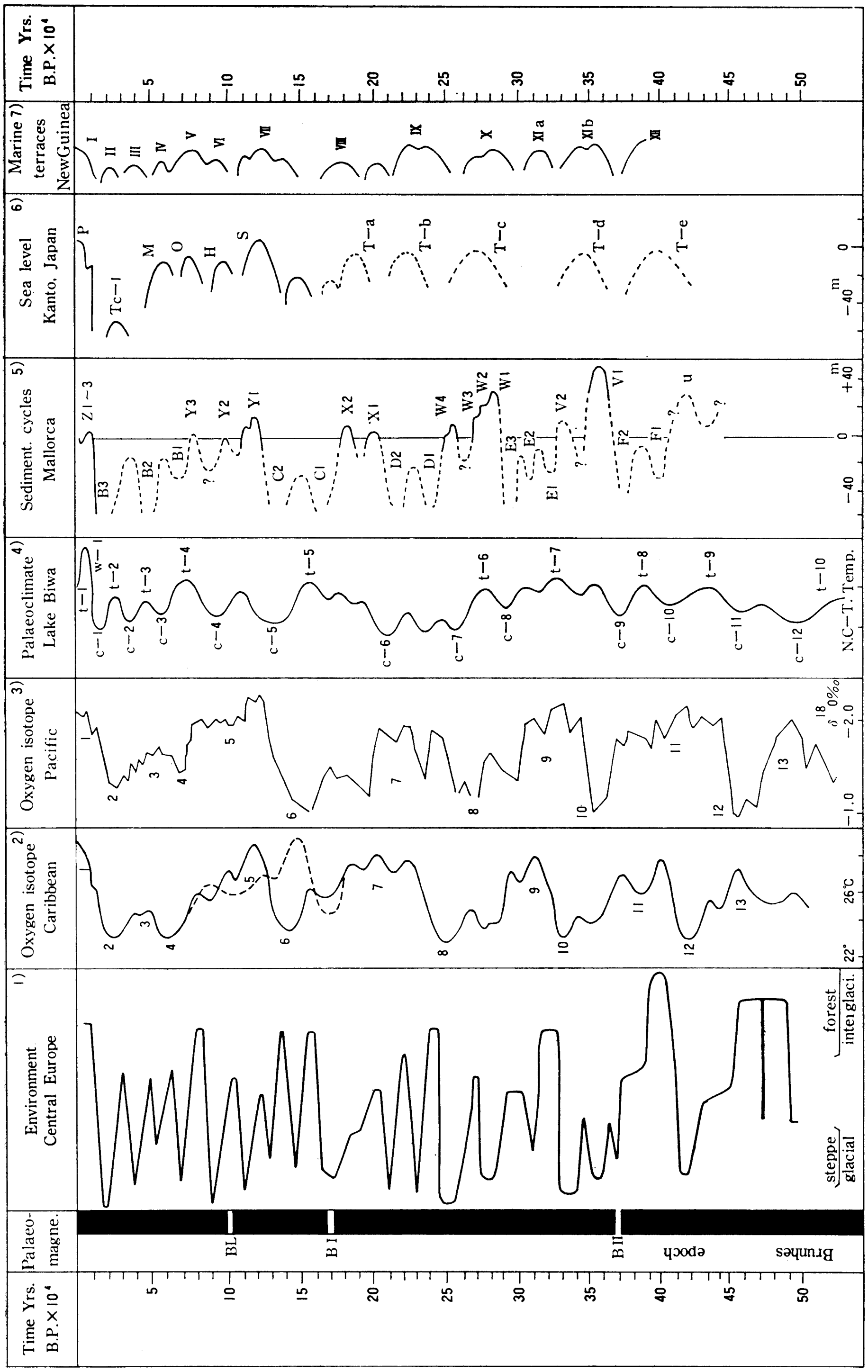
Time Yrs. B.P.×10⁴
Marine terraces NewGuinea 7)
Sea level Kanto, Japan 6)
Sediment. cycles Mallorca 5)
Palaeoclimate Lake Biwa 4)
Oxygen isotope Pacific 3)
Oxygen isotope Caribbean 2)
Environment Central Europe 1)
Palaeo-magne.
BL
B I
B II
Brunhes epoch
steppe glacial
forest interglaci.
N.C.–T. Temp.
26℃
22°
5
10
15
20
25
30
35
40
45
50

Fig. 1

Caribbean Sea and Equatorial Pacific, environmental change in Central Europe reconstructed from loess, palaeosol and gastropod faunal records, and with sedimentary cycles and relative sea-level changes from Mediterranean, Central Japan, New Guinea, etc. throughout the globe.

Firstly, concerning the oxygen isotopic records from the deep-seas, the writer compared their tentative palaeoclimatic curve with Emiliani's isotope temperature record from the Caribbean Sea (Emiliani *et al.*, 1974), and found a rather significant correlation between them (Fuji, 1983). The fact suggests that the palaeoclimatic change around Lake Biwa was primarily controlled by the global glacial-interglacial cycles.

Within V28-238 and V28-239 Cores from the Western Pacific (Shackleton *et al.*, 1973, 1976), twenty-three isotopic stages and more stages were recognized. A comparison between Fuji's curve from Lake Biwa and the record from V23-238 Core is shown in Fig. 1. In correlation between them during the last about 500,000 years the comparison between Fuji's and Emiliani's curves coincides with one between Fuji's and Shackleton's curves.

Secondly, on the comparison between the sedimentary cycles, relative sea level change and palaeoclimate from Lake, there should be some broad correlation between dated sea level changes in regions not affected by glacio-isostasy and the glacial/interglacial cycles recorded in the deep-sea cores, but there are a few problems to be solved in combining the sea level change with the climatic change: (a) Eustatic changes of sea level are affected by both the change of the volume of ocean water and the global tectogenesis, and (b) the correlation between the quantity of ice sheets and the global climate has not been well established. And, there should be some correspondence between ages of lowered sea level and cold climatic condition. The Quaternary sedimentary records from Mallorca in the Western Mediterranean (Butzer, 1975) is a typical example for comparison between terrestrial and deep-sea records. As shown in Fig. 1, the curve from Lake Biwa shows a significant correlation with the sedimentary cycles from Mallorca.

The above-mentioned fact suggests that the high sea level corresponds to the temperate period of Lake Biwa, and that the low sea level to the cold one. The relationship as recognized between the records from Lake Biwa and Mallorca can be pointed out by comparing the palaeoclimate curve from the lake with the sea level curves from Southern Kanto in Central Japan (Machida, 1975) and New Guinea (Chappell, 1974) as shown in Fig. 1. These data may give important clue in order to understand the nature of glacial eustasy.

Fig. 1. Tentative comparison of the palaeoclimate from Lake Biwa, oxygen isotope records from deep-seas, sedimentary cycles from Mallorca, sea level changes from Japan and New Guinea, and Loess cycles from Central Europe. 1: Environmental change in the Central Europe (Kukla, 1970 and 1975). 2: Isotope curve from the Caribbean Sea (Emiliani *et al.*, 1974). 3: Isotope curve from Equatorial Pacific (Shackleton *et al.*, 1973). 4: Palaeoclimatic change curve from Lake Biwa (Fuji, 1983). 5: Sedimentary cycles from Mallorca, Western Mediterranean (Butzer, 1975). Time before 30,000 years ago was estimated on the basis of Butzer's data (1975). 6: Sea level changes from South Kanto, Japan (Machida, 1975). 7: Marine terraces in New Guinea (Chappell, 1974). Time was estimated on the basis of Chappell's data (1974). In palaeomagnetic data: BL, Blake event; B I, Biwa I event; B II, Biwa II event.

Thirdly, with regard to aeolian deposits, within lengthy aeolian depositional sequences from Central Europe, one of standards for correlation in the Quaternary was provided. Many soil layers are intercalated in the loess sequences, and the complete succession appears to contain a record of glacial and interglacial conditions (Kukla, 1970, 1975). In this succession, the loess layers are interpreted as representing glacial condition, and the interbedded palaeosols are considered to be indicative of interglacial condition. By a comparison between the palaeoclimate from Lake Biwa and the Central European aeolian depositional sequences, warm and cold climates correspond well each other as shown in Fig. 1.

As described above, the writer can find a remarkably noticeable similarity between major trends of the records from Lake Biwa, other terrestrial sediments and the deep-seas. However, a more reliable conclusion will be arrived at when more absolute dates and palynological results are obtained for the 200-meter and 1,400-meter cores from Lake Biwa.

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