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1983-1987 (Ⅱ)

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## Researches in the Far East on the Study of the Holocene during the Inter-Congress Time, 1983-1987 (II)\*

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### IV : Submerged forest on the continental shelf, Toyama Bay

About 100 stumps in a standing position have been discovered in 20 to 40m of water in Toyama Bay, Central Japan. Radiocarbon dated samples of these stumps yielded ages of  $8,480 \pm 150$  and  $10,150 \pm 230$  years B. P., indicating that the stumps are remnants of the forest

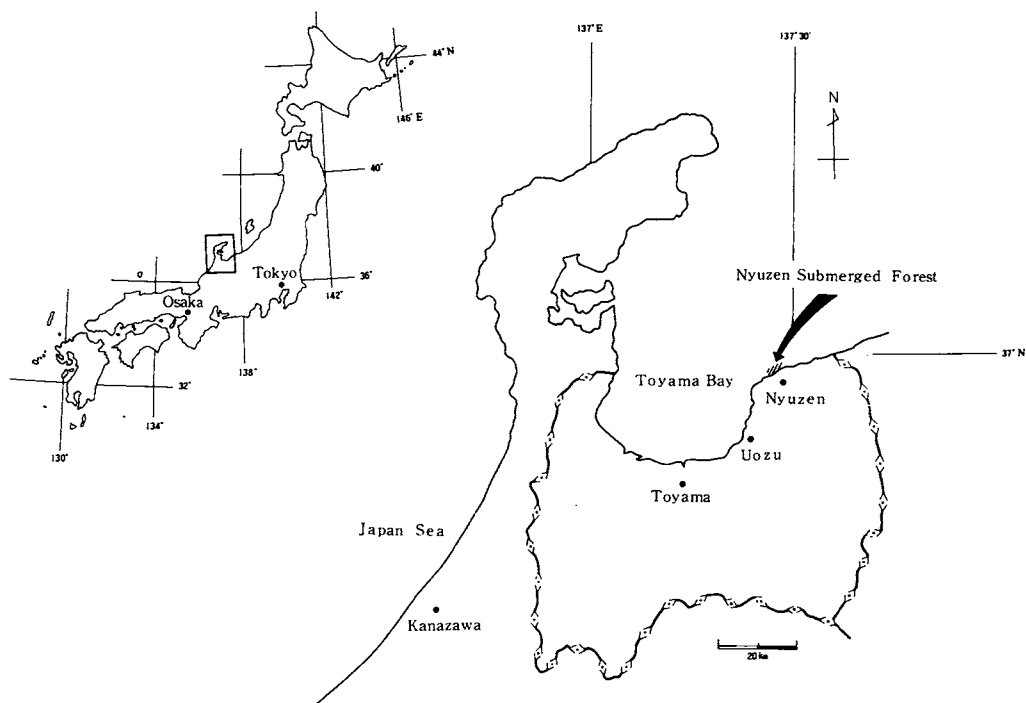


Fig. 4. Index map showing the locality of the Nyuzen submerged forest, Central Japan.

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Fig. 5. Submarine topography in the Nyuzen submerged forest.

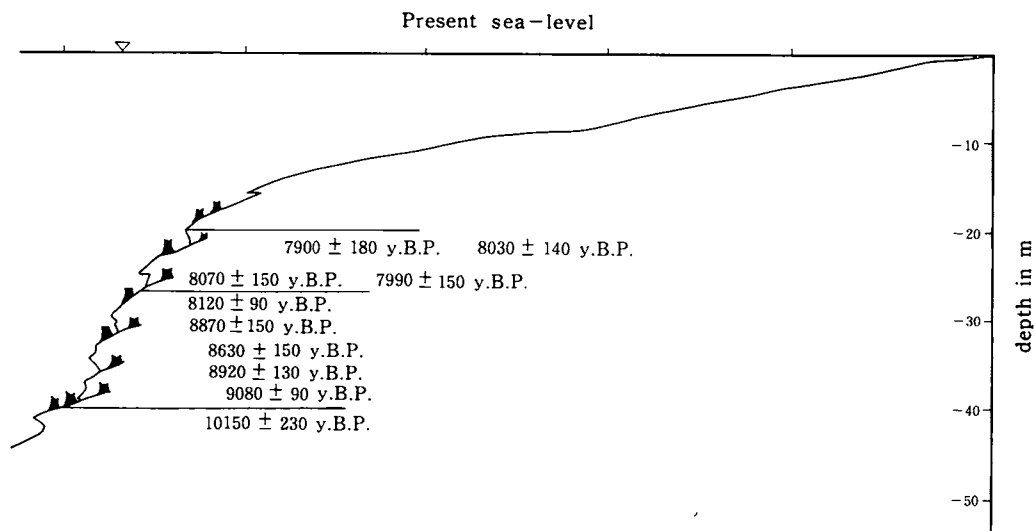


Fig. 6. Schematic diagram showing the relation between  $^{14}\text{C}$  age and depth of the erect stumps from the Nyuzen submerged forest.

which existed during the early Holocene. A palynological research of samples from deposits around the stumps of the submerged forest on the Old Kurobe alluvial fan is summarized as follows: During the age (about 10,200 years ago) in when a sea-level was slightly lower than 35 to 40m of water, a mean annual temperature was  $3^\circ$  to  $4^\circ\text{C}$  lower than the present-day temperature, and about  $9^\circ$  or  $10^\circ\text{C}$ . At that time, the vegetation on the fan was characterized by *Alnus japonica*, *Salix* and *Fraxinus* with *Cryptomeria japonica* belonging to the *Querco-Fagetea* region characterizing the Cool Temperate zone of Japan. On the hills and higher terraces around the fan, the vegetation was covered by *Fagus crenata* and *Quercus mongolica* var. *grosserrata* with *Cryptomeria japonica* belonging to the *Querco-Fagetea* region, and the Subalpine type vegetation as *Tsuga*, *Betula* and *Abies mariesii* was distributed on about 1,000m high and higher mountainous areas. During the later age (about 8,500 years ago) in when a sea-level was slightly lower than 20 to 30m of water, a mean annual temperature was about  $2^\circ\text{C}$  lower than the present-day temperature, and about  $11^\circ\text{C}$ . The flora on the old alluvial fan was occupied by *Alnus japonica*, *Salix* and *Fraxinus* with *Camellia*. Although the vegetation on the higher places around the old alluvial fan was characterized by *Fagus crenata* and *Quercus mongolica* var. *grosserrata* etc. belonging to the *Querco-Fagetea* region, and on the lower terraces and hills, the evergreen broad leaved trees as evergreen *Quercus*, *Castanopsis* and *Camellia japonica* belonging to the *Camellietea japonica* region were distributed, and the Subalpine type plants were not found on about 1,000 to 1,300m high mountainous areas. The Subalpine type plants were distributed locally on about 1,500m high and higher mountainous areas at that time.

Judging from the author's data and other many references, the submerged forest is the oldest forest on the continental shelves throughout the present world.

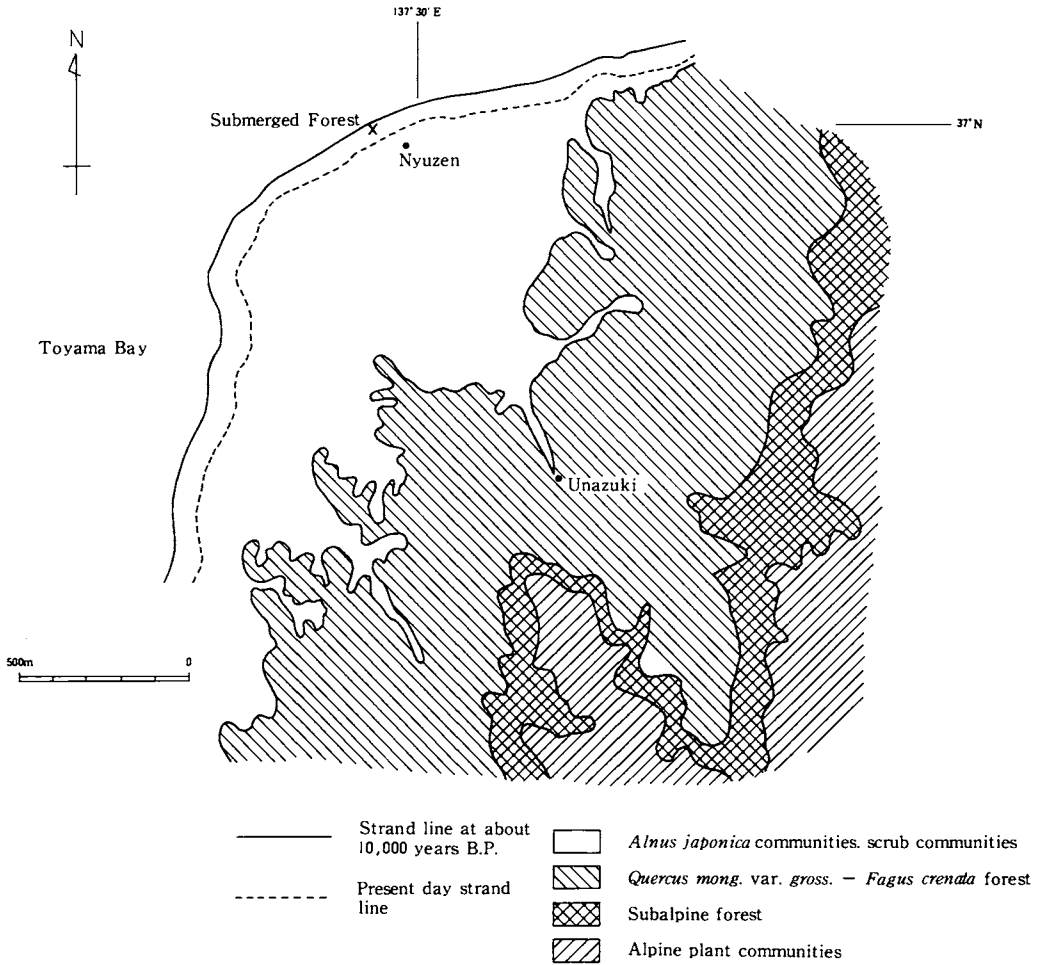


Fig. 7. The palaeovegetational map in and around the studied areas, Toyama Prefecture, Central Japan at about 10,000 years ago.

Tab. 2. Habitats of the trees from the submerged forest, and their present distribution.

tree	habitat	distribution
<i>Salix</i> sp.	low land~hill	—
<i>Alnus japonica</i>	low land	Japan
<i>Quercus serrata</i>	low mountain	Honshu, Shikoku, Kyushu, southern Hokkaido
<i>Morus australis</i>	low mountain~near coast	Japan
<i>Camellia japonica</i>	low mountain~near coast	Kyushu, Shikoku, Honshu, lowland of Tohoku
<i>Ilex macrospoda</i>	low mountain	Japan
<i>Acer</i> sp.	low mountain	Kyushu, Shikoku, Honshu, southern Hokkaido
<i>Viburnum dilatatum</i>	low mountain	—

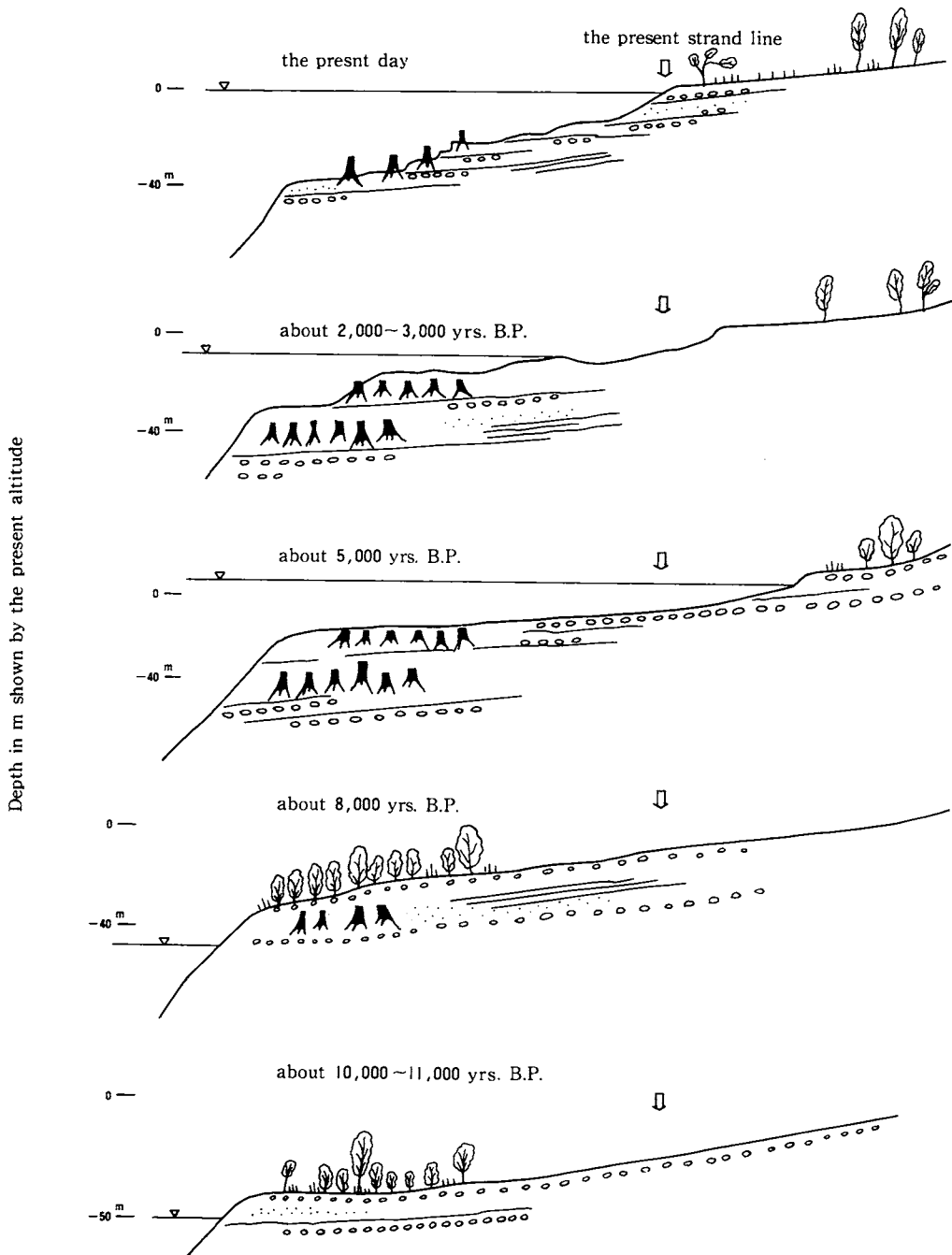


Fig. 8. Schematic figure showing the forming process of the Nyuzen submerged forest. Depths are relative to the present sea-level.

### V : Reconstruction of palaeoenvironment in the archaeological sites

An archaeological investigation is generally one of interdisciplinary researches such as geography, limnology, and environmentology. The archaeologists of the European countries, therefore, had gone on with their studies by the co-operation of natural scientists, especially geomorphologists, geologists, and palaeontologists etc. In Japan, following the establishment of Pleistocene stratigraphy, topography, and palaeontology as respectable fields of scientific endeavor in regard to anthropology about 100-50 years ago, a latter stage of development was more specifically orientaed toward prehistoric man from the Pleistocene deposits in some limestone caves. Certainly much of the research concerning the prehistoric man in the foreign countries such as French, Germany, and Switzerland since about 1850 A.D. affected on the research of anthropology in the Japanese Islands, and had interdisciplinary overtones. The archaeologists and anthropologists of prehistoric studies have long been aware that the natural sciences provide a number of useful techniques. A new pattern, however, was probably first set by the geological and palaeontological investigations of the Kuzuu caves near Tokyo and Akashi coast area near Osaka. Another important individual research should be mentioned as a pioneer an use of stratigraphic method for archaeological investigation by Sugao Yamanouchi.

Following the Second World War, in the foreign countries, biological investigation such as pollen and diatom analyses, and chemical investigation as radiometric dating and chemical analysis of materials from archaeological sites have been used frequently, while the number of contributions and new techniques developed by individual natural scientific division has grown tremendously. However, the Japanese archaeologists had not complied easily and readily the new techniques of natural sciences. In regard to this cause, the author is thinking as following two reasons; firstly, archaeologists do not fully understand on natural sciences, and on the other hand, natural scientists do not fully co-operate together with archaeologists. However, a development of archaeology at the present-day, it is not too much to write, needs some techniques of natural sciences, especially dating by radiocarbon-14, reconstruction of palaeovegetation and estimation of palaeoclimate based on palynology and diatom analysis, inference of ancient coastal line and changes of sea-level during the prehistoric ages by shells, and other marine and/or brachish organisms etc.

A more comprehensive study of past environments needs an approach from geology, especially stratigraphy, and geomorphology concerned with the natural environment, and focuss on the same themes of "man and nature" that are the concern of historical and contemporary geographies. This is a field to which both the natural scientist and the archaeologist should contribute more directly and with greater enthusiasm.

In the recent Japan, a few hundreds of archaeological sites have been excavated within one year, and those excavations have been gone on under the joint research of natural scientists and archaeologists.

### VI : Sea-level changes during the Holocene

Radiometric dates of various horizons of the Postglacial deposits have been obtained from humus, erect stumps, and shells of these deposits through  $^{14}\text{C}$  dating. Based on these dates, geologic and geomorphologic descriptions, the base of the Postglacial deposits is dated as old as or older than 15,000 years ago. Of course, all depths of samples used do not only indicate the ancient position of shoreline or sea-level, but the general tendency in which the sea-level rose rapidly through the period from about 15,000 years B.P. to several thousands of years ago is recognized. From the facts stated above, the regression which took place before the deposition of the Postglacial deposits is interpreted as ascribable to the eustatic drop of sea-level. The transgression after about 15,000 years ago is corresponded to the Flandrian Transgression, and placed roughly at the time of the early Jomonian cultural age. According to the distribution and ages of remains such as shell mounds and of the coastal sand dunes of the Jomonian cultural age, the rise of sea-level during the early Jomonian age might have reached to the present sea-level or to a slightly higher, perhaps about 5m high, and may be chronologically correlated with the Atlantic age. On the other hand, the lowering of sea-level during the period from the end of the middle Jomonian age to the Yayoian age, about 4,000 or less to about 1,500 years ago, might have been about -2m to 0m of the present water, and is chronologically correlated with the Subboreal age. Of course, the Japanese Islands have been affected by the earth movements. The levels estimated by many evidences, therefore, mean a relative sea-level change during the Postglacial.

The author can summarize the relative changes of the sea-level based on the many data during the Postglacial age as follows :

- (1) the regression during the late Würmian stage, ca. 30,000-20,000 years ago ; is estimated to have been about 40m to 50m below the present sea-level.
- (2) the lower stand of sea-level in the latest Würmian stage, ca. 20,000-18,000 years ago ; about 100-80m below the present sea-level.
- (3) the early Flandrian Transgression, ca. 18,000-11,000 years ago ; about 20-30m below the sea-level.
- (4) the slight regression, ca. 11,000-10,000 years ago ; about 40m of the water.
- (5) the late Flandrian Transgression, ca. 10,000-7,000 years ago ; about 30m of the present water to the present level.
- (6) the high sea-level stage, ca. 6,000-4,000 years ago ; about 5m to the slightly higher than the present sea-level.
- (7) the lower sea-level stage, ca. 4,000-1,500 years ago ; about 2m (at maximum) above the water to the present level.
- (8) the relatively stable stage of sea-level with a slight fluctuation, the last 1,500 years ; perhaps the present sea-level.

In additionally, evidence of the Holocene sea-level higher than that of the present-day has been reported by several scientists from the Japanese Islands. Eustatic interpretations have been propounded. However, age and the highest level of the transgression which has been



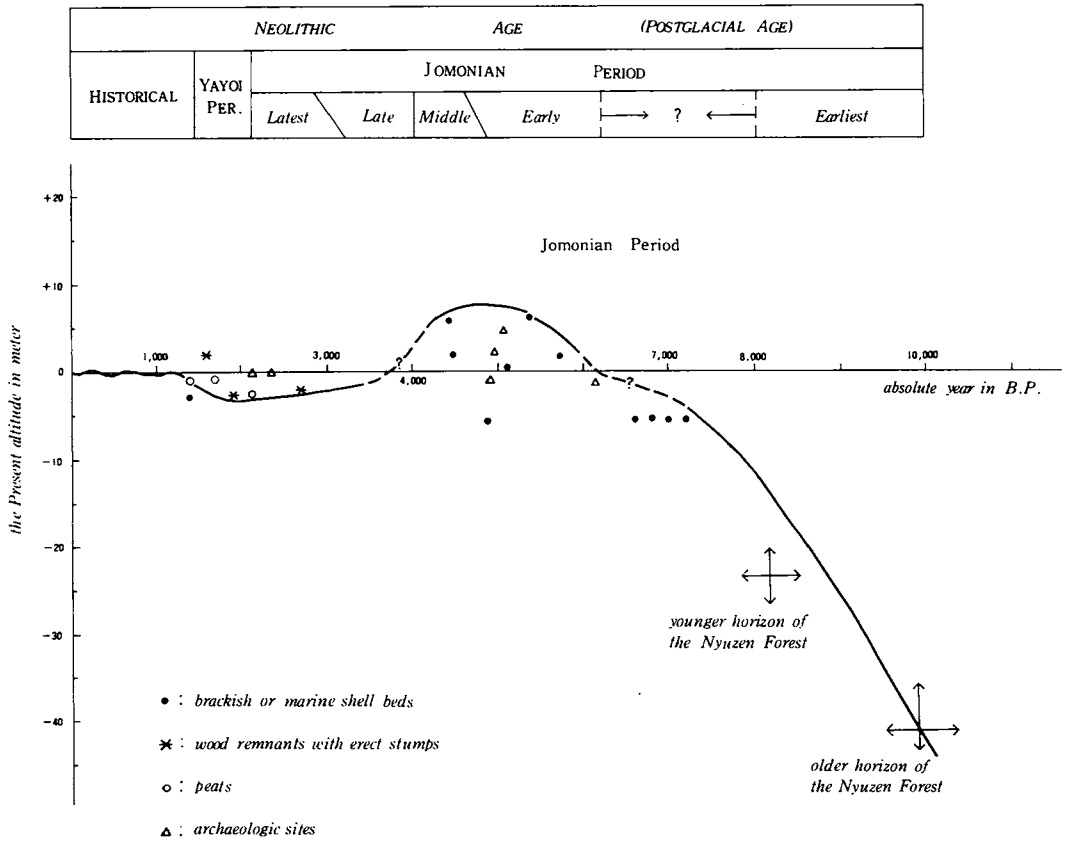


Fig. 9. Sea level changes during the Holocene in the Central Japan.

named the Jomonian Transgression, is different at each locality. Judging from the recent new data, the highest level is reported from most of the coastal areas of the Ryūkyū and in the main islands and some peninsulas of the Japanese Archipelago. Elevation increases toward the oceanic trenches as near Izu Peninsula etc., and also the evidence of the higher sea-level at about 6 meter and more is recognized in Noto Peninsula and along the coasts of some lowland areas of the Japan Sea side. And, in other regions, evidence of emergence concerning subsidence such as the Nobi, Kanto, Kanazawa, and Toyama plains at the present is quite frequent. Several records of sea-level indicate that a step-by-step uplift has occurred. The Japanese Archipelago since the Pliocene, perhaps, has been subdivided geotectonically into several large blocks which have been affected by relative movements such as uplift, subsidence, faults, and earthquakes etc. This interpretation can be explained the cause of the variety of ages and elevations of the past sea-level. This inference that the ancient sea-levels during the Holocene have been situated higher than that of present sea level is reasonable on the basis of evidence from various localities throughout the Japanese Archipelago. However, the author cannot define the absolute change of eustatic sea-level during the Holocene at the present-day.

Tab. 3. Summary of the Holocene chronostratigraphical subdivision in the Japan Archipelago.

years B. P.	climatic subdivision in NW Europe	stratigraphy		pollen zonation		C-14 date (years)	Culture		
		sea coast	bay · lagoon	Hokkaido	Hokuriku		Historical	Yayoi	
1,000	Subatlantic	coarse sand	fine sand with silt and mud	<i>Pinus Abies</i>	<i>Pinus</i> <i>Lepidobalanus</i> <i>Cryptomeria</i> <i>Machilus</i>	A. D. 200±90 (Uozu) B. C. 31±130 (Araumi) B. C. 820±120 (Oishi) B. C. 870±130 (Yahatazaki) B. C. 1,125±130 (Kemigawa) B. C. 1,800±85 (Kiya) B. C. 1,830±150 (Horinouchi)	Historical	Araumi	
2,000					<i>Lepidobalanus</i> <i>Cyclobalanopsis</i> <i>Fagus</i>		Late		Ubayama
3,000	Subboreal						Late	Kasori B	
4,000							Middle	Kasori E Katsusaka Goryogadai	
5,000	Atlantic	fine sand with marine shells	silt with marine shells	<i>Quercus</i> <i>Ulmus</i> <i>Fagus</i>	<i>Cyclobalanopsis</i>	B. C. 3,150±400 (Kamoyama)	Jomonian	Early	Kurohama
6,000					<i>Alnus</i> <i>Lepidobalanus</i>	B. C. 3,240±130 (Sobata) B. C. 3,820±100 (Mawaki)		Early	Futatsugi
7,000	Boreal	coarse sand with marine shells	fine sand	<i>Betula</i> <i>Abies</i> <i>Picea</i>	<i>Lepidobalanus</i> <i>Pinus</i> <i>Fagus</i>	B. C. 6,450±500 (Kishima)	Earliest	Kikuna II	
8,000					<i>Fagus</i> <i>Ulmus</i>	B. C. 7,290±500 (Natsushima) B. C. 8,135±320 (Kamikuroiwa II)		Tado-Kaso Hanawadai Natsushima	
9,000	Preboreal		silty sand					Igusa Hashidate	

### VII : Chronostratigraphic subdivision of the Holocene deposits

With regard to a chronostratigraphic subdivision of the Holocene deposits, samples dated by radiocarbon method for morphological, palynological, stratigraphical and archaeological investigations amount percaps to about 5,000 and more samples in total only the Holocene. On the basis of the data, the author can summarize the Holocene deposits distributed in the Japanese Islands from the view point of chronostratigraphy as shown is Tab. 3..

### VIII : Main Scientific bibliographies published during the Inter-Congress period

- Chinzei, K., Okada, H., Oda, M., Oba, T., Kitazato, H., Koizumi, I., Sakai, T., Tanimura, Y., Fujioka, K. and Matsushima, Y. (1984) : Palaeoceanography since the last glacial in the Pacific along the east coast of Honshu, Japan. In "Sci. Approaches to the Study of Cultural Property", 441-457.
- Chinzei, K. and Oba, T. (1986) : Oxygen Isotops studies of the deep sea sediments around Japan. *Recent Progress of Natural Sci. Japan*, 11 (*Quat. Res.*), 35-44.
- Delibrias, G. and Pirazzoli, P. A. (1983) : Late Holocene sea-level changes in Yoron Island, the Ryukyus, Japan. *Mar. Geol.*, **53**, M7-M16.
- Endo, K. and Sakimoto, K. (1983) : Latest Pleistocene and Holocene stratigraphical records for sea-level reconstruction in Kanto plain, Central Japan. *Abstract Intern. Sympo. Coastal Evol. Holocene*, 15-18.
- Fuji, N., Matsushima, Y., Fujii, S., Kitazato, H. and Mori, S. (1982) : Palaeoenvironment of the Holocene deduced from palaeontological evidences in Nagoya Harbor, Central Japan. *Quat. Res. Japan*, **21**, 153-167.
- Fuji, N. (1983) : Sea-level and climate changes during the Holocene in the Hokuriku region, Central Japan. *Jour. Ishikawa Archaeo. Resear.*, 26, 41-68.
- Fuji, N. (1984) : Palaeoenvironmental change in the alluvial lowland areas during the past 20,000 years, In "Scientific Approaches to the Study of Cultural Property", 465-475.
- Fuji, N. and Taga, M. (1984) : Palaeovegetation and palaeoclimate during the last 15,000 years in Nobi plain, Central Japan. *Bull. Kanazawa Univ. Fac. Education., Nat. Sci. Ser.*, 33, 93-107.
- Fuji, N. and Fujii, S. (1982) : Postglacial sea-level changes in the Hokuriku region, Central Japan. *Quat. Res. Japan*, **21**, 183-193.
- Hasegawa, H. (1984) : Carbonate sand sediments on fringing and barrier reefs in Kume-jima Island, the Ryukyus. *Geogr. Rev. Japan*, **57**, 8, 571-582.
- Horie, S. (ed.) (1984) : Lake Biwa. Dr. W. Junk Publ., Dordrecht, 654pp.
- Horiguchi, M. (1983) : Summary of Juno peaty site and some problems of its natural environment. *Quat. Res. Japan*, **22**, 3, 231-244.
- Ishizuka, T. and Kashiwa, K. (1986) : Holocene water level changes of Lake Ogawara presumed by diatom analysis, Eastern part of Aomori Prefecture, North Japan. *Geogr. Rev. Japan*, **59**, 4, 205-212.
- Izeki, H., Moriyama, A., Fujii, S., Fuji, N., Matsushima, Y., Kitazato, H., Mori, S. and Nakai,

- N. (1982) : Studies of the Holocene deposits in Nagoya Harbor and its surrounding areas. *Quat. Res. Japan*, **21**, 145-182.
- Kadamura, H. (1985) : An environmental geomorphological approach to land transformation studies. *Quat. Res. Japan*, **24**, 3, 157-166.
- Kashima, K. (1983) : Diatom analysis and its application to sea-level studies. *Abstract Intern. Symp. Coastal Evolut. Holocene*, 49-52.
- Kashima, K. (1984) : Holocene geomorphic development in drainage areas of River Maruyama and River Wada, Boso Peninsula, Japan. *Geogr. Rev. Japan*, **58**, 11, 734-743.
- Kashima, K. (1985) : Holocene diatom assemblages in Takagami lowland, Central part of Choshi Peninsula and its relation to changes of sea-level. *Quat. Res. Japan*, **24**, 2, 125-138.
- Kashima, K., Kagasawa, R. and Miyasaki, Y. (1985) : Data of Holocene sea-level change in Kikugawa-plain, Shizuoka, Japan. *Quat. Res. Japan*, **24**, 1, 45-50.
- Kashima, K. (1986) : Holocene succession of diatom — fossil assemblage in Alluvium, and those relations to paleogeographical changes. *Geogr. Rev. Japan*, **59**, 7, 383-403.
- Kato, Y. (1985) : Soils under large-scale land transformation. *Quat. Res. Japan*, **24**, 3, 197-206.
- Kawana, T. and Pirazzoli, P. A. (1983) : Late Holocene crustal movements in Okinawa Island, the Ryukyus, Japan. *Abstract Intern. Symp. Coastal Evol. in the Holocene*, 53-56.
- Kawana, T. and Pirazzoli, P. A. (1984) : Late Holocene Shorelines and sea-level in Miyako Island, the Ryukyus, Japan. *Geogr. Rev. Japan*, **57**, 135-141.
- Kayanne, H. and Yoshikawa, T. (1986) : Comparative study between Present and Emergent of Boso Peninsula, Central Japan. *Geogr. Rev. Japan*, **59**, 1, 18-36.
- Kikuchi, T. (1985) : Small-and micro-scale distribution pattern in vegetation. *Quat. Res. Japan*, **24**, 3, 215-220.
- Kobayashi, T. (1985) : Land transformation and archaeological sites. *Quat. Res. Japan*, **24**, 3, 177-182.
- Koizumi, T., Yamakawa, N., Hara, A. and Sakamoto, S. (1984) : Climatic change in the late Holocene inferred from the buried peat layer in Mt. Tairappyo, Mikuni range, Central Japan. *Geogr. Rev. Japan*, **57**, 10, 739-748.
- Konishi, K., Tsuji, Y., Goto, T., Tanaka, T. and Futakuchi, K. (1983) : Multiple shallow drilling of Holocene coral reefs in Kikaijima. *Gekkan Kaiyo-Kagaku*, **15**, 154-164.
- Maeda, Y., Yamashita, K., Matsushima, Y. and Watanabe, M. (1983) : Marine transgression over Mazukari shell mound in the Chita Peninsula, Aichi Prefecture, Central Japan. *Quat. Res. Japan*, **22**, 3, 213-2.
- Matsubara, A. (1984) : Geomorphic development of the Alluvial plain facing the Inner Suruga Bay. *Geogr. Rev. Japan*, **57**, 1, 37-56.
- Matsumoto, H. (1984) : Beach ridge ranges on Holocene coastal plains in Northeast Japan, the formative factors and periods. *Geogr. Rev. Japan*, **57**, 10, 720-738.
- Matsuoka, K., Nishida, S., Kanehara, M. and Takamura, K. (1983) : Pollen analysis of Holocene sediments obtained from the Muro mountain, central part of Kii Peninsula, Japan. *Quat. Res. Japan*, **22**, 1, 1-10.

- Matsushima, Y. (1984): Neotectonics deduced from Holocene marine terraces along the coast of Sagami and Suruga Bays, central Japan. *Quat. Res. Japan*, **23**, 2, 165-174.
- Matsushima, Y. (1984): Shallow marine molluscan assemblages of Postglacial period in the Japanese Islands. *Bull. Kanagawa Prefect. Museum (Nat. Sci.)*, **15**, 37-109.
- Matsuura, N. (1985): Successive change of the Marine molluscan faunas from Pliocene to Holocene in the Hokuriku region, Central Japan. *Mizunami Fossil Museum Rept.*, **12**, 71-158.
- Miyoshi, M., Ota, Y., Sawa, H., Imaizumi, T. and Kashima, K. (1985): Holocene marine terraces of Okushiri Island, off the Western Hokkaido, Japan. *Geogr. Rev. Japan*, **58**, 9, 596-608.
- Nakagawa, T. (1985): Late Pleistocene and Holocene deposits in Niigata plain, Central Japan -With special reference to subsidence. *Jour. Geol. Soc. Japan*, **91**, 9, 619-635.
- Naruse, T. and Onoma, M. (1984): Sea-level changes in the late Holocene at Kijima, Maejima and Otabujima Islands on the western Harimanada in the Seto Inland Sea. *Quat. Res. Japan*, **22**, 4, 327-331.
- Nasu, N., Fujioka, K., Igarashi, C., Kawahata, H., Mappa, H., Konishi, K. Tanaka, T. and Shimoda, T. (1983): Remnants of an ancient forest on the continental shelf of Northwest Japan. *Boreas*, **12**, 13-16.
- Oba, T. (1983): Palaeoenvironment of Japan Sea since the last glacial age. *Chikyū*, **5**, 37-46.
- Ota, Y., Matsushima, Y. and Moriwaki, H. (1981): Atlas of Holocene sea level records in Japan. *Japanese Working Group of the Project 61, Holocene Sea level, IGCP*, 195pp.
- Ota, Y. Matsushima, Y. and Moriwaki, H. (1982): Notes on the Holocene sea-level study in Japan. *Quat. Res. Japan*, **21**, 133-143.
- Ota, Y., Matsushima, Y., Miyoshi, M., Kashima, K., Maeda, Y. and Moriwaki, H. (1985): Holocene environmental changes in Choshi Peninsula and its surroundings, easternmost Kanto, Central Japan. *Quat. Res. Japan*, **24**, 1, 13-30.
- Ota, Y., Pirazzoli, P. A., Kawana, T. and Moriwaki, H. (1985): Late Holocene coastal morphology and sea-level records on three small islands, the Ryukyus, Japan. *Geogr. Rev. Japan*, **58**, 185-194.
- Pirazzoli, P. A. and Delibrias, G. (1983): Late Holocene and recent sea-level changes and crustal movements in Kume Island, the Ryukyus, Japan. *Bull. Dept. Geogr. Univ. Tokyo*, **15**, 63-76.
- Pirazzoli, P. A., Delibrias, G., Kawana, T. and Yamaguchi, T. (1983): Crustal movements as deduced from Holocene shorelines. In "Abstract Intern. Symp. Coastal Evol. Holocene", 119-122.
- Pirazzoli, P. A., Kawana, T. and Montaggioni, L. F. (1984): Late Holocene sea-level changes in Tarama Island, the Ryukyus, Japan. *Chikyū-Kagaku*, **38**, 113-118.
- Pirazzoli, P. A., G. Delibrias, Kawana, T., and Yamaguchi, T. (1985): The use of Barnacles to measure and date relative sea-level changes in the Ryukyu Islands, Japan. *Palaeogeography, Palaeoclimatology, Palaeoecology*, **49**, 161-174.
- Sakaguchi, Y. (1983): Warm and cold stages in the past 7,600 years in Japan and their global correlation. *Bull. Dept. Geogr. Univ. Tokyo*, **15**, 1-31.

- Sanukida, S. and Matsushita, M. (1986) : Studies on the modern sedimentary environment in Lake Hamana on the Pacific coast of Central Japan. *Quat. Res. Japan*, **25**, 1, 1-12.
- Sasaki, M. (1986) : Pollen analytical studies on surface samples from moors indifferent mountain vegetation, Central and Northern Honshu, Japan. *Quat. Res. Japan*, **25**, 1, 13-20.
- Science Council of Japan (1986) : Recent progress of Natural sciences in Japan ; **11** : Quaternary research, 80pp., Tokyo.
- Simizu, Y. (1985) : Effects of topographical environment on site formation. *Quat. Res. Japan*, **24**, 3, 183-188.
- Sohma, K. (1986) : Recent progress of palynology in Japan, with special reference to the middle and early Pleistocene. *Recent progress of natural sci. Japan, vol. (Quat. Res.)*, 61-70.
- Sugimura, A. (ed.) (1984) : Sea-level changes and tectonics in the middle Pacific. *Rept. HIPAC Project in 1981, 1982 and 1983*, 270pp.
- Takahashi, N. and Igarashi, Y. (1986) : Origin and vegetational succession of upland bogs in the Daisetsuzan Mountains, Central Japan. *Quat. Res. Japan*, **25**, 2, 113-128.
- The Editorial Committee of Ko-bunkazai (1984) : Scientific approaches to cultural property. 984pp., the Dohosha Pub. Co. Ltd.
- Tsuji, S., Minaki, M. and Koike, H. (1983) : Vegetation and agriculture since the Jomon age with special reference to evidence in the northwest Boso Peninsula region, Central Japan. *Quat. Res. Japan*, **22**, 3, 251-266.
- Watanabe, T. (1986) : Vegetation landscape and related Alpine environmental factors of the Kuranosuke Cirque, Tateyama range, Northern Japan. *Geogr. Rev. Japan*, **59**, 7, 404-425.
- Yonekura, N. and Ota, Y. (1986) : Sea-level changes and tectonics in the late Quaternary. *Recent Progr. Natural Science Japan*, **11**, (*Quat. Res.*), 17-34.

#### References Cited

- Fuji, N. (1965) : Palynological study on the Holocene peat deposits from the Hokuriku region of Central Japan. *Bull. Fac. Educ., Kanazawa Univ., Natur. Sci. Ser.*, **13**, 70-173.
- (1975) : The coastal sand dunes of Hokuriku district, Central Japan. *Quat. Res. (Daiyonki Kenkyu)*, **14**, 195-220.
- (1980) : Pollen analysis of the Postglacial deposits from Lagoon Kahoku-gata, Central Japan. *Abstract of the 21st.-Congr. Intern. Assoc. Theoret. & Applied Limnol. (SIL)*, **18**, 745-748.
- (1982a) : Palaeoenvironment of the Holocene epoch in Japan. *Bull. Fac. Educ., Kanazawa Univ., Natur. Sci. Ser.*, **31**, 31-47.
- (1982b) : Chronostratigraphical subdivision of the Postglacial deposits in the Japanese Islands. In "*Chronostratigraphical subdivision of the Holocene*" (ed. by J. Mangerud), *Striae*, **16**, 24-35.
- & H. Kano (1979) : Palynological investigation of the latest Quaternary deposits from Lagoon Kahoku-gata, Central Japan. *Bull. Japan Sea Resear. Inst., Kanazawa Univ.*, **11**, 105-127.
- Iseki, H. (1971) : The erosional bases of the late Pleistocene buried valleys in the coastal region of Japan. *Quaternaria*, **14**, 237-241.
- (1974) : Sea level toward 2,000yr. B. P. in Japan. *Jour. Fac. Literature, Nagoya Univ.*, **62**, 155-176.
- Kaizuka, S., Y. Naruse, & I. Matsuda (1977) : Recent formations and their basal topography in and around Tokyo Bay, Central Japan. *Quatern.*

- Resear.*, 8, 32-50.
- Minato, M., M. Gorai & M. Funahashi (1965): The geologic development of the Japanese Islands. Tsukiji-shokan Pub. Comp., Ltd., 442pp.
- Nasu, N., H. Kagami & J. Chujo (1962): Submarine geology at the entrance of Tokyo Bay. *Jour. Oceanograph. Soc. Japan*, 20th. Anniversary Vol., 98-120.
- Shepard, F. P., N. Niino & T. K. Chamberlain (1964): Submarine canyons and Sagami Trough, east-central Honshu, Japan. *Bull. Geol. Soc. Amer.*, 75, 1117-1130.