Researches in the Far East on the Study of the Holocene during the Inter-Congress Time, 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±150 and 10,150±230 years B. P., indicating that the stumps are remnants of the forest

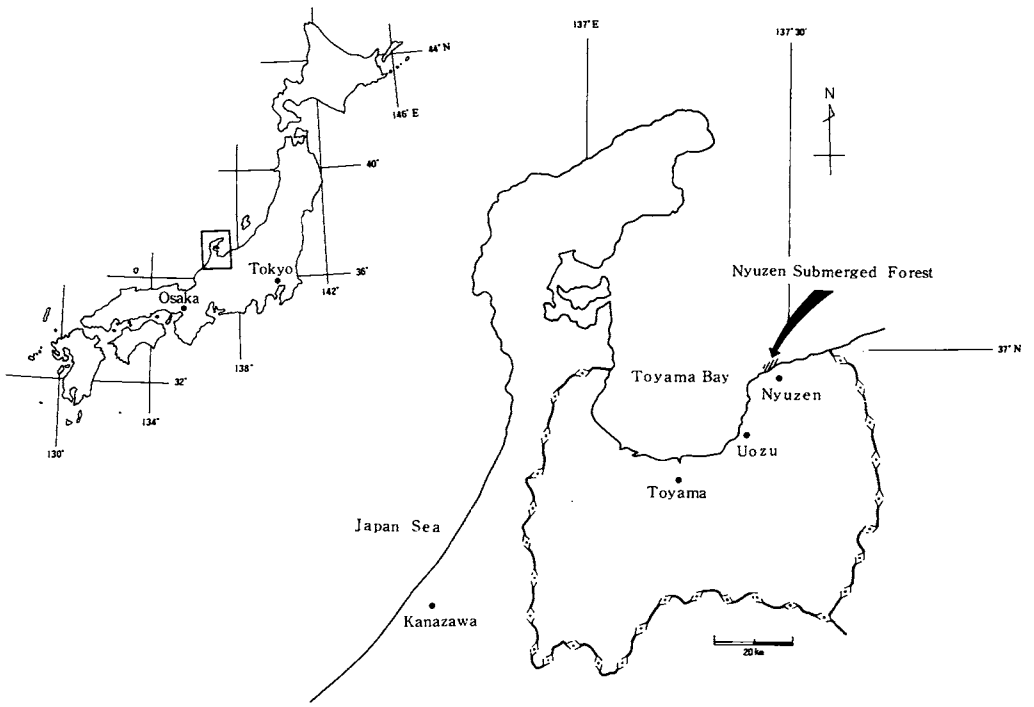

Fig. 4. Index map showing the locality of the Nyuzen submerged forest, Central Japan.

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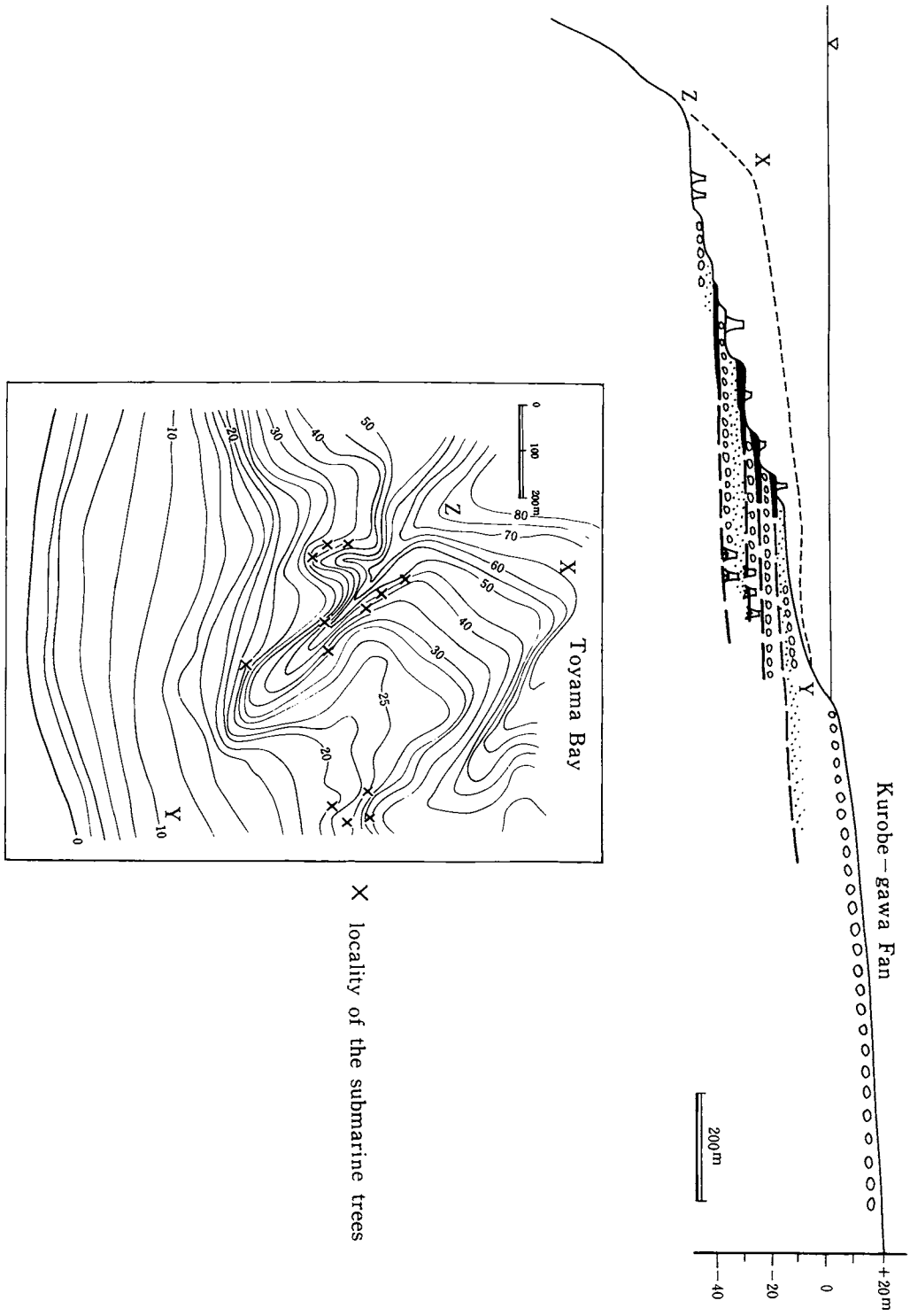

Fig. 5. Submarine topography in the Nyuzen submerged forest.

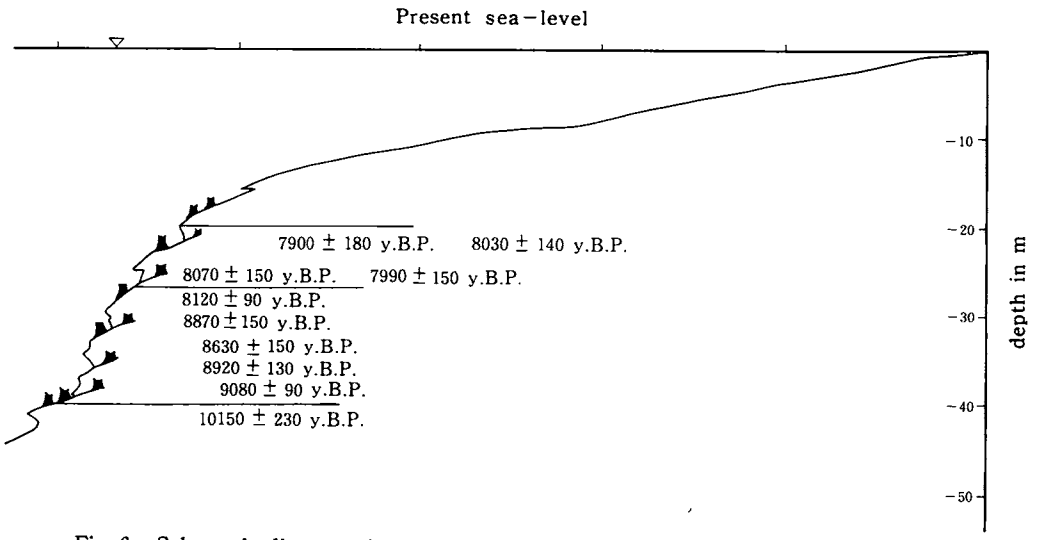

Fig. 6. Schematic diagram showing the relation between ^{14}C age and depth of the erect stumps from the Nyuzen submerged forest.

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° to 4°C lower than the present-day temperature, and about 9° or 10°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°C lower than the present-day temperature, and about 11°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.

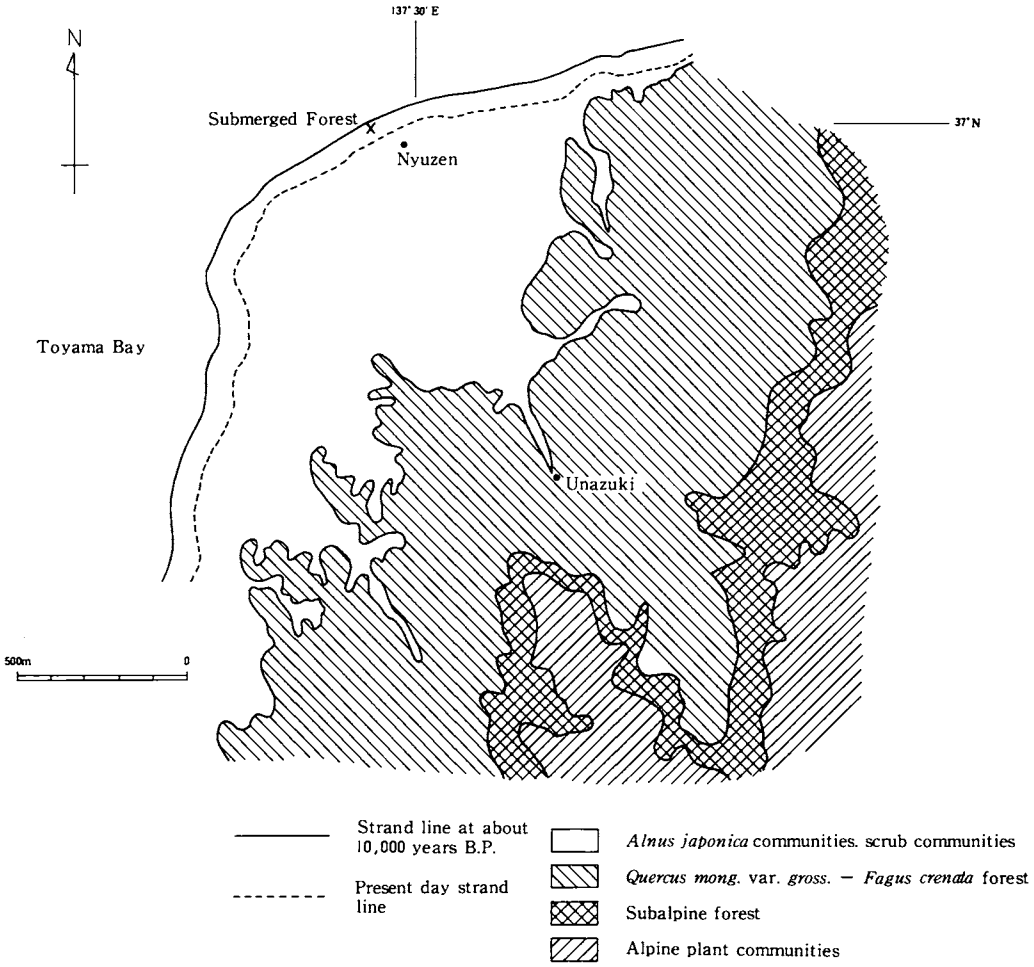

Fig. 7. The palaeovegetational map in and around the studied areas, Toyama Prefecture, Central Japan at about 10,000 years ago.

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

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

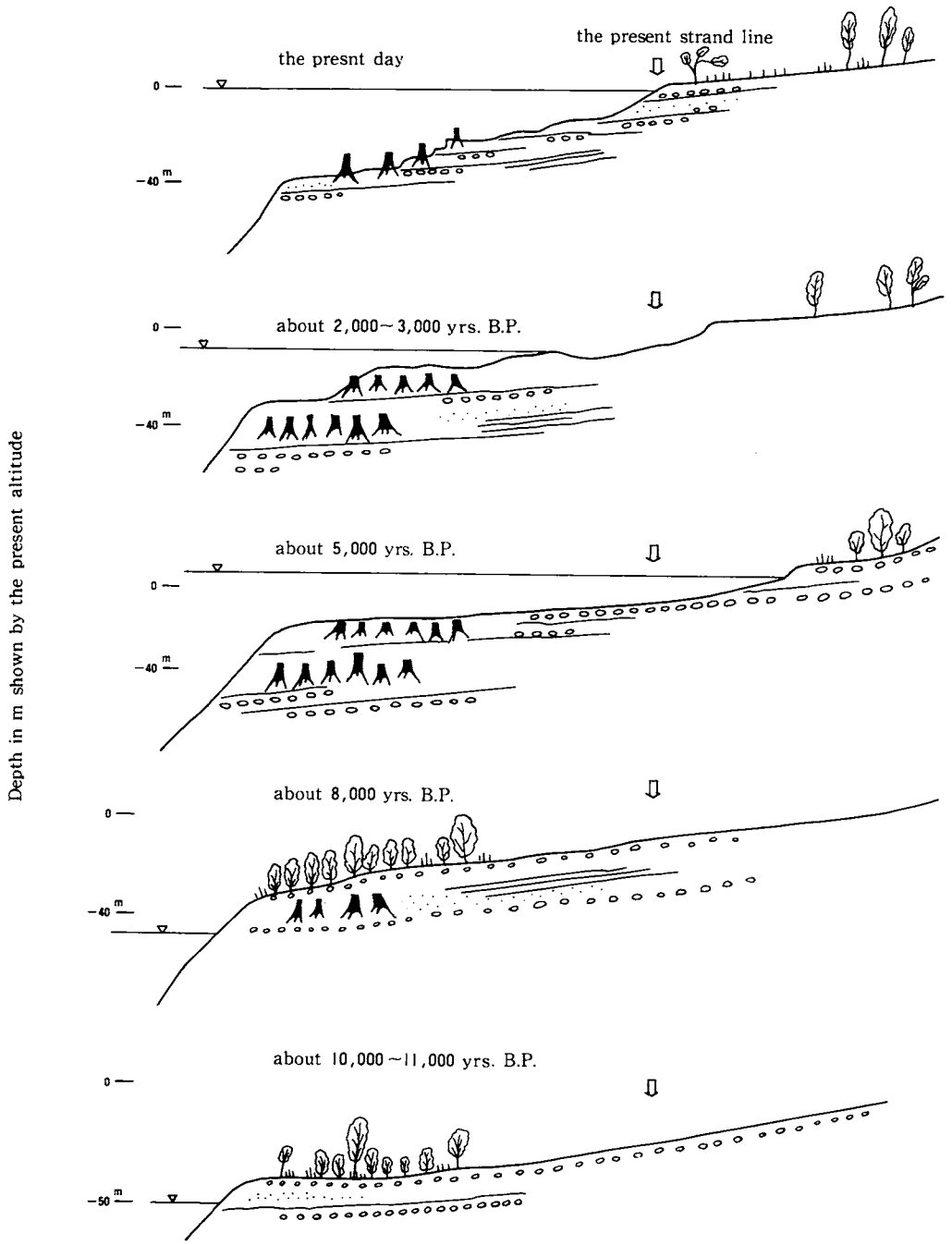

Fig. 8. Schematic figure showing the forming process of the Nyuzen submerged forest. Depths are relative to the present sea-level.

V : Reconstraction 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, especiall 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}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 satge, 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 additionaly, 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

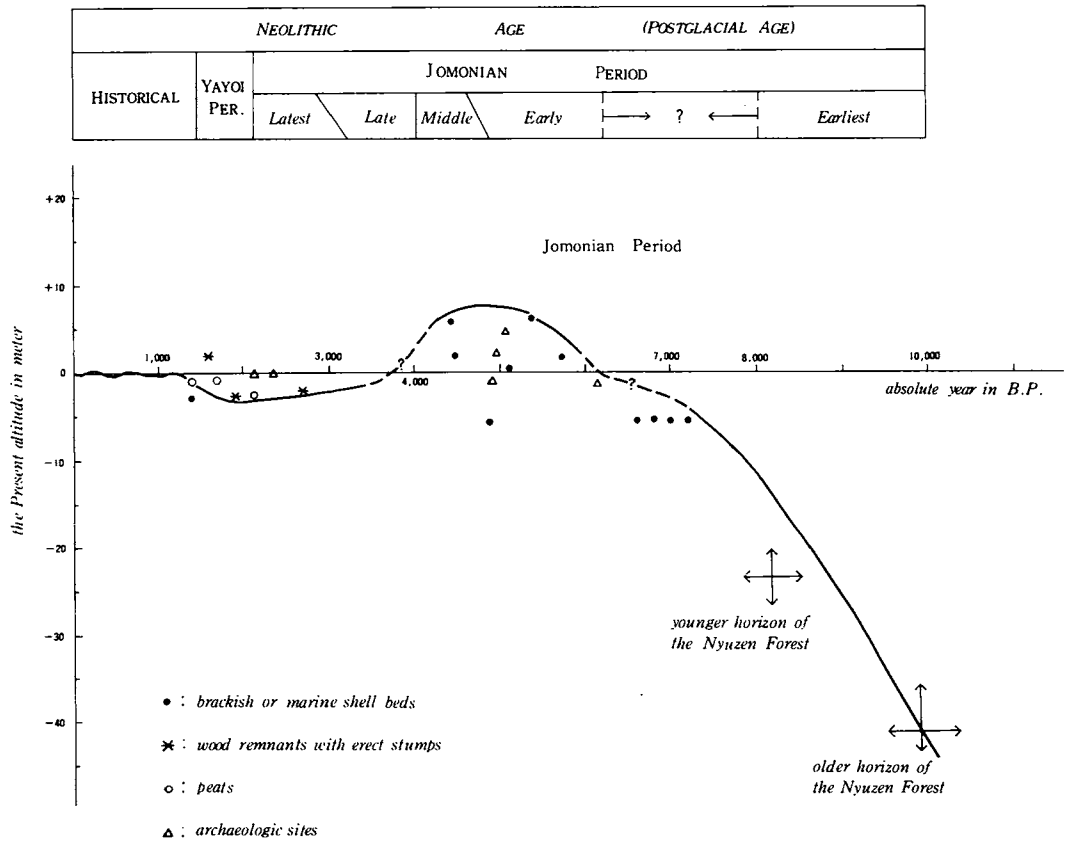

Fig. 9. Sea level changes during the Holocene in the Central Japan.

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 zoning		C—14 date (years)	Culture		
		sea coast	bay · lagoon	Hokkaido	Hokuriku				
1,000	Subatlantic	coarse sand	fine sand with silt and mud	*Pinus* *Abies*	*Pinus* *Lepidobalanus* *Cryptomeria* *Machilus*		Historical		
						A. D. 200±90 (Uozu)	Yayoi		
2,000					*Lepidobalanus* *Cyclobalanopsis* *Fagus*	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)	Jomonian Period	Latest	Araumi
3,000	Subboreal							Late	Ubayama Kasori B
4,000		fine sand with marine shells	silt with marine shells	*Quercus* *Ulmus* *Fagus*	*Cyclobalanopsis* *Alnus* *Lepidobalanus*	B. C. 2,115±135 (Todoroki) B. C. 2,500±145 (Obata) B. C. 2,700±90 (Kobu II) B. C. 2,780±165 (Orimoto)		Middle	Kasori E Katsusaka Goryogadai
5,000	Atlantic					B. C. 3,150±400 (Kamoyama)		Early	Kurohama
6,000						B. C. 3,240±130 (Sobata) B. C. 3,820±100 (Mawaki)			Futatsugi
7,000						B. C. 5,010±110 (Shijimigamori) B. C. 5,160±120 (Akamido) B. C. 5,600±325 (Funayama)		Earliest	Kikuna II Tado-Kaso
8,000	Boreal	coarse sand with marine shells	fine sand	*Betula* *Abies* *Picea*	*Lepidobalanus* *Pinus* *Fagus*	B. C. 6,450±500 (Kishima)			Hanawadai Natsushima
9,000	Preboreal		silty sand		*Fagus* *Ulmus*	B. C. 7,290±500 (Natsushima) B. C. 8,135±320 (Kamikuroiwa II)			Igusa Hashidate

Ⅶ: Chronostratigraphic subdivision of the Holocene deposits

With regard to a chronostratigraphic subdivision of the Holocence 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..

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