# GUIDE-BOOK EXCURSION C–5



(Nov. 6th, 1926)

# KAMAKURA AND ENOSHIMA



PAN-PACIFIC SCIENCE CONGRESS, 1926

JAPAN

# KAMAKURA AND ENOSHIMA

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## TEMPLES AND SHRINES AT KAMAKURA

By Chūta Itō

Kamakura was chosen in the third year of Kenkyū, or A. D. 1192 by Minamoto-no-Yoritomo to be the seat of his feudal government. Impregnable as it was because of the sea which washed its shores and other topographical advantages, Kamakura remained for the ensuing two hundred and seventy-six years the seat of government of the three succeeding feudal clans of the Minamoto, the Hōjō and the Ashikaga. It was however, finally abandoned and left to deteriorate into ruins. Although many historical objects reminiscent of Kamakura's former prosperity have been lost through fires, floods and other natural disasters, there still remains today a number of historical relics of the Kamakura of eight centuries ago. In the following pages, a group of important examples of the ancient architecture of Kamakura will be touched upon.

Of the important Buddhist temples in Kamakura, the following five temples are the most conspicuous: the Kenchōji, Engakuji, Jufukuji, Jōchiji and Jōmyōji. These five temples are the leading temples in Japan belonging to the Zen Sect of Buddhism, a sect which was introduced to Japan from China (Sung Dynasty, A. D. 960-1280), but which has undergone remarkable development in this country. The architecture which marks the temples is, therefore, based on Chinese styles of the Sung Era.

The first to be described here is the Kenchōji. This temple was founded in the fifth year of Kenchō, or A. D. 1253, by Dōryū, a

Chinese priest of the Sung Dynasty. Evidence of Chinese influence is manifest in the style of architecture that characterizes the arrangement of the *Sangharama*.[1] The architectural style of the original buildings has not been very well preserved. The *Shōdō* was constructed in 1458, in the so-called *Karayō*, or "Chinese style," of architecture. The temple bell was cast in 1255, according to an incription on the bell. The Buddhist altar in the *Zikidō* (Refectory) is believed to be one that was constructed at the time the first buildings were erected.

The Engakuji was founded in 1282 by Sogen, a Chinese priest of the Sung Dynasty. Its architectural scale resembles that of the Kenchōji. The *Shari-den*, or "Hall of *Sarira*,[2] was built by Hōjō Sadatoki in 1301, and is the only example of the genuine *Karayō*, or "Chinese style," of architecture in Japan that has remained from the Kamakura period (A. D. 1190-1337). The temple bell is of the same period.

The Jufukuji is the third temple to be touched upon here. Originally completed in 1200, the original buildings have been destroyed, and today there is nothing remarkable in the architecture of the temple.

The Jōchiji, the fourth temple, is said to have been founded during the period from 1278 to 1287, but there are now no traces of the style of architecture that marked the ancient temple.

The Jōmyōji, the fifth temple, is reputed to have been founded in 1201; but the ancient buildings have been destroyed, and today there are few signs of the former prosperous state of the temple.

Outside of these five temples, the best known relic of former times in Kamakura is the image called the *Daibutsu*, or "Great Buddha," at Hase. The *Daibutsu* is an image of Amitabha (Sanskrit name), or Amida (Japanese name), the Buddha of Infinite Light. It is of bronze and measures 36 feet in height. The rendering of the features is rigorous and delicate, and the image is so well made that

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1) *Sangharama* is a Sanscrit term consisting of the two words, *Sangha* and *Arama*, the former meaning "Assembly" and the latter, "Garden." The word meant originally the garden where Buddhist monks took their lessons. Later it came to mean "Monastery" and then, "Temple," in an inclusive sense. In Japan a big temple is sometimes called *Garan*, which is a corruption of this Sanscrit word.

2) *Sarira* is a Sanscrit term, originally applied to the remains of Buddha, and later to those of other saints of the religion. Bones, nails, teeth, hair and ashes are the chief elements of the *Sarira*. The word has become corrupted to *Shari* in Japanese.

The Shariden of Engakuji.

The Daibutsu.

it is regarded as one of the masterpieces of the Kamakura period. According to records, the great image was cast in A.D. 1252. In 1495, the main hall, in which the image had been enshrined, was washed away by a tidal wave ; and since then the bronze figure has been left in the open air.

The temple of Avalokitesvara (Sanskrit name), or Kwannon (Japanese name), at Hase is a structure erected in 1645. Its architecture is not of an excellent type, but the temple is noted for the picturesqueness of its location. Inside the temple is a wooden statue of Kwannon, the personification of Compassion, measuring 26 feet in height. This image is reputed to be one of the two largest wooden statues now in Japan, the other being the statue of the same divinity at the temple of the same name (Hasedera) in Yamato Province. Though said to have been sculptured in the eighth year of Tempyō, or A.D. 736, the present statue at Hase in Yamato appears to be of the Muromachi period of the Ashikaga clan, or of the 15th to 16th century.

Of the Shintō shrines in Kamakura, the shrine of Tsurugaoka-Hachiman (Tsurugaoka-Hachiman Gū) is the most important. The dedication of the shrine took place in 1063 when Minamoto-no-Yoriyoshi, a noted warrior, on his way with an expedition to the Michinoku and Dewa districts, stopped at the beach of Yuigahama, and asked for divine assistance from the god Iwashimidzu-Hachiman in the war in which he was about to engage. In 1191 Minamoto-no-Yoritomo moved the shrine to the present site and enlarged the scale to include the present group of structures, retaining, however, the former style of architecture.

Dazzling in splendor and beautiful in its surroundings, this magnificent shrine stands out among the buildings in the whole district of Kamakura. In the corridor that encircles the main hall, a collection of articles and utensils in use in bygone days is exhibited, taking visitors back in thought to the Kamakura period. Two smaller shrines, the Wakamiya and the Shirahata, are attached to this large shrine.

Prince Morinaga, the unfortunate son of Emperor Godaigo, who was killed at the hands of rebels, is enshrined in the Kamakura Shrine, erected in 1869. It is one of the shrines maintained by the Government. An ancient style of architecture, characterized by neatness and simplicity, marks the structures of this shrine. Back of the shrine is an oubliette in which Prince Morinaga is said to have

been confined before his death, though this tradition is denied by historians.

The sites once occupied by the mansions of Minamoto-no-Yoritomo and the succeeding rulers of the Minamoto, Hōjō and Ashikaga régimes are known; but today there are no historical remains of the buildings which formerly stood there.

In Kamakura there are several graves of important persons who died in the vicinity, including those of Minamoto-no-Yoritomo, Ōe-no-Hiromoto, Shimadzu-Yoshihisa and Minamoto-no-Sanetomo; but all of them are on a small scale. The style of the graves is that of the *Gorin-no-Tō*,[1] or "*Stūpa* of the five elements." Most of the graves of warriors in those days adopted this style.

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# NOTES ON THE ZOOLOGY OF THE DISTRICT ABOUT KAMAKURA AND ENOSHIMA

By Tokio Kaburaki

Not only to persons interested in biology but also to pleasure-seekers the north shore of Sagami Bay, between Kamakura and Enoshima, offers many attractions. The region itself is noted for it natural beauty as well as for numerous historic sites, such as the temple of Hachiman (God of War), the "Daibutsu," or great image of Amida, etc. It is, however, our present purpose to describe the fauna of the district, and this we shall now take up according to its three habitats, terrestrial, aerial and aquatic.

**TERRESTRIAL HABITAT.**—The land fauna, though it comprises a number of animal forms, is of no special interest. Quite the most remarkable of the mammals is the True's mole (*Dymecodon pilirostris*) which is very rarely met with on Enoshima. Its picturesque haunt, formerly a headland, is now at high tide a small island. The mole is nocturnal in its habits, and hides away underground in its burrows

1) *Gorin-no-tō* is a kind of tombstone (called *Stūpa* in Sanscrit and *Tōba* or *Tō* in the Japanese corruption). *Gorin-no-tō* literally means "Five Stone Tomb." According to ancient Indian thought, the universe consisted of five elements, namely, earth, water, fire, wind and space. The "Five Stone Tomb," a tomb made of five stones piled one on top of another, is meant to embody the five elements composing the universe

during the day. The colour of its body is a deep gray, much as in the northern mole-shrew (*Urotrichus talpoides hondonis*) which is also nocturnal in its habits and occurs in this district.

Reptiles and amphibians are ubiquitous, but demand no special attention. The species commonly seen are represented in reptiles by *Elaphe climacophora*, *E. quadrivirgata*, *Agkistrodon blomhoffii*, *Gekko japonicus*, *Eumeces latiscutatus*, *Takydromus tachydromoides*, etc., and in amphibians by *Bufo vulgaris formosus*, *Hyla arborea japonica*, *Rana japonica*, *R. nigromaculata*, *Diemictylus pyrrhogaster*, etc. Quite recently, an attempt has been made near Ōfuna to cultivate the American bullfrog, *Rana catesbiana*, for the market.

Gardens and shrubs are usually infested with snails of which there are a few species, such as *Eulota peliomphala*, *E. quesita*, and others. Of other groups, the oligocaetes have received a little attention, the earthworms recorded hitherto from Kamakura being *Perichaeta fuscata*, *P. kamakurensis*, *P. heteropoda*, etc.

**AERIAL HABITAT.**—Of land birds[1] there are a number of species but all are of the commoner kinds. The sea birds are more interesting. Of the species which frequent the bay of Sagami off Enoshima and Kamakura the most noteworthy are the skuas, which are at present known to be represented by the following three species: *Catharacta matsudairae*, *Coprotheres pomarinus*, and *Stercorarius parasiticus*. The first is of very rare occurrence, and is not found outside of the bay. It invariably flits about quite solitarily, unlike the other two which appear in flocks and range the seas as far as to the Kuriles. Their food consists chiefly of the fish which they force various gulls and shearwaters to disgorge. The shearwaters are numerous, the commonest species being *Puffinus leucomelas* which has a wide range. In early summer the following species also appear in fair abundance: *P. tenuirostris tenuirostris*, *P. griseus griseus*, and *P. carneipes*. More rarely met with is *P. nativitatis* which is distributed near the Bonin and Marcus islands. These shearwaters are often seen flitting about a school of fish, uttering their peculiar cries, or pouncing upon their prey. The petrels, most often seen in early summer, are represented by such forms as *Oceanodroma markhami owstoni*, *O. melania matsudairae*, and *O. furcata*. Of the albatrosses the following species have been noticed on rare occasions: *Diomedea albatrus*, *D. immutabilis*,

1) See Matsudaira's report on a collection of birds from Kanagawa prefecture. *Tori* (The Aves), No. 2, 1915.

and *D. nigripes*. The phalaropes are represented by two species, viz., *Lobipes lobatus* and *Phalaropus fulicarius*. There are also numerous forms of gulls, terns, auks, grebes, divers, godwits, curlews, sandpipers, plovers, and so on.

Of insects found in this district there are several groups, with a considerable number of species. They are, however, of the commoner kinds and call for no special attention.

**AQUATIC HABITAT.** – This falls into freshwater and marine divisions, the former being characterised, as it usually is, by lack of variety. The one peculiarity of interest may be the appearance, in certain of the pools, of species of *Estheria* and *Branchipus*. The aquatic insects frequently met with are of the commoner kinds, and are represented by *Cybister japonicus*, *Gyrinus curtus*, *Hydrophilus acuminatus*, *Agrion quadrigerum*, *Ephera*, and others.

Of all these spheres of life the marine habitat is the most interesting. The fauna is not only remarkable for its numbers, but still more for its diversity. Along this coast four divisions are well marked, viz., the tidal zone, the shallow sea, the pelagic, and the abyssal. For the sake of convenience, mention will be made of these divisions, sometimes in combination, in the descriptions which follow.

**Tidal zone.**—Of this zone, i.e., the space between high and low tide-marks, two kinds of facies may be roughly recognised, the sand beach facies and the rocky shore or cliff facies.

Sand beach facies.—On the sandy beaches of Kugenuma, Shichiri-ga-hama and Yui-ga-hama, which are separated by headlands, may be found an association of deep-water animals and seaweeds driven in by north-easterly storms. Here in thousands are various coiled and bivalve shells, which have been brought up either from mussel-beds offshore, or from deep water. Most peculiar is a pelagic gasteropod, *Ianthina fragilis*, which makes its appearance along the Japan Stream, or *Kuroshiwo*.

Strewn along the beaches is *Lepas anatifera*, which may be mentioned as the commonest cirriped, its body being attached to various foreign objects. Frequently plentiful also are some species of shrimps, spider-crabs, and hermit-crabs. Trailing along the stems and fronds of seaweeds, as well as over some other objects, are found bryozoa and hydroids, which represent many genera. Prominent amongst medusae are *Porpita*, *Velella*, *Physalia utriculus*, *Charybdea*

*rastonii?*, and others, most of which drift in abundance along the *Kuroshiwo*.

In the sandy beach fauna the crustaceans are well represented, with some beetles, mites, and worms. Living in pairs, in burrows between tide marks is the swift sand-crab, *Ocypoda cordimana*, which has one of the chelae very large in the male. They are found in enormous numbers on the beach at Kugenuma. Certain species of *Mysis* are common here, pulling in their cephalothorax at low tide. Under the decaying seaweed of the storm-wave zone, as well as farther down the beach, are always immense numbers of the leaping amphipod (*Orchestia*), commonly called "beach-flea." Some small isopods are also found, feeding on various animal forms.

Rocky shore and cliff facies.—Around Enoshima as well as about the headlands of Koyurugi-saki and Inamura-ga-saki the shores are rocky and can be carefully explored only in their tide-pool facies or at extreme low water. A remarkable alteration in the fauna seems to be noticeable here, as compared with that before the great earthquake of 1923, which destroyed lives and property along the shore and raised the shore itself some four or five feet. On various sides we can see at the present day the exposed rocks thickly crusted with the small rough tubes of the annelid, *Vermilia*, and the mollusc, *Vermetus*, as well as with the empty shells of *Ostrea*, *Mitella*, *Balanus*, and others. So far as I am aware, the most typical rocky-shore facies is well developed on the east side of Enoshima, which affords a congenial habitat to a considerable number of animals and seaweeds.

Swimming in tide-pools are found some fishes which belong chiefly to the Eleotridae. They include such species as *Pterogobius daimio*, *Acanthogobius flavimanus*, *Ainosus geneionemus*, etc.

Echinoderms are common. The first sea-urchin likely to be seen is *Strongylocentrotus purpureus*, which is in the habit of excavating a cup in the rock, within which it lies flush with the surface. With it associate such species as *Cidaris* (*Dorocidaris*) *reini*, *Sphaerechinus pulcherrimus*, and *Diadema setosum*. Common also are some star-fishes, such as *Astropecten scoparius*, *Asterias calamaria*, and *Nardoa semiregularis*. Brittle-stars, such as *Ophioplocus japonicus* and *Ophiothrix marenzelleri*, are also sometimes found here.

Molluscs are much in evidence. The chiton group is well represented, and *Liolophura japonica* and some species of *Ischnochiton* occur in sheltered situations or upon exposed rocks, in company with

species of *Acmaea*, *Patella*, and *Fissurella*. *Patella* is represented by *P.* (*Helcioniscus*) *toreuma*, *P.* (*Scutellastra*) *stellaeformis*, etc. Amongst the weeds and crevices is a small ear-shell, *Haliotis diversicolor*, whose range extends to a depth of about 8 m. Associated with it are some species of gasteropods, such as *Trochus niloticus*, *Dolium luteostoma*, *Cerithium*, etc. The last named shell furnishes a comfortable abode for the hermit-crab. As the commonest gasteropod may be mentioned *Littorina sitchana*, which may be found on the under surface of almost any rock dragged from almost any pool. The rock oyster is a denizen of the rocky shore, in association with *Vermetus*. Embedded in hard clay is oftentimes found *Petricola chinensis*. Less frequent is *Onchidium verruculatum*, which is common on other parts of our coast.

On approaching the rocks between tide-marks we are greeted by *Platygrapsus depressus*. Warily this common crab creeps away, equally ready to dart at a morsel of food or retreat to shelter if its capture be attempted. Between weeds in the pools are frequently found several spider-crabs. In small pools a shrimp, *Leander natator*, floats at low tide. Various hermit-crabs live in appropriated shells among the rocks in the wash of the waves. In myriads around the rocks between tide-marks we find the common isopod, *Ligia exotica*, which rushes to shelter as one approaches.

Often the rocks are encrusted between tide-marks with the small rough tubes of the annelid, *Vermilia* sp. Of other tubicolous worms may be mentioned a species of *Terebella*, which is of common occurrence.

The bryozoa are numerous and varied, representing many genera. Species of *Microporella*, *Schizoporella*, *Flustra*, *Bugula*, *Retepora*, and others may be found growing on stones as well as along the stems and fronds of seaweeds.

Wave-beaten rocks are tufted with sea-anemones, such as *Anthopleura mcmurrichi* and *Cymbactis maxima*. Spread on rocks and amongst the weeds are several sponges. Hydroids are also abundant in tide-pools and under rock shelves.

**Shallow sea fauna, with some representatives of the pelagic and abyssal types.**—Greatly influenced no doubt by the *Kuroshiwo*, which passes by off Sagami Bay, the immediate environs of Enoshima and Kamakura afford us a very rich fauna. Broadly speaking, the fauna exhibits a close similarity in species, and an almost perfect identity in general character, with that about Misaki.

The fish-fauna is such a rich one that it is impossible to give an adequate general account of it in a small compass. A lancelet, *Branchiostoma belcheri*, which has its favourite haunt in the Inland Sea, is occasionally taken off Enoshima. *Myxine garmani* is also often to be seen here. Of sharks and rays, which are frequent offshore, we have such species as *Lepidorhinus foliaceus*, *Zameus squamulosus*, *Squatina japonica*, *Dasyatis akajei*, etc. A rare and interesting species of ganoid fish, *Acipenser kikuchii*, has been recorded from the Sagami Sea. The teleosts include a large number of species, which are stragglers either from the southern, or from the northern waters, but some of them are indigenous. Only a small percentage of them may be catalogued as follows: *Pterothrissus gissu* (Pterothrissidae); *Etrumeus micropus*, *Sardinea melanosticta*, *Stolephorus japonicus* (Clupeidae); *Engraulis japonicus* (Engraulidae); *Lucifer albipinnis* (Stomiatidae); *Plotosus anguillaris* (Siluridae); *Ijimaia dofleini* (Atileopidae); *Synaphobranchus affinis* (Synaphobranchidae); *Leptocephalus megastomus* (Leptocephalidae); *Hyporhamphus sajori* (Hemirhamphidae); *Cololabis saira* (Scombresocidae); *Mugil cephalus* (Mugilidae); *Monocentris japonicus* (Monocentridae); *Scomber japonicus*, *Auxis thazard* (Scombridae); *Lepidopus tenuis* (Lepidopidae); *Trachurus japonicus*, *Decapterus muroadsi* (Carangidae); *Leiognathus rivulatum* (Equulidae); *Centropholis petersii* (Pteraclidae); *Scombrops boops*, *Amia semilineata*, *Cheilodipterus quinquelineatus* (Cheilodipteridae); *Lateolabrax japonicus*, *Chelidoperca herundinacea*, *Anthias margaritaceus*, *Callanthias japonicus* (Serranidae); *Parapristipoma trilineatum* (Haemulidae); *Pagrosomus major*, *Evynnis cardinalis*, *Taius tumifrons* (Sparidae); *Oplegnathus fasciatus*, *O. punctatus* (Oplegnathidae); *Evistias acutirostris*, *Histiopterus typus*, *Quinquarius japonicus* (Histiopteridae); *Upeneoides bensasi* (Mullidae); *Goniistius zonatus* (Aplodactylidae); *Sillago sihama* (Sillaginidae); *Ditrema temmincki*, *Neoditrema ransonneti* (Embiotocidae); *Pseudolabus japonicus*, *Duymaeria flagellifera* (Labridae); *Coradion modestum* (Platacidae); *Monacanthus cirrhifer* (Monacanthidae); *Spheroides spadiceus*, *S. chrysops*, *Canthigaster rivulatus* (Tetraodontidae); *Sebastolobus macrochir*, *S. tokionis*, *S. marmoratus*, *S. albofasciatus*, *Pterois lunulata*, *Inimicus japonicus* (Scorpaenidae); *Agrammus agrammus* (Hexagrammidae); *Pseudoblennis percoides* (Cottidae); *Thysanophrys crocodilus* (Platycephalidae); *Chlidonichthys kumu*, *Lepidotrigla strauchi*, *L. güntheri*, *L. japonica* (Triglidae); *Dactyloptera orientalis* (Dactylopteridae); *Scaeops gran-*

*disquama*, *Paralichthys olivaceus* (Pleuronectidae); *Amate japonica*, *Zebrias japonicus* (Soleidae); *Uranoscopus japonicus* (Uranoscopidae); *Enedrias nebulosus* (Blennidae); *Depidion inosimae* (Gadidae); *Pterophryne histrio* (Antennariidae); etc.

At Koshigoé is a large establishment, recently formed for marketing the catch landed at the various fishing villages which dot the shores of the bay. The fish marketed here are as follows: sharks, sardines, mackerels, tunnies, sword-fish, cavallas, sea-bass, porgies, *Sillago*, *Latilus*, mullets, scorpion-fish, gurnards, plaices, soles, and many other kinds.

Ascidians are not numerous, and the species that are sometimes met with belong to the genus *Halocynthia*. Of the pelagic tunicates, species of *Salpa*, *Doliolum*, and *Appendicularia* are occasionally found.

In addition to the echinoderms found on the rocky shore, a number of fine species occur. Off Enoshima the dredge occasionally brings up such brittle-stars as *Ophiocentrus verticillatus*, *Ophiarachnella infernalis*, *Ophiocrasis marktanneri*, *Ophiomastix mixta*, *Astrodendron sagaminum*, *Astrochema* (*Ophiocreas*) *monacanthum*, *As.* (*Oph.*) *enoshimanum*, *Gorgonocephalus dolichodactylus*, etc. The sea-urchins include such species as *Astriclypeus manni*, *Brissus agassizii*, etc. Of sea-cucumbers the following species have been recorded: *Holothuria cinerascens*, *H. doflcinii*, *Stichopus japonicus*, *Cucumaria japonica*, *Ankyroderma roretzii*, etc.

A gephyrean worm, *Dendrostoma blandum*, is known to inhabit the sea. It may be of interest to know that a shell of *Lingula* was found on the shore of Enoshima.

The neighbouring coast has a great wealth of molluscs, of which it is not possible to give an adequate account in the space at our disposal. Of cephalopods several interesting species are frequent offshore. These belong to the genera *Polypus*, *Euprymma*, *Inioteuthis*, *Loligo*, *Sepia*, and *Ommastrephes*, some of them being found along the *Kuroshiwo*.

Amongst the weeds and crevices occur some important gasteropods, such as *Haliotis gigantea* and *Turbo cornutus*, which are esteemed as table delicacies. The coast near Enoshima is specially famous for the immense catch of *Turbo*. Other important shells which occur in fair abundance are *Dolium luteostoma*, *Eburna japonica*, and others.

Recorded hitherto from the neighbouring coast of this district are a number of bivalve shells. Amongst these we find the following

forms: *Yoldia lischkei*, *Limopsis pelagica*, *Chlamys laetus*, *Pecten squamatus*, *Tellina vusella consanguinea*, *T. nitidula*, *T. iridella*, *T. ostracea*, *Macoma rhomboides*, *M. secta*, *Donax praximus*, *Theora lubrica*, *Mactra sulcataria*, *Cytherea* (*Meretrix*) *meretrix*, *Cardium papyraceum*, *Siligua pulchella*, *Myodora triangularia*, *Anatina kamakurana*, etc. Of these some species like *Cy.* (*Meretrix*) *meretrix* and *Cardium papyraceum* are edible and are highly esteemed in this country.

The shell-work of this district deserves at least passing notice, for it promises to become an important industry. The beginnings of this industry, although hidden in obscurity, are recognised as dating from olden times. For a long time little real progress was made; but since about 1888 the work has developed remarkably. The output, as will be seen in the numerous shops, is varied, and shows some artistic skill, but it is not possible to enumerate the different articles. More than half are toys. Amongst the remainder are found various articles intended for practical use and ornament, such as buttons, spoons, cups, cake-dishes, flower-pots, hair-ornaments, necklaces, folding screens, boxes, and the like. The material consists of various shells, most of which are supplied by other localities, as may be seen in the following table:

| Material | Locality |
|---|---|
| *Terebra* | Loochoo |
| *Eburna* | Sōbō district |
| *Triton* | Miura peninsula and Loochoo |
| *Cyprea* | Sōbō district, Loochoo, and Oceania |
| *Strombus* and *Pterocera* | Loochoo and Oceania |
| *Umbonium* | Sōbō district |
| *Trochus niloticus*, *T. obeliscus*, and *Turbo marmoratus* | Loochoo and Oceania |
| *Pecten yessoensis* | Hokkaido |
| *Amussium japonicum* | Kagoshima |
| *Vola laqueata* | Sōbō district, Prov. Shima, Prov. Bungo |
| *Cristaria* and *Anodonta* | Lake Biwa and Lake Kasumi-ga-ura |
| *Margartifera maxima* | Australia and Oceania |

For many years a considerable amount of the finished articles has been exported to foreign countries, such as England, America, Australia, and China. This export trade may be said to account for about half of the annual production.

Quite the most remarkable of crustaceans is the giant crab, *Macrocheira kaempferi*, which inhabits the Sagami Sea. Although not abundantly, the sea also furnishes us with the edible crab, *Neptunus trituberculatus*, and the spiny lobster, *Palinurus japonicus*. *Scyllarus sieboldii* is also found. *Octolasmis aymonini* and *Heteralepas quadrata* are species of cirripeds recorded from the neighbourhood of Enoshima.

Pantopods are at present known in the following three species: *Ascorhynchus ramipes*, *Cilunculus armatus*, and *Ammothea superba*.

Polychaetes abound in profusion and variety. Of free-living or errant species, the following are those which have been recorded from the waters off Enoshima: *Polynoë pleiopis*, *Harmothoë lamellifera*, *Onuphis holobranchiata*, *Eunice indica*, *Lysidice collaris*, *Lumbriconereis japonica*, *Hesione reticulata*, *Carobia castanea*, *Euphrosyne superba*, etc.

The commonest medusae are species of *Spirocodon*, *Phialidium*, *Liriope*, *Aglaura*, *Charybdea* (*Ch. rastonii?*), *Aurelia* (*A. aurita* var.), *Mastigias* (*M. papua* var. *physophora*), etc. *Physalia utriculus* is frequently driven on the neighbouring coast. Two other siphonophorans, *Porpita* and *Velella*, are often similarly brought in. Ctenophores frequently found along shore are represented by species of *Hormiphora* and *Beroe*.

In the deep waters off Enoshima occur such highly interesting species of alcyonacea as *Dendronephthya maxima* and *Anthomastus muscarioides*. The former attains a very large size, and the latter is of a deep red tinge in its massive coenenchyma. Amongst zoophytes *Anthoplexaura dimorpha*, a notable species of a deep red colour has been found off Enoshima, commonly with *Hydrichtella epigorgia*. The sea-pens are represented by *Funiculina quadrangularis* and *Pennatula fimbriata*. Corals, such as *Corallium elatior*, *C. konojoi*, etc., may be seen in the shop-windows, but they are in reality from coral-beds either off Shikoku and Kyushyu, or near the Bonin Islands.

With the dredge some remarkable siliceous sponges are procurable. As previously recorded from the neighbourhood of Enoshima are the following species: *Eurete schmidti*, *Hexactinella ventilabrum*, *Aphrocallistes bocagei*, and *Acanthascus cactus*. In Enoshima shops specimens of *Hyalonema* are sometimes seen, but they mostly come from off Misaki.

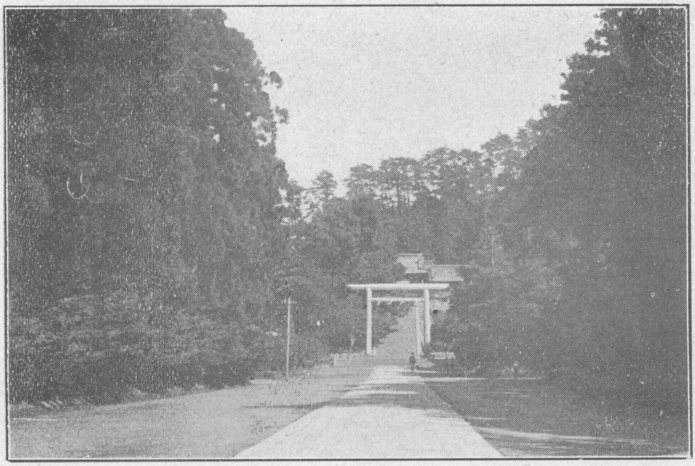

**Fig. 1.** Grove of *Cryptomeria japonica* DON along the highroad to the entrance of Hachiman shrine; a forest of *Pinus Thunbergii* PARL. is seen on the hills behind the temples. Phot. B. HAYATA, Oct. 4, 1925.

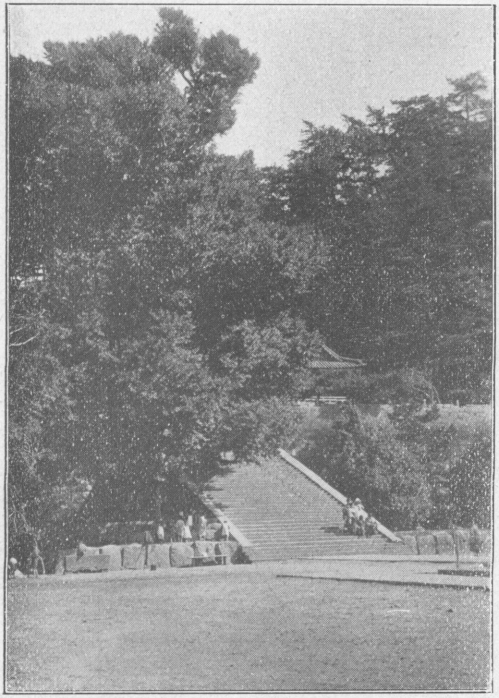

**Fig. 2.** A large specimen of *Ginkyo biloba* LINN. on the left side of the stone-steps. Phot B. HAYATA, Oct. 4, 1925.

# GUIDE TO THE BOTANY OF KAMAKURA AND ENOSHIMA

By Bunzō Hayata

## 1. GENERAL REMARKS

On the coast of the Pacific, within the limits of a day's trip from Tōkyō, on account of their beautiful scenery and historical interest, Kamakura and Enoshima attract crowds of tourists at every season of the year. Botanically they are places of some interest, as they display the general features of the flora of our coastal regions, Enoshima especially being rich in seaweeds. The neighbouring shore districts are diluvial or alluvial plains surrounded by Tertiary hills of no great height. The plains are sandy or loamy, but the hills mostly consist of tuffaceous rocks. The sandy shores are inhabited by common strand plants such as *Carex*, *Ischaemum*, *Ipomaea*, *Lippia* and others, while the hills are covered with the greens of the conifers. In the alluvial plain opposite Enoshima, there are marshy places where we find some associations of *Phragmites*, *Miscanthus*, *Typha* and other hygrophytes. The hill tops are usually clad with pine forests, but the bases and glens are covered with evergreen broad-leaved trees such as *Camellia*, *Eurya*, *Ligustrum*, *Pittosporum*, *Lithocarpus*, *Machilus*, *Cinnamomum*, *Daphniphyllum*, *Girbertia* and others. The marine flora is not uninteresting. On the sandy beach of Kamakura, we find but a few species of *Sargassum* and *Codium* washed ashore, but at Enoshima the marine flora is very rich. The island is well-known among algologists on account of its possessing so many species in so small an area.

## 2. ITINERARY

Within one hour and a half after leaving Tōkyō, we find ourselves at the station of Kamakura. Our first objective is the shrine of Hachiman which sets a little back from the station. Here we find a beautiful grove of *Cryptomeria japonica* Don. along the highway to the entrance of the shrine, and on the hills behind it thin forests of *Pinus Thunbergii* Parl. are to be seen (fig. 1). Walking up the avenue, we come to stone steps leading up to the temple. On the left stands a beautiful specimen of *Ginkgo biloba* Linn. with its dense

foliage, which turns to a bright gold colour in the autumn (fig. 2). The place abounds in historic anecdotes, and it was behind this Ginkgo tree[1] that Kugyō is said to have lurked before he sprang out and cut down the third Shōgun, Sanetomo. That was in the Kamakura period nearly seven hundred years ago, when Kamakura was the centre of political power. At the foot of the hill, there is a broad-leaved evergreen forest composed mainly of *Machilus Thunbergii* S. et Z., *Eurya japonica* THUNB., *Pittosporum Tobira* AIT. and *Taonabo japonica* SZYS.

Now retracing our steps toward the town, we go to the temple of Kōtokuji, the yard of which contains fine specimens of *Cycas revoluta* THUNB. Our attention is attracted by a great image of Buddha, the *Daibutsu*[2] which stands most imposingly by the side of the *Cycas*, and which is said to have been cast in the fourth year of Kenchō, nearly seven hundred years ago (fig 3.). On the right side of the Buddha we find *Pinus Thunbergii* PARL. and on the left, *Machilus Thunbergii* S. et Z. with its grayish trunk and glossy dark green foliage.

From the *Daibutsu*, we go to the south, turning to the right and then to the west, and pass through the cutting of the Gokurakuji. Now following the course of the Gokurakuji-gawa to the south, we come to the shore called Shichirigahama (fig. 4). To the east, surrounding the curved beach, we see the Tertiary hills of the peninsula of Miura all clad with the dark green conifer, *Pinus Thunbergii* PARL. To the west, beyond the blue island of Enoshima, are the Hakone mountains, and high above them towers the truncated cone of Mt. Fuji looming in the clouds. Here in Shichirigahama, we see a common strand consociation, mainly composed of *carex pumila* THUNB., *Calystegia soldanella* R. BR., *Chenopodium acuminatum* WILLD. var. *japonicum* FR. et SAV., *Rumex crispus* LINN., *Wedelia prostrata* HEMSL., *Lippia nodiflora* RICH., *Ischaemum anthephroides* MIQ., *Polypogon misere* MAKINO and others. In the bushes along the shore, *Caesalpinia sepiaria* ROXB., *Setaria glauca* BEAUV., *S. viridis* BEAUV., *S. polystachys* FR. et SAV., *Cynodon Dactylon* PERS. and *Lysimachia mauritiana* LAM. are the common species. In the glen along the Gokurakuji-gawa there

1) The tree is certainly not old enough to have witnessed the tragedy. It is more likely that Ginkgo trees have been planted here in the same place several times one after another, the present specimen being the most recent.

2) Readers are requested to refer to the beautiful description of this Buddha by Lafcadio Hearn in his "Glimpses of Unfamiliar Japan."

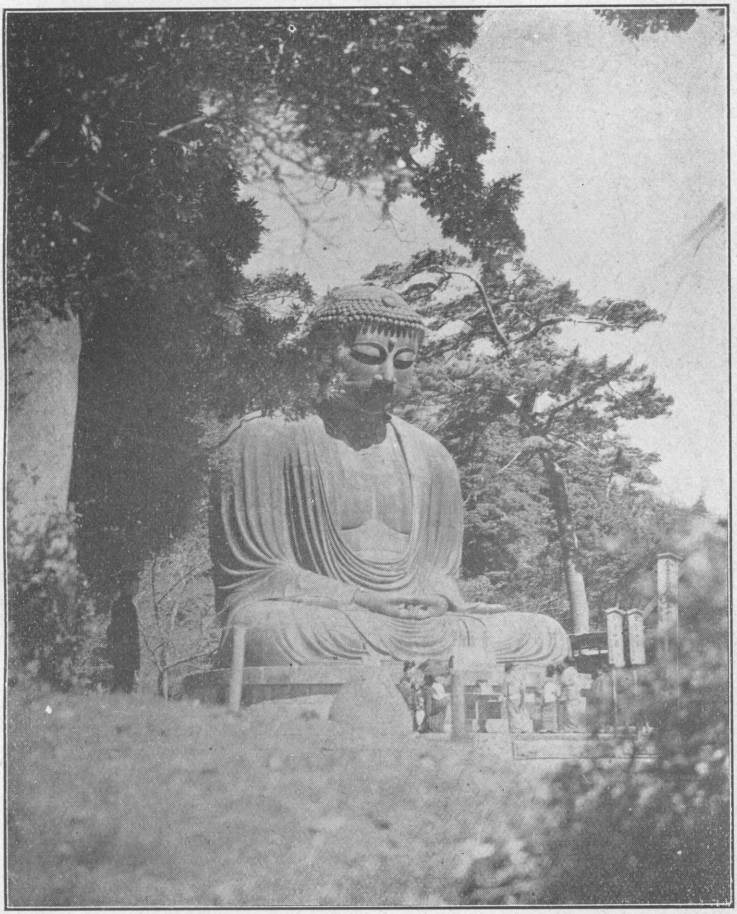

**Fig. 3.** *Machilus Thunbergii* SIEB. et ZUCC. (on the left) with its grayish trunk and dark green foliage overhanging the meditating Buddha; *Pinus Thunbergii* PARL. is seen on the right. Phot. B. HAYATA, Oct. 4, 1925.

Fig. 4. *Ischaemum anthephroides* Mio. in the foreground on the coast of Shichirigahama; the Gokurakuji-gawa, the head of the promontory of Inamuragasaki and far away the pine-clad hills of the peninsula of Miura. Phot B. Hayata, Oct. 4, 1925.

**Fig. 5.** A nearly pure stand of *Miscanthus sacchariflorus* HACK., with some *Phragmites longivalvis* STEUD., in the alluvial plain near Katasé; dark groves of *Pinus Thunbergii* PARL. are seen in the background. Phot. B. HAYATA, Oct. 4, 1925, Katasé, beside the Sakai-gawa.

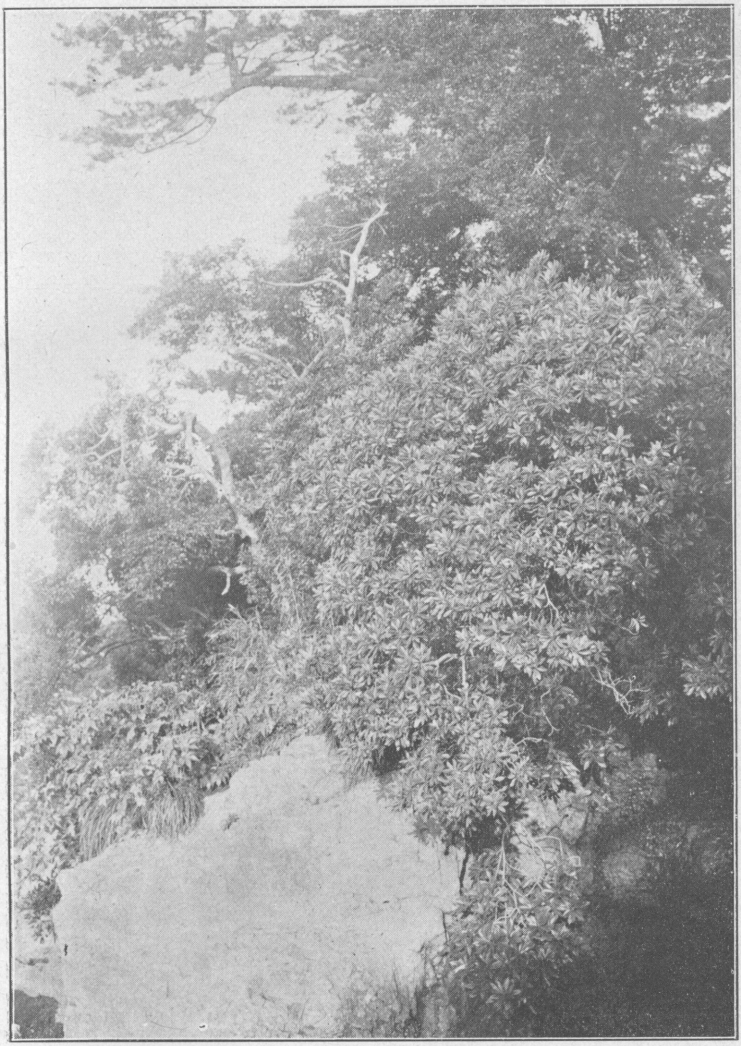

**Fig. 6.** *Daphniphyllum glaucescens* BLUME on the right, *Rubus yenoshimanus* KOIDZ. on the left; several trees of *Pinus Thunbergii* PARL. with their crocked trunks are seen in the background. Phot. B. HAYATA, Enoshima, Sept. 20 1925.

is a broad-leaved evergreen forest, consisting mainly of *Pittosporum Tobira* AIT., *Ilex Othera* SPR., *Camellia japonica* LINN., *Eurya japonica* THUNB. and others, while at the base of the hills and among the greens, a flaming scarlet mass of flowers of *Lycoris radiata* HERB. is very attractive.

As we follow the sandy beach to the west, we see several species of *Sargassum* and *Codium* washed ashore. Now leaving Shichirigahama behind, we come to Sodegaura. Here we get a nearer view of Enoshima clad in green. Presently we arrive at Katasé, which is located in the alluvial plain; its vicinity is more or less marshy. Here is a nearly pure stand of *Miscanthus sacchariflorus* HACK. with some *Phragmites longivalvis* STEUD. and *Typha latifolia* LINN. (fig. 5.).

It is from Katasé that we proceed to Enoshima. The island is said to have been separated from Katasé in the reign of the Emperor Kimmei, in the middle of the sixth century, although there is no historical record of the fact. It is a little more than two kilometers round, its area being nearly 18 hectares, and its height nearly eighty meters above sea-level. It is wholly built up of Tertiary tuff. We cross a long bridge over shallow water and come to the island.

Passing through the street of shops, we climb the long flights of stone steps which lead to the first temple in the shrine of Benten, the goddess of beauty and eloquence. On the right side of the stone steps, may be seen several yellowish spots scattered on the rocks. They are *Trentepohlia aurea*. We go on and observe the woods around us. They are composed principally of *Lithocarpus Sieboldii* NAKAI with its dark gray striately fissured bark, *Machilus Thunbergii* S. et Z. with a gray tuberculate trunk, *Aphananthe aspera* PLANCH. and *Pinus Thunbergii* PARL. Among middle sized trees we may mention *Camellia japonica* LINN., *Pittosporum Tobira* AIT., *Girbertia triloba* MAKINO, *Cinnamomum pedunculatum* NEES., *Neolitsea glauca* KOIDZ., *Daphniphyllum glaucescens* BLUME (fig. 6), *Ilex crenata* THUNB., *Ilex integra* THUNB., *Clerodendron trichotomum* THUNB., *Taonabo japonica* SZYS., *Eurya japonica* THUNB., *Euonymus japonicus* THUNB. and *Aucuba japonica* THUNB. (fig. 7). Small shrubs are represented by *Rubus landabilis* KOIDZ. var. *glauca* KOIDZ., *R. yenoshimanus* KOIDZ., *R. hudrastigolius* A. GRAY, *Bladhia crispa* THUNB., *B. japonica* HORNSTEDT., *Danmacanthus indicus* GAERT. var. *major* MAKINO, *Ligustrum macrophyllum* KOEHNE, *Elaeagnus glabra* THUNB., *E. macrophylla*

THUNB. and others. Ferns are especially abundant on the island. They are *Polystichum aculeatum* (L.) SCHOTT. var. *japonicum* CHRIST., *P. falcatum* DIELS var. *genuinum* MAKINO, *P. lepidocaulon* (HK.) J. SM., *P. varium* (L.) PR., *Coniogramme fraxinea* (Don.) DIELS, *Co. japonica* (TH.) DIELS, *Diplazium japonicum* (TH.) BEDD., *D. Wichurae* (METT.) DIELS, *Dryopteris africana* (DESV.) C. CHR., *D. decursivo-pinnata* (VAN HALL.) O. Ktze., *D. erythrosora* (EAT.) *O.* KTZE., *D. sophoroides* (TH.) O. Ktze. and *Odontosoria chinensis* (L.) J. SM. var. *tenuifolia* MAK., *Onchium japonicum* (TH.) O. KTZE., *Polypodium lineare* THUNB., *P. hastatum* THUNB., *Pteris cretica* LINN. and *P. multifida* POIR. A species of dwarf bamboo, *Arundinaria Chino* MAKINO is found everywhere on this island in the woods as well as on the exposed ground. (fig. 7). In the woods there are nearly pure stands of *Polystichum aristatum* (FORST.) PR. Climbing plants are also numerous. They are *Kadsura japonica* DUNAL., *Piper Futokadzura* SIEB., *Hedera japonica* TOBLER, *Parthenocissus tricuspidata* PLANCH., *Cynanchum japonicum* HEMSL., *Ampelopsis heterophylla* SIEB. et ZUCC., *Celastrus articulatus* THUNB., *Tracherospermum asiaticum* NAKAI, *Euonymus japonicus* THUNB. var. *radicans* MIQUEL, *Lonicera japonica* THUNB. and *Stauntonia hexaphylla* DECNE. On shady rocks, there are found *Reboulia hemisphaerica* (L.) RADDI and *Marchantia polymorpha* LINN.

As we now come nearly to the top, we see some clearings which are occupied by a nearly pure stand of *Miscanthus condensatus* HACK. (fig. 8.).

We then proceed due south, and descend straight to the shore. On the cliffs by the sea, we find *Chrysanthemum marginatum* MATSUM., *Ligularia Tussilagineana* MAKINO (fig. 9), *Beohmeria biloba* WEDD. (fig. 10), *Peucedanum japonicum* THUNB., *Lespedeza cyrtobotrya* MIQ., *Vicia pallida* TURCZ. var. *japonica* MAXIM., *Sedum oryzifolium* MAKINO, *Lysimachia mauritiana* LAM., *Hemerocallis fulva* LINN. and others. On our right, are very broad flat beds of rocks which are submerged at high tide, but are exposed by the ebb (fig. 11.). There was a luxuriant growth of seaweeds on these rocks, before they were raised by the last great earthquake. On these beds, there are seen several puddles at low tide, where the fresh green *Enteromorpha compressa* Grev. and dark brown colonies of Diatoms are found. Down on the rocks in the sea, we see dark brown *Eisenia arborea* ARESCH. form. *bicyclis* YENDO, *Sargussum Ringgoldianum* HARV., *S. Thunbergii*

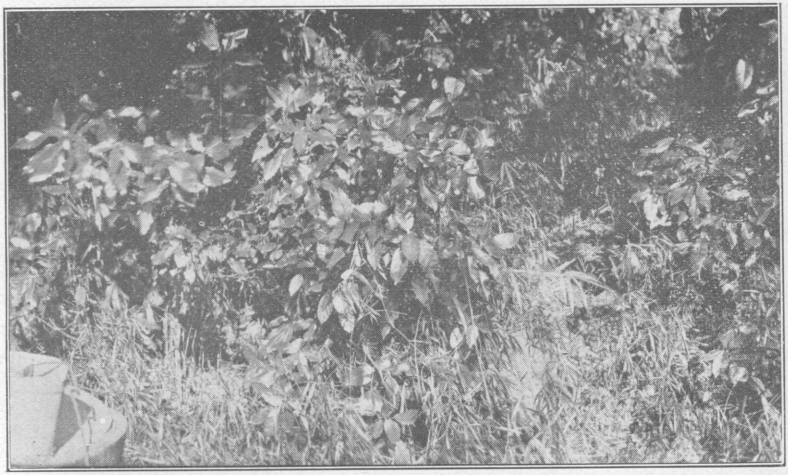

**Fig. 7.** *Aucuba japonica* THUNB. in the middle, and *Arundinaria Chino* MAKINO at the bottom of the picture. Phot. B. HAYATA, March 9, 1925, Enoshima.

**Fig. 8.** *Miscanthus condensatus* HACK., on the top of a hill on Enoshima; *Pinus Thunbergii* PARL. in the background. Phot. B. HAYATA, Sept. 20, 1925.

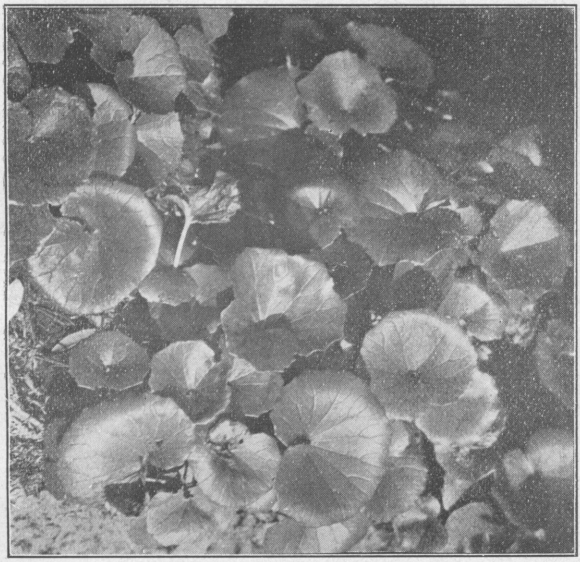

**Fig. 9.** *Ligularia Tussilaginеana* MAKINO on a rock of a steep slope on the western side of Enoshima. Phot. B. HAYATA, Sept. 20, 1925.

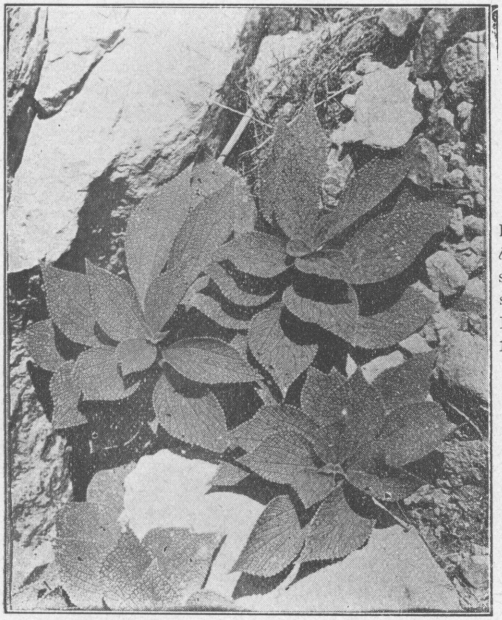

**Fig. 10.** *Boehmeria biloba* WEDD. on a steep rock on Enoshima. Phot. B. HAYATA, Sept. 20, 1925.

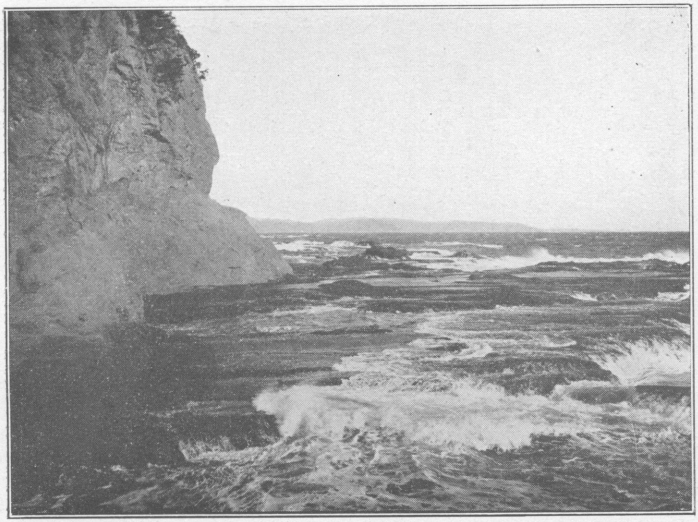

**Fig. 11.** Rocky beds on the southern side of Enoshima where the marine algae mentioned in the list are mostly to be found. Phot. B. HAYATA, March 9, 1925.

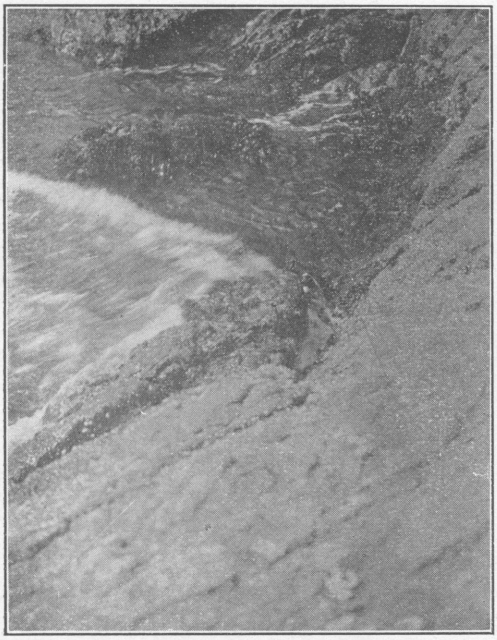

**Fig. 12.** The home of *Aisenia arborea*, *Sargassum sagamianum* YENDO, *S. nigrifolium* YENDO, *S. Ringgoldianum* HAW., *S. Thunbergii* O. KTZE., *Chondrus elatus*, *Gymnogongrus paradoxus* SUR., *Gelidium japonicum* OKAM. and others. Phot. B. HAYATA, Sept. 20, 1925.

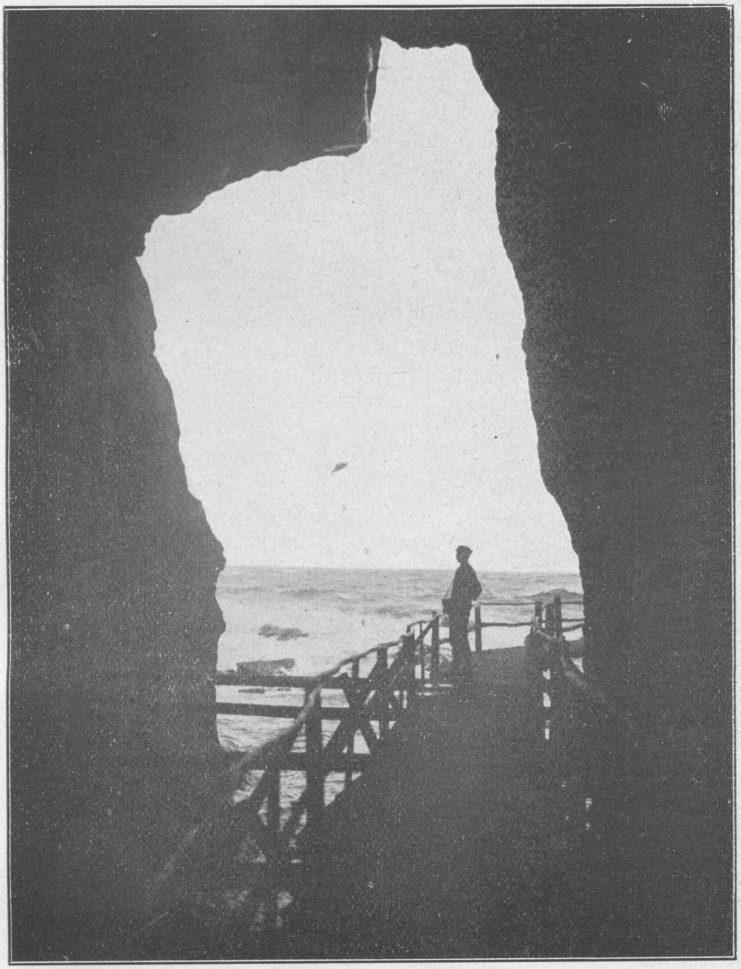

**Fig. 13.** View of the Pacific looking out from the cave; two doves nest in it, one is going out, the other coming in. Phot. B. HAYATA, March 9, 1925, Enoshima.

KUNTZ. and others. Among the Rhodophyceae, *Chondrus elatus* HOLM., *Gymnogongrus paradoxus* SUR., *Gelidium japonicum* (HARM.) OKAM., *Grateloupia affinis* (HARV.) OKAM. and *Gigartina intermedia* SUR. are abundantly found (fig. 12). Now we go along the cliff and passing through a tunnel, arrive at a cave where the goddess of beauty is enshrined. In the cave, all is dark, and there is no botany to speak of! (fig. 13).

The following is a list of the marine flora to be found off this island compiled by Dr. Y. YAMADA at my request.

## 3. LIST OF THE MARINE ALGAE FOUND AT ENOSHIMA AND ITS VICINITY

### CHLOROPHYCEAE

#### Ulvaceae

*Enteromorpha compressa* (L.) GREV.
*E. ramulosa* HOOK.
*Letterstedtia japonica* HOLMES.
*Ulva conglobata* KJELLM.
*U. pertusa* KJELLM.

#### Cladophoraceae

*Chaetomorpha crassa* (Ag.) KÜTZ.
*Ch. torta* MC. CLATCHIE.
*Cladophora utriculosa* KÜTZ.

#### Bryopsidaceae

*Bryopsis plumosa* (HUDS.) AG.

#### Caulerpaceae

*Caulerpa brachypus* HARV.

#### Codiaceae

*Codium coarctatum* OKAM.
*C. contractum* KJELLM.
*C. cylindricum* HOLMES.
*C. divaricatum* HOLMES.
*C. fragile* HARIOT.

*Codium latum* SUR.
*C. mamillosum* HARV.

PHAEOPHYCEAE

**Ectocarpaceae**

*Ectocarpus siliculosus* (DILLW.) LYNGB.

**Sphacelariaceae**

*Sphacelaria variabilis* SAUVAGEAU.

**Encoeliaceae**

*Cotpomenia sinuosa* (ROTH.) DERB. et SOL.
*Endarachne Binghamiae* J. AG.
*Hydroclathrus cancellatus* BORY.
*Thyelophycus caespitosus* KJELLM.
*Scytosiphon lomentarius* (LYNGB.) J. AG.

**Desmarestiaceae**

*Desmarestia tabacoides* OKAM.

**Chordariaceae**

*Cylindrocarpus rugosa* OKAM.
*Leathesia difformis* (L.) ARESCH.
*Myriocladia Kuromo* YENDO.

**Laminariaceae**

*Ecklonia bicyclis* KJELLM.
*E. cava* KJELLM.
*Eisenia arborea* ARESCH.
*Undaria pinnatifida* (HARV.) SUR.

**Cutleriaceae**

*Cutleria cylindrica* OKAM.

**Dictyotaceae**

*Clanidophora repens* OKAM.
*Dictyota dichotoma* (HUDS.) LAMX.
*Dilophus marginatus* OKAM.
*Halyseris latiuscula* OKAM.
*H. prolifera* OKAM.

*Padina arborescens* HOLM.
*Spathoglossum pacificum* YENDO.

### Fucaceae

*Cystophyllum sisymbrioides* J. AG.
*Ishige Okamurai* YENDO.
*Sargassum enerve* AG.
*S. graminifolium* J. AG.
*S. hemiphyllum* AG.
*S. Horneri* AG.
*S. Kjellmanianum* YENDO.
*S. micracanthum* (KÜTZ.) YENDO.
*S. nigrifolium* YENDO.
*S. nipponicum* YENDO.
*S. piluliferum* AG.
*S. patens* AG.
*S. Ringgoldianum* HARV.
*S. sagamianum* YENDO.
*S. serratifolium* AG.
*S. tortile* AG.
*S. Thunbergii* KUNTZE.

## RHODOPHYCEAE

### Bangiaceae

*Bangia fusco-purpurea* (DILLW.) LYNGB.
*Porphyra dentata* KJELLM.
*Porphyra suborbiculata* KJELLM.

### Helminthocladiaceae

*Helminthocladia australis* HARV.

### Chaetangiaceae

*Galaxaura falcata* KJELLM.
*Gloiophloea Okamurai* SETCH.
*Scinaia japonica* SETCH.

### Gelidiaceae

*Acanthopeltis japonica* OKAM.
*Gelidium Amansii* LAMX.

*Gelidium divaricatum* MARTENS.
*G. japonicum* (HARV.) OKAM.
*G. pusillum* (STACKH.) LE JOL.
*G. subcostatum* OKAM.
*Pterocladia capillacea* (GMEL.) BORN. et THUR.

### Gigartinaceae

*Callophyllis crispata* OKAM.
*Callophyllis japonica* OKAM.
*Chondrus elatus* HOLM.
*Ch. ocellatus* HOLM.
*Eudocladia complanata* HARV.
*Gigartina Teedii* (ROTH.) LAMX.
*G. tenella* HARV.
*Gymnogongrus flabelliformis* HARV.
*Gym. paradoxus* SUR.

### Rhodophyllidaceae

*Eucheuma papulosa* COTTON et YENDO.

### Sphaerococcaceae

*Gracilaria confervoides* (L.) GREV.
*G. Textorii* SUR.
*Hypnea musciformis* (WULF.) LAMX.
*H. Saidana* HOLM.
*H. seticulosa* J. AG.
*H. variabilis* OKAM.

### Rhodymeniaceae

*Champia bifida* OKAM.
*C. parvula* (AG.) J. AG.
*Chylocladia Muelleri* (SOND.) J. AG.
*Lomeutaria catenata* HARV.
*Plocamium Telfairiae* HARV.

### Delesseriaceae

*Hemineura Schmitziana* DE TONI et OKAM.
*Hypoglossum geminatum* OKAM.
*Nithophyllum uncinatum* (TURN.) J. AG.

## Rhodomelaceae

*Amansia japonica* (Holm.) Okam.
*Benzaitenia yenoshimaensis* Yendo.
*Chondria crassicaulis* Harv.
*C. dasiphylla* (Woodu.) Ag.
*Enantiocladia latiuscula* (Harv.) Okam.
*Isoptera regularis* Okam.
*Laurencia paniculata* J. Ag.
*L. papillosa* (Forsk.) Grev.
*L. pinnatifida* (Gm.) Lamx.
*Polysiphonia crassa* Okam.
*Polysiphonia fragilis* Sur.
*P. taptnocarpa* Sur.
*Pterosipnonia fibrillosa* Okam.
*Symphyocladia gracilis* (Marteus) Fkbg.
*S. marchantioides* (Harv.) Fkbg.

## Ceramiaceae

*Antithamnion plumula* (Ellis.) Thur.
*Carpoblepharis Schmitziana* (Rbd.) Okam.
*Ceramium Boydeni* Gepp.
*C. clavulatum* Ag.
*C. japonicum* Okam.
*C. paniculatum* Okam.
*C. tenellimum* (Mart.) Okam.
*Griffithsia Schousboei* Mont.
*Spyridia elongata* Okam.

## Gloiosiphoniaceae

*Gloiopeltis cervicornis* (Sur.) Schmitz.
*G. furcata* Post. et Rupr.
*Gloiosiphonia capillaris* (Huds.) Carm.

## Grateloupiaceae

*Carpopeltis angusta* (Harv.) Okam.
*Cryptonemia Schmitziana* Okam.
*Halymenia acuminata* (Holm.) J. Ag.
*H.* sp.
*Grateloupia elliptica* Holm.

*Grateloupia filicina* (WULF.) AG.
*G. flabellata* HOLM.
*G. lancifolia* (HARV.) OKAM.
*G. ligulata* (SUR.) SCHMITZ.
*G. ramosissima* OKAM.
*Prionitis patens* OKAM.

**Rhizophyllidaceae**

*Chondrococcus Hornemanni* (MERT.) SCHMITZ.
*C. japonica* (HARV.) OKAM.

**Corallinaceae**

*Amphiroa aberrans* YENDO.
*A. declinata* YENDO.
*A. zonata* YENDO.
*Cheilosporum maximum* YENDO.
*Corallina officinalis* L.
*Jania radiata* YENDO.
*J. yenoshimaensis* YENDO.

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# GEOLOGICAL GUIDE TO THE ROUTE FROM TOKYO TO ENOSHIMA AND KAMAKURA

BY YOSHIAKI OZAWA

**GENERAL TOPOGRAPHY**:—Topographically the region lying west of Tokyo Bay may be divided into three districts which extend from northwest to southeast. These are (1) the Musashino plain, (2) the Tama hills, and (3) the Sagamino plateau.

The Musashino plain extends from the foot of the Kwantō mountain-land eastward to the Bay of Tokyo. The plain presents wide areas of tabular surfaces lying between the broad, shallow valleys of the rivers Tamagawa and Arakawa, more or less deeply cut by narrow small rivers. Smooth surfaces and eastward sloping plains are the characteristic features, but in portions of the area there are

erosion buttes, such as the Sayama and Asamayama hills, which topographically resemble the Tama hill district.

The Tama hill district lies between the Musashino plain and the Sagamino plateau and is generally higher than the latter two districts and is maturely dissected. The area as a whole descends towards the east at the rate of about 20 m. in each 10 km., from altitudes approaching 200 m. at the foot of the Kwantō mountain-land to about 30 m. above sea level at Tsurumi.

The Sagamino is the crescentric low plateau lying between the rivers Sagamigawa and Sakaigawa. Its general topographical features are the same as those of the Musashino with the exception of an inland basin which will be described in detail in later pages. On the southern margin, i.e. on the coastal region, there is a succession of sand dunes clad by pine trees.

**GENERAL GEOLOGY**:—The geologic formations which are exposed along the railway leading from Tokyo to Fujisawa may be briefly described as follows.

It is necessary to state at the outset that although the younger rock series widely developed in the Kwantō plain have been studied in detail, there are at the present time great differences of opinion as to the age and classification of the formations. Dr. Yokoyama groups them all together under the name "Musashino series," which is divided into the upper and the lower. The lower Musashino is of a unique character, and in its typical development consists of basal conglomerate which rests on the older formations (the Mineoka series of Mr. S. Shimizu) of unknown age in the Miura peninsula, and is followed by a long succession of tuffaceous sandstone and shale containing abundant fossils of marine animals. The tuffaceous rocks often contain abundant pumice and scoriae indicating the vigorous activity of volcanoes at the time of deposition. The term lower Musashino series, in the sense in which Dr. Yokoyama uses it, includes two series separated by unconformity, i.e., the upper, Naganuma, and the lower, Miura. This unconformity is considered by Professor Yabe and Assistant Professor Aoki of the Tōhoku Imperial University to be an important division line indicating the boundary between Pleistocene and Pliocene, while Prof. H. Matsumoto regards the Naganuma beds as of Pliocene age.

The upper Musashino series, which is in places estuarine or fresh water, though mostly marine, was laid down in the older Tokyo Bay

of Prof. Yabe, who divides the series developed in the environs of Tokyo into two, i.e., the lower, Tokyo, and the upper, Narita. Prof. Yabe, moreover, considers that the Naganuma shell bed already cited represents the lower part of the Tokyo Beds. The account above given is briefly shown in the following tabular classification for the convenience of comparison of the opinions.

| | | | | |
|---|---|---|---|---|
| Holocene | Shell Beds of Mobara, Cape Daitō, Yurakuchô, Minato, Inamuragasaki, and Zaimokuza, etc. | | | |
| | Coral Bed of Noma. | | | |
| Pleistocene | Loam with occasional intercalations of gravel. | | | |
| | Upper Musashino | Narita Beds | | Narita Series |
| | | Tokyo Beds | Tokyo Beds in broad sense | |
| Pliocene | Lower Musashino | Naganuma Beds | | |
| | | Miura Series | Upper (Nokogiri) | |
| | | | Lower (Nabuto) | |

Pre-Miura Formations (the Sakuma and Mineoka Series in the Bōsō peninsula)

The following brief accounts of the deposits developed in the Kwantō plain are mainly cited from Prof. Yabe's paper on "Recent Stratigraphical and Paleontological Studies of the Japanese Tertiary."

**THE MIURA SERIES:**—The Miura series, named for the Miura peninsula by Assistant Professor Aoki, consists of a thick mass of tuffaceous rocks, which form a prominent feature of the stratigraphy and structure of the Miura peninsula and the island of Enoshima. The series is divided into two, the lower and the upper, by differences in lithic character and partial unconformity. The lower portion consists of massive tuffaceous sandstone and breccias to which the name Nabuto Beds is applied from a typical exposure in the island of Nabuto in the province of Awa. It is also well developed both in the peninsula of Miura and the island of Enoshima. The upper portion, a thick complex of tuffaceous shale, pumiceous sandstones, and breccia, lies on the Nabuto Beds with partial unconformity, though the boundary is generally a fault.

There are many fossil horizons in the series. The shell beds of Koshiba and Kanazawa in Kuraki-gōri, province of Musashi, the shell bed of Kamakura in Kamakura-gōri, province of Sagami, and a part of the shells of Miyata in Miura-gōri, province of Sagami, belong to the series. Dr. Yokoyama has recently published his memoir on the

fossils of these shell beds and according to him, the Koshiba shell bed, which is the most prolific in fossils of all the localities enumerated above, contains 74 species of molluscs of which 30, hence 40.5 per cent, are extinct. The series also contains abundant foraminifera, some of which, obtained from the shell beds of Nojima near Kanazawa, Kuraki-gōri, province of Musashi, are listed by Prof. H. Yabe and Mr. S. Hanzawa in their paper on "Foraminifera from the shell-beds of Nojima."

**THE TOKYO BEDS (INCLUDING THE NAGANUMA BEDS):**[1]—At the close of the Miura time, which marked also the end of the Tertiary period, pre-Miura and Miura formations became involved in the great movement which deformed the southern area of the Kwantō region. The above enumerated strata were lifted, forming a large land which ran from the southern margin of the present Dōshi mountain-land eastward to the island of Enoshima, Miura and the Bōsō peninsula. This land was a large peninsula separating the older Tokyo Bay from the open Pacific Ocean. In this older Tokyo Bay, were laid down the Tokyo and Narita Beds.

That there had been a progressive subsidence in the older Tokyo Bay during the deposition of the Tokyo and Narita Beds is proved by the thickness of an argillaceous sand layer containing fossils of marine animals. At Tokyo a boring of more than 400 m. showed no signs of a rocky floor or of tuffaceous beds characteristic to the Miura series, and did not reach beyond the argillaceous sand deposits.

The Naganuma shell bed accompanying the typical basal conglomerate rests unconformably on the Miura series at Naganuma near Kamakura, and in turn, in the neighbourhood of Yokohama, it is covered by a thick conglomerate belonging to the next younger Narita Beds. In the environs of Tokyo, sand, clay, and argillaceous sand, which are considered by Prof. H. Yabe to be continuous strata of the Naganuma shell bed, occupy an extensive area, though hidden beneath the younger Narita Beds and loam for the most part. The Tokyo Beds contain abundant fossils of marine animals such as molluscs and foraminifera.

Dr. Tokunaga described 87 species of Gastropoda, three of Scaphopoda, 75 of Pelecypoda and three of Brachiopoda, in total 168

1) In the northern half of the Bōsō peninsula where these beds are most fully developed, there seem to be continuous marine formations from the lowest Naganuma beds to the Narita. These formations overlie the Nokogiri series (comparable with the Miura series in the Miura peninsula) and are called inclusively the Narita series in a broad sense.

species from the shell beds of Ōji, Shinagawa and Tabata. Of these species, only 10 are considered by him as surely extinct. Further, the proportion of the boreal to the tropical species is 1 : 1.46 in the fossil fauna of the Tokyo Beds, and 1 : 9.75 in the recent fauna living in the seas near Tokyo. While Dr. Tokunaga considers the Tokyo Beds of the Pleistocene age, Dr. Yokoyama believes that they are of late Pliocene age.

Prof. H. Yabe and Mr. S. Hanzawa listed 38 foraminifera from the Shinagawa shell bed and 41 from Naganuma. And they conclude that the foraminifera fauna of the Naganuma shell bed is a warm-water one, at least as warm as, or more likely warmer than, the present Sagami-nada. On the other hand, the prevailing forms of foraminifera, found in the Shinagawa shell bed are common in the present Sagami-nada, and contain no warm-water elements like those characterizing the Naganuma shell bed.

The topmost bed of the formation is represented at Tabata in Tokyo by an estuarine deposit of grayish clay; either from this bed or from the base of the overlying sand and gravel, which belongs to the Narita beds, Dr. Tokunaga obtained teeth of *Elephas* (*Loxodonta*) *namadicus* Falc. and Cauth. var. *Naumanni* Mak. The same variety was also obtained from Ichikawa, Yokohama and Kazusa-Minato.

**THE NARITA BEDS**:—In Tokyo, the Tokyo Beds are overlaid by a formation of sand and gravel about 10 meters thick, in which are intercalated clay beds, the whole in places grading into gravel. These sand and gravel beds are more typically developed in the extensive tract lying east of Tokyo (in the province of Shimōsa), where the formation was called by Prof. H. Yabe, the Narita Beds. A part of this formation may perhaps be of fluviatile origin; but in its typical development, it is certainly marine. Cross-bedding is universal in this formation (fig. 1). The distribution of fossils in it is very irregular, fossils being found in considerable heaps here and there. The fossiliferous part usually contains much triturated shell fragments. The shells are almost always water-worn, and the bivalves are seldom found with both valves united. Fossils are almost entirely confined to Mollusca and a species of echinoid, *Echinarachnius mirabilis* (Barn.). The great majority of the Mollusca belong to the Pelecypoda, which much exceed the Gastropoda in the number of species and of individuals.

Dr. Yokoyama described the fossil-shells of the Narita Beds

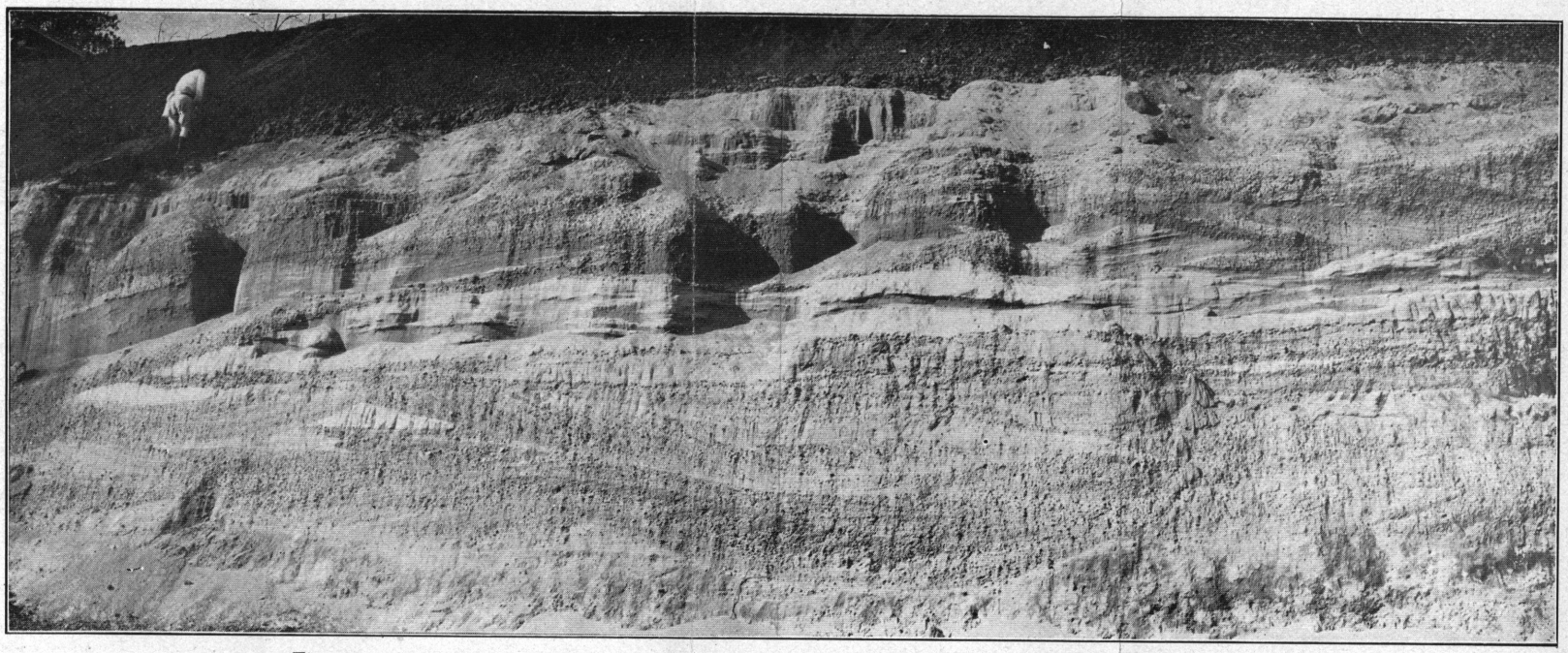


**Fig. 1.** A bluff (now stonewalled) at the Ueno Park in Tokyo, exposing the fluviatile Narita Beds with current bedding overlied by the loam.

collected from the following localities;—Ōtake, Kioroshi, Kamenari, Tega, and Shisui, all in the province of Shimōsa, and Shitō in the province of Kazusa. The number of species of the Mollusca and the Brachiopoda collected in the above named localities amounts to 335 in all, of which the number of species which are not yet known to be living now, amounts to 103, or 30.7 per cent of all the fauna, and from the above fact he assigns to the fossil layer a place in the Upper Pliocene. But Prof. Yabe and others consider that the fossil sheli layer is of Pleistocene age.

**LOAM**:—The uppermost stratum of the Kwantō plain is loam, a homogeneous, non-stratified mass of a loose, reddish brown mixture of clayey and sandy materials, several meters thick. Intercalated in it in places, is a thin layer of pumice which is in process of decomposition to a loamy material, and in places is more distinctly clayey than usual and more or less stratified at the base. This deposit covers everywhere the surface of the uplifted and dissected Kwantō plain.

**HOLOCENE DEPOSITS**:—Since the deposition of the Narita Beds and loam, the Kwantō region has been slightly uplifted and shallow valleys have been cut in it forming dissected upland; it was then submerged by a later subsidence, which produced the drowned effects and deposition represented by a) the coral bed of Noma extending along the Bay of Tateyama, b) the shell sand of Mobara and the shell bed of Cape Daitō, etc., and c) the shell bearing mud deposit along the coast of Tokyo Bay.

It must be added here that the depression of the present Tokyo Bay and the opening of the Uraga Channel were preceded by the subsidence above noted.

The following is a brief description of the Holocene deposits above enumerated.

**a) The coral bed of Noma, in the province of Awa and along the Bay of Tateyama**:—This deposit is younger than the loam and is worthy of special treatment. The bed is a muddy sand filling the old valley bottoms between the many terraced hills composed of the Miura Series, not far from the sea and only 15 meters higher than the present sea level. The fossils consist of large masses of reef-building corals mixed with shells which have recently been described by Dr. Yokoyama in his paper on "Mollusca from the Coral-Bed of Awa." The total number of the species described is 124, out of which 28 or about 23 per cent, according to him, are not known to be living.

Among the remaining 96 species, there are 17 which are the exclusively more southern (tropical) forms. From various considerations, he concludes that the age of the coral-bed of Awa is the Youngest Pleistocene.

**b) The shell sand of Mobara and the shell bed of Cape Daitō, both in the province of Kazusa:**—Almost contemporaneous with the coral bed of Noma, are the shell sand of Mobara and the shell bed of Cape Daitō. The shell sand of Mobara is exposed near Mobara along a stream which flows at the foot of the Tertiary hills through the coastal plain of Kujukurihama along the Pacific. Dr. Yokoyama found in it about 60 species of marine molluscs all still living. The shell bed of Cape Daitō is also without extinct species of Mollusca. This is exposed in a very limited area along the sea-cliffs near Cape Daitō, lying unconformably upon the Miura Series, and forms the base of an old terrace deposit.

Shell beds similar to that of Cape Daitō are also found at Inamuragasaki and Zaimokuza near Kamakura.

**c) The shell bearing mud:**—The shell bearing mud widely distributed along the sea coast of Tokyo Bay especially in the low part or so-called Shitamachi of Tokyo and in the environs of Kazusa-Minato represents the estuarine facies of the coral bed of Noma. The former extension of the present Tokyo Bay northwards, even in pre-historic times, is well established, for many shell mounds are distributed far inland along the broad valleys.

## GEOLOGIC OBSERVATIONS FROM SHINAGAWA TO ENOSHIMA

**SHINAGAWA CUTTING** Just after leaving Shinagawa, the train passes through a long cut known among our geologists as the Shinagawa cutting. When the cut was excavated an excellent exposure showing the succession and relation of the post-Tertiary formations developed in the Kwantō plain was obtained. But now the cut is partly stone-walled and partly covered by grass and only the upper layer, i.e. the loam, crops out. The annexed figures (fig. 2 a, b) from Mr. K. Watanabe's paper, show the succession of the beds from the uppermost layer of the Tokyo Beds to the loam.

**Fig. 2 a.** Section of the West Side of the Shinagawa Cutting.

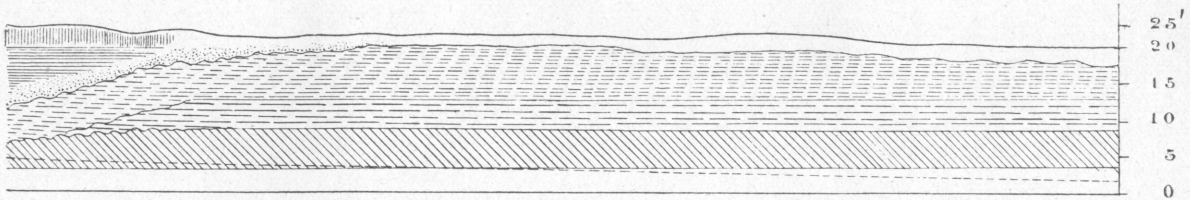
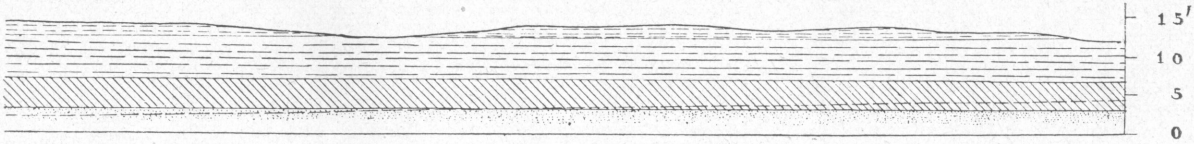
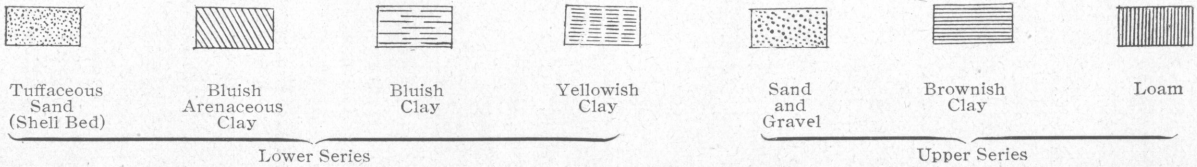



**Fig. 2 b.** Section of the East Side of the Shinagawa Cutting.



**OMORI SHELL MOUND** Just before reaching Ōmori station, the train passes the Ōmori shell mounds which have been wholly excavated; the relics are now covered by grasses and trees. The largest mound, according to the late Edward S. Morse,[1] was originally about 89 meters long along the embankment and 4 meters thick and was situated close to the right[2] hand side of the track. It was composed of loose loam mixed with bones of various animals, stone implements, earths and an immense number of shells of oysters, arcs, cytheres, etc. Such relics of a prehistoric people are very numerous about the Bay of Tokyo far inland along the valleys.

**TAMAGAWA** Beyond Ōmori the hills retreat from the shore of the bay, and the train crosses a flat and well cultivated delta formed by the river Tama-gawa. The lower course of the Tama-gawa nearly coincides with the south-east-east prolongation of the important tectonic line of the Kwantō mountain-land running from Kawakami in the province of Shinano to Itsukaichi in the province of Musashi and separates the maturely dissected Tama plateau from the Musashino low plateau.

That this weak line is tectonically very important is shown by the recent great earthquake occurring on Sept. 1, 1923, when there was a differential movement of such a nature that the northern Kwantō plain—north of the fault—was more or less depressed, and the Tama hilly tract—south of the fault—was upheaved, the maximum upheaval in the southern area having been one meter or more. This differential movement is very interesting when we consider it as connected with the notable differences in topography between the Tama and Musashino uplands.

**TSURUMI** At Tsurumi the traveler may see again extensive hillside cuts on the right, exposing beds of loam, clay, gravel and sand. The gravel and sands with current bedding underlying the loam contain molluscs of blackish water, echinoids and plants. The lowest bed is the sandy clay containing abundant shells quite like those obtained from the Shinagawa cutting. Along the railway from

1) The mound was discovered and excavated by the late Edward S. Morse about 37 years ago. His classical paper on the "Shell Mounds of Ōmori" (Memoirs of the Science Department, University of Tokyo, Vol. I., Part I. 1879) is the first scientific contribution to archeological studies in Japan.

2) The terms right and left as employed throughout this book apply to the west-bound journey.

Tsurumi to Yokohama thick sand and gravel with current bedding continue to make conspicuous bluffs north of the track in many places. Beyond Tsurumi the train passes two stations, Higashi-kanagawa and Kanagawa before reaching Yokohama.

**YOKOHAMA** In the vicinity of Yokohama, the sand and gravel belonging to the Narita Beds give place to conglomerate having large rounded pebbles, and the conglomerate gradually thins out toward the west. Yokohama stands on the narrow alluvial tracts of the river Katabira-gawa, and was therefore totally destroyed by the 1923 earthquake, but much progress has been made since then toward its rehabilitation.

Along the north-north-west course of the Katabira-gawa, a fault runs, which at the center of the city is cut by a younger fault traversing Yokohama northeastwardly. From an argillaceous sand underlying alluvium, *Elephas* (*Loxodonta*) *namadicus* var. *naumanni*, a common mammal of the Tokyo Beds, has Been obtained by well digging.

**HODOGAYA** Leaving Yokohama we proceed along a tributary of the river Katabira-gawa to Hodogaya. On the opposite side of the station we may see a good exposure showing a succession of loam, clay, sand, gravel and tuffaceous sandstone (fig. 3). The last named rock is quarried for the purpose of manufacturing cement.

**TOTSUKA** Beyond Hodogaya station we pass through cuttings and the Shimizuyado tunnel excavated in the Miura Beds and thence enter into the Kashiwa fault valley hemmed in by graceful pine groves, cherry and other trees. At Naganuma, three kilometers south of Totsuka station, a shell bed accompanying conglomerates at the base rests unconformably on a tuffaceous sandstone containing marine shells, echinoids, foraminifera and sharks' teeth (*Chalcarodon megalodon*). From Naganuma the grey tuffaceous sandstone containing pumice becomes conspicuous in the bluffs on both sides of the railroad. The fine tuffaceous sandstone of this locality is utilized in the manufacture of cement, for which it is well adapted and conveniently located. The rock is quarried from the hillsides which are plainly visible from the train on both sides of Ōfuna station.

**YOKOSUKA BRANCH LINE** Ōfuna is the point of departure for Kamakura, Zushi and Yokosuka. From the train for Yokosuka we see a succession of the Miura series from upper to lower which is broken by a fault traversing Zushi from east to west.

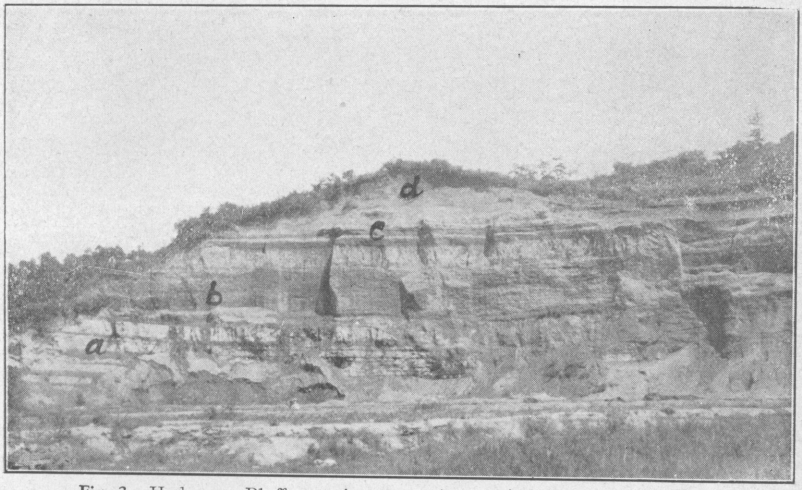



**Fig. 3.** Hodogaya Bluff exposing succession of *a*) tuffaceous sandstone of Miura Series (quarried), *b*) gravel, *c*) sand and clay, and *d*) loam.

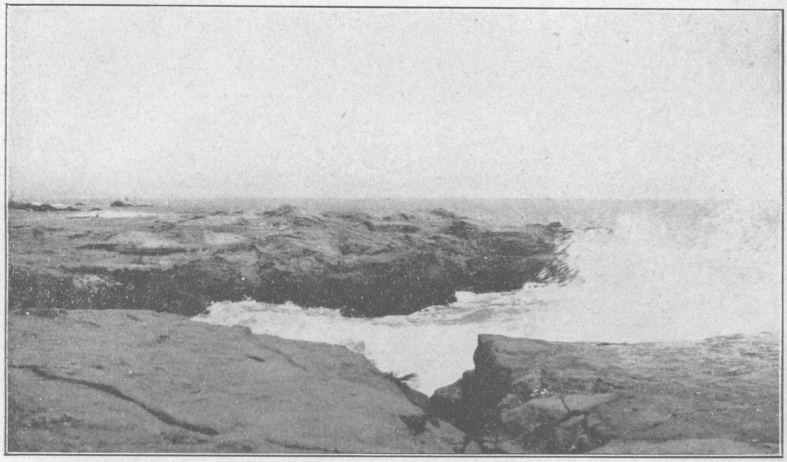


**Fig. 4.** Uplifted abrasion platform, one meter above the water, on the coast of Enoshima : a monument to the great Earthquake of 1923.

At Ayuzuri, two km. south-south-west of Zushi, the basal conglomerate of the Miura series rests unconformably on the highly inclined coarse tuffaceous sandstone of the pre-Miura formations. From Zushi the railway bends broadly to the left and crosses the peninsula from west to east along a trough-like depression formed by parallel faults ; it leads to Yokosuka, the terminus of the branch line, where there is an important Naval Station.

**FUJISAWA** From Ōfuna the train passes the hilly tracts and before entering Fujisawa station it crosses the river Sakai-gawa which marks an important boundary line in the structure of the area. The river Sakai-gawa runs at first southeastward and turns gradually to the south until at Katase it discharges into Sagami Bay. The course is arched and borders the western side of the Tama plateau. The crescentric lowland wedged between the western Dōshi mountain-land and the eastern Tama plateau is named the Sagamino upland ; it is composed of fluviatile sand and gravel of great thickness underlying the loam. The town of Fujisawa is one km. north of the station and stands on the right bank of the river Sakai-gawa. A large part of the town was destroyed by the great catastrophe which occurred in 1923, but reconstruction began at once, and the town is now practically rebuilt.

From Fujisawa we see an excellent faultscarp of a tilted block, the inclined back slope of which descends toward the north ending in an inner basin. The antecedent river Aibiki-gawa cuts through the uplifted margin of the block and flows into the Bay of Sagami.

From Fujisawa an electric car-line runs south crossing the area of sand dunes to Katase, the point on the mainland nearest to Enoshima, which is one of the famous places of interest in the Kwantō.

**ENOSHIMA ISLAND** The Island of Enoshima is connected with the mainland by a long wooden bridge, but when the tide is low, there appears a low beach. The area of the island is 0.25 sq. km. It rises to elevations of about 35 to 60 m., and the summits form a fairly level tableland. The coasts are formed of bold and rugged cliffs, with many fissures and caves running from north to south, islets and rocks arranged almost in the same direction with the above ; the most noted formation is the raised wave-cut platform of about one meter high around the coast (fig. 4). This platform is a

monument to the grandest of the earthquake disturbances which in recent times have visited Japan.

The beds of Enoshima are cut in bold sea cliffs high above the water as described above and afford not only fine shore scenery but also an excellent section of the rocks characteristic of the island. The geologic formations met with in the island are as follows :

Holocene ..... Valley gravel

Pleistocene..... Loam with gravel at its base

Pliocene..... Miura Series { Upper { Tuffaceous sandstone, and agglomeratic tuff. / Lower { Massive tuffaceous sandstone

The foundation of Enoshima consists largely of massive tuffaceous sandstone intercalating tuff breccia, all dipping 30°-40° to the north-north-east ; while the northeastern promontories are formed of well bedded tuffaceous sandstone with basal breccia containing angular fragments of tuffaceous sandstone belonging to the lower series and occasional rounded pebbles derived from the older formations such as the Mineoka series. The strikes of the upper group are somewhat curved (fig. 6), ranging from N 60° W on the west to E-W on the east, and the dips gradually become gentler from the base to the upper part. Passing almost the boundary of the upper and lower groups, there is a fault running N 60° E.

Covering the flat abraded surface of the foundation, there is a thick brown loam intercalating white tuff, the total thickness of which is 20 m. (fig. 5). On the northern end of the island, 25 meters high above the water, we may see a gravel bed directly resting on the tuffaceous sandstone. This gravel is a deposition in the valley bottom cut in the loam, and is decidedly younger than the loam.

**INAMURAGASAKI SHELL BED** From Katase to Hase, where the famous Daibutsu stands, the electric car road is cut in bold sea cliffs high above the water and affords not only fine shore scenery but also an excellent section of the rocks belonging to the Miura series. At Inamuragasaki, about ten meters above the sea water, shell sand is exposed on the bank of a small rivulet. The shell sand contains abundant shells which belong to extant species. A similar shell bed is found at Zaimokuza in Kamakura.

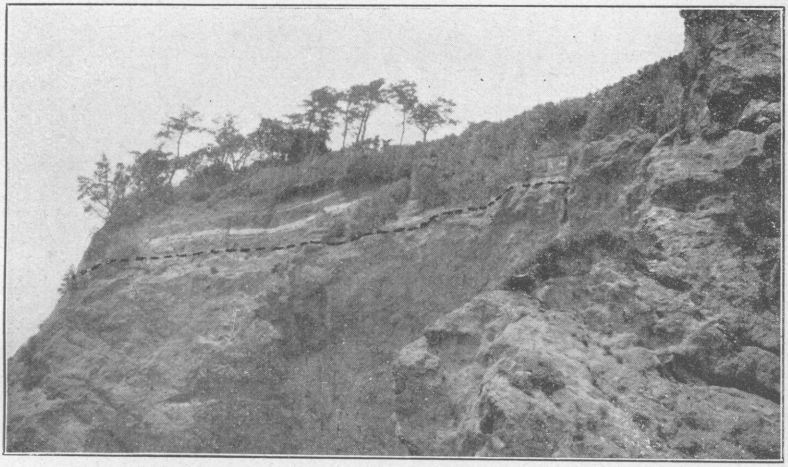


**Fig. 5.** Shore cliff of Enoshima showing stratified loam rests on massive tuffaceous sandstone.

**Fig. 6.** Uplifted sea-coast of Enoshima (northeastern promotary) exposing tuffaceous sandstone of Upper Miura Series with a curved strike.

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大正十五年十二月二十日印行
大正十五年十二月二十五日發行
第三回汎太平洋學術會議
印刷者 木下憲
東京市日本橋區兜町二番地
印刷所 東京印刷株式會社
東京市日本橋區兜町二番地
發賣所 東京地學協會
東京市京橋區木挽町九丁目二十九番地

Executive Office : Rooms of the National Research Council,
Department of Education, Tokyo

CABLE ADDRESS :—KENKYU, TOKYO.

Printed by the Tokyo Printing Co., Ltd.