

GAKUSHUIN NATURAL RADIOCARBON MEASUREMENTS I

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Natural C^{14} measurements have been performed at Gakushuin University since 1959, using a proportional counter of 400 ml (Kigoshi and Tomikura, 1960). The counter presently in service is made of copper tubing and has an effective volume of 900 ml. Acetylene gas is used as counting gas at pressure 600-760 mmHg and prepared in the same way as in the case of 400 ml counter. The counter is shielded by iron sheets of 23-cm thickness and by anti-coincidence with a multianode propane-flow proportional counter of Houterman's type (Houtermans, 1958). A background of 5.6 counts/min has been attained with this counter arrangement. The modern carbon sample filled at 0°C and 760 mmHg shows an activity of 11.8 counts/min. The samples with code numbers greater than GaK-60 were measured by this counter.

The carbon standard used in our measurements is wood from the 1784-to-1800 growth rings of a *Cryptomeria japonica* grown in Mie-ken, Japan. Measurements on single tree rings of this standard sample showed good agreement with each other within the statistical error.

All samples of wood and charcoals were treated with 2 N HCl before combustion. Shells were pretreated with 1 N HCl to dissolve the surface layer. Calculations of age were made assuming the same C^{13}/C^{12} ratio in the samples of wood and charcoal, and correcting the isotopic fractionation in shells using the figures of δC^{13} (-25‰ for wood and 0‰ for shells) given by Craig (Craig, 1953).

In this article almost all measurements made since 1959 having geologic or archaeological meaning are presented. Measurements on tree rings and atmospheric CO_2 which have geophysical and geochemical meaning were presented in separate papers (Kigoshi and Tomikura, 1960, 1961; Kigoshi and Endo, 1961) and omitted here.

Grateful acknowledgment is made to many donors and collectors of samples for descriptions and comments in the date list.

SAMPLE DESCRIPTIONS

I. GEOLOGIC SAMPLES

GaK-110. Osaka Station 9350 ± 190

Wood of *Quercus serrata* from the site near Osaka Station (34° 42' N Lat, 135° 30' E Long, alt 0.75 m), 26.9 m below surface of ground. Sample is imbedded in a layer of sand overlain by marine clay of Umeda layer. Coll. May 1958 by Nat. Railway Corp.; subm. by M. Itihara, Osaka City Univ. *Comment*: the sand layer seems to have been deposited nearly at the sealevel (at least -20 m) of the time shown by the date.

GaK-111. Daito-shi, Osaka **19,800 ± 600**

Peat from W of Mt. Ikoma, Fukano-minami Daito-shi (34° 42' 20" N Lat, 135° 37' 30" E Long, alt 2.5 m), 19.7 m below surface. Sample is from base of the upper of two peat layers. The layer, 1.3 m thick, contains *Menyanthes* remains and is covered with sandy clay (15.5-18.8 m depth) and marine clay (8.2-15.5 m depth). Coll. February 1960 by Fukada Geol. Inst.; subm. by M. Itihara. *Comment*: the lower peat, 0.5 m thick, is separated from the upper peat by clay and sand 1.7 m thick, and is immediately underlain by hard sediments of the Osaka group. See also GaK-164.

GaK-112. Takatsuki, Osaka **26,000 ± 800**

Wood from Takatsuki-shi (34° 51' 10" N Lat, 135° 35' 45" E Long, alt 40.4 m), 3.0-3.3 m below surface. Sample is imbedded in a peat layer within the Tonda gravel layer. The peat layer contains the remains of *Abies homolepis*, *Acer Miyabei* Var. *Shibatai* and *Carpinus erosa*. Coll. March 1960 and subm. by M. Itihara. *Comment*: Tonda gravel layer occurs within a low terrace in the Osaka area and is supposed to correspond to the Tachikawa gravel layer in the Tokyo area.

GaK-163. Nagai, Osaka **>30,000**

Wood from Nagai Station (34° 36' 45" N Lat, 135° 31' E Long, alt 10 m), 9.0 m below surface. Sample is from a peat layer, with *Pinus koraiensis* and *Menyanthes trifoliata*, overlain by marine sandy clay (Uemachi layer) of the middle terrace in Osaka. Coll. March 1959 and subm. by M. Itihara.

GaK-164. Nishitabe, Osaka **>30,000**

Shell of *Anadara granosa bisenensis* Schenck et Reinhart, from Nishitabe, Osaka (34° 37' 20" N Lat, 135° 31' 5" E Long, alt 9.2 m), imbedded in gravel ca. 70 cm thick. Gravel, deeper than 8.5 m below surface, immediately underlain by sediments of the Osaka group. Coll. July 1952 and subm. by H. Kajiyama. *Comment*: date of this sample is closely related to that of GaK-163 as was expected from the stratigraphic relations, but both the peat and the overlying marine layer are beyond the limits of C¹⁴ dating. See also GaK-165.

GaK-165. Sakuramon, Osaka **>30,000**

Shell of *Anadara nodifera* Martens from Sakuramon, Osaka (34° 40' 55" N Lat, 135° 31' 40" E Long, alt 25.0 m), from 7 m below surface, in the Uemachi layer. Coll. April 1951 and subm. by H. Kajiyama. *Comment*: see GaK-164.

GaK-166. Tsutenkaku, Osaka **4840 ± 120**

Shell of *Pecten excavatus* Anton from Tsutenkaku, Osaka (34° 38' 50" N Lat, 135° 30' 30" E Long, alt 3.1 m). Sample is from marine sand 5 m below surface, just above a layer of the Osaka group. Coll. January 1956 and subm. by H. Kajiyama.

GaK-167. Shin-Osaka Station **12,730 ± 340**

Peat from Shin-Osaka Station (34° 43' 40" N Lat, 135° 30' 15" E Long, alt 2.6 m), 22.0 m below surface. Peat layer overlies the sand layer, 1 m thick,

which covers the Tenma gravel layer. Coll. and subm. March 1961 by H. Kajiyama. *Comment*: peat layer contains vivianite and roots of reed, and its fresh water character implies a sealevel of at least -20 m at the time shown by the date.

GaK-168. Niwakubo, Osaka, 1 **4260 ± 110**

Shell of *Ostrea gigas* Thunberg from Niwakubo, Osaka ($34^{\circ} 44' 45''$ N Lat, $135^{\circ} 34' 20''$ E Long, alt 3.3 m), 3.5-4.0 m below surface. Coll. and subm. April 1961 by H. Kajiyama.

GaK-169. Niwakubo, Osaka, 2 **2820 ± 90**

Wood from a locality ca. 200 m from that of GaK-168 ($34^{\circ} 44' 40''$ N Lat, $135^{\circ} 34' 20''$ E Long, alt 3.3 m), 3.0-3.5 m below surface. Sample is imbedded in a peat layer which contains water-caltrop (*Menyanthes*) and vivianite. Coll. and subm. April 1961 by H. Kajiyama. *Comment*: site is in the central part of the plain of Kouchi; the dates of GaK-168 and 169 bracket the time of change from marine to terrestrial conditions, with a fresh water swamp intervening, as the land level rose or the sea fell.

GaK-163. Daisen **3380 ± 60**

Charcoal from S side of Mt. Daisen ($35^{\circ} 21' 47''$ N Lat, $133^{\circ} 32' 37''$ E Long), imbedded in charcoal layer 20-100 cm thick, 20 m below surface, overlain and underlain by volcanic rocks. The charcoal layer is believed to have been formed during an eruption of the volcano Mt. Daisen. Coll. September 1960 and subm. by T. Kimachi.

GaK-115. Edo, Shiga-ken **3180 ± 180**

Wood from N shore of Lake Yogo, Edo, Shiga-ken ($35^{\circ} 31'$ N Lat, $136^{\circ} 12'$ E Long, alt 134 m), 2 m below surface. Sample is part of tree root covered with lacustrine sediments 2 m thick, and 70 cm above present lake level. Coll. January 1961 and subm. by S. Horie, Otsu Hydrobiology Station, Kyoto Univ. *Comment*: sample and its date show a former high (ca. 3 m) level of L. Yogo, after which it fell.

GaK-161. Totchu, Nagano **15,750 ± 390**

Wood from Totchu Akeshinamachi, Nagano ($36^{\circ} 20' 55''$ N Lat, $137^{\circ} 48' 48''$ E Long, alt 600 m). Sample was associated with *Megaceros* and was covered with loam 1.5 m thick. The surface soil, developed in the loam, contains earthenware of the early Jomon culture (Kobayashi, 1958). Coll. and subm. by K. Kobayashi, Shinshu Univ. *Comment*: cf. Y-641, 1590 ± 140 (Stuiver et al., 1960), an unacceptably young date for this wood.

GaK-158. Aiyoshi, Nagano **> 30,000**

Wood from Aiyoshi Tatsuno-machi, Nagano ($36^{\circ} 0' 27''$ N Lat, $137^{\circ} 40'$ E Long), imbedded in the Osakada loam layer with pumice. Coll. and subm. 1961 by K. Kobayashi.

GaK-113. Izumita, Sakaigawa **> 30,000**

Wood of elm or pagoda tree from boring beside river Sakai, overlain by

sand and gravel, Izumita, Sakaigawa, Karitashi Aichi-ken (35° 1' N Lat, 137° 0' E Long, alt 3.2 m), 19.8-21.7 m below surface. Coll. and subm. November 1960, by K. Suyama, Fukada Geol. Inst.

GaK-119. Shirouma-dake, Nagano **520 ± 80**

Wood from the lateral moraine of moraine II of Horie's classification, Shirouma Hakuba-mura, Nagano-ken (36° 45' N Lat, 137° 47' E Long, alt 1500 m), 30 cm below surface. Coll. September 1960 and subm. by S. Horie.

GaK-131. Yanaba, Nagano **> 30,000**

Wood from lacustrine terrace around Lake Aoki and Lake Nakazuna, N of Yanaba Station, Omachi-shi, Nagano (36° 37' N Lat, 137° 51' E Long, alt 820 m). Sample is from ca. 20 m below surface of the terrace and indicates that these lakes were in existence at least 30,000 B.P. Coll. and subm. by S. Horie.

Osawa series, Mt. Fuji

The purpose of the measurements is to know the rate of the development of a big valley (Osawa) on the W side of Mt. Fuji. Samples are wood and charcoal from W of Mt. Fuji (35° 20' 30" N Lat, 138° 37' E Long). Coll. and subm. January 1961 by S. Iwatsuka, Tokyo Univ.

GaK-134. Osawa, 1 **2470 ± 70**

Charcoal preserved as aggregates of several cm diameter under a sand and gravel layer 8 m thick. Sample is in sediments of volcanic mudflow in old Osawa valley, and supposed to have been carbonized by the heat of a mudflow early in the erosion of the valley.

GaK-135. Osawa, 2 **2500 ± 70**

Part of the same sample as GaK-134.

GaK-136. Osawa, 3 **940 ± 60**

Wood from a point ca. 100 m distant from GaK-134, 6 m below surface. Sample is covered by sediments of a volcanic mudflow in present Osawa valley. *Comment:* the stratigraphic relation shows that the dates of Osawa 1 (or 2) and 3 indicate the beginning of the formation of old Osawa valley and present Osawa valley respectively.

Tokyo Bay series

Samples from borings; those of 7-gochi (man-made land in Tokyo Bay) are from SE of the city of Tokyo (30° 39' 0" N Lat, 138° 48' 50" E Long). Depths indicated are measured from mean-tide level of Tokyo Bay. GaK-137 consists of fragments of shells, the other samples are clay with organic matter. Samples of Sunamachi Tokyo consist of clay with organic matter and were taken at points on a line extending from GaK-144, on the shore of Sunamachi (35° 39' 40" N Lat, 138° 49' 40" E Long), to GaK-147, at Yumenoshima (35° 39' 0" N Lat, 138° 49' 40" E Long). Depths are measured from mean-tide level of Tokyo Bay. Coll. and subm. January 1961 by Tokyo Metropol. Harbor Bur.

GaK-137.	7-gochi Tokyo, 12 m depth	980 ± 200
GaK-138.	7-gochi Tokyo, 40 m depth	9870 ± 290
GaK-139.	7-gochi Tokyo, 48 m depth	9310 ± 200
GaK-140.	7-gochi Tokyo, 126 m depth	17,710 ± 440
GaK-144.	Sunamachi, Tokyo, 1, 44.4 m depth	12,300 ± 230
GaK-145.	Sunamachi, Tokyo, 2, 42.4 m depth	11,500 ± 230
GaK-146.	Sunamachi, Tokyo, 3, 40.8 m depth	11,740 ± 200
GaK-147.	Sunamachi, Tokyo, 4, 41 m depth	15,660 ± 740

Comment: all samples are from points near the mouth of River Arakawa. Measured dates indicate a mean sedimentation rate of 5-10 m per 1000 yr, and the rate seems to have been constant over the measured area.

GaK-143. Etchujima, Tokyo > 30,000

Clay from a boring at Etchujima Tokyo (35° 39' 35" N Lat, 138° 47' 40" E Long), 27.3 m below mean-tide level of Tokyo Bay. Coll. December 1958 and subm. by Tokyo Metropol. Harbor Bur. *Comment:* 1 g carbon was obtained from 300 g clay.

GaK-126. Kayabacho, Tokyo > 30,000

Wood from boring at building site, Kayabacho, Tokyo (35° 40' 40" N Lat, 139° 47' 0" E Long, alt -0.37 m), 12.3 m below surface. Sample is from a humus layer, 3 m thick, overlain by the Yuraku-cho layer (sandy silt with shell fragments) and underlain unconformably by hard sand. Coll. and subm. September 1960 by K. Suyama. *Comment:* the early part of the Yurakucho layer seems to be beyond the limits of C¹⁴ dating.

GaK-120. Shinyamashita-cho, Yokohama > 30,000

Wood from boring at building site, Shinyamashita-cho, Yokohama (35° 25' N Lat, 139° 40' E Long (alt -1.56 m), 7.5-8.0 m below surface. Sample is imbedded in hard dark-green marine silt 5 m thick, overlain by marine clay 4 m thick. Coll. and subm. December 1960 by K. Suyama.

Ekoda series, Tokyo

Wood and grass fragments from Ekoda conifer bed, NW of the city of Tokyo. Coll. and subm. June 1961 by Kanto Loam Research Group.

GaK-171. Ekoda, Tokyo, 1 11,330 ± 260

Wood and grass fragments from clay, Ekoda, Tokyo (35° 40' 21" N Lat, 139° 40' 22" E Long), ca. 2 m below surface. *Comment:* 1 g organic carbon was obtained from ca. 1 kg clay by hand-picking fragments of wood and grass.

GaK-172. Ekoda, Tokyo, 2 11,840 ± 290

Sample from same stratigraphic position as GaK-171, from a point ca. 2 m distant. *Comment:* 1 g organic carbon was obtained from ca. 500 g clay. Both samples are overlain by the Tachikawa Loam and the dates of this series

give a maximum age of the Tachikawa Loam. Two measured dates are in good agreement but differ from the date of wood in the same conifer bed (Y-591, $23,700 \pm 600$, Stuiver et al., 1960).

GaK-159. Maebashi **13,130 \pm 230**

Wood from Sojya-machi Maebashi ($36^{\circ} 25' N$ Lat, $139^{\circ} 2' 30'' E$ Long), 40 m below surface. Sample is imbedded in top part of a peat layer overlain by brown pumice. Coll. April 1961 and subm. by F. Arai, Gunma Univ. *Comment*: the pumice is believed to indicate the beginning of big eruptions of Mt. Asama and serves as a time marker in this area. The pumice is older than the Motojuku culture and the dated peat is approximately correlative with the Iwajuku-1 culture (Sugihara, 1956). Pollen analysis of the peat shows that the climate of that time was several degrees colder than at present.

GaK-123. Sekiyado, Chiba **> 30,000**

Peat from Sekiyado-machi Higashi-Katsushika, Chiba ($36^{\circ} 5' N$ Lat, $139^{\circ} 47' E$ Long, alt 14.4 m), 40.8-41.7 m below surface. The peat is interbedded with hard sand (Narita bed) which covers a wide area in Chiba Prefecture. Coll. and subm. September 1960 by K. Suyama. *Comment*: as was expected by stratigraphic relations the Narita bed is beyond the limits of C^{14} dating.

GaK-129. Kazusa Minato, Chiba **8330 \pm 140**

Wood from Kazusa Minato, Amaha-machi, Chiba ($35^{\circ} 15' N$ Lat, $139^{\circ} 50' E$ Long, alt 2 m), several m below surface. Sample is imbedded in marine sediments of Numa Terrace. Coll. February 1961 and subm. by S. Juen, Inst. of Earth Sci., Defense Acad.

GaK-118. Sendai **> 30,000**

Wood from Ipponsugi, Sendai ($38^{\circ} 17' N$ Lat, $140^{\circ} 53' E$ Long, alt 52 m), imbedded in the plant-fossil bed, 10 m thick, 4 m below surface of Musashino Terrace. Coll. by H. Nakagawa, Tohoku Univ.; subm. by S. Juen and S. Horie.

Urami-machi series, Aomori

Peat and wood from borings for buildings in the city of Aomori ($40^{\circ} 48' N$ Lat, $140^{\circ} 45' E$ Long, alt 0.11 m). Peat layer is overlain by volcanic ash 4 m thick and underlain by gravel and pumice. Coll. and subm. September 1960 by K. Suyama. *Comment*: dates of peat are in good agreement and show a big time difference from the date of the volcanic ash.

GaK-121. Urami-machi, 1 **22,200 \pm 900**

Peat from boring no. 1, 26.7 m below surface.

GaK-124. Urami-machi, 2 **23,000 \pm 600**

Peat from boring no. 2, 100 m from site of boring no. 1. Sample is from 27.9-28.7 m below surface, and 2 m below the volcanic ash.

GaK-125. Urami-machi, 3 **21,450 \pm 800**

Peat from the same boring and level as GaK-124.

GaK-122. Urami-machi, 4 **13,900 ± 330**

Wood from a large bog (*Picea*) from boring no. 1, 25 m below surface in the volcanic ash, which is overlain unconformably by sand and silt.

GaK-117. Tottabetsu, Hokkaido **730 ± 90**

Wood from Hidaka Mts., Kasai-gun, Hokkaido (42° 54' N Lat, 142° 45' E Long, alt 1350 m). Sample is from a log included in sediments believed by collector to be till of moraine II of Horie's classification. Coll. 1960 and subm. by S. Horie. *Comment*: date suggests that the sediment may be landslide colluvium rather than till.

GaK-130. Kutcharo, Hokkaido **110 ± 80**

Wood from S shore of Lake Kutcharo, Kawakami-gun, Hokkaido (43° 37' N Lat, 144° 20' E Long, alt 130 m), 1 m below surface. Sample was contained in a pebble of andesite from the middle lacustrine terrace of Lake Kutcharo. Coll. August 1954 and subm. by S. Horie. *Comment*: on geomorphic evidence the terrace seems to be older than the sample date (Horie, 1957).

GaK-133. Akan, Hokkaido **310 ± 80**

Wood from the outside part of a log 1 m in diam, in lacustrine sand and mud on the SW shore of Lake Akan (43° 27' N Lat, 144° 6' E Long, alt 419 m). Coll. August 1951 and subm. by S. Horie.

GaK-132. Kuttara, Hokkaido **1090 ± 60**

Wood from peat layer on SW shore of Lake Kuttara (42° 32' N Lat, 141° 11' E Long, alt 260 m). Peat layer, 40 cm thick ca. 6 m above present lake level, overlies lacustrine sandy clay and is overlain by pumice. Coll. August 1955 and subm. by S. Horie. *Comment*: date suggests a 6-m drop in the level of this closed lake, caused possibly by climatic change.

East Ongul Island series

Shells from East Ongul Island. Coll. by Japanese Antarctic Research Exped.

GaK-200. East Ongul Island, 1 **>30,000**

Small fragments of shells from East Ongul Island (69° 0' 45" S Lat, 39° 34' 6" E Long, alt ca. 4 m). The shells were collected from a mud layer 28 cm thick. The site is 2m from a small pond (10 m diam, 9 cm depth). Coll. January 1961 and subm. by H. Megro, Tokyo Univ. *Comment*: rock surface is depressed at the small pond. Mud and shells in and near the pond are supposed to be remains of sediments of the shallow sea bottom.

GaK-201. East Ongul Island, 2 **3840 ± 110**

Shells from shore of East Ongul Island, ca. 200 m distant from GaK-200 (69° 0' 55" S Lat, 39° 34' 24" E Long, alt ca. 3.5 m). The shells were collected from the surface of sandy shore. The shells include a species (*Adamusi-um* sp.) which is now living near the site. Coll. February 1960 by Y. Yoshida, Tokyo Metropol. Univ.; subm. by E. Megro. *Comment*: the measured date indicates historical change of sealevel, if the shells lived at the sampling point.

II. ARCHAEOLOGIC SAMPLES

A. Andes

Kalasitasaya series, Tiahuanaco

Wood and other organic carbon from Kalasitasaya, Tiahuanaco (17° S Lat, 72° W Long), Bolivia. Coll. by Centro de Inv. Arqueologicas en Tiahuanaco; subm. by E. Ishida, S. Izumi and K. Terada, Tokyo Univ. *Comment*: layer 6 and 4 correspond to the cultural Epoch I and II respectively, the other layers are undetermined.

GaK-51. Kalasitasaya, 1 **630 ± 110**

Organic carbon from Layer 3 (Pit E-14) of pale reddish brown clay. Coll. November 1957.

GaK-52. Kalasitasaya, 2 **2190 ± 130**

Organic carbon from Layer 6 (Pit E-14) of neutral gray clay. Coll. November 1957.

GaK-53. Kalasitasaya, 3 **2410 ± 140**

Organic carbon from Layer 4 (Pit F-15) of charcoal gray black layer. Coll. December 1957.

GaK-55. Garbanzal **1730 ± 70**

Wood from Garbanzal, Peru (3° S Lat, 80° W Long). Sample was taken from a tomb, a part of which is exposed in the side of a brown sand cliff 4 m below its surface. Coll. and subm. July 1958 by E. Ishida, S. Izumi and K. Terada. *Comment*: newly found Garbanzal culture is also known in Ecuador (Ishida et al., 1958).

Las Haldas series, Peru

Organic carbon from the layers of Las Haldas culture, Las Haldas, Ancash, Peru (10° S. Lat, 78° W Long). Coll. and subm. by E. Ishida, S. Izumi and K. Terada. *Comment*: cf. "Andes" (Ishida et al., 1958) p. 191-197.

GaK-106. Las Haldas, 1 **2680 ± 150**

Net made of textile fibres, from Layer 3 (Pit 1), 60 cm below surface. Coll. August 1958.

GaK-107. Las Haldas, 2 **3580 ± 130**

Sugar cane used for binding up a stone pile, from Layer 7 (Pit 1) (brown sand and stone) 140 cm below surface. Coll. August 1958.

GaK-108. Churajon, Peru **540 ± 70**

Organic carbon from Churajon, Moquegua, Peru (17° S Lat, 71° W Long), surface layer 50 cm deep. The sample was in a chullpa (burial stone tower). Coll. August 1958 and subm. by E. Ishida, S. Izumi and K. Terada. *Comment*: Churajon is the only city site of the Urbanist period that has ever been recognized in the South Andes. Cf. "Andes" (Ishida et al., 1958) p. 275-278.

GaK-109. Huaricanga, Peru **3030 ± 70**

Organic carbon from Huaricanga, Dept. Kima, Peru (17° S Lat, 72° W Long). Sample was from a scattered stone pile. Coll. September 1958 and subm. by E. Ishida, S. Izumi and K. Terada. *Comment*: mode of piling of stone is similar to that of Las Haldas. See also GaK-107. cf. "Andes" (Ishida, 1958) p. 203.

*B. Pacific***GaK-152. Ana Teva Shelter, Tahaa, Society Is.** **590 ± 80**

Charcoal from Test Pit 4, 11 in. below surface at bottom of second layer (16° 35' S Lat, 151° 30' W Long), Small dwelling shelter. Well stratified cultural deposit, but shallow. Coll. by Bishop Mus. Tahiti Exped., summer 1960; subm. by K. P. Emory and Y. H. Sinoto, Bishop Mus.

GaK-153. Puu Alii, Hawaii **610 ± 80**

Charcoal from Puu Alii site (H 1), South Point, Kau (18° 54' 45" N Lat, 155° 41' W Long), Hawaii. From Square L-11, 14-17 in. below top of cultural Layer 1, in the thick ash deposit at bottom. Coll. September 1955 by K. P. Emory; subm. by K. P. Emory and Y. H. Sinoto. *Comment*: cf. Gro-2026,2225 2297 (unpub.); see M-863A (580 ± 150, Crane and Griffin, 1959), for discussion.

GaK-154. Tiapaa Society Is., 1 **660 ± 80**

Charcoal from Tiapaa Islet, Maupiti (16° 30' S Lat, 152° 10' W Long), 30 in. below surface in an earth oven located along the shore and partly exposed by wave action. Coll. by Bishop Mus. Tahiti Exped., summer 1960; subm. by K. P. Emory and Y. H. Sinoto.

GaK-155. Tiapaa Society Is., 2 **480 ± 70**

Part of the same sample as GaK-154.

*C. Japan***GaK-54. Yano, Tokyo** **1600 ± 150**

Charcoal from Yano Hachioji, Tokyo, from remains of an oven with fragments of roofing tile supposed to have been used for the construction of Koku-bunji. Coll. 1958 and subm. by M. Naito, Tamagawa Gakuen.

GaK-114. Nanba-guu, Osaka **1610 ± 90**

Wood from Hoen-sakamachi, Osaka (34° 41' N Lat, 135° 31' E Long), 3 m below surface. Site is supposed to be remains of palace (Nanba-guu) of Emperor Nintoku (ca. A.D. 400). Sample was imbedded in the man-made plane layer which is supposed to have been laid down before, perhaps as much as 100 yr before, the construction of Nanba-guu. Coll. 1960 by T. Yamane; subm. by S. Miki, Osaka City Univ.

GaK-170. Kusaka Shell Midden **3060 ± 110**

Shell of *Corbicua sandi* Reinhardt from Kusaka shell midden (34° 41' 25" N Lat, 13° 39' 0" E Long, alt 20 m), 0.7 m below surface. The shell mid-

den contains many shells and fragments of late-Jomon and Yayoi earthenware (Shimada, 1926). Coll. and subm. September 1960 by H. Kajiyama.

GaK-160. Shirataki, Hokkaido **15,800 ± 400**

Wood from Shirataki-mura Yubetsugun, Hokkaido (43° 53' N Lat, 143° 8' E Long), 3.7 m below surface. The sample was imbedded in Shirataki layer which contains a Paleolithic culture (Hokkaido Univ. Res. Group, 1960). Coll. and subm. by K. Kitagawa, Hokkaido Univ.

Old temple series

Samples with code numbers from GaK-61 to GaK-76 are wood of *Chamaecyparis obtusa* Endlicher, used as structural material of old temples in Japan. Other samples are straw, or wood of unidentified species, also related to the construction. Coll. between 1945 and 1956 by J. Kohara, Chiba Univ.

GaK-61. Myoshinji, Kyoto **240 ± 70**

Wood from Sho-hojyo of Myoshinji, Kyoto. Temple constructed ca. A.D. 1653.

GaK-62. Ninnaji, Kyoto **360 ± 45**

Wood from five-storied pagoda of Ninnaji, Kyoto. Temple constructed ca. A.D. 1637.

GaK-63. Koudaiji, Kyoto **290 ± 70**

Wood from Kaizando of Koudaiji, Kyoto constructed in A.D. 1605 or 1606.

GaK-64. Enman-in, Otsu **380 ± 60**

Wood from Shinden of Enman-in, Otsu. Temple constructed ca. 350 yr ago.

GaK-65. Enryakuji, Otsu **380 ± 60**

Wood from Konpon-chudo of Enryakuji, Otsu constructed in A.D. 1642.

GaK-66. Nishi-Honganji, Kyoto **780 ± 100**

Wood from Kokusho-in of Nishi-Honganji, Kyoto. The temple has a complicated history; the Kokushoin is believed to have been constructed in A.D. 1556.

GaK-67. Myoho-in, Kyoto **1210 ± 80**

Wood from Daishoin of Myoho-in, Kyoto. Date of construction unknown.

GaK-68. Kyo-ou-gokokuji, Kyoto **890 ± 65**

Wood from Minami-oumon of Kyo-ou-gokokuji, Kyoto, reconstructed in A.D. 1605.

GaK-70. Byodo-in, Uji **1060 ± 50**

Wood from Hououdo of Byodo-in, Uji, constructed in A.D. 1052.

GaK-71. Rengeouin, Kyoto **670 ± 50**

Wood from Hondo of Rengeouin, Kyoto, constructed in A.D. 1251.

- GaK-72. Daihouonji, Kyoto** **910 ± 70**
Wood from Hondo of Daihouonji, Kyoto, constructed in A.D. 1222.
- GaK-73. Tomyoji, Kyoto** **810 ± 100**
Wood from Hondo of Tomyoji, Kyoto, reconstructed in A.D. 989.
- GaK-74. Horyuji, Nara, 1** **1410 ± 60**
Wood from five-storied pagoda of Horyuji, Nara, believed to have been constructed ca. A.D. 740.
- GaK-75. Horinji, Nara** **1555 ± 90**
Wood from three-storied pagoda of Horinji, Nara, believed to have been constructed ca. AD. 620.
- GaK-76. Gokuraku-in, Nara** **1435 ± 55**
Wood from Hondo of Gokuraku-in, Nara. Date of construction unknown.
- GaK-77. Horyuji Nara 2** **1460 ± 70**
Pieces of straw from earthen wall of five-storied pagoda of Horyuji, Nara.
- GaK-78. Horyuji, Nara, 3** **1410 ± 90**
Wood from a center pole of five-storied pagoda of Horyuji, Nara.
- GaK-79. Daigoji, Kyoto** **1015 ± 85**
Wood from five-storied pagoda of Daigoji, Kyoto, constructed in A.D. 952.

REFERENCES

- Craig, Harmon, 1953, The geochemistry of the stable carbon isotopes: *Geochim. et Cosmochim. Acta*, v. 3, p. 53-92.
- Crane, H. R., and Griffin, J. B., 1959, University of Michigan radiocarbon dates IV: *Am. Jour. Sci. Radioc. Supp.*, v. 1, p. 173-198.
- Hokkaido University Research Group, 1960, Cultural remains from Shirataki site: *Hokkaido Univ. Repts. on the Research of Cultural Development in Northern Part of Japan*, no. 15, p. 207-270.
- Horie, S., 1957, Topographic study of lacustrine terraces and crustal movements around Lake Kutcharo, Hokkaido: *Japanese Jour. Geology and Geography*, v. 28, p. 1-10.
- Houtermans, F. G., and Oeschger, H., 1958, Proportionalzählrohr zur Messung schwacher Aktivitäten weicher β -Strahlung: *Helvetica Phys. Acta*, v. 31, p. 117-126.
- Ishida, E., et al., 1958, "Andes" The report of the University of Tokyo Sci. Exped. to the Andes, *Bijutsu Shuppan-sha*, p. 115-116, 335-336.
- Kigoshi, K., and Tomikura, Y., 1960, Variation of radiocarbon concentration in modern wood: *Chem. Soc. Japan Bull.*, v. 33, p. 1576-1580.
- , 1961, Tritium and carbon-14 in the tree rings: *Chem. Soc. Japan Bull.*, v. 34, p. 1738.
- Kigoshi, K., and Endo, K., 1961, Variation of the atmospheric carbon-14 in recent years at Tokyo: *Chem. Soc. Japan Bull.*, v. 34, p. 1739.
- Kobayashi, K., 1958, Quaternary glaciation of the Japan Alps: *Shinshu Univ., Faculty Liberal Arts and Sci. Jour.*, no. 8, pt. 2, p. 13-67, 12 pls.
- Shimada, S., 1926, Shell midden found at Nakakawachi-gun Kawachinokuni: *Nippon Soc. Jour. Anthropology*, v. 41, p. 12.
- Stuiver, Minze, Deevey, E. S., and Gralenski, J. L., 1960, Yale natural radiocarbon measurements V: *Am. Jour. Sci. Radioc. Supp.*, v. 2, p. 49-61.
- Sugihara, S., 1956, The stone age remains found at Iwajuku, Gunma Prefecture, Japan: *Meiji Univ. Rept. on the Research by the Faculty of Literature, Archaeology*, no. 1, p. 1-64.