3 Results

3.1 Results of U/Th dating in Ishigaki Island

3.1.1 Reliability of dating accuracy for samples

My ^{230}Th dating results, together with the previously reported ^{14}C ages, are shown in Tables 1 and 2. The $\delta^{234}U_{initial}$ values are used as an indicator of diagenetic alteration of fossil corals. If the initial δ^{234}U values of the samples are similar to those of modern corals and seawater, the samples have been kept in the closed system regarding uranium and thorium. In this study, all of our $\delta^{234}U_{initial}$ measurements of *Porites* corals were similar to δ^{234}U value of modern corals (145.8 ‰) reported by Cheng et al. (2000). By using the new ^{234}U decay constant value, the δ^{234}U value of modern corals can be calculated to be 144.1 ‰, which value is still close to our $\delta^{234}U_{initial}$ values. There are some other studies. Delanghe et al. (2002) reported 146.6 ‰ for the δ^{234}U value of modern coral, while Delanghe et al. (2002) and Robinson et al. (2004) reported that value of modern seawater as 149.6 and 146.6 ‰, respectively. These are all similar to our $\delta^{234}U_{initial}$ measurements. Overall, these indicate that correction for such alteration is probably not needed.

The ^{230}Th ages of two horizons of one modern coral core (Samples 98IY03-L and 98IY03-P) and those of three horizons of one *Porites* boulder core IYT1 (Samples IYT1-6-3, IYT1-11-3 and IYT1-16-3) generally agreed well with the ages determined by annual growth band counting (Table 1; Figure 8). However, in detail, the age differences for two samples 98IY03-L and IYT1-6-3 were larger than the estimated error from analytical precision (less than 4 years). Possible cause of the age disagreements is probably heterogeneous inclusion of detrital materials into coral skeleton. The ^{230}Th/^{232}Th ratio of detrital materials may be different from that of dissolved phase in seawater, but the difference becomes significant only for young modern samples (Shen et al. 2008). Thus, these occasional biases from true age would be insignificant for those coral boulders although replicate measurements of coeval samples may be further required to verify the ^{230}Th age accuracy.

Table 1. ^{14}C ages and ^{230}Th ages of massive *Porites* coral boulders on Ishigaki Island.

Sample ID	Location latitude	Location longitude	Size [m]	^{14}C age [year BP ± σ]		$\delta^{234}U_{Initial}$ [a] [‰ ± 2σ]		^{230}Th Age [b] [A.D. ± 2σ]		Date obtained by counting bands [c] [A.D.]	ΔR [years]	Median revised corrected ^{14}C age [A.D.]
Coral boulders												
GPS65	24°30.024'	124°17.043'	4 × 5 × 5	520	±30	147.6	±1.3	1770	±3	-	-16	1764
IYT1-1-3	24°32.820'	124°18.666'	4 × 3 × 3	550	±30	145.4	±1.6	1780	±1	-	16	1766
IYT4-1-2	24°33.971'	124°19.809'	-	620	±30	147.9	±1.3	1772	±5	-	84	1764
IYT3-1	24°33.650'	124°19.455'	-	670	±30	147.2	±1.2	1627	±3	-	-36	1603
IYT2-1	24°33.550'	124°19.357'	-	720	±30	145.4	±1.2	1607	±7	-	5	1594
GPS72[d]	24°31.199'	124°17.968'	7 × 8 × 4	720	±30	145.8	±1.1	1601	±2	-	6	1595
GPS83	24°26.433'	124°15.427'	3 × 3 × 2	500	±150	-	-	-	-	-	-	1837
GPS114	24°26.050'	124°15.044'	3 × 3 × 2	510	±80	-	-	-	-	-	-	1857
GPS122	24°23.839'	124°15.208'	3 × 4 × 3	560	±80	-	-	-	-	-	-	1786
GPS116	24°26.054'	124°15.061'	3 × 3 × 2	600	±80	-	-	-	-	-	-	1756
GPS103	-	-	2 × 2 × 2	650	±80	-	-	-	-	-	-	1621
GPS115	24°26.065'	124°15.037'	3 × 3 × 1	720	±80	-	-	-	-	-	-	1581
Modern coral core												
98IY03-L	-	-	-	425	±30	144.7	±1.3	1904	±2	1910-1912	-25	-
98IY03-P	-	-	-	485	±95	146.9	±1.2	1855	±2	1852-1856	2	-
Fossil coral core												
IYT1-6-3	-	-	-	-	-	148.3	±1.2	1705	±4	1711-1713	-	-
IYT1-11-3	-	-	-	-	-	147.0	±1.3	1659	±2	1658-1659	-	-
IYT1-16-3	-	-	-	-	-	147.9	±1.1	1606	±2	1603-1606	-	-

Decay constants $\lambda_{230} = 9.1705 \times 10^{-6}$ year^{-1} and $\lambda_{234} = 2.82206 \times 10^{-6}$ year^{-1}; $\lambda_{238} = 1.55125 \times 10^{-10}$ year^{-1} (Jaffey et al. 1971).

[a] $\delta^{234}U_{initial}$ was calculated based on the ^{230}Th age (T), i.e., $\delta^{234}U_{initial} = \delta^{234}U_{measured} \times e^{\lambda 234 \times T}$. $\delta^{234}U = ([^{234}U/^{238}U]_{activity} - 1) \times 1000$.

[b] Corrected ^{230}Th ages assuming an initial $^{230}Th/^{232}Th$ atomic ratio of $4.4 \pm 2.2 \times 10^{-6}$, which is the values for a material at secular equilibrium with the bulk earth $^{232}Th/^{238}U$ value of 3.8.

[c] Obtained by counting annual growth bands from the top of the coral.

[d] It is difficult to evaluate the surface position of this boulder.

Table 2. The detailed data of ^{230}Th dating of massive *Porites* coral boulders on Ishigaki Island. Errors are represented by ± 2σ.

Sample ID	^{238}U [ppb]	^{232}Th [ppt]	^{230}Th / ^{232}Th [atomic × 10^{-6}]	$\delta^{234}U$ [a] [‰, measured]	^{230}Th / ^{238}U [activity × 10^{-6}]	^{230}Th Age [year, uncorrected]	^{230}Th Age [b] [year, corrected]	$\delta^{234}U_{Initial}$ [c] [‰, corrected]
Coral boulders								
GPS65	2549 ±3	190 ±4	557 ±13	147.5 ±1.3	2527 ±25	240 ±2	238 ±3	147.6 ±1.3
IYT1-1-3	2498 ±3	35 ±8	2834 ±650	145.3 ±1.6	2397 ±14	228 ±1	228 ±1	145.4 ±1.6
IYT4-1-2	2709 ±3	723 ±14	158 ±3	147.8 ±1.3	2555 ±24	243 ±2	236 ±5	147.9 ±1.3
IYT3-1	2591 ±3	243 ±5	708 ±15	147.0 ±1.2	4026 ±22	383 ±2	381 ±3	147.2 ±1.2
IYT2-1	2759 ±3	961 ±19	203 ±4	145.2 ±1.2	4298 ±22	410 ±2	401 ±7	145.4 ±1.2
GPS72	2861 ±3	196 ±4	1033 ±21	145.6 ±1.1	4288 ±20	409 ±2	407 ±2	145.8 ±1.1
Modern coral core								
98IY03-L	2529 ±3	58 ±1	797 ±23	144.7 ±1.3	1101 ±22	105 ±2	104 ±2	144.7 ±1.3
98IY03-P	2367 ±2	83 ±2	763 ±19	146.9 ±1.2	1621 ±21	154 ±2	153 ±2	146.9 ±1.2
Fossil coral core								
IYT1-6-3	2427 ±3	84 ±2	1511 ±39	148.2 ±1.2	3190 ±42	303 ±4	303 ±4	148.3 ±1.2
IYT1-11-3	2356 ±2	56 ±1	2554 ±56	146.9 ±1.3	3669 ±23	349 ±2	349 ±2	147.0 ±1.3
IYT1-16-3	2187 ±2	46 ±1	3293 ±71	147.7 ±1.1	4225 ±21	402 ±2	402 ±2	147.9 ±1.1

Decay constants $\lambda_{230} = 9.1705 \times 10^{-6}$ year^{-1} and $\lambda_{234} = 2.82206 \times 10^{-6}$ year^{-1}; $\lambda_{238} = 1.55125 \times 10^{-10}$ year^{-1} (Jaffey et al. 1971).

[a] $\delta^{234}U = ([^{234}U/^{238}U]_{activity} - 1) \times 1000$.

[b] Corrected ^{230}Th ages assuming an initial $^{230}Th/^{232}Th$ atomic ratio of $4.4 \pm 2.2 \times 10^{-6}$, which is the values for a material at secular equilibrium with the bulk earth $^{232}Th/^{238}U$ value of 3.8.

[c] $\delta^{234}U_{initial}$ was calculated based on the ^{230}Th age (T), i.e., $\delta^{234}U_{initial} = \delta^{234}U_{measured} \times e^{\lambda 234 \times T}$.

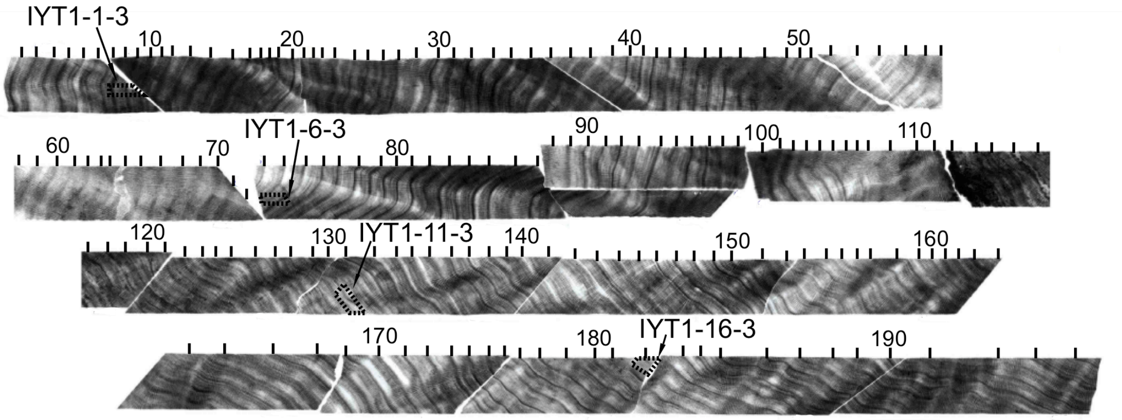

Figure 8. Positive X-radiograph prints of 6-mm-thick slabs of the *Porites* boulder core IYT1. Alternating bands of high (dark color) and low (light color) skeletal density are visible. A high/low density band pair represents one year of growth. The number of years of coral growth correspond to that of density band pairs. Skeletal portions used for ^{230}Th dating are outlined by dotted lines. Core length is 3.2 m and core diameter is 5.5 cm.

3.1.2 Correlation between dating results and historical documents

The "Kyuyo" and "Yaeyama-jima Nenraiki" chronicles describe three inundation disaster events on Ishigaki Island: the 1771 Meiwa earthquake tsunami and two other inundation events with unspecified causes (1625, 1714). These inundation events could be caused not only by tsunamis but also by extreme storms. For these two inundation events, the "Yaeyama-jima Nenraiki" chronicles report only that "a large wave came from . . . .", so that it is difficult to know whether to ascribe them to an earthquake tsunami or a severe typhoon. In addition, a tsunami that occurred on 20–21 October in 1687 as a result of earthquakes off the Peruvian coast (two large earthquakes with magnitudes estimated at 8.0 and 8.4, Dorbath et al. 1990) and was recorded in Okinawa Island, though not in Ishigaki Island. Although no damage was described in the chronicles, this tsunami should have struck Ishigaki Island. Therefore, at least four recognized coastal paleo-inundation events affected Ishigaki Island during the 17–19th centuries. Of the six *Porites* boulders dated by the ^{230}Th method (Figure 2b-2f), two (samples GPS65 and IYT4-1-2) could be directly related to the 1771 Meiwa earthquake tsunami within the analytical error (2σ) of approximately 5 years (Table 1). The date of another specimen (sample IYT3-1) corresponds to the 1625 event (Table 1).

3.1.3 Calculation of local marine reservoir correction values

I plotted the marine reservoir ages and ΔR values calculated from pairs of ^{230}Th and ^{14}C ages obtained from the same coral samples as a function of age (Figure 9). I calculated mean ΔR values for three time windows: 10 ± 37 years for 1600–1780; –8 ± 20 years for 1600–1630; and 28 ± 42 years for 1770–1780. The revised conversions of the ^{14}C ages to calendar ages based on the newly determined ΔR values are shown in Table 1.

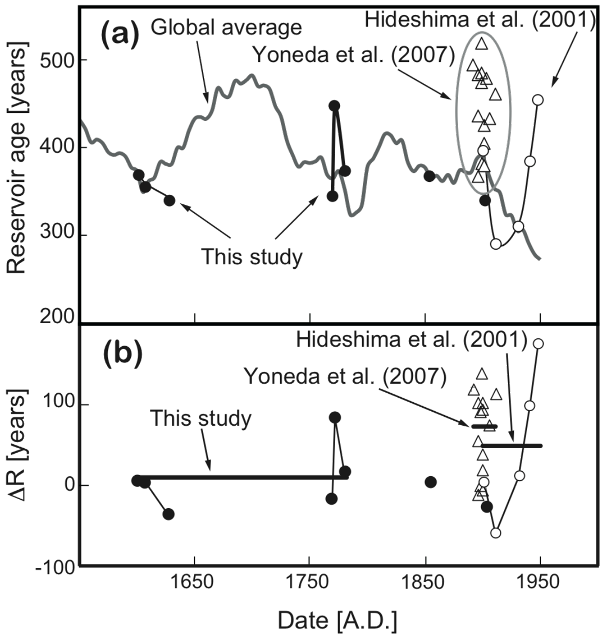

Figure 9. Temporal variations of (a) radiocarbon reservoir ages and (b) ΔR in the Kuroshio region. Symbols: closed circles, this study; open circles, Hideshima et al. (2001); open triangles, Yoneda et al. (2007). The gray curve in panel (a) shows the mean global average of marine reservoir ages (MARINE04; Hughen et al. 2004). The horizontal bars in panel (b) indicate the mean ΔR values of each study: this study, 10 ± 37 years (n = 6); Hideshima et al. (2001), 49 ± 41 years (n = 5); Yoneda et al. (2007), 73 ± 17 years (n = 14).

3.2 Results of Radiocarbon darting in Southern Ryukyu Islands

3.2.1 Reliability of dating accuracy for samples

To check the accuracy of radiocarbon dating, we measured ^{14}C ages of different surfaces of one colony (sample MH11; Figure 6) and the results were well agreed within the dating error (Table 3). Therefore, if the youngest parts of the boulders were collected exactly, accurate sample ages would be obtained by ^{14}C dating. Reproducibility of calibrated ^{14}C ages was also evaluated by measuring same sample (sample MH11-1; Figure 7) for several times (Table 4).

I measured ^{14}C ages of boulders found at Miyako (sample MH5 and MH10; Figure 10) and Ishigaki Islands (sample H1), which have different growth axes in the process of growing (Table 5). If the growth rate of the coral are assumed as 1 centimeter per a year in Ryukyu region, difference of the ages were consistent, indicating that these boulders have a potential for recording the tsunami events twice (Table 5).

Table 3. The ^{14}C ages of the surface parts of massive *Porites* boulder (MH11).

Sample ID	Location		Size	^{14}C age	Calibrated ^{14}C age [cal AD]		
	Latitude	Longitude	[m]	[year BP ± σ]	±1σ range (probability)	±2σ range (probability)	Median
MH11-1-1	24°43.744'	125°27.002'	2.5 × 2.2 × 1.5	425 ±57	1841 — 1951	1722 — 1951	1877
MH11-2				460 ±48	1827 — 1951	1721 — 1951	1904
MH11-3				438 ±71	1819 — 1951	1714 — 1951	1755

Table 4. Reproducibility of calibrated ^{14}C ages by dating same sample (MH11-1).

Sample ID	Location		Size	^{14}C age	Calibrated ^{14}C age [cal AD]		
	Latitude	Longitude	[m]	[year BP ± σ]	±1σ range (probability)	±2σ range (probability)	Median
MH11-1-1	24°43.744'	125°27.002'	2.5 × 2.2 × 1.5	425 ±57	1841 — 1951	1722 — 1951	1877
MH11-1-2				380 ±39	1881 — 1951	1809 — 1951	1865
MH11-1-3				583 ±53	1667 — 1827	1626 — 1951	1861

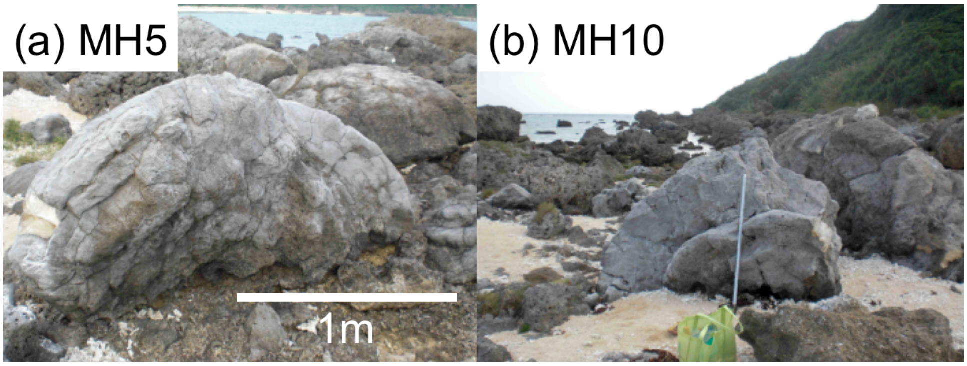

Figure 10. Photographs of *Porites* boulders having different growth axes at Miyako Island.

Table 5. The ^{14}C ages of the surfaces of massive *Porites* boulders having different growth axes.

Sample ID	Location		Size	^{14}C age	Calibrated ^{14}C age [cal AD]		
	Latitude	Longitude	[m]	[year BP ± σ]	±1σ range (probability)	±2σ range (probability)	Median
Boulder MH5							
MH5-1	24°43.744'	125°26.995'	1.8 × 1.5 × 1	1184 ±52	1173 — 1292	1071 — 1324	1226
MH5-2				1125 ±104	1182 — 1386	1057 — 1440	1268
MH10-1	24°43.724'	125°26.993'	- × - × -	1382 ±49	965 — 1114	895 — 1183	1034
MH10-2				1327 ±106	988 — 1219	849 — 1296	1089
Boulder H1							
H1-1	-	-	- × - × -	1456 ±62	880 — 1036	781 — 1120	952
H1-2				1351 ±76	985 — 1170	888 — 1254	1069

As ΔR values are generally not constant over time, strictly it may not be appropriate to apply one estimated ΔR value for 1600-1780 to samples of different ages. However, although no data exist in Ryukyu region except for Hideshima et al. (2001), Yoneda et al. (2000, 2007) and this study. Yamaguchi et al. (2004) and Yu et al. (2010) reported local ΔR values around Taiwan and South China Sea near Southern Ryukyus, respectively, and suggested that the variation of ΔR values were not substantial since middle Holocene. Therefore, in this study I applied my estimated ΔR value to convert ^{14}C ages of all samples into calendar ages.

3.2.2 Calibrated ^{14}C ages of Porites coral boulders

I measured the age of 125 samples from 77 boulders (Table 6). The locations of ^{14}C-dated boulders were shown together with own dates in Figure 11. The results of ^{14}C measurements also showed various ages from more than 2500 years ago to nearly present (Figure 12), which could be attributed to various paleo-tsunamis other than the 1771 Meiwa tsunami. In Miyako and Kurima Islands, many boulders were attributed to tsunamis older than the Meiwa tsunami (Figure 11). Some *Porites* boulders showed much older ages, which were about 3900, 4600, and 5800 years ago. According to these results, past tsunami disasters were likely happened in this region constantly during this period.

Table 6. The ^{14}C ages of 77 *Porites* coral boulders at Southern Ryukyu Islands.

Sample ID	Location: Latitude	Location: Longitude	Size [m]			^{14}C age [year BP ± σ]		Calibrated ^{14}C age [cal AD]: ±1σ range (probability)	±2σ range (probability)	Median
Boulders on Ishigaki Island										
GPS65	24°30.024'	124°17.043'	5	× 5	× 4	520	±30	1719 — 1876	1703 — 1951	1815
IYT1-1-3	24°32.820'	124°18.666'	4	× 3	× 3	550	±30	1695 — 1833	1675 — 1951	1781
IYT4-1-2	24°20.750'	124°14.508'	—	—	—	620	±30	1647 — 1804	1559 — 1838	1699
IYT3-1	24°29.626'	124°16.884'	—	—	—	670	±30	1577 — 1690	1515 — 1802	1639
IYT2-1	24°29.749'	124°16.893'	—	—	—	720	±30	1542 — 1650	1496 — 1680	1593
Bari9	24°31.199'	124°17.968'	9	× 7	× 4	298	±62	1882 — 1951	1775 — 1951	1904
GPS83	24°26.433'	124°15.427'	3	× 3	× 2	500	±150	1717 — 1951	1541 — 1951	1783
GPS114	24°26.050'	124°15.044'	3	× 3	× 2	510	±80	1721 — 1949	1668 — 1951	1814
GPS122	24°23.839'	124°15.208'	3	× 4	× 3	560	±80	1676 — 1878	1593 — 1951	1775
GPS116	24°26.054'	124°15.061'	3	× 3	× 2	600	±80	1636 — 1856	1551 — 1951	1736
GPS103	—	—	2	× 2	× 2	650	±80	1542 — 1803	1485 — 1891	1670
GPS115	24°26.065'	124°15.037'	3	× 3	× 1	720	±80	1510 — 1672	1448 — 1805	1597
GPS68	24°30.650'	124°17.464'	5	× 4	× 4	240	±50	1893 — 1943	1884 — 1951	1912
GPS69	24°30.641'	124°17.435'	2	× 2	× 3	260	±80	1872 — 1951	1730 — 1951	1900
GPS111	24°26.019'	124°15.057'	4	× 3	× 3	390	±80	1834 — 1951	1720 — 1951	1873
GPS102	24°25.995'	124°15.046'	3	× 3	× 3	450	±80	1776 — 1951	1702 — 1951	1849
GPS119	24°23.865'	124°15.194'	4	× 3	× 2	460	±80	1775 — 1951	1698 — 1951	1844
GPS15	—	—	4	× 3	× 1	980	±80	1320 — 1445	1249 — 1518	1384
GPS3-A	24°27.830'	124°15.245'	—	—	—	856	±226	1288 — 1694	1132 — 1951	1497
GPS56	24°29.245'	124°16.682'	—	—	—	632	±38	1626 — 1804	1537 — 1831	1715
GPS96-A	24°26.169'	124°15.096'	—	—	—	832	±40	1445 — 1538	1421 — 1631	1498
GPS36	24°24.134'	124°15.365'	—	—	—	1609	±39	719 — 850	676 — 916	791
GPS38	24°24.153'	124°15.383'	—	—	—	782	±62	1477 — 1618	1437 — 1673	1547
GPS71	24°31.014'	124°17.991'	—	—	—	752	±54	1508 — 1637	1458 — 1679	1570
GPS5	24°28.284'	124°15.513'	—	—	—	933	±56	1353 — 1468	1307 — 1516	1418
H1	—	—	—	—	—	1456	±62	880 — 1036	781 — 1120	952
ITFS-1	24° 28.525'	124° 15.559'	—	—	—	1938	±71	386 — 576	275 — 643	473
Boulders on Tarama Island										
TRM 8	24°39.262'	124°43.656'	1.7	× 1.8	× 0.5	1356	±41	1001 — 1132	929 — 1199	1064
TRM 12	24°38.591'	124°42.997'	1.4	× 1.3	× 0.4	720	±47	1534 — 1655	1476 — 1694	1592
TRM 19	24°38.420'	124°42.727'	2.2	× 1.1	× 0.9	1957	±161	262 — 623	56 — 775	431
TRM 26	24°38.278'	124°42.377'	1.2	× 1.1	× 0.5	1172	±285	929 — 1459	616 — 1705	1192
TRM 34	24°38.277'	124°42.377'	4.3	× 4.2	× 2.8	420	±118	1765 — 1951	1664 — 1951	1837
TRM 45	24°38.266'	124°42.292'	1.3	× 0.9	× 1.4	630	±56	1623 — 1808	1525 — 1879	1691
TRM 47	24°38.254'	124°42.278'	2.9	× 2.2	× 2.5	1008	±131	1259 — 1472	1109 — 1617	1362
TRM 48	24°38.258'	124°42.236'	2.6	× 2.7	× 2	486	±132	1724 — 1951	1574 — 1951	1800
TRM 51	24°38.284'	124°42.202'	2.9	× 2.8	× 1.4	717	±130	1457 — 1716	1406 — 1951	1613
TRM 69	24°38.290'	124°41.850'	3.6	× 3.4	× 3.6	423	±54	1846 — 1951	1723 — 1951	1881
TRM 72	24°38.297'	124°41.850'	1.7	× 1.8	× 1.4	507	±94	1722 — 1950	1640 — 1951	1810
TRM 77	24°38.297'	124°41.871'	2.5	× 2.5	× 2.5	579	±53	1670 — 1829	1633 — 1951	1759
TRM 87	24°38.284'	124°41.902'	1.8	× 1.4	× 0.8	497	±85	1731 — 1951	1670 — 1951	1820
TRM 92	24°38.285'	124°41.999'	3	× 2.5	× 1.7	245	±44	1895 — 1940	1851 — 1951	1913
TRM 99	24°38.290'	124°42.036'	1.6	× 1.4	× 1.3	308	±39	1891 — 1945	1842 — 1951	1911
TRM 101	24°38.289'	124°42.040'	2	× 1.9	× 1.7	480	±50	1807 — 1951	1713 — 1951	1850
TRM 107	24°38.289'	124°42.087'	1.5	× 1.4	× 0.8	266	±40	1895 — 1940	1851 — 1951	1913
TRM 117	24°38.284'	124°42.133'	2	× 1.9	× 0.5	1707	±61	637 — 777	561 — 867	701
TRM 196-2	24° 40.480'	124° 41.339'	1.9	× 1.9	× 1.5	318	±65	1874 — 1951	1730 — 1951	1901
TRM 197	24° 40.498'	124° 41.343'	4.2	× 3.7	× 3.8	5382	±68	-3890 — -3705	-3950 — -3636	-3794
TRM 198	24° 40.498'	124° 41.384'	1.5	× 1.5	× 1	367	±38	1885 — 1951	1822 — 1951	1906
TRM 201-1	24° 38.301'	124° 41.973	1.2	× 1	× 0.8	295	±56	1886 — 1951	1822 — 1951	1907
TRM 202	24° 38.282'	124° 42.379'	1.4	× 1.3	× 0.6	575	±122	1651 — 1950	1529 — 1951	1750
TRM 203	24° 38.276'	124° 42.379'	1	× 0.9	× 0.7	1490	±84	819 — 1019	705 — 1104	916

Table 6. The ^{14}C ages of 77 *Porites* coral boulders at Southern Ryukyu Islands.

Sample ID	Location		Size	^{14}C age	Calibrated ^{14}C age [cal AD]		
	Latitude	Longitude	[m]	[year BP ± σ]	±1σ range (probability)	±2σ range (probability)	Median
Boulders on Minna Island							
GPS229	24° 45.448'	124° 41.283'	4 × 3.6 × 2.6	388 ±55	1861 — 1951	1725 — 1951	1893
GPS232	24° 45.464'	124° 41.418'	— — —	2502 ±58	-322 — -130	-368 — -29	-205
GPS236	24° 45.264'	124° 41.626'	— — —	521 ±50	1714 — 1884	1694 — 1951	1813
GPS237	24° 45.212'	124° 41.697'	1.1 × 1.1 × 0.3	3918 ±55	-2037 — -1845	-2126 — -1745	-1939
GPS240	24° 44.836'	124° 41.897'	4.7 × 3.9 × 3.4	527 ±50	1710 — 1877	1691 — 1951	1807
GPS241	24° 44.819'	124° 41.899'	2.8 × 2.5 × 2	494 ±47	1774 — 1951	1709 — 1951	1839
GPS242	24° 44.818'	124° 41.901'	3.5 × 2.7 × 2	693 ±52	1545 — 1675	1477 — 1803	1614
GPS243	24° 44.816'	124° 41.899'	2.1 × 1.9 × 2	684 ±46	1556 — 1681	1490 — 1803	1623
GPS249	24° 45.109'	124° 41.463'	— — —	1298 ±49	1050 — 1182	1001 — 1256	1121
GPS252	24° 45.039'	124° 41.598'	— — —	618 ±49	1645 — 1808	1540 — 1881	1706
GPS254	24° 44.918'	124° 41.724'	— — —	551 ±49	1690 — 1851	1672 — 1951	1785
GPS255	24° 44.932'	124° 41.769'	— — —	985 ±48	1332 — 1428	1294 — 1465	1381
Boulders on Miyako Island							
MH1	24°43.700'	125°26.981'	1.5 × 1 —	2568 ±42	-351 — -212	-396 — -126	-276
MH2	24°43.710'	125°26.988'	1.8 × 1.2 —	382 ±122	1773 — 1951	1679 — 1951	1847
MH4	24°43.720'	125°26.990'	2 × 2 × 1	1514 ±146	730 — 1034	611 — 1214	893
MH5	24°43.720'	125°26.995'	1.8 × 1.5 × 1	1125 ±104	1182 — 1386	1057 — 1440	1268
MH6	24°43.741'	125°26.990'	4 × 2.5 × 1.5	683 ±56	1546 — 1686	1489 — 1805	1625
MH10	24°43.724'	125°26.993'	— — —	1382 ±49	965 — 1114	895 — 1183	1034
MH11	24°43.744'	125°27.002'	2.5 × 2.2 × 1.5	380 ±39	1881 — 1951	1809 — 1951	1904
Boulders on Shimochi Island							
GPS267	24° 50.345'	125° 8.780'	— — —	2845 ±55	-743 — -548	-783 — -426	-631
GPS272	24° 50.367'	125° 8.663'	— — —	651 ±56	1545 — 1720	1502 — 1840	1663
GPS277	24° 50.419'	125° 8.314'	5.5 × 5 × 3	459 ±23	1851 — 1951	1724 — 1951	1882
GPS278	24° 50.421'	125° 8.340'	5.5 × 4.3 × 3.6	414 ±21	1882 — 1951	1819 — 1951	1904
Boulders on Kurima Island							
GPS284	24° 43.393'	125° 14.363'	1.5 × 0.7 —	2211 ±61	70 — 245	-26 — 339	153
GPS286	24° 43.472'	125° 14.379'	1.3 × 0.7 —	1621 ±54	700 — 845	660 — 936	782
GPS288	24° 43.528'	125° 14.390'	1.8 × 1.4 —	1894 ±53	445 — 594	377 — 661	520

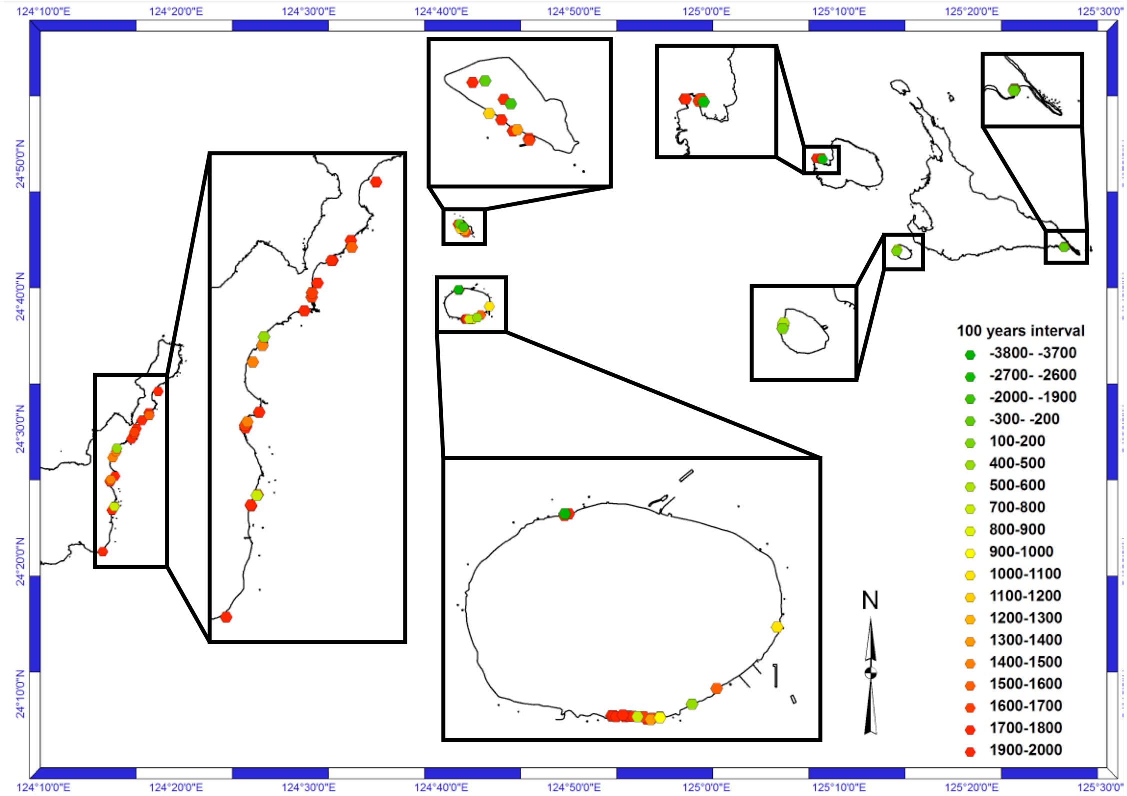

Figure 11. Distribution of the [14]C-dated *Porites* boulders. Color variation shows separating each date with 100 year.

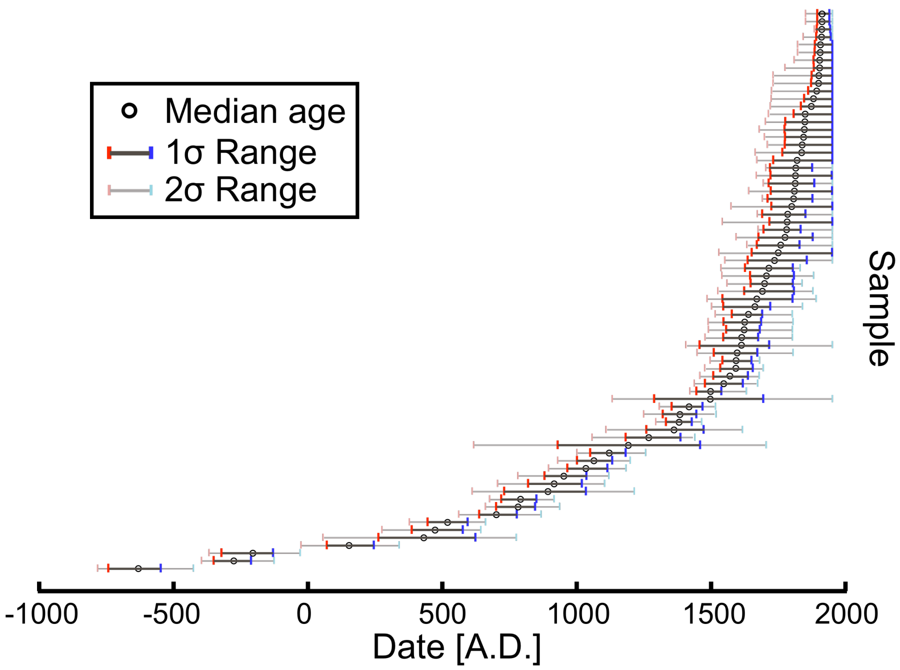

Figure 12. Calibrated [14]C ages of the *Porites* boulders and its age distributions. Some *Porites* boulders showed much older ages, which were not shown in this Figure.