

Replication document for age-depth model of Ha Makotoko

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Load Necessary Libraries and Data

```
library(Bchron)
library(ggplot2)

hm_data <- read.csv("../Data/HM_age_depth_isotopes.csv")

hm_data_bchron <- read.csv("../Data/HM_age_depth_bchron.csv")[-c(6),]

sample_depths <- hm_data$depth_m
sample_depths <- sample_depths[!is.na(sample_depths)]
interp_depth_range <- range(sample_depths)
interp_depths <- seq(0,
                     interp_depth_range[2],
                     0.01)
```

Run Bchronology

```
hm_agedepth <- Bchronology(ages = hm_data_bchron$c14age,
                          ageSds = hm_data_bchron$sd,
                          positions = hm_data_bchron$depth - 0.06,
                          positionThicknesses = hm_data_bchron$thickness,
                          calCurves = hm_data_bchron$curve,
                          predictPositions = interp_depths,
                          extractDate = 1950 - 2009)
```

Summarize the model

```
hm_agedepth_mean <- apply(hm_agedepth$thetaPredict,
                          2,
                          mean)

hm_agedepth_quant <- t(apply(hm_agedepth$thetaPredict,
                          2,
                          quantile,
                          probs = c(0.05, 0.95)))

hm_agedepth_summary <- data.frame(Depth = interp_depths,
```

```

Mean = hm_agedepth_mean,
L05 = hm_agedepth_quant[, 1],
U95 = hm_agedepth_quant[, 2])

hm_agedepth_summary_sample <- subset(hm_agedepth_summary,
                                     Depth %in% sample_depths)

```

Write out results

```

write.table(hm_agedepth_summary,
            file = "../Output/hm_agedepth_Bchron.csv",
            sep = ",",
            row.names = F)

write.table(hm_agedepth_summary_sample,
            file = "../Output/hm_agedepth_Bchron_sample.csv",
            sep = ",",
            row.names = F)

hm_data_with_agedepth <- merge(hm_data,
                               hm_agedepth_summary_sample,
                               by.x = 5,
                               by.y = 1)

write.table(hm_data_with_agedepth,
            file = "../Output/hm_agedepth_Bchron_sample_merged.csv",
            sep = ",",
            row.names = F)

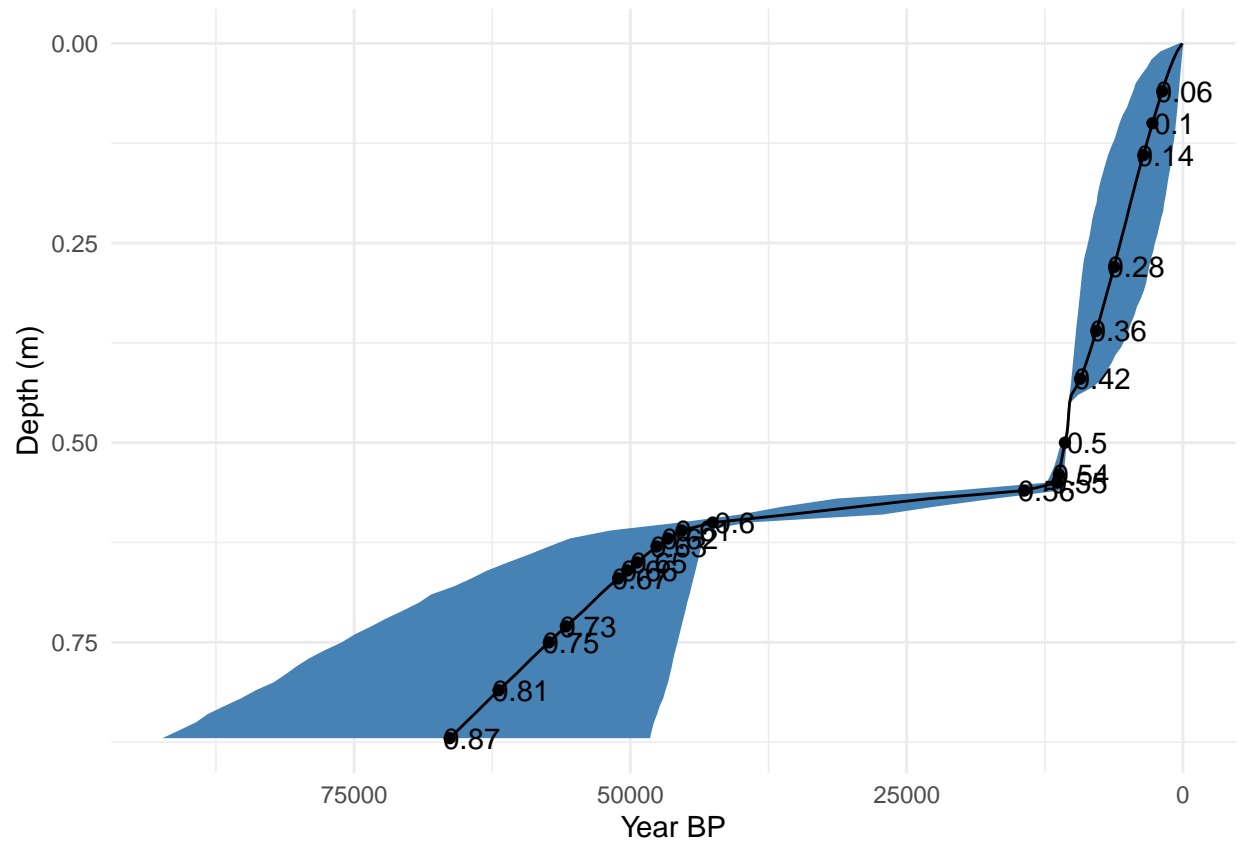
```

Plot the model

```

ggplot(hm_agedepth_summary) +
  geom_ribbon(mapping = aes(xmin = L05, xmax = U95, y = Depth),
            fill = "steelblue") +
  geom_line(mapping = aes(y = Depth, x = Mean)) +
  geom_point(data = hm_agedepth_summary_sample,
            mapping = aes(y = Depth, x = Mean)) +
  geom_text(data = hm_agedepth_summary_sample,
            mapping = aes(y = Depth, x = Mean, label = Depth),
            nudge_x = 2000) +
  labs(x = "Year BP",
       y = "Depth (m)") +
  scale_y_reverse() +
  scale_x_reverse() +
  theme_minimal()

```



```
ggsave(device = "pdf",
        file = "../Output/agedepth_Bchron.pdf")
```

```
## Saving 6.5 x 4.5 in image
```