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$depth,
                           positionThicknesses = hm_data_bchron$thickness,
                           calCurves = hm_data_bchron$curve,
                           predictPositions = interp_depths)
```

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)
```

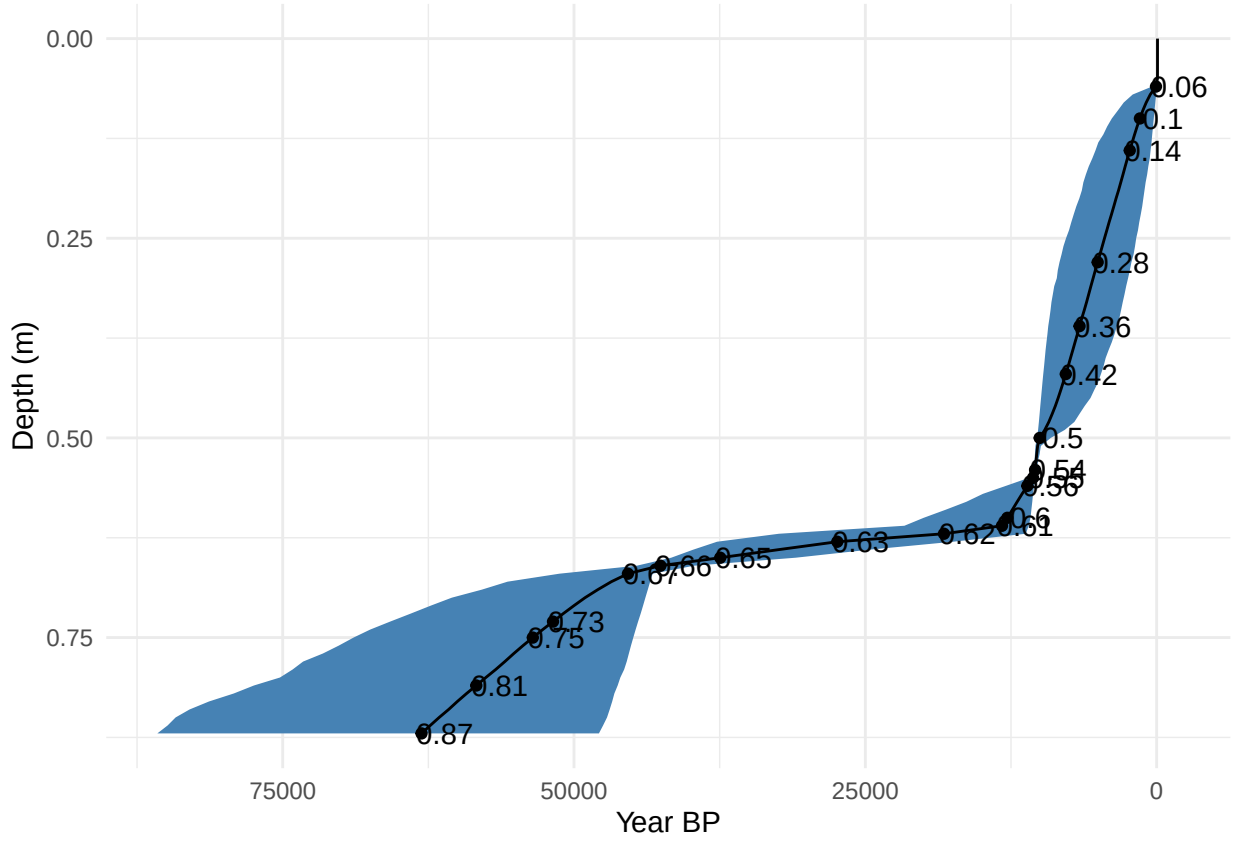
Write out results

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

write.table(hm_agedepth_summary_sample,
            file = "./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)

# funcion for rounding if a column is numeric (for print/publication formatting of the age-depth summary
round_numeric <- function(x){
    if(is.numeric(x)){
        return(round(x, 2))
    } else{
        return(x)
    }
}

hm_data_with_agedepth_rnd <- hm_data_with_agedepth
for(j in 1:ncol(hm_data_with_agedepth_rnd)){
    hm_data_with_agedepth_rnd[, j] <- round_numeric(hm_data_with_agedepth_rnd[, j])
}

write.table(hm_data_with_agedepth_rnd,
            file = "./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 = "./agedepth_Bchron.pdf")
```

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