

Supplemental Material

Supplementary Figure S1. (A) Probabilistic curves and histograms for detrital zircons in SW Ecuador and NW Peru. (B) Newly acquired U/Pb ages for the CT005 sample in NW Peru.

Supplementary Figure S2. (A) $\epsilon\text{Hf}(t)$ and (B) $\delta_{18}\text{O}$ as a function of sedimentary formations plotted against crystallization ages ($^{206}\text{Pb}/^{238}\text{U}$). $\epsilon\text{Hf}(t)$ values are normalized to present day chondritic values (CHUR). Vertical and horizontal bars represent 2σ values.

Supplementary Figure S3. (A) Representative plots of REE distribution. (B) Analysis of the standard zircon 91500. (C) $\log(\text{U}/\text{Yb})$ vs. Hf and $\log(\text{Nb}/\text{Yb})$ compared to continental and oceanic domains (Grimes et al., 2015). (D) Gd/Yb vs. Nb/Yb showing high fractionation values for the 65–45 Ma interval. (E) Mean Th/U plotted against $^{206}\text{Pb}/^{238}\text{U}$ age in 5 Ma intervals.

Supplementary Figure S4. Industrial seismic line showing the forearc area located between the border of the Chongón-Colonche Hills and the Andean piedmont near the Macuchi Block. The vertical exaggeration of the line is ~ 5 . See Aizprua et al. (2020) for more details.

Supplementary Figure S5. $\epsilon\text{Hf}(t)$ plotted against crystallization ages ($^{206}\text{Pb}/^{238}\text{U}$) showing model ages for mantle zircons (black dots). The $^{176}\text{Lu}/^{177}\text{Hf}$ evolution trend is inspired from Jones et al. (2015) for the Central Andes. Model ages (arrows) are from evolved $\epsilon\text{Hf}(t)$ values paired with $\delta_{18}\text{O}$ values for the 75–65 Ma and 45–30 Ma clusters.

Table S1. Sample information

Table S2A. U-Pb data for sample CT005

Table S2B. Operating conditions for the LA-ICP-MS equipment (**U-Pb**)

Table S3A. Lu-Hf isotopic data

Table S3B. Standards for Lu-Hf data

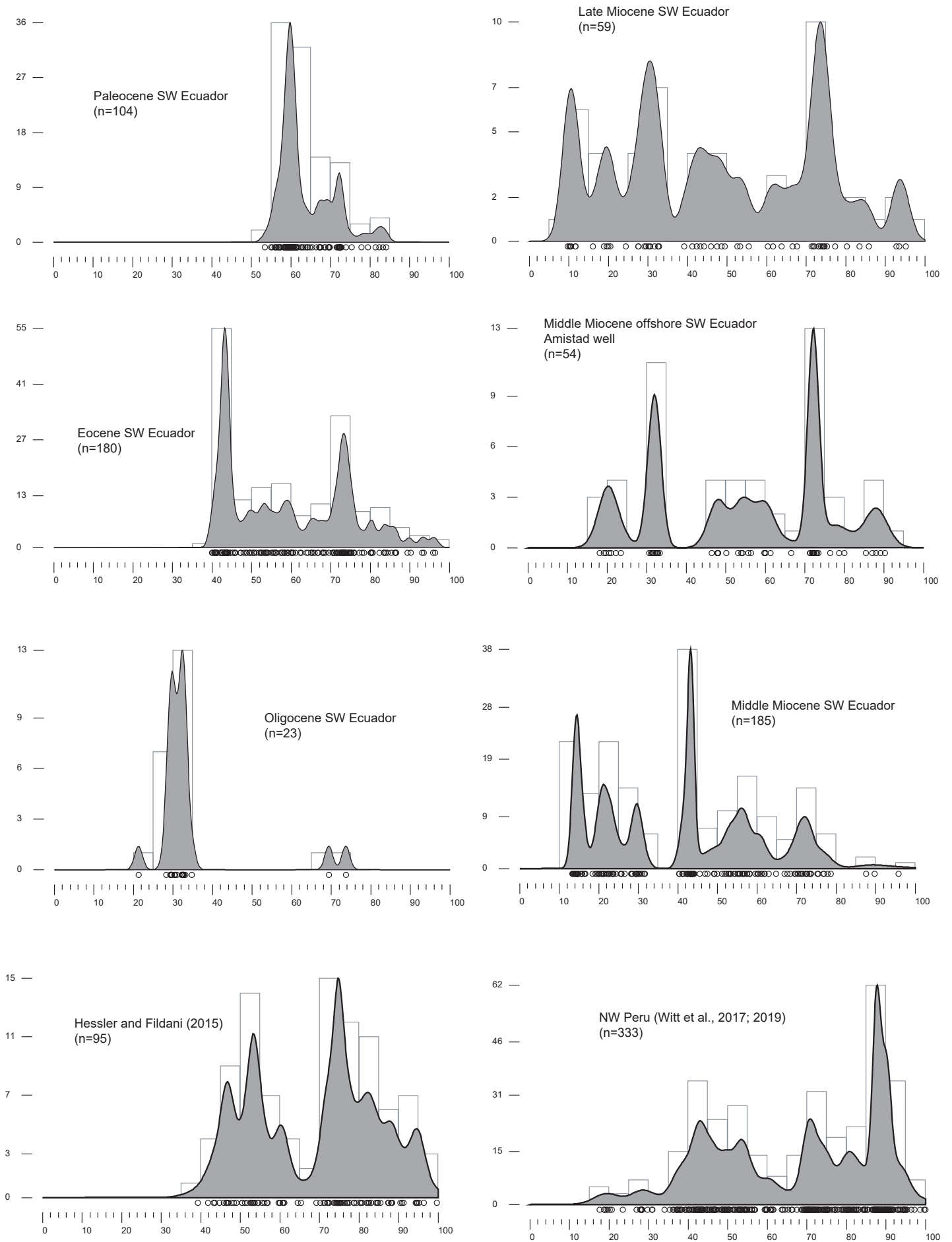
Table S3C. Neogene intrusions. Schutte (2009)

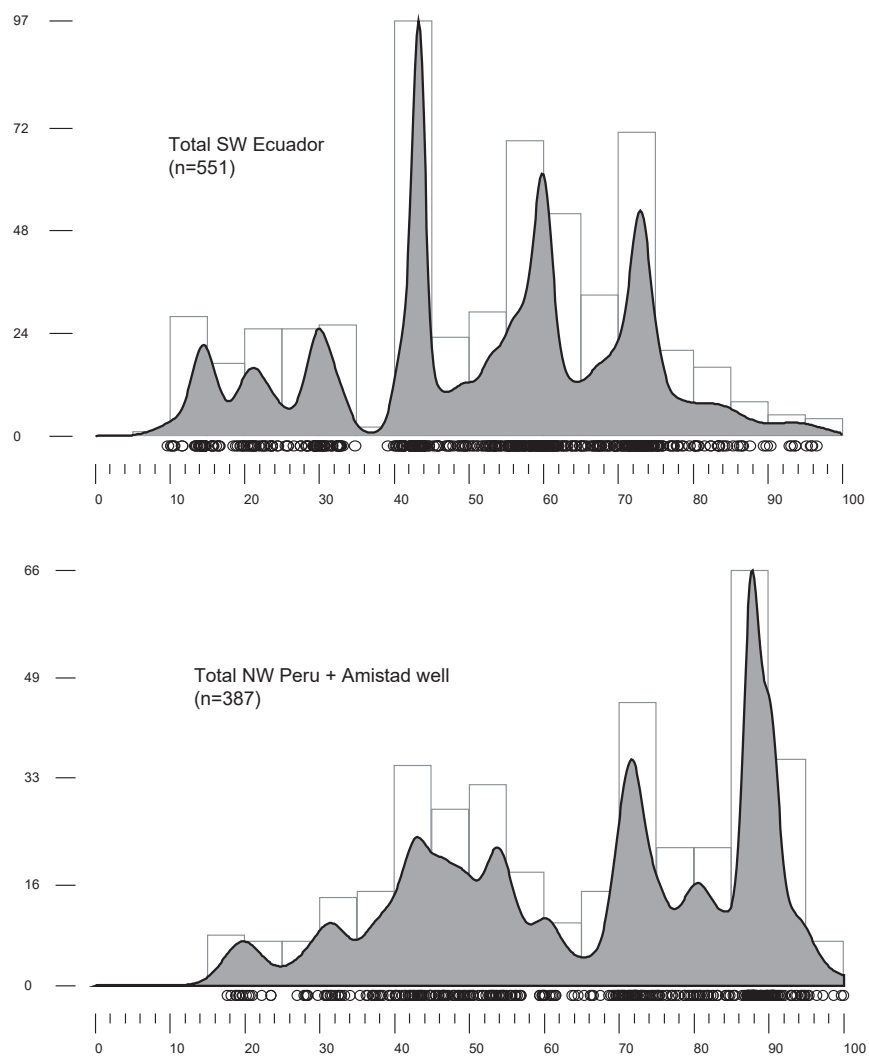
Table S5A. Zircon geochemistry

Table S5B. Standards for zircon geochemistry

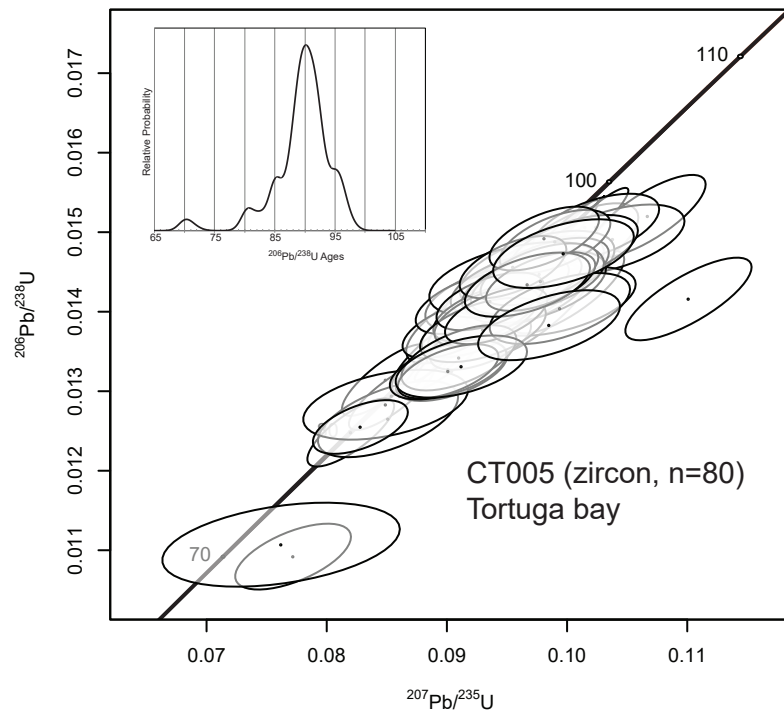
Table S5C. Operating conditions for the LA-ICP-MS equipment (zircon geochemistry)

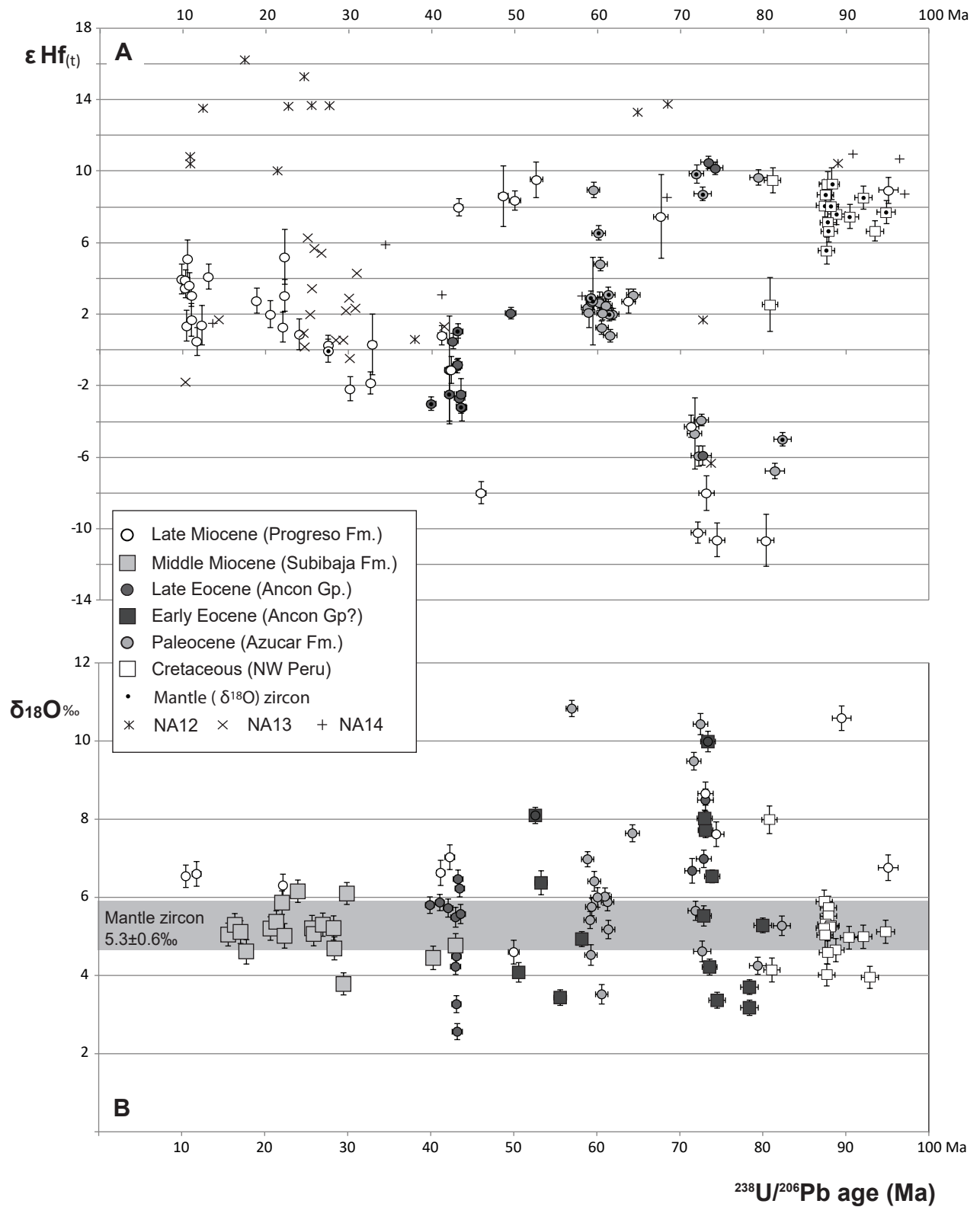
A





B

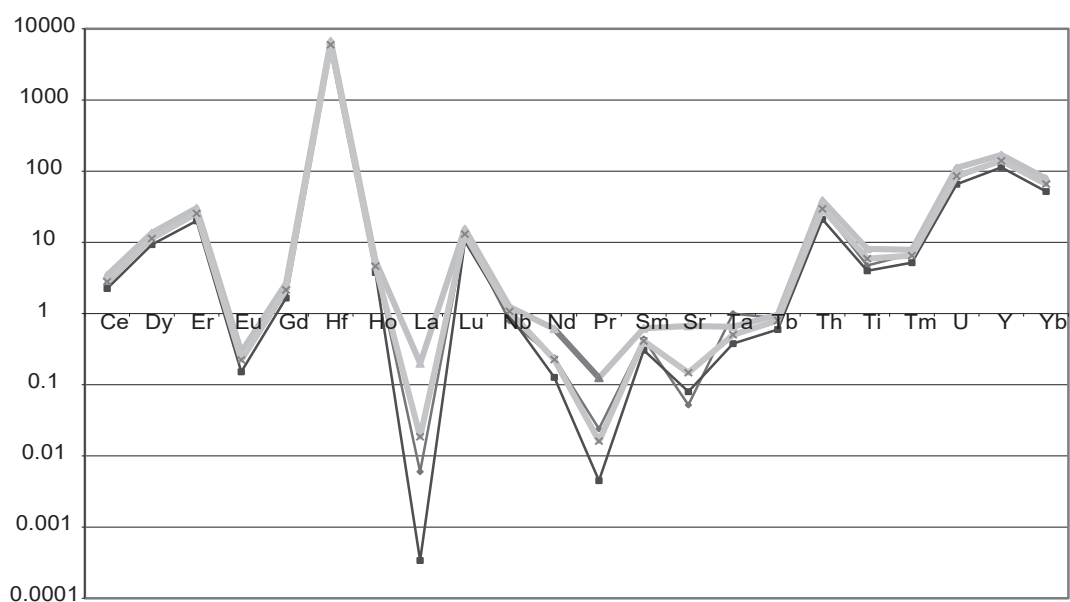
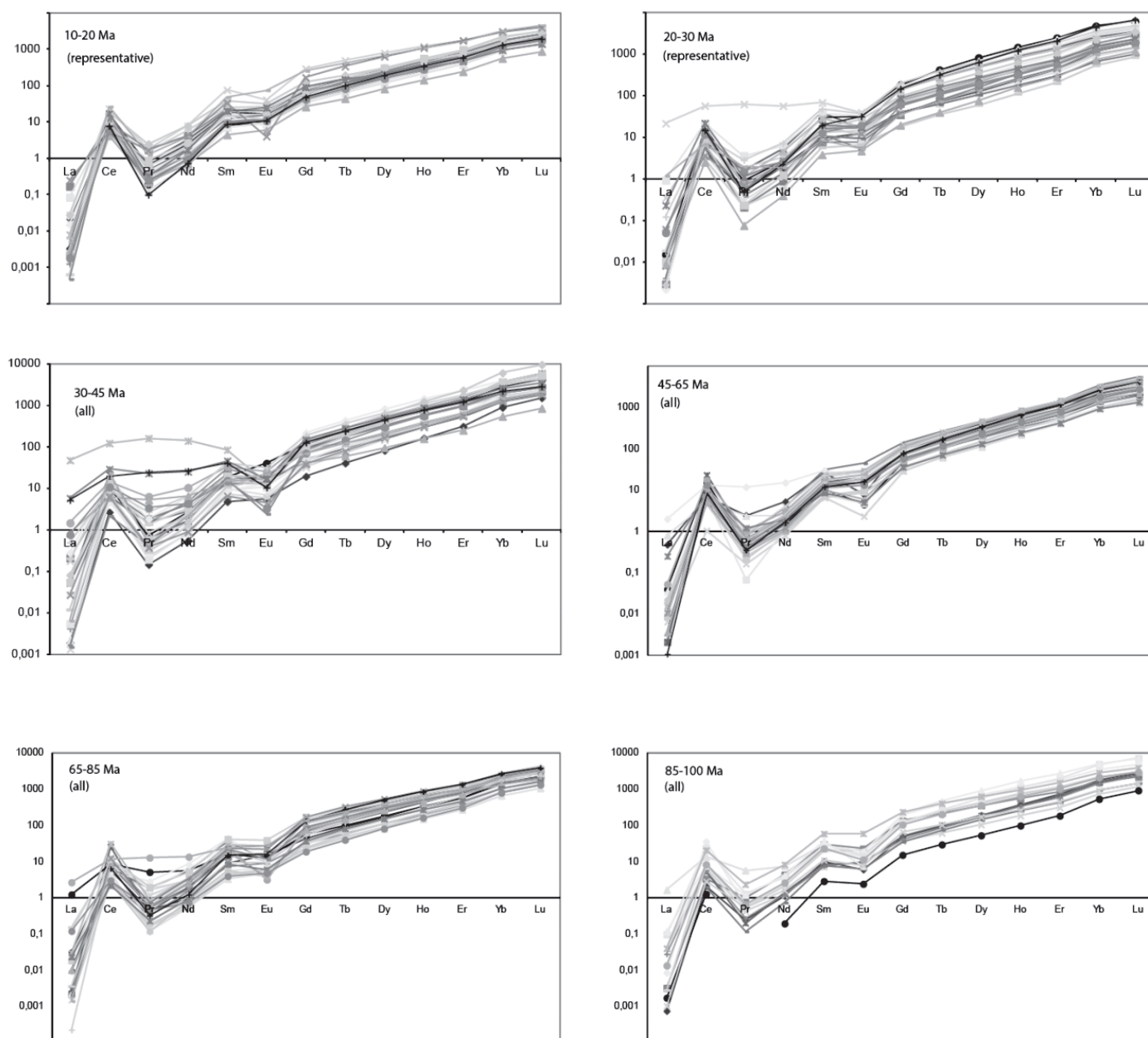




Witt et al., Sup.Fig.2

A

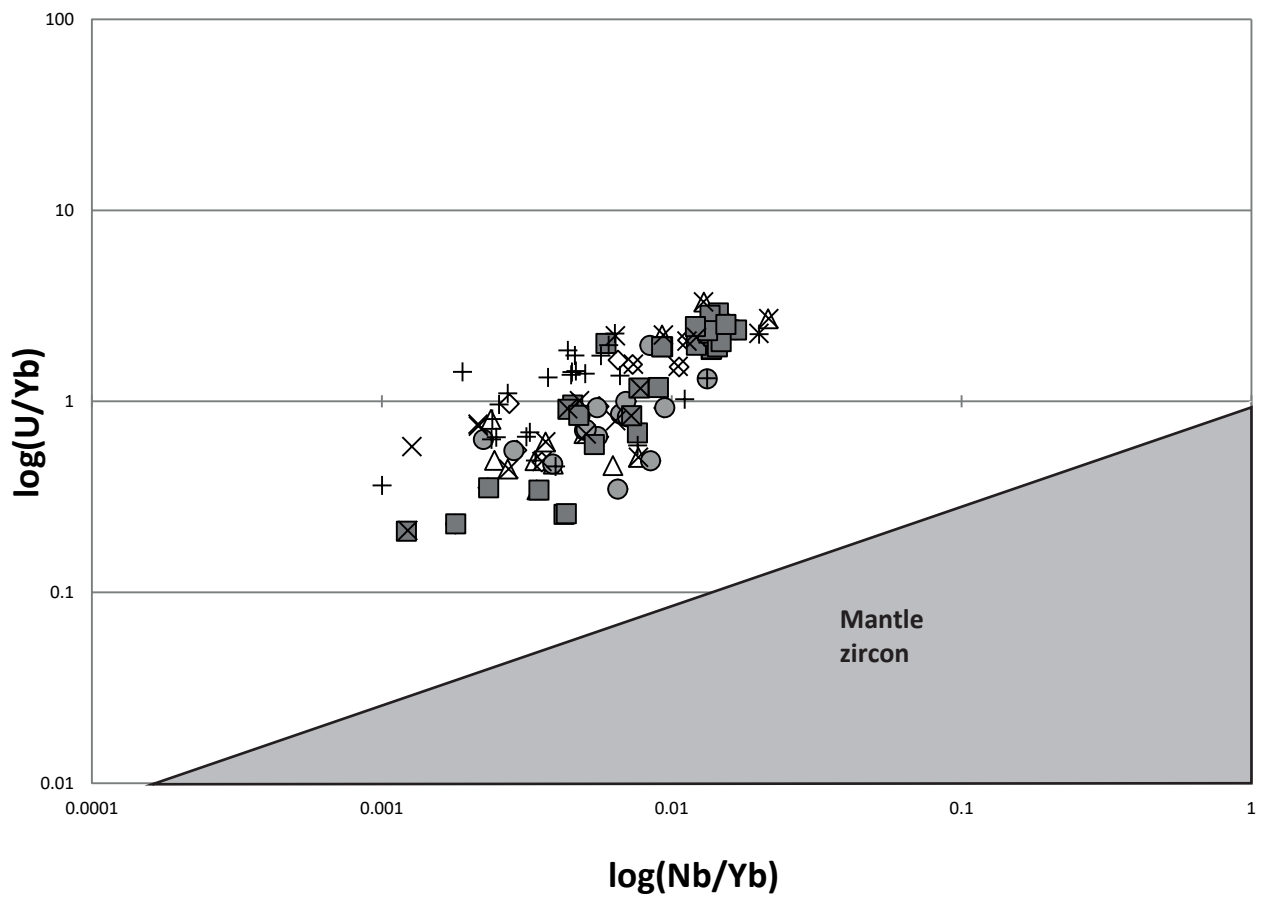
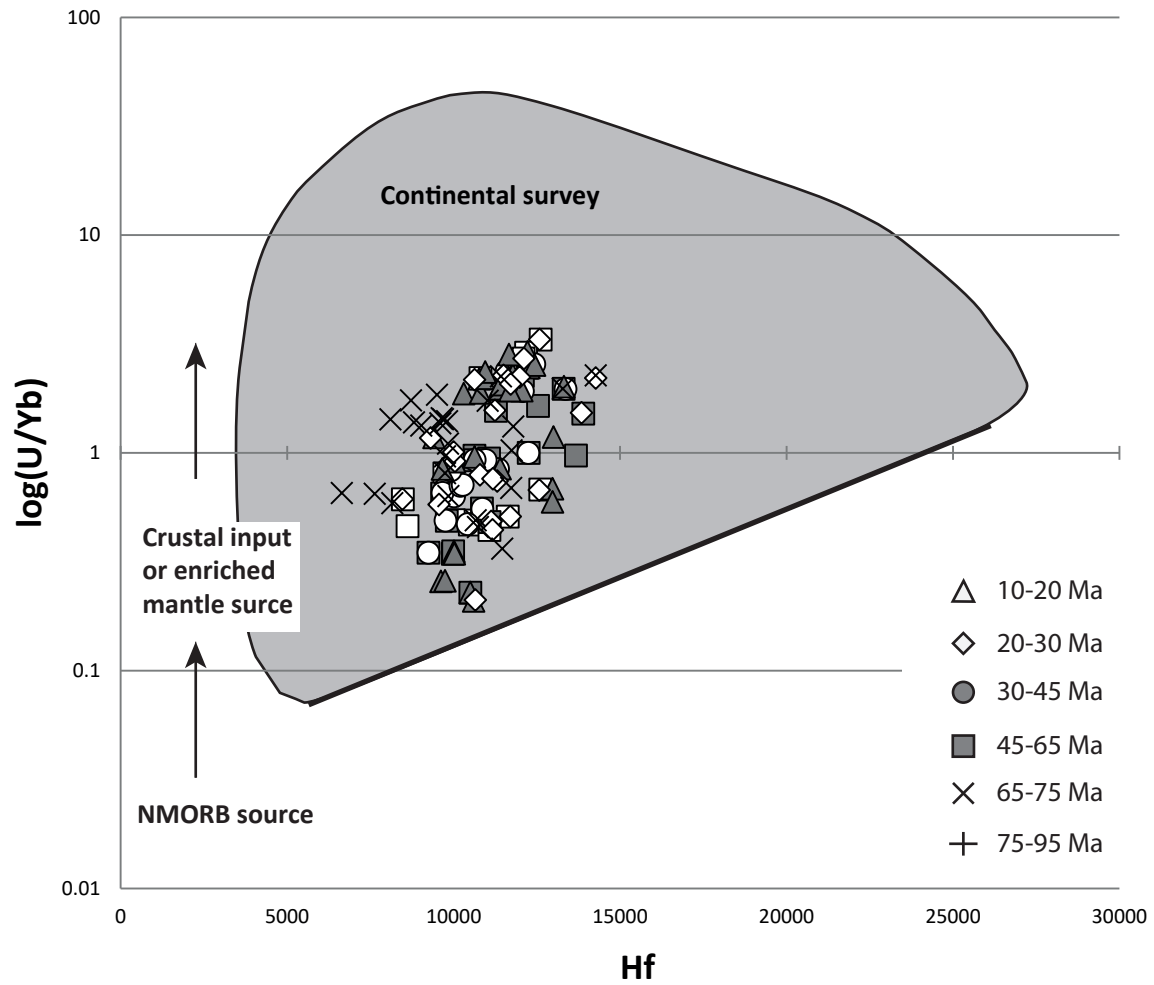
Witt et al., Sup.Fig.3

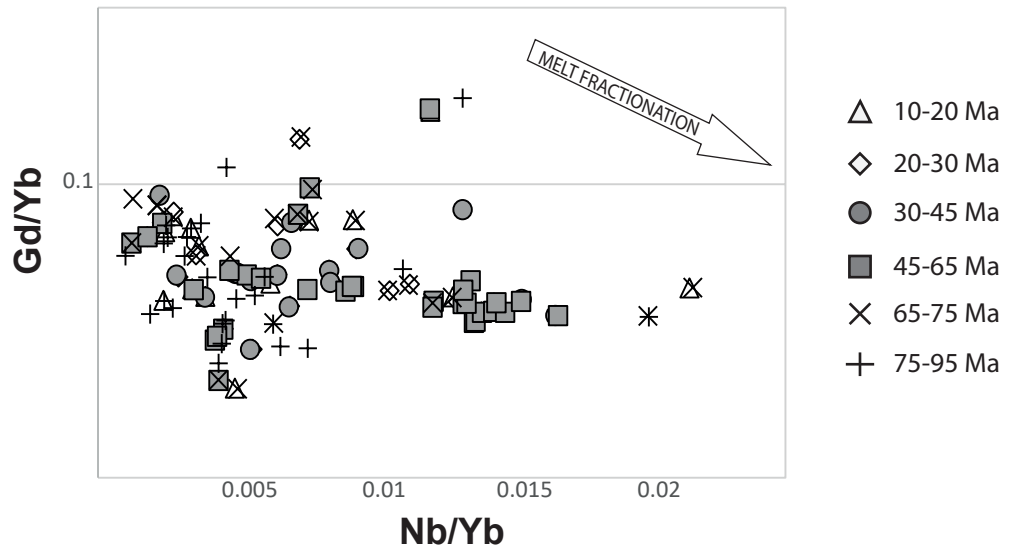
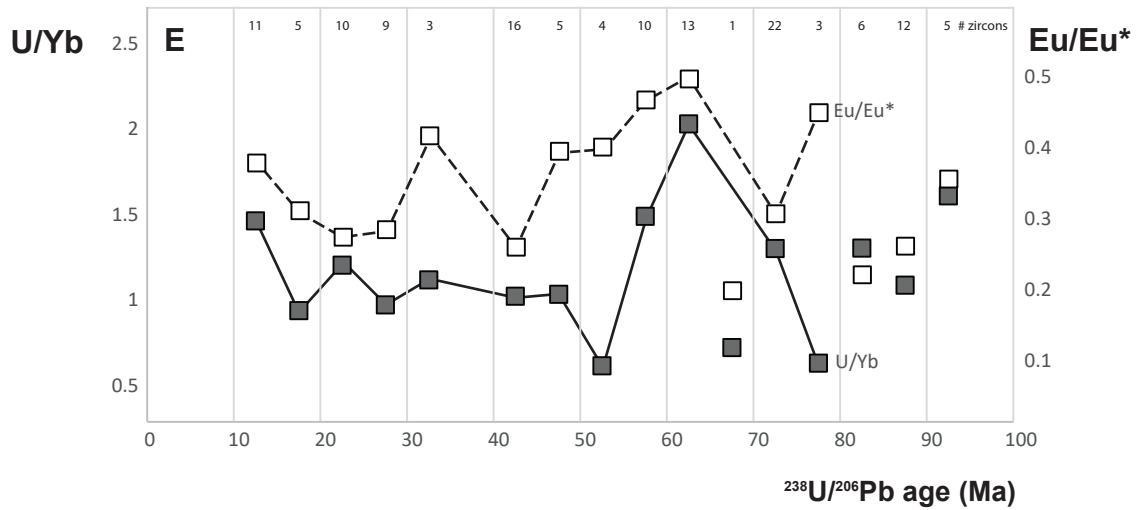
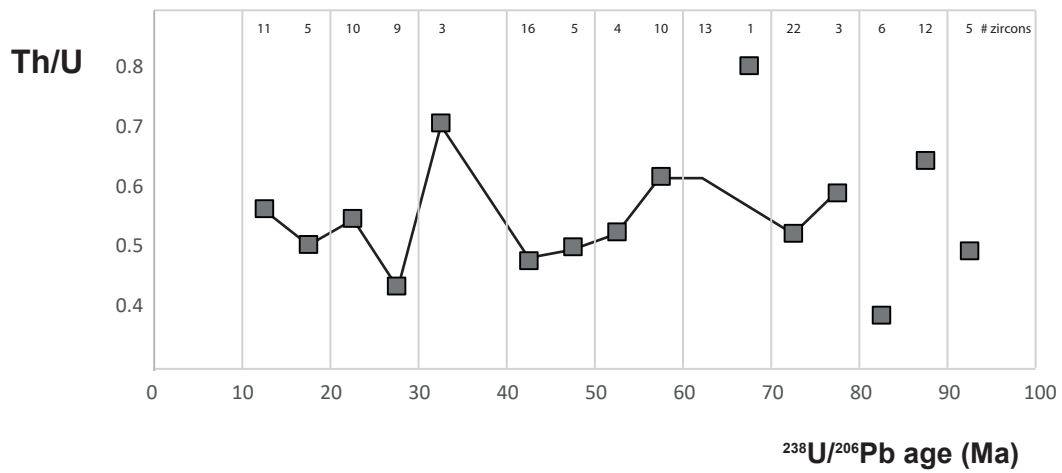


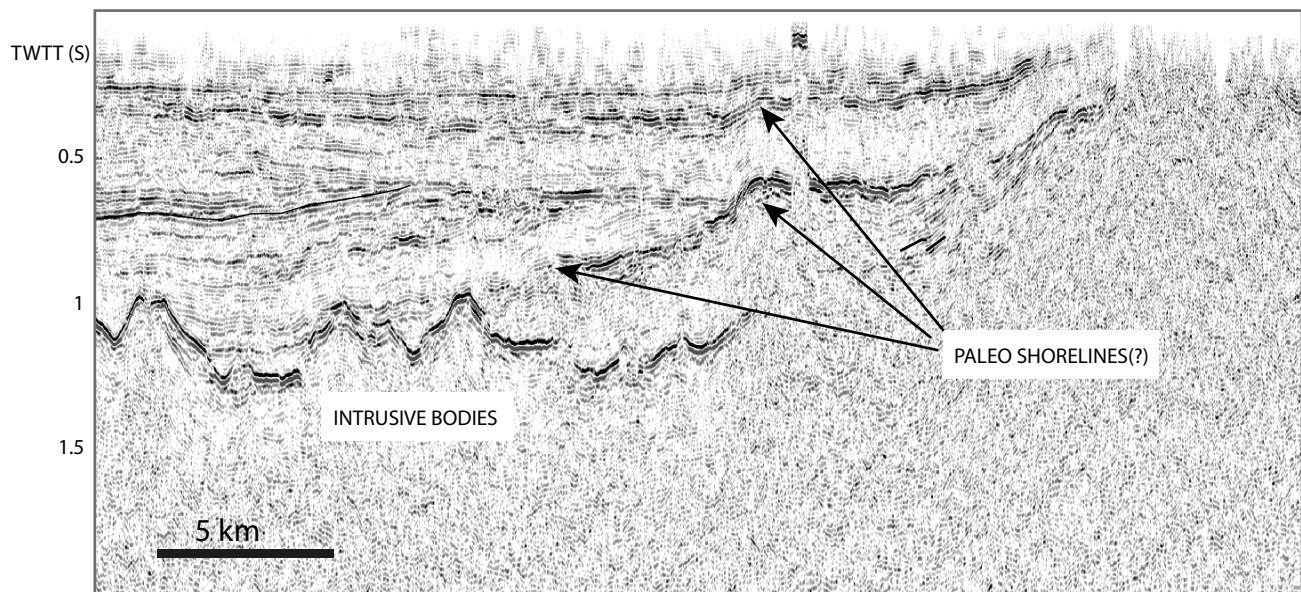
B

—x— Ref. Values
 —●— Min. Meas. Value
 —○— Max. Meas. Value
 —●— Mean Value

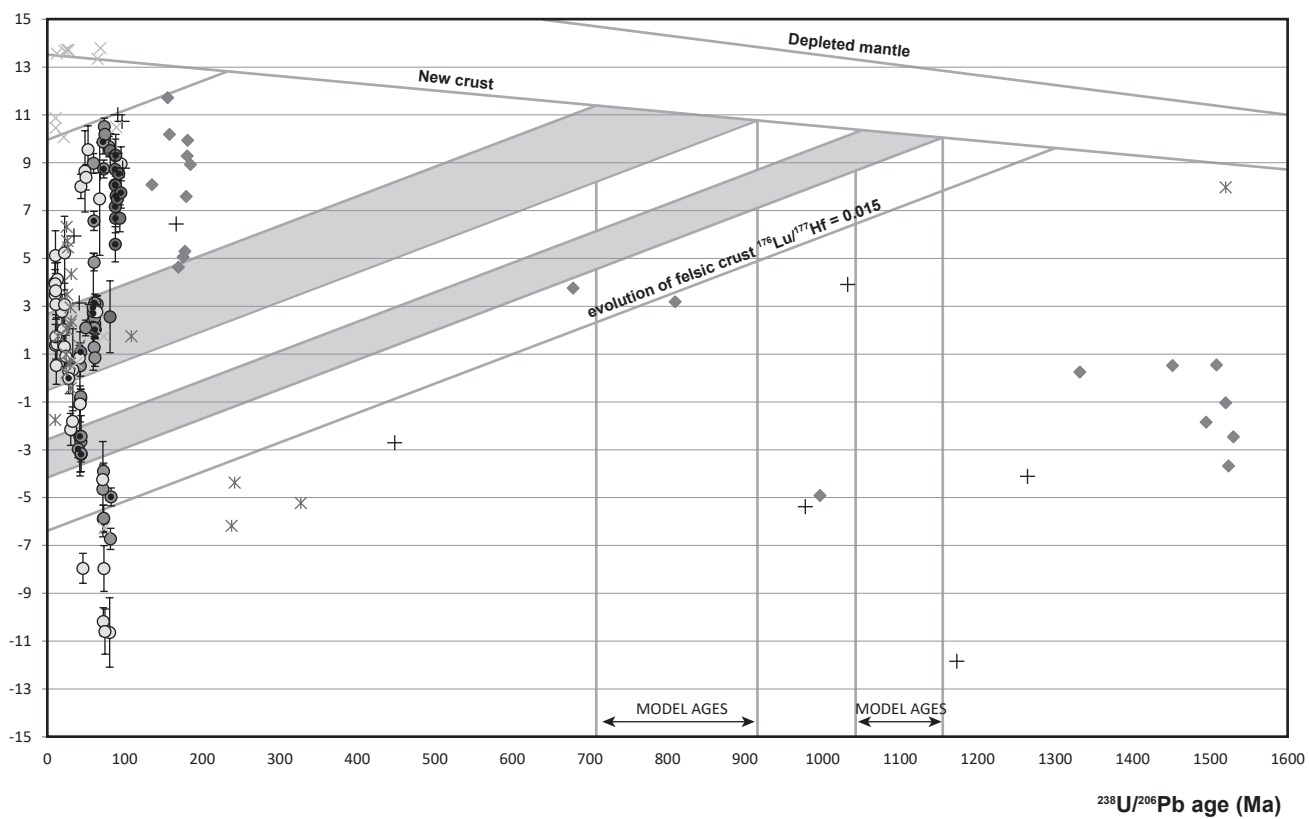
C



D**E**



Witt et al., Sup.Fig.4



- Late Miocene (Progreso Fm.)
- Late Eocene (Ancon Gp.)
- Paleocene (Azucar Fm.)
- Cretaceous (NW Peru)
- ⊙ Mantle ($\delta^{18}\text{O}$) zircon

Pepper et al. (2015) samples

- ◆ NA11 ✱ NA12
- ✱ NA13 + NA14

Witt et al., Sup.Fig.5