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Supplementary Materials for

High-precision U-Pb zircon dating identifies a major magmatic event on the Moon at 4.338 Ga

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The PDF file includes:

Figs. S1 to S5
Legend for data S1

Other Supplementary Material for this manuscript includes the following:

Data S1

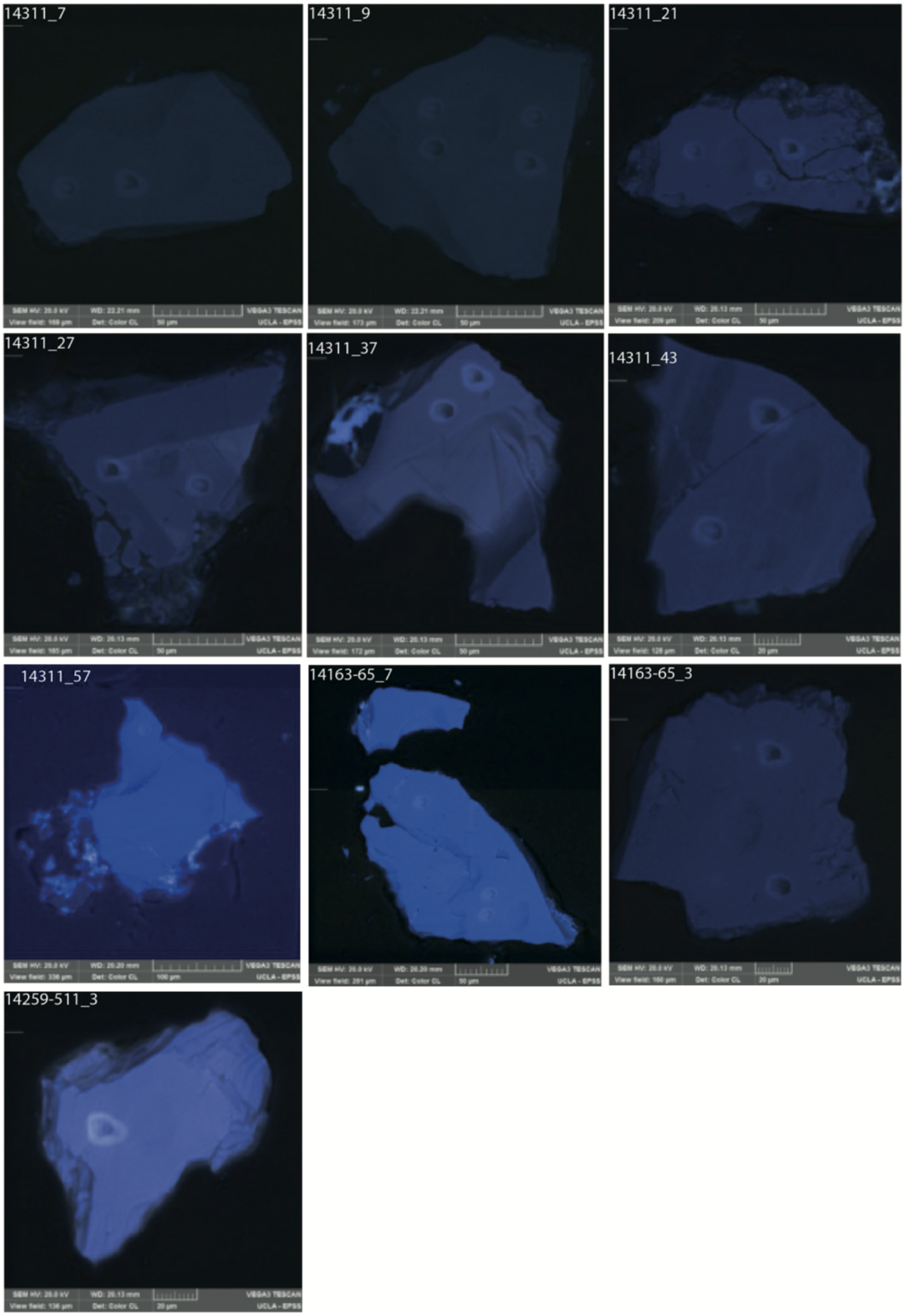


Fig. S1.

CL images of the Apollo 14 grains analyzed in this study (modified from Trail et al. (*17*)). Note that no CL images were available for the Apollo 15 and 17 zircons.

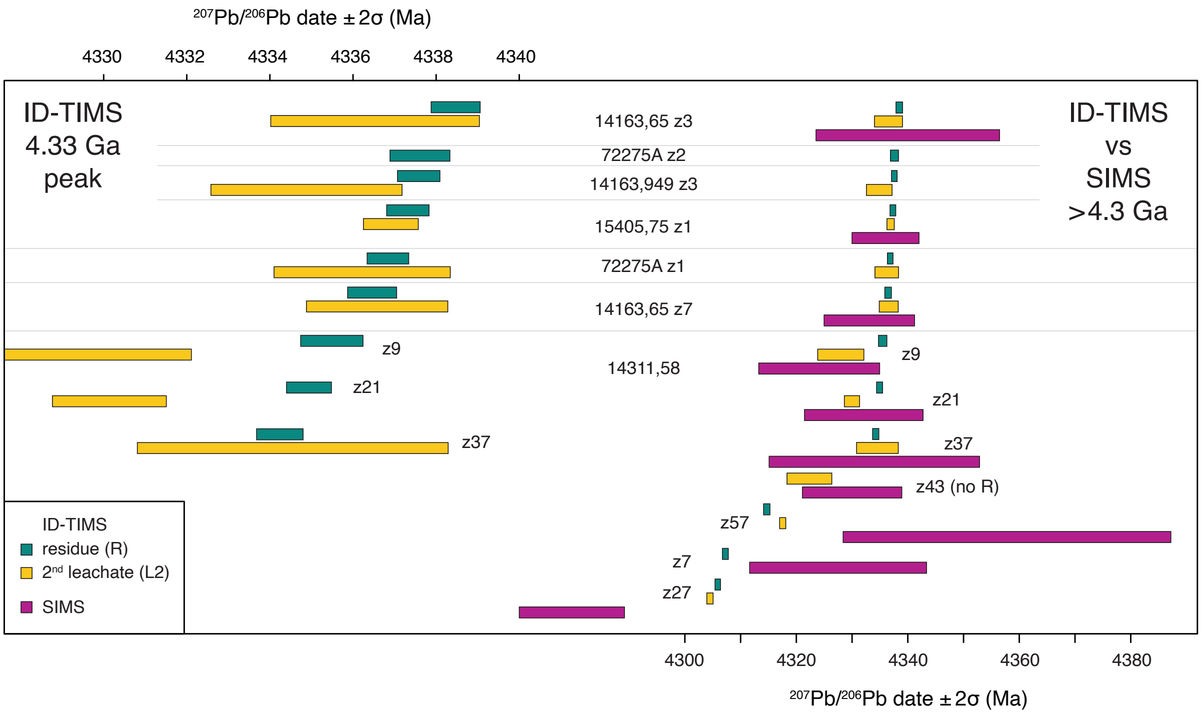


Fig. S2.

Ranked-order plot comparing ID-TIMS $^{207}Pb/^{206}Pb$ dates (residues and 2nd leachates) with corresponding *in situ* SIMS $^{207}Pb/^{206}Pb$ dates of lunar zircons in this study.

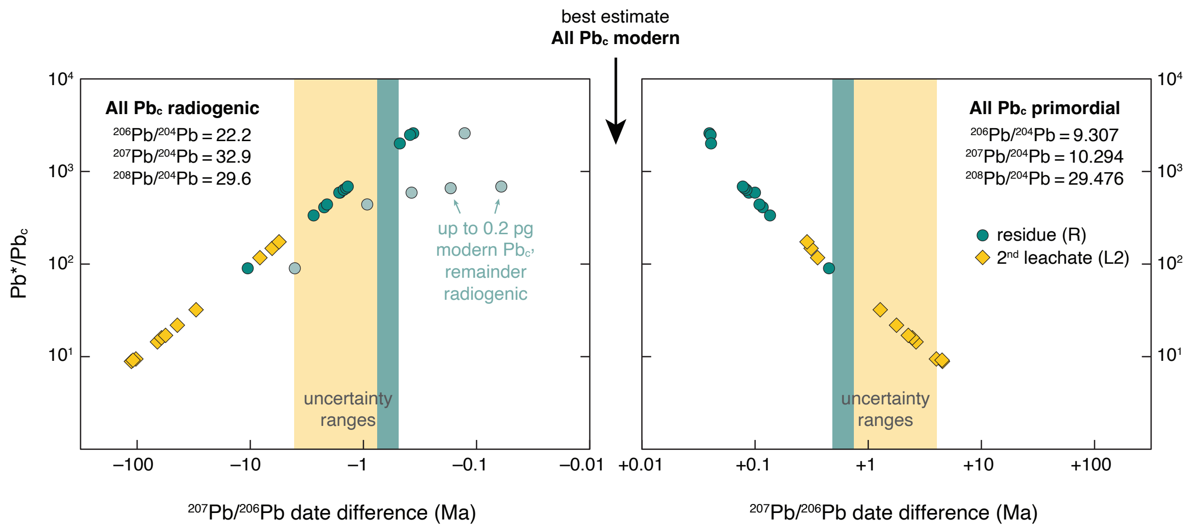


Fig. S3.

Effect of the choice of common Pb (Pb_c) composition on ID-TIMS $^{207}Pb/^{206}Pb$ dates. Endmember scenarios assuming that all common Pb in analyses derives from a lunar reservoir may increase (for primitive compositions such as that of Canyon Diablo Troilite (*27*)) or decrease the $^{207}Pb/^{206}Pb$ dates (for extremely radiogenic compositions such as the approximate lunar model composition at 4.33 Ga from Connelly et al. (*28*)), where the amount of shift is a function of Pb^*/Pb_c. While L2s are relatively sensitive to the partitioning of Pb_c between lab contamination ("modern Pb_c") and the potential lunar endmembers, R compositions are insensitive to this correction. Most Rs had total Pb_c < 0.2 pg expected from routine lab blank analyses; even assuming up to 0.2 pg Pb from lab contamination, the negative shift of all but two residue dates remains within the stated 2-sigma uncertainty.

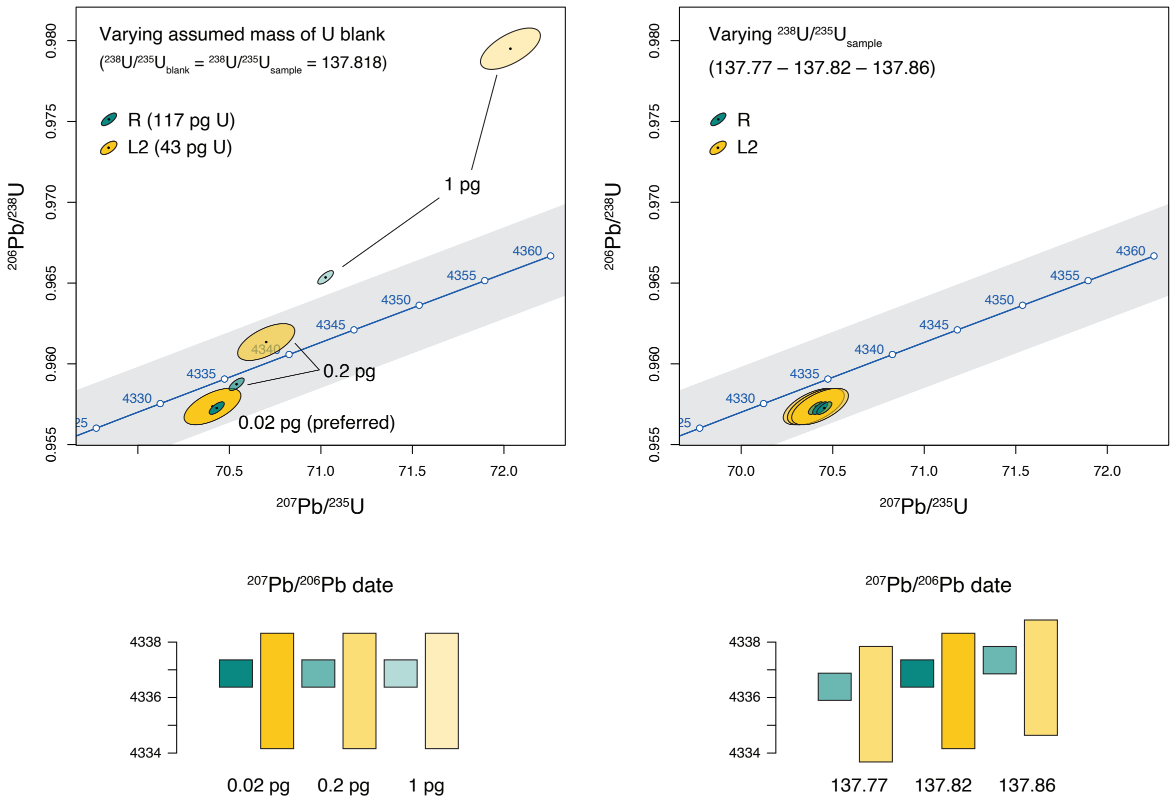
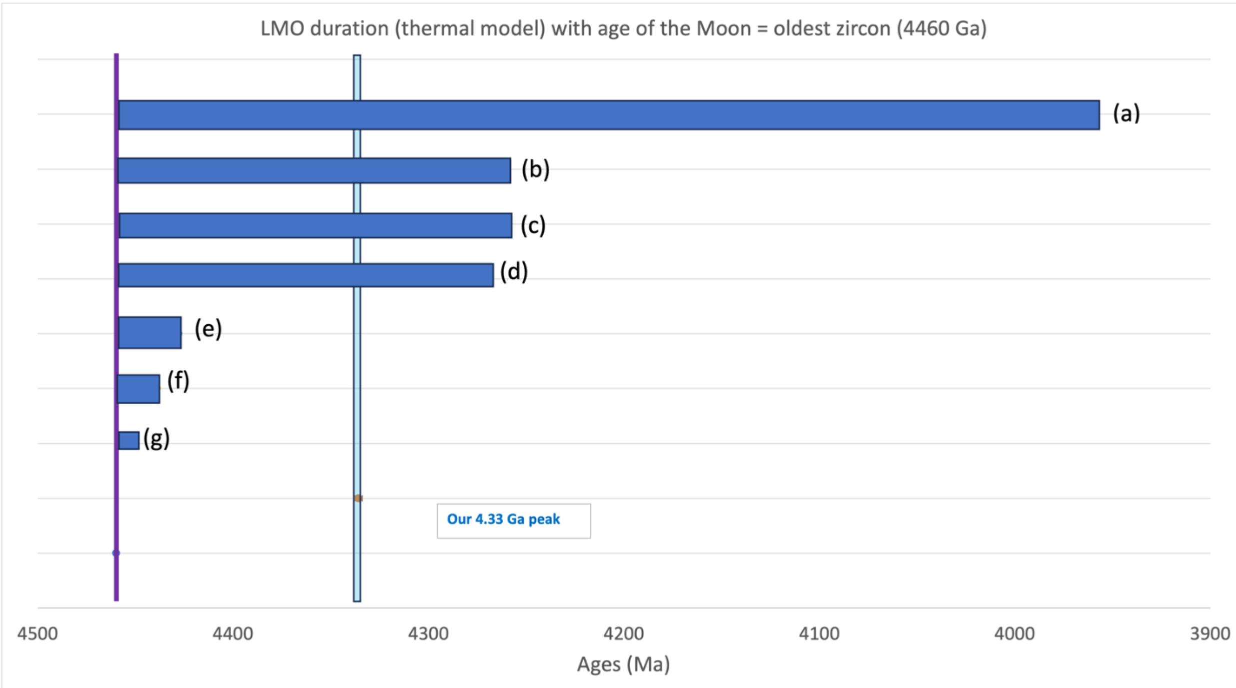


Fig. S4.

Effect of varying the mass of U blank and the sample U isotopic composition on a leachate (L2)–residue (R) pair.



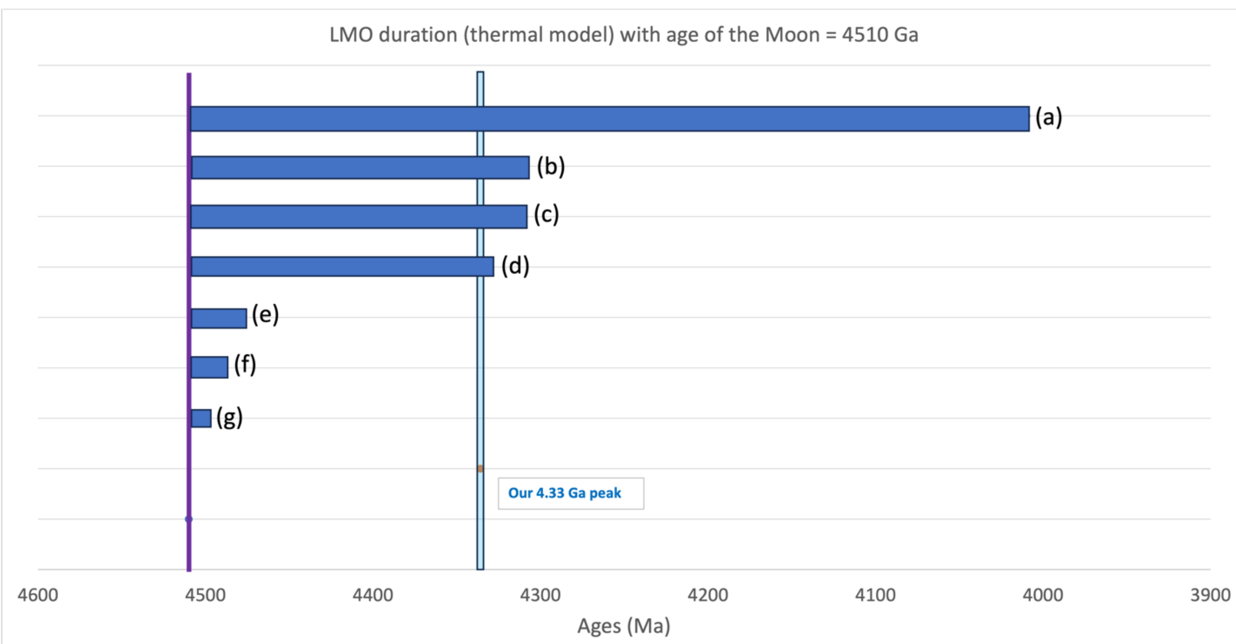


Fig. S5.

LMO durations estimated from thermal modeling of the cooling of the lunar crust, starting with an age of Moon formation equal to oldest lunar zircon (top; Pb–Pb age of 4460 ± 31 Ma presented in Greer et al. (*18*)), and an age of Moon at 4510 ± 10 Ma (bottom (*15*)). Results of thermal modeling from: (a) Solomon and Longhi (*44*), (b) Meyer et al. (*50*), (c) Maurice et al. (*47*), (d) Zhang et al. (*48*), (e) Perera et al. (*46*), (f) Jackson et al. (*49*) and (g) Elkins-Tanton et al. (*45*).

Data S1. (separate file)

All analytical data including zircon U–Pb isotopes (ID-TIMS and SIMS), Hf isotopes, and trace element concentrations.