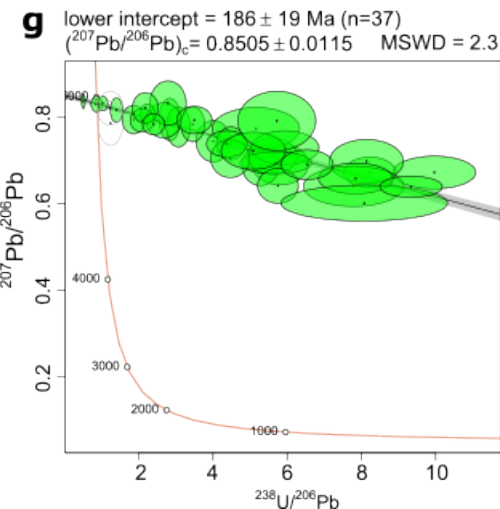
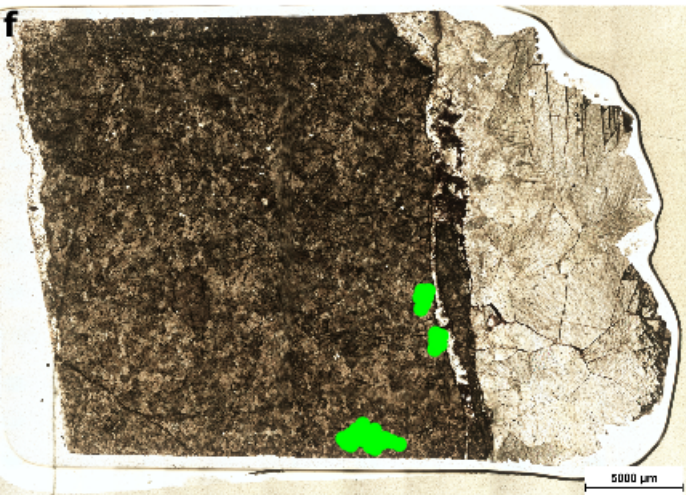
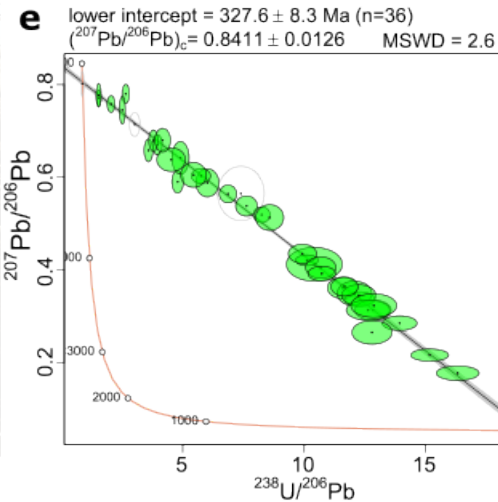
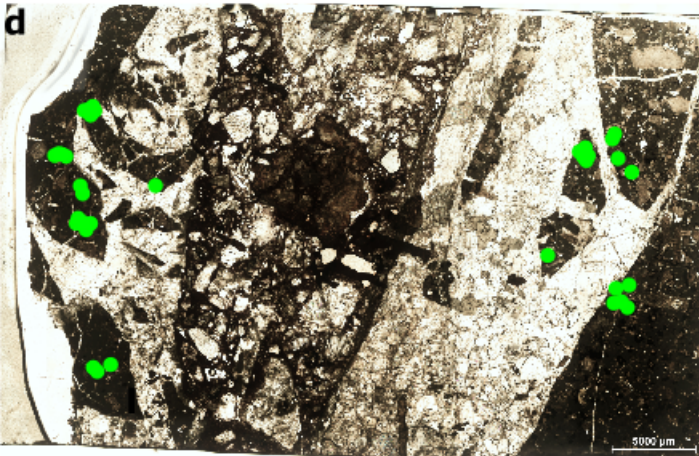
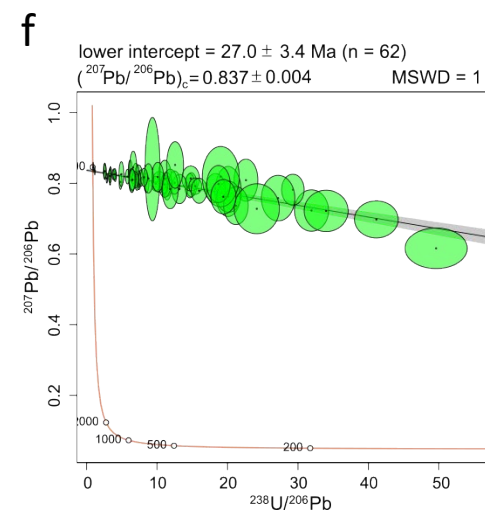
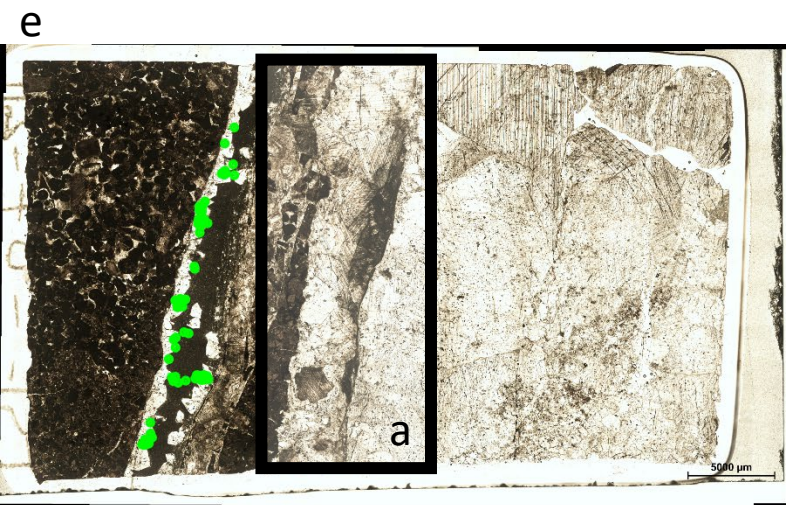
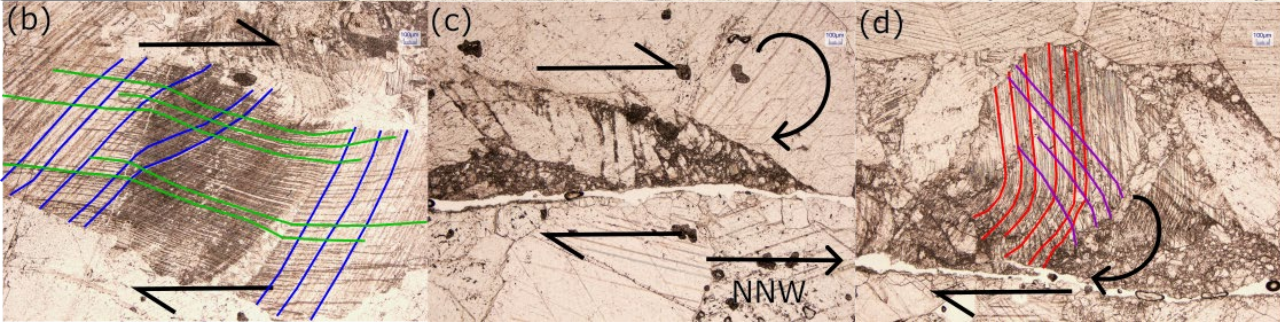
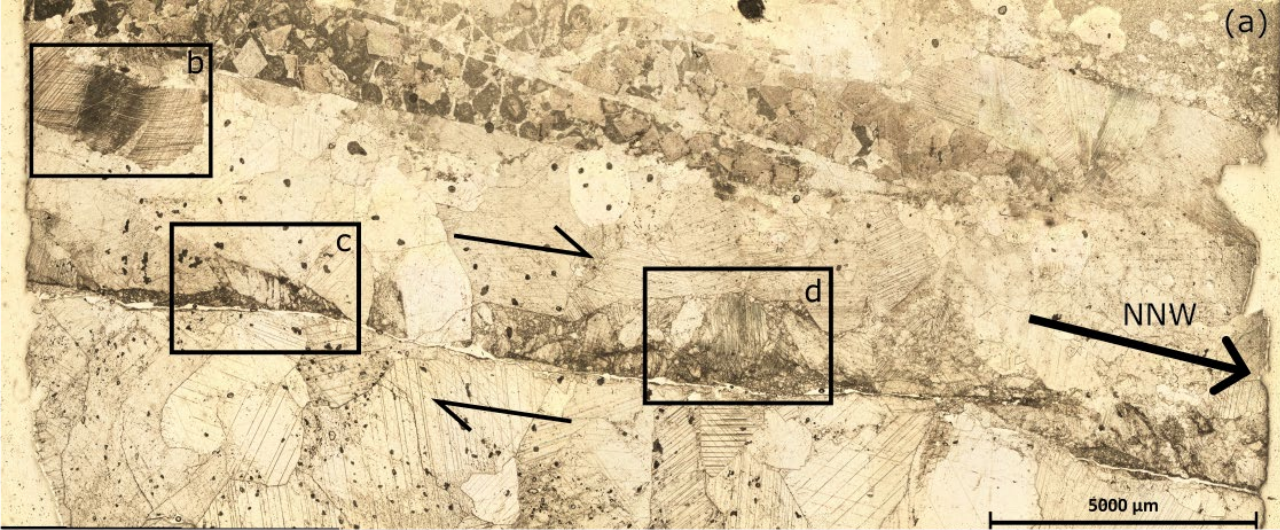


Supplementary 1. Micritisation and recrystallisation age.

Oolitic limestone micritisation, dolomitization and recrystallisation ages. (a) Oolitic limestone from sample TH-03-24. Calcite cements ooids. (b) Oolitic limestone from sample LSW-02-24, with significant micritisation to the ooids, and partially dissolved rhombohedral dolomite crystals. (c) Completely recrystallised limestone, from sample LSW-01-24. Probably forms an alteration seam around the WNW-ESE striking vein. (d) Locations of 80 μ m LA-ICP-MS spots in limestone host rock in sample LSW-02-24. (e) Corresponding U-Pb Tera-Wasserburg plot for micrite host rock in LSW-02-24. $^{206}\text{Pb}/^{238}\text{U}$ intercept age = 327.6 ± 8.3 Ma ($n = 36$, MSWD = 2.6). (f) Locations of 80 μ m LA-ICP-MS spots in recrystallised limestone host rock in sample LSW-01-24. (g) Corresponding U-Pb Tera-Wasserburg plot for recrystallised host rock in LSW-01-24. $^{206}\text{Pb}/^{238}\text{U}$ intercept age = 186 ± 19 Ma ($n = 37$, MSWD = 2.3)



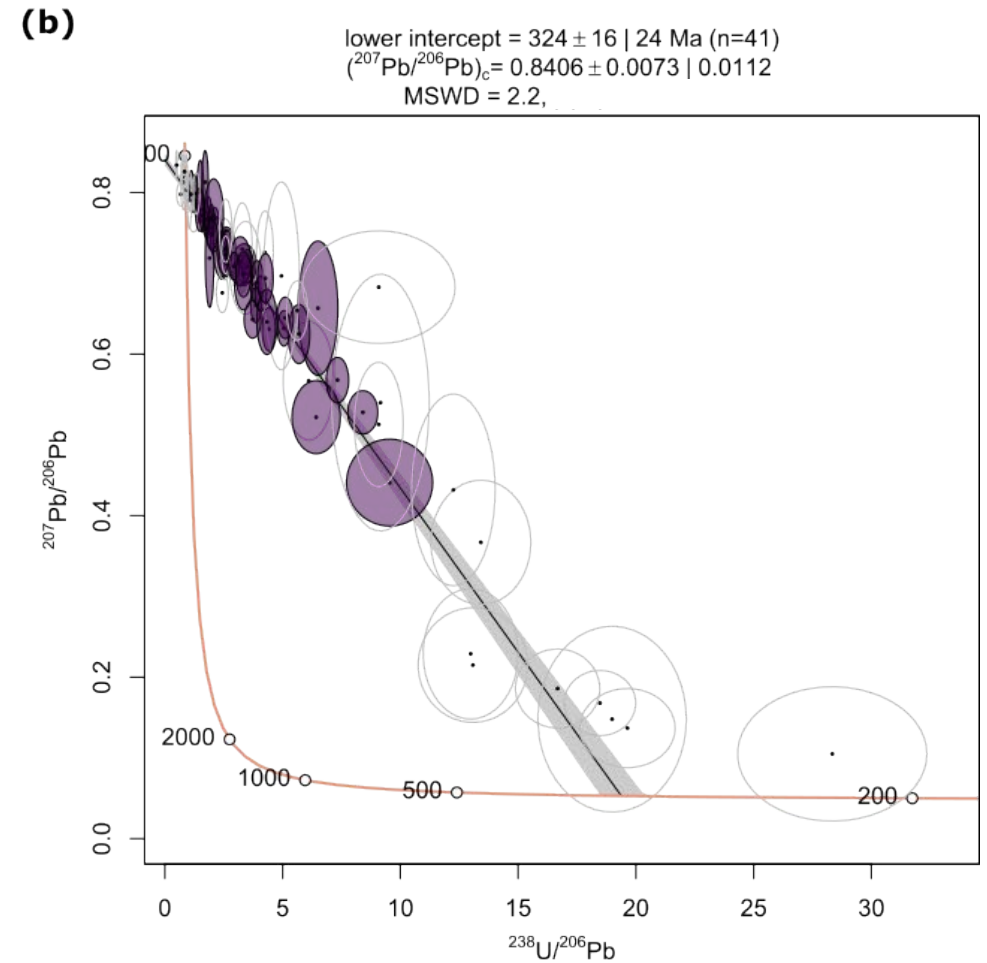
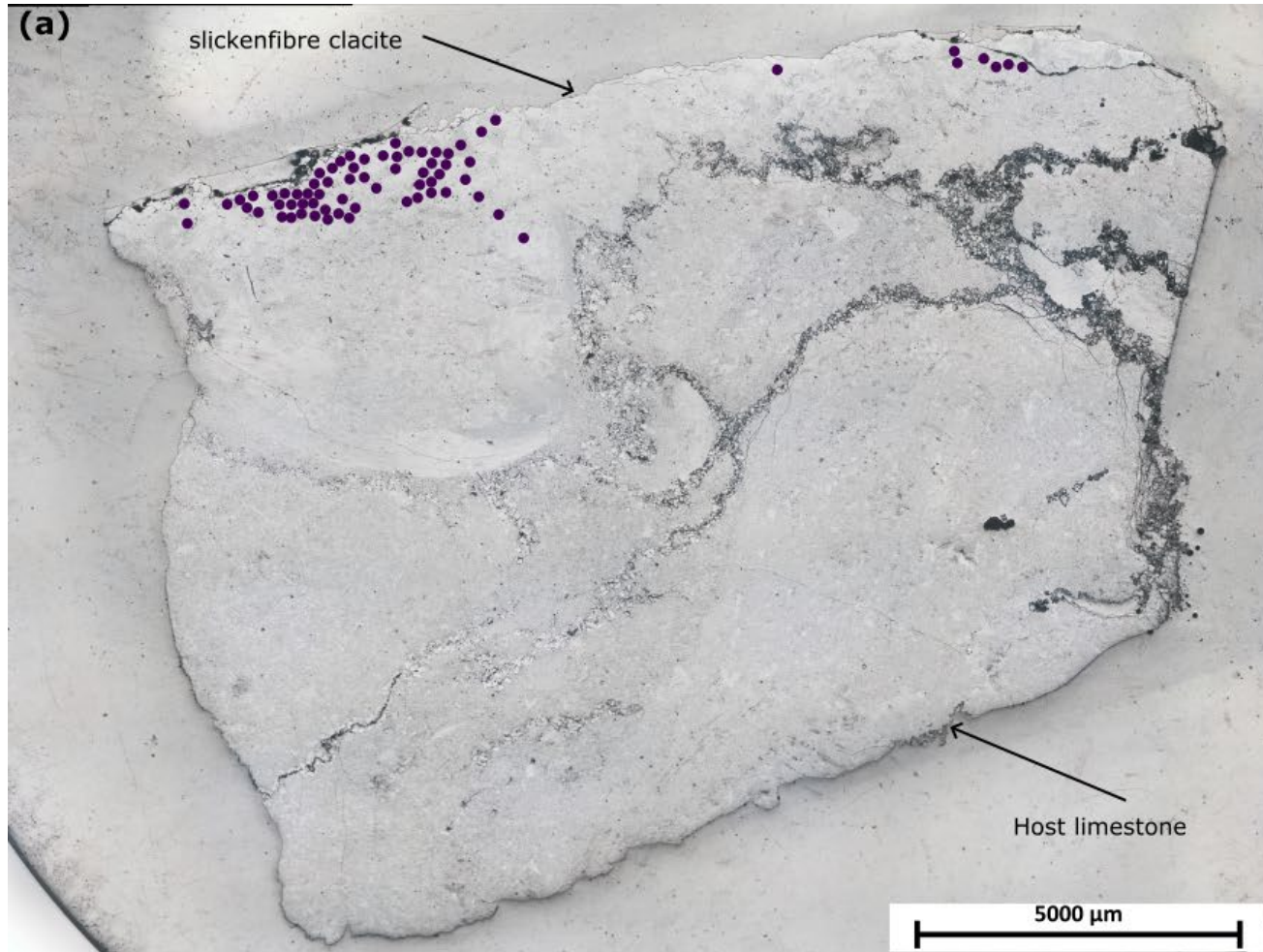
Supplementary 2. Age of sample LSE-07-24 and relationship of dated materials to shear indicators.

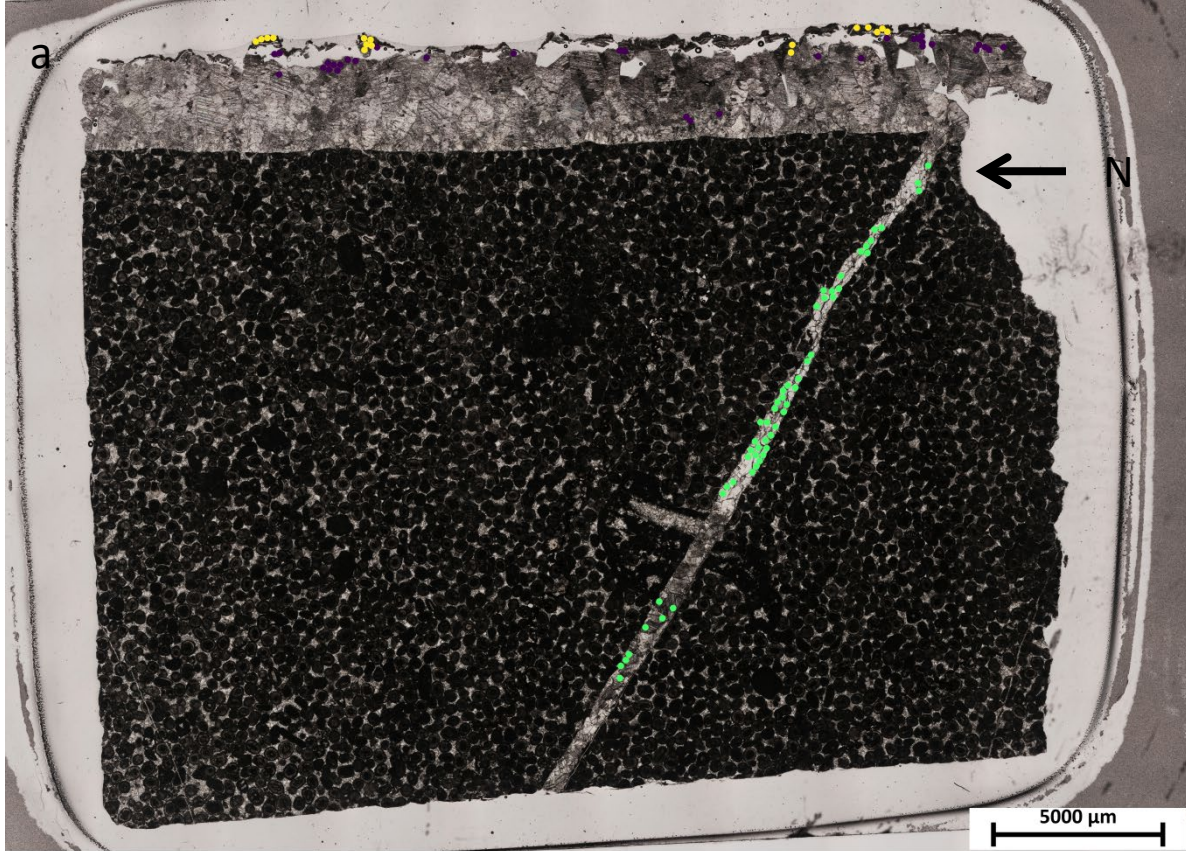


(a) Portion of thin section from sample LSE-07-24 showing the location of shear indicators within the vein. (b) Calcite crystal with 2 sets of cleavage planes are bent into s-shaped shears. (c) Clockwise clast rotation at the edge of the fault plane. (d) 2 sets of cleavage planes are sheared in a clockwise direction adjacent to the fault plane. (e) Location of sample spots in the vein. Shearing affects the dated vein, therefore shear postdates the vein mineralisation. (f) Tera-Wasserburg plot for sample LSE-07-24. $^{206}\text{Pb}/^{238}\text{U}$ intercept age = 27.0 ± 3.4 Ma (MSWD = 1, n = 62).

Supplementary 3. Age of slickenfibres from Tut Head Thrust fault plane, sample TH-02-24.

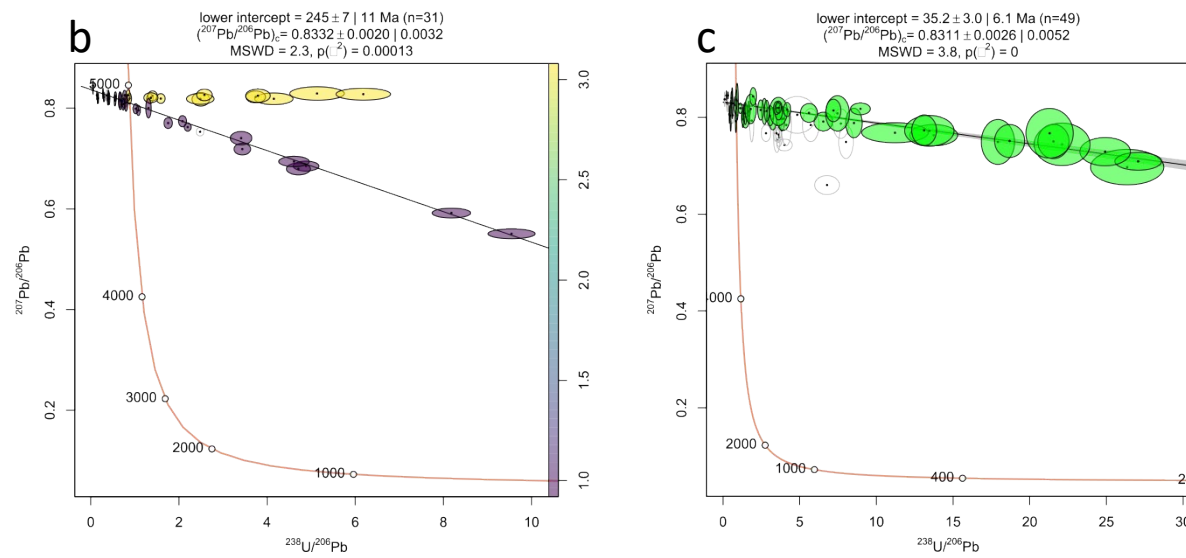
(a) Location of slickenfibres calcite and LA-ICP-MS 80 μ m target spots in sample TH-02-24 (polished chip). (b) Tera-Wasserburg plot for sample TH-02-24. $^{206}\text{Pb}/^{238}\text{U}$ intercept age = 324 ± 24 Ma (MSWD = 2.2, n = 41).





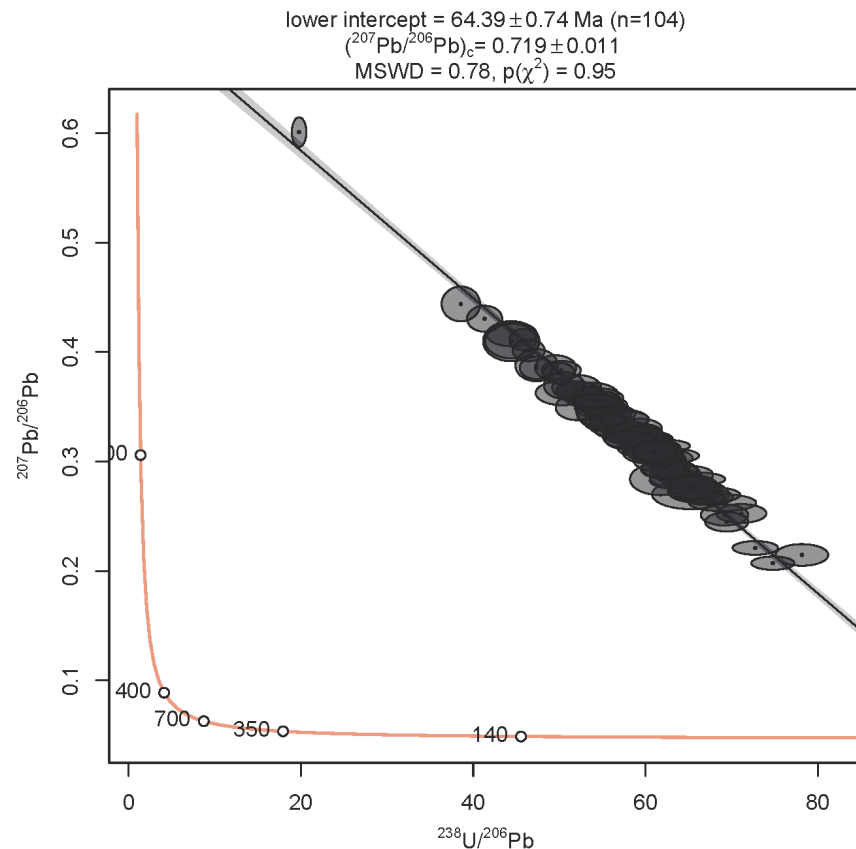
Supplementary 4. Age populations from sample TH-03-24.

(a) Sample TH-03-24 with 3 populations of LA-ICP-MS 80μm target spots. The N-S trending vein, sampled by both yellow and purple spots, is observed to cross-cut the Tut-Head thrust in the field. The NW-SE trending vein was too small (50μm thick) to observe in the field, and cross-cuts the N-S vein in thin section. (b) Tera-Wasserburg plot for the north striking vein in sample TH-02-24. $^{206}\text{Pb}/^{238}\text{U}$ intercept age = 245 ± 11 Ma (MSWD = 2.3, $n = 31$). Two populations of spots were observed for this vein, and were separated into purple and yellow. Purple spots represent the Triassic age population. Yellow spots represent an error from the population at the edge of the sample, although it is unclear why this occurred. (c) Tera-Wasserburg plot for the NW striking vein in sample TH-02-24. $^{206}\text{Pb}/^{238}\text{U}$ intercept age = 35.3 ± 6.1 Ma (MSWD = 3.8, $n = 49$).

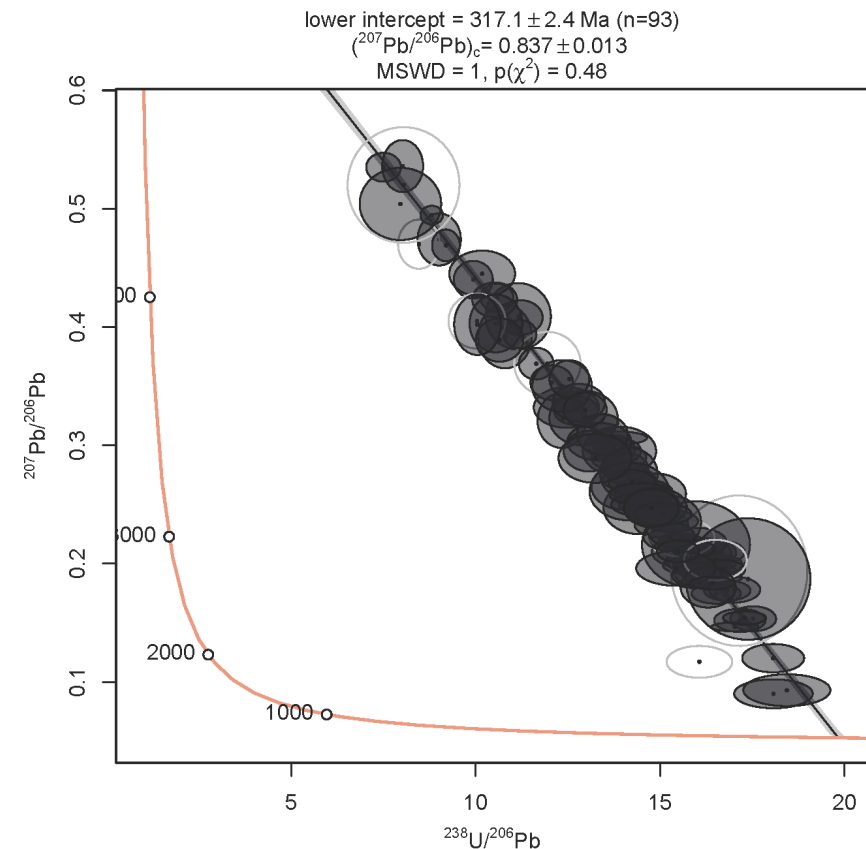


Supplementary 5. Secondary Reference materials for U-Pb calcite geochronology work.

a. Duffbrow. (Hill, C. A., V. J. Polyak, Y. Asmerom, and P. P. Provencio (2016), Constraints on a Late Cretaceous uplift, denudation, and incision of the Grand Canyon region, southwestern Colorado Plateau, USA, from U-Pb dating of lacustrine limestone, *Tectonics*, 35, 896–906, doi:10.1002/2016TC004166.)



b. RA-138. (Guillong, M., Samankassou, E., Müller, I. A., Szymanowski, D., Looser, N., Tavazzani, L., Merino-Tomé, Ó., Bahamonde, J. R., Buret, Y., and Ovtcharova, M.: Technical note: RA138 calcite U–Pb LA-ICP-MS primary reference material, *Geochronology*, 6, 465–474, <https://doi.org/10.5194/gchron-6-465-2024>, 2024.)



Run date	Run session	WC-1 uncorrected	uncertainty	correction
17/07/2025	1	279.9	2.5	1.102
15/07/2025	1	280.4	2.3	1.104
15/07/2025	2	276.4	8	1.088
14/07/2025	1	279.2	2.1	1.099
28/04/2025	1	278.1	3.5	1.095
29/04/2025	2	281	2.9	1.106
29/04/2025	1	281.6	2.6	1.108661
30/04/2025	1	279	3.2	1.098425
01/05/2025	1	274.9	3	1.082283

1. Uncertainties include instrumental drift and were increased in quadrature to include uncertainties of primary RM
2. Final quoted uncertainties in Tera Wasserburg plots are increased in quadrature to include 2% long-term reproducibility
3. Corrected for common Pb using the 207-correction method Isoplot (Ludwig, 2003)

LSE-09-24 from run 150725_run1 and LSE-09-24-new from run 170725_run1 are from different domains within the sample

In TH-02-24, the host rock contains a bivalve recrystallised to calcite. TH-02-24-new spots 1-18 from run 170725_run1 and TH-02-24-s spots 1-5 from run 140725_run1 are located in this bivalve. TH-03-24-vein1-30 from 140725_run1 was accidentally located within the bivalve in sample TH-02-24.