

**Figure S1. (a)** Reference materials used in the calcite in situ U-Pb dating the experiment. **(b-c)**

Representative laser ablation craters in calcite show ideal ablation effects (under reflected light).

Related to Figure 6a.

**Figure S2.** Tera-Wasserburg concordia diagram of AHX-1d in the first U-Pb dating experiment.

Related to Figures 5d and 6f.

**Figure S3.** Tera-Wasserburg concordia diagram of PTKD-2 in the first U-Pb dating experiment.

Related to Figures 5d and 6f.

**Figure S4.** Tera-Wasserburg concordia diagram of LD-5 in the first U-Pb dating experiment. Related to Figures 5d and 6f.

**Figure S5.** Tera-Wasserburg concordia diagram of AHX-1d in the second U-Pb dating experiment.

Related to Figures 6c,d.

**Figure S6.** Tera-Wasserburg concordia diagram of PTKD-2 in the second U-Pb dating experiment.

Related to Figures 6c,d.

**Figure S7.** Tera-Wasserburg concordia diagram of LD-5 in the second U-Pb dating experiment.

Related to Figures 6c,d.