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Supplement of

Thermal annealing of implanted ^{252}Cf fission tracks in monazite

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1 **Supplementary Information**

2

3 *Laboratory annealing experiments:*

4

5 The order of annealing schedules went as follows: 1 hour, 10 hours, 100 hours and 1000
6 hours. For each annealing experiment, two sample mounts (one // to (100) faces and one \perp
7 to the c-axis) were irradiated with collimated ^{252}Cf fission fragments over sequential days.
8 Systematically in every experiment, the mount with grains oriented // to the (100) face would
9 be irradiated first, followed by the second mount with grains oriented \perp to c-axis. Each mount
10 would then be left for 1 day to enable any residual short duration radioactivity to die away to
11 minimize human exposure. The second mount was irradiated at the same time as the first
12 one was "cooling off". Following this procedure, commercial paint stripper was applied to
13 each mount which softened the epoxy so that the grains could be lifted out using forceps. The
14 loose grains were then rinsed in ethanol, dried and placed in an aluminium tube that was
15 already positioned in the pre-heated block heater. The samples were then annealed for the
16 appropriate duration for each temperature step.

17

18 During annealing, the block heater was covered by a ceramic foam block. The temperature of
19 the block heater was monitored by a digital thermometer and checked periodically. A small
20 hole in the ceramic foam block allowed for the thermometer probe to stay positioned in the
21 block heater during the annealing experiments. This allowed for minimal disturbance.

22

23 Once each annealing run was completed, the aluminum tubes were removed from the block
24 heater using crucible tongs and quenched in water. The grains were then positioned polished
25 face down on double-sided tape, re-mounted in cold setting epoxy and left to cure for 24
26 hours. The original polished surfaces were wiped clean with ethanol and etched as described
27 under Section 2.

28

29 For each time schedule, the control samples were exposed to the collimated ^{252}Cf fission
30 fragments while other mounts were annealing in the block heater. This was carried out at the
31 most convenient and efficient time throughout the annealing experiments. Each mount was
32 left for at least 24 hours, then etched one after the other. However, any additional period

33 prior to etching was not recorded but was no more than five days. Therefore, any possible
34 room temperature annealing, as discussed in Section 4, occurred between one and five days.