Figure DR1: Shaded digital elevation model (20 m resolution) of the Hochschwab massif S of the fault core of the SEMP. The Hirschgruben cave (star) is located within a broad fault zone kinematically associated with the SEMP. Fault pattern from Plan and Decker (2006).
**Figure DR2.1:** (a) Massive flowstone that grew in a ceiling niche between footwall and hanging wall and was ruptured by sinistral strike-slip faulting. The main part of the flowstone remained attached to the footwall and left a gap (20 to 30 cm) to some smaller parts being attached to the hanging wall. The tips of blue arrows mark points which were adjacent to each other prior to the offset. Note that the shear sense appears reversed due to the upward view. (b) Line drawing of Figure DR2.1a.

DR2.2 and 2.3: (a) Fault at the passage ceiling that displaced a phreatic ceiling pocket. In both cases the edges are displaced by ~25 cm. (b) Line drawing of pictures. (c) Line drawing of interpretation of the undeformed ceiling pocket.

DR2.4: (a, b) Thin-section (crossed polarisers) and line drawing of scratched flowstone from the hanging-wall (top is down). The pre-event flowstone grew on the dolostone wall rocks. The outer part of the flowstone has been cataclastically deformed by differential movement of a pinched block during sinistral fault displacement. The transition from undeformed to cataclastically deformed flowstone is gradual and marked by a zone of intense mechanical twinning and secondary synthetic microfaults. Post-event flowstone, which grew on top of these cataclasites, is undeformed.

DR 2.5: Thin-section (crossed polarisers with sensitive tint plate) of the transition in the pre-event flowstone from the mechanically twinned calcite crystals to the synthetically fractured proto-cataclasites. Note the sinistral offset of fractured calcite crystals (examples highlighted by circles).

DR 2.6 Same transition zone as in Fig. DR2.5. Note the distorted mechanical twins and the fragmentation of the calcite crystal, indicating sinistral shear during cataclastic deformation.
Figure DR3: Slabbed drill cores of seismically disrupted flowstone from Hirschgruben Cave. All cores are oriented so that top is up. Locations of U-Th dates indicated by red lines and points. The disrupted boundaries between pre- and post-event calcite are marked by yellow arrows. No age data are available from core 2, whose
base is a dolostone. Note severe deformation in the deeper portion of core 4 including high-angle displacement. Also note presence of a fragment of red loam at the seismically disrupted boundary.