“Intermittent fracturing in the middle continental crust as evidence for transient switching of principal stress axes associated with the subduction zone earthquake cycle”

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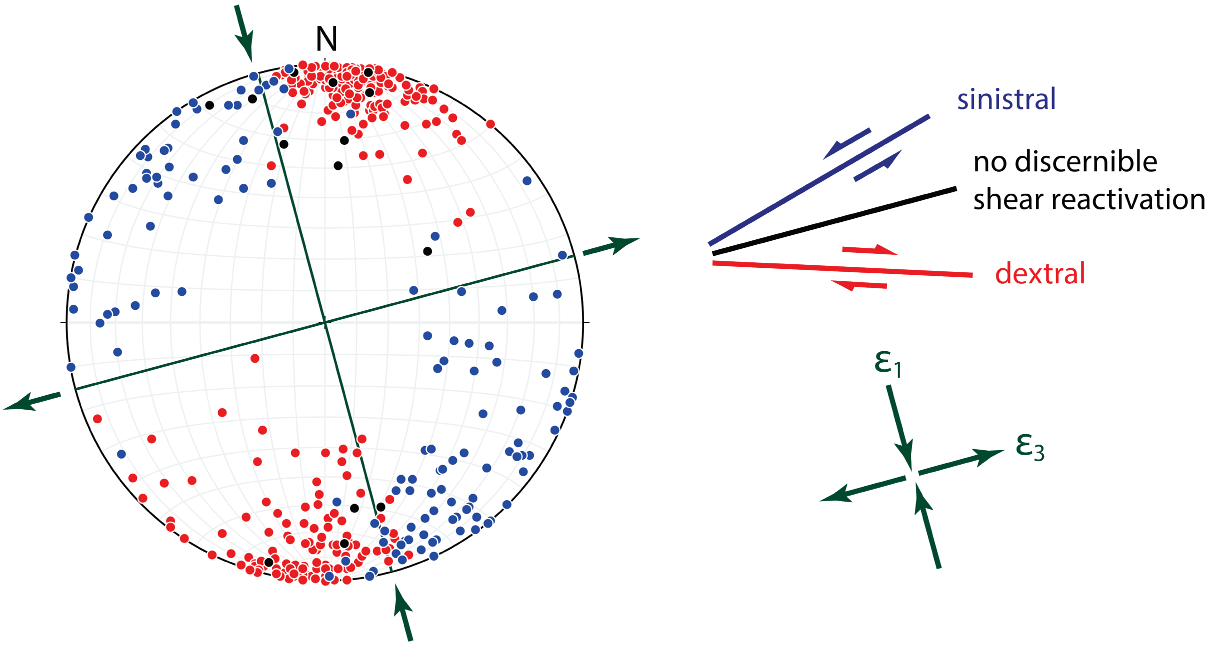
WGS84 GPS LOCATIONS FOR ALL FIGURES

Figure #	Latitude	Longitude
2A	46.974833° N	11.798533° E
2B	46.975106° N	11.798172° E
2C	46.975089° N	11.798144° E
3A	46.973736° N	11.796886° E
3B	46.973628° N	11.796939° E
3C	46.973689° N	11.796603° E
3D	46.978200° N	11.799192° E
3E	46.975058° N	11.775042° E

SHORTENING AND STRETCHING DIRECTION FROM THE SENSE OF DUCTILE SHEAR ON PRECURSOR FRACTURES

A



B

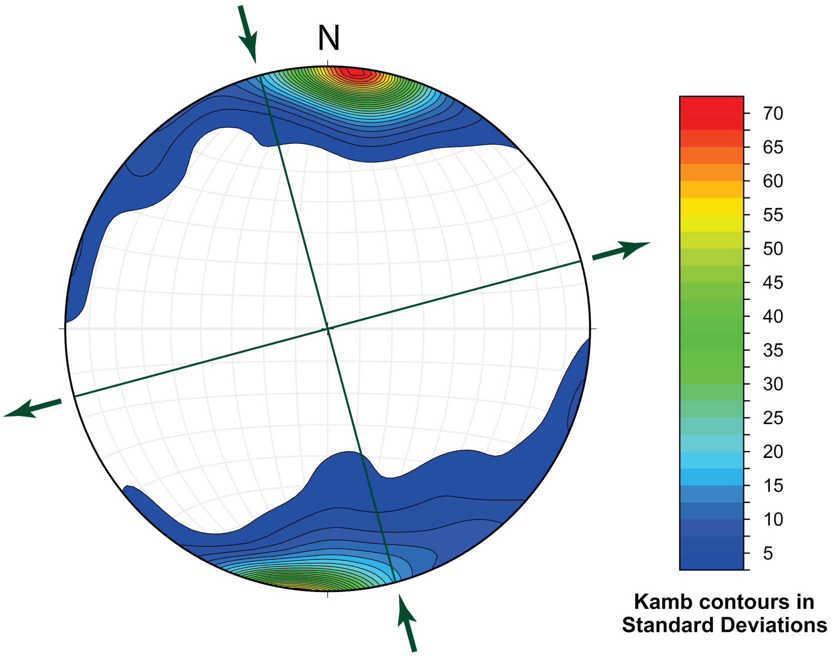


Fig. S1A. Equal area lower hemisphere plot of the poles to fracture planes, with the color scheme distinguishing the sense of shear reactivation (blue = sinistral, red = dextral, black = none). For the effectively strike-slip shear movement on these planes, the bulk shortening (ε_1) and extension (ε_3) directions during aseismic viscous shear will be approximately horizontal, with their directions given by the strike of the planes separating the fields of sinistral and dextral shear.

Fig. S1B. Contoured plot for all the pole data of Fig. S1A. The maximum plunges 02° toward 006°, with this azimuth making an angle of 21° to the inferred bulk shortening direction (ε_1) at 345°. As is obvious from this contour plot, fracture planes are commonly oriented at a high angle (>70°) to ε_1.

DETAILED OUTCROP MAPS

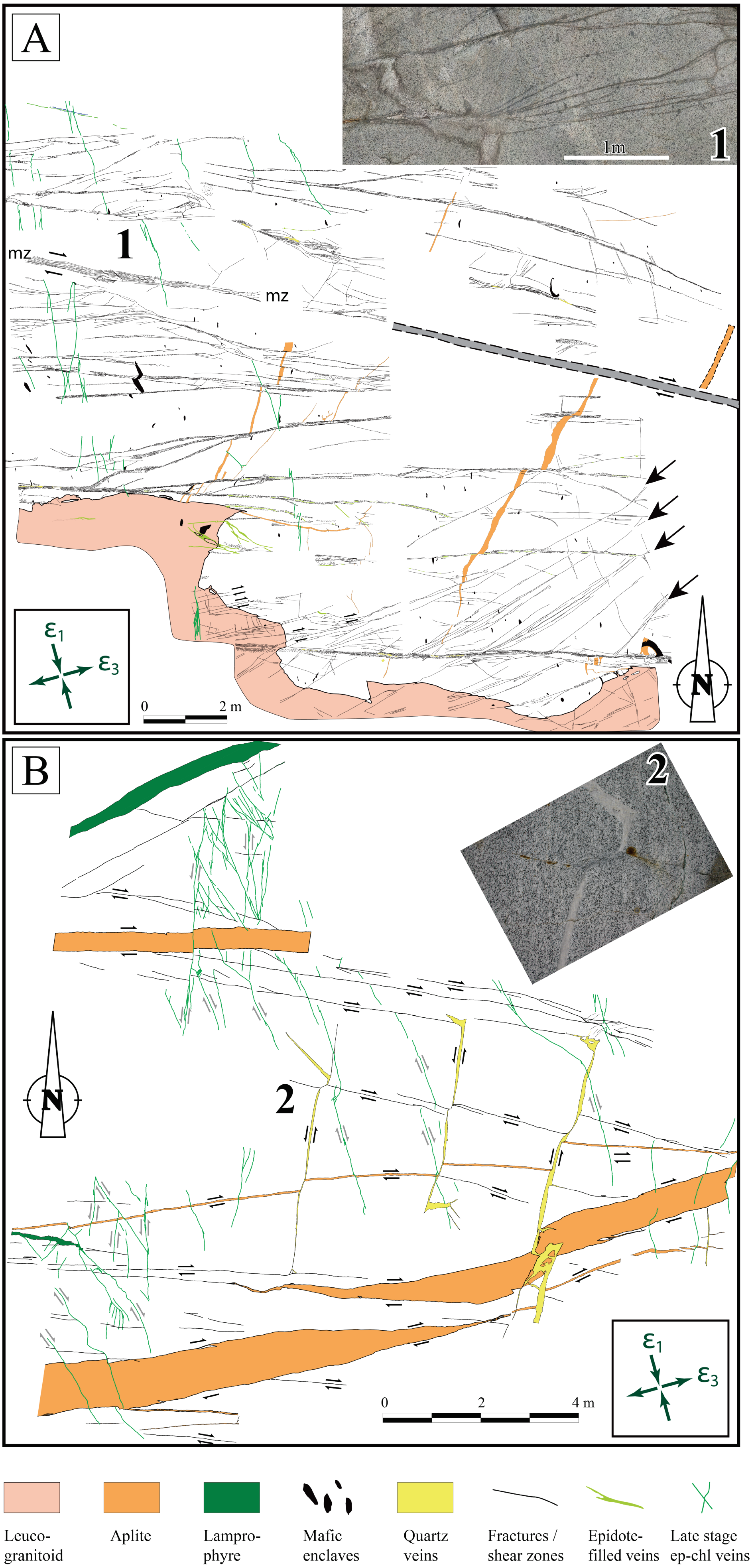


Fig. S2. Detailed outcrop maps (drawn from high-resolution orthorectified photomosaics) from the Neves area, modified after Mancktelow and Pennacchioni (2007). These two maps clearly document the field constraints on the 345° long-term bulk shortening direction and 075° stretching direction active at mid-crustal, amphibolite facies, metamorphic conditions. They also document the development of dextral ductile shear zones overprinting precursor fractures of the E-W set and quartz vein formation during mixed-mode sinistral shearing and extensional opening on the N-S set.

A. Map showing the network of incipient ductile shear zones. The large majority of shear zones in the outcrop are single or paired shear zones exploiting the E-W set of fractures and showing a dextral sense of ductile shear. In the outcrop, there is one major mylonitic zone (labelled as ‘‘mz’’, with an inferred continuation shown as the grey zone with dashed boundaries), accommodating an inferred offset of about 2 m (established from the offset of an aplite dyke), and a few other shear zones with offsets of several decimeters. However, the great majority of shear zones only show offsets on the order of a few centimeters. The pattern of these minor shear zones generally retain the geometry of the precursor fractures The set of NNE-trending fractures, which are well developed in the lower part of the outcrop (indicated by the black arrows), are consistent with a wing-crack system relative to the main E-W set and suggest a sinistral sense of shear during fracture formation. The small double black arrows at the lower left side of the map indicate a dextral reactivation of these fractures, which are mostly un-reactivated elsewhere. The inverse (sinistral) initial sense of shear of the fracture is also evident from the geometric arrangement of some fractures, such as the horsetail splay structure above location 1 (field photograph is given in the upper right inset). GPS coordinates: 46.973111° N, 11.796833° E.

B. Map showing a set of subparallel double-winged NNE-SSW-striking quartz-rich veins (N-S set) associated with dextral ductile shear zones exploiting E-W- to ESE-WNW-striking precursor fractures (E-W set) and aplite dykes. The wing asymmetry of the quartz veins (N-S set) is consistent with sinistral shear during opening, the same as the shear sense during overprinting ductile shear (black arrows). The inset photo (from location 2) is an enlargement of the intersection between a sinistrally sheared quartz vein and a dextrally reactivated fracture, with the development of a typical thinned and strongly foliated zone at the intersection. This thinning zone, with its locally developed solid-state foliation, is effectively perpendicular to the bulk shortening direction at 345°. The grey arrows indicate the sense of shear on late-stage chlorite-epidote- filled faults (Pennacchioni and Mancktelow, 2007). The conjugate array of these late-stage faults indicates that the same shortening direction persisted during cooling and exhumation of the Neves meta-granitoids, with only a slight rotation more toward north. GPS coordinates: 46.976056° N, 11.798722° E.

Fig. S3. Drone mosaic of Fig. 3A without overlays. Left side of photo to N, see Fig. 3A for scale.

Fig. S4. Photomosaic of Fig. 3B without overlays. Top to N, see Fig. 3A for location and scale.

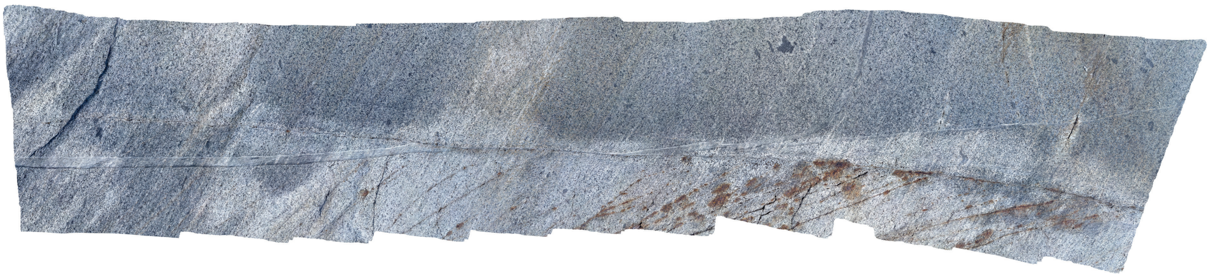


Fig. S5. Detailed photomosaic of upper center of Fig. S4 above, showing fractures with associated single and paired shear zones cross-cutting an older ductile shear zone localized on a magmatic dike. Top to N, see Fig. 3A for location and scale.

Fig. S6. Combined ground and drone photomosaic of the left-stepping fracture zone with horse-tail fracture patterns in the step-over zones. Top to N. See Fig. 3A for location and scale.

Fig. S7. Photomosaic of folded and fractured aplite dyke of Fig. 3C. Top ca. N, see Fig. 3A for location, scale and exact orientation. Pen in center ca. 14 cm for scale.

Fig. S8. Close-up photograph of top-left of Fig. S7, top ca. to S (i.e. 180° rotated relative to Fig. S7). Interplay between fracture and ductile foliation development.

Fig. S9. Close-up photograph of center of Fig. S7, top ca. to S (i.e. 180° rotated relative to Fig. S7). Pen ca. 14 cm for scale. Note precursor fractures, with subsequent localization of single and paired shear zones.

Fig. S10. Close-up photograph of center of Fig. S9, top ca. to S. 1 Euro scale 2.3 cm. Note details of single and paired shear zones.