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Creep with dynamic rupture fluctuation; field evidence from exhumed polyphase cataclastic faults within an extensional regime on the Islands of Kea and Serifos (Western Cyclades, Greece)

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Widespread seismicity and intensely developed active and ancient fault systems are common to the Aegean Region. This active geodynamic setting is part of the westward advancing Anatolian plate and the west- & southward retreat of the Hellenic slab. The islands of Kea and Serifos (see Müller et al., Voit et al., Iglseder et al., session TS10.5, this meeting) represent exhumed mid-upper crustal, southerly-directed extensional detachment systems within the dramatically thinned, now largely aseismic, Western Cyclades. This extensional system is adjacent to, and a possible forerunner for, the seismically active, rapidly widening Gulf of Corinth Rift to the NW. Brittle (sensu lato) deformation in the extensional system is notably distributed in space and protracted over time. Lithospheric failure in the region includes at least two phases: (1) multiple, low-angle cataclastic fault zones formed within, and (sub-) parallel to, a regional mylonitic ductile foliation, and (2) a widespread system of (sub-) vertical cross-cutting steep faults.

To better understand no. (1), the low-angle cataclastic fault zones, we use differential GPS surveying together with thin-section columning, cathode-luminescence, X-Ray diffraction of clay gouge minerals and Ar-dating of authigenic clay cores. The Otzias Bay Detachment (ODB) on Kea comprises a $>>$150 m long, 25 m wide and up to 8 m high broadly folded lens of cataclasite sitting within greenschist facies retrograded calc-schists and marble mylonites. The cataclasite is made up of (A) mm to metre sized breccia clasts of ankeritised dolostone - the protolith of which forms 100's m

long brittlely fractured mega-boudins in the hanging wall of the OBD; these acted as stiff members in the island-wide greenschist mylonitic detachment, (B) cm to 10's cm quartz blocks and breccia, (C) rare cm-scale portions rich in fragments of the hosting calc-schists, (D) poorly to intensely foliated black, grey and red very impure calcareous matrix, and (E) between 2 and 7 discrete (bifurcating/merging), 1-5 cm thick moderately to well-indurated clay gouge-bearing fault cores whose overall geometry is moderately dipping to horizontal. Fabrics in the cataclasite show a range of creep-type fabrics, mm to metre scale breccia tails, smeared out matrix layers and discrete slip planes (usually at fault core margins) that define geometries of S-C planes, flanking structures, and asymmetric porphyroclasts of varying fabric intensity. Such spatial co-existence of fabrics generated at frictional as well as creep conditions have been reported from some other cataclasite zone studies (e.g. Chester, Rutter, Faulkener). However, a feature that is hitherto undescribed (at least to us) is the presence, at the base of the OBD cataclasite of a mylonite that consists of brecciated pieces (cm-10's cm) of the original hosting mylonite! This lies immediately structurally below, but is separated by, a ductile fabric whose discordance angle is very small but nonetheless persistent throughout the area at the contact of the ODB cataclasite and underlying mylonite, thereby marking a key cross-cutting relationship. We term this mylonite-hosting-older-(brecciated)-mylonites, the remylonitised cataclasite (RMC). This entire package is not cross-cut by any of the major (quartz or calcite) vein systems that are widespread in the main mylonites, it is however uprightly folded on m to 10's m wavelengths, further illustrating the coeval role of ductile and brittle processes.

Although a priori co-seismic deformation in the form of pseudotachylites have not been recognised in the studied areas on Kea, we suspect this is due to the absence of suitable host-rocks to generate frictional melts. In contrast to the calcareous schists and marbles of Kea, the Island of Serifos has widespread granitic protoliths and pseudotachylites are common (see Iglseder et al., session TS10.5, this meeting). The otherwise very comparable deformation conditions, detachment system architecture and kinematics of the two islands encourage us to draw a seismotectonic interpretation for both islands. We therefore suggest that the RMC together with overlying OBD ductile fabric cataclasite provide critical evidence for repeated switches in velocity strengthening / weakening. Moreover, we regard these as indirect evidence of seismicity within the basal detachment structure of the ancient Western Cyclades extensional rift system. Finally, we offer that the OBD and RMC provide a direct analogue for the juvenile detachment imaged beneath the Gulf of Corinth.