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Shear zones at the base of the lowermost known unit of the Cretan nappe pile in the Talea Ori, northern central Crete – the long-time deformation record during burial and exhumation from HP-LT metamorphic conditions

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The structural characteristics and microfabrics of shear zones at the base of the lowermost known level of the Cretan nappe pile, exposed at the northern central coast of the Talea Ori Mountains, are presented. There, the high pressure – low temperature (HP-LT) metamorphic sediments provide information on the long-term geological history from the pre-Alpine basement and the Alpine stages of detachment, burial to and exhumation from HP-LT conditions. Information on the unknown pre-Alpine basement of the metasedimentary unit is obtained by the components in low-strain metaconglomerates, where deformation microstructures from the source rocks are preserved or quasi-statically overprinted during the later geological history. Information on the deformation mechanisms and stress history during detachment, burial and exhumation is obtained by high-strain shear zones surrounding the low-strain metasediments. A gradual transition from the low-strain metaconglomerates and associated black shales and metacherts to shear zones characterized by a scaly foliation, shear bands and associated quartz veins is observed. Shear bands occur likewise in black shales, metaquartzites and metaconglomerates and are inclined at various angles to the sedimentary layering or the scaly foliation, respectively. They generally indicate down-faulting of the respective northern block. Associated quartz veins taper wedge-shaped at a high angle to the foliation, decorating the shear band boundaries and showing shear offsets. Microstructures in rocks from these shear bands and related vein quartz show indication of dislocation glide-controlled deformation of quartz by the presence of deformation lamellae, deformation bands, short-wavelength undulatory extinction and localized strings of recrystallized grains. The shear zones document at least two different deformation stages: A first stage of deformation is characterized mainly by dissolution precipitation creep generating the scaly cleavage and implying low-stress viscous flow. A second stage is recorded by the shear bands and associated quartz veins, indicating episodic deformation at transient high stresses. Strain during the second deformation stage is apparently localized in pre-existing shear zones, i.e. representing shear zone reactivation.