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Layer-parallel shear during subduction and exhumation of HP-UHP metamorphic rocks units.

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The continental crust is usually made of layers with contrasted rheological properties and corresponding strengths. At crustal-scale, this can be responsible for décollement between sedimentary cover and basement as well as between upper brittle crust and middle-lower ductile crust, in both shortening and extension. Within the cover, strength variations between sedimentary and/or volcanic layers can lead multiple décollements at different scales. In convergence zones, continental units can undergo successive layer-parallel shearing with opposite sense, top updip during subduction and top downdip during exhumation. Resulting deformations and structures are in particular zones of high shear strain localised in weak layers and flat-ramp type displacement zones cutting through layering. During subduction, they can accommodate either thickening or thinning of layers, and pilling up of lithological units (thrusting). Exhumation is often characterized by combinations of layer-parallel shear and layer-parallel stretching and by extensional flat-ramp extensional systems that develop first in a dominantly ductile environment and then, progressively, in more brittle and localising environments. We illustrate this variety of structures by examples from the HP metamorphic rocks of the Adria continental block (Cyclades, Continental Greece and Peloponese) in the Southern Hellenides. In the Adria block, it is especially noticeable i) that shearing was controlled by the same mechanical layering during both subduction and exhumation and ii) that significant volumes of HP metamorphic rocks show no deformation imprint resulting from exhumation. It is argued that the two successive events of layer-parallel shear with opposite sense that are observed along around 200Km in the direction of convergence could not correspond to a subduction channel-type process. The geometry and kinematics of observed deformations indicate that the Adria continental block has been first subducted, second detached from the underlying downgoing slab and then exhumed in the space accommodated by slab rollback, at surface.