Horizontal compression versus vertical loading in accretionary prisms, the example of Nobeoka, Kyushu, Japan

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In addition to direct observation of samples cored at depth in subduction zones, the study of on-land ancient accretionary prisms provides useful information into the deformation affecting the sediments above the subducting plate interface. The analysis of two-phased prograde deformation of subducted turbidites within the Shimanto Belt on Kyushu, Japan, shows strongly contrasted kinematics between a shallow fold-and-thrust-type stage and a deeper metamorphic compaction-type stage. The deep deformation is characterized by the intense development of a muscovite-chlorite metamorphic foliation at low angle to the sedimentary stratification, with pure shear geometry, which overprinted the structures inherited from the shallower stage. This pure shear geometry is furthermore supported by the strongly oblate magnetic fabrics with a minimum axis perpendicular to the foliation and the two other axes in a girdle within the foliation plane.

The stress geometry within the accretionary wedge is strongly controlled by the coupling at its basis. We propose to relate the change in the geometry of the deformation, from shallow horizontal compression to deep vertical loading, to variations between an outer wedge with high basal friction and internal horizontal compression and an inner wedge with low basal friction and vertical shortening at depth. Furthermore, the compaction affecting sediments within the deepest levels of the accretionary prism results in large mass transfers and constitute a largely unrecognized contribution to the exhumation of deeply-seated metamorphic rocks.