Shear zones between blocks with no differential block movement

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A shear zone is usually defined as a tabular to sheet-like, planar or curvi-planar deformation zone of finite width composed of rocks more highly-strained/foliated than their surroundings. Shear zones are normally viewed as the zones that accommodate relative displacement between two ”blocks” that have moved past each other in opposite directions. This study reports localized zones of shear between adjacent blocks that have not moved past each other.
Unlike conventional shear zones across which shear indicators display consistant symmetries, shear indicators on either sides of the shear zone(s) reported here show reverse kinematics. Thus profiles exhibit a combination of sinistral and dextral shear zones across their centrelines.

Such zones record the loss or passage of missing materials from or through the reference frame. Zones from which materials have been lost are already known as (primary, secondary or tertiary) welds so we refer to the paths along which missing materials have moved as transit paths.

Field observations and modeling suggest that examples of transit paths develop where denser blocks sink within salt structures or solid blocks sinking through a partially molten magma body (stoping), bodies of melt rise through partially molten migmatites, between boudins separated by progressive extension and (perhaps) where slabs of subducted oceanic crust delaminate from the lithosphere and sink into the asthenosphere, (maybe also along channels that have welded after extrusion of their contents).

From the fluid dynamics view these shear zones can be regarded as the low Reynolds number deformation zone within the wake of a body moving through a viscous medium. While compact moving bodies (aspect ratio 1) generate an axial symmetric (cone like) shear zone, elongated bodies (vertical plates or horizontal rod-like bodies) produce tabular shear zones

While the width of conventional shear zones depends on the degree of non-linearity (or damage parameter) of the flow law of the shearing region, the width of the transit path shear zones depend additionally on the characteristic dimensions of the object.

Model examples show that shear strain can be symmetrical across transit paths through homogenous materials but asymmetric across transit paths along contacts between materials with different effective viscosities. While in Newtonian flow conventional narrow shear zones do not form under externally applied shear stresses, narrow unconventional shear zones develop in the wake of sinking objects even in Newtonian fluids.