



Geometry and kinematics of viscous wedges or viscous-rich, in fold-and-thrust belts and accretionary prisms in the presence of salt: an analogue experimental approach

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The critical taper theory is generally accepted by the scientific community for brittle wedges (e.g, critical, overcritical, or undercritical tapers). Much less is known about wedges that comprise large volumes of viscous than brittle material. This is not the case in regular accretionary prisms, but it does exist in some areas (in the central Mediterranean, for example), where such cases occurred.

We conducted a systematic set of experiments, in which the salt analogues where large, viscous layers involved in a convergent setting underlying or overlying a brittle overburden, such as occurred in the Mediterranean after the Messinian Salinity Crisis. Their presence had an impact that is not so well known to people dealing with the general geodynamics of the region. We used the “pull-from-below” technique, in which a tilted basal conveyor belt simulated the subducting plate. We tested the cases where the entire wedge was viscous: results indicate that convergence was entirely accommodated by internal salt flow, with frontal shortening and an incredible amount of very localized extension in the proximal area, near the backstop, while the regional slope remained horizontal. Using the same set up, but adding some brittle overburden led to results that are partly similar and different: in the overburden, there was some frontal contraction, but no proximal extension. But internal flow within the viscous layer (a combination of Poiseuille and Couette flow) kept the surface slope horizontal.

We also applied our research to the specific case of the Mediterranean ridge, where the structure of the accretionary prism (i.e. made of brittle sediments) was well established before the Messinian Salinity Crisis occurred. Then, the area was “flooded” by mobile, Messinian evaporites. There, our experimental results show that this had a major impact on the geometry and kinematics of the sub-Messinian salt series and structures. During that particular experiment, once the “salt” was deposited, the sub-salt thrusts stopped propagating forward, and, instead, were reactivated in order to thicken the hinterland, while the overall surface slope (sub-salt + salt) remained at a near zero slope angle.