



From mantle to crust : stretching the Mediterranean

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The origin of forces driving the deformation of the continental crust near subduction zones and especially in backarc regions is debated. Based on a compilation of SKS fast splitting directions that give an image of flow lines in the mantle around the Mediterranean subduction zones and a comparison with stretching and shear directions in metamorphic core complexes that describe the pattern of deformation at the scale of the middle and lower crust, we show that : (1) the two sets of directions are parallel in the three main backarc regions, namely the Alboran Sea, the Tyrrhenian Sea and the Aegean Sea showing that the lithosphere deforms with the same direction of stretching in the crust and the mantle, suggesting that (2) crustal deformation is mainly driven from below by slab retreat, and (3) the lithospheric fabric is reset within a few millions of years in backarc environments. The two sets of stretching directions are similar in a first approach whatever the age of extension; even below Tuscany where extension is recent the parallelism is clear. This observation shows that the time needed to reset the fabric of the lithosphere to be parallel to the direction of slab retreat is short, of the order of 5-8 Ma. These observations have one further important consequence : the observed scheme and the geometry of slab retreat and upper plate extension is extremely simple, much simpler than the analysis of brittle deformation in the upper crust could suggest. The pattern of deformation at depth is simpler and the upper crust is thus partly decoupled from the lower crust in the vicinity of the brittle-ductile transition. The lower and middle crusts follow the flow imposed by the underlying mantle during retreat, and the upper crust follows passively. In regions of backarc extension where the lithosphere is warm and weak the deformation is thus largely driven from below.