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## A new model for brittle failure at depth involving high-pressure metamorphism

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Intermediate-depth earthquakes are registered in convergence zones where crustal rocks are expected to deform by ductile flow. This paradox is also evidenced in exhumed crustal rocks where brittle structures (e.g., pseudotachylytes and breccias) associated to high-pressure metamorphism have been documented. If the link between brittle deformation and metamorphic reactions appears obvious today, the mechanism involved is still a burning issue. We propose that the initial heterogeneity of rocks, by itself, is sufficient to trigger both metamorphic reaction and brittle deformation. Based on a mechanically consistent dynamic model, we show that local pressure variations due to pre-existing heterogeneities can be high enough to reach the thermodynamic conditions required for reaction initiation. Brittle behaviour is then controlled by the strength difference between the untransformed host rock and its reaction product. This continuous process also explains the higher pressures recorded in eclogite facies rocks of ductile shear zones compared to their brittle host rock. Our results, constraint by natural data, have therefore significant implications for intermediate-depth seismicity.