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# Wet decoupling defines regimes of terrestrial subduction: why and how?

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Main characteristic of the terrestrial subduction is that it takes place asymmetrically - the subducted slab sinks downward, while the overriding plate moves horizontally (one-sided subduction). Numerical experiments show that the stability, intensity, and mode of subduction depend mainly on plate strength and the degree of decoupling along the plate interface controlled by porous fluid pressure. The terrestrial one-sided subduction requires a weak hydrated slab interface and high plate strength. The weak interface is maintained by the release of aqueous fluids from the subducted oceanic crust and sediments. The resulting weak interplate zone localizes deformation at the interface and decouples the strong plates, facilitating asymmetric plate movement. Based on numerical models we identify the following geodynamic regimes of subduction which may form on Earth: (1) stable subduction, (2) retreating subduction with a focused backarc spreading center, (3) retreating subduction with distributed intra-arc extension, (4) advancing subduction with thickening overriding plate. Transitions between these different regimes are mainly caused by the concurrence of rheological weakening effects of (1) aqueous fluids percolating from the subducting slab into the mantle wedge and (2) melts propagating from the partially molten areas formed in the mantle wedge toward the surface. The aqueous fluids mainly affect the forearc region. Strong fluid-related weakening promotes plate decoupling and reduces subduction drag and thus results in stacking of sediments in the accretion prism. In contrast, reduced weakening by fluids results in strong coupling of the plates and leads to advancing collision-like subduction with enhanced subduction erosion. Thickening of the overriding plate and sedimentary plumes in the mantle wedge are the consequences. On the other hand, melts, extracted from the hot regions above the slab, rheologically weaken the lithosphere below the arc which thus controls overriding plate extension and shortening. Strong rheological weakening by melts in combination with weak plate coupling triggers retreating subduction with a pronounced backarc spreading center. Also, weakening of the arc by melts extracted from sedimentary plumes, generate weak channels through which these structures may be emplaced into subarc crust. If there is insufficient melt-related weakening, plumes cannot ascend but extend horizontally and thus underplate the lithosphere.