Changes of plate age at trench: influence on subduction dynamics and surface topography.

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At present-day, the age of the subducting plate at trench largely varies among subduction zones. It ranges in between 0 Ma where active spreading ridges are subducted (e.g., Patagonia) and ~150 Ma for the oldest subducted oceanic lithospheres. The age of the slab at a specific location can also vary through time, implying a change in the slab thickness and associated slab pull. Previous models have shown that such temporal changes can produce significant modifications of the geometry of the slab as well as changes of plates velocity and upper plate deformation. However, the evolution of plate age at trench also depends on the previous history of oceanic spreading, which may vary from one subduction zone to another. Here, we test with mantle-scale analogue models the effect of different rates of plate age decrease at trench (from ~0.25 Ma/My to ~6 Ma/My) by progressively reducing the thickness of the subducting lithosphere. All models show that a thinning slab is generally associated with a slab dip increase. The faster the change in plate age at trench is, the later the change in slab dip occurs, which results in a large variability of slab dip (up to 30-40°) for the same slab age at trench. The change of age at trench also largely impacts subduction velocity and its partitioning into subducting plate and trench advance or retreat, which may in turn impact the deformation regime in the upper plate. We also explore with numerical models how the changes in slab geometry and plate kinematics associated to variations in slab age modify the surface topography above the slab.