

HOW THE COMBINATION OF LOCAL AND TECTONIC FORCES AFFECTS THE SUBDUCTION ZONE INITIATION AT PASSIVE MARGINS

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SZIs are classified as either spontaneous or induced, depending on whether the driving force is local, i.e. the **gravitational instability**, or external, as the **tectonic convergence**^{[1][3][4]}. However, these are **end-members** of a wide variety of possible combinations.

What happens combining a gravitational phase with a convergent phase?

We performed 225 numerical models using the finite-element code **FALCON**^[2] on a 2D passive margin setup.

The flow laws are fixed, but we combine 3 plasticity parameters and weakening laws combinations (**PW2, PW3, PW4**) with 3 viscous weakening laws (**B, C, D**).

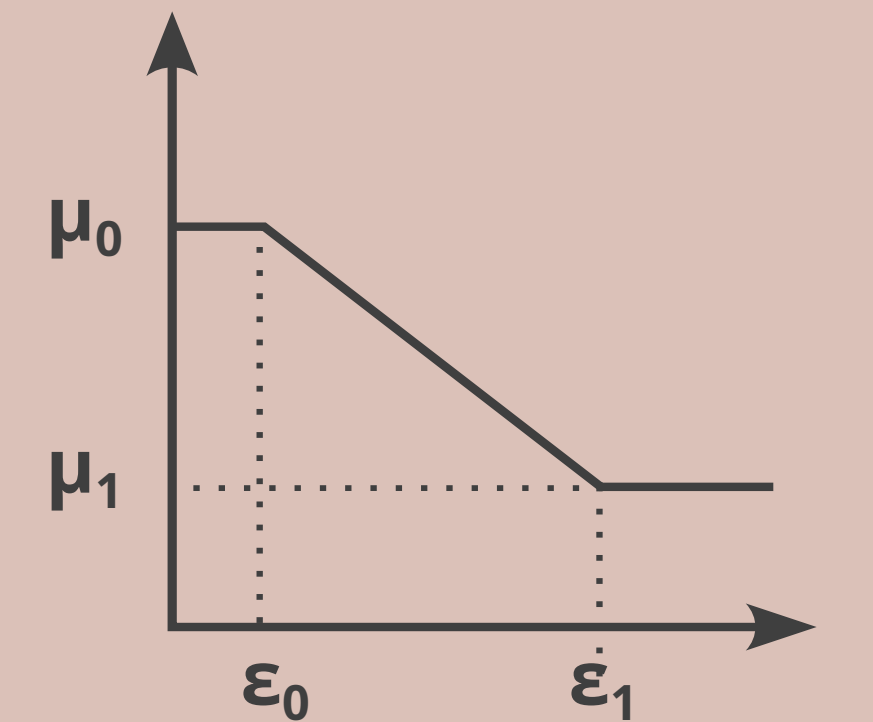
The 6 convergence velocities used are: **0.01, 0.05, 0.10, 0.25, 0.50, 1.00 cm/yr**.

The convergent phase lasts always 30 Myr, but before the onset of the convergence we run **0, 10, 20 or 30 Myr** of gravitational phase (t_{grav}).

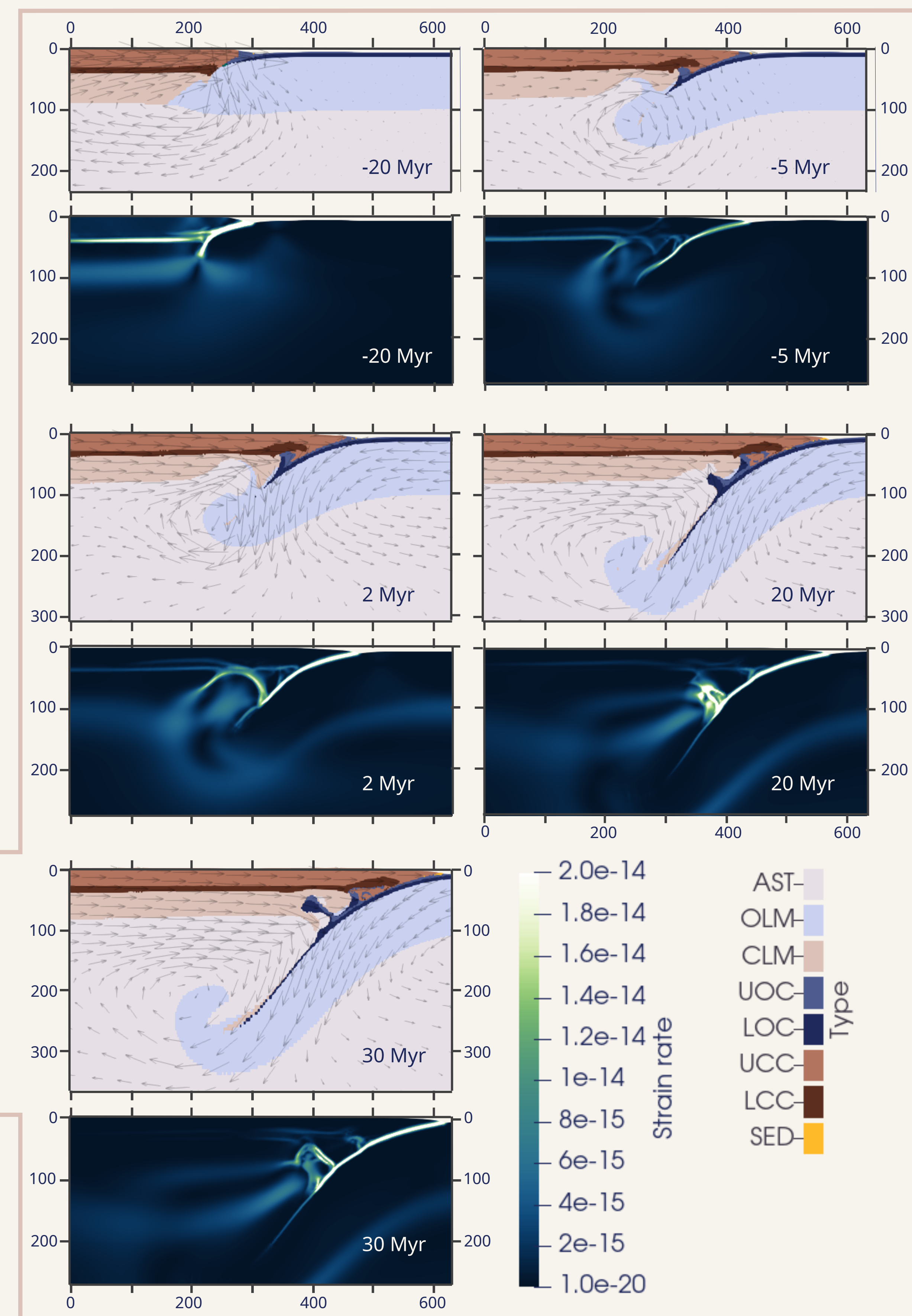
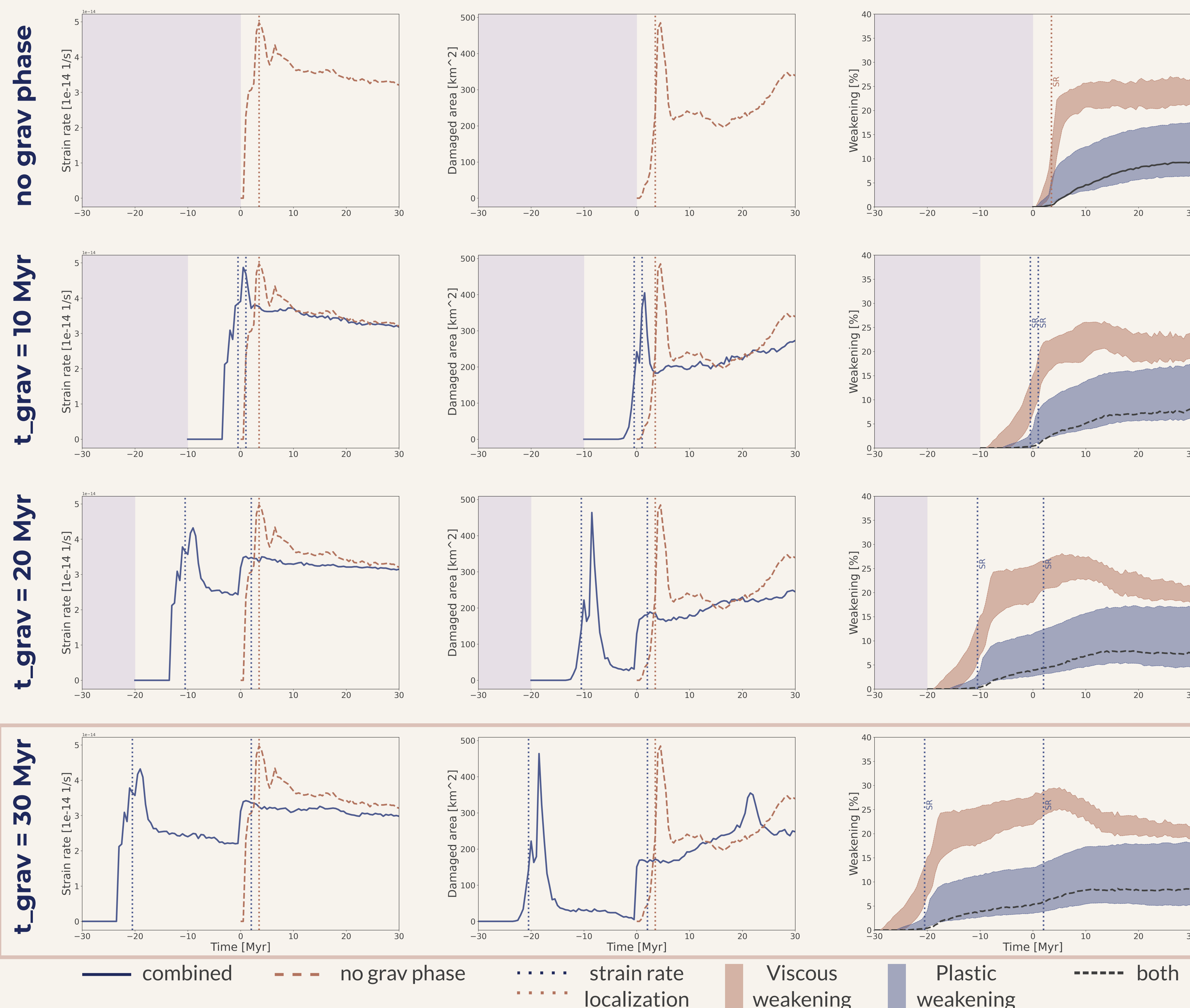
	ϵ	W
B	5 - 10	10
C	0.2 - 0.5	10
D	0.5 - 1.5	10
PW	0.1 - 1.1	-

	PW2	PW3	PW4
Mantle	strong	strong	strong
SED	weak	weak	weak
UCC	weak	medium	weak
LCC	weak	medium	medium
UOC	strong	weak	weak
LOC	strong	medium	medium

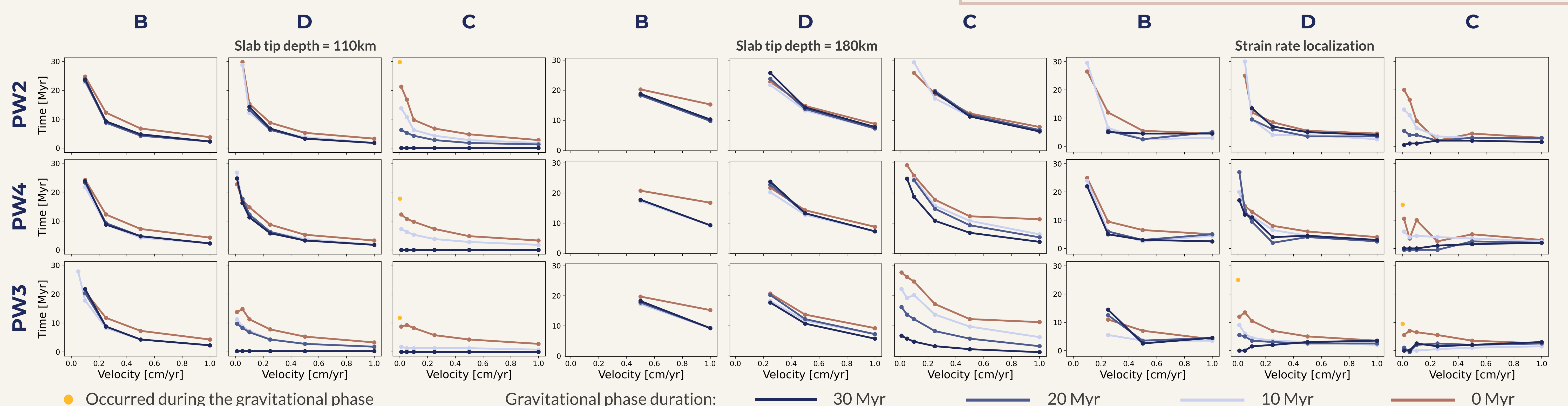
	Phi [°]	C [MPa]
strong	25 - 5	20 - 4
medium	20 - 4	15 - 3
weak	15-3	10 - 2



Model: C, PW3, V=0.5 cm/yr



Area in which the strain rate is $> 2e-14$ 1/s, mean strain rate in this area and percentage of elements that have undergone strain weakening in the OCT zone. Adding a gravitational phase before the onset of the convergence modifies the system evolution.



Time in which the slab reaches the 125% and the 200% of the continental lithosphere thickness (110 km and 180 km) and the strain rate localization for each model. The weakening laws and the convergence velocity act on how much the gravitational phase influences the system evolution.

[1] Cramer, Fabio et al. (2020). **A transdisciplinary and community-driven database to unravel subduction zone initiation**. In: Nat. Commun.

[2] Regorda, Alessandro et al. (2023). **Rifting Venus: Insights From Numerical Modeling**. In: JGR Planets.

[3] Stern, Robert J. (2004). **Subduction initiation: Spontaneous and induced**. In: EPLS.

[4] Stern, Robert J. and Taras Gerya (2018). **Subduction initiation in nature and models: A review**. In: Tectonophysics.