Table 1. Notations and physical values common for all experiments.

Parameter	Values and units	Definition
σ, τ, P	Pa, MPa	stress, second invariant shear stress, pressure
v	m/s , mm/yr	velocity vector
ε	s^{-1}	strain and strain rate (with a dot)
μ^*	10^{10} - 10^{25} Pa s	effective viscosity
φ	5-20º	internal friction angle of crustal and mantle layers
Φ	1.43-2.86	friction angle of the subduction channel
So	10 MPa	cohesion for failure criterion
λ , G	30 Gpa	Lamé elastic constants ($\lambda = G$)
Vx , Vb	5 cm/yr, 3cm/yr	Horizontal upper plate convergence, basal slab-pull velocity
r	450 km	Radius of curvature of oceanic plate
hc	35-40 km	Moho depth
hl	120 - 160 km	Thickness of lithosphere
T	10°-1350°	Temperature
Cp	10 J/kg /°C	specific heat
ΔT	3-10°C/km	initial arc anomaly
α	3×10-5 /°C	thermal expansivity
k	2.5 -2.9-3.3W/m/°C	Thermal conductivity, crust, mantle, subd. channel
H_r , H_o	9.×10-10 W kg-1	Radiogenic heat production, total, surface
h_r	10 km	radiogenic heat production decay depth
$AgeO$ $AgeC$	200-400 Myr	Thermotectonic age of the lithosphere
lc	12 km	Thickness of subduction channel
ke	200, 25, 2000 m2/yr	Coefficients of diffusion for erosion.

Table 2: Values for model layers: density (ρ), friction angle (Φ *or* φ), conductivity (k), and dominant composition (*comp*, referring to Table 3). Bold values indicate different values according to models M1 to M8.

	Oceanic mantle	*Oceanic Crust*	*Asthenosphere*	*Continental upper crust*	*Continental lower crust*	*Continental mantle*	*Subducting sediments*	*Subduction channel*
ρ	3360	3000	3350	2750	3050	3350	2850	3200-3400
comp	oldry	mfgr	oldry	**wetgr-qz-plg**	**plg-mfgr**	oldry	plg	**wetgr-plg**
k	3.3	2.9	3.3	2.5	2.5	3.3	2.9	2.9
$\Phi - \varphi$	20°	20°	10°	20°	10°	10°	5°	**1.43-2.86**°

Table 3: Dislocation creep parameters used in the models (n power exponent, A material constant, Q activation energy), after references provided in Rannalli (1995).

	Dry Olivine (oldry)	Wet Olivine (olwet)	Mafic granulite (mfgr)	Plagioclase (plg)	Quartz (qz)	Wet Granite (wetgr)
n	3	2.5	4.2	3.2	2	1.9
A (Mpa-n/s)	7.e4	3.e4	1.4e4	3.3e-4	1.e-3	2.e-4
Q (Jmol-1)	5.2e5	4.44e5	4.45e5	2.38e5	1.67e5	1.37e5

Table 4: Models parameters (first four columns) and results characteristics (last 6 columns). Initial conditions specify subduction channel strength (friction and creep parameters), thermal anomaly and background geotherm, and distribution of continental crust either strong or weak over the specified X domain. Reference (M1) thermal parameters are a continental Age (*A*) of *400My* and a depth to the *1200ºC* isotherm *hl=140* km. Arc thermal anomaly is defined with an increase of *10ºC/km* in an asymmetric horizontal gaussian located at positions *X=270* to *330* km. *Forearc/backarc* deformation column describes where deformation concentrates most, and *CV* indicates the presence of a Central Valley in the forearc. Where present, rising of *buoyant material* is indicated by an '*x*'. The *Topography* column indicates arc heights above or below 6 km, and their distance to the trench (which approximates the forearc width). *Shortening* refers to amounts of total upper plate shortening. *Trench motion* is assumed positive when advancing landward, largest amounts are indicated in filled gray boxes, retreat is underlined.

	channel strength	**thermal anomaly + continent geotherm**	**Crustal rheology**	**forearc/ backarc**	**crustal root**	**buoyant material**	**topography max & dist.**	**Shorte-ning**	**Trench motion**
M1 SR-SF-CT	ϕ=2.86 plg	10º/km [270-330]km A=400Ma,hl=140km	strong	arc popup CV	arc >50 km		>6 km ~200 km	165km	62km
M2 WR-SF-CT	ϕ=2.86 plg	10º/km [270-330]km A=400Ma,hl=140km	weak 0-300km	both	forearc "erosion"		>6km <200km	200km	100km
M3 WR-SF-CT	ϕ=2.86 plg	10º/km [270-330]km A=400Ma,hl=140km	weak 0-150km	forearc	forearc "erosion"		>6 km <200 km	195km	96km
M4 WR-SF-CT	ϕ=2.86 plg	10º/km [270-330]km A=400Ma,hl=140km	weak 150-300km	backarc CV	backarc >50 km		>6 km >200 km	183km	84km
M6 WR-WF-CT	ϕ=1.43 wgr	10º/km [270-330]km A=400Ma,hl=140km	weak 0-300km	both CV	arc >50 km	x	<6 km ~200 km	155km	55km
M7 WR-WF-CT	ϕ=1.43 wgr	10º/km [270-330]km A=400Ma,hl=140km	weak 0-150km	forearc	forearc >50 km	x	>6 km <200 km	145km	45km
M8 WR-WF-CT	ϕ=1.43 wgr	10º/km [270-330]km A=400Ma,hl=140km	weak 150-300km	backarc CV	backarc >50 km	x	<6 km >200 km	131km	41km
MH5 SR-WF-WT	ϕ=1.43 wgr	10º/km [240-350]km A=400Ma,hl=120km	strong	diffuse arc	arc <50km	x	<6 km ~200 km	125km	26km
MH6 WR-WF-WT	ϕ=1.43 wgr	10º/km [240-350]km A=400Ma,hl=120km	weak 0-300km	both	forearc+arc >50 km	x	<6 km <200 km	175km	75km
MH7 WR-WF-CT	ϕ=1.43 wgr	10º/km [240-350]km A=400Ma,hl=120km	weak 0-150km	forearc	forearc >50km	x	<6 km <200 km	170km	70km
MH8 WR-WF-CT	ϕ=1.43 wgr	10º/km [240-350]km A=400Ma,hl=120km	weak 150-300km	backarc	backarc > 50 km	x	<6 km >200 km	160km	61km
M_{10} no slab-pull	ϕ=2. plg	10º/km [240-350]km A=400Ma,hl=120km	strong	extension basin	arc thinning	X	<1km basin~200km	-150km	*-222km*
Map cold mantles	ϕ=2. plg	10º/km [330-630]km A=400Ma,hl=180km	pre thick 150-500km	backarc	backarc +plateau	x	>200 km	170km	70km
Mfl wet /dry mantles	ϕ=2. plg	2º/km [290-320]km A=500Ma,hl=200km	weak 250-350km						*-92km*