DR 2006077

Petrunin, A and Sobolev, S.V, What controls thickness of sediments and lithospheric deformation at a pull-apart basin?

SUPPLEMENTARY DATA

Table DR1. Rheological and thermo-elastic parameters used in the modelling.

Parameters	Upper crust	Lower crust	Mantle
Elastic and thermal constants [19]	strong/weak	strong/weak	
ρ, [kg/m^3](at 20°C and 0.1 MPa)	2700 2450(sediments)	3000	3300
α, [K^{-1}]	3.7 10^{-5}	2.7 10^{-5}	3.0 10^{-5}
K, G, [Gpa]	55, 36	63, 40	122, 74
C_p, [J/kg/K]	1200	1200	1200
λ, [W/K/m]	2.5 2.0 (sediments)	2.5	3.3
W, [μW/m^3]	1.3	0.2	0
Power-law creep constants	G&T1995	R&D2001	H&K1996
A,[MPa^{-n}s^{-1}])	$1.0 \cdot 10^{-4}$/1.0	$4.0 \cdot 10^{2}$/$4.0 \cdot 10^{6}$/$4.0 \cdot 10^{10}$	$4.9 \cdot 10^{4}$
E_a, [J/mol]	$2.23 \cdot 10^{5}$	$3.56 \cdot 10^{5}$	$5.35 \cdot 10^{5}$
n,	4.0	3.0	3.5
Mohr-Coulomb elasto-plasticity with softening	Friction angle: 30°; dilation: 0°; cohesion: 20 MPa; linear decrease of cohesion to 2 MPa at strain 0.1 and of friction to 10 from strain 1.0 to 2.0		The same as for the crust

Table DR2. Model specification

<table>
<tr><td>First Index, temperature</td><td>1-surface heat flow 50 mW/m2</td><td>2-60 mW/m2</td><td>3- 70 mW/m2</td><td>4- 80 mW/m2</td></tr>
<tr><td>Second Index, Lower crustal rheology</td><td>1-laboratory data R&D2001</td><td>2-reduced strength R&D2001, A*10^4</td><td>3- strongly reduced strength R&D2001, A*10^8</td><td>-</td></tr>
<tr><td>Third Index, density of sediments</td><td>1-2200 kg/m3</td><td>2-2450 kg/m3</td><td></td><td>-</td></tr>
<tr><td colspan="5">Additional Index: w (wide)-15 km spacing between the faults instead of 10 km in other models.
Model “weak”: same as m2.2.2 but with reduced strength of the upper crust (G&T1995 with A*10^4)</td></tr>
<tr><td colspan="5">Examples: m2.1.1 indicates a model with 60 mW/m2 surface heat flow, laboratory data for lower crustal rheology, 2200 kg/m3 for density of sediments and 10 km spacing between the faults; model m3.2.2 indicates a model with 70 mW/m2 surface heat flow, reduced strength of the lower crust (R&D2001, A*10^4), 2450 kg/m3 for density of sediments and 10 km spacing between the faults; model m3.2.2w indicates a model which is the same as model m3.2.2 but with spacing between the faults of 15 km instead of 10 km.</td></tr>
<tr><td colspan="5">List of models (models where no pull-apart deformation was achieved are underlined):
m1.1.1, m1.2.1, m2.1.1, m2.1.2, m2.2.1, m2.2.1w, m2.2.2, m2.2.2w, m2.3.2, m.3.2.2, m4.2.2,</td></tr>
</table>

R&D2001: Rybacki and Dresen (2001); G&T1995: Gleason and Tullis (1995); H&K1996: Hirth and Kohlstedt, 1996

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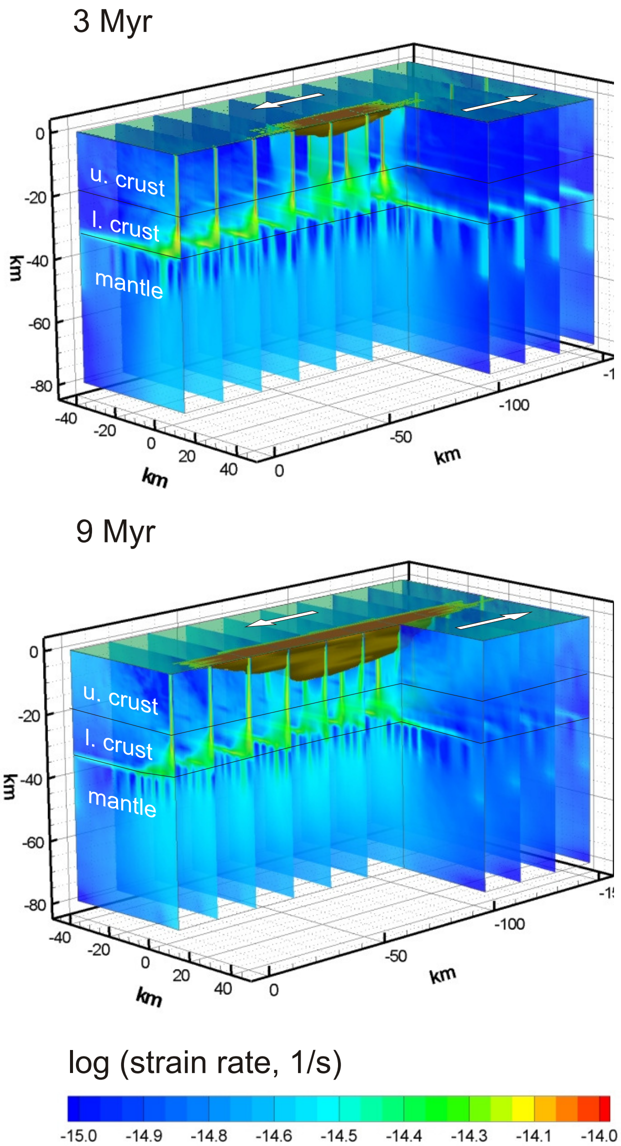

Fig. DR1. Evolution of the strain rate distribution for the pull-apart model m2.2.1. The colours show log strain rate distribution at cross-sections. Note that the upper-middle crust beneath the growing basin (brown) is almost completely detached from the lower crust and upper mantle.

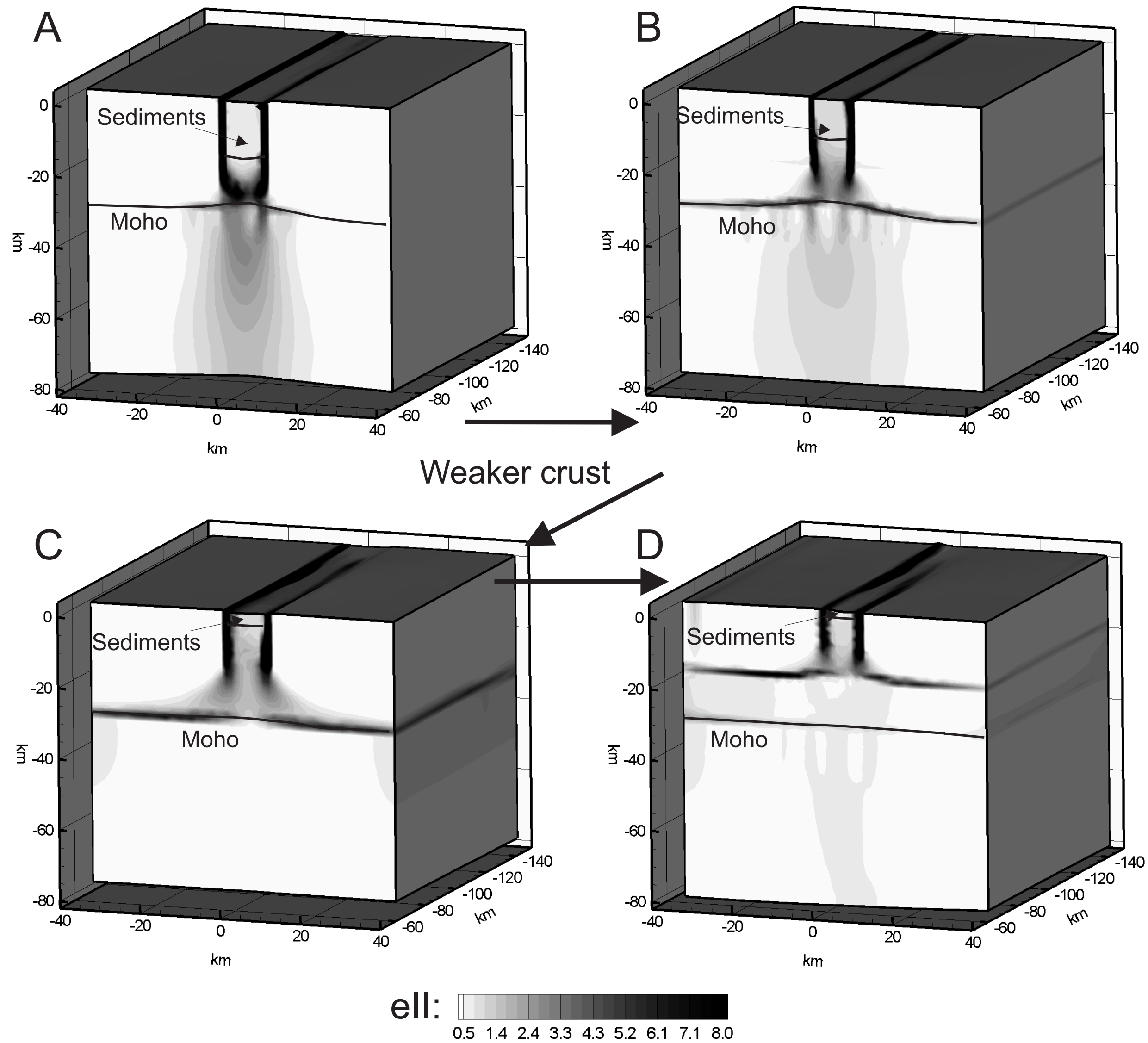

Fig.DR2. (a-d) Distribution of cumulative finite strain after 100 km of strike-slip displacement in the sections crossing the central part of a pull-apart basin for models with gradually decreasing crustal viscosity. Note that the stronger the crust the deeper is the detachment (indicated as domain of high strain) and the thicker is the sedimentary fill of the basin.

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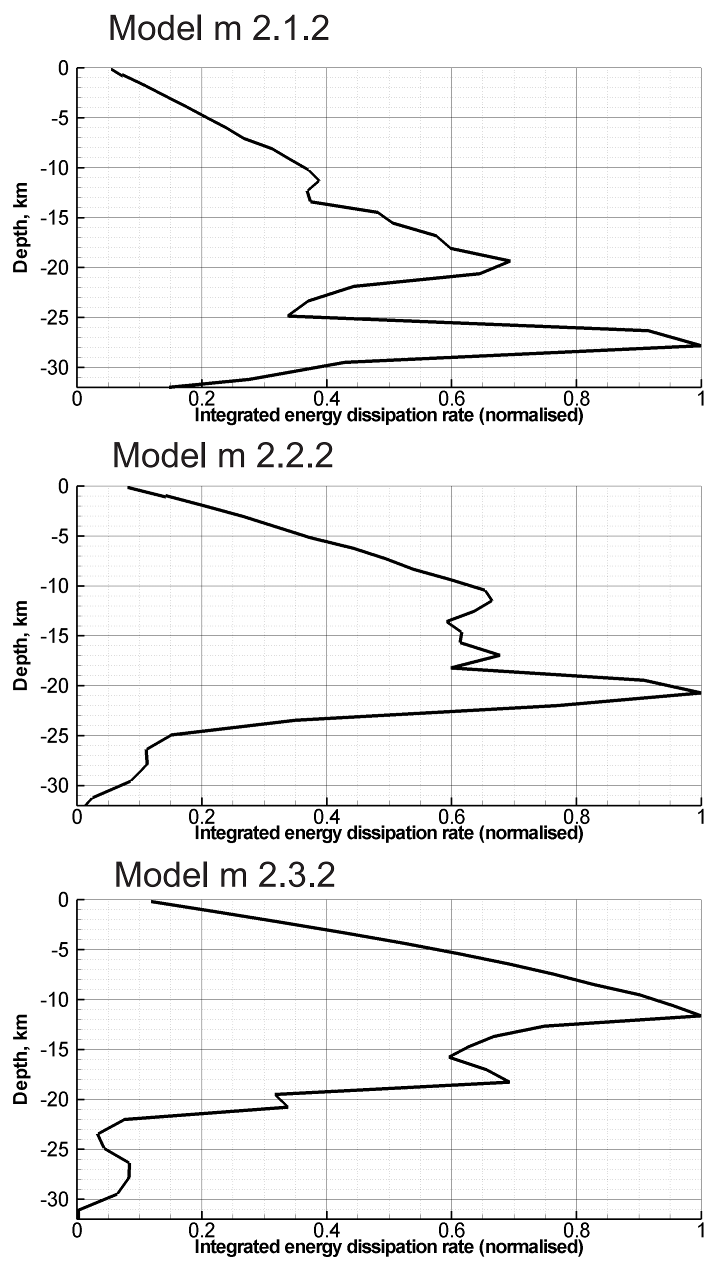

Fig. DR 3. Depth dependencies of the integrated rate of energy dissipation beneath the central part of a model basin for models with different viscosity of the lower crust. The values are normalized