The effect of décollement dip on geometry and kinematics of model accretionary wedges

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Introduction
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• What is the accretionary wedges?
Introduction

- Most accretionary wedges and fold-and-thrust belts form above a decollement dipping toward the hinterland.

- Dip and Friction control the deformation style and the wedge taper, dip and friction can be used to estimate the coefficient of internal friction within accretionary wedges (Davis et al., 1983).
Introduction

• In this study, we use results from physical models to illustrate the combined influences of varying the decollement dip and the basal friction onto the kinematics of accretionary wedges and fold-and-thrust belts.
Experimental procedure
Experimental procedure

• In the six models presented here, we used the same type of dry quartz sand for all experiments, but varied the decollement dip and friction.

(修改自 Dahlen)

(修改自 Hubbert)
Experimental procedure

• The dip of these decollements may increase as loading by growing wedge increases, Mariotti and Doglioni (2000) suggests decollement dips commonly vary from 1–5°
Experimental procedure

Models 1–3 used high-friction sand as the décollement material, while models 4–6 used low-friction glass beads as the décollement material.

Horizontal décollement

Décollement dipping 5° toward the hinterland

Décollement dipping 5° toward the foreland

Fig. 1. Schematic illustration of the setup.
Scaling
Scaling

• Assumed that the material is isotropic and obeys a Mohr – Coulomb behavior typical.

• Model material's angle of internal friction of about 0.7, similar the upper 10 km of the continental crust.
Scaling

• Model results are applicable to their prototype if they are dynamically and kinematically scaled with respect to their natural counterparts.

• In our models the length ratio was $5 \times 10^{-6}$ where 1 km in nature is simulated by 5 mm in the model.
Model results and discussion
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• Unlike in natural examples, measuring the height and length of a wedge during its evolutionary history is relatively easy in experiments.

• Length and height can be measured directly on the model.
Model results and discussion

(A) high-friction dcollement

(B) low-friction dcollement

- Length (5° foreland slope)
- Length (no slope)
- Length (5° hinterland slope)
- Height (5° hinterland slope)
- Height (no slope)
- Height (5° foreland slope)
Model results and discussion

(A) 5° hinterland dipping dcollement

(B) high-friction dcollement
Conclusions
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• The presence of a low basal friction tends to reduce the effect of decollement dip.

• The effect of decollement dip on wedge deformation is most pronounced when basal high-friction (\(\mu = 0.55\)).

• Its effect is less significant in models where the basal decollement low-friction (\(\mu = 0.37\)).
Conclusions

• Model results show that increasing basal slope has a similar effect to that of increasing basal friction; the wedge grows.
Thank you