Geophysical Research Abstracts, Vol. 8, 03370, 2006
SRef-ID: 1607-7962/gra/EGU06-A-03370


# On the relationship between flow in the asthenosphere and the subduction process: can mantle flow control subducting slab geometry? Insights from physical modelling.

**D. Boutelier** and A. Cruden

Dept. of Geology, University of Toronto (boutelier@geology.utoronto.ca)

New physical models of subduction investigate the impact of large-scale mantle flow on the structure of the subducted slab and deformation of the downgoing and overriding plates. The experiments comprise two lithospheric plates made of highly filled silicone polymer resting on a model asthenosphere of low viscosity transparent silicone polymer. Subduction is driven by a piston that pushes the subducting plate at constant rate, a slab-pull force due to the relative density of the slab, and a basal drag force exerted by flow in the model asthenosphere. Large-scale mantle flow is imposed by a second piston moving at constant rate in a tunnel at the bottom of the experiment tank. Passive markers in the mantle track the evolution of flow during the experiment. Slab structure is recorded by side pictures of the experiment while horizontal deformation is studied via passive marker grids on top of both plates. The initial mantle flow direction beneath the overriding plate can be sub-horizontal or sub-vertical. In both cases, as the slab penetrates the mantle, the mantle flow pattern changes to accommodate the subducting high viscosity lithosphere. As the slab continues to descend, the imposed flow produces either over- or under-pressure on the lower surface of the slab depending on the initial mantle flow pattern (sub-horizontal or sub-vertical respectively). Over-pressure imposed on the slab lower surface promotes shallower dip subduction while under-pressure tends to steepen the slab. These effects resemble those observed in previous experiments when the overriding plate moves horizontally with respect to a static asthenosphere. Our experiments also demonstrate that a strong vertical drag force (due to relatively fast downward mantle flow) exerted on the slab results in a decrease in strain rate in both the downgoing and overriding plates, sug-

gesting a decrease in interplate pressure. However, in the six experiments which test the impact of the key parameters (i.e., slab pull force, mantle flow pattern, boundary conditions), we show that the mantle drag force mainly controls the strain regime within the subducting plate, suggesting that the impact on the interplate pressure is minor compared to that on the interplate shear stress.