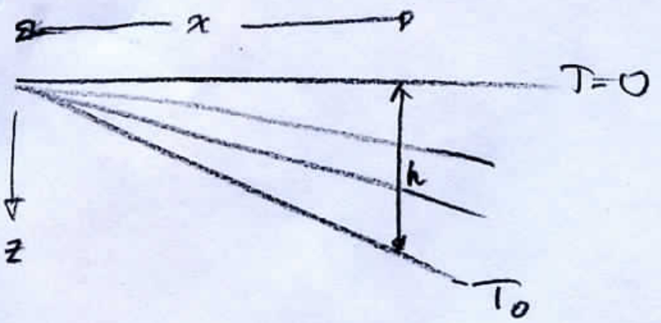
5/28/99 Bending moment due to thermal stress at ridge depends on square of slope of lithosphere-asthenosphere boundary (assumes no history, no fossil stresses)



let $h = ax$, then temperature field is:

$$T(x,z) = T_0 \frac{z}{h} = \frac{T_0}{a} z x^{-1}$$

and horizontal thermal force:

$$f_x = \frac{\partial T}{\partial x} = -\frac{T_0}{a} z x^{-2}$$

and bending moment

$$\int_0^{h=ax} \left(z - \frac{h}{2}\right) f_x \, dz = \int_0^{ax} \left[-\frac{T_0}{a} x^{-2} z^2 + \frac{T_0}{a} z x^{-2} \frac{ax}{2} \right] dz$$

$$= \frac{-T_0}{a} x^{-2} \int_0^{ax} \left(z^2 - \frac{z\,ax}{2} \right) dz = -\frac{T_0}{a} x^{-2} \left[\frac{z^3}{3} - \frac{z^2 a x}{4} \right]_0^{ax}$$

$$= -\frac{T_0}{a} x^{-2} \left[(ax)^3 \left(\frac{1}{3} - \frac{1}{4} \right) \right] = -\frac{T_0 a^2 x}{12}$$

mail buck
Subject: singularities

Last nite we demonstrated that the bending moment was equal to -To a**2 x /12 where a was the slope of the base of the lithosphere (i.e. h=ax).

But the flexural equation contains the second derivative, d2/dx2, of the bending moment ...

Thus is you have a model with a lithosphere that has a kink in its lower boundary - effctively a sudden change in the parameter, a - then there will be a term in the equation that is roughly proportional to the second derivative of a step function. That is d-delta/dx, with delta being the Dirac function.

This could be quite a significant term. And in your two models, it occurs at quite different values of x ...

Perhaps this is why they are so different ...