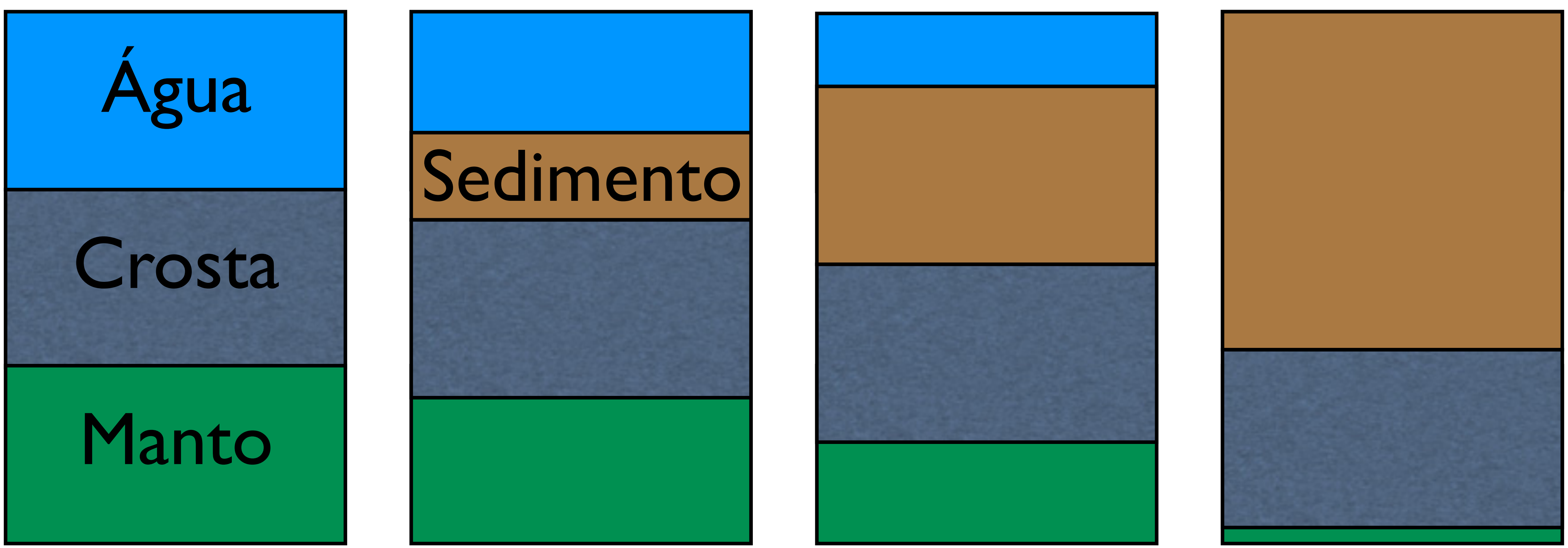
Modelos Quantitativos de Bacias Sedimentares

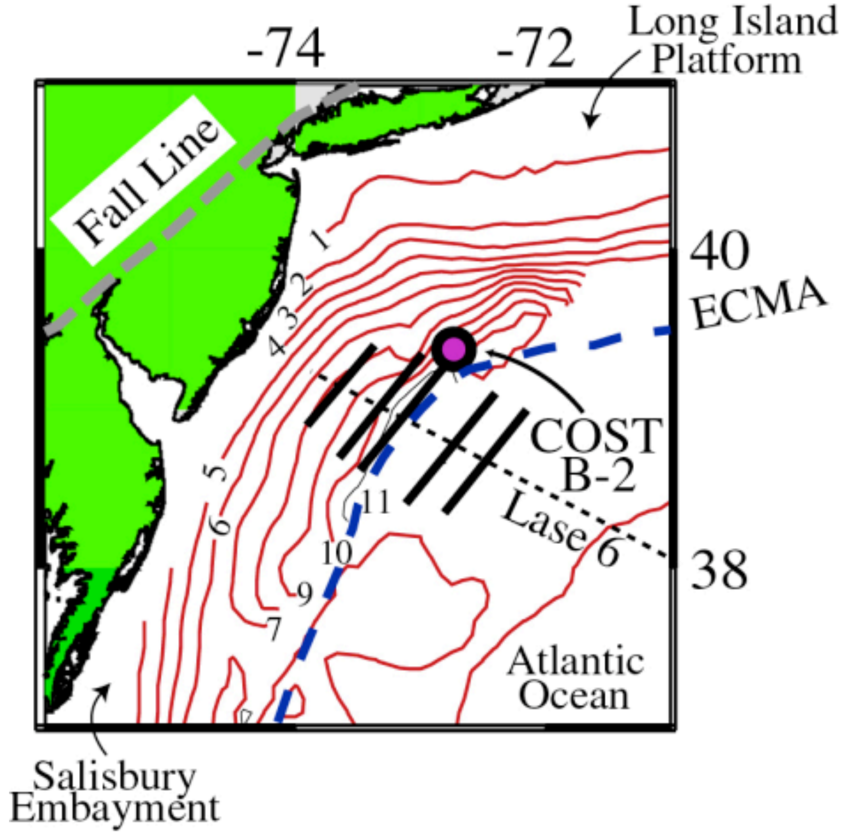
AGG0314

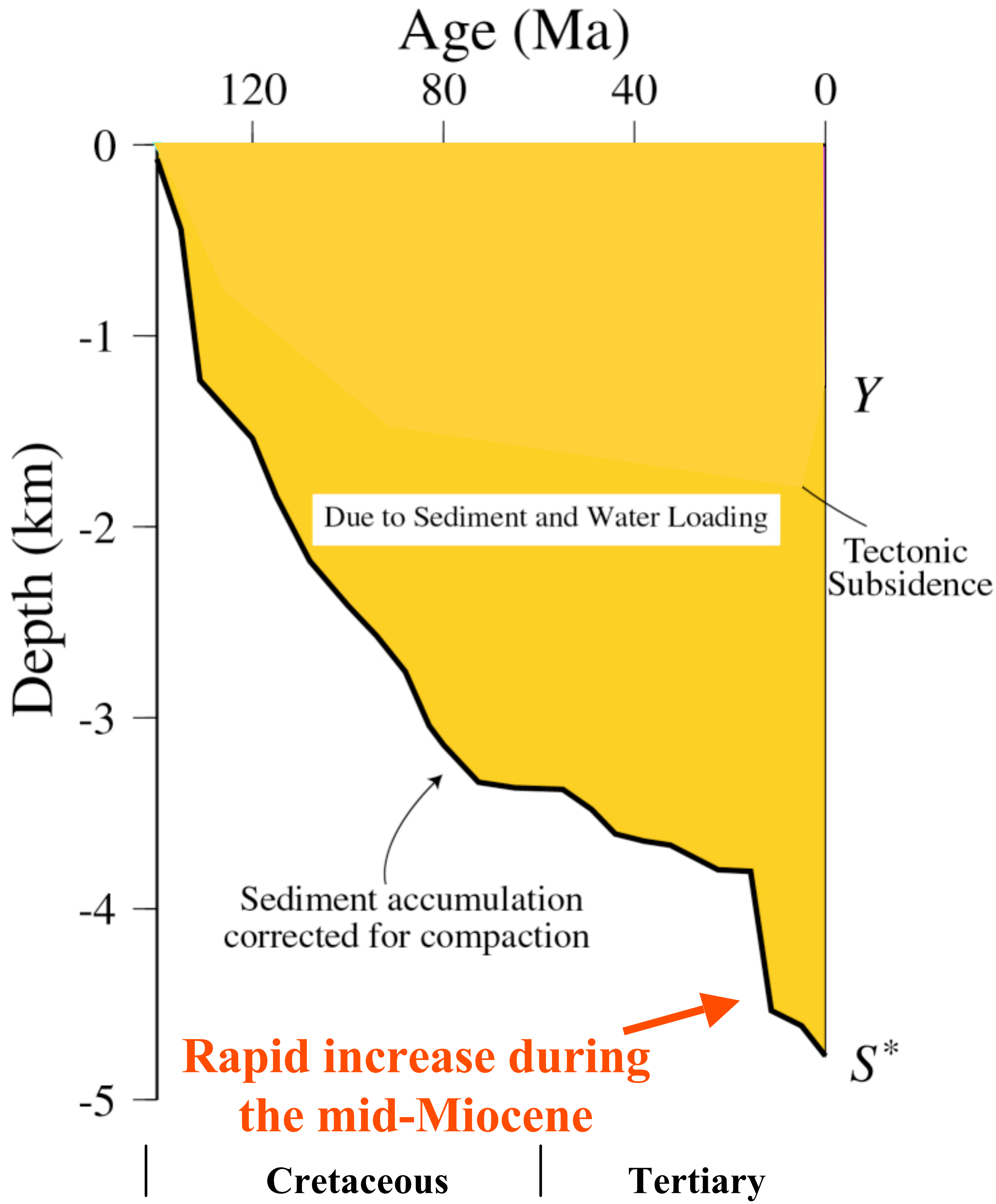
Modelos de estiramento continental - Parte I
Estiramento uniforme e instantâneo

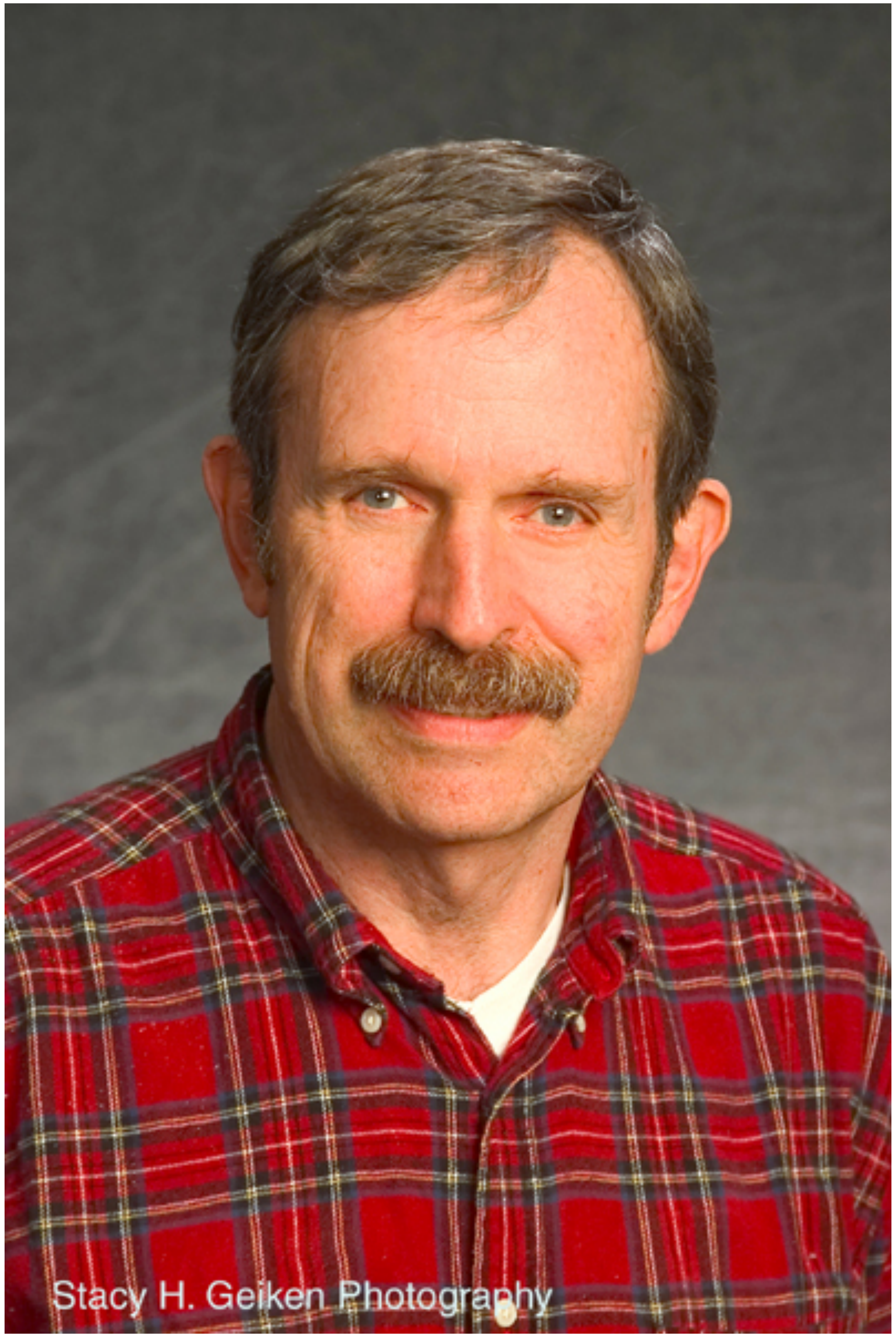
Subsidência das bacias sedimentares



Subsidência observada







Peter Molnar

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Thermal Effects of the Formation of Atlantic Continental Margins by Continental Break up

Norman H. Sleep

(Received 1971 July 29)

Summary

The thermal history of Atlantic continental margins resembles that of the oceanic crust as it spreads away from a mid-oceanic ridge, since the margin was formed when a ridge began spreading beneath a pre-existing continent. During break-up the thickness of the continental crust along the new margin was reduced by subareal erosion and subcrustal processes. Afterwards the continental shelf subsided, probably due to thermal contraction of the lithosphere. The observed subsidence rate on the Atlantic and Gulf coasts of the United States declined exponentially with a time constant of about 50 My, as it does for ridges. Except for the Florida peninsula, deviations of the observed sedimentation from a smooth curve with respect to time could be associated with eustatic changes and variations in the supply of sediments. The subsidence rate of basins in the mid-continent of North America also decreases with a 50 My time constant. In Kansas a subcrustal process must have thinned the crust and initiated subsidence as a sequence of thinly bedded sediments beneath the basin is uneroded.

Introduction

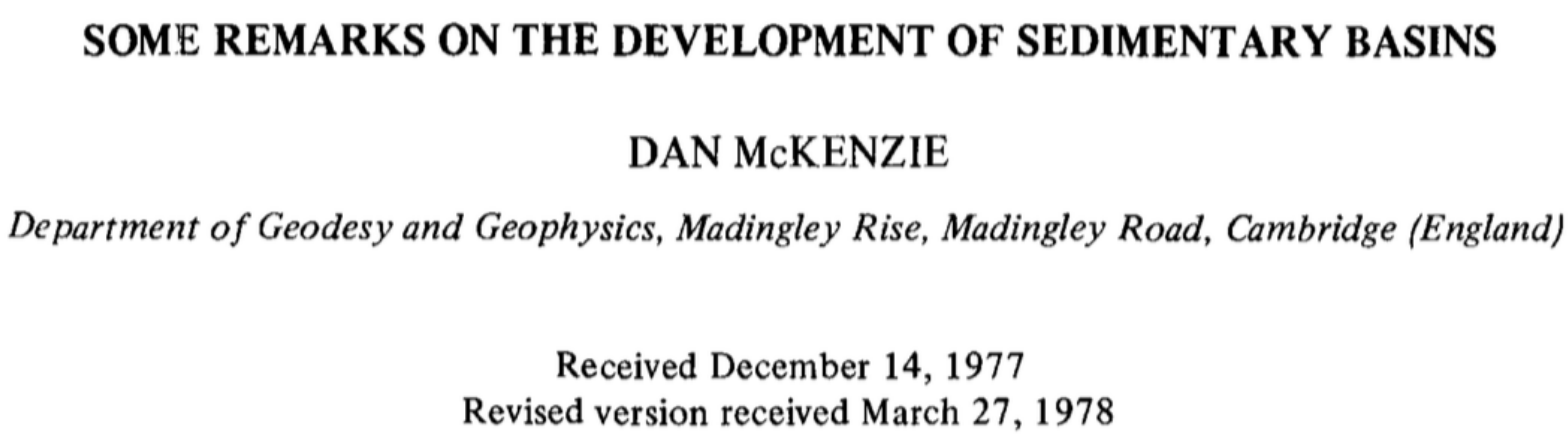
At Atlantic continental margins a steep continental slope truncates older structures. These margins are considered to form when a proto-continent breaks up and drifts apart.

Large amounts of oceanographic and seismic data indicate that the upper 100 km of the Earth, the lithosphere, drifts over the asthenosphere as a rigid slab, while new material is brought up at mid-ocean ridges (e.g. Isacks *et al.* 1968). Atlantic type margins thus form when a mid-ocean ridge begins spreading beneath a continent. The thermal processes at mid-ocean ridges are now well enough understood, that the thermal effects of continental break up on the evolution of the continental margin can be examined and compared with observed data.

This paper is concerned only with the subsidence phase of margin evolution where the continental and oceanic plates are strongly coupled. Folded margins and geosynclines are beyond the scope of this report.

The evolution of Atlantic type margins can be studied by comparing margins of various ages (See, Heezen 1968), and by the examination of the sedimentary record as seen in well cores on margins (Vogt & Ostenso 1967). The latter approach was adopted for this paper. A mathematical model for the evolution of sudsidence rate with time was constructed and compared with observed data from the Atlantic, Florida, and Gulf coasts of the United States, and several basins in the mid-continent region of North America.

Dan McKenzie


SOME REMARKS ON THE DEVELOPMENT OF SEDIMENTARY BASINS

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Modelo de Mckenzie (1978)

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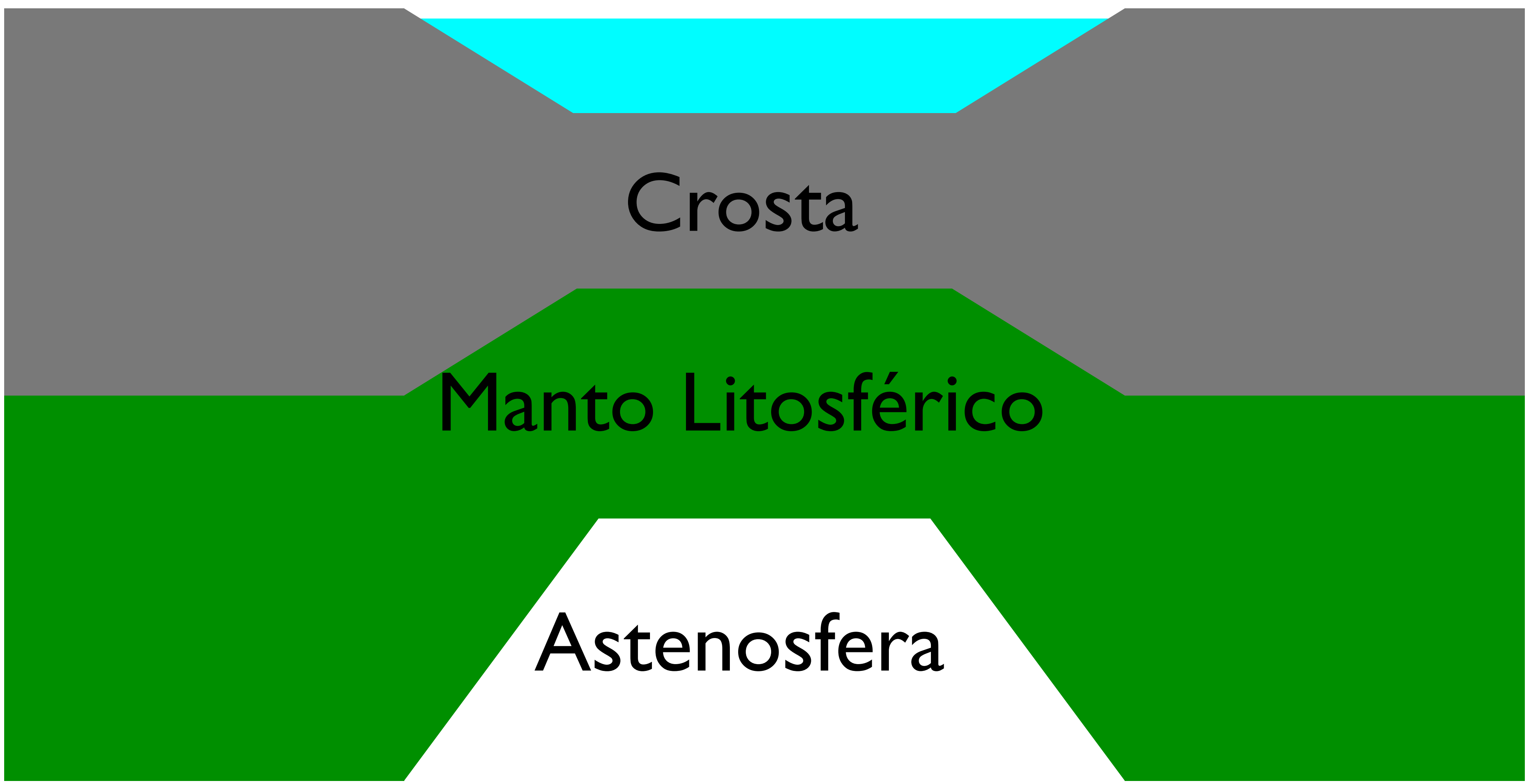
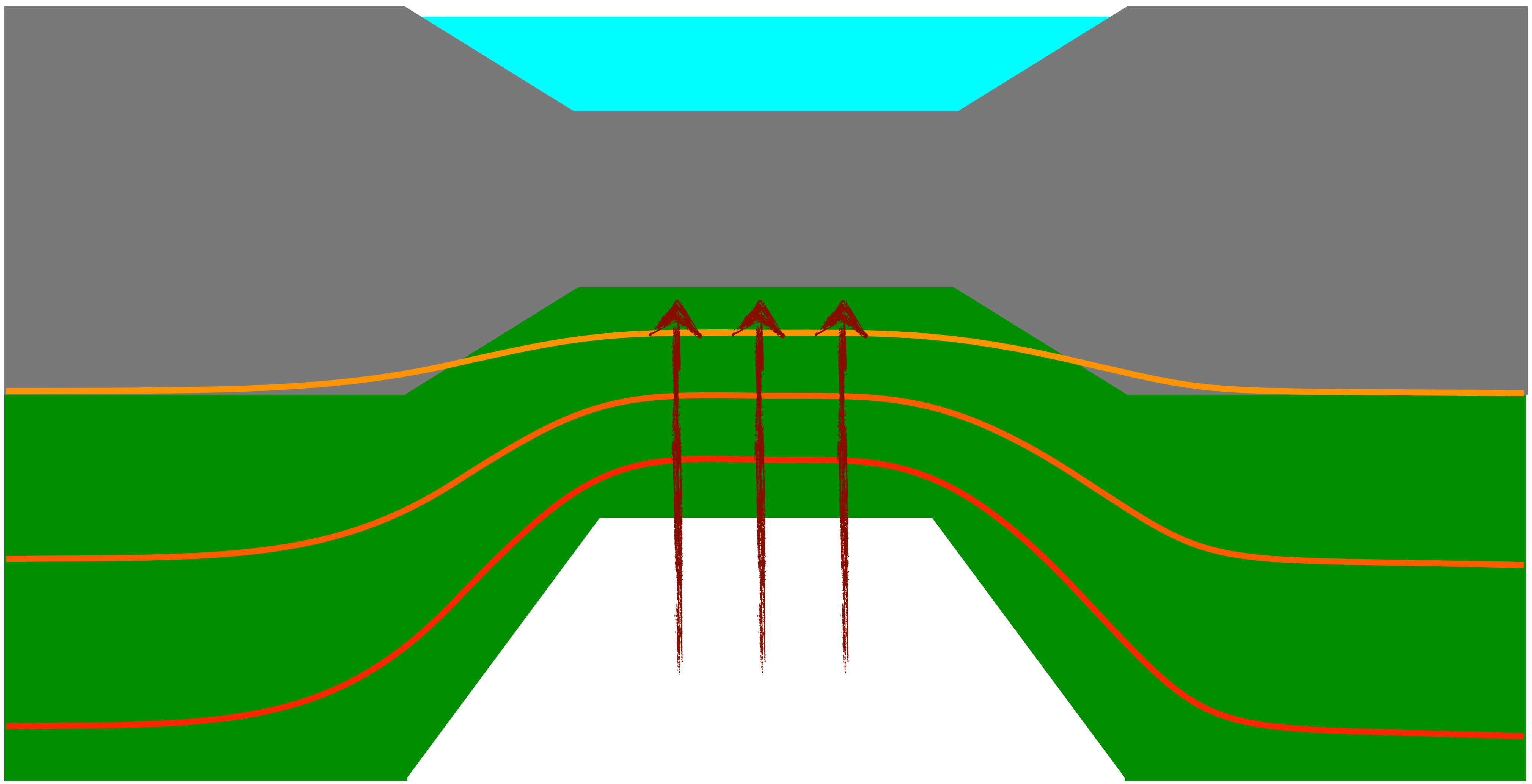


Modelo de Mckenzie (1978)



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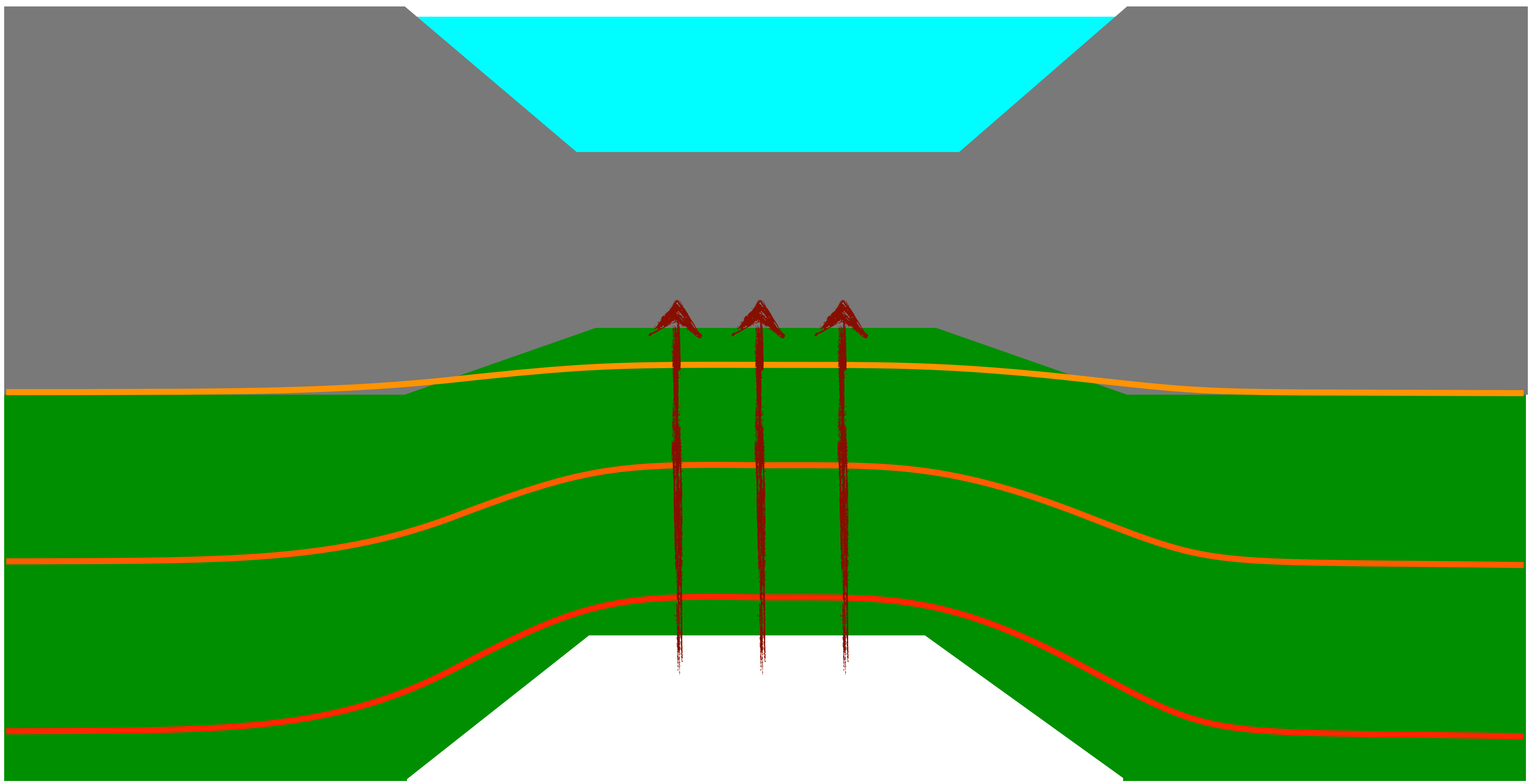
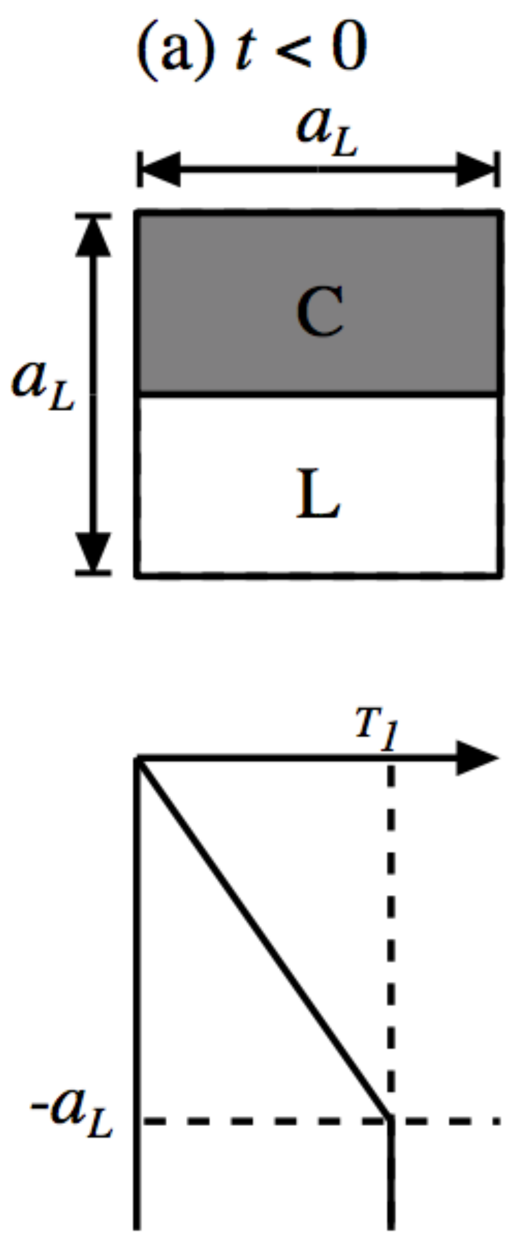
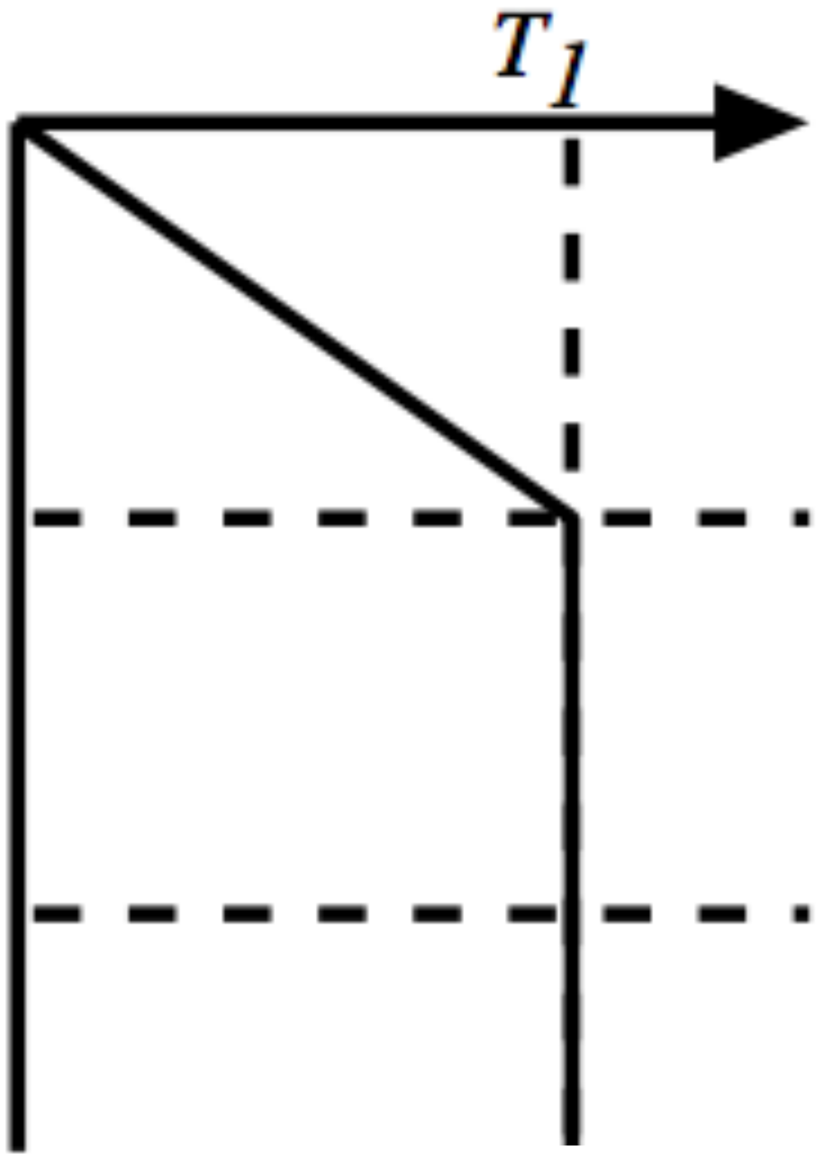


Modelo de McKenzie (1978)





Condição inicial

$$T = T_1 , \qquad 0 < \frac{z}{a} < \left(1 - \frac{1}{\beta}\right)$$

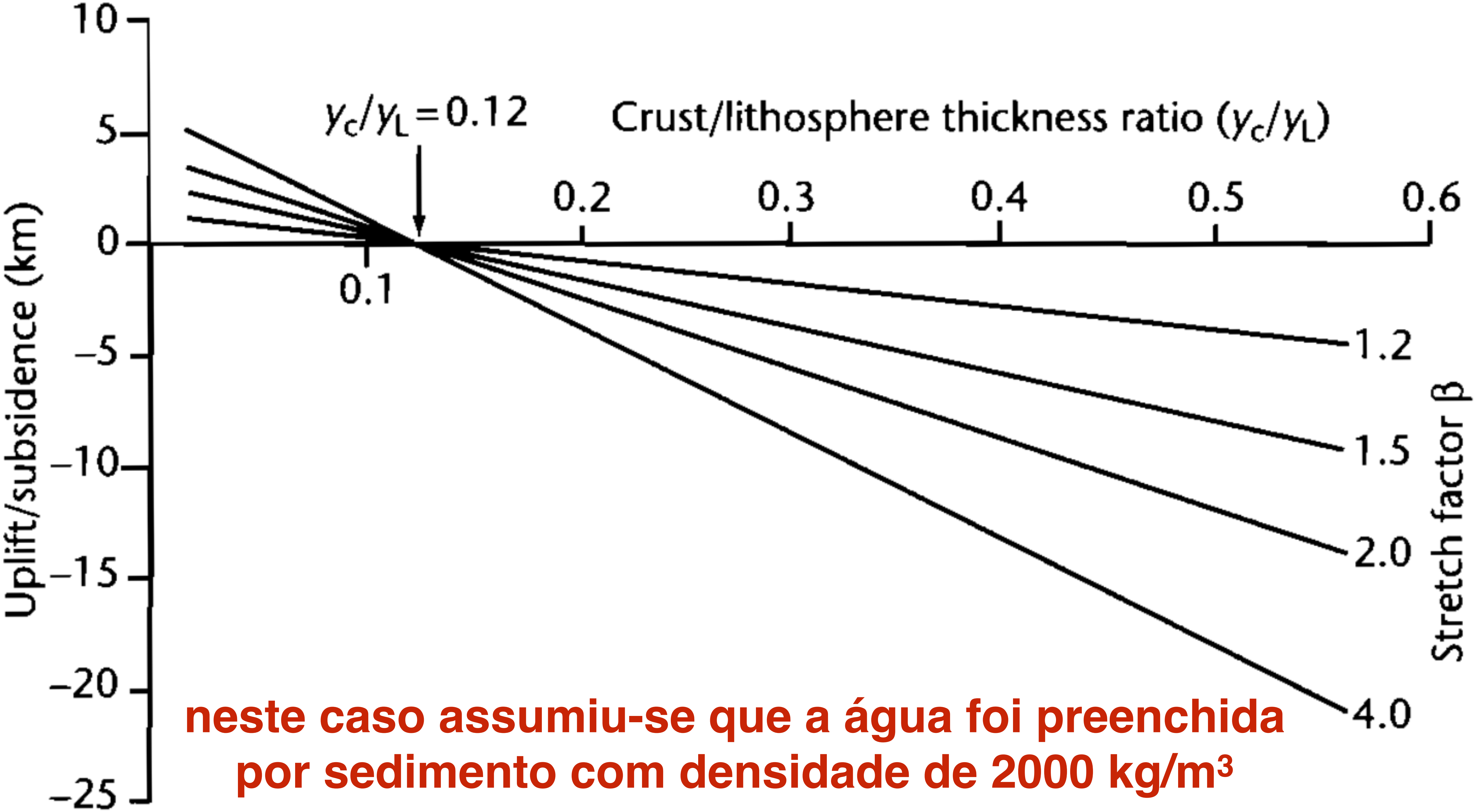
$$= T_1 \beta \left(1 - \frac{z}{a}\right), \qquad \left(1 - \frac{1}{\beta}\right) < \frac{z}{a} < 1$$

Subsidência inicial

$$S_i = \frac{a\left[(\rho_m - \rho_c)\frac{h_c}{a}\left(1 - \frac{\alpha T_1 h_c}{2a}\right) - \frac{\rho_m \alpha T_1}{2}\right]\left(1 - \frac{1}{\beta}\right)}{\rho_m(1 - \alpha T_1) - \rho_w}$$

(no artigo do McKenzie há um pequeno erro de digitação!)

Subsidência inicial



neste caso assumiu-se que a água foi preenchida por sedimento com densidade de 2000 kg/m³

Evolução da estrutura térmica

$$\frac{T}{T_1} = 1 - \frac{z}{a} + \frac{2}{\pi} \sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n} \left[\frac{\beta}{n\pi} \sin \frac{n\pi}{\beta} \right]$$

$$\times \exp\left(\frac{-n^2 t}{\tau} \right) \sin \frac{n\pi z}{a}$$

$$\tau = \frac{a^2}{\pi^2 \kappa}$$

Solução obtida por série de Fourier.

Fluxo térmico

$$F(t) = -k\frac{dT}{dz}$$

$$F(t) = \frac{kT_1}{a}\left\{1 + 2\sum_{n=1}^{\infty}\left[\frac{\beta}{n\pi}\sin\frac{n\pi}{\beta}\right]\exp\left(-\frac{n^2 t}{\tau}\right)\right\}$$

Subsidência térmica

$$S_t = e(0) - e(t)$$

$$e(t) = \frac{a\rho_0\alpha T_1}{\rho_0 - \rho_w}\left\{\frac{4}{\pi^2}\sum_{m=0}^{\infty}\frac{1}{(2m+1)^2}\right.$$

$$\left.\times\left[\frac{\beta}{(2m+1)\pi}\sin\frac{(2m+1)\pi}{\beta}\right]\exp\left(-(2m+1)^2\frac{t}{\tau}\right)\right\}$$