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McKenzie D. Some remarks on the development of sedimentary basins.
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This paper proposed the first model for the development of sedimentary basins that could be tested in detail. Little has changed in the 12 years since it was written, and it is now clear that many basins are formed by stretching. One reason the paper has been so widely cited is that the model allows the rate of oil generation to be calculated directly. [The *SCI*® indicates that this paper has been cited in more than 595 publications.]

The Stretching Model for Sedimentary Basins

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This paper came about by accident. At the time it was written, many people were working on sedimentary basin evolution, but I was not. For the previous 10 years, I had been interested in continental deformation, which is rather different from that of the oceans. I wanted to find out the corresponding rules for the continents and, in 1967, started to collect information about earthquakes in the continental area from Gibraltar to eastern Iran. The most active part of the whole of this region is around the Aegean, and I decided that I would have another close look at the earthquakes in Greece and Turkey while I was on sabbatical leave in 1977.

I went to the Massachusetts Institute of Technology where I shared an office with Bert Bally, who was on leave from Shell for some months. When I talked to him about the faulting in the Aegean, he said it was just like Nevada and that I should come and visit him in Houston and look at Shell's data. I did so in July, I think, which is not the best time to go to the Gulf Coast. He showed me some wonderful reflection profiles, made with sound from explosions, which were later published.[1] What impressed me was the shape of the faults: They were steep at the surface but flattened with depth. This geometry conceals the large amount of stretching that has occurred in the Basin and Range Province in Nevada, which has probably been stretched by a factor of two. I thought that the same process must have occurred in the Aegean. I also realised that the stretching could not be confined to the crust, but must thin the whole plate. This process neatly explained why such areas developed into basins.

My first go at modelling this problem[2] is not widely read. But after I had finished it and had moved to Lamont Doherty Geological Observatory in New York, I realised that I could do the general problem quite simply. I used the symbol β for the amount of stretching, because I had already used α for the thermal expansion coefficient. I proposed several different methods of estimating β from geological observations that have been used since. They are independent and give values, for what is now generally called the beta factor, that agree well with each other. This is principally why the model has been so widely accepted, especially by the oil companies.

Some basins cannot be formed in this way,[3] but, as commonly happens, these basins are being neglected in favour of the stretched ones that we understand better. In the time since the original paper was written, our understanding of the reflection records has improved. The faults are not curved but are flat, and the extension occurs as much by rotation of the blocks between the faults as by the movement of the faults themselves.[4] I still work in the Aegean and am now trying to understand how volcanic magmas are produced as the mantle below the plates moves upwards to fill the hole that is left by the stretching.[5]

Few ideas can have had a greater impact on applied science than has this one. It is amusing that the work was done by someone who thought he was working on another problem and who had not even tried to get research support for the project. This is yet another illustration of how futile it is to try to plan future research.

Once it was clear that the work was of commercial interest, the oil companies took over. They are, in general, very generous with their data, which we use extensively at Cambridge to study the noneconomic aspects of basin formation. But we do not try to work on oil generation and accumulation.

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2. **McKenzie D.** Active tectonics of the Alpine-Himalayan Belt: the Aegean Sea and surrounding regions. *Geophys. J. Roy. Astron. Soc.* 55:217-54, 1978. (Cited 200 times.)
3. **Fowler C M R & Nisbet E G.** The subsidence of the Williston Basin. *Can. J. Earth Sci.* 22:408-15, 1985. (Cited 10 times.)
4. **Jackson J A.** Active normal faulting and crustal extension. (Coward M P, Dewey J F & Hancock P L, eds.) *Continental extensional tectonics.* London: Geological Society of London, 1987. p. 3-17. (Cited 10 times.)
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