Burial stress and burial strain

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Burial stress on a sediment or sedimentary rock is relevant for predicting compaction or failure caused by changes in, e.g., pore pressure in the subsurface. For this purpose, the stress is conventionally expressed in terms of its effect: "the effective stress" defined as the consequent elastic strain multiplied by the rock frame modulus. We cannot measure the strain directly in the subsurface, but from the data on bulk density and P-wave velocity, we can estimate the rock frame modulus and Biot's coefficient and then calculate the "effective vertical stress" as the total vertical stress minus the product of pore pressure and Biot's coefficient. We can now calculate the elastic strain by dividing "effective stress" with the rock frame modulus. By this procedure, the degree of elastic deformation at a given time and depth can be directly expressed. This facilitates the discussion of the deformation mechanisms. The principle is illustrated by comparing carbonate sediments and sedimentary rocks from the North Sea Basin and three oceanic settings: a relatively shallow water setting dominated by coarse carbonate packstones and grainstones and two deep water settings dominated by fine-grained carbonate mudstones and wackestones.

References:

This abstract was first published in: *Geophysical Prospecting*, 2014, **62**, 1327–1336.