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# Estimating the porosity-depth relation of sedimentary rocks from an effective stress/ stress history-dependent porosity model

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It is a general observation that porosity of rocks decrease with increasing burial depth. To model this trend, the well known Athy's law is widely used since 1930. However, this kind of phenomenological porosity-depth relation fails to account for the involved mechanism explicitly. Among others, the increased effective stress with increasing depth is a key factor to dominate the porosity-depth trend. In addition, uplift and erosion may alter the normal trend. This study proposed an effect stress/stress history-dependent porosity model of sedimentary rock based on laboratory measurement. Fourteen samples, including sandstones and mudstones collected from Taiwan Chelungpu-fault Drilling Project (TCDP), were used to determine the parameters in the proposed porosity model. Accordingly, the porosity-depth curve in the TCDP site can be obtained. The results fit well with the porosity-depth relation derived from sonic and density logs measured in TCDP borehole. It is interesting to find the porosity increased abruptly with increasing depth near the Sanyi reverse fault. This observed abnormal trend is reasonably captured by the proposed model. We predicted the porosity of the rocks above the Sanyi reverse fault (10.0-17.1%), which experienced a deeper burial depth than present, is about 2% smaller than those below the fault (12.6-18.6%). It is indicated that the proposed model, which take the effect of uplift and erosion on the porosity into account, is potentially useful to predict the porosity-depth relation in a sedimentary basin.