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New evidence that b-values inversely correlate with stress: Dips of normal fault planes in the Corinth Rift

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The relative size of mean magnitude, $\bar{M}$, in a sample of earthquakes is proportional to the ambient stress or the effective stress and it is inversely proportional to pore pressure. Thus, it is a parameter useful to identify high stress volumes, such as asperities, and volumes (or periods) with high pore pressure. An inconvenient aspect of $\bar{M}$ is that its absolute value depends on the minimum magnitude of earthquakes in the sample. For this reason $\bar{M}$ is commonly mapped by b-values of the relationship, $\log N = a - bM$, because b is inversely proportional to $\bar{M}$ as follows: $b = 2.3/(\bar{M} - M_{\min})$. Mapping the b-value as a function of depth in the western part of the Gulf of Corinth, covered by the permanent seismograph network of the Corinth Rift Laboratory, it was found that b decreases from about 1.55 above 7 km depth to 1.18 at 10 km depth. The geometrical analysis of relocated microearthquakes shows that the seismic activity above 8 km depth takes place along relatively steeply dipping fault planes ($\geq$ 30 degrees), whereas the activity below 8 km occurs on fault planes dipping at low angles. Thus, the b-values are low ($\bar{M}$ is large) where the confining stress across the fault plane is high. We add this evidence to the other lines of reasoning that lead to the idea that low b-values correlate with high stress regimes. The pattern of decreasing b with depth observed in the Gulf of Corinth is similar to that in California, but different from the trend reported in Southern Iceland and Kanto, Japan.