



Are stylolites progressive strain markers and windows into time?

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We used stress inversion techniques on sedimentary stylolites in Zechstein Carbonates of the Lean Gas Field northern Germany in cores from 4000m.

Our analysis shows that the stylolites were still active at a deep burial of 4150m (± 300 m). Burial in this field area started in the Triassic with about 2000m, followed by a slower burial in the mid Cretaceous by 1000m and a final burial phase in the late Cretaceous (another 1000m) followed directly by an inversion of about 400. Our stress values indicate that the stylolites were still active in the Cretaceous at the deepest burial phase. This means that the stylolites record the full compaction history of the basin, from early to late burial. Stylolites that are linked to layers are strongly pinned and record the full history, with teeth reaching more than 4cm. We can potentially identify parts of the teeth that are related to specific geological times according to the history of the sequence. This means that the teeth represent a powerful tool as potential time-marker, because offset veins that cut sides of stylolite teeth can be roughly dated using the offset. In addition we find that the deep stress signal is only recorded in small stylolites with amplitudes of only a few millimetres. Large amplitude stylolites show complex mixed signals. This indicates that the last compaction phase in the deep basin, which was probably only representative by about 4 to 5 mm dissolution at the stylolites only resets small stylolites. Larger amplitude stylolites, especially those with amplitudes larger than the late dissolution will not be completely reset and show complex stress signals.