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The Stratigraphic Distribution of Seismites in Heterolithic Marine Successions: Examples from the Early Paleozoic, Eastern Laurentia

Intervals of soft-sediment deformation have long been regarded simply as the result of random events of slope failure or storm waves. However, there is a growing recognition that many of these deformed intervals are widespread and may be a signature of ancient seismic events. Indeed, many deformed intervals are restricted to times of active tectonism, as well as to specific lithofacies; the vertical distribution of which may be predicted within a sequence stratigraphic model.

Here we propose a model of the stratigraphic distribution of marine seismites using as examples eight large-scale (3rd-order) depositional sequences from the Upper Ordovician (Mohawkian) of Kentucky together with examples from the Early Silurian of Ontario and New York. Within these strata seismites are developed in two specific lithofacies: rhythmically interbedded, tabular calcisiltites and shale representing deep shelf deposition (transgressive and highstand systems tracts), and 2) laminated to flaser bedded fine-grained calcarenites or sandstones interbedded with thin muds. These facies record shallow shelf deposits developed in the regressive systems tract. Deformation is typically most intense in areas of differentially thickened sands, where tidally bedded calcarenites/sands fill channels. These deformed intervals display a range of sedimentary features, which give information about the environment, and timing of deformation.

The regular distribution of deformation prone facies within a single depositional sequence seems to be regulated by eustatic fluctuations. Tectonics provides the triggering mechanism to disrupt deformation prone strata. The record of deformed intervals provides a meter of intensity and timing of pulses of tectonism during orogeny.