

Are shales really that dull? Shining light into dark places and the effects of opening Pandora's Box*

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Fine-grained sedimentary rocks are currently the subjects of great deal of research. In spite being very common they are poorly known, relative to other sedimentary rock types. Most geologists consider them to be the product of deposition in low energy environments, and if they are source rocks, below anoxic bottom waters. Recent petrographic studies of marine mudstones have shown that they are typically organized into very thin, sharp based beds and commonly contain a wide variety of micro-sedimentary structures including: gutter casts, compacted ripples, triplet fabrics, organo-minerallic aggregates, aggregate grains and diminutive burrows. The presence of these fabrics forces a radical reappraisal of the conditions under which they were deposited and the processes responsible for organic carbon enrichment of the sediment.

Using micro textural data derived from classic fine-grained successions e.g. Kimmeridge Clay Formation, Mancos Shale, Whitby Mudstone Formation and Marcellus Shale, the sedimentological processes responsible for mudstone deposition in these units will be reviewed. The presence of a wide diversity of microfibrils suggest that prior to being sedimented the components of the mudstones were: a) delivered to the seafloor as organo-minerallic aggregates and b) then dispersed both in bedload and as fluid mud by processes such as wave enhanced sediment gravity flows and geostrophic flows, prior to c) being burrowed by diminutive organisms that were living close to the sediment water interface. These data suggest that mudstones, and source rocks in particular, were deposited in much more dynamic conditions than most researchers have assumed, and that the deep water, predominantly low energy, anoxic model that is typically the default setting for interpreting their origin needs to be revisited. They also demonstrate that these rocks contain a great deal of useful, but largely unrecognized stratigraphic information, and that they reward careful study.