

An Overview of Experimental Mudstone Sedimentology - Results of Experiments and Applications to the Rock Record

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Abstract

The processes affecting the transport and deposition of mud in natural environments are still poorly understood, yet, understanding these processes is important because much of the earth's surface is covered with muddy substances, two thirds of the sedimentary rock record consist of mudstones, mud accumulation impacts water reservoirs, harbors, and shipping lanes, and because mudstones are an increasingly important energy resource.

From the perspective of a sedimentologist, the need for experimental work in mudstone sedimentology comes from the realization that many mudstones contain small-scale sedimentary structures that can potentially provide information about depositional conditions and history. However, as soon as one attempts to harness these features for interpretation of environments of deposition, one realizes that there simply is not much information available that allows us to link features observed in the rock record to measurable sets of physical variables in modern environments.

Although one might hope to glean the required information from studies of modern mud accumulating environments, the heterogeneity of modern sediments makes it quite difficult to connect observed sedimentary features and measured process variables. Thus, study under controlled conditions in flumes and other experimental apparatuses is essential for true improvement of our understanding of mud deposition.

Flumes can be used to obtain quantitative information about depositional and erosional parameters, but it is of critical importance that the flume be designed in a way that flocculated materials move under shear stress conditions that would be reasonable in natural environments. Recent flume studies have shown that muds can form deposits at flow velocities and shear stresses that would suffice to transport and deposit medium grained sand. Mud suspensions are prone to flocculation and the resulting floccules travel in bedload and form ripples that accrete into beds. The latter finding suggests that for example many laminated shales were deposited from currents rather than by settling from slow moving or still water. There are many other sedimentary features in shales that can be reproduced in flume studies.

As continued progress is being made, these will in coming years provide a quantitative basis for shale sedimentology, as well as offer the potential to better understand the parameters that determine the performance of shale gas reservoirs.

