Bedform and grain size variation in Froude supercritical flow deposits: Field examples of conglomerates, sandstones and fine-grained turbidites in deepwater slope settings.

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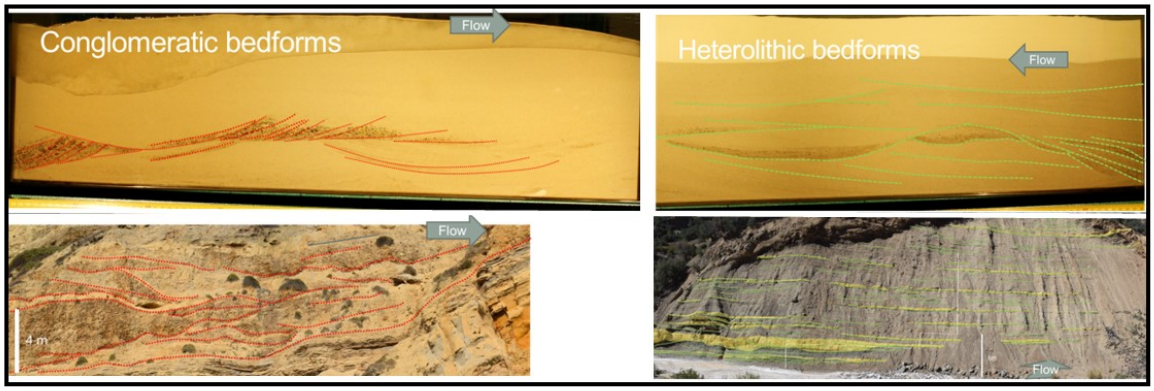
There is a growing body of evidence for Froude supercritical flow bedforms from modern subaqueous steep slopes, from deltaic settings to deepwater continental slopes. Froude supercritical flow bedforms have also been documented in subaerial alluvial to fluvial settings. Morphodynamics of supercritical flow bedforms and their deposits are well established by flume experiments. However, outcrop recognition of Froude supercritical flow sedimentary structures and geometries in those subaqueous settings has not yet been well established. Their recognition in the field is complicated by the various scales of supercritical flow bedforms (e.g., backsets and scour and fill structures), where multi-meter to tens of meters thick bedforms are built by smaller-scale bedforms on centimeter to a meter scale. The large-scale supercritical flow bedform wavelength is characteristically on 10’s to 100 meter scale, and thus the complete bedforms are hard to observe unless the outcrop scale is large. These bedforms have commonly erosional set boundaries, as well as contain internal discordances, and are therefore easily confused with channels. Furthermore, they are formed in various grain sizes ranging from cobble-conglomerate to silty fine-grained deposits, with characteristic grain size trends, such as upward fining, downstream-and-upstream sharp grain-size contacts but gradual lateral changes.
This paper aims to describe supercritical flow sedimentary structures from ancient active margin deepwater continental slopes exemplifying differences between the erosionally bound large-scale bedforms and their host channels that are an order of magnitude larger. We also discuss their morphodynamics based on new experiments conducted with various grain sizes, ranging from silt to granules. We compare the experimental results and outcrop examples, and demonstrate that variable grain sizes provide more complex geometries than the single-grain size supercritical flow bedforms.

Keywords: Froude supercritical flow, deepwater slope, bedform



Upper pictures exhibit the complex scour-fill-structures formed under supercritical flow condition.
The lower pictures are from the outcrop examples from Eocene deepwater slope channnel complex.

