INTRODUCTION TO SEQUENCE STRATIGRAPHY: RECONSTRUCTING THE "SLUG" MODEL USING THE DESKTOP DELTA PHYSICAL MODEL

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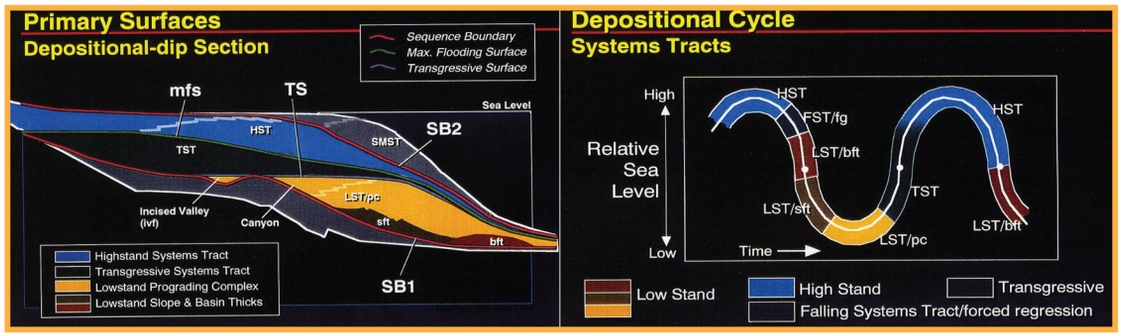
Introduction

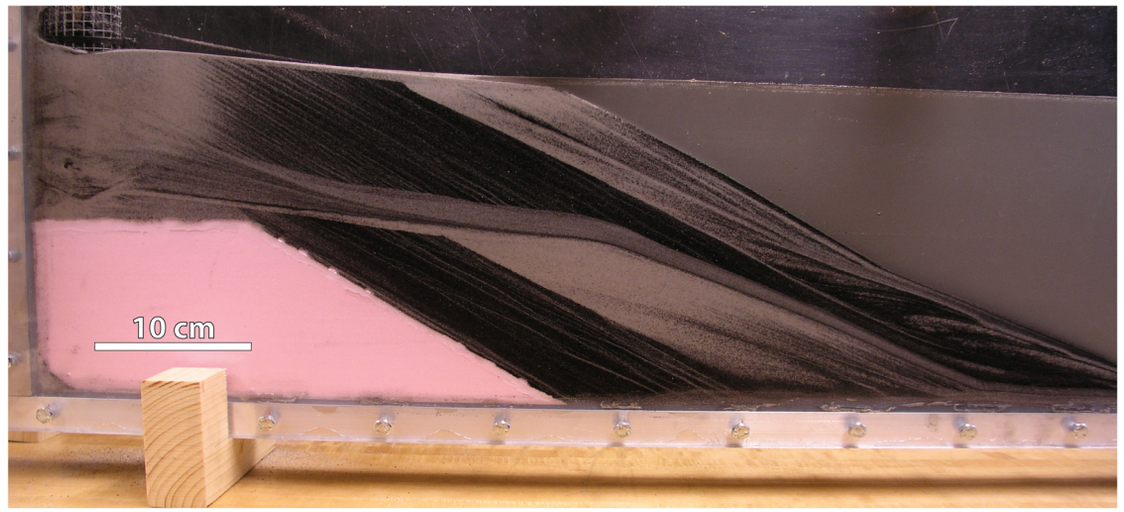
Following the instructions developed by the National Center for Earth surface Dynamics (NCED) and available at http://serc.carleton.edu/NAGTWorkshops/sedimentary/models/desktop_delta.html, we built the desktop delta model and used it to reconstruct the classic "slug" model of sequence stratigraphy for teaching purposes. Constructing the desktop delta model is relatively simple and inexpensive (under $300 without a water recirculation pump). The model is small and does not take up much lab space: the tank made of clear Plexiglas is only about 1.15 m long, 0.4 m high, and 5 cm wide. The model is also fairly easy to operate. It uses a mixture of quartz sand and coal to demonstrate sedimentation patterns from a point source into a standing body of water whose depth can be easily changed.

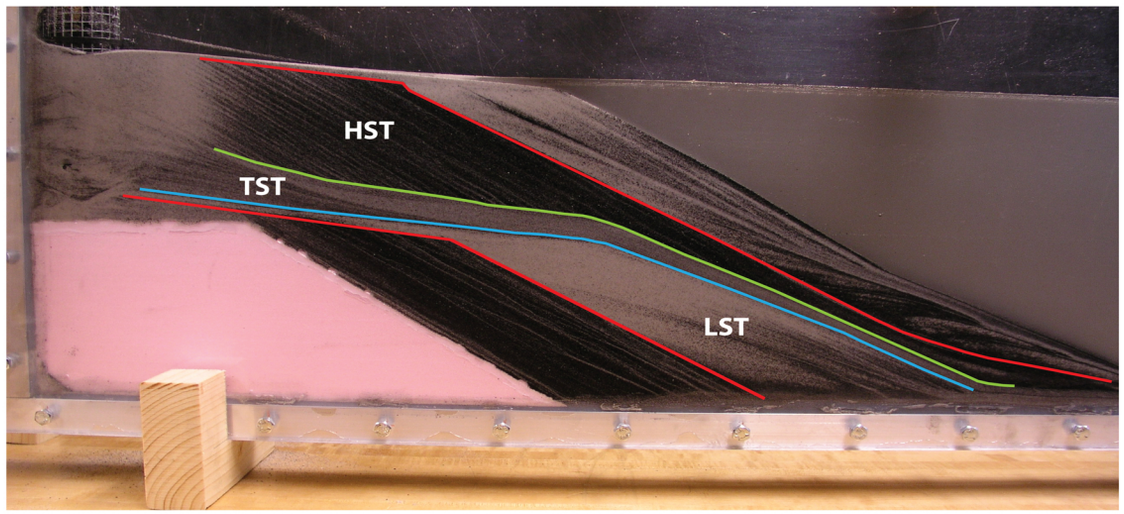
Theoretical Model (modified after Vail 1987 by J. Armentrout)



Results of Physical Modeling

We ran the desktop delta model during one complete cycle of water-level change (the sequence of photographs from left to right above and the accompanying movie) to demonstrate processes of sedimentary sequence development. The model successfully reproduced the "slug" model of sequence stratigraphy (photographs on the right) and all of its main components were visually easily recognized: two sequence boundaries (red lines), and the lowstand (LST), transgressive (TST) and highstand (HST) system tracts separated by the transgressive (blue line) and maximum flooding (green line) surfaces. Even though the desktop delta model also works very well in producing parasequences, we were not able to discern all details of parasequence stacking patterns directly comparable to those of the theoretical "slug" model. It is possible that this aspect of the physical modeling might be improved by further experimenting with variable conditions (e.g., rates of sedimentation or water-level change). Alternatively, a longer channel might be needed to enhance sediment sorting during transport.





Conclusions

Overall, the desktop delta model is an effective teaching tool, which is easy to build and fun to operate. Even though many sedimentology and stratigraphy instructors have already built their versions of the NCED's desktop delta, we would like to encourage others to consider constructing and using such physical models for exploring various sedimentary processes and products with their students.

Acknowledgements

The Smith College Summer Science Program funded the project; Greg Young and Eric Jensen (Center for Design and Fabrication; Smith College) supervised the construction; many other individuals helped with various stages of the project: at Smith College - Tony Caldanaro and H. Robert Burger (Geosciences), Jeff Heath (Information Technology Services), Dick Fish (Art and Biology), and elsewhere - James Ebert (SUNY Oneonta), Tom Hickson (University of St. Thomas), other NCED staff, and organizers and participants in the Teaching Sedimentary Geology (On The Cutting Edge) Workshop in Salt Lake City in 2006.

References

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