D44 Fluvial Transport of Bones: Our State of Knowledge and Future Research Directions

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The author will offer a review of the forensic, anthropological, and paleontological research related to bone transport and deposition in river systems. A synopsis of the consistent results between the studies reviewed will be presented as well as a discussion of the conflicting data and ideas. Directions for future research will be outlined.

This presentation will provide a concise statement of what is known about bone transport and deposition, which should aid investigators in making informed decisions about where to look for the rest of a partial skeleton in a fluvial context, and make more informed reconstructions of the postmortem history of the remains under investigation. In some jurisdictions finding human skeletal remains in fluvial systems is relatively common. However, in a search it is often hard to find more than a few parts of a skeleton, and often reconstruction of the skeleton's history is complicated. This review will not enable investigators to identify exactly where to find bones or to identify exactly what their histories have been, however it will give them more information to work with that may increase their productivity and success rates with such cases.

Understanding the postmortem history of the bones found in forensics, anthropology, or paleontology requires knowledge and understanding of the processes that act on a body and its parts after death. Many modern and fossil remains are found in rivers or in association with river sediments, often having been transported by the river in order to be deposited where they are found. In order to piece together the postmortem history of remains found in fluvial contexts it is essential to understand how bones are transported in and deposited by river systems.

Previous work on the subject has focused on three methods of inquiry: 1) settling column experiments, 2) flume experiments, and 3) observation of bones in rivers. Settling column experiments generate data that can be used to calculate a theoretical behavior of bones in river systems; however, this theory has not yet been tested rigorously. Flume experiments have been used to directly observe bone transport and deposition while subject to water flow. Results of these experiments contradict some of the predicted behavior calculated from settling column studies. Flume data is powerful, however, in order to run flume experiments many flow and sediment conditions are held constant; a situation rarely found in nature. As a result, the conclusions made from flume data on bones have an unknown applicability to natural systems. Few studies have been performed placing bones in rivers and observing their behavior. Those experiments have shown that a bone's shape, size, and initial orientation alter its transport properties within a river. Similarly the interaction between the river bed and the bone being transported significantly alters a bone's transport and deposition potential.

From the above studies it is known that a bone's shape, size, density, and orientation in a flow all alter its transport potential. A bone's shape, size, and orientation can be loosely combined into one variable; the hydraulic shape. The hydraulic shape and density of bones seem to be the controlling factors in the transport of bone material. As flow velocities and water depths change the hydraulic shape, density, and the velocity profile of a river interact to produce deposition or transport of bones. General rules for the interaction between hydraulic shape, flow depth, and flow velocity will be advanced and discussed.

Future research should include a test of the existing bone transport theory generated from settling column experiments. Many bones should be characterized in a settling column, their transport behavior predicted, and this prediction should be tested by placing bones in a river system and observing how they are transported and deposited. Actualistic data obtained from bones in rivers should be compared to flume data to ascertain how applicable flume data is to the real world. Bone weathering and abrasion during transport should also be studied since modifications to bone surfaces could yield useful information about transport distance, and potentially the postmortem interval.

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