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## AN OBSERVED ORIGIN OF SOME MUD PEBBLES

A. L. LUGN

Mud and clay pebbles and cobbles have been observed at many places by different people. They seem to be most common in recent stream deposits and are sometimes seen in eroded alluvial plain sediments. A few geologists have contended that the presence of these mud or clay pebbles in deposits indicates that the deposit as a whole was formed in connection with glaciation and at temperatures near or below freezing. The reason for this conclusion is the belief that balls of mud could not withstand the abrasive and disruptive action of stream transportation unless they were frozen and hard, simulating in that condition a fragment of indurated rock. This may be the history of some mud pebbles in some deposits but it is not a safe criterion on which to date a deposit of sediment.

The purpose of this paper is to record very briefly some observations on the formation of mud balls or mud pebbles. They were observed in all stages of shaping from angular pieces of compact and durable mud to well rounded forms that had experienced some transportation and had been deposited as constituents of gravel bars. The phenomena were observed at many places along the Mississippi river during the summer of 1925. The photographs for the accompanying figures were taken along the east bank of the river at the water's edge opposite the "Chain of Rocks" at St. Louis.

At the above location a deposit of mud, mostly silt and clay, which had been laid down during high water, was observed being eroded by wave action. The gently sloping mud deposit had been eroded and sculptured into typical shoreline forms, as the water level had fallen, with the lowering of the river's stage. Cliffs from one to two feet in height had been cut and terraces built at successive intervals. Three distinct water levels were recorded by these features of wave erosion. The processes and resulting topographic forms appear to be identical with the processes and resulting shore forms seen along the shores of large bodies of water, where indurated rocks are being disrupted by large waves. The only differences are those of scale and kind of material.

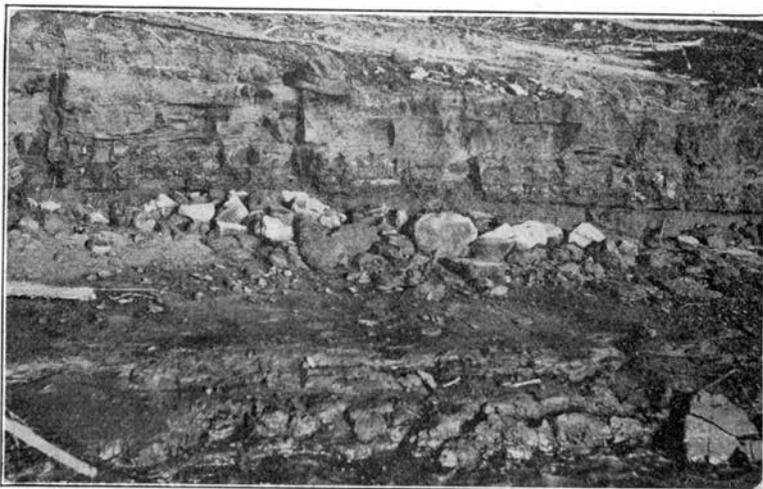


Fig. 1. Low wave-cut cliff with mud fragments which have been milled about by wave action

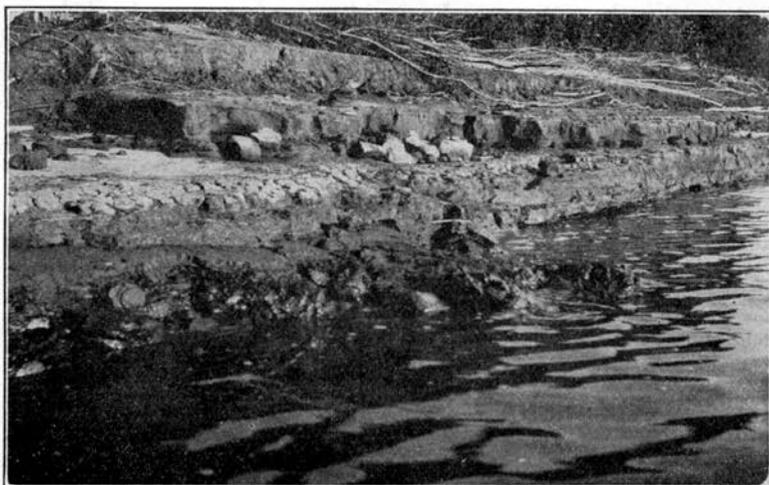


Fig. 2. Low wave-cut cliffs which record three successive stages of water level and fragments of mud being shaped into mud pebbles

Most of the recently deposited mud was being broken up into its original fine particles. Some chunks, however, were sufficiently compact and durable to withstand considerable wear and to take definite shape. Their consistency was such, that they could be considerably flattened by pressure without breaking and they were sometimes durable enough, even when still wet and unwrapped, to be easily carried in a bag without breaking to pieces.

Such mud balls, as they were milled about by the waves and currents, came to have characteristic water-worn shapes. Only a relatively small percentage of any large number of these fragments seemed durable enough to have a very long history, but such as did survive were quite commonly carried for relatively long distances.



Fig. 3. Angular to well-rounded mud fragments in process of shaping by the waves.

Such mud pebbles were observed in gravel bar deposits at numerous places more than a mile from their probable sites of origin. In some cases these had small pebbles of chert or other indurated rock material impressed or "set" in their surfaces, proving beyond a doubt that they had been carried in a soft and plastic condition. It seems conclusive that such mud pebbles and cobbles are often transported several miles, in a more or less plastic condition at ordinary temperatures, before being deposited or completely broken up.

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