period, some with the names of prominent makers; various types of protractors.

Measures of time: sundials of various countries and eras. Those of China are often works of art, being engraved with great care. Most of the various types of sundials are shown. These are in ivory, bronze, silver or wood. Two Japanese clocks of curious mechanism are included.

Instruments of surveying and navigation: These include several remarkable astrolabes beginning with one of the sixteenth century. There are also a number of early quadrants and other instruments in copper and in brass. In general they were secured in Italy, Germany, India, Austria, Iraq, Arabia and France.

Astronomical instruments, including those above mentioned and a number of brass armillary spheres (some of artistic merit) and celestial spheres of brass with the important stars inlaid in silver. These were secured in northern India about thirty years ago. One of them bears the inscription, dated 1645, stating that it is the work of the grandson of the emperor's chief astronomer.

These instruments represent the elementary and utilitarian phase of mathematics. The university already had a large collection of modern geometric models, chiefly of European origin.

DAVID EUGENE SMITH

SOURCE OF PROPULSIVE POWER USED BY FLYING FISH

SEVERAL references have appeared in recent months relative to the method of flight used by flying fishes. In all of them the consensus of opinion seems to be that the flight in itself is purely a glide, with no generation of new motive power once the fish has cleared the water. This is not strictly true.

On a recent hundred-day voyage, mainly through tropical waters, I became interested in their source of motive power and spent literally hours of my leisure time watching the take-offs and flights. Eye analysis of the motions is of course not so reliable as would be possible with a moving picture camera, but on one point the eye does not deceive. These fish, as they leave the surface of the water, do actively lash the water with their tails, and at this time there is a synchronous movement of the wings. Whether the wing movement adds impetus or is purely secondary to body movement of the tail lashing is impossible to say. The point I wish especially to contribute is that these fish, after the take-off, may again and again lower the tail into the surface of the water and lash it violently to gain impetus for continuation of their flight. The entire body does not enter the water; only the tail is lowered by a backward tilting of the whole. I watched this act of renewing impetus numberless times, often seeing it repeated four or five times in the course of a single flight. Naturally it can be observed only when the sea is quite calm.

The flying fish flight, then, is often not simply a sustained glide, but may be a series of glides interrupted by brief periods of tail lashing on the surface of the water for gaining additional impetus. The tail lowering appears to be intentionally performed when the body approaches close to the water surface.

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THE DEPOSITS OF HAYDEN VALLEY IN YELLOWSTONE NATIONAL PARK

YELLOWSTONE RIVER flows north from Yellowstone Lake through a broad depression known as Hayden Valley. The floor of this depression, about 25 square miles in area, is covered with deposits which are mapped in the United States Geological Folio for Yellowstone Park (No. 30) as glacial drift. De Martonne accepted the material as moraine in discussing movements of ice in this area.

In a survey made during the summer of 1933 by the writer in company with Professor Douglas Johnson, of Columbia University, some doubt was raised regarding the earlier identification of the deposits. These doubts were founded on: (1) the well-integrated drainage prevailing in the supposed morainal area, coupled with the fact that the few shallow depressions which do appear are associated with a topography suggestive of slumping; (2) the presence of horizontal bedding revealed in some of the hill slopes and the exposure of laminated silts and clays in holes dug by burrowing animals; (3) the general absence of large boulders. The hills are mantled by loose cobbles and gravel which creep down the slopes and mix with wash from the underlying silt and clays. The superficial resemblance of the resulting material to till probably accounts for its earlier misidentification.

New road cuts in Hayden Valley show that the rolling moraine-like hills are composed largely of finely laminated or varved clays and clay-silts. These unquestionably lacustrine sediments pass downward into fluvial or glaciofluvial sands and gravels which form the basement deposits of the hills.

Recognition of the lacustrine origin of all but the lowest sediments has led to a new conception of the Pleistocene history of Hayden Valley. Details of the history will be discussed in a comprehensive report on the geomorphic development of the Grand Canyon of the Yellowstone River. This study represents one phase of the Big Horn-Beartooth-Yellowstone Project and is supported in part by grants from the Geological Society of America.

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