A. ? notabilis and two nearly complete bones of a large *Dinichthys*—a right suborbital lacking only the extreme anterior portion but showing an arrangement of sensory grooves quite different from that described in other species and an ornamentation of fine pustules distinct from that found on the specimens from the Cuyler Quarry. It measures 12 cm (average) in width and 17.5 cm along the ventral (incomplete) edge. Considerable labor was required with a sledge to get these bones from 500-lb. masses in shape for removal, and in reducing the block containing the suborbital just mentioned a portion of it was broken away, revealing beneath it a part of a slender plate, a left intero-lateral. This bone is rather rarely found in *Dinichthys,* and is especially interesting since from its ornamentation and size, as well as position in the rock, it probably belongs to the same individual as that represented by the suborbital.

The old Chamberlain Quarry north of Ovid (Seneca County), lately reopened, has produced two specimens from the upper layers. The better preserved is a part of a posterior median ventral of *A. ? notabilis* slightly smaller than the one described and figured by Whiteaves from Lake Winnipegosis. The other is a fragment of a finely pustulose plate of a dinichthyd.

A tentative list, pending further study of these interesting denizens of the Tully sea, follows:

Aspidichthys ? notabilis Whiteaves
Dinichthys 3 or 4 sp.
Bothriolepis ? sp.
Rhynchodus sp.
Rhadinichthys ? sp.

S. G. Williams ('87) lists a "fish spine" from the Tully. No fish remains are listed by Cooper and Williams ('35).

JOHN W. WELLS

STATE NORMAL SCHOOL
FREDONIA, N. Y.

MORE ABOUT "FLYING FISH"

HAVING read with considerable interest the numerous articles in SCIENCE about flying fish, I would like to make a few comments which, I believe, may explain their method of flying.

Innumerable observations of flights were made from the decks of the hydrographic surveying ships "Pathfinder," "Fathomer" and "Marinduque" of the Coast and Geodetic Survey by the writer while attached to these vessels when on duty in the China and Sulu Seas. At times as many as forty or fifty fish would be in the air at once, when frightened by the oncoming ship, and it was very common to see a dozen or more leave the water almost simultaneously, some ten to twenty feet ahead of the bow of the ship. In general, they spread out, fanlike, in their efforts to get away from the ship, very often leaving trails extending through 180 degrees from the bow of the ship, and in some cases a few would start in the reverse direction of the ship, indicating the fishes' desire to get away, in any direction, from the source of danger. Such flights have been seen in dead calms with glassy seas through all wind velocities to the monsoons of say about twenty-five miles per hour and waves ten feet high from trough to crest.

Such observations indicate that the fish can take off in any direction, either with or against the wind, and in any sea from smooth to choppy. Fish have been observed swimming to the surface, emerge and then immediately turn and soar away at right angles. Consequently, it is not necessary for him to have momentum to carry him forward. Momentum may help but is not necessary, and my own belief is that all the flying effort is produced after the body leaves the water; the propulsion being entirely by the lower portion of the tail used as an oar in sculling, except that it is not kept in the water but is dipped in, first on one side and then on the other. Better, it is probably not actually dipped into the water but is very efficiently pushed downwards and backwards against the water, lifted and repeated on the other side. The "dots" observed by other writers are not made by pairs, such as would be made by wings, but are alternated. The reason for believing that the lower portion of the tail may not dip clear into the water comes from observations of how a fish may continue his flight and increase his speed after having been out of the water for eight or ten seconds. When getting up speed at the beginning of the flight the water is lashed vigorously and considerable splashing is done and the "dots" are not distinct as they are at the latter part of the "take off."

The body of the fish then becomes horizontal, or nearly so, and with the wings fully spread but without any motion, so far as I could ever detect, the fish flies in a nearly straight course with gradually diminishing speed and decreasing altitude. This usually ends with a return to water, but occasionally the tail of the fish is depressed sufficiently to enable the lower part to reach the water, while the wings are kept outspread, and the sculling is repeated for maybe fifteen or twenty feet, during which time the speed is rapidly increased to as great or greater speed than at the first take-off. The tail is then lifted and the body resumes the horizontal position and the flight continued sometimes to even greater distances than the first portion. I do not remember of ever having seen this done a second time in one flight.

The "dots" made in the second acceleration had seldom, if ever, any accompanying splashing and appeared as depressions in the water rather than elevation. They were closer together at the beginning and

farther apart at the end of the series, clearly showing the increasing speed, and were always alternating from one side to the other.

The length of flights observed varied from two or three feet to perhaps 400 feet and all intermediate distances. Many flights were timed with a stop watch, and the longest observed was twenty-eight seconds. Since the ship speeds were eight to ten knots and the fish could generally keep ahead, their flying velocity may be as much or more than fifteen feet per second.

One evening while the ship was at anchor a seaman caught one and brought him to me while still alive. The fish was about eight inches long and while held in my hand vibrated the after part of his body very vigorously at a frequency, as near as I could estimate, of about twenty complete cycles per second. This was repeated several times for intervals of a few seconds. There was no tendency to move his wings in his struggles, as does a bird when held.

My opinion is that the flight is gliding, entirely, the necessary speed being attained by a process similar to sculling.

HERBERT GROVE DORSEY
U. S. COAST AND GEODETIC SURVEY

LAURENCE

DR. I. R. LESAGE, of Huntington, W. Va., tells me that formerly it was customary among many people of that region, and may still be, to use the term "laurence" when referring to the display of shimmering which one often sees over a hot surface, such as a stubble field on a calm, cloudless summer day.

This term fits the subject precisely because the phenomenon alluded to, being caused by the unequal light refractions of innumerable columns of air of different temperatures, is most pronounced when the surface over which it appears is very hot and therefore reminded of the martyrdom of St. Laurence (Rome, A.D. 258) by roasting alive on a griddle.

Certainly the boy sweating in the harvest field, with never a breath of air stirring and the sun stalled in mid-heaven, can testify to the everlasting appropriateness of the term "laurence" for the shimmering of the burning and blistering heat he must endure. Indeed the term is so altogether fit as to deserve a much wider usage than it appears now to have.

W. J. HUMPHREYS
U. S. WEATHER BUREAU,
WASHINGTON, D. C.

SCIENTIFIC BOOKS

MINERALOGY

Introduction to the Study of Minerals. By AUSTIN FLINT ROGERS. Third edition, 626 pp, $5.00. McGraw-Hill Book Company. 1937.

IN this new edition of his "Introduction," Professor Rogers has, in the main, followed the form and style of previous editions. It covers the entire field of mineralogy in four parts: the properties, description, occurrence and determination of minerals.

Those who are interested in crystallography will welcome the full and clear treatment of this subject, especially the correct description of the symmetry of each of the classes. The Groth-Fedorow nomenclature of classes and forms is used. It is to be hoped that this terminology, which is rapidly gaining in favor, will soon be generally adopted.

A new chapter by Dr. Lloyd W. Staples on microchemical analysis calls attention to methods that have generally been ignored in mineralogical texts.

The descriptive part contains discussions of 222 minerals. The recommendations of the committee on nomenclature of the Mineralogical Society of America, 1935, have been followed in the naming of minerals. The German and French equivalents of each name are given and the origin of most names is explained. References to occurrence are chosen to throw the greatest possible light on the origin and associations of each mineral.

Though nearly twenty pages are devoted to a discussion of crystal structure there is no mention of the structure of individual species in the descriptive part. To the reviewer this seems no great drawback except for the silicates. The structural classification of this most important group of minerals is now so well established that it ought to be generally used.

Professor Rogers' text is very clear and is aided by many simple drawings, convenient subheads and the judicious use of heavy type, which make for easy reading. With these desirable features and a thorough treatment of fundamentals the book is well adapted to the needs of students.

ADOLF PABST
UNIVERSITY OF CALIFORNIA

Oyster Biology and Oyster-Culture. The Buckland Lectures for 1935. By J. H. ORTON. 211 pages, 57 figures. Longmans, Green and Company, New York. Price, $2.00.

AFTER many years of research on the biology of the European oyster, *Ostrea edulis,* and its methods of cultivation, Dr. J. H. Orton has written this book in which he summarizes the principal results of his productive investigations. Following a brief discussion of the anatomy and relations to other mollusks, the author deals more extensively with the habits of the organism, giving particular attention to shell movements, mode of feeding and to shell growth. The sex change of this species, which has been the principal