growth within it and by material washed into it over the barrier. It may be so, but it does not justify the statement that "atoll lagoons tend, as a rule, to become smaller and shallower," and there is no attempt by reference to other atolls to justify it. Solution and material swept out by the tides are said to have nothing to do with the formation of the lagoons of atolls. The picture of a high island crumbling to pieces within the calm of an encircling barrier reef appears to our author to be contrary to all natural laws. On what view does he explain Agassiz's wonderful series of photographs of Fijian islands within barrier reefs? "In this (his own) description," he states, "it is assumed throughout that the lagoon is a slightly submerged reef"; why this assumption without evidence? The encircling reef is said to be "a mosaic inlay of coral fragments, cemented together into a solid platform," but there is no evidence that it was ever really examined. It is supposed to have grown up as a platform, and many of its constituent organisms must surely have remained in their growth-positions. A similar platform is found at 13 feet above mean tide level; it is stated that such a platform can only be formed below this level, and its existence is explained as due to elevation.

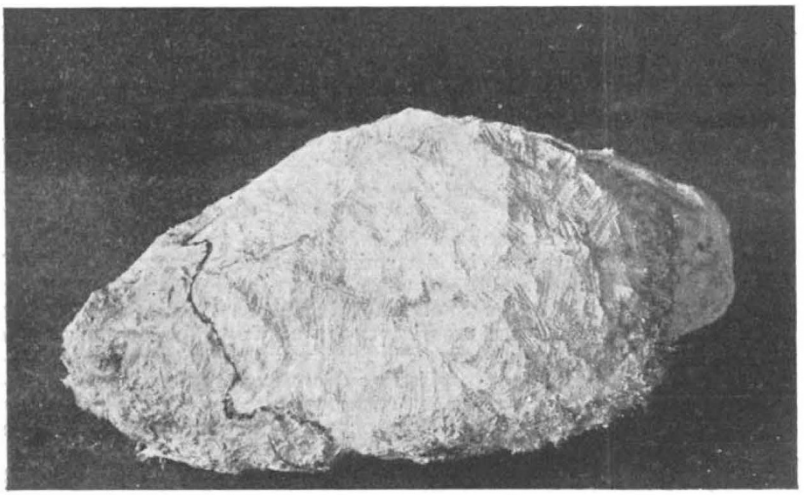

FIG. 2.—Photograph of a Boulder of Alga-covered Dead Coral Rock, to show the bites of a fish of the genus Scarus. The black line marks the edge of the alga covering not bitten away by the fish. From "Coral and Atolls."

Our author does good service in directing attention to the important effects of sedimentation. Sedimentation banks largely form the foundations of reefs, but "it matters not what the base may be so long as its platform comes within the wind-stirred area." "Any elevation which rises to this plane (the *limiting line of sedimentation*) will furnish the corals with a suitable basis." The depth of this *line* varies. It is entirely a supposititious *line*, and, so far as we can understand, may lie at any depth. Direct investigation on the processes of sedimentation in the ocean is certainly needed.

In conclusion, it cannot be said that Dr. Wood-Jones has much new to tell us. His volume is, however, a very readable one, and most suggestive of lines of research on corals, which might profitably be pursued by more precise methods. His range of investigation and reading were obviously too restricted to enable him to draw conclusions as to the formation of coral reefs in general. The account of the fauna and flora is very good, and the note on Scarus as a coral-feeder interesting. The illustrations of corals and other organisms are good, but a specialist should have been consulted, so that the names of the coral genera might have been inserted. An obvious Actinian (p. 161) would not then have been labelled as an Alcyonarian.

RESEARCHES IN STELLAR PARALLAX.[1]

THE Observatory of Yale College has acquired a deservedly high reputation for the zeal with which the staff has prosecuted the inquiry into stellar parallax and the standard of accuracy consistently maintained. This latest contribution to the subject cannot but enhance that reputation for accuracy, for the results sought do not aim so much at applying the method to fresh instances, as to the re-examination of previous investigations with the view of improving their trustworthiness. Of the stars, the distances of which are here discussed, two-thirds have already been the subject of inquiry at Yale or elsewhere, but on various grounds the results have been regarded with a degree of suspicion that made the repetition of the measures desirable.

The new material falls into two classes, one containing stars having a larger annual proper motion than about 0·4″; the other, selected stars in the Pleiades the observation of which might afford evidence as to the distance of the group as a whole. As the results derived from these Pleiades stars are not regarded as conclusive, and do not enter into the final catalogue, they may be dismissed here. One star gave the value zero, indicating that the Pleiades group is at the same distance as the star; the measures of another assigned the small negative parallax of −0·3″, "a value that would give a possible limit of systematic error"; while the third series, resulting in the value +0·6″, suggests that the star does not belong to the group at all, but is nearer to our system, "and this result would seem to be fairly assured." The approximate distance of the Pleiades group still remains a matter of conjecture.

Naturally in a work so long and laborious, difficulties arose in connection with the instrumental and optical equipment, necessitating interruptions in the continuance of the sequences. The most formidable of these was a tendency for the field lens of the eyepiece to work loose, to which inconvenience it is not necessary to refer further, than to express our assurance that the skill and experience of the observers would succeed in effectually removing any traces of systematic error arising from this untoward accident. To show that this confidence is warranted, we may give the final results obtained by the three observers in the case of the Arcturus determination, a star the measures of which have been most scrupulously examined, since for a star of such brilliancy and large proper motion the earlier values of parallax were so suspiciously small, as to suggest that some inherent quality in the star itself, such as colour, or some peculiarity in the observers' method of measuring, had influenced the result. With regard to the detection of

[1] Transactions of the Astronomical Observatory of Yale University Vol. ii., part ii. Parallax Investigations on thirty-five selected stars by Frederic L. Chase, Mason F. Smith, and William L. Elkin (Director). (New Haven: Published by the University, 1910.)

a colour effect in the observations, to which a reference is made in NATURE (vol. lxxv., p. 234), further examination has failed to disclose any systematic error attributable to that cause, while the arrangement and discussion of the several series of measures—Dr. Elkin himself made no fewer than seven—exclude the possibility of any personal peculiarity or habit escaping detection. The adopted parallax values for each of the three observers are as follows :—

Observer.	Parallax.	Probable Error.	Probable Error of Single Obn.	No. of Observation.
Elkin	+0".051	±0".013	±0".240	126
Chase	+0".085	±0".007	±0".127	154
Smith	+0".050	±0".011	±0".126	123

After an elaborate system of "weighting," for details of which we must refer to the original paper, the finally adopted value of the parallax of Arcturus is 0".066 ± 0".006.

The interesting stars 61 Cygni and Groombridge 1830, notwithstanding the repeated attempts that have been made to determine the parallax, are among those stars of which it has been thought desirable to repeat the measures. Without entering into further particulars, it may be said that the results are equally consistent as those obtained in the case of Arcturus, and command equal confidence.

The grand result of the work at Yale, which has occupied the three observers for some years, is to assign a parallax to 200 stars, with an accuracy that we believe has not been attained elsewhere. The three stars in the Pleiades not being included, we have here a catalogue of 197 stars, which Dr. Elkin forms into groups depending on magnitude and proper motion. This table is so small that it can be conveniently given here. It may seem but a modest outcome for so many years of careful and anxious work, but those who appreciate it most will be warmest in their congratulations to Dr. Elkin and his able colleagues on the satisfactory completion of a task of no common difficulty. The table into which so much work is compressed is as follows :—

Proper Motion	0".00–0".34	0".41–0".54	0".55–0".65	0".66–0".96	1".01–7".07
Mag. 0·0–2·5	+0".031 (13)	+0".100 (2)	+0".113 (3)	... (0)	+0".200 (2)
,, 3·0–5·0	+0".026 (9)	+0".024 (7)	+0".114 (5)	+0".091 (8)	+0".162 (6)
,, 5·1–7·0	−0".010 (7)	+0".034 (14)	+0".064 (16)	+0".036 (20)	+0".111 (8)
,, 7·1–9·0	... ... (0)	+0".040 (23)	+0".032 (23)	+0".018 (19)	+0".128 (12)

The number in brackets after the parallax signifies the number of stars in each group. As Dr. Elkin remarks, "There is, with slight exception, manifest a very decided sequence of values, both with respect to magnitude and size of proper motion, such as one might expect." W. E. P.

THE PERFILOGRAPH.

THE perfilograph is an ingenious instrument for recording graphically the undulations of the bottom of a channel in depths up to about six or seven fathoms. It is the invention of Augustus Mercau, an Argentine engineer, by whom a paper was read at Buenos Aires before the Naval Section at the recent meeting of the International American Scientific Congress, in the course of which the instrument was fully described. The principles on which its construction depends and the practical results obtained from its use appear to present some points of interest.

A heavy weight of from 150 to 200 lb. being slowly dragged along the bottom by a wire rope attached to the stern of a steam launch, it is obvious that as the depth changes the inclination of the wire will vary. By an ingenious mechanism, the sine of the angle made by the wire with the horizontal plane is registered graphically in parallel ordinates on a roll of paper, which is slowly unwound by means of clockwork at a rate proportionate to that of the vessel. The lengths of the ordinates, being proportional to the sines of the varying angles, represent the undulations of the bottom referred to the horizontal plane, and are registered on a convenient scale on the paper by means of a system of levers.

The instrument, mounted in the stern of the launch, is placed accurately at a height of 5 feet above the water-line, and the depths are measured from a zero line drawn by a pencil pressing against the roll of paper as it is unwound. The system of levers by which the sines of the angles are registered is connected to a length of tubing of small diameter, through which a thin guiding wire passes. One end of this wire, which is about 50 feet in length, is secured to a spiral spring attached to the weight on the bottom; the other end is led underneath the base of the instrument and secured. The spiral spring yielding to a strain of about 150 lb., the tension on the guiding wire is automatically relieved by throwing the excess of strain on to the towing cable, the length of which is adjusted accordingly. The guiding wire, being thus kept taut by a strain not exceeding 150 lb., the length of tubing through which the wire passes takes up an inclination to the horizontal dependent on the depth of water, and in so doing it actuates the system of levers with which it is connected.

The speed at which the weight can be towed should not exceed three or four knots. There is an arrangement for marking on the paper the instant at which the position of the vessel may be fixed by means of sextant angles. The horizontal scale of the diagram may thus be determined between successive "fixes" by actual observation, independently of the rate at which the paper is being unrolled or the speed at which the vessel may be moving. Unless these two factors remain constant throughout the run, the horizontal scale will be subject to variation. It is desirable therefore to reconstruct the diagram, so far as its horizontal components are concerned, from the data afforded by the "fixes."

The horizontal scale of the diagram is roughly about 1/1000 or about 70 inches to the nautical mile; the vertical scale is about $\frac{1}{4}$ inch to a foot. The instrument has been adopted by the Argentine Hydrographic Service, and has been in constant use for some time past. It is understood that the results are considered quite satisfactory.

An opportunity of witnessing a practical trial was courteously afforded to the present writer by the Argentine naval authorities. The instrument was readily set up and adjusted, and several sectional lines were run across the dredged channel leading to the docks at Buenos Aires. The resulting diagrams over the same section run in opposite directions agreed accurately, and no difficulty whatever was experienced during the trials.

The following advantages have been claimed for the instrument :—(1) Continuity of the section traced; (2) accuracy of results; (3) rapidity as compared with ordinary methods; (4) economy of skilled labour; (5) facility of manipulation; (6) capability of use in circumstances of sea and weather when accurate soundings by the lead could not be obtained.

The trials were carried out in open water with its surface considerably disturbed by a fresh breeze, and afforded a very fair test of the capabilities of the instrument. There is certainly a source of error owing to the motion of the vessel. The section as shown on the diagram is necessarily a combination of