to the subfamily *Stilbiscinæ* of the family *Murœnesocidæ* shows that all are true *Moringuidæ*, the genus *Stilbiscus* being identical with *Moringua*, having the same structure of the fins. Instead of American waters being destitute of representatives of the family, it now turns out that they are the headquarters of the group and that four genera are found therein—*Moringua*, *Aphthalmichthys*, *Leptoconger* and *Gordiichthys*.

The Porto Rican *Apthalmichthys* agrees most closely with the *A. abbreviatus* of the Indo-Moluccan archipelago (Java, Celebes, Amboyna, etc.). It has a more elongated body (the depth about 54 times in the length), and the head forms one-thirteenth of the length. No true pectorals are developed, although a slight fold exists behind the upper portion of the branchial aperture. The tail forms a little more than one-third of the length. The color in life was a uniform gray olive. The specimen is 270 mm. long. The species may be called *Aphthalmichthys caribbeus*. A detailed description will be published hereafter.

This discovery is of unusual interest. It takes a family out of the category of geographically restricted types and adds one to those of tropicopolitan distribution. It is probable that species will be found under analogous conditions in all tropical seas and that they are rare only in museums. But they are of such a shape and occur amidst such environments that they can only be secured by some happy accident, unless they may be deliberately sought for with proper appliances. The family itself has special interest for the morphologist. The species differ from all others in the great extent of the abdominal cavity (about two-thirds of the total length) and the situation of the heart, which is far behind the gill arches and not close to the hindmost one as in fishes generally.

Theo. Gill.
H. M. Smith.

A PRELIMINARY ACCOUNT OF THE SOLAR ECLIPSE OF MAY 28, 1900, AS OBSERVED BY THE SMITHSONIAN EXPEDITION.

Partly in deference to the report of the United States Weather Bureau, from which it appeared that the chance of a fair eastern sky on the morning of the eclipse was about 8 to 1, and after examination by Mr. Abbot of many stations in North Carolina, Wadesboro, of that State, was selected early in April as the site of the Smithsonian observations. The advantages of Wadesboro being also recognized by Professor Young, of Princeton, Professor Hale, of Yerkes Observatory, and the Reverend J. M. Bacon, of the British Astronomical Association, it came about that four large observing parties, besides several smaller ones and numerous excursionists from the surrounding country, were all joined to produce at Wadesboro one of the largest company of eclipse observers ever assembled for scientific purposes. It is a matter for congratulation that the sky at Wadesboro upon the day of the eclipse was cloudless and clearer than the average, so that the efforts of the observing forces were not thwarted by any circumstances beyond their control. The provisions of the Mayor and authorities of Wadesboro for preventing intrusion before and during the eclipse, and thus securing an undisturbed field of operations, deserve especial recognition. Further than this, the many acts of courtesy and hospitality to the visiting astronomers on the part of the townspeople, will long be remembered by the recipients.

The Smithsonian party proper consisted of thirteen observers, and included Mr. Langley, Mr. Abbot, Aid Acting in Charge of the Smithsonian Astrophysical Observatory, Mr. Smillie, in charge of photography, Mr. Putnam, of the United States Coast Survey, Mr. Fowle, Mr. Mendenhall, Mr. Child, Mr. Draper, Mr. Gill, Mr. Kramer and Mr. Smith. Included with these the

Reverend Father Searle and the Reverend Father Woodman gave most valuable assistance. Mr. Hoxie, of Port Royal, South Carolina, and Mr. Little, of Wadesboro, rendered valued assistance to Mr. Putnam during totality.

Professor Hale, of the Yerkes Observatory, was a member of the party, while still in general charge of the Yerkes expedition, and his counsel and aid were of the greatest service. Mr. Clayton, of Blue Hill Meteorological Station, occupied a part of the grounds of the Smithsonian party.

The main object of the investigation was of course the corona, and of this (first) a photographic and visual study of its structure, with (second) a determination by the bolometer whether appreciable heat reaches us from it, and, if possible, an examination of the form of its spectrum energy curve.

The writer had been particularly struck, when observing the eclipse of 1878, on Pike's Peak, by the remarkable definiteness of filamentary structure close to the sun's limb, and had never found in any photographs, not even in the excellent ones of Campbell taken at the Indian eclipse of 1898, anything approaching what he saw in the few seconds which he was able to devote to visual observations at the height of 14,000 feet. His wish to examine this inner coronal region with a more powerful photographic telescope than any heretofore used upon it, was gratified by the most valued loan, by Professor E. C. Pickering, of the new 12-inch achromatic lens of 135 feet focus just obtained for the Harvard College Observatory. This lens, furnishing a focal image of more than 15-in. diameter, was mounted so as to give a horizontal beam from a coelostat clock-driven mirror by Brashear, of 18-inch aperture, and used with 30-inch square plates. To supplement this great instrument, a 5-inch lens of 38-ft. focus, loaned by Professor Young, was pointed directly at the sun. This formed images upon 11x14 plates moved in the focus of the lens by a water clock. Specially equatorially mounted lenses of 6-, 4- and 3-inch aperture, driven by clock work, were provided for the study of the outer corona, and the search for possible intra-mercurial planets.

For the bolometric work the massive siderostat, with its 17-inch mirror, with a large part of the delicate adjuncts employed at the Smithsonian Institution in recent years, to investigate the sun's spectrum, was transported to Wadesboro. The excessively sensitive galvanometer reached camp without injury even to its suspending fiber, a thread of quartz crystal $\frac{1}{15000}$ inch in diameter.

Besides these two chief aims (the photography and bolometry of the inner corona), several other pieces of work were undertaken, including the automatic reproduction of the 'flash spectrum' by means of an objective prism with the 135-ft. lens; the photographic study of the outer coronal region, including provision for recognizing possible intra-mercurial planets, already alluded to, visual and photographic observations of times of contact, and sketches of the corona both from telescopic and naked eye observations.

The assignment of the observers was as follows: Mr. Langley, in general charge of the expedition, observed with the same 5-inch telescope used by him on Pike's Peak in 1878, which was most kindly lent for this special comparison by Professor Brown of the U. S. Naval Observatory; C. G. Abbot, aid acting in immediate charge, assigned with C. E. Mendenhall to the bolometer; T. W. Smillie, having general direction of the photographic work, made exposures at the 135-ft. telescope; F. E. Fowle, Jr., assigned to 38-ft. telescope; Father Searle, directing the assembled telescopes for the outer coronal region, and for intra-mercurial planets, assisted by P. A.

Draper and C. W. B. Smith, exposed two cameras of 3-inch aperture and 11-ft. focus, and two of 4½-inch aperture and 3½-ft. focus; all four of these telescopes being mounted on a single polar axis driven by an excellent clock; DeLancey Gill assisting Mr. Smillie, removed the flash spectrum objective prism at second contact, and made a single long exposure with a 6-inch photographic lens of 7½-ft. focus equatorially mounted; Assistant G. R. Putman, who by the kindness of the Superintendent of the U. S. Coast Survey, was detailed for latitude,* longitude,† and time observations, also observed contacts, directed the striking of signals by Mr. Little, and rendered other valuable services. Mr. Putman was assisted in recording contacts by Mr. Hoxie. R. C. Child, observing with a 6-inch telescope of 7½-ft. focus, made sketches with special references to inner coronal detail, and was in addition charged with all electrical circuits for chronograph and automatic photographic apparatus. Father Woodman, with 3½-inch telescope, observed contacts and made sketches.

The first detachment, consisting of Messrs. Abbot, Fowle, Kramer (instrument maker) and Smith (carpenter), reached Wadesboro May 4th, and were soon joined by Messrs. Draper and Putnam. The latter returned to Washington after a short but satisfactory latitude and longitude campaign, reaching Wadesboro again just before the eclipse. Other members of the party reached camp on and after the middle of the month. The first comers found a very satisfactory shed already erected and piers begun. Not a day passed from the time of the arrival of the apparatus, May 7th, to the day before the eclipse, that was not fully occupied in perfecting the arrangements.

The most striking portion of the installation was the line beginning at the northwest pier, with its equatorial and cœlostat, continued from thence south of east by the two great diverging tubes of the 135-ft. telescope and spectroscope. These tubes were covered with white canvas, presenting the appearance of two immensely prolonged 'A' tents, ending beyond the photographic house, where the 38-ft. telescope tube pointed east and upward at an angle of 42° with the horizon. When the equatorial, with its large special conical tube camera, with all this long branching extent of white canvas ending in the uplifted tube of the 38-ft. telescope, was seen in the light of the moon, the extensive field with its preparations exhibited a still more picturesque scene than by day.

Less imposing, and perhaps more ungainly, was the combination of four great cameras under the main shed, designed to search for new planets and to depict the outer corona. These might well be described as like a cabin and an outbuilding, mounted on a polar axis, yet despite their awkward proportions they were made to follow very accurately.

The morning of the eclipse dawned cloudless and very fairly clear. Deep blue sky, such as the writer had seen on Pike's Peak, of course is not among the ordinary possibilities of an eclipse, but the milkiness of the blue was less pronounced than is usual in the summer season, and all felt that the seeing promised well.

At fifteen minutes before totality a series of rapid strokes on the bell called everyone to his post, and one minute before the expected contact five strokes were given as a final warning. Coincidentally with the actual observation of the second contact by Mr. Putnam, the first of two strokes upon the bell sounded, and the work began. After 82 seconds (the duration of totality from the Nautical Almanac was 92 seconds) three strokes were given as a signal to stop the long photographic exposures. Scarcely

* 34° 57′ 52″ N.

† $5^h\ 20^m\ 17^s.8$ W.

more than five seconds after this the sun's crescent reappeared. The duration of totality as observed by Mr. Putnam was approximately 88 seconds.

To visual observers the sky was notably not a dark one. No second magnitude stars were observed with the naked eye, and most of the on-lookers saw only Mercury conspicuously, though Venus was distinguished at a low altitude, and Capella also

tinctly noticeable. No change in direction of the wind was noticed. Shadow bands were seen, but those who attempted to measure their velocity found them too rapid and flickering for any great exactness in this determination. There was tolerable unanimity among independent observers as to their size and distance apart (about 5 inches) though some thought this less, as totality approached.

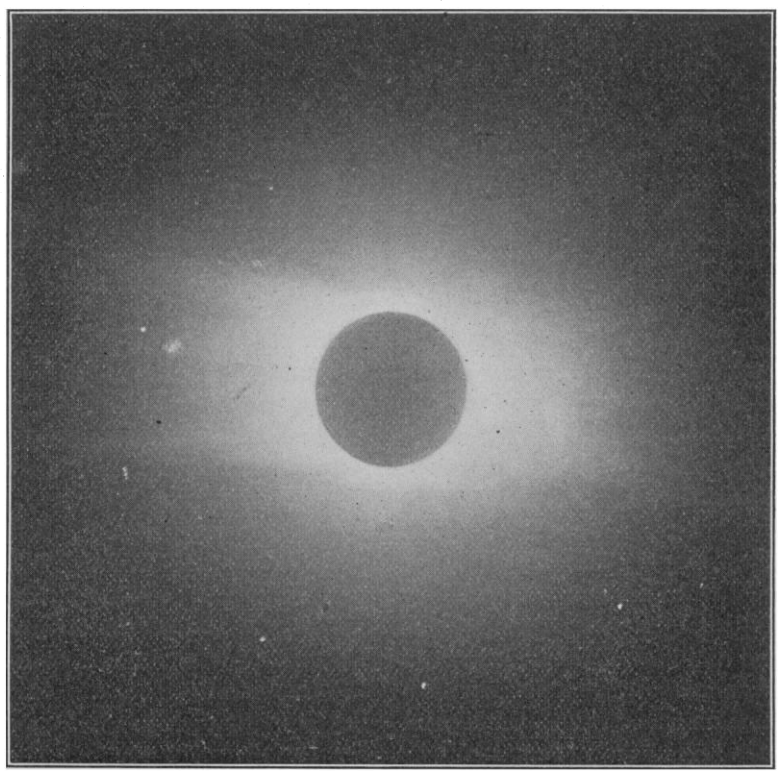

FIG. 1. General view of the corona. Taken with 6-inch lens of 7½ feet focus. 82 seconds exposure.

was seen. So high a degree of sky illumination cannot but have operated unfavorably in the study of the outer corona or in the search for intra-mercurial planets, and this is to be remembered in connection with what follows.

BEFORE TOTALITY.

A deepened color in the sky, a fall of temperature and a rising breeze were dis-

It was noticed that the birds grew silent just before and during totality, but true to their nature, the English sparrows were last to be still and first to begin their discussion of the eclipse, after the return of light.

DURING TOTALITY.

The attention of all visual observers was at once caught by the equatorial streamers.

Father Woodman's comparison of the appearance to a structure of mother of pearl was generally recognized as good, but different observers differed on the color estimate. A yellowish green tinge was noticed by the artist of the party, Mr. Child, while to others the light was straw-colored or golden.

The general coronal form, to the naked eye, was nearly that of the small annexed photograph, which, though taken by one of the smaller objectives, gives a good view of the relative intensities. The same extensions of the equatorial corona could be followed by the naked eye from 3 to $3\frac{1}{2}$ solar diameters.

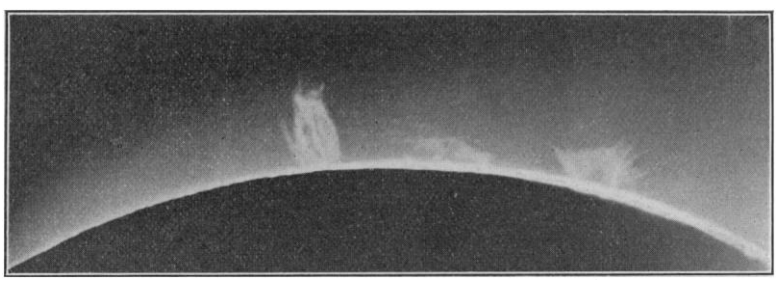

FIG. 2. Prominences on southwest limb of sun. Taken with 12-inch lens of 135 feet focus. Exposure 8 seconds.

The visual telescopic observations of the writer gave little indication of the finely divided structure of the inner corona which he had noticed at Pike's Peak. Structure, to be sure, was evident, but not in such minute subdivision as had then been seen, and though one remarkable prominence as well as several smaller ones was visible, the coronal streamers did not give to the writer the impression of being connected with these prominences, though the relationship of some of them to the solar poles was abundantly manifest.

AFTER TOTALITY.—RESULTS.

Comparing notes after totality, all observers reported a successful carrying out of the program. The greatest interest centers in the direct coronal negatives taken with the 135-ft. telescope. Mr. Smillie exposed six 30x30 plates during totality, with times ranging from $\frac{1}{2}$ a second to 16 seconds, and three others were exposed by him immediately after the third contact.

At this writing, only a part of the negatives taken have been developed. Their general quality may be inferred from the examples here given, after due allowance for the great loss suffered by translation on to paper even with the best care.

Figure 1 is a view taken with one of the smaller objectives (6 inches), given here to afford the reader an idea of the general disposition of the coronal light. The upper part is the vertex in the inverted field.

Figure 2 is a portion of one of the great 15-inch circular images obtained with the 135-ft. focus telescope. It was obtained in the great disk in the last exposure during totality of 8 seconds, showing one of the principal prominences then on the sun's disk, with a disposition of the lower filaments near it.

Fig. 3 is a portion of the same set of plates, but taken with a 16 second exposure. The part near the sun has, of course, been intentionally over-exposed, in order to better exhibit the remarkable polar streamers, extending here to a distance of about six minutes from the sun, but still further in Mr. Child's telescopic drawing (not given).

Figure 4 is a view of a small part of the great apparatus on the field, including the terminus of the horizontal tube with its canvas covering, which has been described as like an extended 'A' tent. The photographic room is seen at the end of the tube and beyond that the tube containing the lens loaned by Professor Young, pointing directly skyward.

That it will be impracticable to give here all of the disc of the moon in the large photographs, will be evident when it is considered that the lunar circumference on each plate is about 4 feet; but it will be inferred from the examples that the prominences and polar streamers as well as their features, appear in imposing magnitude and detail.

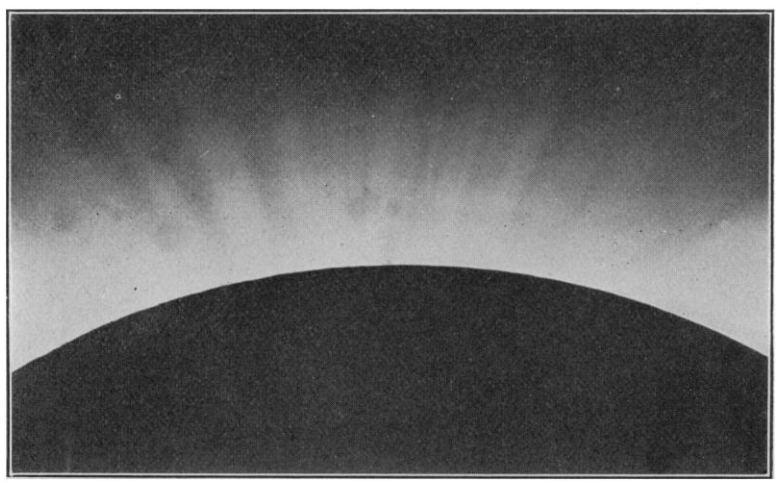

FIG. 3. North polar coronal streamers. Taken with 15-inch lens of 135 feet focus. Exposure 16 seconds.

Many of what it is hoped will be most interesting photographs still await development, but Mr. Smillie's thorough preparation is promising adequate results.

HEAT OF CORONA.

Mr. Abbot, with the aid of Mr. Mendenhall, appears to have measured the heat of the corona, and in spite of previous efforts, this is probably the first time that it has been really shown to exist. For five minutes before second contact, the bolometer was successfully exposed to the region of the sky close to the narrowing crescent of the sun where the corona was shortly to appear. A diaphragm was interposed in the beam having an aperture of only 0.4 sq. cm. and deflections rapidly diminishing from 80 to 6 mm. were obtained, the last being about 40 seconds before totality. Then the diaphragm was opened to 290 sq. cm. and a negative deflection of 13 mm. was observed after totality, where these positive deflections had just been found, showing that the corona was actually cooler than the background which had been used at the room temperature. Next the black surface of the moon was allowed to radiate upon the bolometer, and the still larger negative deflection of 18 mm. was observed.

The important result was that the corona gave a positive indication of heat as compared with the moon.

This heat, though certain, was, however, too slight to be subdivided by the dispersion of the prism, with the means at hand.

The negatives taken to depict the outer

corona show from three to four solar diameters extension for the longest streamers. The equatorial 'wings' as they recede from the sun, are finally lost in an illuminated sky, without any indication of having actually come to an end.

No attempt to carefully examine the plates taken for intra-mercurial planets has yet been possible. It is, however, as has been remarked, doubtful if very faint objects will be found, in consideration of the considerable sky illumination during totality. However, Pleione in the Pleiades, (a star of the 6.3 magnitude) is plainly seen on one of the plates and some smaller ones are discernible.

On the whole, the expedition may be considered as promising to be very satisfactory in its results, and that it was so, is largely owing not only to the efficient care of Mr. Abbot, but to the many gentlemen who have assisted me with the loan of valuable apparatus, with counsel, with voluntary service, and with painstaking observation, to one and all of whom I desire to express my obligations.

S. P. Langley.
Smithsonian Institution,
Washington, D. C., June 9, 1900.

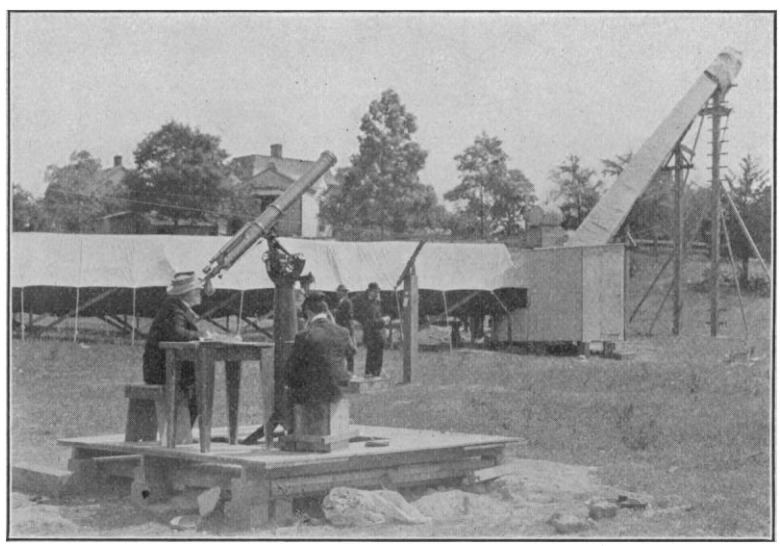

Fig. 4. Dark room and tubes of 135 foot and 38-foot telescopes. 5-inch equatorial in foreground, Professor Langley observing.

SCIENTIFIC BOOKS.

Text-Book of Paleontology. By Karl A. von Zittel. Translated and edited by Charles R. Eastman. English edition, revised and enlarged by the Author and Editor, in collaboration with C. E. Beecher, J. M. Clarke, W. H. Dall, G. J. Hinde, A. Hyatt, J. S. Kingsley, H. A. Pilsbry, C. Schuchert, S. H. Scudder, W. P. Sladen, E. O. Ulrich, C. Wachsmuth. London and New York, Macmillan & Co. 1900. Vol. I. 8vo. Pp. x + 706. 1476 woodcuts.

This volume is the result of an interesting experiment. To take an epitome of a science, impressed with the individuality of an eminent investigator, who is if anything even more eminent as a teacher, a clear synopsis drawn up on an harmonious plan, distinguished by both breadth of outlook and a restraining common sense, and then to entrust the several chapters of this work to men who are essentially special-