plete change in the pelagic fauna within reach of the laboratory, the catch consisting chiefly of larvæ of forms living upon the Bahama Bank. Reports of the Weather Bureau show that, except during the midwinter months, the prevailing winds at the Tortugas are from east to southeast. That is, they blow diagonally across the Gulf Stream toward the station. This, with a reasonable amount of calm weather, would afford ideal conditions for the study of the truly pelagic fauna, which is the most interesting and the least known. Ordinarily one has to go out in a ship to study this fauna, but at Tortugas, as at Bimini, it would be brought to the door of the laboratory by an ocean current, and at the Tortugas there would be the additional advantage that the wind would generally be blowing across the current toward the laboratory instead of away from it.

If a laboratory is established there I shall certainly endeavor to use it, and I hope that its establishment will not be delayed by any idea of great expenditure. Very good work can be done at such a place with very modest equipments.

ROBERT PAYNE BIGELOW.
MASSACHUSETTS INSTITUTE OF TECHNOLOGY,
May 26, 1903.

HAVING spent a season in Jamaica I am disposed to advocate that island with almost unqualified commendations as a site for a research laboratory in the tropical Atlantic.

B. W. BARTON.
JOHNS HOPKINS UNIVERSITY,
May 6, 1903.

SHORTER ARTICLES.

THE ARC OF QUITO.

THE following statement concerning a work of international interest and importance is taken from the *Comptes Rendus, Hebdomadaires, des Séances de l'Académie des Sciences,* tome CXXXVI., No. 14 (6 Avril, 1903).*

* Report presented in the name of the commission charged with the scientific control of the geodetic operations on the Equator. (Commissioners; Mm. Bouquet de la Grye, Hatt, Bassot, Loewy; H. Poincaré, Secretary.)

"The commission formed by the French Academy of Sciences for the scientific control of the geodetic operations on the Equator had a meeting on March 9 to hear the report of M. le Commandant Bourgeois on the work executed during the year 1902." Unhappily, the progress of the work has not been as rapid as was expected last year when the previous report was made. This delay has resulted from two prinicipal causes, the first being the exceptionally unfavorable meteorological conditions. The summits of the mountains were constantly covered with clouds or mist which rendered observations impossible.

Lieut. Perrier remained three months at the station on Mirador, at an altitude of 4,000 meters, and was constantly in the clouds. During his whole stay incessant rains and a furious wind prevailed except at rare intervals. The other parties encountered the same difficulties. At Tacunga, M. Maurain was only able to observe at rare intervals. At Cahuito, M. Lacombe passed many days in the mist and snow without being able to obtain a single observation. M. Lallemand had charge of the reconnaissance and signal building and encountered many obstacles. These unfavorable conditions appeared to have an exceptional character which the reconnaissance could not make known in advance. Ordinarily the season of rain is shorter, and even in the worst months observations are sometimes possible during many hours of the day. Is it possible that the persistent bad weather should be ascribed to the recurrence of volcanic activity which showed itself in the whole of South America after the catastrophe at Martinique?

The volcanoes of the eastern Cordilleras, which ordinarily emit a little vapor, threw out columns of smoke on many occasions, and there were lava flows in the western chain.

Strong earthquake shocks were also felt. These volcanic manifestations did not directly delay the work, but perhaps they were connected with the meteorological conditions which proved to be so serious in delaying the operations.

The second cause of delay was the continued

destruction of the signals by the Indians, and also by the whites. These ignorant people imagined that these signals were erected to mark the location of treasure and they not only threw down the signals but they dug deep in the soil all around and destroyed the marks which had been established in order to recover the exact location of the stations. The warning of the government, the commands of the bishops and sermons of the priests were equally unable to prevent this destruction.

We hope that, thanks to the efforts of the authorities and, above all, to the zealous efforts of the president of the republic, such incidents will become unusual. The destruction of signals in a country where communication is so difficult always entails long delays, but, above all, to find on many occasions that the marks had been destroyed after the position of the station had been exactly determined was most disastrous, as it entailed the reoccupation of all the stations from which the one destroyed had been observed. Thus the destruction of the marks at Chujuj, situated in the center of a polygon, made it necessary to reoccupy the four surrounding stations.

Certain signals have been destroyed three times and almost every report from Captain Maurain mentions other cases of destruction. The most unfortunate of these incidents was the simultaneous destruction of the marks at Panecillo, where one of the principal astronomical stations was located, and of the geodetic station of Pambamarca. The geodetic station had not been occupied, and it was necessary to redetermine the astronomical azimuth of the side Panecillo-Pambamarca, a primary operation which had been completed in 1901.

There is great anxiety about the safety of the stations Zagroun and Lanlanguzo at the ends of the line, from which the work to the south will be extended. If these stations are destroyed it will be necessary to redetermine many other stations. Native officers attached to the expedition have been sent to this line to watch the stations and impress on the local political authorities the importance of preserving it from destruction.

In spite of all these difficulties, we have the satisfaction of stating that the operations have been conducted in such a way as to furnish every guarantee of precision. We regret the delay of some months which will undoubtedly increase the expense, but the scientific value of the work will leave nothing to be desired.

Base Measurement.—Two base lines were measured in 1901, one in the center at Riobamba, measured first with a bi-metallic bar and afterwards with the Jäderin wire; the other on the north at El Vinculo measured only with the Jäderin wire. These measurements were made during the preceding year, but since then they have been reduced. A third base will be measured at Payta in the southern section of the arc at the close of the operations.

Astronomical Observations.—The necessary observations have been entirely completed. The latitude of Tulcan (principal station) was determined in February; the determination of the difference of longitude, Quito-Tulcan required much time on account of unfavorable weather; the evenings of the exchange of telegraphic signals, comprising two entire evenings with four joint determinations at the two stations, two joint half evenings, plus five evenings with two determinations at one station and only one at the other. The computation of these observations has not been completed, but the results appear satisfactory. The exchange of observers was not practicable, but MM. Maurain and Perrier determined their personal equations at Quito and will redetermine them when they meet again. The resulting latitudes are as follows, all the computations having been made:

Payta	−5° 05′ 08″.6
Riobamba	−1 40 00 .9
Panecillo	−0 13 51 .1
Talcan	+0 48 25 .6
Total amplitude of arc	5° 53′ 34″.2
Amplitude of northern section	2 28 26 .5

The northern section includes two secondary astronomic stations, Tacunga and Ibarra. Captain Maurain decided first to determine the longitude between the principal station at Panecillo and the observatory at Quito, so as to take advantage of the continuous presence

of M. Gonnessiat at the observatory for the determination of the longitude of the secondary stations. For this purpose M. Maurain, before starting, determined his difference of personal equation with M. Gonnessiat and then determined the difference of longitude between Quito and the two secondary stations, on three evenings, using one chonograph installed at Quito which registered the observations of the two observers. Telegraphic communication was made without a relay. The latitude of Tacunga was determined on four evenings with a meridian circle and the preliminary general mean is 0° 56′ 00″.97. The results of the observations for altitude at Ibarra are not yet reduced.

Geodetic Operations.—The astronomical observations have been completed and the unexpected delay has all been in the geodetic work.

The northern section from the side Zagroun Lanlanguzo includes thirty stations between the two base lines, and of these thirty stations only six or seven remain to be occupied.

The northern observing party has completed the polygon which encloses the El Vinculo base line, except the central station Machines, while the southern party, starting from the line Zagroun-Lanlanguzo to the south of Riobamba, has reached the line Pichincha-Pambamarca, to the north of Quito. Unhappily we must expect to find difficulties at the remaining stations, similar to those already encountered, on account of the climatic conditions.

The azimuths already determined show a very satisfactory agreement and the mean error of closure of the triangles already computed is about one second.

Zenith Distances.—In general, it is not possible to measure simultaneous reciprocal zenith distances, but reciprocal zenith distances have been obtained between all the stations. The preliminary examination of these observations shows that they are very accordant and the refraction seems suitably constant, which fact the steadiness of the objects observed had indicated in advance. This is confirmed by the rigorous simultaneous measures made by M. Maurain at Pambamarca and by M. Gonnessiat at Panecillo. Under these conditions it is possible to execute good geodetic leveling.

Latitudes of the Third Order.—The attention of the observers was called to the necessity of obtaining observations for latitude as often as practicable.

The theodolite with micrometers could not be used, and it was very difficult to transport the meridian circle. After considerable progress had been made the observers received accessories which enabled them to use the theodolite with micrometers in observations for latitude. Captain Maurain observed a secondary latitude at Tacunga with the meridian circle and then made observations for latitude with the theodolite to ascertain the precision to be expected when that instrument was used. The result was sufficiently good to warrant its use for this purpose in the mountains. There is always a systematic difference between observations on north stars and those on south stars, but the errors from many successive nights are always very small.

The observers will soon receive two Claude Driencourt apparatus; this apparatus, which has been described in the *Astronomical Bulletin,* Vol. XVII., gives results of great precision and is very portable, and it can be utilized at the geodetic stations which remain to be occupied, especially in localities where gravity observations will be made. A great number of observations for latitude of the third order have been made with the theodolite, one to the south of Riobamba, one near Riobamba, two around Tacunga, three around Quito (Pambamarca, Pichincha, Corazon) and four around the northern base line.

Gravity.—This portion of the work has not made much progress. The station at Riobamba is reduced, but it still needs the accurate determination of the rate of the sidereal clock. No other observations have been made. It is still undecided what instruments should be used at the secondary stations. The Sterneck pendulum does not appear to present as great advantages as it was at first believed to possess. M. Maurain

thought of using the new thermo-barometric method which has been used on the Atlantic Ocean, but it has been justly stated that this method would not give results sufficiently precise. However, the chief of the expedition has not lost sight of this important question, and we can be assured that it will not be neglected.

Leveling of Precision.—The completion of the work on the railroad towards the plateau between the Andes permits the levels between Guayaquil and the base line at Riobamba to be determined with much greater facility than was possible when the arc measure was begun.

Topographic Work.—A map on a scale of 1/500,000 will be made of the whole intermountain region and special maps on a larger scale have been made in certain localities.

Magnetic Observations.—Magnetic observations have been made at nearly all the stations. They are not yet reduced.

Studies in Natural Science.—Dr. Rivet has continued his studies relating to the natural sciences and has made a number of additions to the museums. He has undertaken the study of the anthropology of the Indian races in this intermountain region.

The following is the program of work during the year 1903:

1. The completion of work on the northern section.

2. The geodetic observations on the southern sections and more or less of the section Riobamba-Cuença, comprising besides azimuth observations the determination of the latitude 'a la seconde ronde' at each station if possible.

3. A secondary latitude at Cuença and the difference of longitude Cuença-Riobamba (or Cuença-Quito) if telegraphic connection between the former stations can not be made without delay.

4. The magnetic observations as heretofore.

5. The beginning of the levels of precision.

There remains for the following years the geodetic work on the section Cuença-Payta, the pendulum observations, and the connection, if possible, by geodetic observations of the island of Puna, with the meridional chain of triangulation, with a complete astronomical station on Puna.

Isaac Winston.

QUOTATIONS.

THE NEW YORK STATE SCHOOL OF FORESTRY.

When New York established a School of Forestry, to make sure that it should not fall into the hands of politicians and be exploited for 'what there was in it,' it was lodged under the shelter of Cornell University. It was deemed advantageous to make this arrangement for other reasons also, and particularly in order that the teachers and students should have access to the library and laboratories and lecture rooms of the university proper, where the cognate sciences of botany, chemistry, mineralogy and various kinds of engineering are taught. The university chose a professor of forestry of the highest repute, Mr. E. B. Fernow, and placed him in charge of the important work which had been assigned to it, and the state set apart certain forest lands which it owned, in order to impart the needed instruction to students. The annual reports of Professor Fernow have been published and circulated at the state's expense, and have been highly praised by all competent to form an opinion. We have never seen an unfavorable comment upon them by any expert in forestry.

The state also made an annual appropriation for its School of Forestry. That of 1902 was for $10,000, where $30,000 had been asked for. This year the appropriation was vetoed by the governor, and now the attorney-general has been requested by certain summer residents of the Upper Saranac Lake region to bring an action to annul the 'grant of forest lands to Cornell University'—so the dispatches read. Naturally, the newspapers have fallen into the habit of considering the university the beneficiary of both the grant and the appropriation. This is not the first time that the mistake has been made, although the fact is that the state is indebted to the university in respect of this school. The university has no pecuniary interest in the School of Forestry that is not common to all citizens of New York. What is at the bottom of this rage against the School of Forestry it is difficult to see, unless it may be the mere objection of campers, hunters and summer residents. The objectors, whoever they may