THE HIGH SIERRA MAESTRA.

BY

B. E. FERNOW.

Although the Island of Cuba was among the first discoveries of Columbus, and active settlement had even by the middle of the 16th century been pushed to the extent that by 1553 the Indians had been almost totally extirpated, there remains even to-day a surprising proportion of the 43,000 square miles of the island practically a terra incognita, unexplored, undescribed, and unmapped, at least in detail.

This is especially true of the rugged mountain range which skirts the southern shore west from Santiago de Cuba, the highest, wildest, and, at the same time, scenically and historically, most romantic section of the island.

Here, in the wild woods are still to be found the signs of the encampments of the patriots of 1868, who struggled unsuccessfully for ten long years to gain their freedom; subsisting on what they could raise on the mountain sides, grassy slopes and coffee trees, run wild, attesting their presence. Here, the most picturesque scenery, with steep slopes, deep cañons, torrential mountain streams, and ever-verdant forest to the very crests of the craggy peaks, the veritable Switzerland of Cuba, is to be found.

Although the writer visited this region entirely with commercial ends in view, and hence was debarred from exploring more than a limited territory, the absence in literature (apparently) of any description, beyond conjectural remarks, of the characteristics of this region may give point even to this necessarily fragmentary result of a four weeks' tramp over this range.
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The accompanying map, made with the simplest means—namely, pedometer, pocket compass, and aneroid, checked by triangulation method—can, of course, not make any pretense to accuracy. Indeed, a considerable part of the territory was found practically inaccessible, and could only be sketched from various outlooks, assisted by information from the native guides. Yet, being originally drawn to a scale of 2½ miles to the inch and variously tested, it will be found to give a true account of relationships.

Topography, Geology, and Climate.

The entire mountain range from Cape Cruz east to Cape Maisi (or, according to some, only as far as Guantanamo Bay) bears the name of the Sierra Maestra, with special names applied to some of the eastern parts of the range; but it is proper to differentiate, as the natives do, two sections—namely, the “low” and the “high” Maestra, for they differ essentially, not only in altitude, but topographically, geologically, and probably climatically.

The “low” Maestra runs from the eastern terminus with an average altitude of about 1,800 feet for some 40 miles west from Santiago. The “high” Maestra is announced by a very sudden rise of nearly 2,000 feet at the headwaters of El Jobo, this rise culminating with 3,600 feet in the Cerro del Oro (eastern end of our map), and then the main crest maintains a general level of over 3,000 feet, only the narrow saddles falling now and then below that altitude.

While the “low” Maestra is terraced, squarish in outlines, and while geologically R. T. Hill’s description fits it—namely, as composed of non-calcareous conglomerates and shales of Mesozoic and Eocene age . . . . incrusted on the coastward side to a height of 2,000 feet or more by white limestone,” nothing of the kind was found in the “high” Maestra.

Here, indeed, the “master range of the Antilles” lays bare the very backbone of the island in a tremendous uplift of syenites, diorites, diabase, a solid granite mountain. Conglomerates and shale were nowhere seen, and limestone deposits were found in only two very confined spots at the very shore. This refers to some 40 miles of shore-line from the Maso River—our west end of the “low” Sierra—westward.

Those who have given descriptions of this coast range based on observations made from on board of passing steamers have noted the difference in the contours of the mountain peaks from those further east, without suspecting the geological difference as the cause, the purely granitic origin accounting for the bold yet smoother, rounder
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outlines, absence of terraces and of plateau-like, broad mountain backs.

Our observations refer, to be sure, only to a limited portion, somewhat less than 1,000 square miles, of the range; but there seems to be no reason for expecting a change of conditions, at least as far as the highest point, El Turquino, and for some distance beyond. This three-peaked mountain does not lie in the main crest, but on a forward spur toward the sea (as located on the map), reaching an altitude variously estimated at 8,300 to 8,600 feet, unquestionably the highest point of the Antilles, although its surroundings are such as to depreciate the impression of its height.

No white man, outside of native hunters and insurgents, seems to have ascended its three conical heads; nor, indeed, has any part of the interior of the high Sierra been visited by naturalist or other explorer, if our native guides—"prácticos," as they proudly called themselves, first-class woodsmen, one a rebel of old, two of the last generation—are to be trusted.

While not impossible with proper outfit, which means smallest requirements on man-back, an exploration of these mountain fastnesses is not without its difficulties.

While the topography is mostly simple, travel is not easy. The main crest, running almost due east and west, is by no means a continuous ridge, but is from time to time—namely, wherever a river takes its rise—interrupted by superior eminences or peaks, a pair of them rising usually to over 4,000 feet, flanking a much-depressed saddle indicating the source of the river. Long, continuous ridges, similarly interrupted by peaks, run from this backbone, more or less due south, to the sea, and north to the plain of the Cauto River basin, dividing the several river basins in most pronounced manner. Secondary ridges branch off from these, themselves, again, divided by lateral ridges into cañons of the third, fourth, etc., order.

A most striking feature is that noted in other mountains of the tropics—namely, the very narrow, often almost knife-edge salients of the ridges, called by the Cubans "cuchillas." Even the main crest exhibits this feature in the saddles. The watershed between the Rio Sevilla to the south and the Baracoa to the north is, for instance, formed by a saddle hardly 20 feet wide, which falls off to both sides with steep descents.

All the cañons at least start with such steep descents, and change, without terraces, into gentler slopes as the main river valley is approached, which may be in half a mile, with a drop of 1,000 feet or more. An area of a thousand acres laid bare by axe and fire of...
the insurgents, grown up to grass and lately burnt over again, exhibited most beautifully the skeleton of the mountain structure, with every line clearly shown.

There is rarely a broader mountain back or more extensive sink to be seen on the ridges, and altogether there is little flat land to be found anywhere except near the sea front. Even the coastal plain, which is characteristic of the eastern part of the Sierra Maestra, is here restricted to narrow bits between bold promontories, reaching rarely more than a mile inland, the slopes rising rapidly, sometimes precipitously, from the sea, attaining 1,500 to 2,000 feet in two to four miles, and in fifteen to twenty miles joining the main crest.

The tops of the ridges furnish the best, and altogether smooth travel, wild boar and hunters having improved most of them into trails; indeed, they afford the only practicable means of approach to the interior, the slopes being uncomfortably steep and cut up by innumerable caños, and the rivers becoming impassable within a short distance from the sea.

Otherwise these rivers are a delight, and a most interesting feature. They are wild, treacherous mountain streams, with magnificently clear and limpid waters, winding between more or less steep—sometimes precipitous—banks, over boulders, rarely over short falls, to the sea. Their waters being cool enough to drink, and just right for a bath, where a pool had formed, the principal hardship of tropical travel was entirely obviated. A rare sight was afforded from a 1,000-foot hill in the basin of the Bayamita River, exhibiting in one panoramic view the whole river-length with all its windings and side caños, from the very source to the very mouth—a distance, in straight line, of about twenty miles. [See illustration.]

Towards their mouths, a mile or two from shore, the rivers broaden out into deltas, forming more or less broad flood-plains filled with sand, gravel, and rubble; and during the dry season they are mostly lost in the sand and rocks, leaving dry, rocky beds. But during flood-tide—which may come after a single day’s rain, as the writer experienced—they spread over their banks and make new channels. In June, when they are in their maximum stages, they are rampant, and effectively stop all traffic.

At the mouth, usually a seawall of ocean-washed rubble forms a barrier against the sea, sometimes leaving a fresh-water pool behind. The customary mangrove swamps occupy much of the lower ocean front, and in two places the rare sight of a sandy beach—rare in Cuba—is to be had.

Only one of the rivers from the high Maestra varies from the
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above description—the Sevilla, which carries water all the year to its mouth over a sandy shore. Here, also, is found a harbour—by no means a land-locked but rather an open one—formed by coral reefs. Another, smaller, but safer harbour is found at Chiriviquo, where two projecting promontories, one the island Cayo Gama, add their protection to that of the coral reefs. Otherwise the shore, as far as the Turquino promontory at least, does not even afford safe roadsteads, barring one near the last-mentioned harbour.

The climate, while in its general features, of course, more or less like other parts of the island, experiences necessarily modifications such as a high mountain range predicates. While on the north or windward side of the range only one rainy season is recognized, here, to the leeward of the Northeast Trade, and possibly due to the effect of Anti-Trades, it divides itself, just as in Jamaica on the south slopes of the Blue Mountains, into two distinct rainy seasons—namely, a principal, long one, from March to May or June, and a short, secondary one, from the end of September into November. This latter season brings only short daily showers, which, however, lengthen into days when a temporal, a northern seawind, adds its quota of moisture. But although it rains occasionally in every month of the year, the front ranges, especially the southern exposures, represent, in their soil conditions and in their flora, dry country. This is natural, since the high mountain range necessarily precipitates a maximum of the humidity of the Trades on the northern slopes and higher peaks, and the lower elevations get less, while evaporation is here greater. Even in the higher altitudes the flora indicates great variations in moisture conditions, according to relative position of the slopes with reference to the rain-shadow of northeastward elevations: unexpectedly xerophytic and mesophytic conditions alternate.

As regards temperature, greater ranges than in the northern part of the island are to be expected, mainly toward lower temperatures. Indeed, the natives complain that their winters are often uncomfortably cold—in their scanty attire. Snow was seen once on El Turquino during the last ten years. While the cooling effect of the Northeastern Trade, which makes the northern shores endurable, is cut off by the mountain range, local currents have as much if not more effect. Mountain winds at night and the sea breeze of the morning moderate even the heat of August and September, the hottest months of the year, so that only the noonday hours may call forth a desire to sit still. With the exception of the humid, hot spring months and the wet-cold October, the climate ought to be the most delightful of any tropical country.
The whole mountain range from shore to crest is densely wooded; but he who has preconceived notions of how a tropical forest looks, usually derived from descriptions of humid lowland forests in the zone of continuous rains, will be disappointed.

Were it not for the palms sticking out here and there, the outer aspect, to the layman at least, would hardly convey an idea that he is in the tropics. The general aspect of the wooded slopes is very much like that of our northern deciduous forest, say in August, when the rich light greens have darkened and some trees have begun to assume brown autumn tints and to thin out their foliage.

If the visitor be somewhat of a botanist, he might perceive that the foliage is to a much larger extent than with us made up of pinnatifid leaves, and those of leathery texture. As he lands, if he has not seen them in Florida, the mangrove trees, growing out of the very ocean on the coral reefs, may attract his attention. Here he finds the black mangrove (Avicennia nitida), the white mangrove (Laguncularia racemosa), and the common mangrove (Rhizophora Mangle), with its peculiar tangle of aerial roots with which it is anchored—the main root decaying and these aerial roots furnishing the elastic support which is necessary to withstand the constant washing of the waves—all familiar from our own southern shores.

All the other features of a Florida shore are also present: the sea grape (Coccoloba uvifera), joined by the tropico-cosmopolitan shrub (Hibiscus tiliaceus), and some palms, perhaps a different species from the Floridian, occupy the drier, sandy parts.

Entering the woods, we do not find a dark, gloomy interior, a jungle of vines and lianas and dense impenetrable underbrush, over-towered by the spreading crowns of giants, as the usual illustrations of tropical forest represent; but the aspect is quite commonplace, and we are at once made to realize that there are, after all, as varied conditions in the tropics as in the temperate zone, produced mainly by variations in moisture conditions.

Here on these dry slopes a pleasant half-shade prevails; and, indeed, when the vertical rays of the noonday sun pour down, a little more shade would be welcome.

There are, to be sure, typical features which even a superficial examination reveals; the larger amount of epiphytic life, especially, the greater frequency of hanging vines and lianas, of bromeliads and orchids, leaves no doubt of tropical conditions.

After some days of closer examination, the other characteristic
features in the make-up of tropical forests, by which it differs from the northern woods, impress themselves.

These are, in the first place—besides the entirely different species, genera and families, which enter into the composition, the absence of gregariousness and the large number of species compassing the forest—two features which are botanically as well as economically of the greatest interest. The gregariousness of our northern species, like the pines, the spruces, the cypress, the oaks, the maples, the beeches, renders their economical exploitation possible; while in the tropic forest some hundred species in more or less sporadic distribution, singly or in small groups, enter into the composition, and hence exploitation of any one becomes expensive. Moreover, trees of commercial size are here comparatively few and far between, so that in this, apparently so dense, virgin forest, rarely as many as ten, and in the average (as determined from 1,200 acres' sampling) not two trees of merchantable size per acre are found. An undergrowth of small trees, mostly Miji and Yaya, the lancewood, forms the bulk of the stand, among which the large ones are unevenly dispersed. And if we consider that out of the hundred and odd species of arborescent flora (probably altogether not less than 150) which constitute the forest of the Sierra Maestra at least forty divide themselves in this small average stand of commercial sizes, we realize the difficulty of securing quantities of any one species. You may travel for many miles before seeing a specimen or a small group of ebony or lignum-vitæ, and then for days and miles you may not see any again.

To the plant-geographer it is of interest to inquire why this sporadic, scattered distribution is characteristic of the tropics—a question which, as far as the writer knows, has never been answered, if at all raised.

There are three principal factors which determine distribution of species and individuals besides the agencies of transportation—namely, temperature, moisture conditions, and light requirements.

Temperature conditions in the tropics are mostly so uniform, and, especially, the range so small, relatively speaking, that this factor plays a most subordinate rôle here; while in climates with wide temperature ranges, and especially frost, it becomes highly important. Differences in humidity, especially of soil, occur in the tropics in the same manner as in northern climates, and hence we find it possible to classify species according to their demands for moisture and consequent distribution in dry, moist, and wet situations into xerophil, mesophil, and hydrophil species.

Yet we find this classification, at least on the territory in question,
not so pronounced as it would be in the north. Although there are sets of trees which frequent only either the dry or the moist situations, many more species are ubiquitous, occurring on the dry slopes and ridges, as well as in the humid canions and bottoms.

We have, then, the factor of light left to account for distribution within a given area. In the north we are accustomed to classify the species into light-needing, and shade-enduring or tolerant, and, unless soil conditions favour in a pronounced manner one species or set of species, as the light-needing pines on the dry sands, the black jack on the barrens, the cypress in the swamps, the rule is that the shade-enduring—spruces, firs, beech, maple, etc.—become gregarious, as is to be expected, while the light-needing occur mostly in small groups or single specimens, survivors of former groups. In the tropics, if there be the same differentiation of species as regards light requirements, the fact of the great intensity of the light would reduce the importance of this factor, like that of temperature, to a minimum. There is enough light for all functions; all have an even chance; shade-endurance ceases to be a strong weapon of defense or aggression; and hence the sporadic, non-gregarious distribution results. This theory would, of course, require further proofs in detail, beyond the scope of this paper.

There is one other factor of economic geography and forest economy which distinguishes the tropics from the northern forest—namely, the fact that most of the woods produced in the former are hard woods, and generally very hard and heavy, fit mainly for fancy finishing and cabinet woods.

The conifers, which form the great staple of our wood consumption, are absent, although on some of the driest peaks, above 1,800 feet in the front range, a pine (Pinus occidentalis?), is found, apparently for the first time recorded from Cuba, and of special botanical interest, because, while elsewhere it is generally a “white” pine with five or four needles from a sheath, here it has most frequently three and two needles, like “yellow” pine.

The hardness of the tropical woods, like the mahogany, the lignum-vitæ, the granadillo, ebony, sabicú, majagua, mastic, all of which occur here, fits them only for limited uses; hence they are not at once and directly substitutes in our lumber market. There are, to be sure, some species which produce a soft, light wood; but, so far their character is hardly known; moreover, the supply of them is relatively small; and, since they occur not much less scattered than the fancy cabinet woods, the expense of their exploitation will, except under specially favourable conditions, for a long time to come forbid their profitable marketing.
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Among these soft woods there should be mentioned the mighty silk cotton tree (*Ceiba pentandra*), a botanical conundrum, not only on account of its peculiar growth—large buttresses, elliptic shaft form, scanty branching—but of the mystery of its nativity, being found in all tropical countries.

The almácigo or gumbo-limbo of the Bahamas (*Bursera simaruba*), with its peculiar red, papery-flaky bark, is found here in large sizes, and the equally soft-wooded West Indian plum or jobo (*Spondias lutea*), is still more frequent and of larger size.

Altogether the size to which trees grow here, even to the very top of the Maestra, is surprising; and it would appear from the record of botanists as to sizes of Cuban species that they had never seen really virgin growth.

The height of the trees, as is again the rule in much of the tropical forest, is not extraordinary, rarely over 125 feet, but diameters of three and four feet are not rare, and they may exceed six feet. Especially the sabicú (*Pithecolobium arboreum*, not the Sabicu of the Bahamas), the cedar, the mahogany, and the jobo of the valuable species are notable for their size.

The plant-geographer will also find of interest, besides the occurrence of the pine mentioned, the re-discovery of a tree of the Basswood family, the Majagua de Cuba (*Carpodiptera Cubensis*), which, collected by Wright just forty years ago, from the northern side of the range, seems not again to have reached our herbaria. Here it is one of the commonest trees, and, with its bunches of small rose-coloured flowers, becomes a most conspicuous object on the slopes.

A botanical, as well as practically agreeable, surprise were the lemon trees, which are found wild in the shady nooks all over the mountains, producing abundant and perfect fruit, and behaving altogether as if they belonged here. Similarly, wild coffee trees were found, run away from the cafeterias established by the insurgents some thirty years ago, also guavas; and in one location, halfway up to the crest, an abandoned plantation of cacao, coffee, avocado pears, bread fruit, coco palms, bananas, and a number of other fruits showed the adaptation of soil and climate to every kind of tropical products.

Unfortunately for our identifications of the many species, which we could readily distinguish as such, we found that the generally-stated fact of the continuousness of functions in the tropic plant world is only very partially true. While it is true, in a general way, that flowering, fruiting, leaf fall, and budding may take place through-
out the year, it is not true in the sense in which one would be apt to take the statement—namely, as indicating entire absence of periodic movement, of seasonal beginning and cessation of functions. The fallacy was at once brought home to us when we attempted to find fruit under the mango trees which have been planted here, and incurred the derision of the natives—for their fruiting season was over. We did, however, eventually find two fruits; and this is exactly what happens:

While spring is still spring, even here the harbinger of new life, while wet and dry seasons produce rhythmic movement, there are stray individuals, plants or buds—and, perhaps, as in the case of the Majagua, entire species—which disregard the periodicity, and flower or fruit out of season, but the collector who does not want to rely upon the accident of finding these exceptions had better time his visit according to the general plans of nature. Instead of by temperature changes, as with us, the periods are induced by changes in humidity, the hot, rainy season of March to May producing the exuberance of new shoots, flower and foliage, and with many the fruiting is done before September; while the dry winter months see an increasing leaf fall to make room for next season’s growth. Whether and to what extent this periodicity is reflected in annual ring growth of trees has never been settled. The pines unquestionably show definite ring growth; but whether one or two rings a year are formed we had no means of determining. In the deciduous trees the rings are difficult to recognize, if at all present. As to the rate of growth, also, nothing is known, so that the recent attempts to determine the age of some historical Ceiba trees from their size appear entirely futile.

The difficulty of obtaining fruit or flower at the season of our visit resulted in our determining accurately only about one-third of the species recognized, another third doubtfully from checklists of the Spanish names which our guides could give us. But as there is no uniformity in the use of these names on the island, they are probably only in a limited number correct. Unfortunately, the last third of unknowable species includes those which, occupying the top of the Sierra, altitudes not elsewhere found on the island, would be of most interest.

Somewhat above the 2,500-foot level the character of the flora changes and a new set of trees makes its appearance. Large trees of barril, of mulato, of retama, of albeyota, with three to four feet diameters, and several smaller, especially melastomaceous species, which form the arborescent flora of the high altitudes, still await identification.
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The most striking feature near the top of the Maestra is the remarkable variation from xerophytic to mesophytic plant formations, according to whether the slope lies in the rain shadow of a peak or on the windward side, enjoying the abundant humidity of the rain winds directly. The luxuriant masses of ferns, and grasses and other moisture-loving plants characteristic of the latter situations are lost on the former.

Some of the lower-level species creep up to the very top, or at least varieties (geographical?) of them. But the ubiquitous Miji (Calyptranthes spec.), a small tree which forms the undergrowth everywhere else, below the 2,500 foot level, is replaced by other small trees and shrubs, and, in general, the underbrush seems denser on the crest than elsewhere.

Palms—the manacá and the very spiny juta—mixed with tree ferns, occur in larger or smaller groves, and remind us that we are still in the tropics.

Animal Life.

One other feature, which is supposed to pertain to tropical conditions generally—namely, abundant animal life—was found disappointing. As regards mosquitoes, flies, and gnats and other such vermin, their absence, especially in the higher elevations, was, to be sure, a boon; while the continuous sonorous night concert of katydids could have been spared, but otherwise these vast wild woods in the interior, away from the shore, were almost devoid of animal life.

At the base, the loquacious crow (Corvus gundlachi), the unharmonious screechings of a long-tailed jay, and a number of shorebirds enliven the stillness, the many lizards and chameleons, and the curious, uncanny landcrabs, holding largely-attended conventions in the woods, create interest; but in the interior, except for an occasional wood pigeon, or woodpecker, and a still more occasional brown or blue thrush, or owlet, there is little to disturb the solitude. Yet the never-to-be-forgotten morning song of the most melodious of the tropical birds, the solitaire (Myiastes spec.), a veritable nightingale awakening us, when encamped under the palms on the highest crest, compensated for other deficiencies. In the spring, it is said, millions of wood pigeons and other birds enliven the woods; and this, undoubtedly true, again accentuates the fact that here, as in northern latitudes, life moves, after all, in rhythmical periodicity.

Of game, a black-horned deer exists, and wild boar—a run-wild
razor-back—appears from its many trails and wallows more plentiful than it probably is.

Although still for the most part unprospected, there have been found in the front ranges copper, iron, and even argentiferous deposits. Indeed a magnificent development undertaken by ill-informed American capitalists came only lately to grief by finding out too late that iron-ore in solid granite is an uncertain quantity. Nevertheless, if properly explored and exploited, the mineral wealth, the timber, the agricultural possibilities, added to the scenic beauty, the temperate tropic climate, promise to make this region one of the future paradies and a bonanza to the enterprising.

So far, most of it is a solitude; for the twenty-eight families of native half-breeds living within these thousand square miles have hardly made an impression on the sea front. Civilization there is none; neither school, nor church, nor regular communication appears a necessity for this harmless and childlike, yet quite intelligent folk.

To reach this attractive land of dolce far niente or else of toil and trouble, a tug or a sailboat may be hired in Santiago, which, in four hours or two days, as the case may be, lands one in the harbour of Chiriviquo, where a smart little Cuban keeps the store that supplies the region with the few wants which cannot be secured from nature. Or else a horse-back ride of some sixey miles over the camino real, a somewhat dilapidated trail of Spanish times, will do the same.

To the student of tropical botany and plant-geography this comparatively readily accessible and practically virgin field should still yield a rich harvest.

ARCHÆOLOGICAL DISCOVERIES IN CHINESE TURKESTAN.

BY

ELLSWORTH HUNTINGTON.

The most important archaeological work of recent years is probably that of the German expedition which has lately returned from Turfan in Chinese Turkestan. The little basin of Turfan in the midst of the deserts of western China, between Tibet on the south and Siberia on the north, epitomizes the history of Central Asia. It consists chiefly of a desolate plain surrounded by a ring of mountains, some of which rise to a height of 14,000 feet. The most re-