

ted much less artistically, and with infinitely less care than in colder regions; and the widely extended family of the troupiale (*cassicus, icterus etc.*), which come everywhere in flocks to the dwellings of man, leave the care of the nest and the rearing of the young to the thrushes and fly-catchers, so as to enjoy their lives in merry company.

It has been mentioned already, that the vertical extent of the oak-forests is upwards of 5000 feet,\* and thus far extend also the evergreen forests. We find that the most luxurious vegetation exists at the height of 2500 to 4500 feet above the sea. At the elevation of 4000 feet are the tropical forms, such as palms, zamias, scytamineas, aroideas etc. Plants resembling those of the temperate zones begin to appear: liquid-amber and hornbeam (*carpinus*) are most frequent in the forest, and four species of magnolias appear in scattered groups. Near the streams the mighty stems of the plane-trees have a noble appearance, and are replaced higher up by willows and alders.

In places where there is no forest, succulent grasses, ranunculaceæ, and plantains appear, besides the tough-leaved syngenesists (tall thistles and bushes), durantas and hawthorn, the representatives of the heath-tribe, andromedas and arbutus. The herbaceous labiatae are here most diffuse, and precisely these districts are fittest for the management of bees. The extreme limits of the banana and coffee-plant may be taken at 5000 feet, whilst ananas and mangoes no longer flourish at this elevation; European fruits, however, bear plentifully, also the chirimoyas and aguacates (*anona* and *persea*).

Between four and six thousand feet above the sea, most of the original settlements of the natives are met with, along the whole mountain-range. In loftier situations the climate is no longer tropical, frequent rains cool the air, and in winter, rime and snow-storms are nothing unusual. Nevertheless this climate is exceedingly healthy, and uniform; the average temperature being from 13 to 14 degrees of Reaumur; the valleys and mountain slopes are adorned with perennial green, and the products of the frigid zones can be harvested the whole year round.

In the savannah region we passed over the gentle slopes of profound chasms, whose sides contain conglomerate and sandstone, in some of the more elevated spots, a firm grey limestone: in the forest region the mountains are much indented; narrow valleys, steep declivities, sometimes red clay on the surface, sometimes decomposed lava and ashes. Everywhere are indications of volcanic activity, craters fallen in, streams of lava, mountains uplifted and cast down. All the streams are torrents, forming countless waterfalls. A vapoury cloud is often observed rising from some obscure recess of the forest; it is sure to be a cascade, precipitating itself into some deep abyss. The country only here and there assumes the level appearance of pla-

\* This is not to be understood literally; for I discovered a species of oak some hundred paces from the sea near Salinas, a few miles to the south of Vera Cruz, others at an elevation of ten thousand feet in the mountains of Orizava and Toluca.

teaus, or of broader valleys; for the most part it has an Alpine character with a tropical and sub-tropical dress, smiling valleys, dark forest-grown mountains, everywhere moisture, an exuberant vegetable and animal kingdom.

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V.

THE HIGHLANDS. REGION OF PINES.

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The eastern side of the Andes presents us with a vast plain, resembling the sea; the principal mountain-range instead of jutting forth, gradually rises in the form of terraces, each of which is distinguished by the peculiar character of its vegetation. The whole of the country from the gulf of Vera Cruz to the highlands, is of undoubted volcanic formation; nowhere is there a trace of granite or gneiss, but on all sides we meet with conglomerate and tufa, lava, basalt and porphyry. Everywhere there are conical mountains with fallen craters, all open to the east, a proof of the fearful convulsions the country must have been subjected to. In many parts there is a crystalline-slaty stone, with a regular angle of incidence of about 60°, rising in a curve from below; at other points calcareous mountains appear between volcanic formations.

Quite apart, however, from the volcanic agency, it is perfectly evident that the whole country has been cast up from the profoundest depths by plutonic convulsions. The sides of the chasms, often rising perpendicularly from 1000 to 1500 feet, consist in many places of sandstone, mixed with rude blocks of basalt, in massive layers, separated horizontally by patches of rubble, sometimes three feet in thickness, firmly baked together with sand and iron-hydrate. The volcanic stream has open lofty conical flues, extending even as high as the snow-regions. At a considerable elevation above the sea, I have beheld petrefactions of sea-shells, in grey lime, amongst which I was struck by several large pectinites.

Future travellers will present us with geological sketches of the country; I have only alluded to the little I am able to judge of, in order to render the progressive elevation distinct, which here determines the change of climate. In countless spots we find ourselves in the most beautiful woods, in all the luxuriance of a semi-tropical vegetation; a steep mountain-path conducts us 2000 feet higher, and as though by magic we stand in a pine-forest, and hear the whistling of the wind as in the forests of the north. Elsewhere the change is more gradual; but everywhere the ordinary forest trees extend far into the pine-regions, especially the oak, the alder, the arbutus, etc. The lowest limit of the pines is usually 6500 to 6800



feet, and *pinus leuophylla* is the species first met with. The different forms of the Mexican coniferæ have not only been lately described, but miniature specimens of these dwellers on the Andes are seen in most botanic gardens; these, however, can afford no idea of the grandeur and majesty of these mountain-forests. The straight slender stems, often 100 or 120 feet in height, the close summits with the branches inclining downwards, the sharp-pointed leaves, now shorter, now longer, the cones sometimes quite small, sometimes immense, the frowning groups of *abies religiosa*, which are furnished with branches from the base upwards, the solemn stillness prevailing, interrupted only by the occasional scream of the blue jay, of the green aras, or the howl of some hungry wolf — all give rise to a feeling of loneliness, more oppressive even than that of the far-extending prairie. Ravines with foaming mountain-torrents, steep masses of rock, and green meadows, afford now and then some variety to the otherwise monotonous scenery; here, too, we find all the charms of Alpine vegetation. All is familiar to us, from the grasses *poa*, *festuca*, *agrostis*, *tritium*, etc., to the different species of clover, crow-foot, potentillæ, gentianæ, strawberries, and violets. The vacciniæ and one-berries are found here as in the north, the lupins and penstemoneæ blossom even at the height of 11,000 feet, where the alder already disappears, and nothing is found save the *pinus montezumæ*, the forest-tree of greatest elevation. The juniper species, are not met with so high; very few indeed grow on the east side of the mountains, but all the more on the west. The agave and cactus are only seen here and there between the rocks; they object to the moist climate of the eastern declivity, although they are not wholly unrepresented.

On the loftiest, most desolate portions of the mountains, the forest disappears,\* but vegetation does not therefore cease. Large patches are still covered with grass, *spiræa argentea*, and small shrub-like *stevia* indicate the character of the place; *veratrum frigidum*, *pedicularis*, *viola*, *alchemilla*, *arenaria*, *potentilla*, *auricula*, *castilleja* and others are everywhere woven into the fine carpet of grass; at the highest points we find *senecio*, with its silvery beard, the snow-thistle, completely covered with grey felt, and lichens and mosses, as in the lofty regions of the north. Most of the mountain-ridges do not extend to this zone, but the enquirer has it in his power to observe the peculiarities of nature in still loftier regions. A good road conducts us up the volcano of Orizava, a height of 17,800 feet, to the everlasting snow limit, enabling us to observe every description of plant, from the palms to the crippled productions of the Polar regions, in its natural state. At an elevation of 14,200 feet, the grassy region is passed, and a tolerably steep cone of loose sand succeeds, with occasional masses of rock. At the first glance vegetation appears to have wholly ceased, nevertheless a few phanerogamia are still met with, especially where they can obtain a firm hold near the rocks. A small pale yellow and a bright

\* The extreme limit at which wood grows on the Orizava is about 13,500 feet. The pines met with are: *pinus leuophylla*, *p. Montezumæ*, *p. magrophilla*, *p. pseudo strobis*, *abies religiosa*.

yellow draba are found, besides sisymbrium and mouse-ear, arenariæ, shrub-like *senecio*, saussurea-thistle and several grasses, particularly a small *avena*.

At the height of 14,500 feet, all the phanerogamia have vanished, and the vegetation consists merely of mosses and lichens, which cover the separate rocks as high as 14,700 feet. The usual assumption is, that *lecidia geographica* is the plant attaining the greatest elevation in tropical America; on Orizava it is not so. Among the mosses are some, for example, *grimmia*, which extend as high as the lichens, at least as high as the *lecidia*, until at length *parmelia elegans* rises above all. The botanists in general, who have carefully examined this region, and were well acquainted with the Scandinavian Alps, agree with Dr. Frederick Liebmann of Copenhagen, that in the vicinity of the snow-limit of the extreme north, the cryptogamia are more abundantly represented both as to number and variety, than under similar circumstances in the tropical zone. There where mosses and lichens flourish, the snow lies in every hollow, and on the north side of the rocks, the ground is frozen the whole year. A few steps further we are on the borders of the region of eternal snow or ice, for it is a compact mass of 18 or 20 feet in thickness, covered with loose snow, which is constantly thawing and being replaced.

From this boundary of organic life (insects, driven by the wind, are found high up on the snow), little streamlets produced by the thawing, trickle incessantly down the declivities; they unite and form torrents, frequently merging into small rivers.

From this "stand-point", which is higher than the summit of Mont-Blanc, let us again view the country we have traversed, before directing our gaze to the west. An interminable prospect lies before us, too extensive for every different object to be distinguished. We clearly recognize the mirror-like surface of the gulf, the darker forest-region of the coast, the lighter tracts of prairie-land. Then follow the sombre wavy lines of the forest-clad mountains, occasionally interrupted by cultivation. The chasms, indicating the water-courses, are distinctly recognized by their profound shade; solitary white dots in the midst of the foliage we presume to be churches and villages. The mountains ascend from terrace to terrace; we recognize the line of the pine-forests, where they are in full development, and the elevation where the trees completely disappear. From the threshold of rigid death, as from the North Cape, or the glaciers of Iceland, our eyes pass from the arctic zone and the pine groves of the north to the gardens of the Hesperides with their golden fruit, and thence to the glowing zone where the palms and the arborescent grasses are developed. An immeasurable panorama acquaints us with the physiognomy of the country, namely a gradual ascent of the soil from the sea to the ridge of the highlands, from there a gentle declining slope to the far-extending table-land or plateaus.

Let us now direct our attention to this side: for the first time we have an almost unlimited prospect to the west, north and south-west. To the east we have an unbounded horizon, extending far into the gulf, the plain only recognized at an



immense distance; on the other side it is close to us, at the foot of a steep height, on whose summit we now stand. Moderately lofty mountain-chains bound the plain, groups of mountains, mostly pointed, or with blunt cones interrupt the surface, whilst further to the west a lofty cordillera with a snowy summit closes the picture. No forests, no luxuriant meadows can be perceived in the valley, but on all sides cultivated fields, many villages and hamlets, also sand and moor, grey lava-masses, bare mountains, or slopes with a few scattered bushes or low trees. The contrast is so great, that it seems as though one were transported to a totally different country, from the south to the north, from the fragrant forest to the dreary heath.

For the present we have looked about us sufficiently, and will remain between the sea and the mountains, to observe some of the details. First of all let us bear in mind the physiognomy of the whole eastern side of the country. From the sea the land gradually rises to the height of 10,000 to 12,000 feet, then falls again some 3000 or 4000 feet, forming the extensive plateaus, which lie from 6000 to 8000 feet above the sea.

This physiognomy determines the temperature, it being a fixed rule that the thermometer falls as we ascend from the sea-level. If we assume that in 20° North latitude, the average temperature of the atmosphere at the surface of the ocean is 24° Reaumur, we perceive that at an elevation of 14,700 feet in summer, the thermometer falls to zero. Between summer and winter the snow boundary fluctuates perhaps 2000 feet; we may therefore take the average at 13,700 feet, although the boundary of the eternal snow lies higher, which has been ascertained by a barometrical measurement of different snowy peaks of this range. Not merely vegetation, but organic life in general, finds in this gradation of the climate a spot containing the conditions for its perfect development; a circumstance which sufficiently accounts for the vegetable and animal kingdom being so abundantly represented. Let us consider only the number of plants, which within a space of 70 miles (about the distance of the Gulf of Antigua or the mouth of the Alvarado river to the snow of the Peak of Orizava) are actually cultivated, or which the climate would permit being cultivated. In the lower regions, as high as 1500 feet, we have the cocoa-nut, cacao, vanilla, cotton, cloves, nutmegs, pepper, and the other spices of commerce, besides all the fruits of the tropical countries of the east and west; up to 4000 feet grow sugar and coffee, indigo and rice, tea, the banana and tobacco, besides the productive edible roots manioc, yam, arun, arrow-root, batata, curcuma and ginger, and all the fruits of America, Central Asia and Barbary. From here upwards begins the cultivation of the cerealæ of the old world, such as barley and wheat, of the oleaginous plants (olive, poppy, rape, linseed), of pulse and kitchen vegetables, of wine and every kind of European fruit. The mulberry-tree finds its climate at the height of from 3000 to 6000 feet. The most tractable plant is the maize, which is advantageously cultivated from the coast to an elevation of 9000 feet. This useful plant yields in the torrid regions from three to four hundred fold in four months, whilst on the frigid heights it requires ten months before it is perfectly

ripe, and gives a yield of eighty to a hundred fold. Barley ascends higher than maize and is planted at 10,000 feet above the sea, which region is also fit for cultivating the potato. Of the countless solanæ which the country produces, two tuberous-rooted ones are natives of the highest mountains; one with blue, the other with white blossoms. The blue-blossomed kind has been planted from the earliest periods, but only in lofty stations, for in the lower districts it produces only leaves and few bulbs. I have remarked elsewhere that the edible potato is found growing wild everywhere in the highest mountains of Mexico; but one perceives at the first glance, that cultivation has changed the whole type of the plant, which indeed is the case with most cultivated plants; for we must assume that the tame potato and its cultivation were brought hither from some other country. The Aztec language has no name of its own for potato; it is termed "Pápa", and it is not ascertained to what language the word belongs. It is also named Camotli, which has probably the general signification, edible bulb, but is more especially applied to the *Convolvulus batatas*. This much is certain, that the cultivation of the potato does not extend very far, and is only met with on mountains and plateaus at an elevation above the sea of 8000 feet and upwards.

Far more general than the potato is the *Ferraria pavonia*, called by the Indians "kakomitl" or "oseloschutschil" (tigerflower); for this flourishes equally well at the height of 3000 as of 8000 feet. Only the aborigines plant this description of lily, and eat the roasted bulbous root, which in taste much resembles the chestnut.

The jalap-root (*Convolvulus* and *Ipomea jalapa*) is met with only in the humid ravines of the loftier mountains, but without being cultivated; the smilax species or sarsaparillas are natives of the forests at the height of from 3000 to 6000 feet.

In the old world the species of grain are grown in very hot climates, for example in Syria, Egypt and Barbary; it is therefore singular that in the temperate regions of the east coast of Mexico at the elevation of 4000 feet, where the average temperature does not exceed 18° Reaumur, neither wheat nor barley can be grown. The plants themselves vegetate exceedingly well, every seed-corn shoots forth from 20 to 50 stalks, the leaves become broad and dark-green, but the ears are light, all the husks are empty. By repeatedly pruning the plant before it shoots into the stalk, germinating seeds may be obtained, but not sufficient to render the cultivation advantageous. Only the oats yield well, but are of little importance, as they are used for feeding alone, for which purpose maize is in every respect preferable. —

Before closing this chapter, I must allude to a prejudice existing in Europe, which I am wholly unable to comprehend. Frequently I have been asked if the flowers of America were really scentless, and the birds without song. Unfortunate country to which the Creator has given such matchless beauty of form, such wondrous tints, and yet denied all fragrance. Bounteous nature is no step-mother. What delightful odours do we not meet with in the large family of the orchidæ! At a distance of several hundred paces, the stanhopeæ, *epidendrum odoratum*, and others diffuse their subtle aroma through the forest. In the twilight several kinds of *cestrum*



fill the atmosphere with an enchanting perfume, and not less so the *datura grandiflora*, a single tree being sometimes covered with hundreds of white blossoms. The acacias and mimosas have partly the powerful fine scent of the wall-flower, but the large trees are overwhelmed with blossoms. Of many other families of highly odorous plants, I need only mention the serbereæ and tabernamontaneæ, honeysuckle, jessamine, pothos and calla, eugeniæ, ocoteæ, nictagineæ, liliaceæ etc.; among the syngenesists are many very sweet-smelling specimens, and a light breeze from the forest often conveys a perfect cloud of most delicious odours to the wanderer.

It is precisely the same with the singing-birds; the mocking-bird, the blue song-thrush, various silviæ, finches, tanagras and others are by no means inferior to the songsters of the old world.

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## VI.

### THE PLATEAUS.

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From the mountain-ridge we cast a passing glance at the table-land; we will now examine it nearer. It is singular in tropical and sub-tropical regions to behold a country, the climate of which is not unlike that of southern Europe, in consequence of the elevation above the sea averaging from 5000 to 8000 feet. Its extent is about 1500 miles in length, by 500 in breadth. Either mighty plutonic influences must have heaved up the whole country, or being the loftiest mountain-range of the globe, it was undermined and destroyed by fearful volcanic convulsions, and fell in; in the course of ages the great bed of the valley was levelled by the constant action of water. From the frontiers of Guatemala to the Gila river similar appearances are met with; under the 17th degree we find in the Province of Chiapas, plains with lakes, seven thousand feet above the sea, enclosed with lofty mountains covered with pine-forests and oaks; and the same thing is met with in 33° N. Lat. The table-land is continuous from south to north, sloping downwards towards the Atlantic and the South Pacific Ocean, intersected with numerous mountain-chains, which, however, never completely interrupt the communication of the plateaus with each other, nor produce any material difference in the level. From the 18th to the 13th degrees there are carriage-roads, and from Mexico to Chihuahua, a railroad could easily be constructed. Nevertheless certain large hollows may be clearly distinguished, being enclosed by the mountains, and the bottom filled apparently with stagnant waters. The lowest point of these hollows is occasionally indicated by lakes, or in the rainy season by pools, or deposits of common salt, brought thither by the rush of the tropical rains.

The character of the landscape is totally different from the coast-region. The vegetation has nowhere a tropical appearance, neither is it so perfectly developed, nor in such exuberant masses. The grasses are short and fine, the trees low, the mountains bare. Tufa and other rubble cover the slopes, a scarcity of water is almost everywhere remarked, which accounts for the scanty vegetation, particularly in the dry season. And yet precisely here, we meet with abundance of succulent plants, presenting man and beast with a new source of existence. In most places, north and south, the cactus, agave, and yucca, with the mimosa, and syngenesists, especially bacharis, senecio etc., determine the character of the landscape. The traveller, who in the morning has admired the most luxuriant vegetation, in the vicinity of Jalapa for example, where amidst a confused mass of lianas and brushwood, the arborescent ferns are so strikingly beautiful, in the evening imagines himself transported to some far distant region, when regarding the vegetable products of the plain of Perote. In a valley extending farther than the eye can reach, and from fifteen to twenty miles in width, wheat, maize, barley, pulse, etc., are carefully cultivated; here and there villages and large farm-yards are observed. Trees, however, are rare in the plain, if we except some mournful-looking cypresses, sables, or *schinus molle* near the churches and chapels. The eastern cordilleras exhibit pines, but the western hills and mountains are bare, with the exception perhaps of some stunted bushes on the sides of the steep cones and craters. On all sides the agaves (*agave americana*) bound the fields and roads, and surround the scattered dwellings.

The culture of the cerealiæ of the old world is promoted by artificial irrigation, wheat in particular, which is harvested in autumn. In some of the higher valleys barley and maize even require irrigation, the rainy season not being long enough to enable them to attain their maturity. The soil unfit for cultivation is usually turned into pasture-ground; on the steep, rocky declivities even, and on the hardened lava tracts, brown and white goats may be seen in search of food. All these mountains and masses of rocks bristle with prickly cactus plants, in the most whimsical and divers forms. Small, and very prickly mamillariæ, scarcely raise themselves above the ground, groups of a larger kind nestle in the clefts of the rocks, melocactæ and echinocactæ of all dimensions start up, from the size of a fist, to the altitude of a man, from one to three feet in diameter, furnished with short or long, with straight or curved prickles. The opuntia or Indian figs are crowded together in distinct groups, differing in form, size and colour of the leaves or branches, and in blossom and fruit. The cereæ creep like snakes along the ground, cling to the branches of trees and to the rocks, or rise in the form of a pillar thirty or forty feet above the generality of their species. There is one singular species called "organos", whose appearance is almost incredible. A thick ungainly trunk, from four to six feet in height, bearing several hundred upright multangular pillars of all sizes, which being tallest in the middle, and smaller on either side, resemble a large organ. The mountains, where frequently thousands of these plants are seen, are not unlike walls of columnar basalt. This stiff, shadeless vegetation is in many dis-