HUNTING WITH A BOTANIST.

A CONGRESSMAN'S EXPERIENCE IN THE SWAMPS OF FLORIDA.

The Superintendent of the Botanic Garden in Washington Searching for Novelties—His Adventures at Keystone Bluff and Along the St. John's—A Bamboo Grove—A Day Among the Palms—Observations of the Insectiverous Plants—The Dog Banana and Its Uses—Information Obtained from an Unlearned Colored Botanist.

WASHINGTON, May 13.—South on a hunt; not for deer, nor for bear; for neither ducks nor quail; but for plants. The huntsman is William R. Smith, superintendent of the National Botanic Garden, a countryman and an enthusiastic admirer of Robert Burns. He accompanied Commodore Charles Wilkes in his expedition to Japan, and since then has been in charge of the Botanic Garden. Under his supervision it has grown to its present proportions. Its reputation is world wide. Mr. Smith is plain and unassuming. He has enjoyed intimate relations with prominent Senators and Representatives for nearly forty years. He has a broad Scotch accent. Like his friend, ex-Attorney-General A. H. Garland, he is eminently practical, and never dons a dress suit. Although in commission at the Garden for nearly half a century, he had never visited Florida.

I.

We start from Washington on the day before the great naval parade in New York harbor. The weather is cold and the sky overcast. Overcoats are a necessity. The cars are hardly warm enough for comfort. Our trip is over the Atlantic Coast line. We leave Washington at 11 A. M. Over the Rappahannock and over the James we roll into North Carolina. We see the muddy waters of the Roanoke and the Neuse, and before dark are beyond the Great and the Little Pedee.

The botanist leans against the window sill thrilled with ecstasy. Each shrub and tree attracts his attention. The lowliest flowers awaken a lively interest. At times he feels like jumping from the platform of the car to examine some rare specimen. Botanizing by rail, however, requires a keen eye and occasionally a hot wheel. Mr. Smith longs for the latter as he catches glimpses of what he thinks are Venus's fly traps (*Dionæ Muscipula*), a rare curiosity which he says are found growing wild only in the sandy bogs of North Carolina. The hot wheel, however, fails to materialize, and as twilight draws her curtain the disappointed man of science is borne into the Palmetto State.

In the night he crosses the Santee, the Combahee, the Edisto, and the Savannah rivers and their attendant swamps. Long before daylight he is threading the piny forests of Georgia. He crosses the Ogeechee at daylight, and is running over the Altamaha at sunrise. An early riser, he experiences new spells of delight. He sees, for the first time, a palmetto growing wild. It is what the natives term a "scrub palmeeto." Mr. Smith promptly classifies it, but gets no opportunity to examine it. The hot wheel never comes to those who long for it. It is in reserve for those who dread it. Rare plants and shrubs sit from the gaze of the botanist. His pulse beats faster, and he longs to begin work. But the train is on time, and there are no mishaps. At Waycross, seventy-five miles from Jacksonville, he springs from the car to examine two palmettos near the depot. They are thirty feet high. Mules, switching their flanks with their tails, stand in their shade. The sandy soil below them is strewn with the bright black seed of the trees. In an instant the botanist squats between the mules and begins to pick up the seed. So busy is he that the train gets under way before he is aware of it, and he comes within an ace of being left. He says that he gathers the seed, not for the Botanic Garden, but for friends in Europe. Nothing can daunt his enthusiasm. He bemoans treasures beyond his reach, and gravely proposes to get out of the train at the next station and walk to Jacksonville, botanizing on the way. But the hot sun forbids it.

II.

We arrive on the St. John's at 9 A. M. It is twenty-two hours since we left Washington. This train shows the influence of the Pennsylvania Railroad Company on the old coast line. Sixteen years ago it took forty-eight hours to reach Jacksonville from Washington. To-day it is done in far less than half the time, and with royal accommodations.

Our headquarters are at Keystone Bluff, on the St. John's River, two miles below Jacksonville. It is the winter residence of Charles H. Cummings, at whose suggestion the expedition was organized. He places at the service of the botanist a naphtha launch, and entertains him right royally. The botanist proposes to ascertain what foreign plants and flowers will thrive in the climate of Florida, and to collect native specimens for the Botanic Garden in Washington. The launch is used day and night, a glowing moon appearing after the hot sun goes down. The rivers and creeks around Keystone Bluff are carefully explored. Landings are made in the saw grass, in the swamps, and on the pine bluffs. Two large boxes of native plants are collected and forwarded to Washington. It is an expedition exceeding in interest any hunt for birds or animals. Its results must prove interesting to botanists as well as to those who know little or nothing of the vegetable kingdom in the South.

The first search was for palms. Four different kinds were found growing near Keystone Bluff. The first was the palmetto proper (*Sabal Palmetto*). It thrives luxuriantly along the St. John's and throughout the country, attaining a height of sixty or seventy feet. When about twenty years old it loses the boots or straps which clasp the trunk and give the tree such a novel effect.

There are millions of those trees in Florida, but they are being rapidly thinned out. Some inventor has discovered a process by which the heart-leaves of the tree are turned into paper. They are said to make a parchment equal to the parchment of the olden time. There was a shipload of these hearts at Jacksonville awaiting transportation to the manufactory. Each heart represented a tree. The heart is in the top of the trunk. From it the palms arise and radiate. As the lower ones fade and drop, a new layer appears at the top. When large trees are transplanted, signs of decay are apt to appear in the heart. The new leaves turn a sickly yellow, and the fibers are loosened. The water leaks into the heart, and it dies. At such times it can be drawn out of the tree like a cork from a bottle.

The natives call the tree a cabbage tree. The heart is the cabbage. It is chopped from the top of the tree, boiled or pickled, and served upon the table. "Palmeeto kyabbage," as it is called, is a luxury among the wire-grass population. Nor are they alone in their appreciation of this luxury. The Seminoles in the Everglades use it freely. A favorite feast with them is a shipped-nosed, mule-hoofed, razor-backed hog boiled with palmetto cabbage. It makes a sort of a chowder. Each guest takes his turn at the cauldron and helps himself. Very few whites are honored with invitations to these feasts. Bears vie with men in destroying the palmetto cabbage. They climb the trees and tear out their hearts, greedily devouring them.

Whether these trees can grow fast enough to supply the bears, Indians, and other natives with cabbage, and the paper makers with pulp, may soon become a serious question. No tree less than fifteen or twenty years old bears a cabbage worth the chopping out. The trees from which the paper makers are obtaining their pulp are from fifty to a hundred years old. The palmetto is of slow growth. It has a value far beyond that placed upon it by the paper makers. When twenty feet high, well-established in tubs, it will bring $150 from dealers in London. Mr. Smith says that it requires some skill to handle them, but he believes that a fortune might be made in shipping them. The suggestion was made many years ago by Mr. Van Houtte, the eminent ornamental horticulturist of Belgium. The botanist indignantly denounced the destruction of the tree in Florida for food and other purposes. He said that the same murderous operation was being practised in Australia. The Australia cabbage palm (*Corosba Australis*) was being destroyed. The natives kill trees 100 years old to secure a mess of the prized cabbage.

In speaking of edible roots and trees in Florida, the botanist ventured the assertion that if the Confederate army had known more about the vegetation of the South it could easily have prolonged the war. Its defeat was due mostly to the failure of its supplies.

The most abundant palm found by Superintendent Smith in Florida was the saw palmetto (*Sabal Serrulata*). It thrives on the main shore, but it grows luxuriantly along the ocean beach. In the piny woods it has a rich green color, but along the beach the green has a light blue tint. It is more of a shrub than a tree. The roots rise above the ground where its growth is rank, like the roots of a Spanish bayonet. Men have crawled beneath them hundreds of yards near the ocean dunes to set traps at bear wells in obscure places. The stems of the palms are almost triangular in shape and have sharp teeth set along the edges of the triangle, like the teeth of a saw. No man can force himself through a dense thicket of saw palmettos without tearing his clothes into strips. These palms bear berries larger than cherries, with pits in proportion. Bears feed upon them in June, when the turtles disappear. The natives also eat them and brew beer from them. They are oily and have a rancid flavor. Only a native can stomach them.

The third palm found by Mr. Smith was *Sabal Adansonii*, or dwarf palmetto. Some call it the swamp palmetto. It is much taller than its brother, the saw palmetto. The stem is shorter, but the leafy stalk longer. In color it is like verdigris, and it is a tolerably handsome plant in a tub.

The last native palmetto seen was *Chamærops Hystrix*, or needle palm. It is also termed the porcupine palm. Its stem is short and proliferous. The leaves are circular in outline, with numerous tooth divisions, on triangular petioles, with rough edges. The spines come from the spokes of the leaves, and are from six to nine inches long. They are as sharp as needles. They are numerous, erect, and very strong, and readily force attention from the unwary traveller, who takes the plant for the more common swamp palmetto. The needle palm grows in low shady woods, and is the most interesting of the native palms of Florida. Mr. Smith eagerly sought the seed, as he said the palm was highly prized in Europe.

III.

Aside from these four natives, we found many foreign palms thriving in the Floridian climate. The botanist was delighted with the beautiful date palms (*Phœnix Dactylifera*) of St. Augustine. Three of them are over a hundred years old, and a fourth is well along in its second century. Several varieties of this palm and several distinct species were found in the old city. The variety *Canariensis* seemed to do well. It is a native of the Canary Islands, and is one of the best for tub culture. There is a specimen in the garden of the Ponce de Leon so singularly beautiful that the eye never tires of gazing at it. It shades the fountain.

Other species of date palms luxuriating in the soft air of the old Spanish city were the *Reclinata*, the *Spinosa*, and one that looks like a *Farinifera*. The first two are natives of the Cape of Good Hope, and the last is from India. All were swinging their leaves in the garden of the Alcazar.

Mr. Smith learned that the sago palm (*Cycas Revoluta*) is fast becoming acclimated in Florida. It is found growing out not only in Jacksonville, St. Augustine, Sanford, and Tampa, but it revels in little door yards all down the east and west coast. There was a beautiful sago palm on the little place made memorable by the murder of the Packard family a year ago last December. It has been transferred to the yard of the Ocean Hotel, New Smyrna, where it is universally admired. The leaves of the sago palm are now used in large quantities by florists for funeral decorations.

Another rare cycad was seen in the magnificent garden owned by Mrs. Alexander Mitchell near Jacksonville. Mrs. Mitchell is the mother of United States Senator Mitchell, the successor of Senator Sawyer of Wisconsin. She has a rare selection of plants from every quarter of the globe. The cycad came from Malabar. Botanist Smith expressed his satisfaction on learning that it had survived the cold winter. He said that in New Ireland the natives use the nuts of such trees for food. If cultivated extensively in Florida, this food might take the place of the cabbage palmetto and preserve many a fine tree.

At Mrs. Mitchell's place he also found a grove of bamboos in a surprisingly thrifty condition. Young bamboos were springing from the ground by the middle of April. They shoot up like asparagus in a single night. Within three days they become over six feet high. The growth is longitudinal only, the cane gaining nothing in thickness from the moment it emerges from the ground. We saw one ten inches in circumference and ten feet high. It was only five days old. This was the *bambusa Baccifera*, a native of the East Indies. There are several of the species in Mrs. Mitchell's garden. One, and a very strong growing one, had been injured by the frost. The others were variegated and black bamboo.

Nothing could be more deliciously cool than the shade of this bamboo grove. There was no vegetation beneath the trees. They shot up twenty or thirty feet high, leafing far above our heads. Nor was the grove for ornament alone. The canes were utilized. They were used in trellis work and in training rustic arches. A bamboo bridge spanned a little stream in the garden, and rare beds of flowers were fenced in by them.

Mrs. Mitchell escorted the botanist over her garden, extracting and giving information. Probably no woman in the United States has a greater love of the beautiful in nature; certainly none has spent so much money in its gratification. One plant she highly prized for its exquisite odor. It was the *Cineraria*, cultivated in every conservatory North. It was doing surprisingly well in Florida in the open air, despite the cold winter.

IV.

The most interesting part of the expedition, however, was the search for *Sarracenia*, plants that feed upon insects. It began in the forenoon of an exceedingly hot day. The sun fairly scorched the shirts upon our backs. We went up Arlington Creek on the little naphtha launch. It threaded the saw grass and the swamps like a thing of life. A quiet light in the eyes of the botanist betokened an eventful day. He saw the white flowers of the *Thalia* nodding at him from the saw grass and filling the air with perfume. The water, however, was so shallow that he could not reach them with the launch.

Two miles further, and we landed on an island in the shade of a thrifty bay tree. The leaves when crushed in our hands smelt like bay rum. The soil of the isle was dry and sandy with wet wastes near the river. The ground had evidently been under cultivation. Prickly ash was there in profusion. A negro stood near the shore watching our movements. There was no house in sight. When he saw Mr. Smith examining the leaves of the prickly ash his curiosity was excited.

"Dat ah am de toothache tree, gemmen," he said. "Et cures de chills an' fever, an' it am better dan quynyne. But my, ain't it bitter. Yo' wants to chew de peel ob de orange to get de taste out ob yo' mout—'deed yo' does."

He said that his name was Edward King, a native of Florida. He had been employed by some rural botanic physician to gather herbs for the Northern market. The employment jibed with his natural inclinations. He had a name for nearly every herb and shrub, and named the disease for which it was a specific. The botanist gladly availed himself of his services, and gathered some interesting information. Black as a coal, King followed him, listening in astonishment to the botanical names of the various plants and trees.

Mr. Smith found two small orchids in bloom and several other rare plants. Seizing the velvety leaves of a shrub shading the hot white sand, he said, "That's the leather tree."

"Oh, no it ain't, sah," the negro replied. "Dat ah am de dog banana. I seen it many a time agoue. It's got littie bananas on it, like yo' little finger, about two inches long. They gits ripe in de dog days, an' de dogs eats 'em, and likes 'em. Some people eats 'em, too. I can eat almost anyting, but I draws de line on dem dog bananas—'deed I does. I leates 'em for de dogs."

The professional botanist then examined the shrub more critically. He soon found other specimens. Thereupon he readily admitted his mistake. There were scores of them in sight. The plant is known to science as *Asimina Grandiflora*. Its flowers are a yellowish white, with outer petals two inches or more in length. Another species, five feet high, was found, called the *Parviflora*. It had a greenish-purple flower and bears small pear-shaped fruit. There was also a third species known north as the Papaw. All grow on dry, sandy soil and flower in March and April. They belong to the custard-apple family. The botanist was anxious to secure seeds of the dog banana to send to botanic institutions in Europe and elsewhere.

Another discovery that gave him great joy was the coral flower (*Erythrina Herbacea*). He said that he had been looking for it growing wild for twenty years. In a jiffy he tore up a big root of it. It was as thick and as long as a man's arm.

"That's forty years old," the botanist observed. "I have raised them from the seed, and know how long it takes them to grow. A seed sometimes lies in the ground two years before it comes up. I know many a man who would like to have this root."

The negro laughed, and named the disease which the root would cure. It was very common just after the war. Afterward Mr. Smith was about to plant the shrub as a curiosity at Keystone Bluff, but Mr. Cummings's gardener protested. He said that years before the plant had grown so rank near his orange grove that he found it almost impossible to exterminate it. The roots were as difficult to remove as the roots of the saw palmetto.

V.

The search for *Sarracenia* or insect-feeding plants ran along the edge of a swamp back of the creek. They were found in great profusion. The first discovered were what Mr. Smith calls "whiskey shops." They were the trumpet leaf, known to science as *Sarracenia Variolaris*. The darky declared that they were a sure cure for small-pox. The plants are perennial marsh herbs. They are vegetable cups about a foot high, tapering like a long champagne glass, and carefully hooded, so as to preserve the liquor inside. The hood arches the cup like the hood of a bath robe. Yellow flowers arise from the root between the cups. The entrance to the cup is under the arch. There are transparent spots upon the back of the hood, something like the spots on good cigars. The cup contains a liquor intoxicating to insects. An ant or a bug crawls up the outside and disappears beneath the arch. There is probably a thimbleful of liquid in the bottom of the oblong cup. The insect finds a sugary substance beneath the hood, which apparently increases his appetite for the liquor below. Possibly it serves the same purpose as a pretzel in a saloon. At all events the bug or fly descends and sips the fluid, until, stupefied with intoxication, it sinks and finally dies.

Upon opening one of the cups we found therein flies, ants, bugs, little green grasshoppers, and other insects, in a wet, compact mass at the bottom. They had evidently met their fate without struggling or even entering a protest. Attention was called to the transparent spots on the back of the hood. Mr. Smith could not divine their object. The colored botanist, who had been a close observer, gave him information somewhat startling. It was the fact that these whiskey shops are open day and night. The transparent spots serve as windows, and let in the moonlight. Thus the little shop is illuminated, and a train of night customers succeeds those who patronize the still by day. The colored botanist had discovered the secret while out at night hunting raccoons and opossums. He had seen June bugs and other insects that fly by night crowding to the bar.

Our observations confirmed the negro's statement. His theory is undoubtedly true. Dr. Gray's interpretation of Darwin is that there is always a purpose in nature. These transparent spots, serving as windows to countless whiskey shops, seem to prove it. Indeed, the colored botanist said that he had placed a lantern at the side of the plants on nights when there was no moon. The light of the lantern shone through the tiny windows, and in an instant the bar was open for business. The insects crowded into the shop and the proprietor silently robbed them of their lives. The plant is nourished by the operation. It feeds night and day, and the flies, ants, and bugs rot and fertilize it.

The liquid may be pure nepenthe, but it has the deadly effect of morphine. The insects seek it like old topers. It is said that a British Admiral once died on a foreign station. His body was placed in a cask of rum and shipped for England. The sailors of the vessel detached for this service became drunk every night, to the surprise of the officers, who wondered where they got their grog. Finally an old tar, who had been arrested, let the secret out. His messmates, he said, had "tapped the Admiral." The insects who patronize these small vegetable saloons are like the British sailors. When the liquor in the cup is all absorbed, and the V-shaped bottom is choked with dead insects saturated with the fluid, the late comers, finding no beverage, tap the bodies of those who have preceded them. Thoroughly intoxicated by this process, they die in their turn.

An insectivera, seen in great abundance along the line of the railway, was *Sarracenia flava*, or trumpet leaf. It has the shape of a trumpet, and an opening for insects much larger than the plant just described. The leaves are large, erect, and narrowly winged. The lamina are yellow, orbicular, pointed, downy, red at the base, and veined with purple. The trumpets are shaped so as to prevent the adulteration of its liquor by rain or dew. It bears the same flower as the variolaris, and its victims are full as numerous. Each, however, distills different liquor, and has a different class of customers. Both shops arrive in Georgia and South Carolina, despite their restrictive liquor laws. The effect of the liquor on insects is plainly seen. It would be interesting to know whether it would intoxicate men, if enough of it could be procured. It has a sweet taste, something like cider. Cows nip the plant greedily in June, seemingly to affect their milk, which has as fine a color and as good a flavor as Orange county milk.

After an earnest search we found a whiskey shop bearing a red flower as its sign. There were very few of them. It was the *Sarracenia psittacina*, or parrot-beaked pitcher plant. Mr. Smith has named it the Sunday saloon. He says its customers creep in by a back door. Once inside they stand at the foot of a tiny hill, and the liquor runs down to them. They drink, drop, and never return. We afterward saw many of these singular plants along the railroad in Georgia, between Waycross and Savannah, while returning to Washington. The leaves are short and spreading, and the tube is slender and broadly winged. It is marked with white spots, and is netted with purple veins. The beak is incurved, and the orifice of the tube is almost closed.

All these plants protect their liquor from the dew and rain. There is one species, however, which does not do so. It is the *Sarracenia purpurea*, or Huntsman's Cup. It has purple flowers, and is broadly winged. It grows in nearly all of the Florida swamps. The throat is contracted and covered with brown hairs, protecting downward. The botanist has dubbed it "the lager beer saloon." The insect crawls over the hairs and descends the cup to drink the beer. Becoming partly intoxicated it tries to climb out. The down-growing hairs act as a sort of chevaux de frise. The fly cannot surmount nor thread them. It finally drops into the water below and is drowned. This is the one insectiverous plant that drowns its victims. The new guide book says that they all do so, but Mr. Smith says it is clearly a mistake.

Another insectiverous plant is called the Sun-dew (*Drosera*). It kills mosquitoes, and is abundant in the swamps of Florida. It is one of the species of plants of which Mr. Darwin made such interesting investigations. It has from two to six leaves, usually in a horizontal position. Sometimes, however, they have a vertical extension. They are more broad than long. The upper surface is covered with gland-bearing filaments or tentacles. The average number of glands on each leaf is about 190. They are surrounded by drops of a viscid secretion. These drops glitter in the sun, and give the plant its name. Insects are caught in the gummy secretion, and the tentacles are brought into play to secure them. The plants are of a red color, and are almost mossy in appearance.

Near these the *Pinguicula*, another insectiverous plant, was found. Its palate is hairy, and the margins of its leaves usually roll inward. It captures its victims with a glue-like secretion, and is said to absorb them by rolling its leaves around them.

VI.

So much for the insect-feeding plants. A score of other curiosities were found before the scorching sun and the red-bugs drove us back to the launch. The search was continued until May 4, when we returned to Washington, instructed and delighted.

AMOS J. CUMMINGS.

BIG COAL BILLS.

The Ocean Flyers Burn About Two Thousand Tons Every Trip.

From the Marine Journal.

A paragraph has been going the rounds of our exchanges to the effect that an "ocean racer" burns about $15,000 worth of coal every trip. Very little calculation will show how extravagant this statement is. The American liner New York consumes about 328 tons per day, the White Star liner Teutonic about 310 tons, and the Cunarder Etruria 350 tons per day at full speed. It has been stated that the Etruria at a speed of 18 knots burns only 275 tons per day. This consumption would send the greyhounds across with a total use of about 2,000 tons in round figures. The price of coal in New York is considerably less than $4 per ton, and in Liverpool it is cheaper than here, but even at outside figures the cost of fuel per trip, it will be seen, does not exceed $8,000, and we would not be surprised to find the actual average price paid to be less than $6,000.

The fuel bills of such ships are of course, far in excess of those of the average ocean steamer. Triple-expansion engines and improved machinery of the present day have made it possible to so economize coal that the consumption per indicated horse power per hour has been reduced in ratio to much less than two pounds, as against nine pounds in 1830 and five and one-half pounds in 1840. The Teutonic's average is quoted at 1.6 pounds per hour. The majority of ocean steamers of ordinary size travelling at an easy gait think a ton of coal per hour is quite extravagant enough for their propulsion. Our big new war ship Iowa will have a bunker capacity for only 2000 tons of coal to speed her at 16 knots, the Indiana's bunker capacity will be 1,800 tons, the 3,000-ton cruiser Cincinnati's bunker capacity will be only 558 tons, and the crack Japanese ship Yoshino, with a speed of 23 knots, has bunkers to hold only 1,000 tons. It is doubtful if the bunkers of any steamer afloat would hold $15,000 worth of coal if bought in New York.

CAUSES OF THE BIG SHOCKS.

INVESTIGATING THE ORIGIN OF THE ZANTE EARTHQUAKES.

The Earth's Crust Is Folding and Breaking at the Bottom of the Sea Near the Island—A Series of Hundreds of Shocks Since Last August—Fixing Upon Their Place of Origin—Damage Done by Moderate Shocks

The people of Zante had no reason to expect the second series of earthquake shocks late last month, before they had really begun to recover from the calamity of Jan. 31 last. The Ionian Islands are a region of numerous earth tremors and movements of little violence, but destructive earthquakes have followed one another only at intervals of twenty to thirty-five years, and new generations, paying no heed to lessons they might have learned from their fathers, have reared their unsubstantial buildings without regard to the terrible visitations

THE SHAKEN PLAIN AND THE UNDISTURBED HILLS.

that might come. The earthquakes last month were much more violent than those of January. Scarcely a house remains inhabitable in the city of Zante, where 20,000 people lived. In the neighboring village of Gaston not a building is fit to be occupied. Less than 200 people were killed and injured, and it was fortunate that most of the peasants were at work in their fields when their homes were destroyed.

The island of Zante is in the Mediterranean, about fifteen to twenty miles west of the Peloponnesus coast. Its inhabitants raise on their rich alluvial plain large quantities of olives, grapes, and Zante currants. The chief interest which Zante's misfortunes has for us is not the story of destruction, but the studies that have been made to ascertain the causes of these subterranean convulsions, and to add to our knowledge of earthquake phenomena. Immediately after the shock of January 31 the Ecole Française d'Athènes sent Mr. Ardaillon,

a competent observer, to the island, and the report of his observations has just been printed in "Annales de Géographie," together with maps and pictures. This article is based upon the material supplied by his report.

Another observer also was on the ground. Mr. W. G. Forster, director of the Eastern Telegraph Company at Zante, has made a long study of the earthquake phenomena in that region. He has in his house an excellent seismograph, which records the least shocks. The submarine cables connecting Zante with the mainland have also enabled him at times to determine with much precision the direction and apparent centres of these phenomena. His observations were of much value to Mr. Ardaillon.

At 5:34 A. M. on Jan. 31 an earthquake shock threw to the ground a great part of the houses in the country district and many of those in the city. The movement was undulatory, and the duration of the seismic wave was about twelve seconds. A series of vibrations increasing in force and rapidity had preceded the principal shock, and another series, of decreasing violence, followed it. The force of the principal shock was not great compared with many earthquakes. This statement may seem strange in view of the damage done, for

ILLUSTRATES A LAW OF EARTHQUAKES.

about 4,000 of the 10,000 buildings on the island were either entirely destroyed or unfitted for occupancy. The loss amounted to over $400,000, and many might infer that the shock equalled in violence those from which Zante suffered in 1820 and 1840. This, however, was not the case.

The great damage was due not to the violence of the shock but to two significant facts. In the first place most of the houses were very poorly built. The damage to well-built houses was confined to falling plaster and cornices and the breakage of some furnishings. But most houses were built of a poor quality of calcareous tufa that crumbles easily, and the mortar between the layers was hardly better than mud. Upon these fragile walls heavy roofs were placed, and it was certain that upon the occurrence of a shock of considerable intensity the structures would fall.

The other reason that made the destruction great was that most of the ruined buildings stood upon light, easily disturbed ground, where the seismic wave was felt in all its intensity, and there was no obstacle to stop it. The lesson of the terrible earthquake in Japan two years ago was again illustrated in Zante. In Japan the disturbance originated in some rock-ribbed hills, where very little damage was done, while the great alluvial plain at their foot was covered with destruction, about 100,000 houses being levelled with the ground. It is worth remembering that the most violent results of earthquakes are often to be seen in soft, alluvial regions, where the upper strata offer least resistance to the destructive forces.

So in Zante most of the hamlets are built upon the rich alluvial plain that forms the eastern part of the island. Mountains occupy the western part, and among them no damage was done. In the city, however, in the upper part, the flanks and at the bottom of the hill of Castro, an alluvial formation. It was along this soft, alluvial shore, hillside and plain that the destruction was wrought.

One of our pictures is particularly interesting in view of these facts. It shows on the left and in the distance the limestone hills where scarcely any results of the shock were to be found. It shows also a part of the alluvial plain which was so badly shaken. It shows, too, the village of Bugiato, which was almost entirely destroyed, except that portion which creeps a little way up the hillside; and here, as elsewhere, the destruction was greatest right at the foot of the hill; that is to say, at the junction of the two phases of geological formation. All buildings so situated were more completely destroyed than structures further out in the plain.

Mr. Ardaillon says that in the commune of Napthion, the damage was much less serious than in other districts further removed from the earthquake's point of origin, but this commune is underlaid by a thick stratum of limestone, while more distant villages which were destroyed were built upon alluvial soil. Upon the slopes of Skopos he saw two buildings 300 feet from one another, both badly constructed. One, standing upon limestone, was uninjured, while the other, upon a bed of alluvium, was in ruins.

It was due, therefore, to bad building on the one hand and to unstable earth foundations on the other that the shock of moderate force did enormous damage. Mr. Forster says the earth tremors began on Aug. 16, last year, and between that time and the shock of Jan. 31 the seismograph registered 300 shocks, most of them too feeble to be observed except by the recording instrument. After the shock of Jan. 31 the ground was in a state of continual vibration for several days. From Feb. 3 until Feb. 15 the shocks diminished in number and intensity, but did not cease. These numerous shocks were of the same origin and nature, and differed only in intensity. They all originated at some point of the sea bed southeast of the island. The seismograph left no doubt upon this subject, and the big shock of Jan. 31 marked its direction in the clearest manner by the damage it did; and we shall now allude to this very interesting phase of the earthquake.

All the walls, whose façades faced to the southeast and northwest, that is perpendicularly to the direction of the shock, suffered incomparably more than other walls. On the contrary, walls which were parallel to the direction of the shock sustained very little damage. Mallet was the first to record at Naples, in 1857, evidences of this result of severe earth movements. One of our pictures vividly illustrates the fact. M. Ardaillon photographed this long wall constructed parallel to the direction of the shock. The wall did not sustain the slightest damage, while the face of a building at the end of it and perpendicular to the direction of the shock is badly shattered. Walls of buildings that stood diagonally across the line of direction of the earth movement suffered most severely at their angles. Thus every building confirmed the information given by the seismograph as to the direction of the earthquake. The seismic wave was parallel to the axis of the western mountains.

Mr. Ardaillon seems to have fixed approximately the extent and place of origin of the shock. He found that it did not extend to the Strophades Islands, which are thirty-two miles south of Zante. To the north the shock was but feebly felt at the southern end of the island of Cephalonia, eleven miles north of Zante. To the east, the earthquake was feebly felt on the coast of the Peloponnesus opposite Zante, but further south on that coast it was strongly felt at Kataeolo, twenty miles from the southern point of Zante, and more feebly at Pyrgos, seven miles further east. It follows that the earthquake was of a local character, and that the region it affected was not more than thirty-five miles wide and extended only about thirty-eight miles in length from southeast to northwest.

Having thus a basis to reach his conclusion as to the place of origin of the shock, he knew it originated in the southeast because its movement was to the northwest. He concluded that the initial point was in the sea, and nearer to Zante than to the mainland at Kataeolo, because there were ruins at the south end of Zante while there were none at Kataeolo. Then when he considered that the ruin wrought in Zante was great as far north as the latitude of Gaiaro village, he concluded that the place of origin must have been very much nearer to Zante than to Kataeolo, and he concluded that the initial point was in the sea not more than three or four miles southeast of the southern point of the island.

Some instructive speculations may be made as to the causes of the phenomena. The inhabitants of Zante are convinced that their earthquakes are due to volcanic action. In their opinion the volcanic matter which is found in the south of the island at Keri Bay and the oil which floats upon the sea north near Cape Skinaro are certain proofs that there is an active subterranean volcano in their neighborhood. We know, however, that bitumen as well as other natural hydrocarbonets and oils which float upon the surface of the water have nothing to do with volcanic phenomena. Moreover, there are not upon Zante or any other of the Ionian Islands any eruptive rocks.

Mr. Ardaillon has a very reasonable theory to account for these earthquakes. All physical geographers have been impressed with the abrupt irregularities in the ocean bed throughout the Gulf of Corinth and along the entire west side of the Peloponnesus. It was found in taking soundings for cables that contiguous parts of the sea bed varied many hundreds of feet in depth, and also that at different times widely differing depths were obtained in the same places. Thus the soundings of 1865 between Zante and Cephalonia showed a maximum depth of 760 metres, while two years later, after the earthquake of 1867, a depth of 2,440 metres was found between the same islands. In 1886, after the earthquake in which the coast of the Peloponnesus suffered, it was found that changes in the depths of the neighboring waters amounted to from 300 to 600 metres.

Mr. Ardaillon says that all observations with regard to earthquakes in this region, about 150 miles long and 130 miles wide, show that they may be attributed to the same cause, included in the same category. Over all this area sharp differences of level at the bottom of the sea and sudden changes in sea depths are to be observed. It is natural to suppose that we are here in the presence of a line of dislocation along which the crust of the earth is still being disturbed. The earth movements in this part of the Mediterranean are exceedingly due to the phenomena of plication or folding of the earth's upper strata. The same tension and compression which produced many of the mountain ranges is here in action. As the interior of the earth cools it contracts and tends to leave the outer crust behind. The weight of this outer crust, however, is greater than it can sustain, and it is therefore compelled to wrinkle. Thus geologists explain the great ridges and furrows which constitute continents and river basins, and they compare this folding of the earth's crust with the wrinkling of the skin of a dried apple. While this process of wrinkling or folding is going on, the mighty movement, of course, destroys the equilibrium of the rock strata; and, in consequence, earthquakes occur, and continue with greater or less violence until equilibrium is restored.

The earth tremors and shocks that have been felt at Zante almost incessantly since August last and at intervals for many years past seem to be manifestations of this activity at the bottom of the neighboring waters. This region seems, then, to belong in its geological nature rather to the region of the Alps and the Apennines than to that of the Peloponnesus or Africa. Portions of the earth's crust at the sea bottom are being raised and folded or broken, producing corresponding depressions, and disturbing the rock formation for a considerable distance around; and, unfortunately for Zante, it lies in the line of disturbance, and must suffer until the same causes that reared our Appalachian mountains cease to operate in its neighborhood.

CYRUS C. ADAMS.

A BENZINE CAB.

One Solution of the Problem of Rapid Transit on Country Roads.

The benzine cab is the most novel means of transportation in Germany. It is a four-wheeler, guided by a touch of the finger on a lever, and provided with motive power by a benzine engine which neither heats nor smokes the occupants.

The first of this style of cab was completed a month ago in a Mannheim factory, and was started on an exhibition trip to Berlin. It rolled over the country roads at the rate of fifteen or sixteen miles an hour, and at an expense of half a cent's worth of benzine per mile. In every city on his route the conductor, who is at the same time engineer, has run his cab through the streets, taken on and let off curious passengers, and made his way across crowded market places to show the ease and safety with which the machinery can be managed.

The cost of the cab is but $1,000, and this can be reduced in the process of wholesale manufacture to $450 or $500. The inventor expects that it will revolutionize the present system of transportation between country towns and between cities and their suburbs.

Matter Enough.

From Life.

"Why, what's the matter with the boy?"

"I was a seein' how many animals from my Noah's ark I could hold in my mout', and I've been an' swallered a giraffe an' a zebra!"

THE MINING DETRITUS PROBLEM.

The Plan to Authorize Hydraulic Mining in California Under National Supervision.

WASHINGTON, May 13.—The President has appointed during the past week the members of the Board provided for in the act passed by the last Congress to create the California Débris Commission and to regulate hydraulic mining in that State.

The question involved in this legislation has occupied the attention of Congress for several years. In the process of hydraulic mining, as the bill described it, "a bank of gold-bearing earth and rock is excavated by a jet of water discharged through the converging nozzle of a pipe under great pressure, whereby the earth and débris are carried by means of water through flumes or otherwise, and discharged on lower levels into the natural streams and water courses below." It is, of course, evident that this washing away of the gold-bearing gravel banks and the deposit of material elsewhere may be hurtful to river navigation; and, in fact, it was discovered that appropriations had been made in River and Harbor bills for removing obstructions thus created. Naturally an outcry was raised against compelling the Treasury to repair the damage caused by private mining operations. On the other hand, it was considered desirable not to interfere with a valuable industry, provided it could be conducted in a proper way; and accordingly this Commission has been created.

The region in question is that of the Sacramento and San Joaquin rivers. The former is California's chief waterway, and needs to be cared for all the more as it is liable to dangerous overflows. The San Joaquin flowing northward, as the Sacramento flows southward, between the same mountain ranges, unites with the latter near Stockton, and the streams thus combined proceed to their outlet on the Pacific coast. It will be remembered that a few years ago, while Congress was in session, a great freak was threatened in the bank of the Sacramento, a new bar being formed, and that Gov. Waterman sent an urgent despatch for the application of funds available to prevent the river from leaving its proper channel. There was, at that time, a very large sum unexpended for improving the Sacramento, and the Feather, one of its tributaries. It had remained unused, however, for many years, for the reason that the employment proposed for it was that of dredging the Sacramento, and also erecting barriers upon the Yuba, American, and Bear Rivers, tributaries of the Sacramento and the Feather, to hold back the flow of detritus caused by hydraulic mining. Secretary Lincoln had declined to use public funds for impounding the detritus, especially as California had been prevented from using money from the State Treasury for a similar purpose, under a decision rendered by the Supreme Court of the State. This decision was that "the Legislature has no power to impose taxes for the benefit of individuals connected with a private enterprise."

These facts will give a general idea of the importance of the subject under consideration. It involves the valley system of California between its two great mountain chains, the Sierra Nevada and the Coast range. It also involves the navigation of its main waterway in its lower and commercially most important portion, and moreover the agricultural lands which are injured by overflows. Nevertheless, as has been seen, California constructed the prosecution of hydraulic mining important enough for her to make an attempt to restore and regulate it until the courts interfered. A possible compromise was suggested when the plan was brought forward of constructing the required dams and basins for restraining and storing the mining detritus, and placing the cost of maintenance upon the mining corporations for whose benefit they were to be constructed.

In 1884 Congress passed an act to "investigate the mining debris in California," and a Board of Engineers was established under it that recommended the construction of certain restrictive works. In the spring of 1892, in answer to a resolution of Congress, Lieut. Col. W. H. H. Benyaurd furnished estimates of the cost of such restrictive works. He proposed for Van Gieseen Dam, $75,000; for the dam at De Guerre Point, $150,000, and for restrictive works below the latter, $100,000. He added these comments:

> The Board of Engineer Officers appointed to consider the hydraulic mining question in the state of California, reported the existence of vast deposits of material in the various channels of the rivers draining the entire hydraulic mining region, and in the plain below the debouchure of the Yuba River from the foot-hills. Portions of this material will be carried down with each successive flood, and will eventually find lodgement in the navigable portions of the rivers below, to the injury of navigation.
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> The Board proposed the erection of dams at the lowest