

species. In its subsequent appearance, hereafter, it may now be recognized.

The Crambidæ are small moths with narrow front wings, often marked with metallic spots and lines, which are frequently driven up for short staccato flights in our pastures and meadows during the fall months.

The paper concluded with a resumé of the history of the species, so far as known at present, which is omitted as not of general interest.

CANYONS—THEIR CHARACTER AND ORIGIN.*

BY HON. WILLIAM BROSS.

To the professional geologist it may seem an impertinence for a layman to offer any opinions as to the character and the origin of canyons. He may, however, it is hoped, use his eyes without offense, and form such conclusions as the facts which he has observed, may appear to warrant. If they should not agree with the recognized principles of the science as now understood, he will be no worse off than scores of learned Professors in the past, for in this, as in almost every other science, nearly every conceivable absurdity was exhausted before theories were made to agree with acknowledged facts. And here, at the commencement, the conclusion to which the observations to be presented somewhat in detail have led, may as well be stated—viz.: that canyons were formed by some great convulsion of the earth's surface, or by the contraction of mountain chains from their igneous condition in the early history of the planet. Take, for instance, the cañon of the Saguenay—a vast fissure in the mountain chain that lies on the north side of and nearly parallel with the St. Lawrence. The fissure or cañon is some fifty or sixty miles long and lies nearly at right angles to the river. Something like a mile apart, the perpendicular rocks on the north side are, at some points, about 1,500 feet high, the water at their base being several hundred feet deep. No man in his senses, it seems to me, could possibly conceive that this gorge through the granite mountain could have been formed by the action of the insignificant river that empties into Ha-Ha Bay at the northern end of the cañon. The surface of the water, for the whole distance of sixty miles, is on a level with the St. Lawrence, in some places it is several hundred feet deep and the cañon is about a mile wide, through the solid granite rocks. And here another general principle may as well be stated, that, with a single exception, the width of this and the other canyons hereafter to be noticed, is scarcely ever more than a fraction of a mile; seldom a single mile—a fact that strongly indicates uniformity in their origin. And besides, the mountains on both sides are generally nearly of the same height.

TAKE THE CAÑON OF THE HUDSON,

where it passes through the Blue Ridge, above and below West Point. The channel is deep, the tide ebbing and flowing far upwards towards Albany; the mountains on both sides, though rounded off towards their summits, doubtless during the glacier period, are about of the same height, and there is a general correspondence in the dip and thickness of the vast strata of rocks on both sides of the river. With the exception that the cañon is far above tide water, the same general facts are witnessed in that of the Delaware at the water-gap through the same spur of the Allegheny Mountains. In this case there are two well-defined ledges corresponding with each other on both sides of the river; the water is deep and sluggish while passing through the gorge, and all the facts seem to point, with unerring certainty, to some great convulsion in Nature as the origin of the cañon. With the exception that the current of the Potomac is swift at Harper's Ferry, the break in the mountain there,

so graphically described by Jefferson, is very similar to that of the Delaware. This gorge may not have been relatively as deep at its formation as those of the Hudson and the Delaware.

THE CAÑON OF THE NIAGARA

was confessedly formed by the action of the river; but, if the structure of the rocks forming the cañon between the falls and Lewistown be considered, the exception in this case, it is believed, will prove the rule enunciated at the beginning of this paper. The rocks underlying the country between Lewistown and Buffalo are nearly horizontal, and are, in round numbers, as indicated by the gorge below the falls, some 200 feet thick. The upper strata, for say half the distance, are solid limestone, underlaid for perhaps an unknown depth, by soft sandstone, scooped out with comparative ease by the great cataract. Hence, the support of the upper stratum of lime-rock is gradually worn away, and it falls into the gulf below. On the American side of Goat Island, where only a fraction of the river falls over the precipice, the lime-rock lies below in vast blocks, and a rapid is gradually forming, while on the Canada side, the immense river scoops out the sand-rock to a great depth, and the falling sections of the lime-rock are buried out of sight forever. Below the railway bridge, for a long distance, there is a terrible rapid, showing that some other rock at the bottom of the river was harder than the sandstone, or that the stream is partially dammed up by the lime-rocks thrown down between the bridge and the present fall, forced to the position they now occupy by the water, débris, and ice pressing down from above as the river gradually receded towards Lake Erie. This recession will doubtless continue even back to Lake Erie, unless the sandstone dips deeper down into the earth, and the limestone strata become thicker or some other hard rock fills the entire face of the cataract. Then the fall would gradually wear away at the top and become a rapid of gigantic proportions. Now, if the Niagara River, with its vast volume of water at first falling over a lime-rock ledge, at Lewistown, underlaid by a friable sandstone base—a condition of things found, it is believed, in no other cañon upon the continent—has required untold ages to work its way up to its present location, how is it possible for the comparatively small rivers heretofore named, and those to follow, to wear away a pathway to the sea through great mountain ledges of the hardest rock? Such a conclusion would be absurd.

THE CAÑON OF THE MISSISSIPPI

extending, say from Dubuque to the head of Lake Pepin, some 200 miles or more, is an exception to the rule above proposed, mainly in its width, which is some five to seven miles. The sandstone bluffs on either side are generally perpendicular from the top downwards from 200 to 300 feet, when the débris slopes down to the bottom lands or to the majestic river as it sweeps through the alluvium from one side of this broad cañon to the other. There are doubtless good reasons for the opinion that the waters which now find their way from Lake Winnipeg to Hudson's Bay once flowed south and filled full the broad space between the beautiful bluffs of the Upper Mississippi.

THE GORGE OF THE UPPER MISSOURI,

situated about 100 miles below Fort Fenton, is one of the most marked, as it is one of the most beautiful, canyons on the continent. The walls are perpendicular, of white sandstone, scarcely a mile apart, and some eighty feet high. On the top of these walls there is a layer of clay, perhaps of the same thickness, rounded off gracefully by the winds and storms, while in some places it has been all worn away, and the tops of the white sandstone ledges appear as castellated forms, reminding one of the Milan Cathedral, or some of the old ruins

* Read before the A. A. A. S., Cincinnati, 1881.

scattered all over Europe. Between these sandstone walls the river flows smoothly, without giving the least suspicion that the cañon was formed by it. Only some great convulsion could have torn apart this immense sandstone deposit for some twenty or twenty-five miles. It will well repay a visit to the Upper Missouri to see it.

THE GRAND CAÑONS OF THE ARKANSAS,

the South Platte, Clear Creek and the Bowlder strongly resemble each other, and may, therefore, be disposed of in the same paragraph. Through the three first, in spite of the tremendous obstacles they presented, railways have been built, and the saucy little locomotive rings out the echoes from their perpendicular granite walls on either side some 2000 to 3000 feet high. Small rivers—for they are small here—rush through them with angry roar; but it would be worse than idiotic to suppose that they wore down the vast granite walls through which they run to the bed they now occupy. Only Nature's reserved forces, such as the world sees in earthquakes, could rend these granite mountains asunder, and, with perpendicular walls half a mile high, make a pathway for the tiny streams that surge and brawl between them.

THE CAÑON OF THE COLUMBIA

is, in some respects, one of the grandest upon the continent. From Cape Horn to perhaps some twenty miles or more above Celilo, at the head of the Dalles, a distance of sixty or seventy miles, the great river finds its way to the ocean through a gorge, the walls of which are from 500 to 4000 feet high. Even a cursory inspection will convince a practiced eye that for the entire height, and most of the distance, it is composed of nearly perpendicular basaltic rocks. No one series of columns where present reaches from the base to the top of the mountain; but at the foot of the cascades, on the south side of the river, their development is truly wonderful. Suppose before you there is a row of them 500 feet high and twice as long on the face of the mountain; at either end of that thousand feet another row, with their bases on a line with the tops of the first, shoots up another 500 feet, and so on from the base to the top, one row of columns above another, will convince the beholder that the entire mountain is composed of basalt. From the time of the Cæsars to the present all the world has been wondering at, or gazing with admiration at the Giant's Causeway, on the coast of Ireland. It, too, is composed of basaltic columns, and they are actually 300 feet high. Thus America furnishes to Great Britain a ratio in basalt of 3300 to 300; figures which I was wicked enough to write in 1879 would probably represent the influence of the two nations on the affairs of the world 100 years hence.

The Cascade Range, in Oregon and Washington Territory, corresponds with, and is virtually an extension of, the Sierra Nevada, in California. Near the western end of the cañon of the Columbia the Cascades form a splendid rapid, and the river falls thirty-five feet in two miles. From the head of the Cascades steamers run on the smoothly-flowing river for forty-five miles through the splendid cañon to the foot of the Dalles. Here, as the tourist glides along, Mount Hood, clad in a mantle of snow old as creation, peers down upon him through the lateral cañons, while the dark, frowning walls of basalt on either side almost make him shudder and forget for the moment how he can escape from this gloomy prison to the cheerful abodes of mankind. These stupendous basaltic walls, with the river flowing smoothly and beautifully between them, would never for a moment suggest the thought that this grand gorge was formed by the river. Only Nature herself, shaking as a reed this vast mountain-chain, could have rent it asunder

and given us the sublime cañon of the Columbia. Only one other,

THE YOSEMITE VALLEY,

can be compared with it, and to that, as in some respects the grandest of them all, let us now turn our attention. A description of it will be most easily remembered by saying it is a gorge in one of the spurs of the Sierra Nevada Mountains, about twelve miles long, a mile wide, and a mile deep. As many, perhaps most of the members, have visited this grandest wonder of the world, only a brief description of it will be attempted. At El Capitan—or Tu-toc-a-nu-la, the granite wall—they are, on both sides, of the same material—is 3,300 feet high and very nearly perpendicular. At the grand arches, the height is about the same and the south dome is 6,000 feet—a very considerable fraction more than a mile—one-half of which is perpendicular. From either side the waterfalls are splendid. The Bridal Vail is 900 feet; the Yosemite, 2,634, more than half a mile; The Vernal Fall of the Merced River, at the head of the cañon, is 350 feet; and Nevada Fall is 700. The question is how was this vast gorge made through this mountain of granite? Prof. Whitney, if correctly reported, ascribes it to the dropping down towards the centre of the earth of a section of the mountain a mile wide. From this opinion, of this master of geological science, with all possible respect, I beg leave to differ. The facts of its structure, in my judgment, warrant the belief that, like all the other cañons above referred to—that of the Niagara alone excepted—it was formed by an upheaval of the mountain, at that particular point, sufficient to break it apart to the extent of a mile—the more probable cause; or the mountain, while intensely heated, contracted enough to do it. A few of my reasons for this opinion are as follows:

These solid granite mountains were once torn apart—on a smaller scale, it is true—for there are immense seams, perhaps two feet thick, of cream-colored feldspar, running through the walls of this valley; and it is believed that a correspondence can be observed in these seams on both sides of the gorge. If rent asunder to admit the injection of these seams of feldspar, why not on a larger scale? When this vast fissure was first made it was undoubtedly very deep, perhaps half a dozen miles or more. Where the break was in the line of the cleavage there the wall stands up perpendicularly, as at El Capitan, and the arches, and a few other points. Where it was not in the cleavage line, immense masses of rock were thrown into the abyss, and from this source and the debris brought down by the Merced river, the gorge gradually filled up to its present level. At El Capitan and the arches, the granite wall stands unbroken to the top, and you can ride right up to it and, from your saddle, put your hand on that wall rising sheer above you for more than three-fifths of a mile. Your horse stands on the fine disintegrated granite, the last contribution of the snowy range to the eastward. But after the valley was filled up to its present general level, at points where the cleavage was not in the line of the upheaval, as in the rear of Mr. Hutchins' hotel and some other places, the frost and perhaps earthquakes continued to throw down immense blocks, and hence there is at this point, a gradual slope to the top on the south side of the valley, with trees growing wherever they can find a ledge or a crevice to get root in. Another instance, showing how water, frost and other causes have broken the symmetry of the valley, may be seen at the Yosemite Fall. Both the height and the front of the escarpment, east and west of the Fall, are in the same line, while the ice and the stream have worn the wall back at the Fall perhaps a quarter of a mile from the front line. And yet the first perpendicular fall is 1,600 feet, or ten times the height of Niagara.

Such facts might be multiplied almost indefinitely, but

enough for this paper. This general remark, however, should be carefully weighed. The cañon of the Columbia, the Yosemite Valley, the Charquinez Strait connecting the Suisun and San Pablo Bays, and the Golden Gate itself, through which the waters of the Sacramento and the San Joaquin, draining the great Valley of California, find their way to the ocean, are all about a mile wide. With the exception of the cañon of the Mississippi, the same is true, it is here repeated, of all the cañons above referred to in the Rocky Mountains and east of them, noticed in this paper. It is submitted, therefore, that the main facts in regard to them, point almost unmistakably to a similar origin for them all. All these cañons I have myself visited, many of them several times. Several of them are splendid, even sublime, beyond the power of the most accomplished pen to describe. I dared not to attempt it, and have, therefore, simply stated what I have myself seen and drawn such conclusions as the facts seemed to warrant.

Let me add a very few words in conclusion upon a paper on the geological history of the Colorado River and the plateau of it, read at the St. Louis meeting by Col. E. C. Dutton, of Washington. This cañon, as described by Maj. Powell, who has the honor of braving almost incredible dangers to explore it and to give the world their first knowledge of its wonders, is some 1,500 miles long; the perpendicular walls are a mile or a fraction of it apart, and are from 1,000 to 5,000 feet high. They are composed of nearly all the series in the geological catalogue, from the granite all the way up to the highest igneous stratified rocks. Now this, by far the longest, and in some respects the most wonderful cañon in the world, Col. Dutton described as having been worn by the Colorado River. In view of the facts herein presented that conclusions seems supremely fanciful and absurd. Like all the others, it could only have been formed by some great convulsion of the earth's crust, and through it the drainage of nearly a thousand miles along the western slopes of the Rocky Mountains finds its way to the Gulf of California.

ADDRESS OF COL. GARRICK MALLERY, U. S. ARMY.

Chairman of the Subsection of Anthropology of the A. A. A. S. at the Opening of that Subsection.

THE GESTURE SPEECH OF MAN.

Anthropology tells the march of mankind out of savagery in which different people have advanced in varying degrees, but all started in progress to civilization from a point lower than that now occupied by the lowest of the tribes now found on earth. The marks of their rude origin, retained by all, are of the same number and kind, though differing in distinctness, showing a common origin to all intellectual and social development, notwithstanding present diversities. The most notable criterion of difference is in the copiousness and precision of oral speech, and connected with that, both as to origin and structure, is the unequal survival of gesture signs, which it is believed once universally prevailed. Where sign language survives it is, therefore, an instructive vestige of the prehistoric epoch, and its study may solve problems in philology and psychology. That study is best pursued by comparing the pre-eminent gesture system of the North American Indians with the more degenerate or less developed systems of other people.

EXAMINATION OF THE INDIAN SYSTEM.

The conditions and circumstances attending the prevalence, and sometimes the disuse, of sign language in North America were explained. The report of travelers that among Indians, as well as other tribes of men, some were unable to converse in the dark, because they could

not gesture, is false. It is the old story of *Βάρβαρος* and *ἄγλαστος* applied by the Greeks to all who did not speak Greek, repeated by Isaiah of the "stammering" Assyrians, and now appearing in the term *slav* (speaker arrogated to themselves by a large division of the Aryan family), as contradistinguished by the Russians from the Germans, whom they stigmatize as *Njemez* (speechless.)

The theory that sign language was the original utterance of mankind does not depend upon such tales or prejudices. After the immeasurable period during which man has been upon the earth it is not probable that any existing peoples can be found among whom speech has not obviated the absolute necessity for gesture in communication between themselves.

The assertions made that the sign language of Indians originated from one definite tribe or region supposes its comparatively recent origin, whereas the conditions favorable to its development existed very long ago and were co-extensive with the territory of North America occupied by any of the tribes. Numerous evidences were presented as to its antiquity and generality. But the signs are not now, and from the nature of their formation never were, identical and uniform. The process is the same as among uninstructed deaf mutes when associated together, which was explained.

A comparison sometimes made of the diversities of the sign language of the Indians with the dialects and provincialisms of the English language is incorrect, as there is so small a proportion of the sign-using tribes which make identically the same signs to express the same ideas, and also because the signs are not absolute and arbitrary as are the words of English.

ARE SIGNS CONVENTIONAL OR INSTINCTIVE?

Sign language, as a product of evolution, has been developed rather than invented, but each of the separate signs had a definite origin arising out of some appropriate occasion, and the same sign may thus have had many different origins due to identity in the circumstances. No signs in common use were at first conventional. What may appear to be convention largely consists in the differing forms of abbreviation which have been adopted. Yet, while all Indians, as well as all gesturing men, have many signs in common, they use many others which have become conventional in the sense that their etymology and conception are not now known or regarded by those using them. The conventions by which such signs were established occurred during the long periods and under many differing circumstances. Our Indians, far from being a homogeneous race and possessing uniformity in their language, religions and customs, differ from each other more than do the several nations of Europe, and their semiotic conceptions have correspondingly differed.

PERMANENCE OF SIGNS.

Instances were presented of the ascertained permanence of some Indian signs, and of those of foreign peoples and deaf mutes. Though they, as well as words, animals and plants, have had their growth, development and change, those which are general among Indian tribes, and are also found in other parts of the world, must be of great antiquity. Many signs but little differentiated were unstable, while others that have proved to be the best modes of expression have survived as definite and established.

IS THE INDIAN SYSTEM SPECIAL AND PECULIAR?

The Indian system as a whole was compared with those of foreign peoples—the ancient Greeks and Romans, the modern Italians, the Turks, Armenians and Koords, the Bushmen of Africa, the Redjungs and Lelongs of Sumatra, the Fijians, the Chinese, Japanese, and the Australians. The result is that the so-called sign language of Indians is not, properly speaking, one language, but that it and the gesture systems of deaf-mutes and of all