material constituting the very small alluvial fans in front of the gullies incising the northern front of the Baldwin Hills.

CONCLUSION

It is apparent from a preliminary investigation of the occurrence of the recently discovered human remains in Los Angeles that the evidence at present available does not point unequivocally to Pleistocene age of the deposits containing the human material. The fact should be emphasized, however, that the sequence of physical events and of faunal changes in the Pleistocene of California requires much careful investigation before a stage of understanding is reached comparable to that represented by Pleistocene history as now recorded in the region east of the Rocky Mountains.

Extensive trenching of the western region of Los Angeles now in progress should result in fuller knowledge of the geological events recorded in the area under consideration, and should establish more definitely the relationship of the Pleistocene deposits and faunas to those of the Recent. While the present report has not shown that the deposits containing the human remains are old in the sense that they belong to a geological period antedating the Recent period, the age of these beds and of the human remains might well be measured in terms of thousands of years, but not necessarily tens of thousands.

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"ANALYZED SOUND" IN NATURE

THE following is an account of an interesting group of phenomena, fundamentally alike, which have been noticed and described independently by five different observers, including myself. Comparing notes with one of these, Dr. Edward W. Emerson, resulted in his suggesting that I should put a description of his observations and mine together in an article, including also the description of two similar observations left with him by his uncle, Dr. Charles Thomas Jackson.[1] Soon after this conversation still another observation of a similar nature was made by Mr. Raymond Emerson, Dr. Emerson's son, and I am fortunate in being able to include a description of this which he has kindly furnished me. Still more recently Mr. W. Rodman Peabody has told me of another instnace of the same sort of phenomenon.

I can best place the data before the reader by simply giving the descriptions of these observations exactly as they were furnished me, and in the case of my own observation, as I wrote it down soon after I made it.

ANALYZED SOUNDS[2]

While engaged in the geological survey of Maine, I had occasion to make a trip through the forests from Farmington to Saddleback Mountain—and, after passing over a hill, we suddenly came in view of Saddleback between which and our party lay a large dismal swamp with a lake in the midst of it. The huge mountain range covered with snow stretched away for a great distance and presented so magnificent a sight as to call forth a shout from my party. The echo, after some moments, came back in musical tones, though the shout was anything but musical.

A fierce Indian war whoop was returned to us in the softest musical tones, not one of the discords being heard.

A gun was fired and the report came back in a *feu de joie* of long continuance and decidedly musical in its effect. Very discordant yells were made to try the effect, but only musical tones were returned. These interesting acoustic experiments were repeated for a long time with much amusement to the party—to me the matter seemed full of meaning—and was a subject of much reflexion.

While engaged in the earliest mining researches on Lake Superior, in 1844, a very curious instance of analyzed sounds was observed by F. W. Davis and myself—I had been sick and in consequence remained at the log cabin we had erected at Eagle Harbor on Keweenaw Point and sent out our miners to open a mine at Eagle River eight miles distant. Davis and myself set out one day to shoot some pigeons and while wandering not far from the shore in the cedar swamp near the harbor, we both suddenly stopped and listened to a sound which had reached our ears.

It was a melodious and solemn dirge in slow music like that I have sometimes heard in European cathedrals.

We listened for some moments before speaking, wondering where this music could come from. At first we thought it might be that our party of miners were returning and were chanting in the forest. To ascertain if such was the case, we ran in the direction the sound appeared to come from but in a short time we lost it. We then went down to the lake shore and looked up and down the coast from the point, but there was no boat and not a human being to be seen and no music was heard.

On returning to the spot where we first heard it, it was still heard there, but moving a few hundred yards either way, we lost it again. Much puzzled with this strange music of the woods, we returned to our cabin and found that old Jacob, our cook, was then engaged in his operations of making bread and had not been out of the cabin and had not been singing—indeed, he was no musician.

[1] Dr. Jackson was the geologist and chemist whose observation in 1842, of ether anesthesia, induced in himself, led to the introduction of this practice into surgery by Morton in 1846.

[2] From the notes of Dr. Charles Thomas Jackson, chemist and geologist.

To account for these musical tones, I supposed it was a case of analyzed sounds and on comparing the measure, I found that it corresponded to the rote of the waves on the pebbly shore. The vibration of the air produced by the constantly recurring surges was analyzed by the forest and we stood where we heard it in a focus of the echo. Similar phenomena were noticed by the late Francis C. Gray, Esquire, at the Picture Rocks on the north shore of the lake, music like that of a deep-toned organ coming from the pulpit rock, an inaccessible cliff of sandstone.

Thus it appears that when sounds mingled with discords traverse the forest, the foliage absorbs all the discordant notes and the reflected and returned sounds are all pure liquid harmonies.[3]

Is not this also a representation of human history? In the lapses of time the errors and wrongs of the past are lost and only the soft and pure music of truth is reflected back in the distant future—only the heroic and that worth preserving remain and errors are eliminated from the biography of men—and the good they have done lives after them.

Fear not then that any good you have done will be lost, or that malice and envy will poison the history of your good deeds. Time will, with its analytic prongs, separate, absorb and extinguish all the evil that has troubled the present and will fill the future with the harmonies of your noble actions and generous sacrifices.

"THE MUSIC OF NATURE"[4]

In 1862, July, when I was journeying westward with an emigrant train on the California trail, we rested in camp one Sunday to recruit the horses and mules. It was on the North Branch of the broad River Platte not far from Fort Laramie nearing the foot-hills of the Rocky Mountains. We were, therefore, at a considerable altitude. The air was fine and dry, the country an alluvial plain covered with grass, bounding the course of the river which, shallow and shifting, spread its broad waters, yellow and turbid with fine sand, over much country, even in summer. I was tired of the talk of the dozen or two of men, women and children, but the rare sight of a grove which had escaped the prairie fires attracted me. I walked alone into this group of large cotton-wood trees. These and the fringe of dwarf-willows along the stream attracted me after riding and walking for continuous weeks over treeless green plain. I left my mates for the restful solitude that the trees offered. As soon as I arrived there I was surprised by music strangely sounding in the direction of our camp. Yet whence did it come? When I reached camp, and asked whence, no one understood what I was talking about. There had been no music. Every one about camp was quite otherwise employed and no practical joker was about. Some years after, my mother's brother, Dr. Charles Thomas Jackson, surveying in Maine, had a similar experience, finding that at a certain distance his voice would carry in either direction with great distinctness, while nearer, perhaps in each direction, was silence.

The following account was furnished by Mr. Raymond Emerson in a letter dated May 13, 1922:

I was on a gasoline tug boat coming up the Slave and Athabasca rivers in Alberta, Canada, last September from Ft. Fitzgerald and Ft. McMurray. There was a strong current from 3 to 4 miles per hour running, and our boat consequently kept pretty close in shore to take advantage of all the eddies at the bends of the river. The shores were heavily wooded with spruce, jack pine, birch and poplar, and there were many stretches of several miles where the trees had been killed by fire. The tug was pushing a loaded scow and the exhausts of her engines were loud and rather sharp. The sound of these exhausts echoed back clearly from the high banks, but where the banks were low the echo was apparently broken up and came back as a musical rhythmical sound very much like the thrumming noise produced by a person striking the strings of a large harp. This sound was very noticeable and attracted the attention of all the men on both scow and tug. As soon as my attention was drawn to this musical sound I watched carefully to see how it varied with our distance from the shore, etc., and the result of my observation was that whenever we approached a part of the river with low banks and with a heavy growth of fire-killed trees, the sound became more musical, and its resemblance to the sound produced by a harp increased, where the trees were green it was less apparent, and where the banks were high and the boat close under them the musical quality was lacking and the echo came back clear and sharp—a true reflection of the report of the exhaust. The only explanation that occurred to me was that the sound waves were broken up by striking against the dead trees, which of course did not present a uniform reflecting surface; but each tree reflected a part of the sound, and this reflection was broken up into innumerable parts on account of the varying element of distance. When the boat moved a hundred yards or more out into the stream the musical effect decreased and disappeared entirely when we were over 200 or 300 yards away. I should add to the statement that both rivers have an average width of well over a mile, so that whatever echo we had came from the nearer bank only.

My own observation follows.

A SOUND WAVE PRISM

On July 27, 1903, while on a journey through the Bighorn Canyon in Southern Montana by boat, I set out in the morning from our camp at the mouth of the Bull Elk Creek to walk down stream along the right bank of the river, accompanied only by my dog. As I was walking down one of the sandy beaches on the river's edge I heard a howl, beginning at a high pitch and sweeping down into the bass clef. I stopped short and looked around; I could hear nothing but the roar

[3] Dr. Jackson told R. W. E. that this phenomena had never been treated scientifically except in a paper by Dr. Wollaston, and he called it "Analyzed Sound" E. W. E.

[4] Early experience of Edward W. Emerson.

of the river. I took a step backward and the howl reversed itself, starting low and rising to a high pitch. I then moved back and forth over the same ground and found the noise to be no more than the roar of the river, rising and falling like a siren. It seems the rocks around me formed a sort of sounding-board, treating the roar as a prism treats sunlight, placing the tones according to their pitch, the high in one place and the low in another.

I have no doubt the observation could be repeated if the exact spot were revisited at approximately the same time of year, *i.e.*, when the river was at the same height. As nearly as I can recall, the spot was only a few yards (probably five or ten) from the water's edge, and probably not more than a mile down stream from Bull Elk Creek.

Within a few days Mr. W. Rodman Peabody has described to me an interesting case of this phenomenon which he experienced some years ago.

He was travelling with a pack train in the Canadian Rocky Mountains. Some other members of the party had left the pack train in the morning and set out on foot on an all day hunting excursion. Late in the afternoon Mr. Peabody left the pack train at a convenient camping place and set out on foot to find the hunting party at a designated rendezvous where two streams met. He was scrambling down a steep ravine into the canyon where he expected to find the others, when at a point about a hundred yards from a mountain torrent he heard clearly what he took to be a man's voice. He said to himself, "That's W. trying to sing. It's out of tune; so it must be W." The point where he heard it was surrounded by coniferous trees. As he went on, the sound disappeared, but so sure was he that it had been his friend's voice that he fully expected to see him when he emerged from the woods a few yards farther on. To his surprise there was no one in sight. He searched for them till dusk, and then scrambled back up the ravine to the pack train. On his return he heard exactly the same sound as he traversed the place where he had heard it before.

He described it to the guides, and they said they had heard the Indians speak of hearing such things in the mountains, although they had not themselves experienced it. Mr. Peabody concluded that if these guides, although spending their lives outdoors in the mountains, had never noticed this striking phenomenon, it must be of rare occurrence.

Dr. Emerson, in sending the above descriptions, called attention to a passage in the poem entitled "May Day" by his father, R. W. Emerson, which clearly was suggested in part by the observations of Dr. Jackson.

None can tell how sweet,
How virtuous, the morning air;
Every accent vibrates well;
Not alone the wood-bird's call,
Or shouting boys that chase their ball,
Pass the height of minstrel skill,
But the ploughman's thoughtless cry,
Lowing oxen, sheep that bleat,
And the joiner's hammer-beat,
Softened are above their will,
Take tones from groves they wandered through
Or flutes which passing angels blew.
All grating discords melt,
No dissonant note is dealt,
And though thy voice be shrill
Like rasping file on steel,
Such is the temper of the air,
Echo waits with art and care,
And will the faults of song repair.
So by remote Superior Lake,
And by resounding Mackinac,
When northern storms the forest shake,
And billows on the long beach break,
The artful Air will separate
Note by note all sounds that grate,
Smothering in her ample breast
All but godlike words,
Reporting to the happy ear
Only purified accords.
Strangely wrought from barking waves,
Soft music daunts the Indian braves,—
Convent-chanting which the child
Hears pealing from the panther's cave
And the impenetrable wild.

In Volume IX of the Centenary Edition of the complete works of R. W. Emerson, there appears an explanatory note (inserted by Dr. Emerson) referring to this passage in the poem, and giving a condensed statement of his own observation and those of Dr. Jackson, which shows the origin of the idea expressed in the poem. In this note Dr. Emerson mentions waves breaking on the shore of the river as the source of the sound in his own observation.

All the phenomena described above seem to be instances of differential reflection or absorption of sound waves of different pitches. In every case the source of the sound—waves on a beach, roar of a river, exhaust of motor boat or discordant human voice—was one in which many pitches were present. Something in the surroundings, usually trees, must have separated the sounds according to pitch, placing those of one pitch in one place and those of another pitch elsewhere. In this respect the phenomenon appears analogous to that of white light being broken up into pure spectral colors by a prism or diffraction grating. In the original description of my own observation I made no mention of trees. As I recall it, the place where I heard the "howl" was an open one, but there were scattering trees not far away. It is interesting that this phenomenon has been noted in such a variety of natural conditions.

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