

In conclusion, I have met only two eagles inhabiting the Province, the Golden Eagle, the *aquila antiquorum*, the bird of Jove, of Cæsar, the type of the white, red, black, and double headed Teutonic family, and of the first Napoleon; the second or Bald Eagle, our great neighbour has adopted as their symbol.

We may say that the old world having first choice has the finer bird, yet a great maritime country is well symbolised by a Sea Eagle; and Nova Scotians may well say, glancing at our plundered fishing grounds—a fishing one.

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ART. III. THE GREAT AMERICAN DESERT. BY HENRY S. POOLE ESQ., F. G. S., &c., *Govt. Inspector of Mines.*

(*Read Jan. 18, 1878*)

A POPULAR lecturer recently speaking of the Great North-West referred to a map on the wall, and pointing to a great region of country which extends from the parallel of the north fork of the Platte River to the Sierra Nevada, and from the boundary line of British Territory to Mexico, spoke of it as the Great American Desert. To the immigrant pushing across the continent to the golden state, California, it formerly doubtless did seem to be all desert. For after leaving the rich loomy soil of Illinois and Iowa, and the rolling prairie of Nebraska, bright with many-colored flowers, he entered on a region which grew more and more desolate as he advanced towards its centre, and yet he seldom found any of it so poor but that it afforded sufficient nourishment for his cattle, and enabled him with their aid, after many weary months of incessant toil, to reach his destination.

But it is not to that immense region, now better known, and no longer spoken of as *the* desert, that I desire to draw your attention. It is merely to a portion of it that lies nearly in the centre, and forms but a small part of the whole of the country. Without doubt there are in the region referred to by the lecturer, besides the desert that is a desert beyond question, extensive tracts of most desolate and forbidding looking country, as equally ill adapted for cultivation as

the saline plains of the Saskatchewan, or a Bay of Fundy mud flat at low tide. Still as there are many fertile valleys among the mountains naturally well watered, and many extensive plains that need only irrigation to make them blossom as the rose, the term Great American Desert has become restricted to and is now only applied to that comparatively small district, which lies immediately to the west and south-west of the Great Salt Lake in Utah Territory. The northern border of this region is skirted by the Central Pacific Railroad; but before the trans-continental traveller from the east becomes acquainted with its dreary expanse, he has to traverse the passes of the Wahsatch Mountains, where his attention is drawn to the bold scenery of Echo and Weber Cañons, and where as he scans the rugged sides of those passes for glimpses of the picturesque spots, or for unfamiliar views of towering crags and overhanging precipices, he will perchance as he nears Ogden (the junction of the Union and Central Pacific roads,) notice horizontal and parallel lines more or less distinctly marked on the sides of the Cañon. These lines on a nearer approach are seen to be made of wide "beaches", or, as they are locally called, "benches" of gravel, which having a gentle inclination plainward extend in a series of terraces from the foothills of the mountains to the bed of the cañon and margin of the lake. The attention once called to this peculiar feature of the landscape, the eye naturally wanders over the wide view which is presented when the valley of the Great Lake is reached, for further confirmation of the well known theory which their appearance calls to remembrance:—that they are the "beaches" formed by the lake when its waters stood at a much higher level than they do at present.

Through the clear air the continuations of these horizontal lines are seen for miles girdling the mountain sides and the rocky islands in the lake. The more this feature of the landscape is considered, the more conclusive does the evidence seem that each terrace marks the position at which the landwash of the great sea once stood, and that the present lake, large as it is, is but the remnant of one a hundred times greater.

But it is on the borders of the great desert where a wider range gave freer scope to the ancient winds and storms to stir up the

waters of the lake, and scour its shores, that a remarkably well defined beach is most plainly visible. Of so recent a formation does it appear to be, when seen from a distance, that it forcibly reminds the Nova Scotian of the wide beaches and broad spread detritus that surround the islets and headlands of the Bay of Fundy. This desert and its neighbourhood greatly interested me, on account of its peculiar physical characteristics and distinctive features.

From Salt Lake City the most direct trail west skirts the southern margin of the lake, passing close by some hot sulphur springs that bubble up in the fine loomy mire of its margin, by the foot of the Oquirrh Mountain range, where the waters of the lake wash the only stretch of beach to be met with on its southern and eastern boundaries, then along a natural causeway which curves across the flats of Tooele valley and is evidently the remains of a former beach ridge, similar in character to the "boar's back" of Cumberland county, only that it is composed of finer materials—gravel and sand. At the head of the valley ten miles distant, at an elevation of 600 feet above the lake, a very much heavier bar exists entire, which damming back the natural drainage of Rush valley forms Stockton Lake, a lake of fresh water. The trail then skirting the promontory of the Onaqui Mountains, turns south up Skull Valley and leads by a gradual ascent to the divide on the mountain range which overlooks the Great American Desert. From this point at an altitude of 1800 feet above the plain, I obtained a view of exquisite grandeur. At the foot of the steep descent lay the desert, spreading far and wide, with patches of snow on its surface, reflecting, like pools of water, the rays of the setting sun. Immediately in front and apparently at no great distance, though nearly eighteen miles off, the Granite Mountain, the camping ground for the night, lay alone in the desert. Beyond it were the low-lying ranges which border the desert on the west, and further on the Mountains of Nevada. To the right, more than one hundred miles away, the high peaks of Southern Idaho were visible, beyond the northern boundary. But the mind, bewildered by the vast extent of the vista, could hardly direct the attention to localize the unfamiliar

objects, before a low-hanging cloud, its upper surface as it were spray of great waves, dashed by the tempest against the mountain islands and frozen at the instant, rapidly approached, obscured the plain and changed the scene like a dissolving view. This picture was but of short duration, for the cloud quickly advancing soon enveloped me in its misty folds, and left nothing but an ill-defined view of plain and looming mountain visible.

From the Granite Mountain the trail speedily leads to the lowest part of the desert, where no grease-wood or even sage brush grows, and where the mud baked in the dry season glitters with its salt incrustation. Like the sediment on the banks of the Avon it separates into thin layers, but when wet from recent rains is as adhesive and slippery as mud well can be, balling horses' feet much worse than the damp snow does here in the month of March. This mud has a perfectly level surface, and occupies the lower portion of the desert. As the shore of this dried up sea is approached, a gradual though all but imperceptible ascent being made, the character of the detritus from being fine clay becomes more and more sandy; and the sand not baking on the surface as the mud of the interior, gets blown during the dry season into hillocks, and little mounds round each clump or isolated sage bush. It also takes the form of long ridges stretching from point to point at the mouths of bays, or encircling the quondam islands, often many miles from their base, presents the character of sand bars, having gradually sloping faces seaward, and with steep declivities landward, shuts off what must have been immense lagoons from all but slight connexion with the outer sea. A bar of similar character now separates the desert from the high water line of the western shore of the great lake, and as the elevation of the bed of the desert cannot be many feet above the surface of the water in the sea, there may be some truth in the Indian tradition, that long ago the greater portion of this region was permanently under water. It is well known that, after heavy winter storms, wide sheets of shallow water stretch for miles over the desert. Dammed back from the lake the water can only pass off by absorption, or evaporation. It

has been shown by comparing the records of a series of years that the level of the great lake varies.

From the accounts of the early settlers, it appears that the amount of rain-fall largely increased from the time of their first arrival until a year or two ago, when a retrograde decade commenced. They affirm, that during that period the level of the Great Salt Lake rose as much as nine feet, above the height it occupied at the time of their first advent into the valley; and also that in consequence of the increased precipitation the waters of the lake became less saline, in the proportion of 3 to 7—a proportion determined by the quantity of water required to yield the same amount of salt in the pans. As a further confirmation of their statement, they say that the islands in the southern end of the lake could, in early days, be reached on horseback, while now they can only be gained by boats.

A very interesting “tide guage” is to be seen, in a mound on the edge of the lake opposite the village of Bountiful. At the present day only the top of the mound is above water, but ten years ago the edge of the lake was so far from it that a settler thought the surrounding land could be sufficiently drained, and otherwise prepared for crops. He consequently began to cut drains and break up the soil by ploughing and deep trenching, hoping in three years or so, to find the surface sufficiently washed from salts to allow of his planting wheat and corn. His hopes were disappointed, but in ploughing over the top of the mound, he turned up fragments of rude pottery, and a stone similar in shape to the hollowed stones now used by the Arapahoes and other maize-growing Indians of the present day to bruise their corn. Similar mounds were cut open in building the Utah Central Railroad through the valley. It would therefore seem that when the sedentary tribes of Indians, who inhabited the valley previous to the incursion of the Piutes and other predatory tribes, who occupied it on the arrival of the whites, the level of the lake was even lower than at the time when the Mormons first settled the country. That the Salt Lake is not altogether lifeless has been recently proved by the discovery of a crustacean—*Artemia salina*—in its

waters. The species is very similar to that found in the salt pans of Europe.

Returning to the desert where we left the trail, to consider the variations of level in the lake, the old overland stage route, after passing the outlying belt of sand hills, traverses the ancient beach, which starts from the mountain side fully nine hundred feet above the lowest part of the desert, and extends seaward, if I may so term it, for as much as four miles in some places, before the gravel gives place to sand, and for many more miles before the region of salt mud and utter desolation is attained. The whole face of the beach shows evidence that many periods of cessation took place, during the subsidence of the waters. In places, sections of the materials which compose the beach are shown: beds of fine white sand partly cemented, lie interstratified with beds of coarse gravel. In sheltered ravines I have counted eighteen bench lines within an elevation of two hundred feet. In other and exposed places the sloping faces would be of great length, and represent an elevation of one hundred feet or more between the lines of change of grade, as round the points of the old promontories, and in positions parallel to the general course of the plain and valleys. These wide benches would seem to mark the more permanent stages in the general subsidence, and the numerous lines seen in the better sheltered bays, to point to intermediate stages of shorter duration, which on the exposed shore became obliterated by the fluctuations of level in the lake, and by the wash of waves during storms. Again in large land-locked bays, as the present Camp Floyd valley, where a stretch of country twenty-five miles long, by eight wide, has the range of mountains lying parallel to the line of drainage; there a uniform slope of about seventy feet to the mile is seen without any bench lines or divisions into terraces, except it may be round the mounds at the base of points of rocks, and outlying foot hills.

These benches, indubitably prehistoric beaches, cannot fail to be noticed in others of the low-lying valleys of the country known as the "great interior basin," and which includes all Nevada and half of Utah; an area of at least 150,000 square miles. Besides the prominent benches, noticed by every one, a close inspection in

certain districts of the region reveals indications, not very distinct, but suggestive of doubt whether the ancient sea did not extend to even a greater altitude, than where the well-marked terraces define its sometime boundary: a doubt which further attention to the subject almost changes into a belief. The old overland road after leaving the desert, and before entering the confines of Nevada, crosses the Deep Creek, which flows through a narrow elevated valley, on the sides of which at an elevation of 1800 feet above the lake, great beds of gravel uniformly deposited, and evidently by water, have the same parallelism which is so discernible in the valleys opening into the Desert and Great Salt Lake. The lines of level which elsewhere cannot fail to catch the eye, are here through time almost obliterated, and can only be detected when viewing an extended range of country.

What has been the origin of these gravel beds? For beds of a similar character are also to be met with in many other elevated valleys. They are evidently not fluvial. Are they lacustrine; or can they possibly be marine? Lying as they do truly horizontal, it is highly improbable that they can be marine, and were formed when the mountain ranges as islands were emerging from the ocean. Were this possibly the case, then the whole of that country lying between the Wahsatch and the Sierra Nevada must have been bodily elevated 6,000 feet without tilting or breaking in any degree the uniformity of these superficial deposits. And yet if the valleys of this elevated region were not filled by the action of marine denudation, we are forced to conclude, improbable as it may at first seem, that they were by subaërial agency, and that the agent which formed the benches was a lake of fresh water.\* A lake which must have extended over the major part of the greater interior basin, and have had its surface at one time, nearly, if not quite, 2,000 feet above the present level of the Salt Lake. It is

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\* In digging a well near Salt Lake City, fresh water shells were found some forty feet below the surface in the gravel deposits, and on the north side of the lake, the cuts on the railroad, through the gravel and sand, reveal the greatest abundance of fresh water shells. The species that seem to have been most abundant is *Fluminicola fusca*. Varieties of *Limnea*, *Valvata* and *Amnicola*, were also discovered.—HAYDEN.

hard to contemplate what physical changes must have taken place in the adjacent regions of the continent since the earlier days of the present epoch when this immense lake existed, so to affect the climate of a country which for a lengthened period undoubtedly was humid, but is now arid for at least the greater part of the year.

It is evident that for countless ages this great inland sea existed, and receiving the detritus washed from the shores of the numerous chains of islands studding its surface, distributed it according to the size of the particles in the valleys adjacent; carrying the fine sediment to the centre of the valleys, and leaving on its shores the coarser material to form the gravel benches which now belt the mountain ranges. The thickness of these deposits is as yet undetermined. The deepest wells yet sunk have only reached a depth of two hundred feet, and merely show that the materials composing the benches are not all uniform in size. Beds of coarse gravel give place and alternate with beds of fine gravel and sand. Here and there through the deposit, boulders of stone record the existence of ice at times in the days of this ancient lake. The action of ice, probably in the form of glaciers, is also recorded in the well rounded stones found in the gravels of the most elevated valleys, which stones have been fractured and re-cemented together, as are those of a similar character found in the terminal moraines of existing glaciers. From the great width of the main valleys and the precipitous sides of the mountain ranges, I have little doubt but that the bottoms of the valleys were originally much below their present position, and that they have been filled in with detrital matter to the depth of many hundreds, if not thousands of feet.

An apparent further confirmation of the great altitude which the surface of the lake attained in former times is to be seen at Bingham Cañon on the east side of the Oquirrh Mountains, where at a height of 300 feet above the present bed of the cañon and close to the town, a portion of the old bed remains on the side of the mountain. This bed had a steep descent towards the plain, and yet became choked with great water worn boulders of the country rock. In the clay and with the fragments of quartz veins which fill the interstices between the boulders much of the gold which gives Bingham its celebrity as a mining camp, is found. It is



just probable that when the highest benches along the foot hills were formed, they acted as a dam at the mouth of the canon, on the free discharge of the mountain torrent before the general subsidence began, and the old bed became choked with the great boulders which now fill its course.

It is interesting to note that nowhere in all the region of the great interior basin are there any outlets for the drainage of the country. All the moisture which falls is carried off by evaporation. It is supposed by some that there was an outlet for the waters of the ancient lake by the Snake River Pass into the channel of the Columbia River, which flows through Oregon into the Pacific. Whatever may have been the destination of the water in old times, the Great Salt Lake is now the receptacle of all the drainage of the North Eastern portion, while other smaller lakes or sinks terminate the existence of many torrents that rush impetuously and in great volume from the mountain gorges in other sections of the country. Generally these mountain streams flow but a short distance after leaving the rocky bed of the cañon before they are totally absorbed in the deep alluvium of the plains. Some, however, do flow into perennial lakes that are either alkaline or saline; but to sink in a morass is the general destiny of a mountain stream.

Springs also, which in certain districts are numerous, and often of great volume, give rise to streams that originate only to share the common fate, and be lost in their immediate neighborhood. Sometimes these springs burst up in the plain several miles away from the base of the mountains. Those of pure water frequently swarm with fish—mountain trout and suckers. From some the water flows hot, and charged with sulphuretted hydrogen; and from others cold, and contaminated by contact with the alkaline soil through which they rise.

The scarcity of water in this region contrasts strongly with the numerous brooks and rivers we find intersecting this Province in all directions. Water there is a marketable commodity, and is sold either by the inch or hour. It is an object of first consideration to the freighter slowly journeying over the country, to the farmer striving to make a moderate income from the natural fertility of the

soil, and to the miner desirous of the aid of steam to help him extract from the mine his expected fortune.

The scarcity of water restricts the growth of timber to certain districts, and explains the application of the term "treeless wastes," which has been applied to the plains.

In summer, showers are of much more frequent occurrence on the mountains, and fall much heavier on the timbered ranges than on the foothills and valleys. In general a summer storm which drenches the mountain sides affords but at most a gentle shower or temporary shade to the treeless plain. Even the snows of winter fall lightly on the plain, while storms almost daily rage among the peaks of the Wahsatch. Looking at any mountain range, it will be noticed that the Southern slopes of the spurs, parched by the rays of a constantly blazing sun, are utterly barren, while the opposite sides, having a Northern aspect, are heavily clothed with timber. The dark shade of the pine trees deepens the shadows cast in the ravines, and heightening the contrast, throws the crests of the mountain spurs into greater relief.

Wherever in the valleys there is a constant supply of water, trees will grow, as they naturally do along the courses of the streams or artificial irrigation ditches. Again on the foothills clumps of cedar grow wherever springs, which may not even show themselves at the surface, keep the ground moist. I lately referred to the enormous quantity of detrital matter which torn from the mountain sides had been ground down, comminuted and carried off into the depressions between the ranges until it had filled them up and made the present great stretches of plain and valley. The period of time necessary to produce changes so extensive must at least have been great if not incalculable. The very changes themselves would produce such modifications of the surface as to bring fresh elements into the calculation, and reduce the most careful estimates to but wild guesses.

Besides the silting up of the valleys other evidences remain to show the extent of the denudation. Even on the mountain sides there are monuments to point to the wear and tear due to the elements. Castle rock and Pulpit rock in Echo Cañon, and the "red buttes" on the plains of Laramie, are some of these.

Pinnacles also, either isolated or arranged in groups, stand out of the rounded hill side or denuded plain, and resemble the *roches perchés* on pillars of ice on the great *mers de glace* of the Alps. Professor Tyndal has clearly explained how the blocks of stone became perched on pillars of ice on the surface of the *mers de glace*. Similarly these pinnacles capped with blocks of sandstone, more compact and less friable than the conglomerate that composes their shafts, were doubtless formed.

The harder and more enduring blocks of sandstone, fragments of an overlying bed, have protected the more perishable red conglomerate from the disintegrating action of the heavy rains, while the general level of the country was being reduced; and these pinnacles remained to mark its position in times gone by.

Another interesting record similar in character to that preserved by the "red buttes" is the Devil's Slide, as it is called, in Echo Cañon. Two parallel dykes of syenite some four to eight feet thick and close together, rise abruptly to a height of twenty feet above the surface of the mountain side.

The extent of the effect of the subaërial agents on the constituents of mineral veins, in this region, furnishes still more conclusive evidence of the great period of time which has elapsed since the waters of the great lake receded from their more elevated levels to their present position.

In the beds of certain of the canons and on the mountain sides where the strata are of such a nature as to retain the water, there we yet find even at great elevations the constituents of the lodes as sulphurets. But where by natural channels the water absorbed by the ground in the wet season is allowed to drain away, the warm air, containing of course carbonic acid, which filters in, has an opportunity to act on the mineral substances contained in the vein, decomposition is set up and oxidation of the sulphurets takes place in a degree proportionate to the facilities offered by the structure of the vein, and the tendency of the minerals to decompose under such circumstances.

Now since even down on the foothills, the outcroppings of galena lodes are found to consist of cerussite, with here and there

a nucleus of galena, the purity of which has alone effectually resisted the slow combustion which the favorable conditions for the admission of moisture, warmth, and air, have established in the vein where the more easily decomposable iron pyrites are intermixed with the galena, we are forced to conclude that a considerable length of time must have passed away since these veins were first exposed by the subsidence of the lake to the action of the agents of the atmosphere, to allow the decomposition to extend to the depth to which by mining, it is often found to have gone.

In the veins in the limestones of Camp Floyd and Lyon hill, the outer portions are found to contain chloride and chlorobromide of silver, which in depth give place to ruby silver, and at still greater depths, to sulphides and antimonial silver ores. The limestones being open have allowed the action of the elements to transform the sulphides and antimonides into oxides and chlorides of silver, even to a depth of one and two hundred feet.

The Jordan property, the oldest location in Utah, has enormous deposits of carbonate ore, averaging 60 per cent. in lead, cropping to the surface, which in depth, as soon as water is struck, gives place to unconverted galena. As much of this galena is largely mixed with iron pyrites, which the decomposition in the upper portion of the vein changed into sesquioxide of iron, a base rather beneficial than otherwise for the reduction of the ore in the blast furnace, the value of the property which the appearances on the surface indicated is greatly reduced.

The ores from the great Emma mine also supply excellent examples. The specimens on the table show all the stages of change. The nucleus of each nodule being either of galena or of undecomposed sulphoantimonide of lead and silver, is encased by partially oxidized compounds and carbonate of lead and oxide of silver.

I have here a very interesting mineral, the remains of a rodent encased in lead ore. It was found in the Silver Exchange on Lyon Hill. The country rock there is limestone; and fissures penetrate it to a considerable distance. The animal, probably a ground squirrel, to which this portion of a lower jaw belonged, must have

found its way into the fissure to die, or the body must have by some means been carried in, previous to the washing down of the lead ore from higher levels, or before the waters carrying the lead in solution precipitated it on these remains. A mineral vein is a most unusual position in which to find organic remains; and the modernness of these clearly demonstrates the changes which mineral veins are subject to under the favorable conditions which this region presents.

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ART. IV. ON THE STONE AGE OF NOVA SCOTIA. BY J. BERNARD GILPIN, A. B., M. D., M. R. C. S.,

(*Read Feb. 10, 1873.*)

WRITERS upon the Stone Age of the old world know nothing of the habits, the manners, not even the forms of the prehistoric men who fashioned those stone axes and celts, (almost their only record) which have of late excited so great interest. The age of Bronze is a myth. The age of Stone has swallowed every myth in its fabulous antiquity. Not so when we study our own stone period. We know from contemporaneous writers their forms, their habits, their clothing, their wars, their peaces; we can bring to the mind's eye the brown hands that toiled over pointing an agate, or ground down the edge of an axe,—the dusky red man who fished the short summer, hunted the long winter, eat of no bread, asked nothing of the fair land he lived in, but shelter for his game, and its profusion of wild berries which it cost him no toil to gather.

Among the gentlemen who followed DeMonts in planting in the year 1603, the French colony at Port Royal, now Annapolis, Nova Scotia, was LesCarbot. From an old and rare translation (London 1712,) of his original work published 1607 in France. from the library of T. B. Akins, Esq., I quote the following particulars of the habits of our Nova Scotian Indians, at the period of 1603, now two hundred and seventy years gone, and what may be called the end of their stone age. When it began, we can scarcely conjecture.