

glacier. (It is but a few miles north to where Hudson River rock dips under upper silurian.) Evidences that they are masses of Drift are found in the irregular way in which the rocks lie at all angles, and in the fact that where the lower rock is exposed in the cut the under side is glaciated as if by moving over other rocks.

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RELATION OF KINGS COUNTY TRAPS TO THOSE OF CUMBERLAND COUNTY, N. S.  
By V. F. MARSTERS.

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AN ACCOUNT OF VEGETABLE AND MINERAL SUBSTANCES THAT FELL IN A SNOW  
STORM IN LAPORTE COUNTY, JAN. 8-9, '92. By A. N. SOMERS.

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SOME POINTS IN THE GEOLOGY OF MT. ORIZABA. By J. T. SCOVELL.

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BRITISH COLUMBIA GLACIERS. By C. H. EIGENMANN.

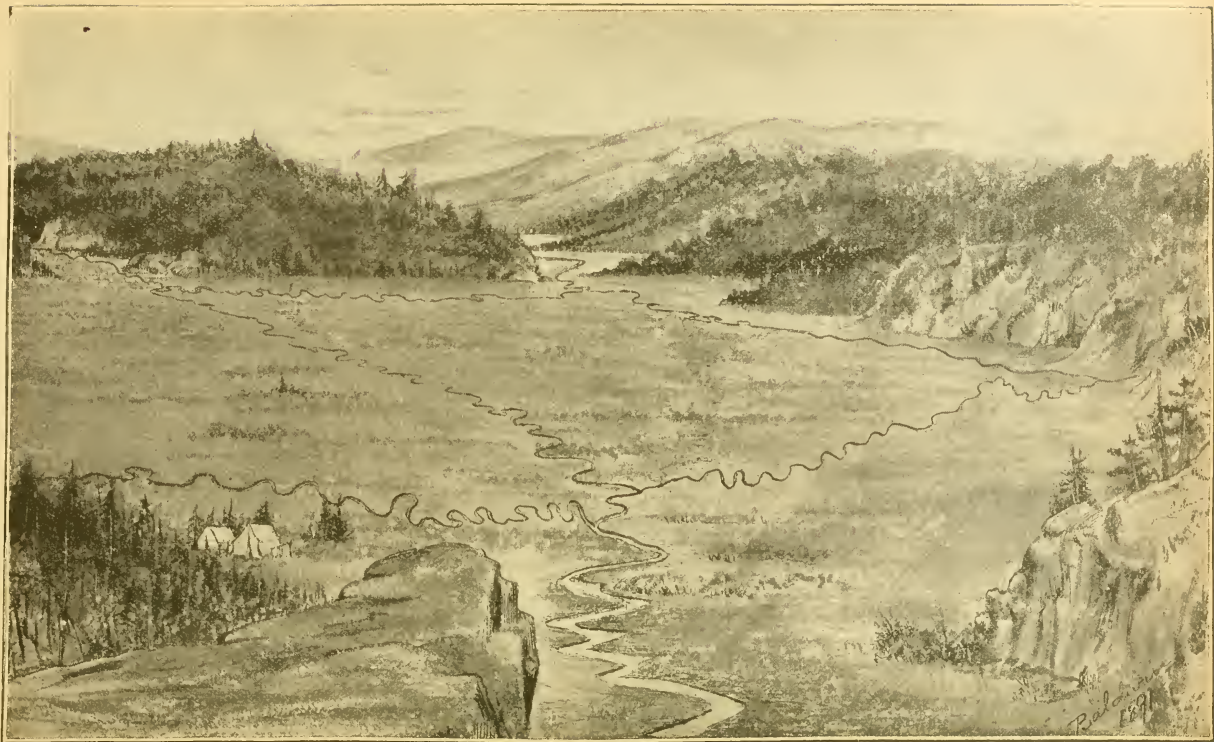
An account was given of the ascent of "The Glacier" in the Selkirks in British Columbia. A number of photographs were shown of the foot of the glacier.

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TWO-OCEAN PASS. By BARTON W. EVERMANN.

[ABSTRACT.]

It was probably in Pliocene times that the great lava-flow occurred in the region now known as the Yellowstone National Park, which covered hundreds of square miles of a large mountain valley with a vast sheet of rhyolite hundreds, perhaps in places, thousands of feet thick. It is certain that such streams and lakes as may have exist'ed there were wiped out of existence, and all terrestrial and aquatic life destroyed. It must have been many long years before this lava became sufficiently cooled to permit the formation of new streams; but a time finally came when the rains,



R. L. ...  
1891

TWO-OCEAN PASS.

falling upon the gradually cooling rock, were no longer converted into steam and thrown back into the air, only to condense and fall again, but being able to remain in liquid form upon the rock, sought lower levels, and thus new streams began to flow. The rhyolite, obsidian, and trachyte were very hard and eroded slowly, but when the streams reached the edge of the lava-field they encountered rock which was comparatively soft and which wore away rapidly. The result is that every stream leaving the Yellowstone Park has one or more great waterfalls in its course where it leaves the lava-sheet. Notably among these streams are Lewis River, the outlet of Lewis and Shoshone lakes, Yellowstone River, the outlet of Yellowstone Lake, Gardiner, Gibbon, and Firehole rivers, and Lava, Lupin, Glen, Crawfish, Tower and Cascade creeks, all leaving the lava-sheet in beautiful falls, varying from 30 feet to over 300 feet in vertical descent. With scarcely an exception, all these streams and lakes are of the best of pure, clear, cold water, well supplied with insect larvæ, the smaller crustacea, and various other kinds of the smaller animal and plant forms sufficient in amount to support an immense fish-life. But it is a strange and interesting fact that, with the exception of Yellowstone Lake and River, these waters were wholly barren of fish-life. The river and lake just named are well filled with the Rocky Mountain trout (*Salmo mykiss*), and this fact is the more remarkable when it is remembered that the falls in the lower Yellowstone River are 109 and 308 feet, respectively, by far the greatest found in the Park.

The total absence of fish in Lewis and Shoshone lakes and the numerous other small lakes and streams of the Park is certainly due to the various falls in their lower courses which have proved impassable barriers to the ascent of fishes from below; for in every one of these streams just below the falls trout and, in some cases, other species are found in abundance. But to account for the presence of trout in Yellowstone Lake was a matter of no little difficulty. If a fall of 30 to 50 feet in Lewis River has prevented trout from ascending to Lewis and Shoshone lakes, why have not the much greater falls in the Yellowstone proved a barrier to the ascent of trout to Yellowstone Lake? Certainly, no fish can ascend these falls and we must look elsewhere for the explanation.

Many years ago the famous old guide, Jim Bridger, told his incredulous friends that he had found on the divide west of the Upper Yellowstone a creek which flowed in both directions—one end flowing east into the Yellowstone, the other west into Snake River. But as he also told them

about many other strange, and to them impossible things which he had seen, among which were a glass mountain, and a river which ran down hill so fast that the water was made boiling hot, they were not disposed to acknowledge the existence of his "Two-Ocean Creek." Subsequent events, however, showed that the strange stories of Jim Bridger were not without some elements of truth.

Two-Ocean Pass was visited by Capt. Jones in 1873, by Dr. F. V. Hayden in 1878, and by Mr. Arnold Hague in 1884. The observations made by these various explorers seemed to indicate that Two-Ocean Pass is a nearly level meadow, near the center of which is a marsh which, in times of wet weather, becomes a small lake, and that "a portion of the waters from the surrounding mountains accumulate in the marshy meadows and gradually gravitate from either side into two small streams, one of which flows to the northeast, the other to the southwest." (*Hayden.*)

From these reports it began to be suspected that trout, ascending Pacific Creek from Snake River, might in time of high water, pass through the lake in Two-Ocean Pass and descend Atlantic Creek and the Upper Yellowstone to Yellowstone Lake, and thus would the origin of the trout of that lake be explained. Dr. Jordan, who spent some time in the Park in 1889, was impressed with the probable correctness of this explanation, but did not visit Two-Ocean Pass.

In 1891, while carrying on certain investigations in Montana and the Yellowstone Park under the direction of the United States Commissioner of Fish and Fisheries, Colonel Marshall McDonald, I was instructed to visit Two-Ocean Pass and determine definitely the conditions which obtain there.

On August 7, accompanied by Dr. O. P. Jenkins and Mr. Burnside Clapham, we started out from Mammoth Hot Springs with a pack-train of ten pack-horses and eight saddle-horses. Our route led us through all the Geyser Basins of the Park and we reached Two-Ocean Pass August 17, where we remained long enough to make a careful examination. This pass is a high mountain meadow, about 8,200 feet above the sea and situated just south of the Park, in long.  $110^{\circ} 10'$ , lat.  $44^{\circ} 3'$ . It is surrounded on all sides by rather high mountains except where the narrow valleys of Atlantic and Pacific creeks open out from it.

Running back among the mountains to the northward are two small cañons, down which come two small streams. On the opposite side is another cañon, down which comes another small stream. The extreme

length of the meadow from east to west is about a mile while the width from north to south is not much less. The larger of the streams coming in from the north is Pacific Creek, and, after winding along the western side of the meadow, turns abruptly westward, leaving through a narrow gorge. Receiving numerous small affluents, Pacific Creek soon becomes a good-sized stream, which finally unites with Buffalo Creek a few miles above where the latter stream flows into Snake River.

Atlantic Creek was found to have two forks entering the Pass. At the north end of the meadow is a small wooded cañon down which flows the North Fork. This stream hugs the border of the flat very closely. The South Fork comes down the cañon on the south side, skirting the brow of the hill a little less closely than does the North Fork. The two coming together near the middle of the eastern border of the meadow form Atlantic Creek which, after a course of a few miles, flows into the Upper Yellowstone. But the remarkable phenomena exhibited here remain to be described.

Each fork of Atlantic Creek, just after entering the meadow, divides as if to flow around an island, but the stream toward the meadow, instead of returning to the portion from which it had parted, continues its westerly course across the meadow. Just before reaching the western border the two streams unite and then pour their combined waters into Pacific Creek; thus are Atlantic and Pacific Creeks united and a continuous water way from the mouth of the Columbia via Two-Ocean Pass to the Gulf of Mexico is established. Two-Ocean Creek is not a myth but a verity, and Jim Bridger is vindicated.

Pacific Creek is a stream of good size long before it enters the pass, and its course through the meadow is in a definite channel, but not so with Atlantic Creek. The west bank of each fork is low and the water is liable to break through anywhere and thus send a part of its water across to Pacific Creek. It is probably true that one or two branches always connect the two creeks under ordinary conditions, and that following heavy rains or when the snows are melting a much greater portion of the water of Atlantic Creek finds its way across the meadow to the other.

Besides the channels already mentioned, there are several more or less distinct ones that were dry at the time of our visit. As already stated, the pass is a nearly level meadow, covered with a heavy growth of grass and many small willows 1 to 3 feet high. While it is somewhat marshy in places it has nothing of the nature of a lake about it. Of course during

wet weather, the small springs at the borders of the meadow would be stronger, but the important facts are that there is no lake or even marsh there and that neither Atlantic nor Pacific Creek has its rise in the meadow. Atlantic Creek, in fact, comes into the pass as two good-sized streams from opposite directions and leaves it by at least four channels, thus making an island of a considerable portion of the meadow. And it is certain that there is, under ordinary circumstances, a continuous waterway through Two-Ocean Pass of such a character as to permit fishes to pass easily and readily from Snake River over to the Yellowstone, or in the opposite direction. Indeed, it is possible, barring certain falls in Snake River, for a fish so inclined to start at the mouth of the Columbia, travel up that great river to its principal tributary, the Snake, thence on through the long, tortuous course of that stream, and, under the shadows of the Grand Tetons, enter the cold waters of Pacific Creek, by which it could journey on up to the very crest of the Great Continental Divide, to *Two-Ocean Pass*; through this pass it may have a choice of two routes to Atlantic Creek in which the down-stream journey is begun. Soon it reaches the Yellowstone down which it continues to Yellowstone Lake, then through the Lower Yellowstone out into the turbid waters of the Missouri; for many hundred miles it may continue down this mighty river before reaching the Father of Waters which will finally carry it to the Gulf of Mexico—a wonderful journey of nearly 6,000 miles, by far the longest possible fresh-water journey in the world.

We found trout in Pacific Creek at every point where we examined it. In Two-Ocean Pass we found trout in each of the streams and in such positions as would have permitted them to pass easily from one side of the divide to the other. We also found trout in Atlantic Creek below the pass and in the Upper Yellowstone where they were abundant.

Thus it is certain that there is no obstruction even in dry weather to prevent the passage of trout from the Snake River to Yellowstone Lake; it is quite evident that trout do pass over in this way; and it is almost absolutely certain that Yellowstone Lake was stocked with trout from the west via Two-Ocean Pass.

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GRINNELLIA AMERICANA. By M. A. BRANNON.

*Grinnellia Americana* is one of the most interesting and beautiful marine plants found along our Atlantic coast. So far as known, it ranges