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The Dæmme Vand, or Rembesdal Glacier-Lake, Norway

Author(s): A. F. Mockler-Ferryman

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NOTE ON DR. GREGORY'S MAP.—Dr. Gregory's sketches are based upon compass-bearings and an estimate of distances. They have been adjusted to the Mombasa Railway survey, and to Lieut. von Hühnel's surveys whilst attached to the expeditions of Count Teleki and Mr. Chanler.

The following corrections should be made on the Map, which was issued with the October number: Delete *Doenyo Gelesha* and the *altitudes* on Laikipia. Correct the following altitudes:—

Lake Baringo, for 3300 read 3200	Longonot, for 8,700 read 9,350
Equator Peak, „ 6300 „ 6150	Jabe Hill, „ 8,500 „ 8,200
Lake Naivasha, „ 6350 „ 6200	Kenya, „ 18,370 „ 19,000

Correct the following place-names:—

For Mau Escarpment read Mau Scarp.	For Tuni read Juni.
„ Rangata Yanoki „ Rangata Nyuki.	„ Loet Divis „ Loel Divis.
„ Lesigria „ Lesuria.	„ Elmentieita „ Elmetaita.

THE DÆMME VAND, OR REMBESDAL GLACIER-LAKE, NORWAY.

By Captain A. F. MOCKLER-FERRYMAN.

THE peculiarity of this lake lies in the fact that it is one of the few known instances of a glacier in a main valley descending across the mouth of an adjacent valley, and thus damming up the tributary stream so as to form a lake. Although it is evident, from the name given to it on the Amt Kart (viz. Dam Lake), that its nature has been long known to the Norwegians, yet previous to 1892, when Dr. Robert Munro visited the neighbourhood,* the lake had received little attention, and, even at the present time, I am unaware that any geologist has examined its formation. Dr. Munro unfortunately arrived at the glacier too late in the day to be able to make the attempt to reach the so-called "pond-lakes" † (Dæmme Vand), and was forced to content himself with the descriptions supplied by trustworthy natives.

Being much interested in the subject, and finding myself, this summer, within a few miles of the glacier, I took the opportunity of paying a visit to the locality, and inspecting the "pond-lakes." Before, however, describing them, a few details relating to the geography and history of the neighbourhood may not be out of place.

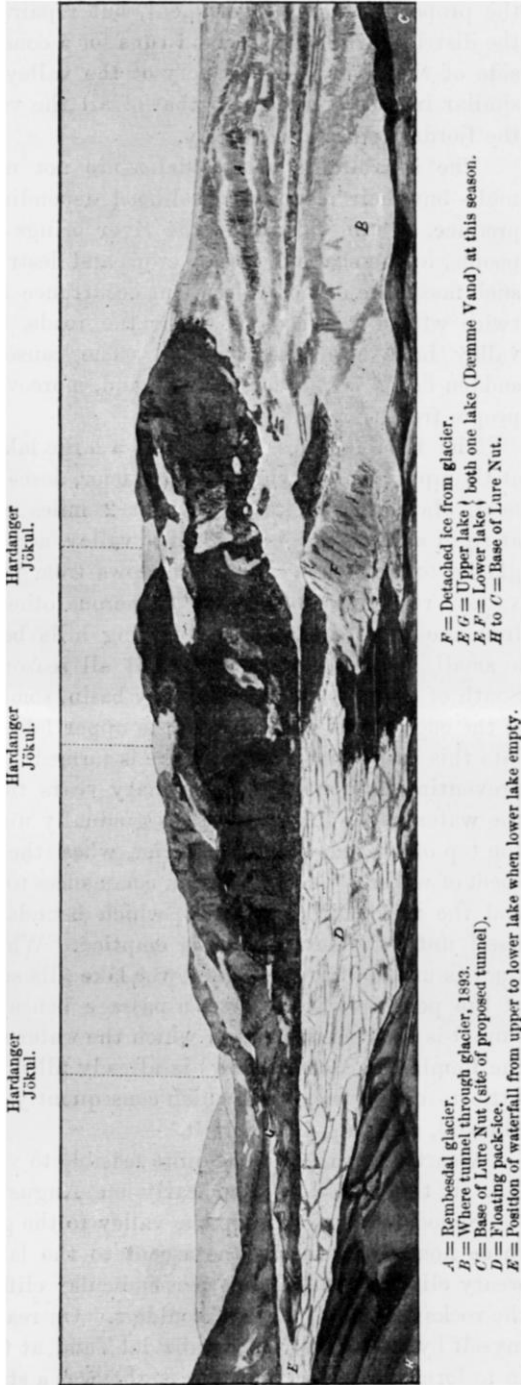
At the head of the Hardanger fjord lies the Eid fjord, into which flow two rushing mountain rivers, the one entering the fjord at Vik (Eid fjord), the other—a few miles to the north—at Simodal. These rivers bring down the melted snows from the vast plateau of Hardanger

* Royal Society of Edinburgh, "On a Remarkable Glacier-Lake, formed by a Branch of the Hardanger-Jökul, near Eid fjord, Norway," by Robert Munro, M.D., M.A. Read March 20, 1893.

† The term "pond-lakes," used by Dr. Munro, is somewhat erroneous. The author of it was a worthy Norwegian, who, when asked to translate "Dæmme Vand," referred to a dictionary, where he found "water contained by a dam," "a pond."

Vidden, and, in the early summer months, are swollen torrents. Both flow through valleys hemmed in by stupendous mountains, and terminating in precipitous cliffs in the shape of the letter U, over the edge of which tumble magnificent waterfalls. With the Vik river we need not concern ourselves; suffice it to say that, some 10 miles from its mouth, it forms one of the grandest waterfalls in Norway, viz. the Vöringfos, which alone is worth many miles of travel to see.

The Simodal is a picturesque and well-cultivated valley, at the extreme end of which issues, between rocky walls, the great Rembesdalfos, a waterfall containing at all seasons a volume of water sufficient to form the wide and swift torrent which flows down the valley. A few feet above the river-banks stand the farms, surrounded by their small patches of cultivation, which, for facility of irrigation, descend almost to the water's edge. Two bridges span the river, the one of light construction, and the other a well-built pile-bridge,



the property of the Government, but repairable by the inhabitants of the district; while a good road runs for a considerable distance on either side of the river. The scenery of the valley is wild and romantic, but similar in most respects to that of all the valleys which run down to the fjords of Western Norway.

The inhabitants of Simodalen are not numerous—perhaps 100 all told—but their means of livelihood depending entirely on their farm produce, an unusual rise in the river brings with it misfortune to the people, in the shape of loss of crops and destruction of property. That such floods are of not infrequent occurrence is well authenticated, and twice within the last six years the roads, bridges, and crops of the valley have been swept away. The cause of these periodical and sudden floods is not far to seek, and, moreover, has been known to the people from time immemorial.

The Rembesdalfos falls out of a large lake—the Rembesdal Vand—at the upper end of which lies a glacier, descending from the vast snow-field, Hardanger Jökulen. About 2 miles up the glacier, and almost at right angles to it, is situated a valley, across the mouth of which the glacier forms a dam. A stream flows from the north down this minor valley, receiving on its way numerous other streams of melted snow from the Jökul, and, the surrounding hills being high and precipitous, a small lake is formed, which, at all seasons, remains full of water. South of this upper lake is a rocky basin, some 150 feet below the level of the edge of the glacier. As the upper lake overflows, the water falls into this basin, and a second lake is formed, the glacier-dam effectually preventing any outlet. In ordinary years the snows melt slowly, and the water in the lower lake rises gradually until it reaches the level of the top of the edge of the glacier, when the two lakes appear as one sheet of water. The water then commences to escape between the glacier and the rocky hill (Lure Nut) which bounds it, cutting a channel for itself until the lower lake is emptied. When, however, the summer thaw is unusually rapid, the lower lake fills so suddenly that the weight of the pent-up waters forces a passage beneath the glacier, and a vast tunnel is excavated, through which the water rushes in one volume. As the Rembesdal Vand (below) is already filled to overflowing, it can do little to check the flood, which consequently sweeps onwards down the Simodal, carrying all before it.

Ascertaining that it was quite feasible to visit the Dæmme Vand from Vik in the day, I started early on August 6, and rowed across to the Simodal. The walk up the valley to the great waterfall took about three hours, and thence the ascent to the lake above was made by a weary climb, up an almost perpendicular cliff, aided by ropes fixed to the rocks and rough steps of boulders. On reaching the summit, I found myself by the side of the Rembesdal Vand, at the point where it narrows in to form the waterfall. The sight was a strange one: the deep-blue

mountain lake, studded with numerous floating icebergs (detached from the glacier), lay nestling at the foot of the green hill-slopes, black granite boulders cropping up, here and there, among the surrounding verdure. A mile or more away in the distance, the glacier fell down into the lake—a streaked and fissured mass of ice. Skirting the edge of the Rembesdal Vand, I soon arrived at the glacier itself, and commenced to cross it, which I found no easy task. Deep crevasses stretched in all directions, and upwards of an hour was occupied in reaching the opposite side. From this point all was plain sailing, as there was nothing to be negotiated more difficult than the rocky precipices of Lure Nut, and a walk of two or three miles, on the snow, by the glacier-side.

In the early afternoon I was standing on the edge of the Dæmme Vand, and surveying the scene. The lakes were nearly full and formed one sheet of water, about 300 yards wide and a mile or so in length. At the northern end the floating masses of ice almost completely covered the surface of the water, while near the glacier the water was more open, though containing huge icebergs. On either side of the valley rise up lofty granite mountains, and across the centre of the lake juts out a low rocky headland, which, when the lower lake empties itself, stretches to the opposite bank, and confines the waters of the upper or northern lake. It was quite evident that, owing to the height of the mountains, there could be no means of escape for the water other than by way of the glacier, and, as far as I could judge, the lake had yet to rise another 10 or 15 feet before it would commence to overflow.

I was fortunate in having with me, as guide, a native of the valley, who was well acquainted with the locality, and who had visited the lake several years in succession, to ascertain for the farmers the state of the waters. Last year (1893) one of the periodical floods occurred, and my guide proceeded to the spot immediately after the disaster. He described the scene he witnessed as one of the most marvellous sights imaginable. The lower lake was completely empty, the bottom being strewn with boulders, amongst which stood huge piles of stranded icebergs. The tunnel in the side of the glacier was of immense proportions, and its smooth sides of the most glorious colouring. The water had passed through with one mighty rush, and had caused the river in the Simodal valley to rise some 50 feet above the normal. The result is still visible, roads for several hundreds of yards being entirely washed away, and the permanent bridge being in ruins.

The outlook this year is more hopeful. The water in the lake has risen gradually, and the tunnel appears to have refilled with sufficient solidity to withstand the water; thus, in all probability, the lake will empty itself over the side of the glacier.

The inhabitants of the valley have invoked the aid of the Government to assist them in preventing these periodical and devastating floods, and skilled engineers have inspected the site of the evil. At first it was

proposed to form a dam, at the top of the Rembesdalfos, so that the Rembesdal Vand should hold the superfluous water from the Dæmme Vand, when a sudden discharge took place. On mature consideration, however, it was feared that it would be impossible to build a dam of sufficient strength to withstand the sudden rush and weight of water, and, were this artificial dam to give way, the floods in the valley would be even more severe than they have hitherto been. It has now, therefore, been finally decided to construct a tunnel, some 50 yards in length, at such a level that it will carry off the water of the Dæmme Vand before it rises to any great height. The cost will be considerable, as the tunnel will be made through the solid rock at the base of Lure Nut, by the edge of the glacier, and its mouth is to be provided with iron doors, to prevent its becoming blocked with ice and snow before the thaws set in each year. It is to be hoped that, when the work is completed, the desired end will be attained, and the unfortunate inhabitants of Simodalen saved from further disasters.

DR. DONALDSON SMITH'S EXPEDITION IN SOMALILAND.

THE following letter has been received at the Society from Dr. Donaldson Smith, who, it will be remembered, started on an expedition across Somaliland to Lake Rudolf, in May last. The letter is dated "Webi Shebeli (or Webi Erer?), lat. $7^{\circ} 11' N.$, long. $42^{\circ} 11' 23'' E.$, September 1-3."

"I have happened on two very wild-looking men, who lead a precarious sort of an existence in this otherwise uninhabited country, collecting gum and shooting game with poisoned arrows. I am offering them heavy bribes to take letters to the coast. They accept, but will not wait long, so I must send you only a very rough and hasty copy of my map. There are many reasons for my not having gone further. I lost many camels the first month, and had to move very slowly with heavy loads; then the trading poor camels for good fresh ones, and buying a lot of additional ones, took some time. I was determined to push as much westwards, after leaving Milmil, as possible, and this brought me almost at once into unexplored country, very rough and bushy. The guides misled me every now and then through ignorance themselves of the country. The men were obliged to do much chopping in places to make a path, notably, from Lafeik to Turfa, and on the march from Turfa to the Erer river.

"I am satisfied with my journey so far. All the poor camels have been got rid of, and to-day we have 110 splendid animals in the best condition. From Turfa I had hoped to continue west and across the Erer river, but it is impossible either to donkeys or camels. In some places the mountains rise so precipitously from the water's edge that a man cannot climb down. The stream is from 1 to 3 feet deep and