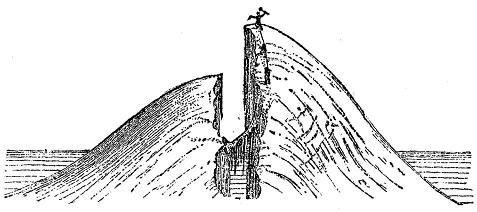
simplest, and because it is that form which has been used in the report of the proceedings of the Montreal meeting in the organ of the Royal geographical society. The present writer has, however, never seen it so spelled on any geographical map. It is spelled in three different ways in the publications of the Canada survey, and in the same number of ways in Stieler's 'Hand-atlas.' J. D. WHITNEY.

## THE TASMAN GLACIER.

A YEAR ago, accounts were published of the attempt in 1882, of Mr. W. S. Green, an Englishman, to ascend Mount Cook, the highest (12,350) of the New-Zealand Alps. He was accompanied by two practised Swiss guides from Grindelwald, and reached a great altitude over snow and ice, but failed in his main object, chiefly on account of bad weather. A somewhat similar exploration was undertaken in March, 1883, by Dr. R. v. Lendenfeld of Christchurch, New Zealand, accompanied by his wife, three shepherds to serve as porters, and a driver for the wagon in which the supplies were carried up to within a few miles of the Tasman glacier. Bad weather on the approach to the mountains was followed by nine days without a cloud, during which a good piece of triangulation was executed, the Hochstetter dome ascended (2,840 m.), and material collected for a fairly detailed map on a scale of 1:80,000. The results of the survey now appear as supplement 75 to *Petermann's mittheilungen* (Der Tasman-gletscher und seine umgebung; Gotha, June, 1884, 80 p.), with a general and local map, a well-executed reproduction of a photograph taken from the medial moraine of the great Tasman glacier, which we copy in reduced form, and several cuts. The glacier was found to be twenty-eight kilometres in length, — three kilometres longer than the Aletsch, the greatest in Switzerland. Its lower part is of moderate slope and slow motion, greatly covered by moraines. Green described the New-Zealand Alps as equalling or exceeding those of Europe in picturesqueness, but Lendenfeld thinks them inferior. The mountain form is less pronounced, the snow-fields are smaller, and the glaciers are much obscured by morainic rubbish: bushes replace pines, and the flat-bottomed valleys are without villages and fields. The summit of the Hochstetter dome, a sharp edge of hard-packed snow, was reached by Lendenfeld, his wife, and one porter, after a daring climb across a delicate ice-bridge, of which the author's rough figure is here copied. Sitting astride

THE NEW-ZEALAND ALPS AS SEEN FROM THE MIDDLE MORAINE OF THE TASMAN GLACIER.

of the ridge, the neighboring peaks rose around them; and all New Zealand, from western to eastern coast, with the ocean beyond on either side, lay below. The



THE TOP OF MOUNT HOCHSTETTER.

story of the journey is simply and graphically told, and suggests a writer of more intelligence and better powers of observation than is usually met with among mountain climbers.

## THE DIGESTIBILITY OF CELLULOSE.

It is a well-established fact, that a considerable portion of the woody fibre which is consumed in such large amounts by herbivorous animals does not re-appear in their excrements, but is apparently digested. In what portion of the alimentary canal, or by means of what secretion, this digestion is accomplished, has been the subject of much speculation and of some experiments; but, until recently, neither had done much to illuminate the matter.

Hofmeister [1] seemed to have gone far towards solving the question when he found that a considerable solution of the cellulose of grass took place in the rumen of sheep. He first enclosed two small samples of fresh grass in cages of german-silver wire covered with muslin, and introduced them into the rumen of a living sheep. After three days the animal was killed, the cages removed, and their contents examined. It was found that seventy-eight and four-tenths per cent of the woody fibre originally present had been dissolved. Subsequent experiments showed that the fluid obtained from the rumen of a freshly killed sheep had also a powerful solvent action on woody fibre, and that the mixed saliva had likewise this power. Experiments on oxen gave no decisive result: those on the horse failed to show any solvent action of the saliva upon woody fibre. Hay, and the 'crude fibre' prepared in the analysis of fodders, were acted upon by the fluid from sheep's rumen, though not so energetically as was the grass.

These results point unmistakably to the first stomach of ruminants as one place where cellulose is digested. Hofmeister ascribes to the mixed saliva the power of dissolving it; but some subsequent experiments by Tappeiner [2] indicate that this is effected by a fermentative process, and that the saliva or fluid from the rumen used by Hofmeister served simply to supply food to the organisms concerned in the fermentation. Tappeiner took samples of the contents of rumen, small intestine, and large intestine, of a ruminant fed exclusively on hay. One sample from each portion of the alimentary canal was at once boiled; to a second some antiseptic (chloroform, thymol) was added, sufficient to stop the action of organized ferments; while to the third nothing was added. All were kept warm, and after a time their content of crude fibre was determined. Those portions from the rumen and large intestine, to which nothing was added, were found to have lost cellulose, while carbonic acid and marsh-gas were evolved. No loss was observed from the contents of the small intestines, nor from the samples treated with antiseptics. Further experiments showed that this fermentation could be produced outside the body. To hay or pure cellulose, mixed with extract of meat, and previously heated to 110° C., a drop of fluid from the rumen was added. After a few days, active fermentation began. Gas was freely evolved, consisting of about seventy-six per cent of carbonic acid and twenty-four per cent of marsh-gas, and the cellulose nearly all disappeared. A second kind of fermentation was also observed, which yielded carbonic acid and hydrogen. In both kinds of fermentation, only the smaller part of the cellulose was volatilized, most of it being converted into acids of the fatty series.

That cellulose is fermentable is not a new observation; Van Tieghem having found that the butyric ferment has the power of decomposing it, with production of hydrogen, carbonic acid, and butyric acid. Tappeiner's experiments are of interest, because they show that the fermentation takes place also in the alimentary canal. This is shown not only by the disappearance of the cellulose in the experiments described above, but also by the presence of the products of the fermentation in stomach and intestines. In ruminants the marsh-gas fermentation seems to prevail. In the stomach of the horse and swine considerable quantities of hydrogen were found. In both cases acetic acid, aldehyde, and an acid having the composition of butyric acid, were found.

These results are important in their bearing on our estimates of the nutritive value of fodders. It having been shown that the digestible portion of the crude fibre has the composition of starch, it has generally been assumed to have the same nutritive value. Tappeiner's experiments show that this is probably not the case. There appears to be a disposition on the part of some critics, however, to rush to the opposite extreme, and, instead of overestimating the nutritive value of cellulose, to underestimate it. The non-nitrogenous nutrients are to be regarded as the fuel of the body, and they are of worth to it in proportion to the amount of energy set free by their oxidation to carbonic acid and water. So far as we can see, it is a matter of indifference whether that oxidation begins in the alimentary canal, or not until the substance has passed into the circulation. Whatever potential energy is contained in the digested cellulose is yielded up to the body sooner or later, with the exception of that portion which escapes in the form of combustible gases. According to Tappeiner, this

[1] *Biedermann's centralblatt*, Jahrg. x. p. 669.

[2] *Thier. chem. ber.*, xi. 303, xii. 266 and 272; *Zeitschr. für biologie*, xx. 52.