been subjected to very severe tests in Paris by M. Hospitalier and other well-known electricians.

The 'juvenile lectures' at the Royal institution, first rendered popular by Faraday in his 'Chemistry of a candle,' are this year being given by Professor Dewar, who has chosen 'The story of a meteorite' as his subject.

The Corporation of Liverpool has just issued the programme of its twenty-first winter course of lectures, to be given in the rotunda lecture-hall of the Free public library. These lectures are paid for by the corporation, and admission thereto is absolutely free. The hall holds about sixteen hundred, and is usually well filled by the 'great unwashed' of Liverpool, on Monday, Tuesday, Wednesday, and Thursday of each week from Jan. 4 to March 11. The first lecture is by Mr. William Lant Carpenter, on 'Temperature and life in the depths of the sea.' Prof. Oliver Lodge, whose lecture on 'Dust' in Montreal will be remembered, and several of his colleagues in University college, Liverpool, as well as some of the professors in Stonyhurst college, are among the lecturers. It is greatly to be wished that other towns, on both sides of the Atlantic, would follow the example thus set. W.

London, Dec. 23.

LETTERS TO THE EDITOR.

*** *Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

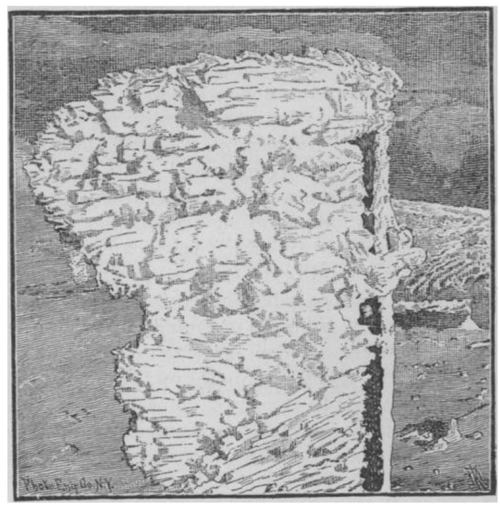
Eskimo building-snow.

I ENCLOSE a photograph, kindly sent me by General Loring, of the Boston Museum of fine arts, of snow impacted on a telegraph-pole, by a strong gale, near the summit of Mount Washington. It furnishes a good example, near home, of the texture of snow, under the influence of a fierce wind and intense cold, and will make clear some remarks I have previously made in your journal regarding the use of snow by the Eskimo among whom I travelled. In my description of the igloo (snow-house) of the Innuit in *Science* during the summer of 1883, I mentioned that the first snows that fall are not used by the Eskimo of my acquaintance to build snow-houses, the preliminary igloos being of ice for three or four weeks, until the deep drifts of snow had been subjected to very low temperatures and the 'packing' influences of strong winds. The winter weather of the summit of Mount Washington is in most respects essentially arctic.

In the accompanying illustration we see readily the peculiar texture or strong 'binding' power of the snow under those conditions of wind and cold, and it is now in a condition for an igloo snow-block. It is readily seen that it must have great cohesion to hold up such a heavy load on such a fragile support.

The cohesion of snow in our latitudes (and the early snow of the Arctic) is of a plastic, wet, or 'pasty' character, as shown in the making of snowballs, the formation of huge balls of snow on the ground as they roll along, snowmen, balling on horses' feet, etc. (also shown by Mr. Williams's letter in *Science* of March 6, 1885; Mr. Stone's letter of May 29, 1885, in *Science;* and others to you). This is essentially unfit for snow-building.

The snow fit for igloos is of a dry, almost stone-like character. The cutting of a thin portion from the side of an arctic snow-block, instead of giving a sheet of plastic snow as from a snowball, produces a shower of fine powder, exactly the same as from a large lump of loaf-sugar. In short, the arctic building snow-block stands in about the same relation to those we would make here, as the brick just from the mould, and before it is dried, bears to the same object when burnt in the kiln, and ready for use. The arctic snow-blocks ring like a well-burnt brick; and this is especially noticeable during intensely cold weather,



HARDENED SNOW ON A MOUNT WASHINGTON TELEGRAPH-POLE.

when I have heard a snow-block, as it was struck with a knife, give forth a clear, metallic, musical sound, not unlike the striking of a highly tempered bar of suspended steel with the hand, or other non-metallic substance.

I remember, when my natives were building a snow-house on the high 'divide' between Back's Great Fish River and Hudson's Bay, the thermometer in the minus 60's, a block of snow rolled down the hill for fifteen or twenty feet, and I doubt if a rolling guitar would have given forth many more confused musical tones than the bumping block as it struck and bounded along down the hard, stone-like bank of snow.

Yet it must not be inferred that this dry, compact snow has any of the characteristics of ice about it. It is not only much lighter than ice, but, I believe, lighter than the plastic snow we have, certainly not so dense as when made into the ordinary snowball. In fact, the least quantity of ice in the snow — which sometimes happens — renders it more or less worthless for building, according to the amount. In the late spring, banks of snow having southern exposures, and thawing slightly about noon, only to freeze again, and others subject to drainage (and a few other causes), often have ice permeating the mass, sometimes in little fine needles, which make the mass worthless, and now and then in little crystals scattered through it. If these crystals are much larger than a pea, and more numerous than one to about every four square inches exposed by a section, the bank is rejected by the Eskimo snow-builder, unless others cannot be found.

The packing of the wind and low temperature are needed to produce the true building-snow, and, in the absence of either one of these conditions, the action of the other seems to be worthless. As to temperature, this is shown by the snow not being good, as judged by the Eskimo, until it is *ik-kee-oo-ad-lo* (very cold) despite the fiercest gales having occurred. It is shown as to the wind by not finding good building material in deep gorges, and other places where the wind cannot get at the snow to pack it down, long after it is perfect in other localities. My information on these points did not come from such observations, however, but directly from Eskimo explanations, and I add these to corroborate them. I do not believe—although I do not positively know—that both wind and low temperature must come together, but both must have happened before the Eskimo will use the snow for building, though possibly the two may be independent in time. When I say the Eskimo will not use it, I mean as a usual thing and in a general way; for in his cheerless country he is often driven to dire expedients, and does many things under a sort of polar protest.

After my detailed description of an Eskimo snow-house in *Science*, and some popular accounts in other periodicals, I learned in several ways (by correspondence and from accounts given me by the editor of *St. Nicholas*) of attempts to reproduce these domiciles in our country having ended in failure. Of course, the main reason of such failures was in the lack of knowledge to construct the igloo, the manual dexterity needed, it being an art which requires no small amount of the early life of an Eskimo to acquire to that perfection we often see among them; yet the builders who failed in their undertakings may console themselves with the fact that it is only in rare cases that the snow will be of the right texture in so low a latitude. The alpine districts, as Mount Washington in the winter, and similar places, might do. Ebierbing (Eskimo Joe, as he was known in the United States), my interpreter, told me that he had built a few igloos in the United States for the edification of curious crowds, but he was only too glad not to see them tumble in and ruin his reputation as well as the house; but, as to living in them, he would never have thought of it.

FRED'K SCHWATKA.

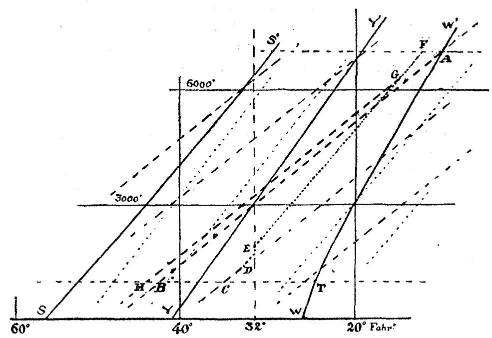
New York City.

'Chinook winds.'

Dr. Dawson's interesting note on the Chinook winds of the north-west does not fully represent the views on the origin of the *foehn* held by Dr. Hann.

The *foehn* winds, and presumably the Chinook also, are often felt on the leeward side of a range before any rain falls on the windward side: therefore, while the evolution of latent heat by condensing vapor is a true and important cause of the warmth of the *foehn* in the manner indicated by Dr. Dawson, it is not the first or the only cause, and I think it is not the most efficient cause. Dr. Hann has shown that the first cause of the warmth is the descent of air from the level of the passes and peaks in response to the needs of a low-pressure area on the leeward side of the range; and, as the temperature of the upper air is not greatly lower than that of the surface air in winter (the vertical decrease of temperature in the atmosphere being slow in this season), the descent of the upper air gives it a warmth and dryness that is very abnormal. The *foehn* is indeed, like our north-east winds, a current that is propagated backwards; first, the air is withdrawn from the plains in front of the mountains by the approach of a low-pressure area; then the air in the valleys flows out over the plains; next the upper air descends from the passes into the valleys, warming as it falls; finally the air rises on the farther side of the range, clouds form in it, rain falls from it, and it therefore cools slowly in its ascent; but, as soon as the little cloud that crosses the range is dissolved, the air warms rapidly in its descent; and thus the *foehn* is established. Doubtless the last two processes go on together.

I have used the accompanying figure (based on a diagram by Hertz) to illustrate the *foehn* problem:



the full lines represent the variation of mean temperature with altitude for the year (YY'), summer (SS') and winter (WW'); while the broken lines are ordinary adiabatics, showing the change in temperature of ascending or descending masses of air that are warmer than their dew-point; and the dotted lines are adiabatics for the retarded cooling of masses of air in which vapor is condensing. Now, in winter, when the lower air at a station one thousand feet above the sea, with a temperature of 24° F., (shown at T), moves away, and is replaced by air that descends from an elevation of seven thousand feet, where its temperature is 10° (A), the latter will reach the ground (B) with a temperature about 42°, and a very low relative humidity: it is almost twenty degrees warmer than the air whose place it has taken. The descent must be rapid, or else the air will be much cooled on approaching the cold ground.

A second example shows the action of rain: starting on the farther side of the mountains, with a temperature of 35°, suppose the air ascend five hundred feet from C to D before any condensation takes place; then, clouds forming and rain falling, further cooling is slow, as shown by the steeper dotted line, DF. Where this line crosses the temperature of 32°, there will be a brief ascent without any cooling, until all the cloud-particles are frozen: this is shown by a short vertical turn at E, but the effect is small.