

lighting, and their elasticity varied in almost the same proportion as their susceptibility to change of resistance from stress, so that, the alteration of resistance divided by the strain produced, ranged in the five specimens between the limits 2'144 and 2'835. The corresponding numbers in the case of most pure metals (aluminium is an exception) are *greater* than these, and in the case of nickel, with which metal curiously enough the effect of moderate longitudinal traction is to *decrease* the resistance, the alteration of conductivity is *much* greater.

It will be observed from the numbers given above that the diminution of resistance which can be produced in carbon by pressure is very slight, so much so indeed that if we could compress a carbon rod to *half* its original length, the resistance would not be diminished to one-third of the original resistance, and that therefore the amount of compression which can be really produced without danger of breakage causes such a slight decrease of resistance as requires special precautions and a good galvanometer if this decrease is to be measured with any accuracy.

King's College, Strand, March 7 HERBERT TOMLINSON

Palæolithic Floors

IN reference to this subject, as adverted to by Mr. W. J. Knowles, NATURE, vol. xxv. p. 409,—several Palæolithic working-places, floors, or old land surfaces have been described. With some of these surfaces, I am slightly acquainted, and with one of them I am *well* acquainted, as it was discovered by myself in London, in 1877—8. This surface is in the Valley of the Hackney Brook, an affluent of the Lea, which in its turn is a northern tributary of the Thames. The course of the Hackney Brook is illustrated in the No. of NATURE (p. 417) which contains Mr. Knowles' letter; when excavations are made in this valley, Palæolithic implements and flakes are disinterred, which in some instances belong to the Thames and are very ancient, in others to the Lea and probably somewhat less ancient, whilst a third set of implements belong to the Hackney Brook, and undoubtedly date from a very recent period of the Palæolithic age. In the surface humus of the Lea near the Hackney Brook, Neolithic celts, polished and unpolished are also found with flakes of the same age.

When I first found Palæolithic implements in the gravel, sands and loam of north-east London, I was greatly puzzled by some of the examples being considerably abraded, whilst others were as sharp as if just made. The sharp examples belong to one stratum and the abraded specimens to a totally different one. The explanation of the abraded and unabraded examples rests in the fact that near the Hackney Brook most of the gravel is about ten or twelve feet below the surface, but this Thames gravel and its contained abraded implements has nothing whatever to do with the Hackney Brook, the old banks of which are about four or five feet below the present surface, and on these banks (which I have examined in the stream's course for three quarters of a mile, north and south at Stoke Newington, and Shacklewell) there lived at one time a considerable colony of Palæolithic men. The floor upon which this colony of men lived and made their implements has remained undisturbed till modern times and the tools, together with thousands of flakes, all as sharp as knives, still rest on the old bank of the brook just as they were left in Palæolithic times. In some places the tools are covered with sand, but usually with four or five feet of brick-earth; the sand when it occurs is full of the shells of fresh-water molluscs.

The floor is exposed in digging for the foundations of houses, it is sometimes visible as a dark line only at the base of the loam; at other times by the presence of a few inches of gravel; occasionally the traces of the floor are obliterated. All the implements from this floor are as sharp as on the day they were made, a few are dull in colour, the majority are lustrous, a few are whitish from their long contact with clay, but though the surface of the implements is whitened by decomposition, yet the tools remain perfectly sharp. As a rule the implements of the Hackney Brook are small in size, beautifully made, and extremely neat, some rivaling in exquisite workmanship the best Neolithic work: scrapers are fairly common, but not of the horse-shoe form. Were the makers of these tools the same with the men of some of the caves? the evidence seems to point in that direction. "Cave-men" could not always have been in caves, surely some of these "Cave-men" lived in communities in the open air, and it seems clear that if we are to find intermediate links between Palæolithic and Neolithic times we must not confine ourselves to caves

but search for traces in positions like the comparatively modern Valley of the Hackney Brook.

It appears to me that these minor tributaries of great rivers have never been properly searched. Geologically considered, the Thames with its gravel and implements must be extremely ancient, whilst the shallow unimportant Hackney Brook must be comparatively modern. In these minor affluents then we have traces of the more recent cohorts of Palæolithic men, and the tools that are found, seem, by their style of workmanship, to prove their comparatively recent date.—Recent as that date may be however, I consider it to be far older than the times when the lower terraces of the Thames were laid down, for in these lower gravels, implements and flakes (with the exception of some stray example now and then, that has been washed down from a higher position) are absent.

Any person is at liberty to look over the things I have got from this place, but at present I do not wish for the number of the tools to be further reduced by gifts or exchanges. Many objects I have already given away, but, for a time, at any rate, I wish to *keep the things together*, as they teach a better lesson *in company* than when distributed in different collections. As for the simple flakes, whether sharp and belonging to the till now undisturbed Palæolithic floor of the Hackney Brook, or abraded and belonging to the deeper excavations exposing the old terrace of the Thames, any one is welcome to any number of examples of these from me, and I am willing to send them as gifts to anyone, provided I am not put to expense in transit.

At the present time the Palæolithic floor is to be seen in section in several places, and I will conclude by mentioning one. On the north side of Stoke Newington Common, (nearest point, Stoke Newington Railway Station, from Liverpool Street) there are four new roads; the easternmost road is named Fountayne Road, and is marked on Stanford's Library Map of London. At the extreme south end of Fountayne Road, *i.e.* the Stoke Newington Common end, on the east side, shallow foundations of about four feet have been dug for a few new villas; now, if the two or three northernmost of these shallow excavations are looked into at a depth of about three feet, a thin stratum of gravel, a few inches only in thickness, will be seen sloping southwards into the (here filled in) Hackney Brook. This is the floor upon which the Palæolithic men once walked, lived, and made their tools. In the excavation for the two northernmost villas I recently saw the loam carefully removed, and on this spot two pointed Palæolithic implements (one amongst the best of my collection) were found, the first black and lustrous, the other buff, mottled with white from long contact with the loam, and lustrous, both as sharp as knives; they were picked up with numerous flakes on the very spot where they were originally laid down by their Palæolithic owner or owners.

A word of warning to visitors. After I published my localities in 1868, certain persons went to the places mentioned, and offered large sums of money to the men for implements and flakes; in this case, the unfortunate result was, that the men and boys of this spot soon found that they could strike off flakes and even make implements sufficiently near to deceive "avid but unwary collectors." Therefore, unless any visitor instantly knows at sight (which is quite easy) a genuine implement or flake from one made on the spot, let him buy nothing of the boys or men without first consulting the writer of this note.

WORTHINGTON GEO. SMITH

125, Grosvenor Road, Highbury, N.

The Advance of Norwegian Glaciers

IN NATURE, vol. xxv. p. 449, you quote an account from *Naturen* of the changes of movement observed in Norwegian glaciers. In this it is stated that the great Folgefond glacier, near the Sörfjörd, a branch of the Hardanger, has had alternation of advance and retreat, but that it advanced 40 metres between 1860 and 1878. This, no doubt, is an account of the very remarkable advance of the Buerbrøe (brøe is Norsk for glacier) near Odde, on the Sörfjörd. I visited the place in 1874, and the recent ploughing up of a considerable bit of the valley by the vast irresistible ice-plough was very striking, while the glacier itself was very beautiful. My object, however, is to repeat a strange piece of folk-lore, which tends to show that in this particular spot, the advance of the glacier must have been long-continued. The legend was told me by Asbjörn Olsen, a very intelligent guide at Odde, who speaks good English. The tale was that long ago the Buer valley extended far into the mountains, and was full of farms and cultivation. It had also a

village, a church, and a pastor. One winter night when a fearful storm was threatened, three Finns (*i.e.* Lapps) entered the valley and begged shelter in vain of the inhabitants. At last they asked the priest, and he too refused. Then the wrath of the heathen wizards was raised, and they solemnly cursed the valley and doomed it to destruction by the crawling power of the ice, until the glacier reached the lake below. The Lapps were seen no more, but on their disappearing the snow began to fall. The winter was awful. The glacier approached by awful steps, and by degrees engulfed the cursed valley and farms. Nor is the curse yet exhausted, for the glacier creeps down the valley each year, and has yet a mile to go before it reaches its destination in the lake above Odde. I am no judge of folk-lore, but this weird tale seemed to me a genuine piece of it, and not invented for the occasion, as Olsen gave it half jokingly as the tradition of the district. The farmer who owns the remnant of the doomed valley, wanted then to sell it, as he saw his acres swallowed up each year, but no one will buy. If this tale be genuine, it points to a prolonged advance of the Folgefond, which has led to the tale of the Lapps' curse. Those interested in ice-action will see a fine example of the "Tyssenstrengene," or polished stone fells of Norway, between Odde and the splendid Skjægdals (or Ringedal's) Fos. The rocks are so polished by the ancient ice that a path is made over them by putting rough fir trees down to give a foothold. The ice-polishing on the Grimsel Pass in Switzerland, is a mere nothing to these "Tyssenstrengene."

J. INNES ROGERS

Intelligence in Birds

OUR English jackdaws are not behind Miss Bird's Japanese crows in at any rate one of the instances of intelligence told by her. Many years ago it was a frequent amusement of ours to watch the encounters between a tame jackdaw and the stable cat. The cat's dinner used to be put down outside the stable-door, and, warned by experience, she hastened to dispose of as much as possible before the arrival of the jackdaw. He seldom went directly to the meat in the plate, but attacked the enemy in the rear, settling himself with both feet on her outstretched tail to steady it, and then administering pickaxe blows on it with his beak. Of course it was impossible to stand this, and with a forcible exclamation the cat used to spring away, and Jack took possession of the plate, until our sense of justice obliged us to recall and defend the rightful owner.

E. HUBBARD

March 6

Auroral Display

I SEE by your number of NATURE, vol. xxv. p. 386, that an auroral display was witnessed in England on February 20, between 7 and 8 p.m. A very magnificent one was seen in the Hardanger-fjord on the same evening at the same hour, by a friend of mine, and the Captain of the ss. *Folgefonden* says he has never seen a finer. Could it have been the same aurora?

W. E. KOCH

Lysefjord near Stavanger, Norway, March 9

ON THE CHEMISTRY OF THE PLANTÉ AND FAURE ACCUMULATORS

PART II.—The Charging of the Cell

IN NATURE (vol. xxv. p. 221) we directed attention principally to the local action that takes place on the negative plate of a Planté or Faure battery. We pointed out the close analogy between zinc coated with spongy copper, and lead coated with spongy peroxide, in their action on water or dilute sulphuric acid; and we showed the importance of the lead sulphate produced in moderating this action. We now propose to treat of the chemical changes involved in the preparation of the cells.

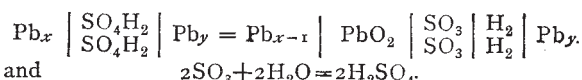
The procedure of Planté in forming his battery is at first sight extremely simple. He takes two coils of lead, separated from one another, and immersed in dilute sulphuric acid; a current is sent through the liquid from one lead plate to the other, and the final result is, that the one becomes covered with a coating of lead peroxide, while hydrogen is given off against the other plate. On the view that the sulphuric acid merely serves to diminish

the resistance, and so facilitate the electrolysis of water, the ready explanation would be given that the two elements of the water are simply separated at the two poles. But it seems more in accordance with the facts of electrolysis, to suppose that the sulphuric acid, H_2SO_4 , is itself the electrolyte, and that the oxygen results from a secondary chemical reaction. As a matter of fact, if water be employed, no peroxide is formed, but only the hydrated protoxide, even though a current from twenty-four Grove's cells be made use of. The addition of a single drop of sulphuric acid to the water is enough to cause the immediate production of the puce-coloured oxide.

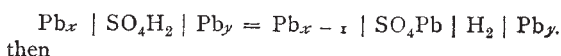
If we take two plates of lead in dilute sulphuric acid, and pass the current from only one Grove's cell, a film of white sulphate, instead of peroxide, makes its appearance on the positive pole, and the action practically ceases very soon. If, however, the current be increased in strength, the sulphate disappears, and peroxide is found in its place. In Planté's procedure, spongy lead, and lead peroxide are indeed found on the respective plates. But, in consequence of the local action which takes place during the periods of repose, lead sulphate will be produced from the peroxide, and afterwards, in the course of the "formation," this must be reduced to metallic lead by the hydrogen.

It may seem at first sight improbable that an almost insoluble salt of the character of lead-sulphate should be decomposed under these circumstances. To test this fact by direct experiment, we covered two platinum plates with lead-sulphate, immersed them in dilute sulphuric acid, and sent a current through. We found not only that the sulphate was reduced by electrolytic hydrogen, but that it was peroxidised by electrolytic oxygen. The white sulphate was, in fact, decomposed to a large extent at each plate, the positive being covered with deep chocolate-coloured peroxide, the negative with grey spongy lead.

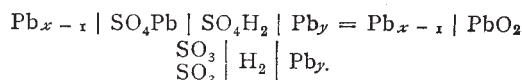
The reaction which takes place in charging a Planté battery may be viewed in two ways. The simplest may be thus expressed in the notation which we have employed in some previous papers. For convenience, the reaction is divided into two stages:—



But it may be that lead-sulphate is always formed in the first instance, and decomposed on the continuation of the current.



then



and



It seems not improbable that both these reactions may take place according to the varying density, or other circumstances of the current. The coating of peroxide interposes a great difficulty in the way of the further oxidation of the metallic lead. Hence Planté needs the successive periods of repose, to admit by local action of the formation of lead-sulphate, and the oxidation of the increasing amounts of finely-divided lead thus brought into the field of action.

To obviate this waste of power and time, Faure covers both plates with red lead, and converts this into spongy peroxide and spongy lead respectively by the current. Now the first thing that happens, when the plates are immersed in the dilute sulphuric acid is a purely chemical action. The minium suffers decomposition according to the formula—

