several thousands worked flints, some of which still of the Mousterian type, many worked bones, including arrow points, and also fragments of pottery."[1]

2. The discovery, in several caves in Belgium, of the remains of pottery in Upper Palæolithic deposits.[2]

3. The finding, by me, in a small valley to the north of Ipswich, of fragments of pottery, of a hitherto unknown type[3] associated with flint implements of Upper Mousterian or Lower Aurignacian forms, in a geological deposit of manifest antiquity. In regard to this latter discovery, I may say that it was by no means easy to recognise, at first, that the fragments of what looked like charcoal in the geological deposit mentioned were indeed pieces of pottery, and it was only by a very careful examination that this recognition was made possible.

Personally, so small a value do I place upon the making of primitive pottery as an indication of the advancement and capabilities of any prehistoric people, that it would not surprise me to hear of its discovery in, for example, a 'floor' of Late Acheulean age.

It is, of course, possible, for those who do not believe that Palæolithic man made pottery, to deny that any of the discoveries I have enumerated are of Palæolithic age. But this claim carries with it the necessity of proving it to be true.

J. REID MOIR.

Ipswich.

[1] Hrdlicka, *Annual Report of the Smithsonian Institution*, 1913, p. 522.

[2] *Bull. Soc. préhist. de France*, 1907–8 (two papers).

[3] "Antiquity of Man in East Anglia." Camb. Univ. Press, p. 87, Fig. 35.

### Short Wave Echoes and the Aurora Borealis.

BOTH Prof. Appleton and Dr. van der Pol have suggested in letters in NATURE of Dec. 8 that the echoes observed by Prof. Størmer with delays of about ten seconds might be explained by the disturbance spending a long time in a region containing so many electrons per c.c. that the group velocity of the disturbance was very small.

The effective dielectric constant $\epsilon$ and conductivity $\sigma$ of a region containing $N$ free electrons per c.c. for waves of frequency $\omega/2\pi$ are given by $\epsilon + \frac{4\pi\sigma}{i\omega} = \frac{3+2\alpha}{3-\alpha}$, where $\alpha = -\frac{4\pi N e^2}{m(\omega^2 - if\omega)}$; $f$ measures the rate at which the velocity of the electron becomes uncorrelated with its initial velocity, so that $f = v/l$ where $v$ and $l$ are the velocity and effective free path of the electron. The condition that the group velocity is zero is that $\epsilon = 0$, *i.e.*, since $f \ll \omega$, $N = 3m\omega^2/8\pi e^2 = 1{\cdot}9 \times 10^6$ electrons per c.c. for wave-length 30 metres (Dr. van der Pol, *loc. cit.*, using the formula valid for small $\alpha$, obtains $N = 10^6$).

Even if the atmospheric pressure is very low, so that collisions with atoms contribute little to $f$, a minimum value of $f$, for given $N$, is fixed by the effects of the electrostatic forces between the electrons, and between the electrons and other ions. A calculation I have recently made (*Proc. Roy. Soc.*, A, vol. 121, p. 464) gives the following approximate formula for the effective mean free path in such circumstances,

$$l = 3v^4 \Big/ 4\pi\left(\frac{2e^2}{m}\right)^2 N \log\left(3v^6/4\pi\left(\frac{2e^2}{m}\right)^3 N\right).$$

Assuming $v = 1{\cdot}2 \times 10^7$ (P. O. Pedersen, "The Propagation of Radio Waves," p. 44), we obtain $l = 4{\cdot}8 \times 10^2$ cm., $f = 2{\cdot}5 \times 10^4$.

For a delay of $t$ seconds the signal intensity is reduced to $e^{-ft/2}$ of its initial value (Prof. Appleton, *loc. cit.*), that is, for a delay of 10 sec. to $e^{-125{,}000}$. The suggested explanation seems, therefore, to be untenable, unless it is assumed that $v$ is much larger. If $v$ were 30 times as large ($v = 3{\cdot}6 \times 10^8$, corresponding to 37 volts) the minimum reduction for a 10 sec. delay would be to $e^{-4{\cdot}6} (= 1/100)$ of its initial value.

The above objection does not apply to the second explanation put forward by Prof. Appleton.

L. H. THOMAS.

Trinity College,
Cambridge, Jan. 14.

### Oiling of Plates for Ultra-violet Photography.

IT has long been known that a substitute for the Schumann plate for ultra-violet spectroscopy beyond 2500 A. can be made by oiling the surface of the plate. These oiled plates were found by Harrison (*Jour. Optical Soc. Amer.*, vol. 11, pp. 113 and 341; 1925) to be in some respects superior for photometry, as Schumann plates are rather uneven, having spots of greater sensitivity. All the methods so far suggested for oiling the plates are rather messy and involve the cleaning of the plate before development. There is also a loss of sharpness due apparently to the thickness of the oil coating. The following method used by me seems to overcome these disadvantages and may be of interest to other workers in the subject. I use a filtered solution of 5 grams of vaseline in a litre of petroleum ether. The quantity of vaseline may be increased for certain work. The plates are flooded with this solution in a dish and lifted out and rapidly dried. After exposure they can be developed without further treatment by the 'stand method.'

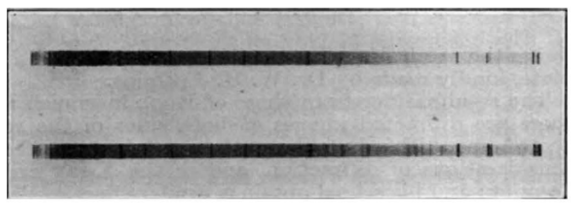

FIG. 1.

The accompanying photograph (Fig. 1) is of the aluminium condensed spark from the visible to 1830 A. The exposure was 15 sec. in each case on a Wellington anti-screen plate. The first exposure was made, the plate was then flooded with the 0·5 per cent solution three times, being dried between each. The second exposure was then made and the plate developed in glycin.

A. CHRISTOPHER G. BEACH.

Chelsea Polytechnic,
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### Raman Lines from Hydrochloric Acid Gas.

(BY CABLE, THROUGH SCIENCE SERVICE, WASHINGTON, D.C.)

BY employing a long end-on tube excited by a parallel Cooper Hewitt mercury arc with aluminum reflectors, I have obtained the modified lines of gaseous hydrochloric acid at atmospheric pressure corresponding to the vibration–rotation absorption band at 3·6 $\mu$, a double line with indications of fine structure. Improved technique is expected to permit higher dispersion.

R. W. WOOD.

Jan. 28.