Triplicate oxygen determinations were made with the $^1/_2$ cc analyser of SCHOLANDER (1947). The instrument is considered accurate to .02 per cent. Measurements were only made after values for local air showed that the instrument was working well. Woods Hole air has never been found to vary significantly from 20.94 per cent over a period of several years. The data are presented in Table 1.

Table 1. Per Cent Volume of Oxygen in Antarctic Air

Sample	Latitude	Longitude	Date	Analysis 1	Analysis 2	Analysis 3	Average
SP-1	10 S	100W	12/16/54	20.90	20.91	20.88	20.90
9	73 S	163W	1/27/55	20.82	20.84	20.83	20.83
10	72 S	131W	1/30/55	20.82	20.82	20.85	20.83
11	69 S	100W	2/3/55	20.88	20.87	20.85	20.87
12	65 S	65W	2/6/55	20.86	20.89	20.85	20.87
15	72 S	15W	2/15/55	20.88	20.87	20.85	20.87
21	12 N	38W	4/2/55	20.86	20.86	20.86	20.86
Woods Hole...	42 N	70W	5/7/56	20.93	20.94	20.96	20.94

All of the samples are significantly below local air by amounts varying from .04 to .11 per cent. Two of the samples are from the tropics where normal values have always been reported. In view of this it is believed that the slightly lower oxygen percentage arose during the sampling and storage of the gas. Because of the greater solubility and reactivity of oxygen nearly all of the conceivable errors would tend to lower it in relation to nitrogen. DOLE ET AL. (1954) found that they had to allow for chemisorption of oxygen in the steel cylinders used to take atmospheric samples from rockets. One is not able to calculate how large such an effect might be. The measurements given here probably do not represent a significant departure from normal atmospheric composition. Since they are as much as .4 per cent above the summer values of Lockhart and Court, their earlier work is not substantiated. It is hoped that the large amount of Antarctic work during the International Geophysical year will include more atmospheric composition measurements.

Woods Hole, Massachusetts, December 25, 1956.

JOHN KANWISHER
Woods Hole Oceanographic Institution.

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On Short-Period Magneto-Hydrodynamic Waves in the Ionosphere

Gentlemen,

An interesting paper by Dr. B. Lehnert was published in *Tellus*, 1956, **8**, No. 2, p. 241. This paper explains the giant pulsation in terms of magneto-hydrodynamic waves travelling between the different ionospheric layers in the auroral zone. It is assumed that the velocity of Alfvén's waves is $H(4\pi\varrho)^{-1/2}$, where ϱ is the density of the atmosphere including neutral atoms. I see some difficulties in this suggestion. The periods of waves T lay in the range between 60 and 300 sec. For the ionosphere the time t_n of mean collisions is according to Dr. B. Lehnert (private communication)

Layer	D	E	F_1	F_2
t_n (sec)	$5 \cdot 10^{-6}$	$5 \cdot 10^{-4}$	1	300

for neutral atoms.

In the D, E and F_1 layers the value of $t_n < T$. However this condition is insufficient to make the neutral part of the atmosphere to oscillate with the ions.

Let the velocity of ions in the wave be v_i. Let the ions reach this velocity due to the action of the magnetic force during the time $t < t_n$. As a result of collisions the ions can transmit their momentum to the neutral atoms. But the abundance of neutral atoms is much greater than that of ions. The total momentum of the atmosphere will be about $\frac{\varrho_i}{\varrho} \varrho v_i$ after one collision. N collisions are needed in order that the whole atmosphere should acquire the wave matter velocity. If the wave energy is expressed in terms of the strength of the disturbing magnetic field h, the velocity of ions in the magneto-ionic waves will be about $v = h\,(4\pi\varrho)^{-1/2}$. If the whole atmosphere takes part in magneto-hydrodynamic oscillations, the velocity of matter will be about $v = h\,(4\pi\varrho)^{-1/2}$. We have an approximate condition

$$N \cdot \frac{\varrho_i}{\varrho}\,\varrho v_i \approx \varrho v \text{ and } N \approx \frac{v\varrho}{v_i \varrho_i} \approx \left(\frac{\varrho}{\varrho_i}\right)^{1/2}$$

The wave period must exceed $4Nt_n \approx 4\left(\frac{\varrho}{\varrho_i}\right)^{1/2} t_n$ in order that the atmosphere would be able to take part in the magneto-hydrodynamic oscillations. If this condition is not fulfilled only the magneto-ionic waves will exist. The velocity of their propagation is about $v = H(4\pi\varrho_i)^{1/2}$ and the damping of these waves is very large according to Dr. J. Piddington's investigations. Calculations show that this condition is not fulfilled in the normal E, F_1 and F_2 layers.

Crimea, USSR, December 28, 1956.

I am, Gentlemen,

Yours faithfully

S. B. Pickelner

Crimean Astrophysical Observatory.

Dear Sir,

In a recent paper (*Tellus*, 1956, **8**, No. 2, p. 241) an attempt has been made to explain the giant pulsations in the auroral zones in terms of hydromagnetic waves. Prof. S. B. Pickelner has pointed out in the preceding note that the coupling between the ions and the neutral gas is too poor for the total mass of gas to oscillate as a whole. I fully agree that, with the present knowledge of ionospheric data, such a type of oscillations is impossible outside the auroral zones. What speaks in favour of such oscillations inside the auroral zones is that the periods of oscillation of ordinary hydromagnetic waves can be made consistant with the observed periods of giant pulsations (between 60 and 300 seconds). In order not to conflict with the difficulties pointed out by Pickelner the ionization degree has to be high inside the region of a giant pulsation. Consequently, reliable data have to be obtained for the ionization degree inside such a region before it can be decided whether a hydromagnetic approach is relevant or not.

Stockholm, Sweden, January 7, 1957.

Bo Lehnert

The Royal Institute of Technology.

Errata

Volume 8, number 4. Page 434, 2nd column, line 7 from below: For "alone on giant hygroscopic nuclei" read "in the life of one cumulus bubble".