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ABSTRACTS*

Adel, Arthur. Concerning the vertical distribution and origin of atmospheric nitrous oxide.

The author's discovery of nitrous oxide¹ in the earth's atmosphere has received numerous confirmations,² both in this country and abroad. The amount present is comparable with that of atmospheric ozone, about 3 mm N.T.P.³

It was subsequently discovered that nitrous oxide is one of the most abundant constituents of soil air,⁴ whereupon it was suggested by the present author that escaping soil air might well be a principal source of the atmospheric nitrous oxide.⁵ R. C. Taylor, R. A. Brown, W. S. Young and C. E. Headington⁶ find nitrous oxide the most abundant constituent of soil air, constituting more than one-fifth, by volume.

It is the purpose of this note to summarize several lines of evidence, recently adduced, which lend strong support to this early hypothesis regarding the gas's origin, which make it seem probable that the nitrous oxide "layer" is adjacent to the earth's surface, and which strongly suggest the idea that atmospheric nitrous oxide is an important phase in the nitrogen cycle.

(a). The effective radiation temperature of atmospheric nitrous oxide is about 10°C as deduced from observations of the atmosphere's infra-red emission spectrum.⁷

(b). A British Admiralty Group, investigating atmospheric transmission in the infra-red, have found large concentrations of nitrous oxide in air paths parallel and close to the surfaces of the land and sea.^{2(c)}

(c). An inspection of solar spectra recorded aboard high-flying aircraft reveals a greatly diminished absorption by nitrous oxide in the 7.8 micron region.⁸

(d). Finally, a recent mass spectrographic analysis has revealed that in the atmosphere near ground level the concentration of nitrous oxide is about 5×10^{-5} per cent by volume.⁹

Apropos of the foregoing evidence it appears very likely that nitrous oxide escapes from the soil into the atmosphere, compelling, also, the conclusion that this escape constitutes a phase of the nitrogen cycle. It thus becomes clear, for the first time, how nitrogen, captured from the atmosphere and fixed in the soils of the earth, is ultimately returned to the atmosphere at the conclusion of the nitrogen cycle:

(a). Nitrous oxide appears in the soil as a decomposition product of the fixed nitrogen compounds,

(b). The nitrous oxide escapes into the atmosphere,

(c). Nitrous oxide diffusing into the upper atmosphere is decomposed photochemically by $\lambda < 2000\text{\AA}$ into N_2 , O_2 , and NO ; and at these high atmospheric levels NO is also decomposed photochemically into nitrogen and oxygen by $\lambda < 2000\text{\AA}$.

(d). Presumably, the nitrous oxide accumulates above the earth's surface until the rates of accumulation and decomposition are equal.

1. *Ap. J.* **90**, 627, 1939; **93**, 509, 1941.

2. (a) J. H. Shaw, G. B. B. M. Sutherland and T. W. Wormell, *Phys. Rev.* **74**, 978, 1948.

(b) M. Migeotte, On the Presence of CH_4 , N_2O , and NH_3 in the Earth's Atmosphere, in *The Atmospheres of the Earth and Planets*, p. 284, 1949.

(c) H. A. Gebbie *et al.*, Admiralty Research Laboratory, T.R.E./T. 2129, Dec. 1949.

3. Arthur Adel, Selected Topics in the Infra-red Spectroscopy of the Solar System, in *The Atmospheres of the Earth and Planets*, p. 272, 1949.

* Of papers presented at the Eighty-fourth Meeting of the American Astronomical Society, Haverford, Pa., Dec. 27-30, 1950.