Contrary to the widespread conception that the Atlantic continental shelf extends seaward approximately to the one hundred fathom line, Professor Johnson finds that the margin of the continental platform is only a few fathoms below sea level off Florida, is from twenty-five to thirty-five fathoms deep off Georgia and the Carolinas, forty to forty-eight fathoms opposite Maryland, forty-eight to fifty-five off the New Jersey and Long Island coasts and sixty to seventy fathoms deep at the outer edge of the Banks. The margin of the shelf certainly pays scant attention to the one hundred fathom depth at which it is traditionally supposed to occur and apparently was not developed with respect to the present relative position of land and sea. On the contrary, the author concludes from the depth of the floor of the submerged lowlands in the Gulf of Maine that the depth of submergence for New England is at least as great as twelve hundred feet.

Although primarily of interest to the specialist in geology and geography this book will undoubtedly make an appeal to a wide range of readers. The discussion of the submarine physiography of the Gulf of Maine and the Newfoundland Banks leads to an apt suggestion concerning the route and time of migration of the peculiar coastal plains flora which Professor Fernald has been investigating during recent years in Acadia and Newfoundland. Those interested in coast protection and marsh reclamation will find much of interest and of value. In fact, all who love the sea and the forms it fashions along the land will find answers to many of the questions they have frequently asked about our coastal scenery.

So far as Professor Johnson's deductions are concerned, it is probable that in the main they will meet with the general approval of those competent to pass judgment upon them. On the other hand, the assertion that this portion of the North American shore line is now stationary with respect to sea-level and has remained so during the few centuries of historic occupation will doubtless meet with opposition. The rather widespread view that this coast is now sinking at the rate of a few inches per century must certainly be looked upon with suspicion on account of this and other of Professor Johnson's publications, but it can not be said as yet to be disproved. More facts are needed before certain conclusions are justified; perhaps these will be forthcoming in the same author's projected volume on "The Coastal Plain Shoreline." In the meantime, geologists and geographers are deeply indebted to Professor Johnson for this stimulating and scholarly publication.

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SPECIAL ARTICLES

A NEW TYPE OF GASEOUS CATALYSIS

IN SCIENCE[1] of November 6 a preliminary account was given of certain organic gas reactions produced at ordinary temperature by the ionizing action of radon. In the last paragraph of that paper announcement was made of the discovery that nitrogen ions (N_2^+) have the same power of causing the polymerization of acetylene of cyanogen and of hydrogen cyanide, as do their own ions $C_2H_2^+$, $C_2N_2^+$ and HCN^+, respectively. Since nitrogen, although exerting this accelerating influence, did not itself in any case enter into permanent combination, we termed the effect *"ionic catalysis."*

It appeared important to find how general this effect of inert gases might be. Therefore *helium, neon* and *argon* were separately mixed with acetylene and a small quantity of radon was introduced as ionizing source. In all three cases the results were the same as for nitrogen; the ratios $\frac{-M_{C_2H_2}}{N_{(C_2H_2+He)}}$, $\frac{-M_{C_2H_2}}{N_{(C_2H_2+Ne)}}$ and $\frac{-M_{C_2H_2}}{N_{(C_2H_2+A)}}$ were all initially equal to about 20, the value for $\frac{-M_{C_2H_2}}{N_{C_2H_2}}$ in the case of pure acetylene. This value is maintained even when the ionization of the inert is as much as 50 per cent. of the total. The specific ionizations relative to air are: $i_{He} = 0.211$; $i_A = 1.25$; i_{Ne} (estimated by interpolation from He and A) = 0.75. By assuming $\frac{-M_{C_2H_2}}{N_{(C_2H_2+Ne)}} = 19.6$, and calculating backward, we predict $i_{Ne} = 0.75$. No experimental value for i_{Ne} was available.

Having thus shown the effect to be quite general for inert gases, we desired to see if it is confined to polymerization of triple bond compounds like C_2H_2, C_2N_2 and HCN. We, therefore, compared the rates of combination of $2H_2 + O_2$ with and without the presence of nitrogen. Again the nitrogen ion contributed just as much to the reaction velocity as the 0_2^+, H_2^+ and 0_2^- ions do. Since the ionization of N_2 is almost double that of electrolytic gas when they are mixed in equal proportion, $1N_2$ to $1(2H_2 + O_2)$, the reaction rate would be expected to be nearly 3 times as fast as if N_2 were absent, which was found experimentally to be the case. Or $\frac{M_{H_2O}}{N_{(O_2+H_2+N_2)}} = 4 = \frac{M_{H_2O}}{N_{(O_2+H_2)}}$. Incidentally, this indicates that not only the N_2^+ ions are effective but all the free electrons from these N_2^+ ions are trapped by O_2 to form 0_2^- ions, which are

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[1] SCIENCE, 62, 422 (1925).

also equally effective (compare J. Am. Chem. Soc. 47, 2678 (1925)). Argon when mixed with electrolytic gas also was found to have a positive catalytic effect, though less than that of nitrogen.

The generality of the effect having been thus extended, the question arose as to why CO_2 when generated in other reactions had failed to show a similar catalytic effect. Is the exception peculiar (1) to CO_2, or (2) to the systems in which it has been generated, or (3) to both? To settle (1), CO_2 has been used in acetylene polymerization and in water synthesis with the following results: $\frac{-M_{C_2H_2}}{N_{(C_2H_2 + CO_2)}} = 17.4$, at a point in the reaction where 55 per cent. of the positive ions are CO_2^+. While it thus appears that CO_2 acts quite normally as an inert ion catalyst, about 10 per cent. of CO_2 was found to be lacking in the gas phase at the end of the reaction when C_2H_2 was completely exhausted from an initial (1:1) mixture. Whether this amount of CO_2 had reacted chemically has not been determined. In the system $1(2H_2 + O_2) + 1CO_2$, carbon dioxide did not prove to be inert. The entire rate of reaction was accounted for as the sum of the known rates of the separate reactions: $2H_2 + O_2$ and $2H_2 + CO_2$. (*loc. cit.*)

To settle (2), argon has been used as inert catalyst in the reaction $2CO + O_2 = 2CO_2$, where CO_2, although produced by the reaction, fails to accelerate it. Argon was found to catalyze the reaction, but less than the normal, just as it was found to do in the oxidation of hydrogen.

In discussing these results, Professor K. T. Compton proposed a very interesting hypothesis, namely, that when the inert gas has a higher ionization potential than the reacting gas has, the positive ion of the inert upon colliding with the neutral reactant molecule will ionize the latter by taking away an electron from it; for example, with neon and acetylene, $Ne^+ + C_2H_2 = Ne + C_2H_2^+$. The $C_2H_2^+$ then behaves just as if it had been originally formed by an alpha-particle collision. This would explain at once why the inert ions have the same power of producing polymerization as have the primary ions of the reactant. The catalytic reactions so far considered conform generally with this principle—but it will be possible to give it a severer test by choosing inerts with ionization potentials definitely lower than those of the reactants. Then there should not only be no positive catalysis, but a high degree of negative catalysis by the reverse process.

The question resolves itself into a fundamental one of the properties of gaseous ions. When the positive ion of the inert gas meets a neutral molecule, do they exchange the positive charge, or do they unite and form a clustering center? Or, putting the question another way: Does the ion of the inert revert to the neutral state upon first effective collision with the reactant, or not until after clustering is complete and electrical neutrality is reestablished by the return of an electron? Professor Compton has volunteered to approach the question from the physical side and we have planned a series of experiments which ought to afford a decision through the chemical evidence to be obtained. A more extended discussion will be postponed, awaiting the new results.

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CONCENTRATION OF THE GROWTH-PROMOTING PRINCIPLE OBTAINED FROM YEAST. (VITAMIN B.)

It was reported in our previous communication[1] that the growth-promoting principle present in the brewers' yeast could be prepared in a form which was in a unit weight approximately 2,000 times stronger than the dried yeast itself. The substance was still a complex mixture. Further purification was made difficult by the fact that the process was accompanied by large losses of active material. It was urgent therefore to seek for a more economical method of concentration. Such has now been developed.

In only three steps a material is obtained which is equal in potency to the material previously described and which is associated with a loss of only 50 per cent. of the original material. The starting material is the fraction of yeast extract prepared according to Osborne and Wakeman. The aqueous solution of this material is brought to $pH = 4$. Some inert material settles out. From the solution the active material is precipitated with alcohol. The solution of this material is treated with nitrous acid and by this treatment a substance is obtained which is active in daily doses of 0.0018 gm. The maximum loss in active units is 10 per cent. Often such material is prepared without any loss in active units. The composition of this material is $C = 38.2$, $H = 6.0$, $N = 10.3$, $P = 7.6$, $S = 1.46$, $NH_2.N = 0$. The sulfur was present mostly in the form of $-SH$ groups. From this material the active principle was extracted with silica gel. From the gel by extraction at pH 9.5 a material was obtained which was active in daily doses of 0.00008 gm. The material contained about 4 per cent. of sulfur. The white rat was used as the experimental animal.

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B. J. C. van der Hoeven

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[1] Levene, P. A., and van der Hoeven, B. J. C., *J. Biol. Chem.*, xlv, 483 (1925).