XVII. Observations on the constituent parts of atmospheric air

Count de Morozzo

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The author describes, also, two sorts of crania found in the mosses in the department of La Somme, and which have a great resemblance to those of the urus, which are nearly one fourth larger.

Cit. Cuvier concludes his researches as follows: 1. It is not agreeable to truth to assert that the animals of the south have formerly existed in the north, their species not being perfectly identic. 2. That there have existed in all countries animals which do not exist at present, and that are nowhere to be found in any known part of the globe. He therefore leaves it to geologists to make such changes or additions, in regard to their systems, as they may think necessary to explain the facts which he has thus established.

XVII. *Observations on the Constituent Parts of Atmospheric Air.* By Count de MOROZZO. With the Remarks of F. VAN HUMBOLT. From the Journal de Physique, *Fruëidor*, 6th Year.

IN the memoir which I published in 1784, on animal respiration in dephlogisticated or oxygen gas, I offered some reflections respecting the constituent parts of atmospheric air, founded on experiments I had made. Lavoisier, in his Elementary Treatise of Chemistry, does not agree with my experiments. That author says, that the component parts of atmospheric air are 73 parts of mephitic or azotic gas, and 27 of oxygen gas, eminently respirable. It will then be seen, adds he, that when animal substances are dissolved in the nitric acid, there is disengaged a great quantity of gas, which extinguishes a lighted candle, injures animals, and which has a perfect resemblance to that part of atmospheric air which is unfit for respiration. If to 73 parts of this fluid we add 27 of oxygen gas, obtained from mercury reduced to the state of an oxyde by calcination, there is formed a

fluid perfectly similar to that of the atmosphere, and which has all its properties.

The following, on the other hand, are the corollaries which I have deduced from a great number of experiments made to ascertain the duration of animal life in noxious aeriform fluids, mixed in different proportions with oxygen gas, tending to illustrate the real composition of atmospheric air.

1. The examination by means of burning tapers is not accurate for ascertaining the salubrity of the air. I shall quote only two examples. A fifth part of oxygen gas mixed with air contaminated by the vapour of sulphur, suffered a candle to burn, while an animal shut up in it died in a few seconds. A seventh part of the same gas mixed with air vitiated by the vapour of charcoal, supported flame, while an animal died in it almost instantaneously.

2. That pure and salutary part said to be contained in atmospheric air, which forms a third of it according to Scheele, and a fourth according to Lavoisier, is not a real dephlogisticated oxygen gas; since this gas united with mephitic airs, in a much less proportion than a third or fourth, supports the flame of a candle after an animal dies in it, which is not the case with atmospheric air.

3. The real component parts of atmospheric air are still unknown; since, with a mixture of different gases, nothing has been obtained but compound gases, which have indeed some properties of air, but never those of atmospheric air.

The author, to illustrate the question, relates eight characterizing marks of atmospheric air, acknowledged by philosophers; and adds, that though he tried, by a multitude of experiments, to compose atmospheric air, by mixing dephlogisticated gas with different mephitic gases, the gases so obtained always contained something not to be found in atmospheric air.

He

He repeated the experiments of Lavoisier, by mixing 73 parts of fixed air (carbonic acid gas), obtained from lime, with 27 of gas obtained from the red precipitate. This mixture, indeed, exhibited to him all the characters and properties of atmospheric air, but it differed considerably from it in its essential property.

A candle is suddenly extinguished in atmospheric air in which an animal has died; another animal could not live in it an instant. On the other hand, in this artificial mixture, a flame burnt with vivacity; and a second animal, a sparrow, lived 25 minutes, a third 14 or 15: a light, introduced after the death of the third sparrow, burnt still with a bright flame. "*This mixture then does not form an elastic fluid perfectly similar to that of atmospheric air, and having all its properties.*" He tried to add to this mixture phlogisticated gas, inflammable air, and that in which an animal had died. A second and third animal lived in them some time, and a candle was not extinguished.

Remarks on the above Observations, by F. Von Humbolt.

The memoir of Count Morozzo treats of a very important subject with which I have been engaged for some months. The Italian philosopher has observed the difference between natural atmospheric air and an artificial compound of azot and oxygen; but, in my opinion, he goes too far, in asserting that atmospheric oxygen is not vital gas; though I agree with him that we are not able to form an aeriform fluid, such as the illustrious Lavoisier announces in his Elements of Chemistry, perfectly similar to that of the atmosphere. I however find that this difficulty consists neither in our ignorance of the *quantity*, nor of the *quality* of the two gaseous bases. The difference found between the effect of natural and artificial atmospheric air, is to be ascribed to the *state of the combination* in which the oxygen is joined to the azot. The atmosphere is not a *mixture*: its constituent parts ought to be considered as in a state of *chemical combination*.

nation. It is for this reason that the two bases of a specific gravity so different, that of azot and that of oxygen, do not entirely separate from each other, though the high regions are most charged with azot. Hence azot retains so strongly the last portion of the oxygen, which phosphorus, the sulphure of pot-ash, and other-acidifiable bases ought to take from it; and I have for this reason seen that the nitrous gas acts in proportions very different in decomposing the natural atmospheric air, or a compound of 27 of oxygen and 73 of azot. But how could Morozzo think to imitate the atmosphere by mixing the carbonic acid and oxygen? He has confounded azot with the carbonic acid gas. But he assures us that his atmospheric air with a carbonic acid base, gave the same specific weight as atmospheric air. Here is a very striking experiment: one cubic inch of azot weighing 0,46624 grains, while the same cubic inch of carbonic acid weighed 0,67500 grains! Morozzo tells us that a candle burnt in his artificial mixture with a very brilliant flame (*con fiamma lucidissima*). By combining 0,25 of the carbonic acid with 0,75 of oxygen, I have seen a wax taper extinguished. The same thing took place when, in company with Tasseart in Vauquelin's laboratory, I mixed two parts of the carbonic acid gas with ten parts of atmospheric air. There is then formed a new chemical combination: the carbonic acid lays hold so strongly of the oxygen of the atmosphere, that the affinity presented by the lighted wax taper is not powerful enough to take it away. In my work on the analysis of the mephitic vapour of mines, which is about to be translated into French, it will be seen that there exists airs not unfit for respiration, which are composed of 0,27 of oxygen, 0,70 of azot, and 0,03 of carbonic acid gas. It is the state of the combination, and not always the quantity of oxygen, which renders air more or less capable to destroy animal life, or to extinguish flame.