geometricians; but he further insists that, for the investigation of abstruse and latent truth, and the evolution of intricate problems, the analytical method is on every consideration to be preferred to the geometrical.

Observations and Experiments upon oxygenized and hyperoxygenized Muriatic Acid; and upon some Combinations of the Muriatic Acid in its three States. *By* Richard Chenevix, *Esq. F.R.S. and M.R.I.A.* Read January 28, 1802. [*Phil. Trans.* 1802, *p.* 126.]

The author introduces the subject of his paper by stating that Mr. Berthollet, having observed a large portion of common muriate of potash to be always produced along with the hyperoxygenized muriate, had formed an ingenious conjecture, that the quantity of oxygen, relatively to the acid, was greater in the salt than in disengaged oxygenized muriatic acid; but that no experiments having appeared since the year 1788 to prove this assertion, he was induced to examine the properties of the salt, and the nature of the acid it contains. He next mentions such authors as have treated any part of his subject; and intimates that Mr. Hoyle of Manchester appears to him to be the chemist, who, after Mr. Berthollet, has approached nearest to the truth. He then proceeds to describe the means by which he has determined that the acid contained in his hyperoxygenized muriate of potash is, in fact, an acid *sui generis*; and those by which he arrived at the proportion of oxygen. After which he treats of the saline combinations of oxygenized and hyperoxygenized muriatic acids.

To determine the proportion of oxygen in hyperoxygenized muriatic acid, he distilled one hundred grains of hyperoxygenized muriate of potash in a coated glass retort, and collected one hundred and twelve cubic inches of oxygen gas, = 38·3 grains. He then precipitated by nitrate of silver the salt which remained in the retort, and a small portion of it that had been volatilized into the tube, and obtained a quantity of muriate of silver, corresponding with twenty of muriatic acid; and hence he concluded that one hundred parts of hyperoxygenized muriatic acid contained,

Oxygen	65
Muriatic acid	35
	100

He then passed a current of oxygenized muriatic acid through a solution of potash, and distilled the liquor to dryness in an apparatus, by which he could ascertain whether there was any disengagement or absorption of oxygen from the liquor or from the salt it held in solution. No oxygen was disengaged or absorbed; and hence it appears that the same quantity was now condensed in the hyperoxygenized muriate of potash as was originally contained in a relative quantity of oxygenized muriatic acid. The salt thus obtained, Mr. Chenevix, for the sake of brevity, calls *entire salt*. He analysed it,

and found it to contain common muriate of potash 84, hyperoxygenized muriate 16. But by the proportions established above, 16 hyperoxygenized muriate contain 6 of oxygen, and this, with the acid contained in the whole 100 of entire salt, gives the proportions,

Oxygen	16
Muriatic acid	84
	100

These proportions differ a little from those obtained by Mr. Berthollet and by Mr. Cruikshank; the former mentions 11 per cent. of oxygen, the latter 43. But Mr. Berthollet, in all probability, used an acid which already contained a little simple muriatic acid, or else he did not expel all the oxygen from his oxygenized muriatic acid by the light of the sun. And Mr. Cruikshank having made use of hyperoxygenized muriate of potash and muriatic acid, to obtain that which he examined, the result was a mixture of oxygenized and hyperoxygenized muriatic acid gases.

Having stated the proportions of the acids, the author passes on to the examination of the salts. Oxygenized muriates are decomposed at the very moment of their formation, and are resolved into common muriates and hyperoxygenized muriates. To prove this, Mr. Chenevix asserts that he always obtained the same proportion of muriate of silver, by pouring some nitrate of that metal into the recent liquor of the entire salt, as into some that he had evaporated. But he concludes that the acid does really come into contact with the alkali, and unite with it, in the state of oxygenized muriatic acid, because ammonia is decomposed by a current of that acid; and ammonia (as is afterwards proved) is not decomposed either by common or by hyperoxygenized muriatic acid. From this experiment he concludes also, that hyperoxygenized muriatic acid has a much greater affinity than oxygenized muriatic acid to the salifiable bases.

Mr. Chenevix then passes to the examination of the hyperoxygenized muriates. These are all formed by the resolution of the elements of oxygenized muriates into common muriates and hyperoxygenized muriates. They have properties that characterize them fully. The acid is expelled by all acids, except the benzoic, acetic, acetous, boracic, prussic, and carbonic; and the order of affinity of the salifiable alkaline and earthy bases is potash, soda, barytes, strontia, lime, ammonia, magnesia, alumina, and silica.

The first species is, therefore, hyperoxygenized muriate of potash, which the author thinks can exist in two states. It was from this salt chiefly that he attempted to disengage the acid. If sulphuric acid be poured upon it, a crackling noise is heard, and an orange-coloured liquor, with greenish yellow fumes, is disengaged; but the acid cannot thus be obtained pure, as the heat necessary to bring it over is sufficient to decompose it. In attempting to distil this mixture a violent explosion ensued as soon as heat was applied. As a caution to those who would repeat the experiment, Mr. Chenevix describes an accident which happened to Dr. Vandier, by which that gentle-

man was dreadfully wounded, and was near losing his sight: by dropping the salt into sulphuric acid there is less danger of explosion at the beginning; but still the acid does not come over without decomposition. By cooling the first receiver with ice, the author thinks that he has obtained the acid in the form of little orange-coloured octahedral crystals.

Nitric acid produces nearly the same phænomena.

Muriatic acid decomposes the salt, and takes a part of the oxygen from the hyperoxygenized muriatic acid, and becomes oxygenized.

Phosphoric, tartareous, oxalic, arsenic, and citric acids decompose this salt with the help of heat.

Some attempts were made to combine diamond with oxygen, in the humid way, by means of this salt and this acid; but they did not prove successful. Caloric is mentioned as a considerable ingredient in this as in all hyperoxygenized muriates.

The proportions of the salt are,

Hyperoxygenized muriatic acid	58·3
Potash	39·2
Water	2·5
	100·0

The second species is hyperoxygenized muriate of soda. This salt Mr. Chenevix obtained pure by crystallizing in alcohol. It is decomposed by the same agents as the former species. It is deliquescent. Its proportions are,

Hyperoxygenized muriatic acid	66·2
Soda	29·6
Water	4·2
	100·0

A distinguishing character of the earthy hyperoxygenized muriates is their resemblance to their respective muriates, in point of solubility. The author at first despaired of being able to separate them from the muriates which accompany their formation; but phosphate of silver afforded him the means. Phosphate of silver decomposes all simple muriates, and the hyperoxygenized muriates remain alone in solution. It was thus he obtained them pure enough for analysis. He found the following proportions in each salt:

Third species. Hyperoxygenized muriate of barytes.

Hyperoxygenized muriatic acid	47·0
Barytes	42·2
Water	10·8
	100·0

Fourth species. Hyperoxygenized muriate of strontia.

Hyperoxygenized muriatic acid	46
Strontia	26
Water	28
	100

Fifth species. Hyperoxygenized muriate of lime.

Hyperoxygenized muriatic acid	55·2
Lime	28·3
Water	16·5
	100·0

The sixth species of hyperoxygenized muriate of ammonia cannot be formed by direct combination. By pouring a solution of carbonate of ammonia into a solution of any of the earthy hyperoxygenized muriates, the earth is precipitated with the carbonic acid, and hyperoxygenized muriate of ammonia remains in the liquor. This salt is decomposed at a low temperature, and has all the characters of the genus to which it belongs. It is a very striking example of the force of co-operating affinities which can unite this acid with ammonia; while oxygenized muriatic acid decomposes that alkali. It is also a proof of the different attractions exercised by these two acids toward the salifiable bases.

Hyperoxygenized muriate of magnesia is the seventh species. Its proportions are,

Hyperoxygenized muriatic acid	60·0
Magnesia	25·7
Water	14·3
	100·0

The author has not determined the proportions of the eighth species, viz. hyperoxygenized muriate of alumina, because this salt was always decomposed by phosphate of silver; and he imagines that hyperoxygenized muriate of silica does not exist.

He then states some corrections which he has made in the proportions of common muriates, respecting the quantity of water they contain. This he esteems to have been rated too high by the chemists who have examined them. He exposed a given weight of muriate of potash to a red heat, and examined it to know if any of the acid had been expelled. Some portion had been volatilized, and upon this correction he established the proportions he has announced in this paper.

He then passes to the metallic salts of this genus, a number of which he has formed by passing a current of oxygenized muriatic acid through water, in which the oxide was suspended. Copper, iron, lead, and silver, he readily combined with the acid. The last of these salts he considers with greater attention for two reasons: first, because it affords a very striking difference between the hyperoxygenized and common muriatic acids; and, secondly, on account of its extraordinary properties. This salt is soluble in three parts of water, crystallizes by cooling, is not affected by light, but is decomposed by all the weak acids, even vinegar. Rubbed in a mortar with about three-fourths of sulphur, it detonates by a very gentle pressure, and with so much violence that Mr. Chenevix estimates the expansive force at nearly ten times that of a mixture of sulphur and hyperoxygenized muriate of potash.

He then states two extraordinary and unforeseen productions of this acid: one was during an analysis of manachanite from Botany Bay, in which oxygen had passed from oxide of titanium into a combination of potash with muriatic acid, and formed hyperoxygenized muriate of potash; and the other was in distilling nitro-muriatic acid upon platina. He tried the action of manganese in the same manner as the titanium, but could not succeed; nor did nitric acid convert oxygenized into hyperoxygenized muriatic acid.

Mr. Chenevix states that Mr. Berthollet had proposed to consider muriatic acid as the radical of the other two, and says that oxygenized muriatic acid corresponds with nitrous and sulphureous acids, and hyperoxygenized muriatic acid with nitric and sulphuric.

Our author states the arguments in favour of the old and the new mode of denomination; and upon the consideration that many bodies called acids have not been proved to contain oxygen, and that of some the contrary has been demonstrated, he seems inclined to think that an impartial hearing of both sides of the question must, in the present state of chemical knowledge, decide in favour of

Muriatic radical, or some word of the same import,	instead of	Muriatic acid;
Muri*atous* acid,		Oxygenized muriatic acid;
Muri*atic* acid,		Hyperoxygenized muriatic acid.

Experiments and Observations on certain Stony and Metalline Substances, which at different Times are said to have fallen on the Earth; also on various Kinds of native Iron. By Edward Howard, *Esq. F.R.S.* Read February 25, 1802. [*Phil. Trans.* 1802, *p.* 168.]

In considering the copious contents of this paper, we shall find it convenient to distribute them under the four following heads: 1. The historical part; 2. The descriptive part; 3. The analytical part; and 4. General observations on the subject, and a comparison of these stones with other substances which seem to bear some affinity to them.

And, First, as to the historical part. Waving all former accounts, both of the ancients and moderns, of stones which, under the names of Ceraunia, Bœtilia, Ombria, Brontia, Belemnitæ, &c. were supposed to have fallen from heaven, of which accounts most are disproved, and others are involved in inexplicable obscurity, we may lay some stress on the instances adduced by Mr. King, in his late tract "concerning stones which are said to have fallen from the clouds;" and also on the evidence of the Abbé Bachelay, who laid before the French Royal Academy a stone, which he asserted had been found on the 13th of September, 1768, still hot, by persons who saw it fall; and that of Professor Barthold, who analysed and described a stone found near Ensisheim in Upper Alsace, under the unqualified name of Pierre de Tonnere. These observations and experiments of the Abbé and