posed by the soap, the soda of which combines with the acetic acid, and the fatty acids with the oxide of lead. The wax and oil serve to give consistence to the preparation. It is used as a mild cooling dressing for scrofulous swellings, and other local inflammations, as well as for fractured limbs: in the latter case its principal use is as a mechanical support.

[The *U. S. Pharmacopœia* directs to take of solution of sub-acetate of Lead, two pints; Soap, six ounces; white Wax, ten ounces; Olive Oil, a pint. Boil the solution of sub-acetate of Lead with the Soap, over a slow fire, to the consistence of honey: then transfer to a water bath and evaporate until all the moisture is dissipated; lastly, add the Wax previously melted with the Oil and mix.]

3. EMPLASTRUM SAPONIS, L. E. D. (U. S.;) *Soap Plaster.* (Soap, sliced, lbss.; Litharge Plaster, lbiij. *L. D.* (U. S.)—Litharge Plaster, ℥iv.; Gum Plaster, ℥ij.; Castile Soap, in shavings, ℥j. Mix the soap with the liquefied plaster, and boil down to a proper consistence.) The quantity of soap here ordered is said by Mr. Scanlan[1] to be too much by one-half; as when prepared by the formula of the London and Dublin pharmacopœias it is quite pulverizable and falls into crumbs. The Gum Plaster ordered by the Edinburgh College will tend to obviate this defect. Boiling is unnecessary. This plaster, spread on leather, is used as a discutient and mechanical support.

4. EMPLASTRUM SAPONIS COMPOSITUM VEL ADHÆRENS, D. *Adhesive Plaster.* (Soap Plaster, ℥ij.; Litharge Plaster with resin, ℥iij. Make a plaster, which should be melted and spread on linen.)—This plaster is less apt to irritate than the litharge plaster with resin, "owing to the much smaller proportion of resin. It is a very useful application to those abrasions of the skin which take place in consequence of long confinement to bed."[2]

ORDER XIII.—COMPOUNDS OF BARIUM.

1. BARY'TÆ SUL'PHAS, *E. D.*—SULPHATE OF BARYTA.

HISTORY.—Native sulphate of baryta, called *Ponderous* or *Heavy Spar* (*Spathum ponderosum,*) was formerly confounded with sulphate of lime. In 1774 Scheele discovered baryta, and in the year following, Gahn analyzed heavy spar, and found that it was composed of sulphuric acid and baryta.

NATURAL HISTORY.—It is peculiar to the mineral kingdom.

It frequently occurs crystallized in forms belonging to the right prismatic system. The crystals are commonly tabular. The *Straight-lamellar Heavy Spar* forms splendid groups of crystals. It occurs in Cumberland, Durham, Westmorland, &c. The *Curved-lamellar Heavy Spar* is generally known as *Cock's Comb Barytes.* It is common in Scotland, Derbyshire, &c. *Compact* or *Earthy Sulphate of Baryta* occurs in Staffordshire and Derbyshire, and is called *Cawk.* The *Bolognese Spar*, from Monte Paterno, near Bologna, is *Radiated Sulphate of Baryta.*

PROPERTIES.—Sulphate of baryta has a density of from 4·41 to 4·67. It is inodorous and tasteless. When pure it is, in the pulverulent form, quite white. The form of its crystals has been above noticed.

"White or flesh-red; heavy; lamellar; brittle." *Ph. Ed.*

Characteristics.—Before the blowpipe it decrepitates, but is not easily fused. "This difficult fusibility constitutes a good mark of distinction between this mineral and sulphate of lime or of strontian."[3] Ultimately it melts into a hard white enamel. It is insoluble in nitric acid. Reduced to powder, mixed with charcoal, and ignited, it is converted into sulphuret of barium, which, on the addition of hydrochloric acid, evolves sulphuretted hydrogen (see p. 406,) and yields a solution of chloride of barium (See the tests for this salt at p. 485.)

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[1] Dr. Montgomery, *Observations on the Dublin Pharmacopœia*, p. 596.

[2] *Ibid.* p. 597.

[3] Dr. Thomson, *Outlines of Mineralogy, Geology, and Mineral Analysis*, vol. i. p. 104. Lond. 1836.

COMPOSITION.—Sulphate of baryta has the following composition:—

	Atoms.	Eq. Wt.	Per Cent.	Berzelius.
Baryta	1	77	65·8	65·643
Sulphuric Acid	1	40	34·2	34.357
Sulphate of Baryta	1	117	100·0	100 000

PHYSIOLOGICAL EFFECTS.—According to the experiments of Orfila (*Toxicologie Générale.*) it is inert.

USES.—Sulphate of baryta, on account of its cheapness, is the usual source from whence the other salts of baryta are obtained; and on this account it has been introduced into the Edinburgh and Dublin Pharmacopœias. In its pure state it is sometimes employed as a pigment.

2. BARY'TÆ CAR'BONAS, *L. E.* (U. S.)—CARBONATE OF BARYTA.

HISTORY.—In 1783, Dr. Withering recognised the native carbonate, which has, in consequence, been called, after its discoverer, *Witherite.*

NATURAL HISTORY.—It is peculiar to the mineral kingdom.

Witherite occurs in the lead mines of the North of England; as of Anglesark, in Lancashire. *Baryto-Calcite*, a compound of carbonate of lime and carbonate of baryta, is met with at Alston Moor, Cumberland.[1]

PREPARATION.—The native carbonate of baryta is sufficiently pure for the preparation of the other barytic salts, and is the kind meant in the London Pharmacopœia.

Absolutely pure carbonate may be prepared by the addition of a pure alkaline carbonate to a solution of chloride of barium.

It may also be obtained by igniting (or boiling in water) finely-powdered sulphate of baryta with three parts of carbonate of potash, or carbonate of soda, and washing away the resulting alkaline sulphate.

PROPERTIES.—Native carbonate of baryta occurs massive, stalactitic, and crystallized. Its crystals belong to the right prismatic system. The sp. gr. of this mineral is 4·3. Heated before the blow-pipe it melts into a white enamel, with the evolution of much light and the loss of carbonic acid. Artificially prepared carbonate is a fine, tasteless, odourless powder. It is almost insoluble in both hot and cold water; 4,304 parts of cold, or 2,304 parts of hot water, being required to dissolve one part of carbonate. It is more soluble in carbonic acid water.

Characteristics.—It dissolves with effervescence in hydrochloric acid: the evolved gas is carbonic acid: (see p. 302) the solution contains chloride of barium (see p. 485 for its characteristics.)

COMPOSITION.—The following is the composition of this salt:—

	Atoms.	Eq. Wt.	Per Cent.	Berzelius.	Berard.
Baryta	1	77	77·7	77·9	78
Carbonic Acid	1	22	22·2	22·1	22
Carbonate Baryta	1	99	99·9	100·0	100

PURITY.—It should be white, odourless, tasteless, and entirely soluble in hydrochloric or nitric acid, by which its freedom from sulphate of baryta is demonstrated. Neither caustic ammonia nor hydrosulphuric acid should produce any precipitate or change of colour in the hydrochloric solution, by which the absence of alumina and metallic matter (lead or iron, or copper) may be inferred. If excess of sulphuric acid be added to this solution, the whole of the baryta is thrown down in combination with the acid, and no precipitate should be occasioned by the subsequent addition of carbonate of soda, by which the absence of lime is shown.

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[1] For some curious anecdotes respecting its discovery at this place, see Parkes's *Chemical Essays*, vol. i. p. 324, 2d edit. London, 1823.

Totally soluble in diluted hydrochloric acid. This solution on the addition of ammonia or hydrosulphuric acid, does not give any precipitate, and it remains colourless; when more sulphuric acid is added than is necessary to saturation, nothing is afterwards thrown down by carbonate of soda.—*Ph. Lond.*

"One hundred grains dissolved in an excess of nitric acid are not entirely precipitated with sixty-one grains of [anhydrous) sulphate of magnesia [or one hundred and twenty-five grains of the crystallized sulphate of magnesia."]—*Ph. Ed.*

Physiological Effects. α. *On Vegetables.*—Germination does not take place in carbonate of baryta. (Vogel, in De Candolle, *Phys. Végét.* p. 1341.)

β. *On Animals.*—Cows and fowls have been destroyed by swallowing the native carbonate. (Parkes, *Chem. Essays*, vol. i. p. 330.) Orfila (*Toxicol. Générale.*) says a drachm of the powder killed a dog in six hours; but C. G. Gmelin (*Versuche über d. Wirk. des Baryts*, &c., p. 8.) gave two drachms to a dog: vomiting took place, and the animal was well the next day. A drachm killed a rabbit in three hours. When applied to a wound it has proved fatal. (Campbell, quoted by Christison, *Treatise on Poisons*, 3d ed. p. 532.) From the above experiments carbonate of baryta appears to act as an acro-narcotic poison: when swallowed it causes vomiting, inflames the alimentary tube, becomes absorbed, and acts specifically on the nervous system, causing convulsions, paralysis, and insensibility.

γ. *On Man.*—Only one case illustrating its action on the human subject has been published. (Dr. Wilson, *Lond. Med. Gaz.* vol. xiv. p. 487.) A young woman swallowed half a tea-cupful of the powdered carbonate: in two hours she had dimness of sight, double vision, ringing in the ears, pain in the head, and throbbing in the temples, a sensation of distention and weight at the epigastrium, distention of stomach, and palpitation. Subsequently she had pains in the legs and knees, and cramps in the calves. A day or two after the cramps became more severe. These symptoms, slightly modified, continued for a long time.

Uses.—Carbonate of baryta is employed in the preparation of the chloride of barium. It is not administered as a medicine.

Antidote.—(Vide *Barii Chloridum.*)

3. BA'RII CHLO'RIDUM, *L.* (U. S.)—CHLORIDE OF BARIUM.

(Barytæ Murias, *E. D.*)

History.—This compound was discovered by Scheele in 1775. It was at first termed *Terra Ponderosa Salita*, and afterwards *Muriate of Barytes.*

Preparation.—All the British Colleges give directions for the preparation of this salt.

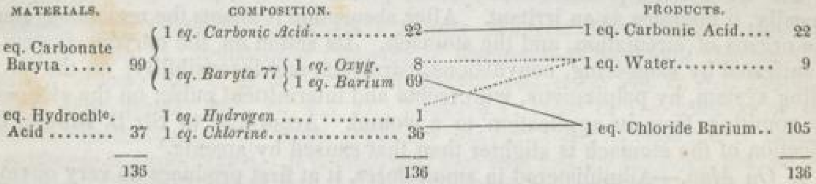
The formula of the *London College* is as follows:—Take of Carbonate of Barytes, broken into small pieces, ℥x.; Hydrochloric Acid, Oss.; Distilled Water, Oij.—Mix the Acid with the Water, and add the Carbonate of Barytes gradually to them. Then, heat being applied, and the effervescence finished, strain and boil down the liquor, that crystals may be formed.

The *Edinburgh College* directs it to be prepared either in the same way as the London College, or as follows:—Take of Sulphate of Baryta, lbij.; Charcoal, in fine powder, ℥iv.; Pure Muriatic Acid, a sufficiency. Heat the sulphate to redness, reduce it to a fine powder, mix the charcoal with it thoroughly, heat the mixture in a covered crucible for three hours at a low white heat. Pulverize the product, put it gradually into five pints of boiling water; boil for a few minutes; let it rest for a little over a vapour-bath; pour off the clear liquor, and filter it if necessary, keeping it hot. Pour three pints of boiling water over the residuum, and proceed as before. Unite the two liquids; and while they are still hot, or, if cooled, after heating them again, add pure muriatic acid gradually so long as effervescence is occasioned. In this process the solutions ought to be as little exposed to the air as possible; and, in the last stage, the disengaged gas should be discharged by a proper tube into a chimney or the ash-pit of a furnace. Strain the liquor, concentrate it, and set it aside to crystallize.

The *Dublin College* also prepares it from the sulphate. The process is as follows:—Take of Sulphate of Baryta, *ten parts;* Charcoal, reduced to the most subtle powder, or of Lampblack, *one part.* Let the Sulphate of Baryta be roasted in the fire, and whilst red hot thrown into water; then let it be reduced to the finest powder, in the manner directed for Prepared Chalk. Let the powders, intimately mixed together, be passed into a crucible, and exposed to a strong heat until they become red hot, during four hours. Let the mass, when cold, be dissolved in a quantity of boiling distilled water, amounting to ten times the weight of Sulphate of Baryta, and let the liquor be filtered. To this add, avoiding the vapours, as much muriatic acid as may be sufficient to saturate the baryta. Then let the liquors be filtered, from which, by evaporation and cooling, let crystals be formed.

[The formula of the *U. S. Pharmacopœia* is near to that of the London College—it orders, Carbonate of Baryta, a pound; Muriatic Acid, twelve fluid ounces; Water, three pints.]

When hydrochloric acid and carbonate of baryta are mixed together, one equivalent or 37 parts of hydrochloric acid react on one equivalent or 99 parts of carbonate of baryta; and the products are one equivalent or 22 parts of carbonic acid, which escape; one equivalent or 9 parts of water, and one equivalent or 105 parts of chloride of barium.



When a mixture of sulphate of baryta and charcoal is submitted to an intense heat, the carbon combines with the oxygen of the sulphuric acid and of the baryta, and forms carbonic oxide, which escapes. The residue digested in water forms a solution of sulphuret of barium. On the addition of hydrochloric acid, hydrosulphuric acid gas is evolved, and the solution by evaporation yields crystals of chloride of barium.

Properties.—Chloride of barium crystallizes in right rhombic plates or tables, sometimes in double eight-sided pyramids, which belong to the right prismatic system. To the taste this salt is disagreeable and bitter. Its sp. gr. is 2·825. In dry warm air the crystals effloresce, but in the ordinary states of the air they undergo no change. When heated they decrepitate, lose their water of crystallization, and at a red heat fuse. At a white heat, according to Planiava, this salt volatilizes. It is soluble in both cold and hot water: 100 parts of water at 60° dissolve 43·5 of the crystallized salt,—at 222°, 78 parts. It is slightly soluble in ordinary rectified spirit, but is said to be insoluble in pure alcohol.

Characteristics.—Nitrate of silver added to a solution of chloride of barium causes a white precipitate (*chloride of silver*) soluble in ammonia, but insoluble in nitric acid (see p. 218.) As a barytic salt it is known by the following tests:—No precipitate is produced in a dilute solution of chloride of barium by ammonia, hydrosulphuric acid, or ferrocyanide of potassium. But the soluble sulphates, phosphate, and carbonates, occasion with chloride of barium white precipitates (which are respectively *sulphate*, *phosphate*, and *carbonate of baryta*.) The sulphate of baryta is insoluble in nitric acid. Chloride of barium communicates a greenish-yellow tint to flame.

Composition.—Crystallized chloride of barium has the following composition:—

	Atoms.	*Eq. Wt.*	*Per Cent.*	*Berzelius.*	*Phillips.*
Barium	1	69	56·09	85·201	85·5
Chlorine	1	36	29·26		
Water	2	18	14·63	14·799	14·5
Crystallized Chloride Barium	1	123	99·98	100·000	100·0

Purity.—The crystals should be colourless, neutral to test paper, permanent in the ordinary states of the air, (if they become moist or are deliquescent, the presence of chloride of calcium, or chloride of strontium, may be suspected,) and their dilute aqueous solution should undergo no alteration of colour by the addition of ferrocyanide of potassium, hydrosulphuric acid, tincture of nutgalls, or caustic ammonia, by which the absence of metallic matter (as iron, lead, or copper) may be inferred. If excess of sulphuric acid be added, the filtered solution should be completely volatile when heated, and should occasion no precipitate on the addition of carbonate of soda, by which the absence of lime or magnesia is proved.

"Ninety grains in solution, acidulated with nitric acid, are not entirely precipitated by forty-nine [forty-four] grains of [anhydrous] sulphate of magnesia," [or ninety grains of crystallized sulphate] *Ph. Ed.*

It is unnecessary to acidulate with nitric acid, as the pure chloride is perfectly soluble in simple water.

PHYSIOLOGICAL EFFECTS. *α. On Vegetables.*—This salt is poisonous to plants. (Marcet, quoted by De Candolle, *Phys. Végét.*)

β. On Animals.—The action of chloride of barium on animals is, according to Sir B. Brodie, (*Phil. Trans.* 1812, p. 205.) analogous to that of arsenic. Locally, it operates as an irritant. After absorption it affects the nervous system, the organs of circulation, and the stomach. Its action on the nervous system is manifested by staggering, convulsions, paralysis, and insensibility; on the circulating system, by palpitations, with feeble and intermittent pulse; on the stomach, by vomiting, from its application to a wound. According to Sir B. Brodie, the affection of the stomach is slighter than that caused by arsenic.[1]

γ. On Man.—Administered in *small doses*, it at first produces no very obvious effects. In some cases the appetite appears to be improved. Soon we observe an increased secretion of urine, tendency to sweating, and not unfrequently loose stools; so that it appears to operate as a liquefacient (see p. 194.) With no other obvious symptoms than these, glandular swellings or enlargements sometimes become softer and smaller: hence it is resolvent. If we persevere in the use of gradually augmented doses, the appetite becomes disordered, nausea and vomiting, with not unfrequently griping and purging, come on: a febrile state, with dry tongue, is produced, the nervous system becomes affected, and the patient complains of giddiness and muscular weakness. Sometimes, according to Schwilgué, (*Traité de Mat. Méd.* vol. i. p. 441, 3^{me} ed.) under the continued use of it, catarrhal discharges from the eye, nose, ear, &c. take place; inflamed or suppurating lymphatic glands evince signs of an augmented excitation, wounds assume a more healthy appearance, and, in some cases, cicatrize.

In *large medicinal doses* very unpleasant effects have been occasionally observed from its use: such as vomiting, purging, sometimes griping, contracted pulse, giddiness, and great muscular debility, almost amounting to paralysis, with trembling. (See an illustrative case in *Medical Commentaries*, xix. 267.)

In *excessive* or *poisonous doses* (as an ounce) the affection of the nervous system is more obvious. In one recorded case the symptoms were convulsions, ain in the head, deafness, and, within an hour, death. (*Journ. of Science*, vol. ix. p. 382.)

In conclusion, it may be observed, that considered medicinally chloride of barium is most analogous to, though more powerful than, chloride of calcium, and is applicable in the same cases: regarded toxicologically, it may be compared to arsenic, but it acts less energetically on the stomach, and more rapidly on the nervous system, and causes death in a shorter time.

USES.—The principal medicinal use of chloride of barium is in the treatment of *scrofula*, for which it was introduced into medicine by Dr. Crawford in 1790,[2] and was subsequently used by Hufeland[3] with great benefit. The latter writer has employed it in all the forms of this disease, but especially in excited and inflamed conditions, (particularly of delicate and sensible parts, as of the lungs and eyes,) in painful ulcers, indurations which are disposed to inflame, and cutaneous affections. It has also been administered as a resolvent, deobstruent, or alterative, in

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[1] See also the experiments of Orfila in the *Toxicol. Génér.*, and of C. G. Gmelin in his *Versuche über die Wirkungen*, &c.

[2] *Medical Commentaries*, Dec. 2d, vol. iv. p. 433; and *Medical Communications*, vol. ii.

[3] *Erfahr. üb. d. Gebr. u. d. Kräfte d. salzs. Schwererde*, Berl. 1794; and *Vollst. Darstell. d. med. Kräfte u. d. Gebr. d. salzs. Schwererde*, Berl. 1794.

some other diseases; for example, *scirrhus* and *cancer*, *cutaneous diseases*, *bronchocele*, &c. As a local application, a solution of it has been used as a wash in herpetic eruptions, and as a collyrium in scrofulous ophthalmia.

In pharmacy and chemistry it is extensively employed as a test for sulphuric acid and the sulphates.

Administration.—It is used in the form of aqueous solution.

Antidotes.—The antidotes for the barytic salts are the sulphates, which form therewith an insoluble sulphate of baryta. Hence, sulphate of soda, sulphate of magnesia, alum, or well or spring water (which contains sulphate of lime) should be copiously administered. Of course the poison should be removed from the stomach as speedily as possible. To appease any unpleasant symptoms caused by the continued use of large medicinal doses, opiates may be employed.

LIQUOR BARII CHLORIDI, L. (U. S.;) *Solutio Barytæ Muriatis*, E.; *Barytæ Muriatis Aqua*, D.; *Solution of Chloride of Barium.*—(Chloride of Barium, ʒj.; Distilled Water, f℥j.; *L. E.*—Muriate of Baryta, *one part;* [℥j. U. S.] Distilled Water, *three parts;* [℥iij. U. S.] *D.* Dissolve.) Dose of the solution of the London Pharmacopœia, ten drops, gradually and cautiously increased until nausea or giddiness is experienced. It is employed also as a test for sulphuric acid or the sulphates. Common water, and all liquids containing sulphates, carbonates, or phosphates in solution, are incompatible with it.

4. BARY'TÆ NI'TRAS, *E.*—NITRATE OF BARYTA.

History.—This salt was formed soon after the discovery of baryta.

Preparation.—It "is to be prepared like the muriate of baryta [chloride of barium, see p. 484,] substituting pure nitric acid for the muriatic acid."—*Ph. Ed.*

Properties.—It crystallizes in octohedrons. It is soluble in water, but insoluble in alcohol. It is decomposed, with decrepitation, by a bright red heat, and furnishes pure baryta.

Characteristics.—As a nitrate, it is known by the tests for this class of salts already mentioned (see p. 267.) The characters of the barytic salts have been before stated (see p. 485.)

Composition.—The crystallized salt is anhydrous. Its composition is as follows:—

	Atoms.	*Eq. Wt.*	*Per Cent.*	*Berzelius.*
Baryta	1	77	58·7	58·8
Nitric Acid	1	54	41·3	41·2
Nitrate of Baryta	1	131	100·0	100·0

Physiological Effects.—Similar to those of the chloride of barium.

Uses.—It is employed as a test. Fire-work makers use it to communicate a green tinge to flame.

SOLUTIO BARYTÆ NITRATIS, E. *Solution of Nitrate of Baryta.* (Nitrate of Baryta, 40 grs.; Distilled Water, 800 grs. Dissolve the salt in the water; and keep the solution in well-closed bottles.) Employed as a test for sulphuric acid.

Order XIV.—COMPOUNDS OF CALCIUM.

1. CALX, *L. E.* (U. S.)—LIME.

(Calx recens usta, *D.*)

History.—Lime, and the mode of obtaining it by burning the carbonate, were known in the most remote periods of antiquity. Hippocrates (*Popularium*, ii. sect. 5.) employed this earth in medicine. Dr. Black, in 1755, first explained the nature of the process for making it. In 1808 Davy showed that this substance was a metallic oxide, and hence it has been termed the *Oxide of Calcium.* To distinguish it from the hydrate of lime, it is called *Caustic Lime*, or *Quicklime* (*Calx viva*,) or *Burned Lime* (*Calx usta.*)