the largest quantities. Garnierite, a double hydro-silicate of nickel and magnesia, is free from sulphur, arsenic, antimony, and cobalt, as the following analysis* will show:

	Oxygen.	Ratios.
Silica	22	2
Protoxide of nickel.....	4.07	—
Magnesia	6.56	1
Alumina.....	0.28	—
Lime.....	—	—
Water.....	18	4
Gangue	3	—
100		

It is, however, almost always found in connection with the oxides and chromate of iron. The mineralogical formula is

and a large block from the mines of Mr. J. Higginson, Numoa, New Caledonia, at once attracts attention to the show case.

Nickel ore had previously been treated by a long and complicated series of operations embracing both the wet and dry methods; but as no sulphur, arsenic, or antimony, and only infinitesimal quantities of iron and cobalt, have to be extracted from garnierite, two dry operations are sufficient. M. Garnier, who is connected with the company, has devoted the greater portion of the last four years to perfecting the process of extraction, and it is mainly due to his exertions, seconded by the skillful engineers under him, that nickel may now be obtained at a moderate price. By a simple operation, the ore, containing from 10 to 15 per cent. of metal, is transformed into a matt, or regulus, with from 40 to 75 per cent. of metallic nickel. This is effected by a roasting, or preliminary fusion, in blast-furnaces erected near the mines by Messrs. J. Higginson & Co., who have contracted to supply the French company with as much of the raw material as they may require. The matt, specimens of which are exhibited, is shipped by the French company to their works at Septèmes, near Marseilles. Here it is refined in special furnaces, and run into ingots perfectly free from sulphur, containing 99½ per cent. of pure nickel, ¼ per cent. being utilizable metallic substances, and the remaining ¼ per cent. waste. Besides ingots, portions of which have been polished, *grenaille*, or granules, of nickel are shown both varieties being used for forming the various alloys.

No small amount of prejudice exists against nickel among those who only know it in the state of electro-deposit; and this is not surprising, for not only does the thin coating of nickel soon wear off with cleaning, and expose the metal beneath, but even, in the case of iron and steel, nickel-plating affords no thorough safeguard against the oxidizing influences of the atmosphere. Although the French company produce and supply anodes of nickel for restoring to the galvanic bath the metal taken up by electro-deposit, and also salts, in the form of simple sulphate of nickel and double sulphate of nickel and ammonia, for forming the bath, they are endeavoring as far as possible, to supersede this use of the metal by their various alloys. They contend that an alloy containing 20 per cent. of pure nickel is not liable to oxidation, and may be wrought with the same plant and by the same processes as brass and copper, while the finished articles are 20 per cent. stronger, and cost only a trifle more, than if made of brass and nickelized. The absence of oxidation saves much labor in cleaning, as the articles remain bright, and only require occasional washing, but no special cleaning like brass. By the side of white nickel bronze castings just as they have left the moulds, the show case contains a great variety of finished specimens formed by casting, rolling, or drawing, while others are *repoussé*, turned or engraved. All present that pure tint so much prized in nickel; and it is a satisfaction to know that they are composed of the same substance all through, and will not turn color on being exposed to the air, nor show red or yellow edges when worn with cleaning. Among the objects exhibited may be especially mentioned railway-carriage door-handles and hand-rails, door-handles for the New Opera, hinges, part of machines, taps and cocks, a large bowl beaten out of the solid casting, locks, name-plates, hooks and chains, buckles, lamps and reflectors, mathematical and optical instruments, medals and coins, statuettes and other works of art, for which it is admirably suited on account of its silver-like appearance. In fact, the collection is as varied as possible, in order to show what has actually been accomplished in the various branches of industrial art. The nickel is not worked up in a pure state, as it is found too brittle; but, besides the castings a *maillechort*, or German silver, is made, which differs from what has hitherto been known as German silver, in being of a white instead of a yellow tint. Among the sub-exhibitors may be mentioned M. Rivain et Bezault, F. A. Lange, Gaspard et Belle, Lebrégeal, Sékutowicz et Huber, Quinier, Horstmann, Faucault, Grubier et Tranchard, Pinédo, and Chertier, besides the Silverine Company for spoons and forks.

By no means the least interesting exhibits are the articles made of *Acier Larocque*, or nickel steel, contributed by MM. Rullier, Mauget et Cie., consisting of an anvil and set; sledge, fitters' and coppersmiths' hammers; hatchets and other edge tools; a yacht anchor and vessel fittings; and also some drawn tubes. This combination is the result of experiments by M. Larocque, who found that a very small amount of nickel added to steel increases its strength, and causes edge tools made of the mixture to stand better than if of steel alone. This quality of great strength, combined with the cleanliness and freedom from oxidation imparted by the nickel, admirably fits nickel steel for the manufacture of surgical instruments, specimens of which are exhibited.

Besides the collective exhibition, the various products of the Compagnie Française may be seen worked up in the collections of individual exhibitors. In the pavilion of the President of the Republic is a suspension or hanging lamp, all the parts of which, whether cast, rolled, or stamped out, including the tubes and wire composing the chains, are of white nickel bronze. One specimen in the trophy of bells near the east entrance is composed of the same alloy, and it is said that the exhibitor, M. Crouzet Hildebrand—time honored name in bell founding—is so pleased with the result that he intends hereafter to employ it exclusively. Some beautiful furniture, including a chair and work-table for the future Queen of Spain, is shown by M. Giraudon; the framework is covered with the polished skin of a Chinese shark, inlaid with nickel, and the mouldings with a fine sheet of nickel bronze, the two harmonizing admirably

* Note sur un nouveau minéral de Nickel (Garnierite), par M. Gillet—Paris, ingénieur civil des mines, communication faite à la Société des Sciences Industrielles de Lyon.

and producing a highly artistic effect. Nickel bronze also enters into the composition of the lockwork of MM. Vaillant Fontaine et Quintart, the metal fittings of M. Gits, the saddlery of the Maison Million, and the mirror frames of M. Carpentier. In fine, if the Exhibition of 1878, at which the gold medal was awarded for this metal, showed that an important trade had been started in the metallurgy of nickel, that of 1879 shows the practical application of its products to the most important branches of industry.

The company do not sell various alloys ready made, the content of nickel in which cannot well be checked; but they supply either their pure nickel or an alloy containing half nickel and half copper, which facilitates the somewhat new process of fusion. In order to facilitate the introduction of their nickel alloys into foreign countries, however, and insure purity, they undertake to inspect the casting of the ingots at the works of the most skillful French founders, and to guarantee the purity of the ingots.

ACTION OF LIME ON SILICA IN MORTAR.

By W. B. ROBERTS, M.S.A.

HAVING found in the recent analysis of some specimens of old mortar from the walls of a building erected about two hundred years ago, considerable traces of hydrated silica, it occurred to me that possibly the hardening or setting of mortar might be due to some chemical action occurring between the lime and the silica when these ingredients were mixed, whereby some proportion of the silica was caused to assume the gelatinous form; that this being then incorporated by the usual mixing process, subsequently solidified, binding the whole bulk with a hard network of silica. To test this, I obtained two good specimens, one from the exterior, and one from the center of a wall which was two feet thick, for the purpose of making a careful analysis of each. In order to compare the results with those of some experiments presently to be described, I also examined a sample of mortar from a building of comparatively recent date.

Subjected to the mechanical test of a gradually increasing pressure, the two older samples proved about equal in hardness, while both of them were harder than the third. The samples taken for analysis were quite free from brick, and few of the grains of sand were of greater weight than about 1 gm.

The specimens were crushed fine in a steel mortar, and 200 grms. of each treated for twelve hours with sulphuric acid (sp. gr. 1.65); the temperature was then gradually raised until the excess of acid was completely expelled; after cooling the residue was boiled up repeatedly with water: the insoluble residue gave the total silica—conveniently referred to as silica, silica free, and sand.

To find amount of soluble silica, the insoluble residue was boiled with a saturated solution of sodium carbonate for a considerable time; the liquid, after filtration, was treated with hydrochloric acid and evaporated to dryness in the usual way, and gave the amount of free and combined soluble silica in the mortar. * Then, to ascertain how much, if any, free hydrated silica, i.e., silica which was or had been gelatinized, existed in the mortars, 200 grms. of each were treated with saturated solution of sodium carbonate exactly in the manner just described for separating the soluble silica from the sand. The percentage of previously gelatinized silica was confirmed by treatment with pure hydrofluoric acid. The other constituents were estimated by the ordinary methods. The following were the results obtained:

	I.	II.	III.
	From Exterior of old Wall.	Interior of old Wall.	More recent Mortar, Exterior.
Sand.....	67.12	67.19	55.54
Combined silica.....	1.12	0.93	0.18
Free hydrated silica.....	0.68	0.40	0.09
	68.92	68.52	55.81
Calcium carbonate.....	25.05	28.04	31.84
Magnesium carbonate.....	0.68	0.60	0.09
Sodium carbonate.....	0.90	1.41	trace
Lime originally as silicate	1.05	—	—
Soda.....	0.41	—	—
Calcium sulphate.....	0.49	0.43	0.19
Sodium chloride.....	0.17	0.14	0.08
Oxide of iron, alumina.....	0.02	0.02	0.01
Water, hygroscopic.....	2.09	1.02	1.78
	99.78	100.18	99.80
Carbonic anhydride.....	11.78	13.18	15.03

To find as far as possible whether the original lime had contained any calcium silicate—this being, as is well known, produced sometimes in comparatively large quantities during the burning of different limestones—as much of the lime as could be picked out free from sand by the aid of a lens was tested for free or combined soluble silica in the same way as the mortar. The results were:

	I.	II.	III.
	0.17	0.20	0.11
Soluble silica per cent.....			

Further, to test whether, in a comparatively short time, the sand would be attacked by freshly slaked lime, 300 grms. of fine sharp sand, free from soluble silica, were placed in each of three bottles under the following conditions for six months, after which time analysis gave the results stated below:

I. Mixed with 150 grms. pure lime, and sufficient water to make a thick paste, and prevented from absorbing CO₂.....

II. Same as I., but with the addition of 2 grms. of mixed carbonate of soda and potash.....

III. Same as II., with occasional slow current of CO₂, besides constant access of atmospheric air,.....

From the general results of the above analysis and experiments, I conclude that the accepted theory of the hardening of mortar, namely, that it is due to the absorption of carbonic acid is unshaken.

In the cases of the experiments I. and II. the conditions have been very favorable for the action of the lime upon the silica, but its effects are manifestly too small to materially influence the hardness of the resulting mortars. However, samples I. and II. were harder than III., although I. contained much less CO₂ than III. My general conclusion may be summarized as follows:

(1.) Practically no gelatinization of silica occurs in the manufacture of mortar.

(2.) That under the ordinary conditions of access of at-

mospheric air the lime in mortars becomes gradually dehydrated, absorbs carbonic acid, and forms neutral carbonate.

(3.) That the absorption of carbonic acid is very slow.

(4.) A slight action takes place between the lime and the silica, though this appears to be too small to determine its nature.

(5.) That, although even the small proportion of dry silicates slightly increases the hardness of a mortar, the ordinarily sufficient hardness of mortar is obtained by simple dehydration and carbonation.

These conclusions appear to be confirmed by the fact that lime already containing a small proportion of carbonate is preferred to pure lime for making mortar.—*Chemical News*.

VOLATILITY OF PLATINUM IN CHLORINE GAS AT HIGH TEMPERATURES.*

By SEELHEIM, of Utrecht.

SOME years ago the author made the curious observation that when platinum foil is kept at a red heat in dry chlorine gas, the metal gradually volatilizes, and in a colder part of tube gets re-deposited as a sublimate, consisting of measurable crystals of the regular system. The crystalline nature of the sublimate proves that the metal must have traveled through the tube as a vapor. In order, however, to make quite sure of this important result, the author, quite lately, repeated the experiment in a modified form, consisting in this, that he heated a quantity of platinum chloride in a porcelain flask to bright redness. The flask was allowed to cool and then cautiously broken up, when the metallic platinum due from the chloride was found, not at the bottom of the flask, but somewhere higher up at the sides, in the form of a crystalline sublimate. This, the author says, confirms what was observed some time ago by Troost and Hautefeuille, who found that platinum chloride, when heated to 1,400° C. in a porcelain flask, and allowed to cool, suddenly gives a deposit of PtCl₂, while when cooled down gradually it yields only Cl₂ and metallic platinum.

The volatilization of the platinum must be owing to a chemical cause. We must assume that the metal, when heated in chlorine gas, passes, at least, temporarily, into a volatile chloride, which, at lower temperatures, breaks up again into chlorine gas and metallic platinum. If this chloride is PtCl₂, and PtCl₂=1 molecule, its vapor should occupy the same volume as the "Cl₂" contained in it, and consequently Victor Meyer's experiments proved, as before, that "Cl₂" at high temperatures dissociates into two or more molecules. But it is more natural to assume that the PtCl₂ vapor has only a transitory existence, being continually formed and re-decomposed into Pt vapor and chlorine. At any rate, Victor Meyer's results do not prove that chlorine gas (at 1,500° or so) undergoes dissociation, because what he operated upon was not pure chlorine but chlorine contaminated with volatilized platinum.

So far Seelheim. In my opinion the most natural interpretation of Seelheim's and Meyer's results is to assume that 2(Pt+Cl₂), produced by the decomposition at a dull red heat of 2PtCl₂, at higher temperatures, associate into 2PtCl+Cl₂=6 vols. (i.e., 6 times the volume of ½H₂)=3 times the volume the 2Cl₂ present at the lower temperature. Or else we may assume that the atomic weight of platinum is pt.=½Pt, and that, what on starting was 2pt.Cl₂ (solid), at higher temperatures got transmitted thus:

Meyer's discovery, then, appears to be a mistake, but it is one of those mistakes that could only have been committed by a great experimenter like him.—W. D. Anderson's College, Glasgow, Nov., 1879.

PREPARATION OF PERFECTLY PURE HYPOPHOSPHITE OF SODA.†

By M. BOYMOND.

It has long been known that the preparation of hypophosphite of soda by the action of phosphorus on a solution of soda is not a practical process. This finds a ready explanation in the property possessed by the hypophosphites of oxidizing rapidly in alkaline solutions in proportion as the base is energetic and the solutions concentrated. It consequently happens that in heating phosphorus in a strong solution of potash or soda, much phosphite is formed, and in boiling hypophosphites in such solutions they are converted, with disengagement of hydrogen, into phosphites and phosphates. Besides the formation of a considerable quantity of phosphite, this process presents the inconvenience that the phosphite and phosphate formed, as well as the alkali in excess, are dissolved, and are very difficult to eliminate.

As to the preparation of the hypophosphites by means of a milk of lime, although that base presents important advantages over soda—as the quantities of phosphite and phosphate formed are less considerable and the elimination of these salts and the lime in excess is more easy—this process does not yield a perfectly pure product, the proportion of phosphite and phosphate present amount sometimes to as much as five per cent. Hypophosphite of soda prepared with such a salt of lime could not be pure. Besides, even when the hypophosphite of lime is perfectly pure, the evaporation in a water-bath of an alcoholic solution of pure sodic hypophosphite is sufficient to give rise to an appreciable quantity of phosphite.

The author has obtained this salt entirely pure by employing, in the place of hypophosphite of lime, a clear solution of hypophosphite of baryta, in the following manner:

25 grammes of commercial hypophosphite of soda, containing phosphite, and one gramme of hypophosphite of baryta (sufficient to precipitate all the phosphorous and phosphoric acid contaminating the product) were mixed and water added so that the volume of the whole solution did not exceed 50 c.c. Some time afterward, without filtration, nearly 200 c.c. of absolute alcohol were added, the mixture was allowed to stand, and then filtered. In this way all the phosphoric acid was precipitated, as well as nearly all the excess of baryta in the state of hypophosphite. To the clear filtered liquid was added, in small quantities, sufficient solution of sulphate of soda to precipitate the baryta still dissolved; then about 100 c.c. of absolute alcohol was added and the liquid allowed to stand. The clear liquid obtained by filtration and decantation was afterwards mixed in a

* A condensed translation of an article in the last number of the *Berichte der Deutschen Chemischen Gesellschaft*. Communicated by Prof. Dittmar.—*Chemical News*.

† *Repertoire de Pharmacie*.

* Thorpe, "Quantitative Analysis," p. 185.