



XCI. Report of the progress of the sciences in France in 1813

J.C. Delametherie

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consequently strains the guys when going very quick. The dotted lines at *x*, fig. 3, I propose to be a piece of plank to be continued on the end of the topsail-yard, so formed or filled up as to carry off the body of water complained of.

(Signed) ANTHONY LOCKWOOD.

XCI. *Report of the Progress of the Sciences in France in 1813.*
By J. C. DELAMETHERIE*.

ANIMAL PHYSIOLOGY.

On the influence which the temperature of the air exercises in the chemical phenomena of respiration.

RESPIRATION has been latterly regarded as a kind of combustion, viz. that of the carbon and hydrogen contained in the venous blood. The oxygen absorbed by this combustion forms carbonic acid and water.

It has been endeavoured to ascertain the quantity of atmospheric air which a man of a middling stature inspires at each inspiration, and expires at each expiration. It has been supposed that it was from 20 to 30 and even 40 cubic inches; but I have shown that this supposition is not correct. A man of a middling stature inspires only a few inches of atmospheric air. Now the atmospheric air contains only about one fifth oxygen, or 0.21.

In the act of respiration a very small portion of this oxide inspired is combined with carbon, and forms carbonic acid.

Another portion of this oxygen is combined with a portion of inflammable gas, and there is a production or disengagement of water. But the greater part of this light portion of oxygen is not combined, and it is found in the air expired mixed with carbonic acid.

But Delaroche, like myself, has discovered that there is a *production of azote*.

He made a great number of experiments in order to determine the influence which the temperature of the air exercises in the chemical phenomenon of respiration. He placed at different temperatures animals in *manometres* or glass vessels with large apertures, hermetically closed by copper plates and screws. If we compare, he says, the results of the experiments made on one and the same animal placed in the same circumstances and at *different temperatures*, we shall see that almost in all the experiments upon the cold-blooded animals, the quantity of oxygen absorbed was a little greater when the temperature was low than when it was high.

* Abridged from the *Journal de Physique, de Chimie, et d'Histoire Naturelle*, for Jan. 1814.

The difference between the quantities of carbonic acid formed at different temperatures is still less considerable.

In all cases there is less carbonic acid produced than oxygen absorbed. *I concluded*, he says, *with M. Berthollet, that there was a production of azote.*

In an experiment made upon a hare, the manometre contained 0·7900 azote, 0·2100 oxygen.

After the experiment, the azote was 0·7991, the oxygen 0·1516, and the carbonic acid 0·0416.

There was therefore a production of 0·0091 of azote, and 0·054 of oxygen absorbed. I had remarked the same phenomena, and I have observed in my Essay upon pure Air, that in the air expired there was always a production of a portion of *impure air*, the azote of the new nomenclature.

Spallanzani has proved that a contrary effect takes place in the cold-blooded animals. My experiments, says M. Delaroche, prove also that heat augments in a most remarkable manner the activity of respiration in these animals. The quantity of oxygen absorbed by frogs exposed to a heat of 27° has been in one experiment *double*, and in the other *quadruple*, to what it was when the external temperature did not exceed six or seven degrees.

ANIMAL HEAT.

Respiration being regarded as a kind of combustion, it has been considered as the principal cause of the heat of animals; but I have shown that too much stress has been laid on this cause.

1. *a.* We find that a man of middling stature only takes in at every inspiration a few cubic inches of atmospheric air. Now atmospheric air contains but little more than one-fifth of oxygen, or 0·21.

b. There is but a small quantity of this oxygen combined in respiration, certainly less than a cubic inch.

2. *a.* A man who sleeps tranquilly takes cold, although he breathes quite at his ease.

b. If he takes exercise, he acquires heat, and even perspires.

c. An animal exposed to a severe cold may perish if it does not take exercise. If, on the contrary, it moves or carries burdens, it preserves its life.

d. Consequently the muscular motion has the greatest influence on animal heat.

3. Oxygen gas contains very little heat; therefore the small portion which is combined in the act of respiration has produced very little heat.

I have concluded from these facts, that animal heat proceeded

ceeded but in a very trifling degree from the caloric extricated from the oxygen inspired.

4. If animal heat proceeded from respiration, or from the combustion of the carbon in the act of respiration, the lungs ought to possess a greater degree of heat than the other parts of the system, as Brodie has asserted, which is not the fact. He thinks that animal heat is in a great measure under the influence of the nervous system and of the brain.

In the muscular movements the nervous system is in a state of activity more or less considerable; this is the reason that heat is produced in the animal body.

5. The fermentation of the various animal liquors contributes much to the heat of animals, for we know that every fermentable substance contracts heat. Now all the animal liquors are in a perpetual state of fermentation.

6. There are continual combinations in the animal œconomy which give new products, such as the phosphoric, uric, sebic, acids, glutine, fibrine, &c. &c. Now all these combinations are uniformly accompanied with an extrication of caloric.

7. The galvanic action is powerfully exerted among the various heterogeneous particles of the bodies of animals which ferment. This galvanism is very intense in the electric eel, &c. and contributes powerfully to animal heat.

BOTANY.

Picot la Peyrouse has given a complete history of the plants of the Pyrenees. Cassini has published an elegant work on the Synantheræ, or Syngenesiæ of Linnæus, the Composita of Tournefort.

Palisot de Beauvois, having ascertained that the methods for the study of the Gramineæ were imperfect, has proposed a new one, which he calls *Agrostographia*. Desvaux has published some additional observations on the Lycopodiæ, of which Jussieu and Mirbel have furnished us with an extract.

Bonpland has published the second number of the rare plants of Navarre and Malmaison.

Redouté continues his work on the Liliacæ. Mirbel has published the description of various new fruits, and also a History of Botany from its infancy among the Greeks to the present time.

Decandolle has given an elementary treatise on botany, or an explanation of the principles of natural classification, and of the art of describing and studying vegetables. Tristan has published a fine work on the budding of plants.

VEGETABLE PHYSIOLOGY.

Under this head M. Delametherie, after stating it to be his opinion

opinion that the analogy between the organization of plants and animals becomes daily more evident, gives a sketch of the memoir of M. Link on the structure of vegetables, which has been already given at length in the Philosophical Magazine.

MINERALOGY.

Cordier has made some researches respecting the stone called by some mineralogists *water sapphire*, and by some others blue quartz. It is brought from India, and particularly from Ceylon. Its gravity is 2.580, which removes it from the sapphire. Its colour is blue at first sight; but when we view it in a plane perpendicular to the direction which had shown the blue, its colour is of a clear brown inclining to gray. This double colour made M. Cordier suppose that this stone was a variety of the dichroïte.

Of the Ligurite.—This stone has been discovered by Viviani in the mountains of Liguria near Genoa. This substance, which I have not seen, appears to several naturalists to be a variety of Titanite.

Of the Chlorite in secondary strata.—It was once supposed that chlorite existed only in primitive strata, but it has since been found in secondary also. It is met with in the vicinity of Paris. Risso has also observed it in the environs of Nice. Near the castle of Nice, he says, there are regular beds of *chloritous* marl with belemnites. These facts show that minerals, which have been thought peculiar to primitive strata, may be transported into secondary. Lambotin has found fluor also in the environs of Paris; but it is crystallized with calcareous spar, which proves that it has been brought there and deposited.

Of the Lherzolite.—I have given this name to a stone from Lhers in the Pyrenees, where Le Lievre found it: it appears to be a variety of smaragdite.

Charpentier junior saw large beds of it in the same place. He regards it as a variety of augite, but augite has not as yet been found *en masse*. Vogel analysed it, and found as follows:

Silex	45
Alumine	1
Lime	19.50
Magnesia	16
Oxide of iron	12
Oxide of chrome	0.50
Oxide of manganese a slight trace.	
Loss	6

This analysis approaches very closely to that of the green smaragdite, made by Vauquelin.

Picotite.—We sometimes find in the heart of the masses of lherzolite,

herzolite, a blackish substance which seems to have some connection with Gadolinite. Charpentier gave it the name of Picotite, from the name of Picot de la Peyrouse.

Mines of Tin discovered in France—Tin mines have been discovered near Limoges, and others at Pirac near Nantes.

Of Rocks.—The year 1813 has supplied us with various works upon rocks; but they have not all met with the approbation of mineralogists, and they continue to adopt the nomenclature of rocks given by the Germans, imperfect as it is.

Pinkerton has published a work of considerable extent upon rocks.

Other mineralogists have also proposed a new nomenclature for rocks: but it may be fairly thought that they wished them to have been unanimously rejected, for they are removed from all the *philosophical principles of language*. They gave, for example, the name of *mimosa* to a rock composed of feldspar and augite. Now there is no naturalist, or even amateur, who does not know that a celebrated plant, viz. the sensitive plant, is called *mimosa*; when we read the word *mimosa*, who can tell whether a stone or a plant is alluded to?

It would be useless to detail the other defects of works so unanimously disapproved.

Crystallography.—After noticing Dr. Wollaston's labours on the molecules of crystals, M. Delametherie proceeds:—Werner told me during his last visit to Paris, that he thought the figure of the primitive molecules of matter was spherical.

Preschtal adopted the same opinion. Bodies, he says, do not crystallize but when they are in a liquid state. Now every fact seems to prove that the molecules of liquids are spherical. Descartes had published the same opinion. He said that the molecules of his two first elements, fire and the luminous fluid, were spherical.

GEOLOGY.

This branch of science has been this year the subject of the labours of a great number of scientific men. Geology is equally advanced with the other branches of natural philosophy. It has problems, it is true, which have not been as yet resolved, but there are problems in all the other natural sciences.

Of primitive Earths.—The primitive earths form the major part of our globe. The geologist cannot therefore study too minutely those with which we are acquainted, such as granites, porphyries, gneiss, schists, anygdaloids, the metals, the anthracites, &c.

Charpentier jun. has given some interesting details respecting the Pyrenees. Hoff and Jacobi have visited, as intelligent mineralogists,

neralogs, the Thuringewald, and Braun Neergard has given us an account of their journey. In similar researches we ought chiefly to mark out the chains of primitive earths which traverse the surface of the globe. I have distinguished for instance five great masses of primitive earths in France :

1. A portion of the Alps.
2. The Cevennes.
3. A portion of the Pyrenees.
4. The mountains of Bretagne.
5. The Vosges.

Secondary Earths.—On this subject Risso has given a description of the calcareous earths in the vicinity of Nice. All these secondary earths contain quantities more or less considerable, of fossils, *i. e.* traces of animals and vegetables.

The knowledge of fossils may afford some notions as to the formation of the strata of the globe in latter times : this branch of geology, therefore, is making rapid progress, as we are better acquainted with living animals and vegetables. I have distinguished three fossil orders :

Marine fossils deposited at the bottom of the sea.

Fresh-water fossils deposited in fresh water.

Land fossils deposited in the bowels of the earth, or buried by the fall of mountains, without having been touched by water.

We can also distinguish

The fossils of organized beings which live in the ocean.

The fossils of organized beings which live in fresh water.

The fossils of organized beings which live on the continents.

FRESH-WATER STRATIFICATIONS.

It cannot be doubted that there were strata formed in fresh-water lakes after the lowering of the level of the water of the ocean, as I have proved in my *Theory of the Earth*, tome v. p. 137.

Lamanon long since recognised fresh-water shells in the strata of the environs of Paris ; which made him say that several of these strata, and particularly the chalks, were formed in *fresh-water lakes*. He has said the same of the chalks of Aix in Provence.

Coupé has also given accurate descriptions of the soils in the environs of Paris : he there recognised fresh-water shells.

Cuvier and Brongniart have adopted the opinion of Lamanou with respect to certain soils in the environs of Paris. They suppose that they have been formed in fresh water, because fresh-water shells are there found. They found at Montmartre a *cyclustome of a blackish colour*.

Brongniart, Prevost, and Desmaret jun. also observed fresh-water shells in part of Auvergne. Bendaut has also found *lymneæ* (fresh-water shells) near Vaucluse. They have also been found

found near Valence in Dauphiny; near Roanne, and Orleans; in the plains of Ulm, and at Rome; in Silesia, and at Burgos in Spain.

The Isle of Sheppy at the mouth of the Thames has also presented some fresh-water shells. Faujas has also seen them on the banks of the Rhine, near Mentz, and at Frankfort on the Maine.

Risso has made us acquainted with the shells which are found in the environs of Nice.

“The waves,” he observes, “acting continually on the rock, detach these marine petrifications, polish them, mix them with the sea shells of the present day, and the remains of the terrestrial molluscæ carried along by the pluvial waters:—the whole form new deposits, which will perhaps be ænigmatical subjects of meditation for future generations.

Most of these naturalists have said that the soils in which these fresh-water shells are found had always been formed in these fresh waters, and they call them *soils of fresh-water formation*.

It cannot be denied that there have been strata formed in fresh water after the retreat of the sea. We see them formed every day in lakes of fresh water; but we cannot say that all the soils in which fossil fresh-water shells are found have always been formed in fresh water. For we have seen in these very soils, as at Montmartre, shells which are not sea shells, bones of quadrupeds of *terra firma*, &c.; the latter evidently washed by currents of water. The fresh-water shells must also have been brought there by the waters, as observed by Risso at Nice. In fact, it cannot be doubted that the fresh water which daily flows into the sea, carries with it the remains of animals and vegetables of *terra firma*, and the remains of animals and vegetables which live in fresh water. Thus the waters of the Seine may carry to Havre planorbes, lymneæ, bulimi, from the fresh water of the environs of Paris.

The greatest part of these shells is broken, as observed at Grignon, but some are preserved perfectly entire.

FOSSIL QUADRUPEDS.

We have had a great number of observations on the fossils of the mammiferous and oviparous quadrupeds. Cuvier has brought them all under view in one work, and added his own observations.

He has spoken of 78 fossil quadrupeds, as well viviparous as oviparous.

Twelve are analogous, he says, to living animals: these are,

1. A kind of hippopotamus.

2. The stag.

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E e

2. The

3. The goat.
4. The ox.
5. The aurochs.
6. The musk ox.
7. The deer.
8. The hyæna.
9. The wolf.
10. The dog.
11. The horse.
12. The sheep.

Sixteen or eighteen other species of fossils appear to be analogous to existing *genera*, but not to existing species : these are,

- The elephant.
- The rhinoceros.
- The tapir.
- The small hippopotamus.
- The bear.
- The jacuar.
- The hare.
- The fox.
- The crocodile.
- The turtle, &c. &c.

Finally, 48 other fossil species do not appear analogous either to existing species or existing *genera* : these are,

- The megalonix.
- The megatherium.
- Five species of mastodonta.
- Ten species of paleotherium.
- Five species of anoplotherium.
- A petrodactyl.

Some authors have spoken of fossil remains of apes. Swedenborg says that the bones of the sapajon have been found in copper-mines at Menungen; but Cuvier thinks that these bones rather belonged to the bat genus.

Fossil bones of the human species have also been spoken of. Cuvier thinks that these bones are not human bones.

Fossil Birds.—There are fossil birds. I have stated in my Theory of the Earth, that I have seen them in the chalks of Montmartre. Doubts have been raised improperly on this subject, for soon afterwards I saw several. But we do not know of any others.

Fossil Fishes.—In the great number of fossil fishes which have been observed in several places, as at Mount Bolca, several have been recognised similar to those of the present day.

Fossil Shells.—Fossil shells have been observed from the highest antiquity. The priests of Egypt spoke of them to Herodotus.

tus. Pythagoras had seen them, according to Ovid. But our knowledge in this respect has made great progress latterly.

Lamarck and Defrance have made us well acquainted with those in the environs of Paris. Cuvier, Brognard, Faujas, and Brard, have laboured in the same field with success.

We distinguish three orders of fossil shells, viz. sea shells, fluviatile, and terrestrial.

The sea shells are the most numerous. In the dépôt of Grignon alone, nearly 600 species are found, the species or genera of which exist at present in different seas, far asunder.

Most of the same species are to be found at Courtagnon near Rheims, according to Lamarck.

Fluviatile and terrestrial shells are less numerous. Daudebert Ferrusac counts 83 known species: 21 helices and bulimi; 1 vertigo; 24 lymneæ; 10 planorbi; 1 physis; 5 cyclostomes; 11 paludines; 1 potanidis; 3 melanopsides; 3 melanies; 2 shells approaching to the bulimus glans; 1 neritine. Twenty-five of these species, he adds, have their analogous species in the same soil. Eight have their analogous species now existing in the Indies and America. Fifty have no analogies, so far as has been hitherto discovered.

Of Crustaceous and Fossil Insects.—At Maestricht as well as at other places crustaceous fossil insects have been discovered, and every naturalist is acquainted with the insects in amber.

Of Fossil Madreporæ.—All these productions in the fossil state are very abundant.

Of Fossil Vegetables.—Fossil vegetables are extremely abundant, since they enter into the composition of the immense quantity of coal and peat moss with which the earth abounds.

We also find great quantities of fossil and petrified wood, &c. Some of these productions seem never to have been removed from the place where they are found, such as the forest of Palm-trees observed by Audenrieth on the banks of the Neekar, and the forest observed by La Fruglaie on the sea-coast near Morlaix.

But the greater number appear to have been carried to distances more or less considerable.

a. Generally we only find separate portions of the skeletons of animals, such as the teeth, thigh bones, and never the entire organized beings.

b. We find collected in the same dépôt, marine, fluvial, and terrestrial fossils.

c. Fossils have their analogous fossils in countries far distant from each other.

The above facts therefore indicate that these fossils have been carried

d. by the currents which take place at sea ; *e.* by those which take place in lakes ; *f.* by the currents of rivers ; *g.* by catastrophes which have happened on the surface of the globe.

CATASTROPHES ON THE SURFACE OF THE GLOBE.

Geologists, proceeding upon the various facts exhibited by the theory of the earth, conclude, with the priests of Memphis and all subsequent philosophers, that various catastrophes, more or less considerable, have happened on the earth's surface. Some even suppose that there have been general catastrophes.

In my *Theory of the Earth* I have cited the following causes as likely to have produced these particular catastrophes : viz.

1. *Particular Inundations.*—*a.* Abundant rains which have swoln the streams of the Nile, the Niger, and the Menau. *b.* Overflowings of lakes, of which history makes mention in abundance : such were the deluges of Ogyges, Deucalion, Prometheus, &c. *c.* Violent winds have produced great inundations in Holland, by swelling the sea, as in 1218 and 1646.

These sea waters have remained a more or less considerable time on peat mosses and other strata formed in fresh water, and deposited fossil shells. Poiret observed near Soissons peat mosses containing fluvial shells, covered with strata containing sea shells, cerites, venuses, and oysters.

d. Explosions of subterraneous fires throw up part of the sea, and cause particular inundations.

e. The fall of some mountains has produced some local inundations.

2. Earthquakes have occasioned many singular catastrophes on the surface of the globe ; but these have been confined to certain countries only. That of Lisbon in 1755 shook some countries very distant ; but its effects were far from producing a general catastrophe.

The dreadful explosions of the enormous volcanoes of Mexico and Peru produce only limited catastrophes.

3. The passage of a comet close to the earth has also been regarded as a cause which must have produced a great catastrophe on the surface of the globe, by swelling the waters of the ocean ; but all astronomers are now agreed that this hypothesis has no probable foundation.

4. But there is another cause which ought to produce, after some centuries, great changes on our globe : this is the increase of its mass, which I have proved ought to take place. I have said, in my *Theory of the Earth*, that “ a great part of the secondary strata is formed of the remains of organized beings : such are the bitumens which form immense and very deep strata, fossil

fossil plants, shells which form the major part of a great-number of stones, fossil bones, several saline substances of these stratifications."

The mass of the terrestrial globe augmenting, ought to produce changes in its relations with the other planetary bodies : their mutual attractions will change. The sun, on the other hand, perhaps loses part of its mass. It appears clear to me, therefore, that after some centuries great changes will take place upon our globe. This was the doctrine of the ancient philosophers. Ovid makes Pythagoras say in his *Metamorphoses*, book xv.

Nihil equidem durare diu sub imagine eadem
Crediderim.

Lucretius has also said, book v.

————— multosque per annos
Sustentata ruet moles et machina mundi.

But of what nature will these changes be ? We are not in possession of a sufficient number of facts to be able to predict their nature.

As to the hypothesis of De Luc, who has advanced that the *existence of the human species is posterior to that of other species*, it appears to me to be defective. We do not find, he says, fossil human skeletons. To this I answer :

1. We find only about 12 *species* of known quadrupeds, and from 16 to 18 *genera*. Are we to conclude that none of the other species and genera existed at the epoch in question ?

But, it is added, the human species is now-a-days so multiplied.—It is easy to answer that the human species was not, at that period, so numerous as it has been since large societies have been formed.

3. Lastly, we know that the bones of the largest animals which die in the fields, in the woods, &c. are speedily decomposed if they are exposed to the air. We do not find in our forests any bones of our modern boars, stags, and wolves, nor in Africa any bones of the elephant or rhinoceros.

4. Those which are fossil have been preserved, therefore, by being enveloped soon after the death of the animal in earth or sand. This event must have taken place under extraordinary and unexpected circumstances. Thus we meet with very few fossils of quadrupeds, fishes, birds, and vegetables, in comparison with the immense quantity which has existed.

It is otherwise with fossil shells : they are very abundant. Nevertheless this quantity is very small when compared with those which have existed ; and we ought to consider well, that we find in some places immense heaps of shells of various coun-

tries, with fossils of quadrupeds, whales, &c. : they seem to have been heaped together by local circumstances.

Fossil vegetables are also very abundant. All the species of vegetables and animals now in existence may not have commenced their existence at the same epoch and in the same countries : thus the animals of the continents have begun to exist long before the sea animals ; but nothing shows that the human species began to exist after the ape and monkey species, &c.

Epochs at which Fossils have been deposited.—It is difficult to assign these epochs ; but it may be asserted in general, that

a. The fossils which are found in calcareous, gypseous, schistous, or bituminous stones, were deposited when these stones were formed, and consequently are the most ancient of fossils.

b. Ravines (*breches*) having been formed subsequently to stones, the fossils of ravines are therefore posterior to those of stones.

c. Coal and peat moss are also posterior to secondary stones. The fossils which exist in coal and peat moss are therefore also posterior to those of stones.

d. Alluvial strata are also posterior to the above ; consequently the fossils contained in these soils are in general more modern.

e. Caverns have never been discovered until after the sea had retired. The troglodyte animals could only have retired thither at very recent periods, and left their remains there. Fossils of sea animals have never been found there.

Volcanoes.—The city of Caraccas in South America has been destroyed by an earthquake, and various parts of Europe have experienced similar visitations ; but they were not so violent, nor attended with any new phenomena. There has also been an eruption of volcanic substances from the sea near the Azores. Earthquakes may be occasioned by volcanic eruptions : the gases which are emitted from inflamed substances pass through the chinks of the strata with rapidity, and produce shocks more or less violent. But other earthquakes, such as those which take place without any appearance of volcanic eruptions, seem to be occasioned by the galvanic action of different heterogeneous particles of the globe, particularly metallic substances.

In order to measure the intensity of earthquakes, an instrument called the *Elkysmometer* has been invented. This instrument makes oscillations when it is shaken. We estimate the intensity of subterranean commotions by the size and number of the oscillations of the instrument.

GEOGRAPHY.

Gosselin, in his *Inquiries into the Geography of the Ancients*, has shown that the Greek geographers, Eratosthenes, Hipparchus,

chus, Posidonius, Strabo, and Ptolemy, had drawn their information from a people of still greater antiquity. He supposes them to have been the Hindoos. But it appears more probable to me that it was the Tartars and Chinese. The latter were acquainted long before any other nation, with printing, the mariners' compass, gunpowder, the use of silk, and astronomy.

The knowledge of the mariners' compass announces that they were great navigators, and consequently they must have had an extensive knowledge of geography. Their astronomical acquirements gave them the means of ascertaining longitudes and latitudes. The desire for travelling is now general, and learned travellers daily extend our geographical knowledge. Morier has given us some geographical details respecting Persia, Armenia, and Asia minor. Kimmel has published his Journey to Mount Caucasus. Mawe has made us better acquainted with the Brazils, and given us some interesting details on the mineralogy of those countries, their diamond and gold mines, &c.

[To be continued.]

XCII. *On the Assay of Minerals by means of the Blowpipe.*
By M. HAUSSMAN, *Inspector General of Mines at Cassel**.

Circumstances necessary to be observed in the preparation for the experiment : volume of the fragment to be assayed.

It ought to be proportioned to the size of the flame to which it is exposed. If the aperture of the blowpipe be only the diameter of a pin, the volume of the fragment ought not to be larger than a pepper corn. In order to support the fragment, we may use : 1. Pincers of platina, or with platina points at least. 2. A small glass tube or cylinder, the end of which is to be softened in order to fix the fragment to it. 3. A small bit of cyanite, according to Saussure's method. 4. Charcoal of good quality, particularly poplar and elm, flattened on one side, and with a small hole in it in which to place the fragment. We may cover this piece of charcoal with another piece ; and in this case a passage must be made for the flame, which ought to fall on the fragment contained in the hole. 5. We may compose a stud for support with charcoal dust pounded in mucilage of gum tragacanth. We must form of this paste parallelopipedons, and dry them slowly. 6. We may use a small spoon of gold or silver, but above all of platina, the end of which is fixed in a pipe or in a wooden handle, to preserve the fingers from being scorched.

* *Journal des Mines*, Jan. 1811, vol. xxix. p. 61.