318 b. Oryktt.

VI

SYSTEM

OF

MINERALOGY,

COMPREHENDING

ORYCTOGNOSY,
GEOGNOSY,
MINERALOGICAL CHEMISTRY,

MINERALOGICAL GEOGRAPHY, AND
ECONOMICAL MINERALOGY.

By ROBERT JAMESON,

REGIUS PROFESSOR OF NATURAL HISTORY AND KEEPER OF THE MUSEUM IN THE UNIVERSITY OF EDINBURGH, FELLOW OF THE ROYAL AND ANTIQUARIAN SOCIETIES OF EDINBURGH, OF THE LINNEAN SOCIETY OF LONDON, HONORARY MEMBER OF THE ROYAL IRISH ACADEMY, OF THE MINERALOGICAL AND PHYSICAL SOCIETIES OF JENA, ETC.

VOL. II.

EDINBURGH:

PRINTED BY A. NEILL & CO.

1805.

ADVERTISEMENT.

THIS Volume concludes my Account of the Oryctognoſtic Syſtem of WERNER. The reader will find the *deſcriptive language* fully explained in Mr WEAVER's excellent Tranſlation of WERNER's Work on the External Characters, and in a Treatiſe on the ſame ſubject by myſelf, now in the Preſs.

R. J.

MAY 1805

To Mr Werner from his
affectionate & much obliged
pupil & friend
Robert Jameson

MINERAL SYSTEM.

CLASS II.

FOSSIL SALTS.

THE ſaline ſubſtances included under this claſs, are thoſe only which are found in a natural ſtate: the numerous artificial ſalts detailed in ſome ſyſtems of mineralogy, are conſequently excluded. The greater number of theſe natural ſalts appear to be formed by the agency of air, water, &c. and are therefore more properly atmoſpheric than terreſtrial products. Natural rock ſalt is perhaps the only exception, it being found in the anterior of the earth.

The characters by which the ſubſtances of this claſs are diſtinguiſhed from thoſe of the other claſſes, are principally their *taſte* and *eaſy ſolubility*.

The different ſpecies reſemble each other ſo much in many characters, that Werner, to avoid unneceſſary repetition in deſcription, uſes the term *Saline Conſiſtence* to expreſs all thoſe characters which have a reference to hardneſs, tenacity, and frangibility. Thus, all ſaline foſſils are ſoft, and very ſoft; often even friable, brittle, and eaſily frangible; and theſe characters are termed *Saline Conſiſtence*.

FIRST SPECIES.

Natural Soda, or Natron.

Natürliches Mineral Alkali.—*Werner.*

This ſpecies may be divided into two ſubſpecies:
1. Common Natron. 2. Radiated Natron.

FIRST SUBSPECIES.

Common Natron.

Gemeines Natron.

Alkali minerale natron, *Wall.* t. 2. p. 61.—Alkali fixe mineral, *Rom. d. L.* t. 1. p. 146.—Natürliches mineral alkali, *Wid.* ſ. 579.—Natron, *Kirw.* v. 2. p. 6. *Id. Eſtner*, b. 3. ſ. 18, —Nat. min. alkali, *Emm.* b. 2. ſ. 31.—Carbonate de Natron. *Lam.* t. 1. p. 462.—Soude carbonatée, *Hauy*, t. 2. p. 373. 379.—L'alkali mineral, ou le carbonate de ſoude, *Broch.* t. 2. p. 30.—Natron, *Reuſs*, b. 3. ſ. 4 *.

External Characters.

Colour yellowiſh or greyiſh white.

Occurs in fine flakes, or in duſty particles, and is uſually looſe.

It has a ſharp alkaline taſte.

Chemical Characters.

It effervesces with nitric acid. Is eaſily ſoluble in water, and its ſolution colours blue vegetable

* *Reuſs*, Lehrbuch der Mineralogie nach des Herrn O. B. R. *Karſten* Mineralogiſchen Tabellen, 3 Bände.

getable tinctures green. It is very fusible before the blow-pipe.

Constituent Parts.

Egyptian Natron.		Bohemian Natron.	
Dry carbonat of soda,	32.6	Carbonat of soda,	89.18
Dry sulphat of soda,	20.8	Carbonat of lime,	7.44
Dry muriat of soda,	15.0	Carbonat of magnesia,	1.35
Water,	31.6	Extractive matter,	2.03
	100.0		100.0
Klaproth, Beiträge, b. 3. f. 80,		*Reuss*, Min. b. 3.	

Natron of Hungary.

Carbonat of soda,	14.2
Muriat of soda,	22.4
Sulphat of soda,	9.2
Earthy residuum,	9.2
Water,	45.0
According to *Lampadius*,	100.0

Geognostic Situation.

It occurs either as an efflorescence on the surface of soil, or on decomposing rocks of particular kinds, or on the sides and bottoms of lakes, that become dry during the summer season. In Hungary, according to Ruckert and Pazmand, there are so many natron lakes, that 50,000 quintals of soda could be obtained from them annually. In some places of the same country, it effloresces on the

the ſurface of the ſoil, heath, &c. According to Dr Reuſs, it is obſerved efflorеſcing on meadows near Prieſen and Sebnitz in Bohemia, and on decompoſing gneiſs in the vicinity of Bilin, where it is renewed every ſpring. About twenty leagues north-eaſt of Grand Cairo, in Egypt, there is a limeſtone valley, in which there are ſeveral extenſive natron lakes, which become dry during the ſummer ſeaſon, and leave their ſides and bottoms covered with a great quantity of ſoda or natron.

Geographic Situation.

In *Europe*, it occurs in Bohemia, at Bilin, Carlſbad and Eger; in Hungary, in the neighbourhood of Debrezin, diſtrict of Bahar, &c.; in Switzerland, at Schwartzberg, in the canton of Berne; in Italy, in the Phlagrean Fields, Monte Nuovo, near Naples, and Mount Ætna in Sicily.

In *Africa*, it occurs in Egypt at the city of Nitria, the valley of the Natron Lakes, Nubia, and the iſland of Teneriffe.

In *Aſia*, in Bengal, Sina in the neighbourhood of Pekin, in Thibetian Tartary, Perſia, Natolia, diſtrict of Ochotſk, in the government of Irkutſk, in the neighbourhood of Nertchinſk in Siberia, and in Bolowoi-ofero in the Tauride.

SECOND SUBSPECIES.

Radiated Natron, or Natural Soda.

Strahliches Natron.—*Klaproth.*

External Characters.

Colour greyiſh, and yellowiſh white.

Occurs in cruſts, and cryſtallized in capillary or acicular cryſtals, which are aggregated on one another, or in radia.

Is gliſtning, and

Tranſlucent.

Conſtituent Parts.

Water of cryſtallization,	22.50
Carbonic acid,	38.0
Pure ſoda,	37.0
Sulphat of ſoda,	2.50
	100.0

Klaproth, Beit. b. 3. ſ. 83.

Geognoſtic and Geographic Situations.

Mr Bagge, Swediſh conſul at Tripoli, has given the following information reſpecting this intereſting ſub-ſpecies of natron. "The native country of this natron, which is there called *Trona*, is the province Sukena, two days journey from Fezzan. It is found at the bottom of a rocky mountain, forming cruſts, uſually the thickneſs of a knife,

and

and ſometimes, although rarely, of an inch, on the ſurface of the earth. It is always cryſtalline; in the fracture, it conſiſts of cohering, longiſh, parallel, frequently radiated cryſtals, having the aſpect of unburnt gyps. Beſides the great quantity of trona, which is carried to the country of the negroes and to Egypt, fifty tons are annually carried to Tripoli. It is not adulterated with ſalt. The ſalt-mines are ſituated on the ſeaſhore; but the trona occurs twenty-eight days journey up the country *." According to the accounts of Mr Barrow, it would appear alſo to occur in the diſtrict of Tarka in Boſhieman's Land, in Southern Africa.

Uſes—of Natron.

It is principally employed in the manufacture of glaſs, in the manufacture of ſoap, and for the waſhing of linen. It is ſometimes purified before it is uſed, but more frequently (particularly that from Egypt) it is uſed in its natural ſtate. In Hungary, particularly at Debrezin, it is uſed in great quantity in the manufacture of ſoap: it has been alſo employed in conſiderable quantity in Scotland and England. In Siberia a fine white glaſs is manufactured with it: in the Levant the natron of Suckena is mixed with tobacco, in order to give it a ſharper taſte. The ancient Egyptians

* Schriften der Schwed. Acad. d. wo. bd. 35.

tians are ſaid to have macerated dead bodies in it for ſeveral months previous to preparing them as mummies. It is ſometimes alſo purified for the alkali it contains, and is then uſed as a flux, &c.

Obſervations.

1. Klaproth reſtored to this ſpecies the old name *Natron*, a word ſaid to be derived from the name of the town Nitria in Upper Egypt, where, as already mentioned, it occurs in conſiderable quantity.

2. The term *Natural Mineral Alkali* may alſo be uſed; for the common objection to this name, that mineral alkali is found in animal and vegetable ſubſtances, does not render it the leſs proper; becauſe the name only implies, that this alkali occurs in great quantity in the mineral kingdom, not that it is peculiar to it.

SECOND SPECIES.

Natural Nitre.

Natürlicher Salpeter.—*Werner*.

Nitrum terra mineraliſatum, *Wall.* t. 2. p. 45.—Nitrate de Potaſſe, *De Born*, t. 2. p. 57.—Natürlicher Salpeter, *Wid.* f. 602.—Nitre, *Kirw.* vol. 2. p. 25.—Natürlicher Salpeter, *Eſtner*, b. 3. f. f. 55. *Id. Emm.* b. 2. f. 16.—Nitrate de Potaſſe, *Lam.* t. 1. p. 468.—Potaſſe Nitratée, *Hauy*, t. 2. p. 346. 355.—Le Nitre natif, *Broch.* t. 2. p. 17.—Salpeter, *Reuſs*, b. 3. f. 21.

External

External Characters.

Colour greyiſh and yellowiſh white, ſometimes approaching to ſnow white.

Is flaky; ſometimes verges on ſolid and maſſive, and then it ſhews an imperfect foliated fracture, and granular diſtinct concretions.

Saline conſiſtence.

Taſte ſaltly cooling.

Chemical Characters.

Placed on red hot iron or burning coals, it hiſſes and detonates.

Conſtituent Parts.

The Natural Nitre of Molfetta according to Klaproth:

Nitrat of potaſs,	44.55
Sulphat of lime,	25.45
Carbonat of lime,	30.40
Muriat of potaſs,	0.20
	100.60

Geognoſtic and Geographic Situations.

It is uſually found in thin cruſts on the ſurface of ſoil, and ſometimes alſo covering the ſurface of compact limeſtone, and calc-tuff. "In India, Spain, and, according to others, in Perſia and China, it germinates in certain ſeaſons out of the earth;

earth; and, what is moſt ſingular, this earth accumulated in heaps, and thus expoſing a larger ſurface to the atmoſphere, is found to reproduce it annually *." Even in the hotteſt countries of Aſia and Peru, it forms effloreſcences on the ſoil. It is alſo found in various parts of Europe. The Duke de Rochefoucault diſcovered it in France, in limeſtone caves: it is found in the county of Bamberg in a ſpecies of limeſtone marl; and at Homberg near Wurzburg, it is found incruſting calc tuff. One of the moſt remarkable repoſitories of natural nitre is that which was diſcovered by the Abbé Fortis, near Molfetta, in the kingdom of Naples. It there occurs incruſting a yellowiſh-grey coloured compact limeſtone. It is never found in beds with the limeſtone, as mentioned by ſeveral mineralogiſts, but always on its ſurface.

Uſes.

In Hungary, Spain, Molfetta, Peru and the Eaſt Indies, conſiderable quantities of natural nitre are collected; but the greateſt proportion of that uſed in commerce, is obtained by working artificial nitre beds. Theſe conſiſt of the refuſe of animal and vegetable bodies undergoing putrefaction, mixed with calcareous and other earth. Its principal uſe is in the fabrication of gunpowder: it is alſo uſed in medicine, and many of the arts.

* Kirwan, Mineralogy, vol. ii. p. 25, 26.

THIRD SPECIES.

Natural Rockſalt.

Natürliches Kochſalz.—*Werner.*

This ſpecies is, by Werner, divided into two ſubſpecies, 1. Rock or Stone Salt; 2. Lake Salt.

FIRST SUBSPECIES.

Rock or Stone Salt.

Steinſalz.—*Werner.*

This ſubſpecies is ſubdivided into two kinds; *a.* Foliated Rockſalt. *b.* Fibrous Rockſalt.

a. Foliated Rockſalt.

Blättriches Steinſalz.—*Werner.*

Muria foſſilis pura; Sal gemmæ, *Wall.* t. p. 53.—Sel marin et Sel gemme, *Rom. d. L.* t. 1. p. 374.—Blättriches Steinſalz, *Wern.* Pabſt. b. 1. ſ. 361.—Lamellar Sal Gem, *Kirw.* vol. ii. p. 32.—Blättriches Steinſalz, *Eſtner*, b. 3. ſ. 63.—*Id. Emm.* b. 1. ſ. 19.—Soude muriatée criſtalliſé, et Soude muriatée amorphe, *Hauy*, t. 2. p. 356, 365.—Le Sel Gem lamelleux, *Broch.* t. 2. p. 21.—Blättriches Steinſalz, *Reuſs*, b. 3. ſ. 30.

External

External Characters.

ITS moſt common colours are white and grey. Of white it occurs greyiſh, yellowiſh and milk-white, but it ſeldom approaches to ſnow-white. Of grey, aſh, ſmoke, and pearl grey. From pearl grey it paſſes, though rarely, into fleſh, blood and brick red. Still ſeldomer do we obſerve the white varieties marked with Berlin, azure or violet blue ſpots or patches.

It is ſaid alſo to occur ochre and wine yellow.

Occurs maſſive, ſometimes diſſeminated, and alſo cryſtallized in cubes.

On the freſh fracture, it is ſplendent, and its luſtre is reſinous, inclining to vitreous.

Fracture ſtraight foliated; complete threefold rectangular cleavage.

Fragments cubic.

It preſents large, coarſe, and ſmall granular diſtinct concretions.

In general, it is ſtrongly tranſlucent, ſometimes ſemitranſparent and tranſparent.

Alternates between ſoft and ſemihard.

Not particularly brittle.

Eaſily frangible.

Not particularly heavy.

Specific gravity, 2.143.

Feels almoſt greaſy.

b. Fibrous

b. Fibrous Rockſalt.

Faſriges Steinſalz.—*Werner.*

Faſriges Steinſalz, *Wern.* Pabſt. b. 2. ſ. 363.—Fibrous Sal Gem, *Kirw.* vol. ii. p. 25.—Faſriges Steinſalz, *Eſtner*, b. 3. ſ. 71.—*Id Emm.* b. 2. ſ. 23.—Le Sel Gem fibreuſe, *Broch.* t. 2. p. 25.—Soude muriatée fibreuſe, *Hauy*, t. 2. p. 356. 365.—Faſriges Steinſalz, *Reuſs*, b. 3. ſ. 27.

External Characters.

Colour greyiſh, yellowiſh and ſnow-white; ſeldom marked with ſtripes of aſh-grey, Berlin and violet-blue.

Occurs maſſive.

Internally, it is from ſhining to gliſtning, and its luſtre is pearly.

Fracture parallel, ſometimes delicate, ſometimes coarſe, and uſually curved, fibrous.

Fragments ſplintery.

It is ſtrongly tranſlucent, verging on ſemitranſparent.

In other characters it reſembles the preceding kind.

Chemical characters.

Decrepitates briſkly when expoſed to the action of the blow-pipe, or when laid on burning coals.

Conſtituent

Conſtituent Parts.

Pure muriat of ſoda contains

Soda,	42		35
Muriatic acid,	52		40
Water,	6		25
Bergman,	100	*Kirwan*,	100

Geognoſtic Situation.

According to Werner, rock or ſtone ſalt occurs in beds, and theſe beds are uſually ſhort and very thick, forming what he terms *liegende Stöcke*, lying maſſes. It is accompanied by a ſpecies of clay, which is intermediate between common and indurated clay, much impregnated with ſalt, and often contains immenſe maſſes of it. It has alſo as accompanying rocks, ſtinkſtone, gyps, limeſtone, and ſandſtone. It appears to lie over the firſt or oldeſt floetz gyps formation, conſequently muſt be covered by the ſecond ſandſtone formation. According to Werner, it occurs alſo in veins at Aehlen, in the canton of Berne*. It is ſaid alſo to form whole hills, as at Cordova, ſixteen leagues from Barcelona in Spain, where, according to Bowles, there is a hill between four and five hundred feet high entirely compoſed of it.

Geographic

* Werner's Gänge, ſ. 79.

Geographic Situation.

In the north of Germany, rocks of the ſalt formation and ſalt ſprings occur,—an evidence of the exiſtence of ſalt beds, as all ſalt ſprings iſſue from ſalt beds or rocks richly impregnated with ſalt; but no ſalt beds appear at the ſurface until we come to the Circle of Auſtria and the neighbouring countries. The range of ſalt beds commences at Hall in the Tirol *, paſſes through Reichenthal in Bavaria, continues to Hallein in Salzburg, Hallſtadt, Iſchel, and Ebenſee in Auſtria, and terminates at Auſſe in Stiria. The further continuation of the ſalt depoſition is found at a conſiderable diſtance, that is, in Hungary at Marmoros, Rhona, Szek, and Speries: then again in the great incloſed circular valley of Tranſilvania; from thence it extends through Wallachia, Moldavia, Buckovina, Gallicia, to Upper Sileſia.

The ſalt repoſitory of Marmoros is well known. In Tranſilvania, which is a vaſt circular valley, having its bottom covered with ſalt, there are many extenſive ſalt-works: in Moldavia there are alſo numerous ſalt-mines; and what is worthy of remark,

* At Sulzbach, on the Necker, in Swabia, there is a great bed of clay richly impregnated with ſalt, and ſometimes even containing great maſſes of it. This appears to be the furtheſt limit of the ſalt beds on that ſide of Germany.

remark, the rockſalt itſelf there forms hills. The ſalt-mines of Viliſka are ſituated about two leagues ſouth-eaſt of Cracau in Weſt Gallicia, and about nine miles to the north-eaſt of the Carpathian Mountains. They have been worked ſince the year 1251, and their depth and extent is very great; by ſome ſaid to be 900 feet, and having an extent of more than a league from eaſt to weſt. According to Abbé Eſtner, the ſalt of Hungary, Tranſilvania, and Weſt Gallicia, occurs only of a grey colour. The party-coloured is found principally in Upper Auſtria, Salzburg, Stiria, and the Tyrol. The beautiful blue foliated variety was formerly found at Iſchel in Upper Auſtria; and the very rare green variety is at preſent found at Berchteſgaden and Hallein in Salzburg, where the fibrous blue variety which occurs in the Tirol is alſo found.

There are beſides immenſe depoſites of ſalt in Old and New Caſtile in Spain, alſo great quantity in Cheſhire in England *. In France there are ſalt-ſprings, but no ſalt-beds have hitherto been diſcovered.

Beſides the great depoſitions of this mineral found in *Europe*, it is alſo very extenſively diſtributed in the other quarters of the globe. In the northern

* According to Profeſſor Playfair, the ſalt of Cheſhire occurs ſometimes in ſpherical diſtinct concretions; and Profeſſor Pictet of Geneva obſerved it in columnar diſtinct concretions.

northern part of *Africa*, on both ſides of the Atlas Mountains, vaſt quantities of rockſalt occur. Mr Horneman, on his journey from Cairo to Ummeſogeir, diſcovered a plain on the ſummit of the chain of limeſtone mountains that bound the Deſart of Lybia to the north, conſiſting of a maſs of rockſalt ſpread over ſo large a tract of ſurface, that in one direction no eye could reach its termination, and its width he computed at ſeveral miles.

In *Aſia*, as at Teflis and Tauris in Perſia, according to Chardin, there are great maſſes of rockſalt; alſo in the neighbourhood of Schmachie and Baku, and other places of Schirvan *. In the Deſart of Caramania, rockſalt is ſo abundant, and the atmoſphere ſo dry, that the inhabitants uſe it for building their houſes †. It is found alſo near Herſk in Siberia, in China, in Caſchmere; and in the province of Lahor in Hindoſtan there is a hill of rockſalt equal to that of Cordova: the ſalt of this hill is cut into diſhes, plates, and ſtands for lamps ‡.

In *South America*, according to Ulloa and Abbé Guiſeppe Jolis Faenza, it is found in vaſt quantity on the elevated Deſarts of Peru, where it is very hard. In the interior of North Ameri-

ca,

* G. Gmelin's Ruſſiſche Reiſe, iii. 43. ſeq.

† Chardin, iv. 65.

‡ Pennant's Outlines of the Globe, vol. i. p. 42. &c.

ca, it is found in conſiderable quantity: great maſſes of it have been found at the junction of the ſtream of Atha-pus-caou, with the Atha-pus-caou Lake; and at the head of the Miſſiſippi there are ſalt ſprings.

'According to Governor Hunter, it is found in conſiderable quantity in New Holland.

Uſes.

Its uſes are very various and important. We employ it daily as a ſeaſoning for our food: vaſt quantities are employed for the preſervation of animal fleſh, butter, &c.; it is alſo uſed as a manure, in the manufacture of earthen-ware, ſoap-making, and in many metallurgic operations. It affords muriatic acid and ſoda, by certain chemical proceſſes. It is ſometimes employed in its crude ſtate, but is more commonly purified.

SECOND SUBSPECIES.

Lakeſalt.

Seeſalz.—*Werner.*

Seeſalz.—*Reuſs*, b. 3. f. 36.

External Characters.

Colour white.

It occurs either in thin plates, which are formed on the ſurface of ſalt-lakes, or inland ſeas, or in grains on their bottoms.

It is tranſlucent, and, like the former, of ſaline conſiſtence.

Geognoſtic and Geographic Situations.

It is found on the bottoms and ſides of ſalt-lakes.

It is collected in the iſlands of Cyprus and Milo, in the Mediterranean ſea. Nearly the half of the peninſula of the Tauride is filled with ſalt-lakes, which afford a great quantity of lakeſalt; and quantities are collected in the neighbourhood of the Caſpian.

In *Africa*, at Manzelach near Alexandria, there are two ſalt-lakes, which afford a great quantity of fine white ſalt. The bottom of the ſalt-lakes in the land of the Hottentots and the Caffres, is ſo compactly covered with ſalt, that it appears like ice, and the grains or diſtinct concretions adhere ſo cloſely together, that the maſs is as hard as many ſtones. Many extenſive kingdoms are ſupplied with ſalt from the Lake of Dombu, which is ſituated in the great Deſart of Bilma, in the kingdom of Bornu.

FOURTH SPECIES.

Natural Sal Ammoniac.

Natürlicher Salmiack.—*Werner.*

Sal Ammoniacum, *Wall.* t. 2. p. 77.—Sel Ammoniac, *Rom. de L.* t. 1. p. 382. *Id. Born.* t. 2. p. 54.—Natürlicher Salmiack, *Wid.* p. 610.—Sal Ammoniac, *Kirw.* vol. ii. p. 33.—Natürlicher Salmiack, *Eſtner*, b. 3. f. 78. *Id. Emm.* b. 2. f. 24.—Muriate d'Ammoniac, *Lam.* t. 1. p. 473.—Le Sel ammoniaque, *Broch.* t. 2. p. 27. — Ammoniaque muriatée, *Hauy*, t. 2. p. 380. 386.—Salmiack, *Reuſs*, b. 3. f. 38.

External Characters.

Colour greyiſh-white, and yellowiſh-white, which often falls into yellow.

It is flaky, and of ſaline conſiſtence.

Taſte urinous.

To the above deſcription, which is that of Werner, the Abbé Eſtner adds, that it occurs maſſive, ſtalactitic, tuberoſe, ſmall botryoidal, corroded, and alſo cryſtallized; 1. Cube, with more or leſs deeply truncated edges and angles. 2. Complete rhomboid. 3. Rectangular four-ſided priſm, accuminated by four planes, which are ſet on the lateral edges. 4. Garnet dodecaedron, ſometimes alſo truncated on all the edges *.

Cryſtals

* Mr Klaproth mentions its occurring in oblique four-ſided priſms.

Cryſtals are ſmall and very ſmall, and adhere or interſect one another.

Lateral planes of the cryſtals uſually ſmooth.

Externally ſhining; internally ſplendent or ſhining, and luſtre vitreous.

Fracture even, or uneven, and ſometimes exhibits a tendency to fibrous.

Sometimes occurs in ſmall and fine granular diſtinct concretions.

The cryſtallized is ſemitranſparent and tranſparent.

The flaky cryſtals poſſeſs ſome degree of flexibility.

Is light.

Taſte urinous.

Chemical Character.

When placed on burning coals, it emits a peculiar odour, and is volatilized in the form of a white ſmoke: when burned or rubbed with lime, it emits an ammoniacal ſmell.

Conſtituent Parts.

The natural ſal ammoniac of Bucharia, according to Klaproth, contains

Muriat of ammonia,	97.50
Sulphat of ammonia,	2.50
	100.0

Klaproth, Beit. b. 3. f. 94.

Geognoſtic

Geognoſtic Situation.

It is a product of volcanoes, and pſeudo-volcanoes, where it occurs in the different forms already mentioned. It is ſaid alſo to be found in the waters of different lakes in Tuſcany.

Geographic Situation.

It is found in Italy, at Solfatara, Veſuvius, Ætna, the Lipari and Æolian Iſlands; Tuſcany; France; Hecla in Iceland, and in the vicinity of inflamed beds of coal in Scotland and England; in *Aſia*, in Thibet, Perſia, the Turkeſtan Mountains in the Calmuck country, Bucharia, and the Iſle of Bourbon.

Obſervation.

The Natural Sal Ammoniac of Bucharia, according to Karſten, forms a diſtinct SUBSPECIES, of which he gives the following deſcription, under the name

Muſchlicher Salmiack.

Conchoidal Sal Ammoniac.

Colour greyiſh-white.
Occurs in angular pieces.
Surface uneven.
Externally, glimmering.
Internally, ſhining, and luſtre vitreous.

Fracture

Fracture nearly perfect conchoidal.

Fragments indeterminately angular.

Semitranſparent, and tranſparent.

Is malleable. Soft. Light. Taſte ſtinging, urinous.—*Klaproth*, Beit. 3. b. ſ. 93.

FIFTH SPECIES.

Natural Epſom Salt.

Natürliches Bitterſalz.—*Werner.*

Sal neutrum acidulare, *Wall.* t. 2. p. 71.—Sel d'Epſom, Sel de Sedlitz, Sel d'Angleterre, Vitriol de Magneſia, *Romé de L.* t. 1. p. 306.—Natürliches Bitterſalz, *Wid.* p. 595.—Epſom Salt, *Kirw.* vol. ii. p. 12.—Natürliches Bitterſalz, *Eſtner*, 3. b. ſ. 44. *Id. Emm. z.* b. ſ. 14.—Le Sel amere natif, ou Sel d'Epſom natif, *Broch.* t. 2. p. 11.—Magneſie ſulphatée, *Hauy*, t. 2. p. 331. 336.—Bitterſalz, *Reuſs*, 3. b. ſ. 53.

External Characters.

Colour greyiſh-white.

Occurs in capillary efflorescences, and is ſometimes mealy, ſometimes flaky.

Saline conſiſtence.

Taſte ſaltly bitter.

Conſtituent

Conſtituent Parts.

The conſtituent parts of the purified Epſom ſalt, the ſulphat of magneſia of the chemiſts, is, according to

Bergman,	and	*Kirwan.*
Sulphuric acid,	33	29.46
Magneſia,	19	17.0
Water of cryſtallization,	48	53.54
	100	105.

Chemical Characters.

Before the blow-pipe, it diſſolves very eaſily by the aſſiſtance of its water of cryſtallization, but it is difficultly fuſible. Its ſolution gives a precipitate with lime-water.

Geognoſtic and Geographic Situations.

It occurs as an efflorеſcence on clayey ſtones, as common clay, ſlate clay, clay-ſlate, grey wacke, and porphyry ſlate; at Jena, it occurs in gyps rocks; at Witſchiz in Bohemia, on half-burnt clay; on porphyry ſlate at the village of Kaitz; at Stiahlaw on clay ſlate; and at Solfatara on decompoſing lava. In the mines at Clauſthal in the Hartz, it occurs in conſiderable quantity; at Gran in Hungary, it efflorеſces on ſandſtone, clay, and compact limeſtone. It is alſo contained in many

mineral

mineral ſprings, particularly in thoſe of Epſom, and it often effloreſces on old walls.

Uſes.

When purified, it is uſed as a purgative medicine, and it is valued by chemiſts on account of the magneſia which can be obtained from it.

SIXTH SPECIES.

Natural Glauber Salt.

Natürliches Glauberſalz.—*Werner.*

Sal mirabile, *Wall.* t. 2. p. 70.—Sel de Glauber, *Rom. d. L.* t. 1. p. 301. *Id. Born.* t. 2. p. 26.—Natürliches Wunderſalz, *Wid.* ſ. 597.—Glauber Salt, *Kirw.* vol. 2. p. 9.—Natürliches Glauberſalz, *Eſtner*, 3 b. ſ. 50. *Id. Emm.* 3 b. ſ. 401.—Le Sel de Glauber natif, *Broch.* t. 2. p. 14.—Glauberſalz, *Reuſs*, 3 b. ſ. 49.

External Characters.

Colour greyiſh and yellowiſh white; ſeldom ſnow or milk white.

Occurs in the form of mealy effloreſcences; in cruſts, ſeldom ſtalactitic, ſmall botryoidal, reniform; and cryſtallized.

1. In acicular cryſtals.

2. In

2. In ſix-ſided priſms, more or leſs flatly acuminated by three planes, which are ſet on the alternate edges or planes.

The acicular cryſtals are ſmall, the priſms middle-ſized, and ſo grown together, that they are with difficulty diſtinguiſhable.

Internally ſhining, and luſtre vitreous.

Fracture of the cryſtallized varieties ſmall conchoidal; others fine-grained uneven; the decompoſed earthy.

Fragments indeterminately angular, blunt-edged.

Occurs ſometimes in ſmall and fine granular diſtinct concretions.

Soft, earthy varieties friable.

Brittle.

Eaſily frangible.

Has a cooling, and then a ſaltly bitter taſte.

Chemical Characters.

Before the blow-pipe, it is affected in the ſame manner as Epſom ſalt, but its ſolution does not give a precipitate with lime-water.

Conſtituent Parts.

Natural Epſom Salt of Eger, according to *Reuſs*, (Chemiſch-mediciniſche Beſchreibung des Kaiſer Franzens Bades, Dreſden, 1794), contains

Sulphat of ſoda,	67.024
Carbonat of ſoda,	16.333
Muriat of ſoda,	11.000
Carbonat of lime,	5.643
	100.

Geognoſtic Situation.

It occurs on the borders of ſalt-lakes, in efflo-reſcences on muiriſh ground, ſandſtone, marl-ſlate, and on old and newly-built walls.

Geographic Situation.

At Eger in Bohemia, it occurs efflorefcent on meadow ground; in old ſalt mines at Auſſee, Iſchel and Hallſtadt in Upper Auſtria; at Altenberg in Stiria; at Deretſke, Kammerwald, Biha, Puſta, Szent-Iwan, Kalos and Felſobanya, in Hungary; Hildeſheim; Durrenberg by Hallein in Salzburg; Schwartzburg in Switzerland; Vaira Madrit by Aranjuez in Spain; Solfatara in Italy.

In *Aſia*, it occurs on the banks of many Siberian ſalt-lakes; neighbourhood of the Lake Baikal, the defart plains of Iſet, Iſchim, and Barebyn.

In *Africa*, in Egypt.

Uſe.

It is uſed as a purgative medicine, and in ſome countries as a ſubſtitute for ſoda, in the manufacture of white glaſs.

SEVENTH

SEVENTH SPECIES.

Natural Alum.

Natürlicher Alaun.—*Werner.*

Alumen, *Wall.* t. 1. p. 31.—Sulphate d'Alumine, *D. B.* t. 2. p. 32.—Natürlicher Alaun, *Wid.* f. 593.—Alum, *Kirw.* vol. 2. p. 13.—Natürlicher Alaun, *Eſtner*, b. 3. f. 39. *Id. Emm.* 2 b. f. 9.—L'Alaun natif, *Broch.* t. 2. p. 6.—Alumine ſulphatée alkaline, *Hauy*, t. 2. p. 387. 398.—Alaun, *Reuſs*, 3 b. f. 58.

External Characters.

Colour yellowiſh and greyiſh white.

Occurs as a mealy efflorescence, or in delicate capillary cryſtals.

Taſte ſweetiſh aſtringent.

Chemical Characters.

It is ſoluble in from ſixteen to twenty times its weight of water. It melts eaſily by means of its water of cryſtallization; and by continuance of heat, it is converted into a white ſpongy maſs.

Conſtituent Parts.

Natural Alum of Freienwald.

Alumina,	15.25
Oxide of iron,	7.50
Potaſs,	0.25
Sulphuric acid and water of cryſtallization,	77.0
	100.0

Klaproth.

Geognoſtic

Geognoſtic Situation.

Near Gottwig, in Auſtria, it incruſts black coal; at Komothau, in Bohemia, it is efflorescent on alum earth; and at Muhlbach, in the ſame country, on bituminous wood. It is ſometimes obſerved in the neighbourhood of volcanoes, incruſting lava; but it occurs moſt frequently, and in greateſt quantities, as an efflorescence on alum ſlate.

Geographic Situation.

Many places in the tranſition mountains in the ſouth of Scotland, alſo in coal mines near Paiſley; in Bohemia, at Komothau, Weitentrebetitſch, and many other black-coal mines in the Saatzer and Leitmeritzer Circles; in Auſtria, at Gottwig, Thalern, and Krems; Stiftiz in Carinthia; the Irſonberg in Bavaria; in Italy, in the caves of Segoneio in Sardinia, Stromboli, Solfatara, the Alum Caves at Cap di Miſeno, near Naples, and Veſuvius; Iſland of Milo, in the Helleſpontic Archipelago; Arragon in Spain; Sweden; Norway.

Africa, in Egypt.

Uſes.

It is employed as a mordant in dyeing; alſo in the manufacture of leather; as a medicine; for preſerving animal ſubſtances from putrefaction, and for preventing wood from catching fire.

EIGHTH

EIGHTH SPECIES.

Hair Salt.

Haarſalz.—*Werner.*

Haarſalz, *Wid.* ſ. 590. *Id. Eſtner*, 3. b. ſ. 33. *Id. Emm.* 2. b. ſ. 10.—Le Sel capillaire, *Broch.* t. 2. p. 8.—Haarſalz, *Reuſs*, b. 3. ſ. 63.

External Characters.

Colour ſnow, yellowiſh, greyiſh, ſometimes verging on greeniſh white, which paſſes to pale apple green.

Occurs in very delicate capillary cryſtals, which are ſometimes ſcopiformly aggregated, and ſometimes ſo cloſely adhering, as to appear compact.

Saline conſiſtence.

Taſte, ſweetiſh aſtringent.

Conſtituent Parts.

From its taſte, it is conſidered to be nearly of the ſame nature with alum; but Klaproth has analyzed what he conſiders as hair ſalt, and which he found to be ſulphat of magneſia, mixed with ſulphat of iron. It remains to be determined how many of the varieties enumerated in the following liſt of localities, are to be referred to the true hair ſalt,

Geognoſtic

Geognoſtic and Geographic Situations.

It occurs often in fiſſures of black-coal beds in Bohemia; on alum earth at Thalern in Auſtria; on decompoſing iron pyrites in the ſilver-mines of Kongſberg in Norway. It is found alſo at Schemnitz, Kremnitz, and Neuſohl in Hungary; at Flachau, Mordling, Brennthal, Wolfbachthall, Taxenbach, and Sieglitz in Salzburg; Rammelſberg in the Hartz; near Naples; Whitehaven in England; and near Paiſley in Scotland.

Obſervations.

1. It bears a ſtriking reſemblance to fibrous gyps; from which, however, it is diſtinguiſhed by taſte, hardneſs, &c.

2. It appears to be formed principally from decompoſing common iron and liver pyrites.

NINTH SPECIES.

Rock Butter.

Bergbutter.—*Werner.*

Bergbutter, *Wid.* ſ. 589. *Id. Emm.* 2. b. ſ. 13.—Le Beuvre de Montagne, ou Le Bergbutter, *Broch.* t. 2. p. 10.—Bergbutter, *Reuſs*, 3. b. ſ. 66.

External Characters.

Colour greyiſh white, and ſtraw-yellow.

Occurs

Occurs maſſive, and tuberoſe.
Is tranſlucent.
Saline conſiſtence.
Taſte partly ſweetiſh aſtringent; ſometimes ſour.
Has rather a greaſy feel.

Conſtituent Parts.

Appears to have nearly the ſame conſtituent parts as alum.

Geognoſtic and Geographic Situations.

It oozes out of fiſſures of rocks of alum ſlate, and, according to Reuſs, it is found alſo on alum-earth.

It is found at Muſkau in Upper Luſatia; Saalfeld in Thuringia; Salzburg; oozing out of rocks of alum-ſlate in the iſland of Bornholm in Denmark; and, according to Pallas, in ſimilar ſituations, on the banks of the great river Jeniſei in Siberia.

Near Paiſley in Scotland.

TENTH SPECIES.

Natural Vitriol.

THIS ſpecies is divided into three Subſpecies. 1. Iron Vitriol. 2. Copper Vitriol. And, 3. Zinc Vitriol.

FIRST

FIRST SUBSPECIES.

Iron Vitriol.

Eiſen Vitriol.—*Werner.*

External Characters.

Colour emerald and verdigris green; ſometimes bordering on ſky-blue; ſometimes on graſs-green. On the ſurface, yellowiſh brown.

Occurs maſſive, tuberoſe, ſtalactitic and cryſtallized in

1. Capillary cryſtals.
2. Imperfect rhombs.
3. Oblique double four-ſided pyramids, with diſſimilar lateral planes, which therefore terminate in a line.

Is ſplendent, and luſtre vitreous.

Fracture more or leſs perfect foliated.

Occurs in ſmall and coarſe granular diſtinct concretions.

Saline conſiſtence.

Taſte ſouriſh aſtringent.

Geognoſtic and Geographic Situations.

It occurs uſually along with iron pyrites, by the decompoſition of which it is formed.

It is found at Minitz, near Mühlhauſen, and Grunlas, near Ellbogen in Bohemia; in the mines of

of Schemnitz and Cremmitz in Hungary; Nagyag in Tranſilvania; Rammelſberg, near Goſlar in the Hartz; Neuricht in the Upper Palatinate; Raſchau in Saxony; Salzburg; Veſuvius, Solfatara, the iſlands Vulcano and Stromboli in Italy; Fahlun in Sweden; and in many of the Engliſh mines.

Pic de Teyde in Teneriff; Greenland, in America.

Uſe.

It is employed to dye linen yellow, and wool and ſilk black; in the preparation of ink, of Berlin blue, for the precipitation of gold from its ſolution; and ſulphuric acid can be obtained from it by diſtillation. The reſiduum of the latter proceſs (colcothar of iron), is uſed as a red paint, and when waſhed, for poliſhing ſteel, glaſs, &c.

SECOND SUBSPECIES.

Copper Vitriol.

Kupfer Vitriol.—*Werner.*

External Characters.

Its moſt common colour is dark ſky-blue, which ſometimes approaches to verdigris green. By expoſure to the air it becomes yellow.

Occurs maſſive, diſſeminated, ſtalactitic, dentiform; and cryſtallized,

1. In capillary cryſtals.
2. Cubes which are truncated, ſometimes on the edges, ſometimes on the angles.

Cubes are large and middle ſized, and ſometimes ſcalarwiſe aggregated.

The planes of the cryſtals are ſmooth.

Externally and internally ſhining, and luſtre vitreous.

Fracture perfect conchoidal.

Fragments indeterminately angular, ſharp-edged.

Tranſlucent.

Soft.

Very brittle.

Eaſily frangible.

Taſte ſtyptic.

Chemical Characters.

If a plate of iron be inſerted in a ſolution of copper vitriol, it becomes ſoon incruſted with metallic copper: With ammonia, its ſolution acquires a blue colour.

Geognoſtic and Geographic Situations.

At Herngrund, near Neuſohl, in Lower Hungary, it occurs in nearly all the preceding common and particular external ſhapes, accompanied with fahl ore in grey-wacke ſlate. The cubic variety is found in the Rammelſberg in the Hartz;

Hartz; it is found alſo at Spitz in Auſtria; Zalathna in Tranſilvania; in the Brennthaler Mines, near Muhlbach in Pinzgaw in Salzburg; in the neighbourhood of Chruſocio in the iſland of Cyprus; Fahlun in Sweden; Siberia; copper mines, county of Wicklow, in Ireland; Angleſea in England.

Uſe.

It is uſed in cotton and linen printing, and the oxide ſeparated from it by painters.

THIRD SUBSPECIES.

Zinc Vitriol.

Zinkvitriol.—*Werner.*

External Characters.

Colour greyiſh, yellowiſh, reddiſh and greeniſh-white.

Occurs tuberoſe, ſtalactitic and coralloidal.

Tranſlucent.

Saline conſiſtence.

Taſte ſtyptic.

Geognoſtic and Geographic Situations.

It is found in the Rammelſberg, particularly abundant in places where much blende occurs. It is found alſo at Spitz, in Auſtria; at Schemnitz, in Hungary; Salzſburg; and Sahlberg in Sweden.

Obſervation.

Obſervation.

At Herrngrund near Newſohl in Hungary, a vitriol of cobalt is found, accompanied with quartz, gyps, copper glance and copper pyrites.

BORAX.

This ſubſtance is not admitted into the mineral ſyſtem by Werner, becauſe it is ſtill uncertain whether or not it occurs in a ſolid ſtate. From ſeveral creditable reports, it appears to occur in ſolution in certain lakes; but if this be its only ſtate of aggregation, it can only be an object of attention to the hydrographer, becauſe, by being diſſolved, it is deprived of thoſe characters which the oryctognoſt uſes for its deſcription and diſcrimination.

CLASS

CLASS III.

INFLAMMABLE FOSSILS.

THE foſſils belonging to this claſs are light, brittle, moſtly opaque, always yellow, brown or black, ſcarcely ever cryſtallized, and do not feel cold. They are more nearly allied to the metallic than to the ſaline or earthy claſſes of foſſils. This claſs is by Werner divided into four genera, viz. 1. Sulphur genus. 2. Bituminous genus. 3. Graphite genus. 4. Reſin genus.

The SULPHUR Genus contains one ſpecies, viz. *Sulphur*, which contains the following ſubſpecies: *a*. Common Sulphur; *b*. Volcanic Sulphur.

The BITUMINOUS Genus is ſubdivided into the following ſpecies: 1. *Foſſil or Mineral Oil.* 2. *Mineral Pitch*, of which there are three ſubſpecies, *a*. Elaſtic; *b*. Earthy; *c*. Slaggy. 3. *Brown Coal*, which contains the following ſubſpecies: *a*. Bituminous Wood; *b*. Earth Coal; *c*. Alum Earth; *d*. Common Brown Coal; *e*. Muir Coal. 4. *Black Coal*; or as it was uſed to be termed, Stone or Common Coal, which comprehends the following ſubſpecies: *a*. Pitch Coal; *b*. Columnar Coal; *c*. Slate Coal;

Coal; *d.* Cannel Coal; *e.* Foliated Coal; and *f.* Coarſe Coal.

The GRAPHITE Genus contains three ſpecies. 1. *Glance Coal;* of which there are two ſubſpecies: *a.* Conchoidal; *b.* Slaty. 2. *Graphite,* which contains two ſubſpecies: *a.* Scaly; *b.* Compact. 3. *Mineral Charcoal.*

The RESIN Genus contains two ſpecies; 1. *Amber,* of which there are two ſubſpecies: *a.* Yellow; *b.* White. 2. *Honeyſtone.*

FIRST GENUS.

SULPHUR GENUS.

FIRST SPECIES.

Natural Sulphur.

Natürlicher Schwefel.—*Werner.*

It contains two ſubſpecies: *a.* Common Natural Sulphur; *b.* Volcanic Natural Sulphur.

a. Common Natural Sulphur.

Gemeiner natürlicher Schwefel.—*Werner.*

Sulphur nativum purum flavum, *Wall.* t. 2. p. 123.—Soufre, *Rom. d. L.* t. 1. p. 289. *Id. De Born.* t. 2. p. 91.—Natürlicher Schwefel, *Wid.* ſ. 646. *Id. Wern.* Pabſt. 1. b. 368.—Native Sulphur, *Kirw.* vol. 2. p. 69.—Nat. Schwefel, *Eſſner,* 3 b. ſ. 178. *Id. Emm.* 2 b. 189.—Soufre, *Lam.* t. 1. p. 68.—Le Soufre natif, *Broch.* t. 2. p. 37.—Soufre, *Hauy,* t. 3. p. 277. 287.—Schwefel *Reuſs,* 3 b. ſ. 84.

External

External Characters.

Colour perfect ſulphur yellow, of different degrees of intenſity, paſſing into honey yellow, lemon yellow and wax yellow, with an intermixture of grey and brown.

Occurs maſſive, diſſeminated; and cryſtallized,

1. In high very acute octahedrons, (whoſe baſe is oblique,) which terminate in a point or a line.
2. The ſame figures with truncated ſummits.
3. The acute octahedron, whoſe ſummits terminate in a point, acuminated by four planes which are ſet on the lateral planes. The ſummits of the acuminations are ſometimes truncated.
4. Fig. 1. in which the edges of the common baſis are truncated. The truncations become ſometimes ſo large, that the figure may be conſidered as a four-ſided priſm very acutely acuminated by four planes, which are ſet on the lateral planes.
5. The octahedron having the obtuſe angles of the baſe truncated.
6. Double ſix-ſided pyramid with two oppoſite broader, and four oppoſite ſmaller lateral planes, which therefore terminates in a line. —*Reuſs.*
7. Compreſſed ſix-ſided pyramid, acuminated by four planes, which are ſet on the ſmaller lateral planes.

Cryſtals

Cryſtals are middle ſized, ſmall and very ſmall; rarely large.

Surface of the cryſtals is ſmooth and ſplendent.

Internally, it is intermediate between ſhining and gliſtening, and its luſtre is adamantine, approaching to reſinous.

Fracture ſmall grained uneven, paſſing to ſplintery.

Fragments indeterminately angular, blunt edged.

Is tranſlucent; but in cryſtals ſemitranſparent and tranſparent. Duplicating tranſparent.

Is very ſoft.

Not particularly brittle.

Very eaſily frangible.

Exhales a faint ſulphureous ſmell.

Light.

Specific gravity, 1.990 to 2.033.

Chemical Characters.

When placed on inflamed coals, it burns with a bluiſh flame, and emits a pungent ſuffocating vapour, and is totally volatilized.

Geognoſtic Situation.

It occurs commonly in maſſes in gyps, limeſtone, and marl. Near Artern, it occurs along with honeyſtone and bituminous wood.

It is ſometimes found in veins that traverſe primitive rocks; in veins of copper pyrites that traverſe

traverſe granite at Schwartzwald in Swabia; in Siberia, in the gold mines of Catharineburg, and in lead-glance veins in the Altain mountains.

It occurs alſo in neſts in limeſtone in Ireland; in ſandſtone at Budoſhegy in Tranſilvania; along with red manganeſe ore at Kapnik, and with red orpiment at Felſobanya.

Very lately the celebrated and enterpriſing Pruſſian traveller, Von Humboldt, communicated to the National Inſtitute of France, a note, in which he mentions his having diſcovered, in the province of Quito, between Alauſi and Ticſan, a bed compoſed of ſulphur and quartz in a mountain of mica ſlate; and alſo great quantities of ſulphur in primitive porphyry.—*Annales de Muſeum National, cahier* 17.

Geographic Situation.

In *Europe*, it occurs at Baaden in Auſtria; Kapnik and Felſobanya in Hungary; Budoſhegy in Tranſilvania; Swoſſauetz in Weſt Gallicia; Artern in Thuringia; Schwartzwald in Swabia; Lauenſtein in Hanover; Bevieux, Sablin near Bex, and Jura in Switzerland; Lothringen and Mont d'Or in France; Urbina in the Papal Territories; Verruca in Tuſcany; Tortona in Piedmont; the Valley of Mazarra in Sicily, (where the large cryſtals are found); alſo near Naples; in the mountains of Grenada, Andaluſia, and Conil near Cadiz in Spain; Caſan, Sumarc on the Wolga in Ruſſia.

In *Aſia*, it occurs in the Uralian mountains; Sernaya Gora near Nertſchinſk, Altai, Orenburg, Katharinenburg, and on the river Bolſhaya in Siberia.

In *America*, in the iſland of Guadaloupe, and the province of Quito.

b.

SECOND SUBSPECIES.

Volcanic Natural Sulphur.

Vulcaniſcher natürlicher Schwefel.—*Werner.*

Le Soufre natif volcanique, *Broch.* t. 2. p. 42.—Vulcaniſcher Schwefel, *Reuſs*, 3. b. ſ. 90.

External Characters.

Colour ſulphur yellow, inclining conſiderably to green.

Occurs ſometimes corroded, veſicular, perforated, amorphous; ſometimes as a ſublimate in flowers.

Is gliſtening, and its luſtre is reſinous, inclining to adamantine.

Fracture coarſe-grained uneven.

Fragments indeterminately angular, blunt-edged.

Is tranſlucent in a ſlight degree.

In other characters, it agrees with the preceding ſubſpecies.

Geognoſtic and Geographic Situations.

It occurs only in volcanic countries, where it is found in greater or ſmaller quantity amongſt lava. Solfatara, in the vicinity of Veſuvius, is one of the moſt famous repoſitories of natural volcanic ſulphur, and it is there collected in conſiderable quantities, for the purpoſes of commerce. It is alſo found in great quantity in the celebrated volcanic iſland Iceland; alſo in Ætna; iſland Vulcano, and the Lipari Iſlands. It occurs alſo in the iſland of Teneriff, and in the iſlands of St Lucie, Domingo, Martinique and Guadaloupe, in the Weſt Indies.

In the iſland of Java, in the Eaſt Indies.

Uſe.

It is uſed as a medicine, and it enters as a principal ingredient into the compoſition of gunpowder; its vapour is uſed for whitening wool and ſilk; and ſulphuric acid, which is ſo uſeful, is prepared from it.

SECOND

SECOND GENUS.

Bituminous Genus.

FIRST SPECIES.

Foſſil or Mineral Oil.

Erdöl.—*Werner.*

Bitumen fluidiſſimum leviſſimum naphtha, *Wall.* t. 2. p. 89.—Bitumen craſſius, Petroleum, *id.* t. 2. p. 592.—Naphte, *Rom. d. L.* t. 2. p. 192.—Petrole, *id.* t. 2. p. 591. *Id. De Born.* t. 2. p. 75.—Naphtha, *Wid.* ſ. 617. *Id.* Naphtha, Petrol, Mountain or Mineral Tar, *Hatchett*, Lin. Tranſ. vol. 4. p. 131.—Naphtha, *Kirw.* vol. 2. p. 42.—Petrol, *id.* vol. 2. p. 43. *Id. Eſtner.* 3 b. ſ. 95. 97.—*Id. Emm.* 2 b. ſ. 41.–43.—Naphte, Petrole, *Lam.* t. 2. p. 536.—Bitume liquide blanchatre; Bitume liquide brun ou noirâtre, *Hauy*, t. 3. p. 312.—La Naphta, L'Huile minerale commune, ou le Petrol, *Broch*, t. 2. p. 59.–60.—Naphtha, Gemeines Bergöl, *Reuſs*, 3 b. ſ. 96.–101.

External Characters.

Colour browniſh-black, paſſing to blackiſh-brown; ſometimes inclining more to the one, ſometimes more to the other; ſome varieties incline to green.

It is fluid and troubled.

Generally tranſlucent.

More or leſs approaching to ſhining, and its luſtre is reſinous.

Feels

Feels greaſy.
Somewhat viſcid.
It wets.
Feels a little cold.
Swims.
Smell bituminous.

Chemical Characters.

It inflames eaſily, emits a bluiſh flame, and gives a ſmoke more or leſs opaque, according to the denſity of the oil, and ſometimes leaves a very ſmall earthy reſidue.

Conſtituent Parts.

Compoſed of carbon, hydrogen, and probably a little oxygen.

Geognoſtic Situation.

It flows almoſt always from rocks of the coal formation, and uſually from the immediate vicinity of beds of coal. It occurs ſometimes in marſhes, on the ſurface of ſpring water, or it flows and trickles unmixed from its repoſitory.

Geographic Situation.

The paleſt coloured and leaſt viſcid varieties of rock oil, or what has been termed Naphtha *, are found in great quantity at Baku and Scamachia on

* Werner doubts the exiſtence of the colourleſs and very inflammable varieties of naphtha deſcribed by ancient writers.

on the weſtern ſhore of the Caſpian, particularly in the adjacent promontory of Aſhberon. In the neighbourhood of Aſtracan, there are ſprings that pour out great quantities of it. It is alſo found near Modena, in the neighbourhood of Miano in the Dutchy of Parma; at the bottom of Veſuvius; in the Faroe iſlands, and the iſland of Iceland.

The more viſcid and darker-coloured varieties are found in *Europe*; at Gaming in Lower Auſtria; Moldavia; Hungary; at the paſs Oytoſch in Tranſilvania; Croatia; Hafing in the Tyrol; Pukutien near Kalueſch in Gallicia; Porentru in the Biſhopric of Baſle, now the department of Mont Terrible, and Chatonoy near Berne; Parma; at Pietra Bianca, on the ſouthern foot of Veſuvius; near Petraglia in Sicily; Dalmatia; in France at Sulzin Alſace, Gabian in Languedoc, Auvergne and Gaſcogne; Hecla in Iceland; Lancaſhire in England; St Catharine's Well near Edinburgh; and in the iſland of Pomona, one of the Orkneys.

In *Aſia*, in Perſia on the borders of the Caſpian, at Semenowa in Siberia, and the ſtream Taliza in the Altai.

In *America*, on the banks of the Ohio, and the iſland of Newfoundland. Many ſprings in Pennſylvania carry rock-oil along with them, and, according to the accounts of travellers, in immenſe quantities.

Uſes.

Uses.

In Piedmont, Perſia, Japan, and other countries, it is uſed in lamps in place of oil, for lighting ſtreets, churches, &c. It is alſo, when mixed with a little earth, uſed for warming rooms. It is alſo uſed, inſtead of common tar, to preſerve wood from decay, and from worms; alſo as a varniſh, and in fire-works.

SECOND SPECIES.

Mineral Pitch.

THIS ſpecies is by Werner divided into three ſubſpecies. 1. Earthy Mineral Pitch. 2. Slaggy Mineral Pitch. 3. Elaſtic Mineral Pitch.

FIRST SUBSPECIES.

Earthy Mineral Pitch.

Erdiges Erdpech.—*Werner.*

Semicompact mineral Pitch, or Maltha, *Kirw.* vol. ii. p. 46.—Le Poix mineral terreuſe, *Broch.* t. 2. p. 65. — Erdiges Bergpech, *Reuſs*, 3. b. f. 107.

External Characters.

Colour, blackiſh-brown.

Occurs maſſive.

Nearly

Nearly dull, or faintly glimmering.

Fracture earthy, or ſmall-grained uneven, ſometimes approaching to ſplintery.

Fragments indeterminately angular, pretty blunt-edged.

The ſtreak ſhining, and reſinous.

Is very ſoft.

Completely ſectile.

Not particularly difficultly frangible.

Feels greaſy.

Pretty cold.

Light, almoſt ſwimming.

Smell ſtrongly bituminous.

Chemical Characters.

It burns with a clear and fierce flame; emits an agreeable bituminous ſmell; and depoſites much ſoot.

Geognoſtic and Geographic Situations.

It is found in the valley of Travers, near Newburg, in the principality of Neufchatel in Switzerland. It is ſaid alſo to occur at Lothringen in France; in the Hartz and near Prague in Bohemia. In the Hartz, it occurs in veins that traverſe grey wacke; and at Prague, in calc-ſpar veins that traverſe tranſition greenſtone.

SECOND

SECOND SUBSPECIES.

Slaggy Mineral Pitch.

Schlackiges Erdpech.—*Werner.*

Bitumen ſolidum coagulatum friabile, Aſphaltum, *Wall.* t. 2. p. 93. — Aſphalte ou Bitume de Judée, *Rom. de L.* t. 2. p. 592. *Id. De Born.* t. 2. p. 78.—Bergpech or Judenpech, *Wid.* f. 624.—Aſphalt or Compact mineral Pitch, *Kirw.* vol. ii. p. 46.—Aſphaltum, *Hatchett*, Lin. Tranſ. vol. iv. p. 132.—Schlackiges Erdpech, *Eſtner*, 3 b. f. 110. *Id Emm.* b. 2. f. 50.—Aſphalte, *Lam.* t. 2. p. 533. 635.—Bitume ſolide, *Hauy*, t. 3. p. 313.—La Poix minerale ſcoriacée, *Broch.* t. 2. p. 66.—Schlackiges Bergpech, *Reuſs*, 3. b. f. 113.

External Characters.

Colour velvet-black, which ſometimes approaches to browniſh-black.

Occurs maſſive and diſſeminated.

Internally ſplendent and ſhining; often gliſtening, and its luſtre is reſinous.

Fracture is ſometimes imperfect, ſometimes very perfect conchoidal.

Fragments indeterminately angular, pretty ſharp-edged.

Is very ſoft, ſometimes paſſing into ſoft.

Opaque.

Sectile, ſo that it can be cut with a knife.

Retains its luſtre in the ſtreak.

Not very difficultly frangible.

Feels greafy.
Light.
Smell bituminous.

Geognoſtic Situation.

It is found nidular in veins, along with calc-ſpar and brown ironſtone, at Kamſdorf in Saxony; at the Violenberg near Grund, in pieces the ſize of a hen's egg, mixed with ſlaty glance-coal, in veins compoſed of compact brown ironſtone, cellular quartz and ſtraight lamellar heavy ſpar; at Iberg in the Hartz, accompanied with lead-glance in calc-ſpar druſes. In the Thalitter Mines it occurs in pieces in copper ſlate; at Carrarach in Cornwall in veins, accompanied with lead-glance, copper pyrites, fluor and calc ſpar. In the iſland of Trinidad, there is a lake three miles in circumference, covered with a bituminous ſubſtance, which is ſaid to reſemble ſlaggy mineral pitch; and a ſimilar ſubſtance is found on the ſurface of the Dead Sea in Paleſtine.

Geographic Situation.

Beſides the places already mentioned, it occurs at Morsfeld in the Palatinate; in the quickſilver mines of Deux Ponts; Salzburg; Valley of Travers near Newburg, in the principality of Neufchatel; Bex, in the canton of Berne in Switzerland; Avlona in Albania; Semenowa in Ruſſia.

Uſe.

The Egyptians employed it in the proceſs of embalming bodies *. The Arabians ſtill uſe a ſolution of it in oil to beſmear their horſe harneſs, to preſerve it from inſects. The ancients alſo uſed it as an ingredient in mortar; and it is ſaid that the walls of the famous city of Babylon were built with a mortar of this kind. The German tranſlator of J. Bar. de Vignola's *Civil Baukunſt*, obſerves, "I may here alſo remark, that we find in the accounts of travellers that buildings are often conſtructed with pitch; and that Peter de Val mentions, that he examined very old buildings, the ſtones of which were cemented by means of mineral pitch, and which were ſtill very firm, and in good order."

Obſervations.

1. The ſubſtances deſcribed under the name Aſphalt, Jews Pitch, Mineral Pitch, principally belong to this ſubſpecies, although under theſe names,

* Rouelle concludes from experiments which he made on mummies, that the Egyptians employed ſlaggy mineral pitch in embalming the dead. This operation was performed in three different ways; the firſt with ſlaggy mineral pitch alone; the ſecond with a mixture of this bitumen, and a liquor extracted from cedar, called Cedria; and the third with a ſimilar mixture, to which reſinous and aromatic ſubſtances were added. *Hauy*, Mineralog. t. 3. p. 315, 316.

names, by ſome mineralogiſts, earthy mineral pitch is und rſtood.

2. Gagat or Jet, is a variety of pitch coal, and therefore cannot be arranged under this ſpecies.

THIRD SUBSPECIES.

Elaſtic Mineral Pitch.

Elaſtiches Erdpech.—*Werner.*

Elaſtic Bitumen, *Hatchett*, Linn. Tranſ. vol. iv. p. 146. &c.—Mineral Cahoutchou, *Kirw.* vol. ii. p. 48.—Elaſtiches Erdpech, *Eſtner*, 3. b. ſ. 106. *Id. Emm.* 3. b. ſ. 106.—Cahoutchou foſſile, *Lam.* t. 2. p. 540. — La Poix minerale elaſtique, *Broch.* t. 2. p. 64. — Bitume elaſtique, *Hauy*, t. 3. p. 313. 314.—Elaſtiches Bergpech, *Reuſs*, 3. b. ſ. 110.

External Characters.

Colour blackiſh-brown, ſometimes inclining to browniſh-black, ſometimes to reddiſh-brown.

Occurs maſſive, diſſeminated, globular, ſtalactitic, and with impreſſions.

Internally, ſhining and gliſtening, and its luſtre is reſinous.

Fracture curved ſlaty. Croſs fracture conchoidal.

Fragments indeterminately angular, alſo ſlaty.

Is tranſlucent on the edges.

Streak

Streak ſhining.
Very ſoft.
Perfectly ſectile.
Elaſtic flexible.
Light, verging on ſwimming.
Speçific gravity,—*Hatchett*, from 0.9053 to 1.233
La Metherie, 0.930
Jordan, 0.9021

Geographic and Geognoſtic Situation.

Mr Hatchett, in his very intereſting memoir on Bituminous Subſtances, publiſhed in the Linnean Tranſactions, informs us, that the elaſtic bitumen is found in the cavities of a vein in the lead-mine called Odin, which is ſituated near the baſe of Mamtor, to the north of Caſtletown in Derbyſhire. The vein is compoſed of lead-glance, accompanied with fluor-ſpar, calc-ſpar, heavy ſpar, quartz, blende, calamine, ſelenite, and ſlaggy mineral pitch.

Obſervations.

1. According to Hatchett, a complete tranſition is to be obſerved from Mineral Oil to Elaſtic Mineral Pitch.

2. Like the elaſtic gum, called Cahoutchou, it removes the traces of graphite (black lead), but it at the ſame time ſoils the paper a little.

THIRD

THIRD SPECIES.

Brown Coal.

This ſpecies is divided into five ſubſpecies: 1. Bituminous Wood. 2. Earth Coal. 3. Alum Earth. 4. Common Brown Coal. And, 5. Muir Coal.

FIRST SUBSPECIES.

Bituminous Wood.

Bituminöſes Holz.—*Werner.*

Vegetabile foſſile bituminoſum, *Wall.* t. 2. p. 415.—Bituminöſes Holz, *Wid.* ſ. 631. *Id. Wern.* Pabſt. 1. b. ſ. 365.—Carbonated Wood, *Kirw.* vol. 2. p. 60.—Bituminöſes Holz, *Eſtner*, 3 b. ſ. 166. *Id. Emm.* 2 b. ſ. 54.—Le Bois bitumineux commun ou parfait, *Broch.* t. 2. p. 44.—Bituminöſes Holz, *Reuſs*, 3. b. ſ. 146.

External Characters.

Colour ſometimes light, ſometimes dark brown, approaching to wood-brown, or browniſh-black.

Its external ſhape reſembles exactly that of ſtems and branches of trees, but is uſually compreſſed.

Principal fracture glimmering, ſometimes approaching to gliſtening. Croſs fracture ſhining. The firſt is lighter coloured than the ſecond.

Fracture

Fracture fibrous in the ſmall, flaty in the great, and correſponds with the woody texture.

Croſs fracture in ſome varieties imperfect conchoidal.

Fragments ſplintery, cuneiform, ſeldom indeterminately angular.

Opaque.

Streak ſhining.

Is ſoft.

Sectile.

Rather elaſtic flexible.

Feels more or leſs cold.

Not very difficultly frangible.

Light, almoſt ſwimming.

Chemical Characters.

It burns with a clear flame, and evolves, during combuſtion, a ſweetiſh bituminous ſmell, which is very different from that of black coal.

Conſtituent Parts.

According to Vauquelin, the bituminous wood of Rollo contains the following ingredients:

Vegetable earth,	54
Sulphat of iron,	10.7
Sulphur,	0.8
Oxide of iron,	12.7
Sulphat of lime,	0.7
Silica,	9.2
Loſs,	

Geognoſtic

Geognoſtic Situation.

It occurs uſually in alluvial land in beds of common brown coal, ſometimes alſo forming whole beds, of which a ſmall portion is converted into brown coal and earth coal. It ſometimes alſo occurs in fragments, branches, &c. in clay, and in the Pruſſian amber mines it is found in conſiderable quantity, and ſometimes with adhering amber. Is found alſo in great quantity in the neweſt floetz trap formation; in which it forms beds, is embedded in pitch-coal, or in trap breccia. It occurs alſo in maſſes in limeſtone and ſandſtone, belonging to the independent coal formation.

Geographic Situation.

In England, at Bovey, near Exeter; in Scotland, in the floetz trap formation, accompanied with pitch-coal, in the iſland of Skye; in ſeparate pieces, in trap breccia, in the iſland of Cannay; in floetz limeſtone in the iſland of Skye; and in the independent coal formation in the county of Mid-Lothian; Bohemia in the Saatzer and Leitmeritzer Circles; Auſtria; Tranſilvania; Moravia; Leoban in Stiria; Irſenberg in Bavaria; Weiding, Zottenwieſe, the Upper Palatinate; Kieſlingſwalde near Landeck in Sileſia; Beider See near Halle, in the circle of Saal; near Merſeburg, in the circle of Leipſic; and Artern, Eiſleben in Thuringia; Kaltennordheim near Eiſenach, and Wehrau in Upper Luſatia; Habichtſwalde in Heſſia;

Heſſia; Cloiſa Lech in Wurtumberg; Freinwalde and Königſwalde in Brandenburg; Minden in the territory of Hanover; Weſterwald; Salzburg; different places in France; Iceland; Ruſſia.

Uſe.

It is employed as fuel where great heats are not required.

Obſervations.

1. In Iceland, where it occurs in great quantity, it is called Suturband.

2. It paſſes into common brown coal, with which it is often confounded; alſo into pitch-coal.

SECOND SUBSPECIES.

Earth Coal.

Erdkohle.—*Werner.*

External Characters.

Colour light blackiſh-brown; often alſo dark; ſometimes paſſing to yellowiſh-grey, which borders on wood-brown.

Occurs maſſive. Its conſiſtence is between cohering and looſe, but more inclined to the latter.

Its particles are dufty, and foil a little.

Internally, faintly glimmering, almoft dull.

Fracture in the fmall, intermediate between uneven and fine earthy.

Fragments indeterminately angular, blunt-edged.

Streak fomewhat fhining.

Is very foft, paffing to friable.

Is light, almoft fwimming.

Occurs ufually burft, and falls eafily into pieces.

Chemical Characters.

The brown varieties burn eafily, and diffufe, during combuftion, a fmell like that of burning bituminous wood. Alkohol diffolves a brownifh coloured bitter fubftance, having many of the properties of vegetable extract. By diftillation it affords a honey-yellow coloured oil, which is foluble in alkohol, and appears to be intermediate between refin and volatile oil. When this oil is freed of its watery parts, by expofure to a gentle heat, and then allowed to cool, it acquires the confiftence of white cerate *.

Conftituent

* This oil, according to Klaproth, refembles very much in its properties the fubftance called Sea or Lake Wax, which is found at Barguſin, on the fhores of the Lake Baikal.

Conſtituent Parts.

Earth Coal of Schraplau.

Carbonated hydrogen,	59 cubic inches.
Carbonic acid,	8.5
Acid water,	12.0 grains.
Empyreumatic oil,	30.0
Coal,	20.25
Lime,	2.0
Sulphat of lime,	2.5
Clay,	0.5
Oxyd of iron,	1.0
Sand,	11.5

Klaproth.

Geognoſtic and Geographic Situations.

It is found, along with bituminous wood, in Thuringia, in diſtrict of Mansfeldt; and in the circles of Saal and Leipſic, it occurs in beds from twenty to forty feet thick, having an extent of ſeveral ſquare miles.

Uſe.

It is uſed as fuel where no great degree of heat is required, as in heating rooms, in ſalt, nitre and alum works, and in diſtillation. But to render it fit for theſe purpoſes, it muſt be moiſtened with water, beat in troughs, then made into bricks and dried. Sometimes it is intermixed with ſmall black

black coal, to increaſe the intenſity of the heat. Its aſhes are uſed with advantage as a manure, and a colour reſembling umber is prepared from it.

Obſervations.

1. Voight in his intereſting Treatiſe on Black and Brown Coal, mentions a variety of earth coal, which has an aſh-grey colour, and which, when applied to the flame of a candle, burns and melts like ſealing wax, at the ſame time diffuſing a not diſagreeable odour *.

2. It paſſes into bituminous wood, from which it differs principally in its ſtate of aggregation.

3. Umber or Cologne earth is ſaid to be a variety of earth coal.

4. When much iron pyrites is diſperſed through it, alum is prepared from it, as is the caſe at Muhlbach, and Komothau in Bohemia.

5. Its name is derived from its ſtate of aggregation and uſe.

* Mr Hatchett, in an intereſting memoir lately read before the Royal Society of London, deſcribes a ſubſtance under the name Retin-aſphaltum, which appears to be the ſame as that mentioned by Voight. It may probably be a diſtinct kind of earth coal.

THIRD SUBSPECIES.

Alum Earth.

Alaunerde.—*Werner.*

Terra aluminaris, *Wall.* t. 2. p. 32.—Alaunerde, *Wid.* f. 398. —*Id. Eſtner*, b. 2. f. 647.—*Id. Emm.* b. 2. f. 299. — Aluminite bitumineux, *Lam.* t. 2. p. 116.—La terre alumineuſe, *Broch.* t. 1. p. 383.

External Characters.

Colour blackiſh-brown, and browniſh-black.

Maſſive.

Dull, ſometimes glimmering, but this probably owing to an intermixture of mica.

Fracture earthy, with a tendency to ſtraight ſlaty.

Breaks into tabular pieces.

Streak ſhining.

Feels a little meagre, and ſometimes greaſy.

Sectile.

Intermediate between very ſoft and friable.

Light.

Chemical Characters.

When expoſed to heat, it burns with a flame; and when left ſome time expoſed to a moiſt atmoſphere, it becomes warm, and at length takes fire.

Geognoſtic

Geognoſtic Situation.

It occurs frequently in beds of great magnitude in alluvial land, and ſometimes alſo in the floetz trap formation.

Geographic Situation.

It is found in Bohemia, Saxony, Auſtria, Naples, Hungary, and in the Vivrais in France.

Uſe.

It is lixiviated, to obtain the alum it contains; it is even ſometimes uſed for fuel.

Obſervations.

1. It was formerly arranged in the clay genus; but Werner has lately transferred it to its preſent place in the ſyſtem.

2. It is already deſcribed at page 320. &c. of vol. 1.

FOURTH SUBSPECIES.

Common Brown Coal.

Gemeine Braunkohle.—*Werner.*

Braun Kohle, *Eſtner*, 3. b. ſ. 126.—La Houille brune, *Broch.* t. 2. p. 47.—Gemeine braun Kohle, *Reuſs*, 3. b. ſ. 154.

Colour, light browniſh-black, which paſſes into complete blackiſh-brown.

Occurs

Occurs maſſive.

Internally ſhining, and ſometimes gliſtening; and its luſtre is reſinous.

Fracture rather imperfect large conchoidal; and ſometimes ſhews the fibrous woody texture.

Fragments indeterminately angular, more or leſs ſharp-edged.

Streak is lighter in the colour.

Is ſoft, and very ſoft.

Rather ſectile.

Not very brittle.

Pretty eaſily frangible.

Light.

Chemical Characters.

Burns with a weak blue-coloured flame, and emits a ſmell like that of burning bituminous wood.

Conſtituent Parts.

200 grains of the Bovey brown coal, by diſtillation, yielded,

	Grains.
1. Water, which ſoon came over acid, and afterwards turbid, by the mixture of ſome bitumen,	60
2. Thick brown oily bitumen,	21
3. Charcoal,	90
4. Mixed gas, conſiſting of hydrogen, carbonated hydrogen, and carbonic acid,	29
	200

Hatchett, Phil. Tranſ. 1804.

Geographic

Geographic Situation.

It is found at Bovey near Exeter; in the Leitmeritzer, Saatzer, and Ellbogner circles in Bohemia; in the counties of Mansfeldt, Thuringia, Magdeburg, and the circles of Saal and Leipfic, in Lower Saxony; in Heffia, at the famous hill called the Meiffner; at Kaltennordheim, in the diftrict of Eifenach; at Stockhaufen and Hoen in Weflerwald; ifland of Bornholm in Denmark; in the Faroe iflands; Greenland.

Geognoftic Situation.

Occurs in alluvial land, and in the neweft floetz trap formation.

Ufe.

For the fame purpofes as bituminous wood, &c.

Obfervations.

1. We find in it, 1. Iron pyrites. 2. Honeyftone. 3. Amber. 4. A fubftance, refembling the retin-afphaltum of Hatchett.

2. It is to be obferved paffing into bituminous wood and moor coal; fometimes alfo into pitch coal.

FIFTH SUBSPECIES.

Moor Coal.

Moorkohle.—*Werner.*

Moorkohle, *Eſtner*, 3. b. f. 129.—La Houille limoneuſe, *Broch.* t. 2. p. 48.—Moorkohle, *Reuſs*, 3. b. f. 157.

External Characters.

Colour dark blackiſh-brown.

Occurs maſſive.

Internally, gliſtening, and its luſtre is reſinous.

Principal fracture imperfect ſlaty; croſs fracture even, approaching to flat conchoidal.

Fragments trapezoidal, approaching to cubical.

Is ſoft and very ſoft.

Rather ſectile.

Streak ſhining.

Uncommonly eaſily frangible. The moſt frangible ſpecies of coal.

Light.

Chemical Characters.

Nearly ſame as thoſe of brown coal.

Geognoſtic Situation.

It occurs in great beds in alluvial land; alſo in the neweſt floetz-trap formation.

Geographic Situation.

In the Leitmeritzer, Saatzer and Ellbogner circles in Bohemia; at Thalern near Krems in Auſtria; ſaid alſo to be found in Tranſilvania, Moravia, the iſland of Bornholm in the Baltic Sea, and the Faroe iſlands. It occurs more frequently in Bohemia than in any other country.

Obſervations.

1. When it is for ſome time expoſed to the air, it burſts and falls into pieces: this burſt aſpect is very characteriſtic of this ſubſpecies.

2. In it we ſometimes obſerve traces of wood, but it appears principally compoſed of reeds.

3. It paſſes into the preceding ſubſpecies.

FOURTH SPECIES.

Black Coal.

Schwartzkohle.—*Werner.*

This ſpecies contains ſix ſubſpecies: *a.* Pitch Coal; *b.* Columnar Coal; *c.* Slate Coal; *d.* Cannel Coal; *e.* Foliated Coal; and *f.* Coarſe Coal.

FIRST SUBSPECIES.

Pitch-Coal.

Pechkohle.—*Werner.*

Pechkohle, *Eſtner*, 3. b. f. 132.—La Houille piciforme, ou le Pechkohle, *Broch.* t. 2. p. 49.—Pechkohle, *Reuſs*, 3. b. f. 142.

External Characters.

Colour velvet-black, and browniſh-black when it is paſſing into bituminous wood.

Occurs maſſive, in plates, and ſometimes in ſhape of branches, but with a regular woody internal ſtructure.

Internally ſhining, ſometimes ſplendent, and its luſtre is reſinous.

Fracture large and perfect conchoidal.

Fragments indeterminately angular, pretty ſharp-edged.

Is ſoft.

Rather brittle.

Not particularly difficultly frangible.

Light.

Specific gravity, according to Wiedenman, 1.308.

Chemical characters.

Burns with a greeniſh flame; and, according to Voigt, emits a very ſtrong ſweetiſh bituminous ſmell,

ſmell, like the different ſubſpecies of brown coal, and leaves a light yellowiſh-coloured aſh.

Geognoſtic Situation.

It occurs in all the three principal coal formations, but moſt frequently in that ſubordinate to the neweſt floetz-trap formation.

Geographic Situation.

It is found in the coal fields or diſtricts of the Lothians; Fifeſhire, Linlithgowſhire, iſland of Skye, and at Cannoby and Sanquhar, in Dumfrieſſhire in Scotland; at Newcaſtle, Tindel Fells, Bolton and Whitehaven in Cumberland in England; in Auſtria; Hungary; the Bannat; Tranſilvania; Upper Luſatia; Sileſia; on the famous hill called the Meiſſner, in Heſſia; Wurtumberg; Franconia; Bavaria; Salzburg; Italy; Spain; France; Pruſſia.

Uſe.

It is uſed as fuel, either in its natural ſtate, or when converted into coaks. According to a report publiſhed in the "Journal des Mines," twelve hundred men are employed in the diſtrict of Aude in France, in fabricating, with the pitch-coal of that neighbourhood, roſaries, buttons, ear-rings, necklaces, bracelets, ſnuff-boxes, drinking veſſels, &c. One thouſand hundredweight are yearly expended for this purpoſe; and, to Spain alone, the

value

value of 18,000 livres is fold. In Pruffia, the amber diggers, who name it Black Amber, cut it into various ornamental articles.

Obfervations.

1. It is the darkeft coloured, and its conchoidal fracture is the moft perfect of any of the fubfpecies of coal.

2. According to Voigt, it is to be obferved paffing on the one fide into glance-coal, and on the other into brown coal *.

3. Its name is derived from its pitchy afpect. It was formerly known by the name Gagat or Jet, a name derived from the river Gaga, or the city Gagas in Leffer Afia, where it was formerly dug.

4. It is named Black Amber by the Pruffian amber diggers, becaufe it is found accompanying amber, and, when rubbed, becomes faintly electric.

5. Several varieties of flaggy mineral pitch, and cannel coal, are known by the name Jet.

SECOND SUBSPECIES.

Columnar Coal.

Stangenkohle.—*Werner.*

Stangenkohle, *Eftner*, 3. b. f. 139.—La Houille fcopiforme, ou le Stangenkohle, *Broch.* t. 2. p. 51.—Stangenkohle, *Reufs.* 3. b. f. 136.—*Id. Voigt's* Steinkohlen, Gefch. f. 190.

External

* This obfervation of Voigt's needs further confirmation.

External Characters.

Colour intermediate between velvet and greyiſh black, inclining ſometimes to iron black; ſeldom to browniſh black.

Occurs maſſive.

Internally, ſhining and ſplendent, and its luſtre is reſinous, ſometimes inclining a little to ſemimetallic.

Fracture rather imperfect conchoidal.

Fragments indeterminately angular.

Occurs in thick, very thick, curved, parallel, columnar diſtinct concretions, having ſmooth glimmering ſurfaces.

Is ſoft.

Rather brittle.

Uncommonly eaſily frangible.

Light.

Chemical Characters.

It burns without flame or ſmell, and leaves a greyiſh-white coloured aſh.

Geognoſtic Situation.

Occurs at the Meiſſner in the neweſt floetz-trap formation, along with glance-coal, pitch-coal, and brown-coal. It occurs along with other ſubſpecies of coal in the following order, proceeding from

from the upper to the lower part of the great mafs of coal of which the Meiffner is compofed.

1. Columnar coal.
2. Glance-coal.
3. Pitch-coal.
4. Brown coal, which often verges on pitch coal.
5. Brown coal, which often includes in it bituminous wood and earth-coal.
6. Bituminous wood.

This mafs of coal is covered by bafalt and greenftone.

Geographic Situation.

It has been hitherto found only in the Meiffner, near Almerode in Heffia. It is faid alfo to have been found in England and Scotland, but this is very problematical.

Obfervations.

1. Voigt is of opinion, that it is principally diftinguifhed from glance-coal by its columnar diftinct concretions, and fays he has obferved the complete tranfition from columnar coal through glance-coal to pitch-coal.
2. It deferves probably to be arranged as a fubfpecies of glance-coal.

THIRD

THIRD SUBSPECIES.

Slate-Coal.

Schieferkohle.—*Werner.*

Schieferkohle, *Eſtner*, 3. b. ſ. 147. — La Houille ſchiſteuſe, ou le Schieferkohle, *Broch.* t. 2. p. 52. — Schieferkohle, *Reuſs*, 3. b. ſ. 132.—*Id. Voigt*, ſ. 10.

External Characters.

Colour intermediate between velvet-black and dark greyiſh-black. Sometimes it preſents a pavonine or peacock-tail tarniſh, ſometimes a rainbow tarniſh.

Occurs maſſive.

Is ſhining and gliſtening, and its luſtre is reſinous.

Principal fracture nearly ſtraight ſlaty; croſs fracture ſmall grained uneven, paſſing into even and imperfect conchoidal.

Fragments indeterminately angular, ſometimes even trapezoidal.

Is ſoft.

Not particularly brittle, approaching to ſectile.

Eaſily frangible.

Light.

Specific

Specific gravity,

According to *Kirwan*, 1.250 to 1.370 Engliſh.
1.259 From Irvine in Scotland.
Wiedeman, 1.277
Richter, 1.28125 to 1.3730 From Sabrze in Sileſia.
1.32132 to 1.3820 Bielſchowitz.

Chemical Characters.

It burns longer than cannel or columnar coal; cakes more or leſs, and after combuſtion leaves a flag.

Conſtituent Parts.

Slate-Coal of Walden.

Bitumen,	36.875
Carbon,	57.993
Earth,	5.823
Iron and oxide of manganeſe,	1.157

Richter.

Slate-Coal of Sabrze.

Bitumen,	32.934
Carbon,	63.312
Earth and oxide of iron,	3.904

Richter.

Slate-Coal of Bielſchowitz.

Bitumen,	37.890
Carbon,	58.172
Earths and oxide of iron,	3.937

Richter.

Slate-Coál of Whitehaven.

Carbon,	56.8
Mixture of aſphalt and maltha, in which the aſphalt predominates,	43

Kirwan.

Geognoſtic Situation.

It occurs moſt frequently in the independent coal formation, accompanied with thin layers of pitch-coal.

Geographic Situation.

It is found wherever the independent coal formation occurs; conſequently it is very widely diſtributed.

In England it is found in vaſt quantity, at Newcaſtle, and in the great expanſe of the coal formation in that neighbourhood; in the whole tract of the coal formation which ſtretches from Bolton, by Allonby, Workington to Whitehaven; in Scotland, in almoſt

almoſt every quarter of the great river-diſtrict of the Forth; in great quantity in the river-diſtrict of the Clyde, and at Cannoby, Sanquhar and Kirkonnel in Dumfriesſhire*; it is found alſo in Thuringia; electorate of Saxony; Bohemia; Sileſia; Hungary; the Tyrol; Stiria; Bamberg; Bavaria; Salzburg, and France.

Obſervations.

1. It paſſes ſometimes into cannel and foliated coal.

2. It very frequently contains mineral charcoal.

3. Its name is derived from its ſlaty fracture.

FOURTH SUBSPECIES.

Cannel Coal.

Kennelkohle.—*Werner.*

Cannelkohle, *Eſtner*, 3. b. ſ. 151.—La Houille de Kilkenny, ou le Kennelkohle, *Broch.* t. 2. p. 53.—Cannelkohle, *Reuſs*, 3. b. ſ. 130.—*Id. Voigt*, ſ. 172.

External Characters.

Colour dark greyiſh black.

Maſſive.

Internally gliſtening, and its luſtre is reſinous.

Fracture

* Williams' Mineral Kingdom; Mineralogical Deſcription of Dumfriesſhire.

Fracture ſometimes large and flat conchoidal, ſometimes even.

Fragments irregular or cubical.

Is ſoft and ſemihard.

Not particularly brittle.

Eaſily frangible.

Light.

Specific gravity,

According to *Kirwan*, 1.232
Watſon, 1.237
La Metherie, 1.270
Blumenbach, 1.275

Geognoſtic Situation.

Occurs with the preceding ſubſpecies in the independent coal formation.

Geographic Situation.

It is found in England near Whitehaven, Wigan in Lancaſhire, Broſely in Shropſhire, Athercliff near Sheffield; in Scotland at Gilmerton, in the neighbourhood of Edinburgh, and Muirkirk in Clydeſdale *.

Uſe.

On account of its ſolidity, and the good poliſh it is capable of receiving when pure, it is cut into drinking veſſels of various kinds, inkholders, ſnuff-boxes, &c.; but its principal uſe is as fuel.

Obſervation.

* Williams' Mineral Kingdom; Mineralogical Deſcription of Dumfriesſhire.

Obſervation.

According to the Biſhop of Llandaff, its name is derived from the word *candle*, becauſe in ſome places the poor people uſe it in place of lights.

FIFTH SUBSPECIES.

Foliated Coal.

Blätterkohle.—*Werner.*

Id. Eſtner, 3. b. f. 155.—Le Charbon lamelleux, *Broch.* t. 2. P. 54.—Blätterkohle, *Reuſs*, 3. b. f. 128.—*Voigt*, f. 72.

External Characters.

Colour intermediate between velvet-black and greyiſh-black; ſometimes it has a pavonine tarniſh on the fracture.

Occurs maſſive.

Principal fracture ſplendent, croſs fracture gliſtening, and its luſtre is reſinous.

Principal or longitudinal fracture ſtraight foliated, ſingle cleavage, which is more or leſs perfect; croſs fracture flaty.

Fragments indeterminately angular, approaching to cubical.

Is ſoft and very ſoft.

Not particularly brittle, approaching to ſectile.

Very

Very eaſily frangible.
Light.

Geognoſtic Situation.

It occurs in the independent coal formation.

Geographic Situation.

It is found in the electorate of Saxony and in Sileſia.

SIXTH SUBSPECIES.

Coarſe Coal.

Grobkohle.—*Werner.*

Id. Eſtner, 3. b. ſ. 158.—La Houille groſſiere, ou la Grobkohle, *Broch.* t. 2. p. 55.—Grobkohle, *Reuſs*, 3. b. ſ. 123.

External Characters.

Colour dark greyiſh-black.
Occurs maſſive.
Is gliſtening.
Croſs fracture coarſe grained uneven; the longitudinal fracture generally ſlaty.
Fragments ſometimes indeterminately angular, ſometimes rather blunt-edged.
Is ſoft.
Is ſemihard: it is the hardeſt ſubſpecies of coal.
Rather brittle.

Pretty

Pretty eaſily frangible.
Light, paſſing into not particularly heavy.

Geognoſtic Situation.

Is found in the independent coal formation.

Geographic Situation.

Occurs in the coalworks in the neighbourhood of Dreſden.

GENERAL OBSERVATIONS ON THE DIFFERENT SPECIES OF COAL.

1. *Compariſon of the ſeveral Subſpecies of Coal in regard to hardneſs, tenacity, frangibility, luſtre, &c.*

a. Coarſe coal is the heavieſt and hardeſt; the hardneſs diminiſhes through ſlate coal, foliated coal to earth coal, which is the ſofteſt.

b. Cannel coal is the moſt difficultly frangible: foliated coal and columnar coal are the eaſieſt frangible.

c. Foliated coal, glance-coal, and pitch-coal, have the ſtrongeſt luſtre; moor-coal and coarſe coal the weakeſt.

d. Bituminous wood, earth-coal, and brown coal, burn worſt, and emit a peculiar odour; the other ſubſpecies do not emit the peculiar odour, and give a ſtronger heat.

e. They all afford aſhes, excepting coarſe, foliated, and ſlate coal, which give ſlags; the

the aſhes are ſometimes whitiſh and ſometimes reddiſh: the ſlags are owing to the mixture of calcareous and argillaceous earths, and iron.

2. There is an uninterrupted tranſition from bituminous wood to the moſt diſtant ſpecies of black coal. This tranſition is denied by *Voigt*, but without ſufficient reaſon.

3. There are, according to *Werner*, three principal formations:
   1. Independent or true coal formation.
   2. That which is ſubordinate to the neweſt floetz-trap formation.
   3. That which is found in the alluvial land.
   a. The coal of the independent coal formation occurs with clay, ſlate-clay, marl, ſandſtone, limeſtone, and greenſtone *.
   b. That ſubordinate to the neweſt floetz-trap is accompanied with wacke, baſalt, greenſtone, and clay ironſtone.
   c. The third formation, which occurs in alluvial land, is accompanied with ſand and clay.

Theſe formations are alſo characterized by their accompanying ſpecies of coal. Thus, 1. The independent coal formation, which is the oldeſt, contains only foliated, coarſe, ſlate, and cannel coal, ſometimes alſo pitch-coal. 2. The ſecond,

* Mineralogical Deſcription of Dumfrieſſhire, p. 169. to p. 174.

second, besides these, contains principally pitch-coal, also moor, glance, and columnar coal, and very seldom slate-coal. 3. In the newest formation, which comprehends those species of coal which have suffered the least alteration, we find bituminous wood, earth-coal, alum earth, moor-coal, seldom brown coal, and pitch-coal.

4. All naturalists are now agreed that the greater part of coal is derived from vegetables, which have been altered by certain natural operations, hitherto but imperfectly known.

FOURTH GENUS.

GRAPHITE GENUS.

FIRST SPECIES.

Glance-Coal.

Glanzkohle.—*Werner.*

This species contains two subspecies: 1. Conchoidal Glance-Coal. 2. Slaty Glance-Coal.

FIRST SUBSPECIES.

Conchoidal Glance-Coal.

Muschliche Glanzkohle.—*Werner.*

Id. Esner, 3. b. s. 135.—La Houille eclatant, ou le Glanzkohle, *Broch.* t. 2. p. 50.—Glanzkohle, *Reuss*, 3. b. s. 138.—*Id. Voigt*, s. 90.

External Characters.

Colour iron-black, of various degrees of intenſity, which rather inclines to brown; and on the ſurface has a tempered-ſteel coloured tarniſh.

Occurs maſſive and veſicular; the interior of the veſicles has a tempered-ſteel coloured tarniſh.

Internally ſhining, verging on ſplendent, and its luſtre is metallic.

Fracture large and ſmall conchoidal; yet we can frequently obſerve a trace of the ligneous texture.

Fragments indeterminately angular, ſharp-edged.

Soft, ſometimes bordering on ſemihard.

Rather brittle.

Eaſily frangible.

Light.

Chemical Characters.

It burns without flame or ſmell, and leaves a white-coloured aſh.

Conſtituent Parts.

Inflammable matter,	96.66
Alumina,	2.0
Silica and iron,	1.33

Schraub. Beſchr. d. Meiſſner, ſ. 146.

Geognoſtic Situation.

Has been hitherto found only in the neweſt floetz trap formation, where it is accompanied with colum-

har coal, pitch-coal, common brown coal, and bituminous wood.

Geographic Situation.

At the Meiſſner in Heſſia: ſaid alſo to have been found at Newcaſtle.

Obſervations.

1. It appears to paſs into ſlaty glance-coal, (coal-blende).

2. On the Meiſſner, where it is principally found, it occurs along with other ſubſpecies of coal, in the following order, beginning with the uppermoſt: 1. Columnar coal: 2. Conchoidal glance-coal: 3. Pitch-coal: 4. Common brown-coal, paſſing into pitch-coal: 5. Brown-coal, with incloſed bituminous wood and earth-coal: 6. Bituminous wood.—*Voigt.*

SECOND SUBSPECIES.

Slaty Glance-Coal.

Schiefrige Glanzkohle.—*Werner.*

Plombagine charbonneuſe, ou Anthracolite, *De Born.* t. 2. p. 296.—Kohlenblende, *Wid.* f. 653.—Native mineral Carbon, *Kirw.* t. 2. p. 49.—Kohlenblende, *Eſtner*, 3. b. f. 197.—*Id. Emm.* t. 2. p. 77.—Anthracite de Dolomieu.—*Id. Lam.* t. 1. p. 76.—La Blende charbonneuſe, ou la Kohlenblende, *Broch.* t. 2. p. 79.—Anthracite, *Hauy*, t. 3. p. 307.—Kohlenblende, *Reuſs*, 3. b. f. 183.

External

External Characters.

Colour dark iron-black, ſeldom inclining to brown; it is even ſometimes ſteel-grey, particularly the varieties that border on graphite.

Occurs maſſive.

Is ſhining and gliſtening, and its luſtre is intermediate between metallic and ſemimetallic.

Principal fracture is more or leſs perfect flaty; croſs fracture ſmall and flat conchoidal.

Fragments indeterminately angular, pretty ſharp-edged, ſometimes even trapezoidal.

Is ſoft; in ſome rare varieties, viz. thoſe paſſing into graphite, very ſoft.

Uncommonly eaſily frangible.

Is intermediate between ſectile and brittle.

Light, approaching to not particularly heavy.

Specific gravity, *Klaproth*, 1.530; *Hauy*, 1.800; *Thomſon*, 1.415; *La Metherie*, 1.300; *Groeſs*, 1.468; *Kirwan*, 1.526.

Chemical Characters.

According to Dolomieu, when reduced to powder, and heated in a crucible, it does not give any ſulphureous or bituminous odour, and, on diſtillation, it affords neither ſulphur nor bitumen. By expoſure to a conſiderable heat, it burns without flame, and at length is conſumed, leaving a greater or leſſer portion of aſh, according to its purity.

Conſtituent

Conſtituent Parts.

Guyton.		*Panzenberg.*		*Dolomieu.*
Carbon,	63.73	Carbon,	90	72.05
Oxygen,	31.27	Silica,	4 to 2	13.19
Clay & oxide of iron,	5.0	Alumina,	4 to 5	3.29
		Oxide of iron,	2 to 3	3.47
		Loſs,		8
			100	100.0

Geognoſtic Situation.

It occurs in embedded maſſes, beds and veins, in primitive, tranſition and floetz rocks. It occurs in Spain, in gneiſs; in Switzerland and Savoy, in mica ſlate and clay ſlate; at Liſchwitz near Gera, in Saxony, in tranſition rocks; in the independent coal formation in the iſland of Arran in Scotland *; and in the ſame formation near the village of Brandau, in the Saatzer circle in Bohemia.

Geographic Situation.

Beſides the localities already mentioned, the following are given by mineralogiſts. In mineral veins, at Schemnitz in Hungary; at Violenberg, Lehrbach and Clauſthal in Hartz, where it is accompanied with brown ironſtone and ſlaggy mineral pitch, and with red ironſtone and calc-ſpar; Salzburg; Vallais; Savoy; Aoſta in Piedmont, and at Strido, in the territories of Florence; Auvergne in France; St Juan, St Ildefonſo, San Lorenzo near La

* Mineralogy of the Scottiſh iſles, vol. i. p. 75.

La Chapelle, in Spain; in the mines called Gotteshülfe in der Noth, Siebenbrüder, and Güte Gottes at Kongſberg in Norway, accompanied with calc-ſpar and native ſilver; in the government of Katharinoflow in Siberia; in Dauphiny, in embedded maſſes, in a rock which Brochant ſuppoſes to be grey-wacke; at Kilkenny in Ireland.

Obſervations.

1. It has ſome reſemblance, in chemical compoſition, to alum ſlate and drawing ſlate.

2. It was formerly conſidered to be excluſively a product of primitive and tranſition rocks, until it was diſcovered in the independent coal formation in the iſland of Arran.

3. Its occurrence in floetz rocks does not weaken in the ſmalleſt degree the concluſions drawn from its occurrence in primitive rocks reſpecting primitive original carbon, independent of animals or vegetables.

SECOND SPECIES.

Graphite.

Graphit.—*Werner.*

This ſpecies contains two ſubſpecies: 1. Scaly. 2. Compact.

FIRST SUBSPECIES.

Scaly Graphite.

Schuppiger Graphit.—*Werner.*

Colour dark ſteel grey, which approaches to light iron black.

Occurs maſſive and diſſeminated.

Is uſually gliſtening, ſometimes glimmering, and its luſtre is metallic.

Fracture ſcaly foliated, paſſes ſometimes into large conchoidal, and is ſometimes ſlaty and uneven at the ſame time.

Fragments indeterminately angular, ſometimes trapezoidal.

It occurs in coarſe, ſmall and fine granular diſtinct concretions.

Streak is ſhining, even ſplendent, and its luſtre is metallic.

Is very ſoft.

Perfectly ſectile.

Rather difficultly frangible.

Writes and ſoils.

Feels very greaſy.

It is intermediate between not particularly heavy, approaching to light, and heavy.

Specific gravity, (but uncertain whether of ſcaly or compact graphite),

Kirwan,	1.987	2.267
Briſſon,	2.1500	2.456
Hauy,	2.0891	2.2456

SECOND

SECOND SUBSPECIES.

Compact Graphite.

Dichter Graphit.—*Werner.*

External Characters.

Colour nearly the ſame with the preceding, only rather blacker.

Internally glimmering; ſometimes gliſtening; and its luſtre is metallic.

Fracture fine grained uneven, which paſſes into even, and alſo into large and flat conchoidal.

Some varieties ſhow a ſlaty longitudinal fracture.

In other characters it agrees with the preceding ſubſpecies.

Chemical Characters.

When heated in a furnace it burns, and during combuſtion emits a great deal of carbonic acid, and leaves a reſiduum of red oxide of iron.

Conſtituent Parts.

Berthollet.		*Scheele.*	
Oxide of carbon,	90.9	Carbon,	81
Iron,	9.1	Oxygen,	9
		Iron,	10
	100		100

Graphite

Graphite of Pluffier according to *Vauquelin*:

Oxide of carbon,	23
Iron,	2
Alumina,	37
Silica,	38
	100

Journal des Mines, N. 12. p. 16.

Geognoſtic Situation.

It occurs uſually in beds, ſometimes diſſeminated, and in imbedded maſſes, in gneiſs, mica-ſlate, clay-ſlate, and the independent coal formation; probably alſo in tranſition ſlate.

Geographic Situation.

It is found at Burrowdale near Keſwick (probably in tranſition ſlate) in England, and near New Cumnock in Ayrſhire in Scotland; (in the independent coal formation*); in Bohemia; Auſtria; Bavaria; Paſſau; Stiria; Hungary; Tranſilvania; Salzburg; Savoy; France; Spain; Norway; and Iceland. It is ſaid alſo to have been found at the Cape of Good Hope; in Greenland; and Thutſkoi Noſs in Aſia.

Uſes.

The finer kinds are firſt boiled in oil, and then cut into tables or pencils: the coarſer parts and the refuſe of the ſawings are melted with ſulphur, and

* Mineralogical Deſcription of Dumfrieſſhire, p. 157. &c.

then caſt into coarſe pencils for carpenters: they are eaſily diſtinguiſhed by their ſulphureous ſmell. It is alſo uſed for brightening and preſerving grates and ovens from ruſt; and, on account of its greaſy quality, for diminiſhing the friction in machines. Crucibles are made with it, which reſiſt great degrees of heat, and have more tenacity and expanſibility than thoſe manufactured with the uſual clay mixtures.

THIRD SPECIES.

Mineral Charcoal.

Mineraliſche Holzkohle.—*Werner.*

External Characters.

Colour greyiſh black.

Occurs in ſmall angular, ſomewhat cubical ſhaped pieces.

Is glimmering, bordering on gliſtening, and its luſtre is ſilky.

Fracture fibrous, which ſometimes ſhews the woody texture.

Fragments indeterminately angular, blunt edged, ſometimes alſo ſplintery.

Soils ſtrongly.

Is ſoft, paſſing into friable.

Light.

Geognoſtic and Geographic Situation.

It occurs in thin layers in ſlate-coal, brown coal, earth-coal and moor-coal, and it is found equally widely diſtributed *.

FIFTH GENUS.

RESIN GENUS.

FIRST SPECIES.

Amber.

Bernſtein—*Werner.*

This ſpecies contains two ſubſpecies: 1. White; 2. Yellow.

FIRST SUBSPECIES.

White Amber.

Weiſſer Bernſtein.—*Werner.*

Id. Werner, Pabſt. 1. b. f. 367.—Le Succin blanc, *Broch.* t. 2. p. 69.—Weiſſer Bernſtein, *Reuſs*, 3. b. f. 166.

External Characters.

Colour ſtraw-yellow, which ſometimes inclines to yellowiſh-white.

Occurs

* Mineralogical Deſcription of Dumfriesſhire, p. 88.

Occurs maſſive, and ſometimes aſſociated with the yellow ſubſpecies.

Is gliſtening, approaching to ſhining, and its luſtre is reſinous.

Fracture conchoidal, but not ſo perfect as the yellow ſubſpecies.

Fragments indeterminately angular, ſharp-edged.

Is only tranſlucent.

In other characters, it reſembles the following ſubſpecies.

SECOND SUBSPECIES.

Yellow Amber.

Gelber Bernſtein.—*Werner.*

Id. Werner, Pabſt. 1. b. ſ. 367.—Le Succin jaune, *Broch.* t. 2. p. 70.—Gelber Bernſtein, *Reuſs*, 3. b. ſ. 169.

External Characters.

Colour wax-yellow, which paſſes, by a kind of lemon yellow, into honey yellow; from this it paſſes into dark yellowiſh brown, and hyacinth red.

Occurs almoſt always in indeterminately angular blunt-edged pieces, having a rough uneven ſurface.

Externally almoſt always dull; internally ſplendent, and its luſtre is intermediate between vitreous and reſinous.

Fracture

Fracture large and perfect conchoidal.

Fragments indeterminately angular, very ſharp-edged.

Tranſparent.

Is ſoft.

Rather brittle.

Pretty eaſily frangible.

Rather cold to the feel.

Light and ſwimming.

Specific gravity, 1.078 to 1.085

Chemical Characters.

It burns with a yellow-coloured flame, and if the heat be ſtrong enough, melts and emits a peculiar agreeable odour, and leaves very little aſhes.

Phyſical Characters.

When rubbed it acquires a ſtrong negative electrical virtue. This property was known to the ancients, who termed amber *electrum*; from whence is derived the word *electricity*.

Conſtituent Parts.

Is compoſed of carbon, hydrogen and oxygen. The Benzoic acid is probably a product of diſtillation.

Geognoſtic Situation.

It is found in layers of bituminous wood, and in moor-coal; alſo in a breccia formed by the aggregation

gation of fragments on ſandy ſea-ſhores; and frequently floating on the ſea.

Geographic Situation.

On the coaſts of Pruſſia, Courland, Liefland, and Ruſſia; Sweden; Pomerania; Weſt Pruſſia; in Jutland; iſland of Bornholm; more rarely on the iſlands of Fyhn and Moen, and the iſland of Zeeland; Norway; in the Bannat; at Wittenberg, in the Electorate of Saxony; in the Dutchy of Wurtemberg; in Switzerland; Sicily; France; Spain. According to Sir John Hill, it is ſaid to have been found in digging into the alluvial land in the vicinity of London. Found alſo ſometimes on the ſeaſhores of ſeveral parts of England. Said alſo to be found in Siberia, and the iſland of Madagaſcar.

Uſe.

Being ſuſceptible of a fine poliſh, it is cut into necklaces, bracelets, ſnuff-boxes, and other articles of dreſs. Before the diſcovery of the diamond and other precious ſtones of India, it was conſidered to be the moſt precious of jewels, and was employed in all kinds of ornamental dreſs. Altars were alſo ornamented with it. The greateſt quantity at preſent conſumed in commerce, is purchaſed by Armenian and Grecian merchants, but it is ſtill uncertain where they diſpoſe of it. It is conjectured by

by ſome, that it is purchaſed by pilgrims, previous to their journey to Mecca, and that on their arrival there, it is burnt in honour of the prophet Mahomet. The acid and oil obtained from it are uſed as medicines.

Obſervations.

1. It often contains inſects of various ſpecies, in a ſtate of complete preſervation; alſo leaves and other parts of vegetables.

2. Various conjectures have been propoſed reſpecting its origin and formation. By ſome, it is held to be a vegetable gum or reſin; others, as Hermbſtadt, conſider it a mineral oil, thickened by abſorption of oxygen; and Mr Parkinſon is of opinion that it is inſpiſſated mineral oil.

3. There was lately found in Pruſſia, a maſs of amber, which weighed upwards of 13 lbs., and whoſe contents amounted to 318¾ cubic inches. Five thouſand dollars are ſaid to have been offered for it; and the Armenian merchants aſſert, that in Conſtantinople it would ſell for 30,000 or 40,000 dollars.—"Neues allgemeines Journal der Chemie, "von Hermbſtadt und Klaproth," 1. b. ſ. 224.

4. Pitchcoal is ſometimes found along with amber, and is called by the amber diggers, Black Amber, and is ſold to the ignorant at a great price.

5. Specimens incloſing inſects, &c., are highly valued; and the amber dealers are ſaid to be poſ-

ſeſſed

ſeſſed of means of ſoftening it, and introducing inſects and other foreign bodies into it.

6. When one part of the empyreumatic oil, obtained by diſtilling mineral pitch, is boiled ſeveral times, with one and half parts of turpentine, a compound is formed, which bears a great reſemblance to amber, and which is very often cut into necklaces and other ornaments, and ſold as true amber.

SECOND SPECIES.

Honey Stone.

Honigſtein.—*Werner.*

Id. Wid. ſ. 639.—Succin tranſparent en Criſtaux octaedres, D. B. t. 2. p. 90.—Mellilite, *Kirw.* t. 2. p. 68.—Honigſtein, *Emm.* t. 2. p. 86.—La Pierre de Miel, ou le Mellite, *Broch.* t. 2. p. 73.—*Id. Hauy*, t. 3. p. 335.—Honigſtein, *Reuſs*, 2. b. ſ. 52.

External characters.

Colour darker or lighter honey-yellow, paſſing into wax-yellow.

Occurs ſeldom maſſive; almoſt always cryſtallized,

1. In low, obtuſe octahedrons, which are ſometimes truncated on the angles of the common baſis. When theſe truncations increaſe, it paſſes into the

2. Four

2. Four-ſided priſm, acuminated by four planes, which are ſet on the lateral edges, like the hyacinth.
3. Garnet dodecahedron.

The ſummits of the cryſtals are ſometimes rounded or truncated by a convex plane.

Planes are ſmooth and ſplendent.

Luſtre intermediate between vitreous and reſinous.

Fracture perfect conchoidal.

Fragments indeterminately angular, pretty ſharp edged.

Is duplicating tranſlucent, paſſing into opaque.

Is ſoft; ſofter than amber.

Brittle.

Eaſily frangible.

Light.

Specific gravity, 1.5858 to 1.666.

Chemical Characters.

Before the blow-pipe, without addition, it becomes white, emits no vapour, and a ſcarcely perceptible odour; it is at length reduced to aſhes, without ſhowing any flame.—*Brochant.*

According to Lampadius, before the blow-pipe, it burns with a weak flame, and becomes opaque and black, and a white infuſible powder remains behind. Borax and natron diſſolve it in part, and leave undiſſolved a white opaque reſidue.

Conſtituent Parts.

Alumina,	16
Mellilitic acid,	46
Water of cryſtallization,	38
	100

According to *Klaproth.*

Vauquelin finds it to be compoſed of 66.6 of mellilitic acid, and 33.3 of ſilica, lime and alumina.

Phyſical Character.

According to Hauy, it acquires, by rubbing, a ſlight degree of electricity.

Geognoſtic and Geographic Situations.

It occurs ſuper-impoſed on bituminous wood and earth-coal, and is uſually accompanied with ſulphur. It has been hitherto found only at Aertern in Thuringia, and Langenbogen in the circle of Saal. It is ſaid alſo to have been found along with ſlaggy mineral-pitch in Switzerland.

Obſervations.

1. Its name is borrowed from its honey-yellow colour.

2. Werner referred it to its preſent place in the ſyſtem, from its external characters. Karſten and Reuſs conſider it as a ſpecies of the clay genus, on account of its containing a conſiderable portion of alumina.

3. It

3. It differs from amber in colour; in being cryſtallized; duplicating tranſlucent; ſofter; heavier, and leſs powerfully electric.

4. It is chemically diſtinguiſhed from amber: On burning coal, amber melts and diffuſes an agreeable odour; honey-ſtone, on the contrary, becomes white, without fuſion or odour.

GLASS

CLASS IV.

METALLIC FOSSILS.

To give a minute detail of the phyſical and chemical characters of this claſs of minerals, would be improper in a work of this kind, whoſe principal object is to make us acquainted with the external aſpect of ſimple minerals. I refer thoſe who wiſh for particular and accurate information on this ſubject, to THOMSON's excellent "Syſtem of Chemiſtry."

I. PLATINA GENUS.

FIRST SPECIES.

Native Platina.

Gediegen Platin.—*Werner.*

Platina aurum album, *Wall.* t. 2. p. 365.—Platine, *Romé de Lile*, t. 3. p. 487.—*Id. de Born*, t. 2. p. 479.—Platin, *Werner*, Pabſt. 1. b. ſ. 31.—*Id. Wid.* ſ. 661.—*Id. Kirw.* vol. ii. p. 109.—*Id. Emm.* 2. b. ſ. 106.—*Id. Lam.* t. 1. p. 96.—Le Platine natif, *Broch.* t. 2. p. 86.—Platine natif ferrifere, t. 3. p. 368.—Platin, *Reuſs*, 3. b. ſ. 234.

External Characters.

Colour very light ſteel-grey, which approaches to ſilver-white.

Occurs

Occurs in flat, ſmall and very ſmall grains, having pretty ſmooth ſurfaces; ſeldom in ſmall angular grains, with impreſſions of other minerals.

Externally ſhining and gliſtening, and its luſtre is metallic.

Fracture, on account of the ſmallneſs of the particles, cannot be determined. It is, however, probably hackly.

Streak more ſhining than the true luſtre.

Is intermediate between ſemihard and ſoft.

Completely malleable.

Common flexible.

Uncommonly heavy.

Specific gravity, 15.601. Purified, 20.980.

Chemical Characters.

Soluble in the nitro-muriatic acid. Infuſible, without addition, excepting in the focus of a burning-glaſs, or when expoſed to the action of flame urged by oxygen gas. It is the leaſt fuſible of the metals. It does not amalgamate with mercury.

Conſtituent Parts.

From the recent analyſes of crude platina by Dr Wollaſton and Mr Smithſon Tennant, we learn, that it is a much more compound body than was formerly ſuſpected, containing, beſides platina and iron, no leſs than four other metals, namely, Irridium, Oſmium, Rhodium and Palladium.

Geognoſtic

Geognoſtic Situation.

It has been hitherto found only in a ſecondary repoſitory, in ſand, in which it is accompanied with iron-ſand, gold grains, cryſtals of quartz, topaz and ſpinelle, and particles of ſilver amalgam and graphite *. According to Ulloa, it is found maſſive in veins; but this obſervation has not been confirmed by ſubſequent travellers.

Geographic Situation.

In South America, in the two gold mines of Novitia and Citaria, north from Choco in Popajan. It is ſaid alſo to have been found in the iſlands of St Domingo and Barbadoes.

Uſes.

Its property of remaining unaltered in the air, or when expoſed to high heats, of reſiſting the action of many ſalts, and of receiving a fine poliſh, have rendered this metal uſeful for various chemical and phyſical inſtruments, as pyrometers, crucibles, pendulums, reflecting teleſcopic mirrors, and for wheels in the conſtruction of watches. Reflecting mirrors made of glaſs, although they preſerve their luſtre and poliſh well, are inconvenient, becauſe they form a double image: mirrors made with metallic alloys, which were ſubſtituted in

* The gold is ſeparated from the platina, either by waſhing or by amalgamation. This accounts for the preſence of quickſilver in platina.

in their place, give but a ſingle image, but tarniſh on expoſure to the air: mirrors of platina poſſeſs the advantage of not tarniſhing, and they give but one image, and, owing to their great denſity, augment the reflecting power. Of all metals it expands the leaſt by heat, and follows the moſt regular courſe in its expanſion; hence it is admirably fitted for meaſures. The geometers *Delambre* and *Mechain*, in meaſuring the arc of the meridian contained between Dunkirk and Barcelona, uſed, in their operations, rods made of this metal. *Klaproth* has ſhown, that it may be uſed with great advantage in painting and ornamenting porcelain; and although when burnt in and burniſhed it has nearly the ſame colour as ſilver, yet it is not, like it, liable to be tarniſhed by ſulphureous effluvia, or to be affected by alterations of the atmoſphere. The platina uſed for thoſe purpoſes is repeatedly melted with arſenic; without its aid, we could only have obtained it in very ſmall maſſes, owing to the intenſe heat required for its fuſion, and the ſmall quantity fuſed.

Obſervations.

1. The name Platina is originally Spaniſh, and is the diminutive of *plata*, ſilver, probably on account of its reſemblance to it in colour, or owing to its occurring in ſmall grains.

2. It is diſtinguiſhed from ſilver by its colour, external ſhape, greater hardneſs, and ſpecific gravity.

3. It is chemically diſtinguiſhed from ſilver by

its

its infusibility without addition, and its insolubility in nitric acid.

4. In the cabinet of the Academy of Bergaria in Biscay, there is said to be a mass of platina, the size of a pigeon's egg. Humboldt has lately presented the King of Prussia with a mass which is still lager.

SECOND GENUS.

Gold Genus.

FIRST SPECIES.

Native Gold.

Gediegen Gold.—*Werner.*

Werner divides this species into three Subspecies: 1. Gold-yellow Native Gold. 2. Brass-yellow Native Gold. 3. Greyish-yellow Native Gold.

FIRST SUBSPECIES.

Gold-yellow Native Gold.

Gold-gelbes gediegen Gold.—*Werner.*

Id. Wern. Pabst. 1. b. s. 3. *Id. Emm.* 2. b. s. 111. *Id. Estner,* 3. b. s. 215. l'Or natif, jaune d'Or, *Broch.* t. 2. p. 89.—Gold-gelbes gediegen Gold, *Reuss,* 3. b. s. 246.

External Characters.

Colour perfect gold-yellow, which is more or less light or pale; in some varieties inclines a little to brass-yellow.

Occurs

Occurs ſeldom maſſive, often diſſeminated, in membranes, in roundiſh and flattiſh pieces, in grains which are large, coarſe, ſmall and fine, in leaves, filiform and reticulated; alſo cryſtallized in the following figures:

1. Cube.
2. Octahedron.
3. Simple three-ſided pyramid, with truncated angles.
4. Garnet dodecahedron.
5. Leuzite cryſtal, or the acute double eight-ſided pyramid, accuminated on both extremities by four planes, which are ſet on the alternate lateral edges.

The cryſtals are very ſmall and minute.

The ſurface of the cryſtals is uſually ſmooth, ſometimes alſo druſy and rough; of the leaves delicate druſy or ſmooth, and of the grains rough.

External luſtre of the cryſtals is ſplendent; that of the grains gliſtening.

Internally it is glimmering, paſſing into gliſtening, and its luſtre is metallic.

Fracture fine hackly.

Fragments indeterminately angular.

Very blunt-edged.

Streak ſhining.

Is ſoft.

Completely malleable.

Common flexible.

Uncommonly heavy.

Specific gravity of pure gold, 19.258 to 19.640.

Geognoſtic Situation.

It occurs in veins, in mineral beds, alſo diſſeminated in rocks, and in grains in alluvial land.

In primitive mountains it is found in gneiſs, mica-ſlate, and clay-ſlate, &c.; in Salzburg and the Tyrol, it occurs in mica-ſlate; in Upper Hungary in gneiſs; in clay-ſlate in Peru; in clay-porphyry in Tranſilvania *.

It occurs moſt commonly with quartz, and alſo very frequently with iron pyrites and grey antimony.

Its other accompanying minerals are quartz, calc-ſpar, felſpar, heavy ſpar, copper pyrites, red ſilver ore, brittle ſilver-glance, brown ironſtone, lead-glance, blende, and very ſeldom gyps.

In Bohemia it occurs along with quartz. At Schemnitz in Hungary, although now very rare, it uſed to be found filiform and in leaves, accompanied with ſilver-glance, and brittle ſilver-glance; ſometimes alſo diſſeminated in hornſtone. At Kremnitz it was formerly found in cellular quartz, and on cryſtallized quartz, greyiſh-white ſtraight lamellar heavy-ſpar, brittle ſilver-glance, and maſ-

five

* It has never been found in granite?

ſive fahl-ore. At Magurka, alſo in Hungary, it was found, accompanied with greyiſh-white quartz and grey antimony. In the mine Helena, at Oravicza in the Bannat, it is found dentiform and filiform, in pale fleſh-red and greeniſh-white limeſtone, with white cobalt-ore and copper-nickel; and at the mine St Nicolai, it occurs filiform in calcſpar, along with copper pyrites, and arſenic pyrites. Some time ago, it was found diſſeminated and filiform, with cryſtallized orpiment, in the Winceſlai Mine at Kapnik. The native gold of Sztaniſcha occurs filiform, and in leaves ſuperimpoſed on calcſpar and clay-porphyry; that from Bulkoy in ſandſtone with arſenic pyrites. The gold of Groſskirchheim in Carinthia occurs in maſſive and cryſtallized quartz, with tile ore, copper and iron pyrites, and other copper-ores. In Zillerthal in the Tyrol, both in the Auſtrian and Salzburgian parts, it occurs diſſeminated, filiform, in membranes, and alſo cryſtallized, and accompanied with maſſive and cryſtallized iron pyrites, in mica-ſlate. The Norwegian, at Eidſvold occurs in leaves, and cellular, accompanied with iron pyrites and brown iron ochre. At Mork in Liſle Herred, alſo in Norway, in quartz, accompanied with copper-green: And at Aardals copperwork, in membranes, on variegated copper-ore, and ſometimes cruſted over with compact malachite. The Siberian occurs ſometimes on iron ſhot quartz, with red lead-ore; ſometimes on brown

iron-

iron-ſtone, and in granular heavy-ſpar, or with horn-ore.

Geographic Situation.

Europe.—Cornwall in England; Leadhills in Scotland; County of Wicklow, in Ireland; Bohemia; Carinthia; the Tyrol; Lower Hungary; Upper Hungary; the Bannat; Tranſilvania; Saxony, at Johanngeorgenſtadt; France; Piedmont; Spain; Ruſſia; Sweden, at Ædelfors; Norway.

Aſia, in Siberia; China; Japan; iſland of Ceylon; Philippine iſlands; Maldive iſlands, and iſland of Sumatra.

America, in Mexico; Peru; Chili, and Brazil.

Africa, in Sofala; Mozambique; Monomotapa; Abyſſinia, and Æthiopia.

The ſand of many rivers is auriferous*. In *Europe,* are mentioned the Danube and Waga in Auſtria; Zazawa, Moldau and Iſer in Bohemia; the Aranyoſch, Szamoſch, Maroſch, and ſome rivers of the Hazegerthal in Tranſilvania; the Rhine, the Inn and Iſer in Bavaria; the Saale, the Seilla, in the circle of the Lower Rhine; the Eder in Heſſia; the Jugelbach, Peckhoferbach, and the Schwarzwaſſer in the Saxon Obererzgeberge; the Goltſch in

* The gold found in rivers uſually belongs to the gold-yellow ſubſpecies.

in Voigtland; the Rhone, Arriege, and many rivers in France.

Africa. In great quantity in many of the African rivers.

America. The rivers Matto Groſſo, and Minas Geræs in Brazil; and the river Tipohaus in Peru.

Obſervations.

1. It appears to poſſeſs all the cryſtallizations of the ſpinelle.

2. There are different formations of gold, and this ſubſpecies is by Werner conſidered to be the oldeſt.

SECOND SUBSPECIES.

Braſs-yellow Native Gold.

Meſſing-gelbes gediegen Gold.—*Werner.*

Id. Werner's Pabſt. 1. b. ſ. 5.—*Id. Emm.* 2. b. ſ. 113.—L'or natif d'un jaune de Laiton, *Broch.* t. 2. p. 91.—Meſſing-gelbes gediegen Gold, *Reuſs*, 3. b. ſ. 258.

External Characters.

Colour braſs-yellow, which is more or leſs light or pale, and ſometimes inclines to ſilver-white.

Occurs diſſeminated, rarely maſſive, capillary, moſs-like, reticulated, and in leaves; alſo cryſtallized in thin ſix-ſided tables, in which the terminal

terminal planes are ſet alternately oblique and ſtraight on the lateral planes *.

It is rather lighter than the preceding ſubſpecies, the remaining characters are the ſame.

Conſtituent Parts.

The Bohemian, according to *Lampadius*,

Gold,	96.9
Silver,	2.0
Iron,	1.1
	100

Geognoſtic Situation.

It occurs in veins in grey wacke, grey wacke ſlate, and tranſition limeſtone, and is accompanied with quartz, amethyſt, maſſive fahl-ore, and iron and copper pyrites. It occurs alſo in bituminous wood and black-coal.

Geographic Situation.

At Eula in Bohemia; in the Vöröſchpataker Mountains, and Offenbanya in Tranſilvania; in various places in Salzburg; in the mine called Louiſa Auguſta at Kongſberg in Norway.

Obſervation.

* Abbé *Eſtner* aſſerts, that he has ſeen braſs-yellow and greyiſh-yellow gold ores having all the regular external ſhapes of gold-yellow gold ore.

Observation.

When its colour becomes very light, it borders on goldiſh ſilver, and then it uſually occurs in calc-ſpar.

THIRD SUBSPECIES.

Greyiſh-yellow Native Gold.

Graugelbes gediegen Gold.—*Werner.*

Id. Emm., 2. b. ſ. 114.—L'Or natif d'un jaune griſatre, *Broch.* t. 2. p. 92.—Fahlgelbes gediegen Gold, *Reuſs*, 3. b. ſ. 260.

External Characters.

Colour braſs-yellow, which falls ſtrongly into ſteel-grey.

Occurs in very ſmall flattiſh grains, like platina.

Surface is gliſtening.

Is never cryſtallized.

It is heavier than braſs-yellow native gold, but lighter than gold-yellow native gold.

In other characters it does not differ from the preceding.

Geognoſtic Situation.

It occurs along with platina.

Obſervation.

Chemical Characters of Gold.

It is ſoluble in nitro-muriatic acid, and is precipitated from its ſolution by a ſolution of ſulphat of iron.

Uſe.

The uſes of it are numerous and important; but we cannot at preſent enter into the detail of them, becauſe it is intended for the part of this work which treats of economical mineralogy. But, for almoſt every purpoſe, it is mixed with a quantity of copper, which is uſually about $\frac{1}{24}$, and never exceeds $\frac{3}{4}$, which gives the gold a conſiſtence and a hardneſs which it does not poſſeſs when pure.

Obſervations.

1. Iron-pyrites, containing an accidental mixture of gold, has been, by ſome mineralogiſts, deſcribed as an ore of gold. To this diſtinction, however, it has no claim. The richeſt goldiſh or auriferous pyrites is found at Facebay in Tranſilvania, and which contains 0,02 to 0,03 of gold. Auriferous pyrites occurs alſo at Adelfors and Smoland in Sweden; in the Bereſowſkiſchen Mine in Siberia; in the Vallais and the Griſons in Switzerland; in Dauphiny, and Mexico.

2. It is diſtinguiſhed from copper and iron pyrites, by its colour, ſpecific gravity and malleability.

3. Although,

3. Although, in comparison with iron, it occurs in very small quantities, yet it is nearly equally widely distributed in nature.

4. Helms relates, that near La Paz in Peru, about eighty years ago, an overhanging cliff fell down, in the fragments of which, masses of gold, from two to fifty pounds weight, were found.

5. The subspecies of gold differ from each other, not only in their external characters, but also in their chemical composition.

The first subspecies is pure; the second contains a little silver, probably also a minute portion of copper and iron, and the third is probably a mixture of gold and platina.

THIRD GENUS.

MERCURY GENUS.

FIRST SPECIES.

Native Mercury, or Quicksilver.

Gediegen Queckſilber.—*Werner.*

Mercurius virgineus, Hydrargyrum nativum, *Wall.* t. 2. p. 148. —Mercure natif, *Rom. de L.* t. 3. p. 152.—Gediegen Queckſilber, *Wid.* ſ. 719.—*Id. Wern.* Pabſt. 1. b. ſ. 6.—Native Mercury, *Kirw.* vol. ii. p. 223.—Gediegen Queckſilber, *Emm.* 2. b. ſ. 129. — Mercure natif, *Lam.* t. 1. p. 166. — *Id. Broch.* t. 2. p. 96.—*Id. Hauy*, t. 3. p. 423.—Gediegen Queckſilber, *Reuſs*, 3. b. ſ. 269.

External Characters.

Colour perfect tin-white.

Occurs perfectly fluid; and in larger or ſmaller parties or globules in the cavities of other ores of mercury.

Is ſplendent, and its luſtre is metallic.

It does not wet the finger.

Feels very cold.

Is uncommonly heavy.

Specific gravity, 13.581. *Hauy.*

Conſtituent Parts.

According to Klaproth, it contains no intermixture of any other metal.

Chemical Character.

Before the blow-pipe, it is volatilized, without giving any ſmell.

Geognoſtic Situation.

It occurs uſually with cinnabar, and, as already mentioned, in globules or parties. The globules are ſometimes at their ſurface, combined with ſulphur, thus paſſing to the ſtate of cinnabar. Sometimes the mercury is combined with a little ſilver, then it becomes more coherent, and forms the tranſition to the following ſpecies.

At Idria, it occurs in a compact limeſtone, which is much traverſed by veins of calc-ſpar; alſo in ſandſtone, which contains diſſeminated iron pyrites and maſſive and cryſtallized cinnabar; at Allemont it occurs with natural amalgam and cinnabar, in calc-ſpar.

Geographic Situation.

It is found at Friaul in Idria; Niederſlana in Upper Hungary; Delach in Carinthia; Morsfeld and Wolfſtein, in the Palatinate; Potſberg and Stahlberg, in Deux-Ponts; Schwarzleogang, Sulfenberg near Brixen, in the valley of Brixen; Allemont in Dauphiny; Almadin in Mancha, and Xea d'Albararie in Arragon, in Spain; Guanca-Velica in Peru, in South America.

Uſes.

To this metal we owe our knowledge of many of the moſt important and univerſal natural phenomena. By the barometer it enables us to meaſure the denſity of the atmoſphere; by the thermometer, to meaſure its temperature; and in chemical experiments, it affords the only ſure and infallible means of collecting gaſes abſorbable in water,—a property which has enabled chemiſts to make many brilliant and important diſcoveries.

Its property of amalgamating, enables us, at far leſs expence than by the uſual metallurgic operations,

tions, to extract minute portions of gold and filver from poor ores. Without the procefs of amalgamation, the important filver-mines of Saxony, from want of fuel, would in all probability have been long fince abandoned. When amalgamated with tin, and laid on glafs, it forms mirrors. Amalgams of gold and filver are employed for plating other metals: they are eafily applied, and the mercury is volatilized by application of heat. Its oxides act as very powerful medicines.

Obfervations.

1. The greater part of the mercury of commerce is obtained by diftilling native cinnabar, not from native mercury, which occurs but in fmall quantity.

2. When rendered folid by artificial freezing mixtures, it is found to be malleable, and to cryftallize in octahedrons.

3. Probably the fracture of frozen mercury is hackly?

SECOND SPECIES.

Natural Amalgam.

Natürliches Amalgam.—*Werner.*

Amalgame natif d'Argent, *Rom. de L.* t. 3. p. 162.—Natürliches Amalgam, *Werner*, Pabft. 1. b. f. 7.—*Id. Wid.* f. 722.—

Natural

Natural Amalgama, *Kirw.* vol. ii. p. 223.—Naturliches Amalgam, *Emm.* 2. b. ſ. 134.—Amalgame natif d'Argent, *Lam.* t. 1. p. 120.—*Id. Broch.* t. 2. p. 99.—Mercure argenteal, *Hauy*, t. 3. p. 432.—Amalgam, *Reuſs*, 3. b. ſ. 273.

THIS ſpecies is divided into two ſubſpecies. 1. Fluid or ſemifluid amalgam. 2. Solid amalgam.

FIRST SUBSPECIES.

Fluid or ſemifluid Amalgam.

Flüſſiges oder halbflüſſiges Amalgam.—*Werner.*

External Characters.

Colour intermediate between tin-white and ſilver-white, according as it contains more or leſs ſilver, but uſually inclines more to the firſt.

Occurs in ſmall maſſive pieces, and in balls; ſometimes alſo in membranes, and diſſeminated; alſo cryſtallized as follows:

1. Octahedron, more or leſs deeply truncated on the edges. When the truncating planes become ſo large, that the original planes diſappear,
2. Garnet dodecahedron is formed. The edges of this figure are alſo frequently truncated; and often ſo deeply, that it paſſes into the
3. Leuzite cryſtal, or the double eight-ſided pyramid, flatly acuminated on both extremi-

ties

ties by four planes, which are ſet on the alternate lateral edges.

Cryſtals ſmall and very ſmall; uſually imbedded; ſometimes alſo two or three adhering together.

Externally ſhining and ſplendent, with a metallic luſtre.

Has probably a conchoidal fracture.

Fragments indeterminately angular, pretty blunt-edged.

Soft, and partly ſomewhat fluid.

Not particularly brittle.

When it is preſſed between the fingers, or cut with a knife, it emits a creaking ſound like artificial amalgam.

Uncommonly heavy.

SECOND SUBSPECIES.

Solid Amalgam.

Feſtes Amalgam.—*Werner.*

Colour ſilver-white, which in ſome varieties falls into reddiſh white.

Occurs maſſive and diſſeminated.

Is ſhining, approaching to gliſtening.

Fracture is imperfect flat conchoidal, ſometimes paſſing into fine-grained uneven.

Fragments

Fragments indeterminately angular.
Semihard.
Brittle.
Creaks ſtrongly when cut.
Uncommonly heavy.

Chemical Characters.

Expoſed to the fire, the mercury volatilizes, and we obtain a ſmall button of ſilver.

Conſtituent Parts.

According to

Heyer	*and*	*Klaproth.*
Quickſilver,	74	64
Silver,	25	36
	99	100

Geognoſtic Situation.

It is uſually accompanied with native mercury and cinnabar; it alſo occurs along with native ſilver, and iron-pyrites.

Geographic Situation.

It is found at Roſenau and Niederſlana in Hungary; Morsfeld in the Palatinate; Moſchellandſberg and Stahlberg in Deux Ponts; Eraſmus Mine, and Vogelhalte in Leogang in Salzburg; and Sahlberg in Sweden.

Obſervations.

Obſervations.

1. It is diſtinguiſhed from native ſilver, by colour, fracture, tenacity, ſpecific gravity and ſound.

2. Native ſilver when rubbed on copper does not whiten it as amalgam does.

THIRD SPECIES.

Mercurial Horn-Ore, or Corneoûs Mercury.

Queckſilber Hornerz.—*Werner.*

Mercure corné, ou Mercure doux volatile, *Rom. d. L.* t. 3. p. 161.—Queckſilber-hornerz, *Wern.* Pab. 1. b. ſ. 7.—*Id. Wid.* ſ. 724.—Mercury mineralized by the vitriolic and marine Acids, *Kirw.* t. 2. p. 266.—Queckſilber-hornerz, *Eſtner*, 3. b. ſ. 275.—*Id. Emm.* 2. b. ſ. 136.—Mercure corné, *D. Born.* t. 2. p. 399.—*Id. Lam.* t. 1. p. 168.—La Mine d'Mercure cornée, ou le Mercure muriaté, *Broch.* t. 2. p. 101.—Mercure muriaté, t. 3. p. 447.—Queckſilber-hornerz, *Reuſs*, 3. b. ſ. 277.

External Characters.

Colour aſh-grey, of various degrees of intenſity, which paſſes into yellowiſh-grey, and from this into greyiſh-white, and even ſometimes inclines to greeniſh-grey.

Occurs very rarely maſſive, almoſt always in ſmall veſicles, which are cryſtallized in the interior.

The

The cryſtals are,

1. Rectangular four-ſided priſm, acuminated by four planes, which are ſet on the lateral edges.
2. Rectangular four-ſided priſm, acuminated by four planes, which are ſet on the lateral planes?
3. Six-ſided priſm bevelled at both extremities, the bevelling planes ſet on the two largeſt oppoſite lateral planes?
4. Octahedron, having its ſummits and edges truncated?

The three laſt-mentioned figures are mentioned by Brochant, Eſtner, &c.; but their exiſtence is ſtill doubtful.

Cryſtals are minute, which renders it difficult to determine their figure. They are externally ſometimes ſmooth, ſometimes druſy, and in general ſplendent.

Internally ſplendent, with a diſtinct adamantine luſtre.

Fracture ſtraight foliated, as far as can be obſerved, and alſo fine and ſmall grained uneven.

Sometimes it preſents fine granular diſtinct concretions.

Faintly tranſlucent, and weakly tranſlucent on the edges.

It does not change its colour in the ſtreak.

Soft, approaching to very ſoft.

Sectile, can be cut with a knife.
Easily frangible.
Appears to be heavy.

Chemical Characters.

It is volatilized before the blow-pipe, and emits a garlic smell. It is soluble in water, and the solution mixed with lime-water gives an orange-coloured precipitate.

Constituent Parts.

Mercury,	70
Sulphuric and muriatic acids,	30
	100 *Kirwan.*

Geognostic Situation.

In the quicksilver mines of the Palatinate and Dutchy of Deux Ponts, it is accompanied with native mercury, cinnabar, ochrey brown ironstone, seldomer with fibrous malachite, massive and crystallized copper-azure, massive fahl-ore, in cavities of an iron-shot clayey sandstone, sometimes in clay ironstone, and red ironstone. That at Idria, occurs in cavities of an indurated clay, accompanied with crystals of cinnabar; sometimes in slate-clay, which is traversed with small veins of cinnabar.

Geographic Situation.

Horzowitz, in Bohemia; Moschellandsberg, in Deux Ponts; Morsfeld, in the Palatinate; Rutha

in

in Upper Heſſia; and the mine of Entredicho in Spain.

Obſervation.

It was diſcovered about twenty-five years ago in the mines of the Palatinate by Mr Woulfe.

FOURTH SPECIES.

Mercurial Liver-Ore, or Mercurial Hepatic-Ore.

Queckſilber Lebererz.—*Werner.*

This ſpecies contains two ſubſpecies: 1. Compact: 2. Slaty.

FIRST SUBSPECIES.

Compact Mercurial Liver-Ore.

Dichtes Queckſilber Lebererz.—*Werner.*

Id. Werner, Pabſt. 1. b. ſ. 8.—Compact hepatic mercurial Ore, *Kirw.* vol. ii. p. 224.—Dichtes Queckſilber Lebererz, *Eſtner,* 3. b. ſ. 281.—*Id. Emm.* 2. b. ſ. 140.—Mine de Mercure hepatique, *Broch.* t. 2. p. 104.—Dichtes Lebererz, *Reuſs,* 3. b. ſ. 282.

External Characters.

Colour intermediate between dark cochineal red and dark lead-grey.

Occurs

Occurs maſſive.

Internally gliſtening and glimmering, and its luſtre is ſemimetallic.

Fracture even; rarely approaches fine-grained uneven; ſometimes paſſes into imperfect flat conchoidal.

Fragments indeterminately angular, not particularly ſharp-edged.

Streak ſhining, and of a cochineal red colour.

Opaque.

Soft.

Sectile.

Eaſily frangible.

Uncommonly heavy.

Specific gravity, 7·937 *Gellert.*

7·186 to 7·352. *Kirwan.*

Geognoſtic and Geographic Situations.

It is the moſt common ore of mercury at Friaul in Idria. It occurs there in large maſſive pieces.

Obſervation.

By much handling it loſes its colour, and becomes black and ſhining.

SECOND

SECOND SUBSPECIES.

Slaty Mercurial Liver-Ore.

Schiefriges Queckſilber Lebererz.—*Werner.*

External Characters.

Its colour is nearly the ſame with the preceding ſubſpecies, only rather a little redder.

Occurs maſſive.

Principal fracture ſhining, croſs-fracture glimmering, and both have a ſemimetallic luſtre.

Principal fracture curved and thick ſlaty; croſs-fracture even.

Fragments ſlaty.

Uncommonly eaſily frangible.

In other characters, it agrees with the preceding ſubſpecies.

Conſtituent Parts.

Both ſubſpecies are ſaid to be mineralized with ſulphur, and to contain more mercury and leſs ſulphur than cinnabar. It is ſaid alſo to be combined with a portion of iron and clay. Some varieties are ſaid to contain from 70 to 80 *per cent.* of mercury.

Geognoſtic Situation.

It occurs along with cinnabar, and ſometimes iron

iron and liver pyrites, and probably in the coal formation.

Geographic Situation.

Friaul in Idria; Almadin, in Spain; Nertſchinſik in Siberia; and it is ſaid alſo to have been found in the Dutchy of Deux Ponts.

Obſervations.

1. Along with this ſpecies, there occurs in Siberia and Idria two foſſils, which deſerve to be noticed.

a. Is a variety of *coarſe coal*, having a reddiſh colour, and which contains in the hundredweight from a few pounds to twenty pounds of mercury. It is there conſidered as a variety of mercurial horn-ore, and is called *Branderz*.

b. The ſecond foſſil is a variety of *bituminous ſhale*, which has diſſeminated through it numerous balls of the before-mentioned coarſe coal, and is called *Corallenerz*. It alſo contains a conſiderable portion of mercurial horn-ore.

2. Its name appears to be derived from its colour, which has conſiderable reſemblance to that of the liver.

FIFTH

FIFTH SPECIES.

Cinnabar.

Zinnober.

Of this ſpecies, there are two ſubſpecies. 1. Dark red Cinnabar. 2. Bright red Cinnabar.

FIRST SUBSPECIES.

Dark-red Cinnabar.

Dunkel-rother Zinnober.—*Werner.*

Id. Werner, Pabſt. 1. b. ſ. 8.—*Id. Wid.* ſ. 728.—Dark red Cinnabar, *Kirw.* v. ii. p. 228.—Dunkelrother Zinnober, *Eſtner*, 3. b. ſ. 290.—*Id. Emm.* 2. b. ſ. 144.—Le Cinnabre d'un rouge fonce, ou le Cinnabre commun, *Broch.* t. 2. p. 107.—Mercure ſulphuré, *Hauy*, t. 3. p. 437.—Dunkel-rother Zinnober, *Reuſs*, 3. b. ſ. 287.

External Characters.

Its principal colour is perfect cochineal red, which in ſome varieties falls ſtrongly into lead-grey; in others paſſes into carmine red.

Beſides maſſive, diſſeminated, in blunt-cornered pieces, in membranes, amorphous, dendritic, and fruticoſe, it occurs alſo cryſtallized. Its cryſtallizations are the following:

1. Rather

1. Rather obtuſe rhomb, truncated on the two diagonally oppoſite obtuſe angles.
2. Six-ſided table, which is formed by the increaſe of the truncating planes of the preceding figure.
3. Regular ſix-ſided priſm, either perfect, or acuminated by three priſms, which are ſet on the alternate lateral planes.
4. Three-ſided pyramid, either double or ſingle, and in which the angles are ſometimes more or leſs deeply truncated.
5. Octahedron, or double four-ſided pyramid, which ſometimes terminates in a line. It is formed from the ſingle three-ſided pyramid, by the truncating planes of the angles increaſing till they meet.

The cryſtals are ſmall, and very ſmall; occur in druſes, on one another, ſide by ſide, and promiſcuous.

Externally the cryſtals are ſplendent.

Internally it is ſhining, which, according to the differences in the fracture, paſſes into gliſtening, and ſometimes into glimmering, with an adamantine, verging on ſemimetallic luſtre.

Fracture ſometimes fine-grained uneven, ſometimes even and conchoidal. It occurs alſo more or leſs perfect foliated, with a twofold obliquely interſecting cleavage *.

Fragments

* The foliated varieties have the ſtrongeſt luſtre.

Fragments indeterminately angular, blunt-edged.

The foliated varieties preſent ſmall and fine, ſeldom coarſe granular diſtinct concretions; the fine granular paſſes into even and conchoidal. One variety appears to paſs into ſlaty.

The maſſive is opaque, or tranſlucent on the edges; the cryſtals are tranſlucent, ſometimes ſemitranſparent, and even verging on tranſparent.

Yields a ſcarlet-red ſhining ſtreak.

Is very ſoft, paſſing into ſoft.

Sectile.

Eaſily frangible.

Uncommonly heavy.

Specific gravity, from Deux Ponts, according to *Kirwan*, 7.786; from Almadin, according to *Briſſon*, 6.9022; cryſtallized, from the ſame place, alſo by *Briſſon*, 10.2185.

Conſtituent Parts.

From Deux Ponts.

Mercury,	81.
Sulphur,	15.2
Iron,	4.7

Lampadius.

Chemical Characters.

Before the blow-pipe, it is completely volatilized; giving a blue flame, and a ſmoke which has the odour of ſulphur.

For Geognoſtic and Geographic Situations, ſee the following ſubſpecies.

SECOND SUBSPECIES.

Bright Red Cinnabar.

Hochrother Zinnober.

Id. Wern. Pabſt. 1. b. ſ. 11.—*Id. Wid.* ſ. 727.—*Id. Eſtner*, 3. b. ſ. 297.—*Id. Emm.* 2. b. ſ. 146.—Le Cinnabre d'un rouge vif, ou le Cinnabre fibreux, *Broch.* t. 2. p. 111.—Mercure ſulphuré *rouge* vif, *Hauy*, t. 3. p. 440.—Lichtrother Zinnober, *Reuſs*, 3. b. ſ. 293.

External Characters.

Colour bright ſcarlet-red.

Occurs maſſive and diſſeminated.

Internally glimmering; croſs-fracture dull.

Fracture intermediate between earthy and fibrous; croſs-fracture earthy.

Fragments indeterminately angular, blunt-edged.

It is opaque.

Streak ſhining.

Soils.

Is very ſoft, paſſing into friable.

Sectile.

Very eaſily frangible.

Heavy, inclining to uncommonly heavy.

Geognoſtic Situation.

Werner has aſcertained two formations of this ſpecies: *The firſt* occurs in beds in primitive mountains, in rocks of clay-ſlate, talc-ſlate, and chlorite-ſlate, and is accompanied with quartz, calc-ſpar, ſparry ironſtone, and a little iron pyrites, copper pyrites, iron-glance, and iron-mica. *The ſecond*, which is the moſt extenſive and frequent, occurs in the independent coal formation.

Geographic Situation.

Dark Red Cinnabar.

The dark red occurs at Horſowitz in Bohemia, accompanied with red ironſtone, ſparry ironſtone, iron-pyrites, compact and ochrey brown ironſtone, yellow blende, and ſtraight lamellar heavy ſpar; at Friaul in Idria, in the independent coal formation; Roſenau in Upper Hungary, in clay-ſlate, chlorite-ſlate, and talc-ſlate; Schemnitz, and Kremnitz in Lower Hungary; Dombrawa, Ampoya, Baboya near Zalathna in Tranſilvania; Carinthia; Leogang and Salfenberg in Salzburg; Wolfſtein and Morsfeld in the Palatinate; Moſchellandſberg, Stahlberg, and Waldgreweiler in Deux Ponts; Naſſau; Darmſtadt; Upper Palatinate; Hartenſtein in Saxony; Silvena in Tuſcany; St Arei, and the canton of Lamure in France; Almadin in Spain, in the independent coal

coal formation; alſo at Almadeneyos, Quadalperal, las Cuebas, &c. in Spain.

Aſia.—Nertſchinſk in Siberia; on the peninſula of Taigonos, at the mouth of the ſtream Topoleſka in Kamtſchatka; and in Japan.

America.—Near the city of Guancavelica in Peru.

Bright Red Cinnabar.

The bright red cinnabar is found along with ochrey, compact and fibrous brown ironſtone, and dark red cinnabar; does not occur ſo abundantly as the dark red, and is found principally in the mercury mines of the Palatinate. It is ſaid alſo to be found at Schemnitz in Lower Hungary; Friaul in Idria; Carniola; Almaden in Spain; Leogang, in Salzburg; and the Brunnalpe in the valley of Brixen.

Mercury belongs to the rarer metals. There are many countries where it does not occur, as Norway, Sweden, Great Britain and Ireland. In Ruſſia it exiſts in but ſmall quantity. It is found in conſiderable quantity in Germany; but the moſt important mercury mines are thoſe of Almadin in Spain, which have been worked upwards of two thouſand years.

Uſe.

It is the ore from which the greateſt quantity of the mercury of commerce is obtained. It is alſo uſed by the painter as a pigment; but artificial cinnabar, on account of the purity and bright-

neſs

neſs of its colour, is preferred. It is alſo uſed for tinting wax of a red colour.

Obſervations.

Eſtner mentions a mineral which he calls Stink-zinnober; and other mineralogiſts give accounts of a Mineral Æthiops and a Red Oxide of Mercury: but all theſe are too imperfectly deſcribed to be admitted into a ſyſtem of oryctognoſy; therefore they are not acknowledged by Werner.

FOURTH GENUS.

SILVER GENUS.

FIRST SPECIES.

Native Silver.

Gediegen Silber.—*Werner.*

This ſpecies is divided into two ſubſpecies: 1. Common Native Silver. 2. Goldiſh or Auriferous Native Silver.

FIRST SUBSPECIES.

Common Native Silver.

Gemeines gediegen Silber.—*Werner.*

Id. Wern. Pabſt. 1. b. ſ. 12.—*Id. Eſtner.* 3. b. ſ. 319.—*Id. Emm.* 2. b. ſ. 156.—L'Argent natif ordinaire, *Broch.* t. 2. p. 116. —Argent natif, *Hauy*, t. 3. p. 384. —Gediegen Silber, *Reuſs*, 3. b. ſ. 310.

External

External Characters.

Colour pure ſilver-white; but its ſurface, by expoſure to the air, by which it abſorbs ſulphur, becomes yellowiſh-brown; ſometimes alſo greyiſh-black.

Occurs maſſive, diſſeminated, in blunt-cornered pieces, in plates, and in membranes: it is ſaid alſo to occur in Spaniſh America, in rolled pieces*. Beſides theſe, it preſents the following particular and regular external ſhapes; dentiform, filiform, reticulated, in leaves, capillary, which latter, when it is very much entangled, paſſes into compact. The cryſtallizations are the following:

1. Cube.
2. Octahedron.
3. Rectangular four-ſided priſm.
4. Double ſix-ſided pyramid, whoſe extremities are truncated.
5. Double three-ſided pyramid, whoſe angles are truncated.
6. Hollow four-ſided pyramid.

Its octahedrons are often obliquely aggregated in rows; its cubes often rectangularly aggregated, ſo as to form the reticulated external ſhape; and the pyramids are obliquely aggregated, and form the dendritic external ſhape.

Cryſtals

* In the Imperial Cabinet of minerals at Vienna, there is a rolled piece of native ſilver from Spaniſh America, which weighs upwards of 36 pounds.

Cryſtals are ſmall, very ſmall and microſcopic.

Surface of the cryſtals is ſmooth; that of the particular ſhapes longitudinally ſtreaked; that of the external ſhape in leaves is ſometimes druſy, ſometimes ſtreaked.

The ſurface varies from ſplendent to glimmering, according to the kind of ſurface; that of the cryſtals being ſplendent and ſhining; of the particular and common external ſhapes, gliſtening and glimmering, with a metallic luſtre.

Fracture fine hackly.

Fragments indeterminately angular, blunt-edged.

Streak is ſplendent with metallic luſtre.

Soft.

Perfectly malleable.

Common flexible.

Uncommonly heavy.

Specific gravity, 10.000 *Gellert.*
10.333 *Selb.*

But it varies conſiderably according to its intermixture with other ſubſtances.

Chemical Characters.

Is ſoluble in nitric acid at the common temperature of the atmoſphere, but the ſulphuric acid does not act on it until heated. It is precipitated from its ſolution in nitric acid by muriatic acid; and the precipitate, which is *luna cornea*, is inſoluble in water: if a plate of copper be immerſed in a ſolution of nitrat of ſilver, the ſilver

is

is depoſited, in its metallic ſtate, on the ſurface of the copper.

Geognoſtic Situation.

It appears to be peculiar to the newer primitive rocks, where it occurs in veins, and is uſually accompanied with heavy-ſpar, and quartz. It occurs alſo in floetz rocks. The dentiform, filiform, and capillary, appear to belong to an older formation than the dendritic. It occurs accompanied with a conſiderable variety of minerals, as appears from the following account.

The native ſilver of Mexico occurs in a fine-grained quartz, which is ſometimes mixed with heavy-ſpar and calc-ſpar, and is accompanied with yellow blende, cobalt-cruſt, ſilver-glance, corneous ſilver-ore, and copper-green.

The native ſilver of Peru, according to Helms, is accompanied with a conſiderable variety of minerals. The following inſtances are from his *Tagebuch einer Reiſe durch Peru.* In the mining diſtrict of Guantajaya in the province of Arica, it is found ſometimes in brown-ſpar, ſometimes in quartz, with ſilver-glance, corneous ſilver-ore, ſparry ironſtone, and arſenical pyrites; at Iauricocha, two German miles from Paſco, in the province of Tarma, it is found diſſeminated in brown ironſtone; in the *Subdelegatio Guanta*, in the province of Guamanga, in calc-ſpar, with ſilver-glance, lead-glance, arſenical pyrites, radiated iron-pyrites, yellow

yellow blende, red manganeſe-ore, quartz, and fluor-ſpar; in the mining diſtrict of Chanca in calc-ſpar, with ſilver-glance, red ſilver-ore, and iron-pyrites. In the province of Potoſi, in the kingdom of Plata, it occurs in iron-ſhot quartz, with corneous ſilver-ore and earthy copper-azure.

The native ſilver of Kongſberg in Norway, is found principally in veins that traverſe beds of hornblende-ſlate, which lie in mica-ſlate. It is there accompanied with calc-ſpar, fluor-ſpar, ſilver-glance, blende, copper and iron pyrites, lead-glance, cobalt-cruſt, cobalt-glance, white and grey cobalt-ores and copper-green.

In Greenland, it is ſaid to occur diſſeminated in compact magnetic ironſtone.

The native ſilver of Freyberg, in the electorate of Saxony, is found in heavy-ſpar and brown-ſpar, accompanied with ſilver-glance, copper-nickel, blende, iron-pyrites and native arſenic, in veins that traverſe gneiſs; at Johanngeorgenſtadt, in the ſame country, it occurs with blende, lead-glance, reticulated cobalt-glance, cobalt-cruſt and liver-pyrites, in jaſper, agate, flint, &c. in veins that traverſe mica-ſlate.

The native ſilver of Chalanches in Dauphiny is accompanied with earthy cobalt-ochre, cobalt-cruſt and nickel-ochre.

The Bohemian native ſilver occurs in brown ſpar, quartz which is ſometimes mixed with calc-

ſpar, in maſſive and cryſtallized amethyſt, and is accompanied with liver, radiated and common iron-pyrites, lead-glance, blende, cobalt, ſilver-glance, nickel and nickel-ochre, ſparry ironſtone, &c.

The *ſaalband*, or rock which forms the walls of the veins, is often impregnated with native ſilver: of this we have ſtriking examples at Johanngeorgenſtadt, Kongſberg, Schlangenberg in Siberia, and Joachimſthal in Bohemia.

Geographic Situation.

Europe.—It is found in different places in Bohemia; at Trieſch in Moravia; Annaberg in Lower Auſtria; Schemnitz in Lower Hungary; Nagybanya in Upper Hungary; at Kapnic, &c. in Tranſilvania; Saſka, in the Bannat; many places in the metalliferous mountains of the electorate of Saxony; Naſſau; Stahlberg and Saalberg, in Deux Ponts; Suabia; Rudelſtadt in Sileſia; Vogelhalt in Schwarzleogang, in Salzburg; Andreaſberg in the Harz; in Alſace, and the mountains of Dauphiny in France; at Hur-gorland in Cornwall, and, it is ſaid, formerly in the iſland of Iſla, one of the Hebrides; Kongſberg in Norway.

Aſia.—Kolywan and Nertſchinſkoi, in Siberia; and iſland of Java.

America.—In Mexico, Peru, La Plata and Chili.

In ſome of the above-mentioned places, ſilver has

has been found in conſiderable maſſes. Thus we are told, that in the year 1750, there was found in the famous mine of Himmelsfürſt, near Freyberg in Saxony, a maſs of native ſilver, which weighed one hundredweight and a quarter: in 1771, an equally large maſs was found. It is alſo mentioned by Albini, in his "Meiſſniſche Berg-chronicke," p. 30. that at Schneeberg, in 1478, a rich ſilver vein was diſcovered, and ſo large a block of native ſilver and ore cut out, that Duke Albert of Saxony deſcended into the mine, and uſed this huge block, which ſmelted four hundred centners of ſilver, (centner is 110 pounds,) as a table to dine on.

The greateſt quantity of ſilver which is found in Europe, is raiſed from the mines of the electorate of Saxony, thoſe at Joachimſthal in Bohemia, and the Biack Foreſt (Schwarzwald) in Suabia. The mines of Kongſberg, which formerly delivered a conſiderable quantity of ſilver, are now become ſo poor, that they have been lately abandoned.

Spain formerly furniſhed very great quantities of ſilver. The Carthaginians having ſucceeded to the Phenicians in the principal maritime commerce of the world, immenſe riches flowed into their country. One of the principal ſources of their opulence, was the celebrated ſilver-mines which they poſſeſſed in Spain. The moſt conſiderable were thoſe near Carthagena. Theſe were

of

of argentiferous or filverifh lead-glance. We are told, that one of them afforded to Annibal a daily return of 300 pounds weight of filver; which was a moft prodigious fum, particularly in thofe times, when the precious metals, from their fcarcity, were fo highly valued. It was from this fource that the Carthaginians drew thofe treafures, which enabled them to fupport the famous Punic wars.

In Afia it has been hitherto found only in fmall quantity.

The greateft quantity is raifed from the mines of Mexico and Peru, and, notwithftanding the moft wretched fyftem of mining, their produce has not been fenfibly diminifhed. Gold and filver appear to be as plentiful in the wonderful regions of Peru and Mexico, as iron in other countries.

Ufe.

Its ufes in coinage, and in numerous other ufeful and ornamental works, are well known. Certain preparations of it are alfo ufed in medicine.

Obfervations.

Native filver is diftinguifhed from antimonial filver and native antimony, by fracture and tenacity; it has a hackly fracture, and is completely malleable, but they have a foliated fracture, and are brittle.

SECOND

SECOND SUBSPECIES.

Goldiſh or Auriferous Native Silver.

Guldiſches gediegen Silber.

Id. Werner, Pabſt. 1. b. ſ. 12.—*Id. Eſtner*, 3. b. ſ. 315.—*Id. Emm.* b. 2. ſ. 154.—L'Argent natif aurifere, *Broch.* t. 2. p. 114.—Guldiſch Silber, *Reuſs*, 3. b. ſ. 322.

External Characters.

Colour is intermediate between ſilver-white and braſs-yellow.

Occurs diſſeminated, in membranes, which are pretty thick, paſſing into plates; capillary, and in leaves.

Its ſpecific gravity, on account of the quantity of gold which it contains, is greater than that of common native ſilver.

In other characters, it agrees with the preceding ſubſpecies.

Conſtituent Parts.

It is an alloy of ſilver and gold, which latter is often in very conſiderable quantity.

Geognoſtic and Geographic Situations.

It is found at Kongſberg in Norway; Schlangenberg in Siberia. It is ſaid alſo to occur in Salzburg.

That

That of Kongſberg is found, in general, in maſſive calc-ſpar, with rock-cryſtal, fluor-ſpar, lead-glance, blende, copper-pyrites and iron-pyrites in veins, that traverſe hornblende-ſlate.

That found at Schlangenberg occurs ſometimes on granular heavy-ſpar, with membranous ſilver or copper-glance, and copper-pyrites, ſometimes on aſh grey-coloured ſplintery quartz.

Obſervations.

1. This ſubſpecies is very rare.

2. We have an uninterrupted tranſition from common native ſilver to native gold; and in this tranſition ſeries, the goldiſh ſilver holds the middle place.

SECOND SPECIES.

Antimonial Silver.

Spiseglas Silber.—*Werner.*

Mine d'Argent blanche antimoniale, *Rom. d. L.* t. 1. p. 460.—Antimonialiſch gediegen Silber, *Wid.* ſ. 684.—Antimoniated native Silver, *Kirw.* v. ii. p. 110.—Spies-glance Silber, *Eſtner*, 3. b. ſ. 337.—*Id. Emm.* 2. b. ſ. 162.—Argent antimonial, *Broch.* t. 2 p. 119.—*Id. Hauy*, t. 3. p. 391.—Spies-glance Silber, *Reuſs.* 3. b. ſ. 325.

External

External Characters.

Colour is intermediate between silver-white and tin-white; sometimes inclining more to the one, sometimes more to the other, yet in general more to the first.

Occurs massive, disseminated, and crystallized. Its crystallizations are,

1. Rather oblique four-sided prism.
2. Perfect six-sided prism; sometimes truncated on all the edges; so that it assumes a round-ish aspect.
3. Six-sided table.
4. Cube, which is rarely perfect, usually truncated on one or more of its angles.
5. Very acute six-sided pyramid.

Surface of the prisms is usually longitudinally streaked; the surface of the other figures is smooth.

Externally glistening, sometimes only glimmering.

Internally shining and splendent, with a metallic lustre.

Fracture perfect foliated, but the number and direction of the cleavages hitherto unascertained.

Occurs in coarse, small and fine granular distinct concretions.

Sectile.

Not particularly difficultly frangible.

Soft.

Soft.

Uncommonly heavy.

Specific gravity, 9.4406, *Hauy*.—10,000, *Selb*.

Chemical Characters.

Heated on charcoal before the blow-pipe, the antimony is volatilized with the odour which is peculiar to it, and there remains a mafs of filver, furrounded with a brown flag, which colours borax green.

Conftituent Parts.

Silver,	89	78		75.25
Antimony,	11	22		24.75
According to *Selb*.	100	100	*Vauquelin*.	100.0 *Abich*.
Silver,	80.2	84		
Antimony,	19.8	16		
Accord. to *Hauy's* calculation.	100.0	100		The variety in fine granular diftinct concretions, according to *Klaproth's* analyfis.
Silver,	76			
Antimony,	24			
	100			The variety in coarfe granular diftinct concretions, according to *Klaproth's* analyfis.

Geognoftic and Geographic Situations.

It occurs in veins which are compofed of calcfpar, heavy-fpar, and rarely a little fluor-fpar, and is accompanied with lead-glance, native filver, feldomer

ſeldomer with iron-pyrites, brown-blende, and fahl-ore.

It is found at Kaſalla near Guadalcanal in Spain; at Vittichen and at Altwolfach in the principality Fürſtenberg; at Andreaſberg in the Hartz. It is ſaid alſo to have been found at the Rathhauſberg in Gaſtein, and the Goldberg in Rauris in Salzburg.

Obſervations.

It is diſtinguiſhed from native ſilver by its brittleneſs and a foliated fracture; from white cobalt-ore by its fracture, it having a foliated, whereas cobalt-ore has a coarſe and fine-grained uneven fracture; from arſenical pyrites in fracture and hardneſs, the pyrites having a fine-grained uneven fracture, and giving ſparks with ſteel.

THIRD SPECIES.

Arſenical Silver.

Arſenicſilber.—*Werner.*

Wern. Pabſt. 1. b. ſ. 28.—Argent arſenical, *D. B.* t. 2. p. 417.—Arſenikaliſch gediegen Silber, *Wid.* ſ. 687.—Arſenicated native Silver, *Kirw.* vol. ii. p. 111.—Arſenicſilber, *Eſtner*, 3. b. ſ. 342.—*Id. Emm.* 2. b. ſ. 165.—L'Argent arſenical, *Broch.* t. 2. p. 122.—Argent antimonial arſenifere et ferrifere, *Hauy*, t. 3. p. 398.

External Characters.

Colour tin-white, which paſſes into ſilver-white, and verges on light lead-grey.

It is always more or less tarnished with a blackish colour.

Occurs massive, disseminated, small reniform, and globular.

Reuss mentions the following crystallizations:

1. Compressed six-sided prism, with roundish lateral edges.
2. Simple, very acute, six-sided pyramid, having pretty deeply truncated extremities.

Internally from shining to glistening, which borders on glimmering, and its lustre is metallic.

Fracture more or less perfect small and fine foliated *.

Fragments indeterminately angular, blunt-edged.

Occurs in small and fine granular distinct concretions; also in thin and curved lamellar distinct concretions, which are bent according to the external surface.

Is soft, passing into semihard.

Lustre is increased in the streak.

Sectile, slightly inclining to brittle.

Not particularly difficultly frangible.

Uncommonly heavy.

Chemical Characters.

Before the blow-pipe the arsenic and antimony are volatilized, and emit a garlike smell; a globule of silver remains, which is more or less pure.

Constituent

* Fracture said sometimes to be even.

Conſtituent Parts.

According to the analyſis of *Klaproth*, that from the mine Samſon at Andreaſberg affords

Arſenic,	35.0
Iron,	44.25
Silver,	12.75
Antimony,	7.
	99.0

Geognoſtic and Geographic Situations.

It occurs uſually with native arſenic, dark-red ſilver-ore, brittle ſilver-glance, lead-glance, and brown blende, in maſſive white calc-ſpar. It is found in the Hartz, at Altwolfach in the principality of Fürſtenberg in Swabia, and at Guadalcanal and Kaſalla in Spain.

Obſervations.

1. It does not tarniſh ſo quickly as native arſenic, and its colour is lighter than that of arſenic.

2. It paſſes on the one ſide into native arſenic, on the other into native ſilver.

3. It is a rare mineral.

FOURTH

FOURTH SPECIES.

Corneous Silver-Ore, or Horn-Ore.

Hornerz.—*Werner.*

Minera Argenti cornea, *Wall.* t. 2. p. 331.—Argent corné, *Rom. de L.* t. 3. p. 463.—*Id. De Born.* t. 2. p. 420.—Hornerz, *Werner*, Pabſt. 1. b. ſ. 29.—*Id. Wid.* ſ. 691.—Corneous Silver-Ore, *Kirw.* vol. ii. p. 113. — Hornerz, *Eſtner*, 3. b. ſ. 348.—*Id. Emm.* 2. b. ſ. 168. — Argent corné, *Lam.* t. 1. p. 130. — La Mine cornée, ou L'Argent corné ou muriaté, *Broch.* t. 2. p. 127.—Argent muriaté, *Hauy*, t. 3. p. 418, 422.—Hornerz, *Reuſs*, 3. b. ſ. 330.

External Characters.

Its moſt frequent colour is pearl-grey, of all degrees of intenſity, which borders ſometimes on milk-white, and ſometimes approaches to lavender and violet-blue. Alſo, although rare, it is leek-green, which inclines ſometimes to mountain-green, ſometimes to piſtachio-green.

It acquires a browniſh tarniſh, or changes its colour, and becomes darker.

Occurs maſſive, diſſeminated, in thick membranes, in roundiſh hollow balls, which have a druſy ſurface, and are ſometimes filled with ſilver-black: alſo cryſtallized,

1. In cubes;

2. In acicular and capillary cryſtals, which are very rare.

The

The cryſtals are either imbedded, ſuperimpoſed, ſcalarwiſe aggregated, or are ſo aggregated that they form druſy envelopes (druſenhäutchen); and they are ſmall, and very ſmall.

Surface of the cryſtals is ſmooth; ſometimes the lateral planes are pitted or marked with ſmall hollows.

Externally ſhining, inclining to ſplendent.

Internally it is from ſhining to gliſtening, with a reſinous luſtre. (By long expoſure the luſtre diſappears.)

Fracture is intermediate between imperfect flat conchoidal, and fined-grained uneven.

Fragments indeterminately angular, blunt-edged.

Is more or leſs tranſlucent, paſſing into tranſlucent on the edges.

Streak ſhining.

Soft, paſſing into very ſoft.

Slightly common flexible.

Perfectly malleable.

Not particularly difficultly frangible.

Heavy.

Specific gravity, 4.804, *Gellert*; 4.7488, *Briſſon*; 4.748, *Hauy*.

Chemical Characters.

Heated on charcoal before the blow-pipe, it melts quickly, diſengages a diſagreeable odour, and

leaves

leaves a globule of filver; it is even fufible by the flame of a candle.

Conftituent Parts.

Silver,	67.75
Muriatic acid,	21.0
Sulphuric acid,	0.25
Oxide of iron,	6.0
Alumina,	1.75
Lime,	0.25

According to *Klaproth*, 1. b. f. 134.

Geognoftic Situation.

Occurs always in veins, and ufually in their upper part,—a proof of the newnefs of its formation. It is ufually accompanied with brown iron-ochre; often alfo with filver-glance and filver-black, but feldom with native filver, red filver-ore, lead-glance, quartz and heavy-fpar.

At Annaberg in Auftria, it was formerly found along with fibrous malachite, copper-green, maffive and cryftallized copper-azure, and filver-black, in compact limeftone; at Schemnitz in Hungary, it occurs in maffive quartz, accompanied with fibrous malachite, filver-black and white lead-ore: the Saxon occurs in veins that traverfe mica-flate, in brown iron-ochre and iron-fhot quartz, accompanied with native filver, filver-glance, filver-black, red filver-ore and lead-glance. In the mountain of Chalanches, it was found in calc-fpar, accompanied

panied wſth ſilver-glance, native ſilver, ſilver-black, ſeldomer in earthy cobalt-ochre, with red ſilver-ore and native ſilver. The Siberian from Schlangenberg occurs ſometimes on compact lime-ſtone, ſometimes on ſandſtone, accompanied with tile-ore, native ſilver, goldiſh ſilver, fibrous mala-chite, earthy copper-azure and white lead-ore. The Mexican is accompanied with native ſilver and ſilver-glance; the Peruvian from the moun-tain of Colquijirka in hornſtone, accompanied with fahl-ore, iron-pyrites, ſilver-glance, lead-glance, white lead-ore and heavy-ſpar; from Guantajaga in the ſame country, in calc-ſpar and brown-ſpar, with native ſilver and copper-green. The Corniſh occurs in ſmall cubes on iron-ochre *.

Geographic Situation.

Europe.—At Joachimſthal and Gotteſgab in Bohemia; Oberſchöna, Marienberg, and at preſent in Johanngeorgenſtadt, in the Saxon Erzgebirge; Schemnitz, in Lower Hungary; Chalanches near Allemont, Markirchen in Alſace in France; Gua-dalcanal in Spain; very rarely at Kongſberg in Norway; and Cornwall in England.

Aſia.—In the mines of Schlangenberg in the diſtrict of Koliwan, in Siberia.

America.—Cuexnabaca in Mexico; at Quanta-jaga, on the borders of the Pacific Ocean, in the kingdom

* Babington's New Syſtem of Mineralogy, p. 151.

kingdom of Peru; and at Colquijirka, two miles from Paſca in Chili.

Obſervations.

1. Eſtner, Brochant, Reuſs, &c. deſcribe a ſubſpecies of horn-ore, under the name of *Erdiges Hornerz*, but it is not acknowledged by Werner.

2. Its name appears to be derived from its property of cutting like horn.

3. The name *Horn-Ore* is probably to be preferred to the more uſual one, Corneous Silver-Ore, becauſe it is equally ſignificant, and is much ſhorter.

FIFTH SPECIES.

Silver-black.

Silberſchwärze.—*Werner.*

Silberſchwärze, *Wid.* ſ. 694.—Sooty Silver-Ore, *Kirw.* vol. ii. p. 117.—Silberſchwärze, *Eſtner*, 3. b. ſ. 365.—*Id. Emm.* 2. b. ſ. 173.—L'Argent noir, *Broch.* t. 2. p. 132.—Silberſchwärze, *Reuſs*, 3. b. ſ. 338.

External Characters.

Colour bluiſh-black, which inclines a little to dark lead-grey.

Occurs maſſive, diſſeminated, as a coating or cruſt, corroded, perforated, amorphous, and filling up the globular horn-ore.

It occurs in all the degrees of conſiſtence, from friable to ſolid.

Internally

Internally dull, paſſing into feeble metallic glimmering.

When friable, it preſents dull duſty particles, but, when ſolid, its fracture is fine earthy, which inclines to uneven.

Fragments indeterminately angular, blunt-edged.

Is weakly tranſlucent.

Is very ſoft, ſometimes paſſes into ſoft, ſometimes into friable.

Gives a metallic ſhining ſtreak, which is characteriſtic for this ſpecies.

Soils very little.

Eaſily frangible.

Sectile.

Heavy.

Chemical Characters.

Melts eaſily before the blow-pipe, and by a ſtronger heat is converted into a flaggy maſs: by gradual heating, the ſulphur, and probably a little arſenic and muriatic acid is volatilized, and a dull globule of ſilver remains.—*Reuſs.*

Conſtituent Parts.

Are ſtill imperfectly known. It appears to be a compound of ſilver, with ſulphuric and muriatic acids, in which the ſulphuric acid predominates. It thus connects together horn-ore and ſilver-glance.

Geognoſtic Situation.

It occurs in veins, and is uſually accompanied with ſilver-glance and horn-ore, alſo with brittle ſilver-glance, brown iron-ochre, native ſilver and heavy-ſpar.

The ſilver-black from Windiſchleithen at Schemnitz in Hungary, occurs with iron-ochre, ſilver-glance, iron-ſhot quartz, malachite, and white lead-ore; from the Thereſia Schacht near Schemnitz, in iron-ſhot quartz with malachite; at Kremnitz with native gold, amethyſt, and ſilver-glance; at Kapnik in quartz, with lead-glance, and brittle ſilver-glance; in the mountains of Chalanches with native ſilver, earthy-cobalt ochre, cobalt-cruſt, nickel ochre, and calc-ſpar; at Schlangenberg in Siberia it occurs along with other ores of ſilver, on quartz and hornſtone *; at Kongſberg in Norway, in the mine called Hülf Gottes in der Noth on calc-ſpar; and in that called Auf Got allein die Ehre, diſſeminated in quartz †.

Geographic Situation.

At Joachimſthal in Bohemia; Schemnitz, Kremnitz and Nagybanya in Hungary; Kapnik in Tranſilvania; Oberſchöna near Freyberg, Johanngeorgenſtadt, Katharina at Raſchau, and Marienberg, in the electorate of Saxony; Chalanches, near Allemont in Dauphiny; Kongſberg in Norway; and Schlangenberg in Siberia.

Obſervations.

* *Eſtner*, 3. b. ſ. 336,—368.

† *Reuſs*, 3. b. ſ. 341.

Obſervations.

1. Some mineralogiſts conſider this ſpecies as decompoſed horn-ore, but Werner is of opinion that it is an original depoſition.

2. It has been alſo aſſerted, that when it occurs along with other ores of ſilver, it is always the neweſt. This obſervation, however, is incorrect, as we often find it covered with horn-ore.

3. Its name intimates, that it has a black colour, and is principally compoſed of ſilver. I uſe *Silver-black* in preference to *Sooty Silver-ore*, the name applied to this ſpecies by Kirwan, in order not only to preſerve uniformity in the nomenclature, but becauſe it is more correct.

4. The name *Silver-black* is not more objectionable than Mountain Green, Mountain Blue, Iron-Earth, Iron-Sand, Cobalt Bloom, &c. denominations applied to mineral ſpecies by the beſt Engliſh mineralogiſts.

SIXTH SPECIES.

Silver-Glance.

Glaserz.—*Werner.*

Minera Argenti vitrea, *Wall.* t. 2. p. 329.—Mine d'Argent vitreuſe, *Rom. de L.* t. 3. p. 440.—Argent vitreuſe, *De Born.* t. 2. p. 424.—Glaſerz, *Werner*, Pabſt. 1. b. ſ. 33.—*Id. Wid.* ſ. 696. — Sulphurated Silver-Ore, *Kirw.* vol. ii. p. 115.—Geſchmeidiges Silberglanſerz, *Eſtner*, 3. b. ſ. 370.—Glaſerz, *Emm.* 2. b. ſ. 175. — Argent vitreuſe, *Lam* t. 1. p. 120.—*Id. Broch.* t. 2. p. 134.—Argent ſulphuré, *Hauy*, t. 3. p. 398, —402.—Glanzerz, *Reuſs*, 3. b. ſ. 342.

External

External Characters.

Colour dark blackiſh lead-grey. On expoſure, its ſurface acquires a tempered-ſteel coloured tarniſh.

Occurs uſually maſſive, diſſeminated, in membranes, and ſeldom in plates; alſo in ſeveral particular external ſhapes, as dentiform, filiform, capillary, reticulated, irregular dendritic, ſtalactitic, in leaves, with globular and pyramidal impreſſions, corroded and amorphous; alſo cryſtallized. Its cryſtallizations are the following:

1. Cube, which is either perfect or truncated on its edges or angles, or on both at the ſame time.
2. Octahedron, which is the fundamental cryſtal. It is either perfect or truncated on its angles or edges. When the edges of the common baſis are very deeply truncated, it paſſes into the rectangular four-ſided priſm, acuminated on both extremities by four planes, which are ſet on the lateral planes.
3. Garnet dodecahedron, which is formed from the cube or the octahedron, by the truncation of their edges. Its edges are ſometimes truncated.
4. Double eight-ſided pyramid, flatly acuminated on both extremities by four planes, which are ſet on the alternate lateral edges. It is formed

formed by the acumination of each of the angles of the octahedron with four planes.

The two laſt-mentioned cryſtallizations are very rare.

Cryſtals ſeldom middle-ſized; uſually ſmall and very ſmall; ſuperimpoſed, or aggregated in rows. The octahedron is uſually aggregated in rows, but the other cryſtallizations uſually ſuperimpoſed. The cubes are ſometimes hollow.

Surface of the cryſtals is ſometimes ſmooth, ſometimes druſy.

Externally ſhining and gliſtening, and when dru-ſy, faintly glimmering.

Internally it alternates from ſhining to gliſtening, and its luſtre is metallic.

Fracture commonly ſmall-grained uneven; ſometimes it inclines to imperfect ſmall and flat conchoidal.

Fragments indeterminately angular, blunt-edged.

Streak ſhining.

Is ſoft.

Completely malleable.

Common flexible.

Difficultly frangible.

Uncommonly heavy.

Specific gravity, 7.215, *Gellert*; 7.200, *Lametherie*; 6.9099, *Briſſon*.

Chemical

Chemical Characters.

Before the blow-pipe it loſes its ſulphur, and the ſilver is reduced to its metallic ſtate. If heated gently in a furnace, the ſulphur diſſipates, and the ſilver appears in its metallic ſtate, in dentritic and capillary forms, reſembling native ſilver.

Conſtituent Parts.

From Himmelsfürſt.		*From Joachimſthal.*	
Silver,	85	Silver,	84.81
Sulphur,	15	Sulphur,	14.19
	100		99.0
	Klaproth.		*Klaproth.*
Silver,	84	Silver,	75
Sulphur,	16	Sulphur,	25
	100		100
	Sage.		*Bergman.*

Geognoſtic Situation.

Is always found in veins, and is uſually accompanied with native ſilver, red ſilver-ore, horn-ore or corneous ſilver-ore, brittle ſilver-glance, lead-glance, iron-pyrites, ſparry ironſtone, iron-ochre, brown-blende, brown-ſpar, heavy-ſpar, calc-ſpar and quartz.

At Schemnitz in Hungary it occurs in a variety of forms on common quartz, amethyſt, and brown ſpar, accompanied with native ſilver, brittle ſilver-glance, copper-pyrites, lead-glance, yellow blende, common, radiated and liver pyrites, brown and calc

calc ſpar, earthy lithomarge, and very rarely native gold; at Annaberg in Auſtria it has been found maſſive, in membranes, on ſmoke-grey compact limeſtone; at Kongſberg in Norway it is found in the Juſtitz Mine, accompanied with native ſilver, or diſſeminated in calc-ſpar, or as a coating; in the Gleichen and Herzog Ulrick Mine in quartz, verging on rock-cryſtal, ſlate-ſpar, or in axinite; in the mine called Gotts Hülfe in der Noth, between cryſtals of iron-pyrites and on calc-ſpar.

The Peruvian occurs in quartz with native ſilver; or in calc-ſpar with arſenical pyrites, lead-glance, and radiated iron-pyrites.

Geographic Situation.

At Joachimſthal, Gotteſgab, Weiperth, Aberdam, Roſtock, Priſbram, Ratieborzite, and Jungwoſchitz in Bohemia; Lower Auſtria; Schemnitz and Kremnitz in Hungary; Freyberg, Johanngeorgenſtadt, Schneeberg, and Annaberg in the electorate of Saxony; near Wittichen, Altwolfach, and Reinerzau in Swabia; Chalanches, near Allemont in Dauphiny; and Markirchen in Alſace in France; Kongſberg in Norway; Schlangenberg in Siberia; Mexico and Peru in America.

Obſervations.

1. The literal tranſlation of the German name *Glaserz* is *Silver-glaſs*. As the term *glaserz* is evidently

evidently a corruption of *Glanzerz*, I have ventured to give this ſpecies the name *Silver-glance*, (Silberglanz), a name which ought alſo to be adopted in the German, to preſerve uniformity and conſiſtency in the nomenclature.

2. The common name *Vitreous Silver-ore*, as it conveys an erroneous meaning, ſhould be rejected.

SEVENTH SPECIES.

Brittle Silver-Glance.

Sprödglaserz.—*Werner.*

Argent fragile, *De Born.* t. 2. p. 429.—Sprödglaſerz, *Wid.* ſ. 669.—*Id. Werner's* Pab. 1. b. ſ. 41.—Sprödes Silberglanzerz, *Eſtner*, 3. b. ſ. 398—Sprödglaſerz, *Emm.* 2. b. ſ. 180.—L'Argent vitrieux aigre, *Broch.* t. 2. p. 138.—Argent noire, *Hauy*, t. 3. p. 416.—Sprödglanzerz, *Reuſs*, 3. b. ſ. 351.

External Characters.

Its colour is intermediate between iron-black and dark lead-grey.

Occurs maſſive, diſſeminated, in membranes, and very often cryſtallized. Its cryſtallizations are the following:

1. Equiangular ſix-ſided priſm, with ſtraight, or convex terminal planes.
2. Same priſm acuminated by ſix planes, which are ſet on the lateral planes, and the extremities of the acuminations ſometimes very deeply truncated.

3. When

3. When the figure No. 1. becomes very ſhort, it paſſes into the equiangular ſix-ſided table.
4. When the convex terminal planes of the priſm meet the lens, is formed
5. Rectangular four-ſided table, truncated on the angles and edges *.

The tabular cryſtals often interſect one another, and thus form the cellular external ſhape; and ſometimes they are ſuperimpoſed. They are ſeldom middle-ſized, uſually ſmall, and very ſmall, and even microſcopic.

The lateral planes, particularly of the priſm, are longitudinally ſtreaked; in the other figures the planes are ſometimes ſmooth, ſometimes druſy.

Externally it is highly ſplendent, and ſometimes uncommonly ſo.

Internally it alternates from ſhining to gliſtening, and its luſtre is metallic.

Fracture uſually coarſe or fine-grained uneven; but that of the cryſtals is more or leſs imperfect and ſmall conchoidal.

Fragments indeterminately angular, not particularly ſharp-edged.

In the ſtreak it retains its colour and luſtre.

Is ſoft.

Brittle, which is a principal character.

Eaſily frangible.

Uncommonly heavy.

Specific gravity, 7.208.—*Gellert.*

* Probably the three-ſided pyramid occurs in this ſpecies?

Chemical Characters.

Heated on charcoal before the blow-pipe, it melts with difficulty, and the ſulphur, arſenic and antimony, are in part volatilized. A globule of imperfectly malleable ſilver, accompanied with a brown ſcoria, remains behind.

Conſtituent Parts.

According to Klaproth, the brittle ſilver-glance from the mine Hoffnung Gottes in Groſs-Voightſberg near Freyberg, affords

Silver,	66.50
Sulphur,	12.
Antimony,	10.
Iron,	5.
Copper and arſenic,	0.50
Earthy ſubſtances,	1.
	95

Klaproth, Beiträge, 1. b. ſ. 166.

Geognoſtic Situation.

Is always found in veins, and uſually accompanied with dark red ſilver-ore, lead-glance, and white ſilver-ore, into which it ſometimes paſſes.

It is found principally in Hungary and Saxony, but is more rare than the preceding ſpecies. In the mines of Chemnitz, it occurs with common quartz, amethyſt and brown-ſpar, accompanied with ſilver-glance, copper-glance, lead-glance, iron-pyrites, brown and black blende, dark red ſilver-

ſilver-ore, very ſeldom light red cinnabar and native gold, calc-ſpar, brown-ſpar and calcedony. In the mines of Kremnitz it is uſually found on quartz mixed with brown-ſpar, and amethyſt, accompanied with iron and copper pyrites, dark red ſilver-ore, ſeldomer with native gold. The Saxon brittle ſilver-ore occurs uſually accompanied with red ſilver-ore, copper and iron pyrites, ſparry iron-ſtone, brown and black blende, glance-cobalt, plumoſe grey antimony-ore, quartz, brown-ſpar, calc-ſpar, and fluor-ſpar. The Bohemian at Joachimſthal is accompanied with dark red ſilver-ore, liver-pyrites, calc-ſpar, and brown-ſpar. The lens occurs along with dentiform native ſilver in the mine called Seegen Gottes at Kongſberg. The Siberian is accompanied with granular heavy ſpar, copper-pyrites, copper-azure, and brown blende.

Geographic Situation.

At Joachimſthal, Pribram, and Ratieborzitz in Bohemia; Schemnitz and Kremnitz in Hungary; Boitza in Tranſilvania; Himmelsfürſt near Freyberg, Schneeberg, Johanngeorgenſtadt, Oberwieſenthal, and Annaberg, in the electorate of Saxony; Altwolfach in Fürſtenberg in Swabia; Gemeſeck in Hewbachthale, Schöſwande in Felberthale, in the Pinzgaw, in Salzburg; Clauſthal and Andreaſberg in the Hartz; Chalanches near Allemont

mont in Dauphiny in France; Kongſberg in Norway; Schlangenberg in Siberia; and Peru.

Obſervation.

It paſſes, by means of white ſilver-ore, grey antimony-ore, into native antimony?

Uſe.

It is one of the richeſt ores of ſilver.

EIGHTH SPECIES.

Red Silver-Ore.

This ſpecies is divided into two ſubſpecies: 1. Dark red Silver-Ore. 2. Light red Silver-Ore.

FIRST SUBSPECIES.

Dark red Silver Ore.

Dunkles Rothgiltigerz.—*Werner.*

Id. Wern. Pabſt. 1. b. ſ. 45.—*Id. Wid.* ſ. 703.—Dark red Silver-Ore, *Kirw.* vol. ii. p. 123. — Dunkles Rothgiltigerz, *Eſtner*, 3. b. ſ. 410.—*Id. Emm.* 2. b. ſ. 185.—L'Argent rouge foncé, *Broch.* t. 2. p. 143.——Argent antimonié ſulphuré, *Hauy*, t. 3. p. 402,-416. — Dunkles Rothgiltigerz, *Reuſs*, 3. b. ſ. 358.

External Characters.

Its colour is intermediate, between cochineal-red

red and lead-grey, which ſometimes paſſes into iron-black.

Occurs maſſive, diſſeminated, dendritic, in membranes, and cryſtallized in the following figures,

1. Equiangular ſix-ſided priſm, which is either perfect, or its lateral edges are bevelled.
2. Equiangular ſix-ſided priſm acuminated by three planes, which are ſet on the alternate lateral edges.
3. Equiangular ſix-ſided priſm flatly acuminated by ſix planes, which are ſet on the lateral planes. The extremities of the acuminations are ſometimes ſo deeply truncated, that the acuminating planes become truncations on the terminal edges; and the edges of the acumination are ſometimes truncated.
4. The preceding figure a ſecond time acuminated by three planes, which are ſet on the alternate edges of the firſt acumination.

Cryſtals are middle-ſized, ſmall, and rarely very ſmall.

Their ſurface is ſometimes ſtreaked, often ſmooth.

Cryſtals occur often in druſes.

Externally ſplendent, with a luſtre which is ſometimes metallic, ſometimes adamantine.

Internally it alternates from ſhining to glimmering, and has ſometimes a metallic, ſometimes a ſemimetallic luſtre.

Fracture

Fracture uſually coarſe and fine-grained uneven, the cryſtallized varieties imperfect and ſmall conchoidal, ſometimes verging on even, and it is ſaid that ſome varieties ſhow an imperfect foliated fracture, but very rarely.

Fragments indeterminately angular, blunt-edged.

Maſſive varieties are opaque; cryſtallized ſemitranſparent paſſing into tranſparent; and ſometimes only tranſlucent.

Affords a cochineal-red coloured ſtreak, and retains its luſtre.

Is ſoft.

Sectile.

Eaſily frangible.

Heavy, approaching uncommonly heavy.

Specific gravity, 5.608; 5.684, *Gellert*; 5.5637, *Briſſon.*

Chemical Characters.

On charcoal, before the blow-pipe, it flies into ſplinters, but ſoon melts with ſlight bubbling, and emiſſion of a prètty copious ſmoke, which colours the coal and the blow-pipe yellow; and leaves a globule of ſilver.

Geognoſtic Situation.

Occurs always in veins, and is uſually accompanied with lead-glance, white ſilver-ore, brittle ſilver-glance, calc-ſpar and brown-ſpar.

The dark red ſilver-ore of Schemnitz occurs commonly

commonly with brittle ſilver-glance, and has uſually the ſame accompanying minerals and vein-ſtones. At Kremnitz, it occurs uſually on quartz and amethyſt, accompanied with brittle ſilver-glance, iron and copper pyrites, and brown-ſpar, and ſometimes with ſilver-glance and native gold; at Felſobanya, it occurs on quartz and hornſtone, accompanied with iron-pyrites, brown-blende, brittle ſilver-glance, and lead-glance; at Foghatgymas, in quartz, with copper-pyrites, brittle ſilver-glance, lead-glance, brown ſpar and iron-ochre; at Boitza, in Tranſilvania, it occurs in quartz and brown ſpar, accompanied with iron-pyrites, yellow blende, lead-glance, brittle ſilver-glance, brown-ſpar, and amethyſt; at Joachimſthal, in Bohemia, it occurs in liver-pyrites, or calc-ſpar, or quartz, and is accompanied with brittle ſilver-glance, &c.; at Ratieborzitz, on diſintegrated gneiſs or amethyſt, with iron-pyrites, lead-glance, yellow blende, arſenical pyrites, brittle ſilver-glance, copper-pyrites, and brown-ſpar. The Saxon occurs almoſt always with brittle ſilver-glance. The dark red ſilver-ore of the Hartz occurs ſometimes in lead-glance, with quartz, iron-pyrites, calc-ſpar, ſometimes in quartz, with ſuperimpoſed zeolite, ſometimes with quartz and calc-ſpar, liver-pyrites, lead-glance, and native arſenic *. At Kongſberg, it occurs in calc-ſpar, and lead-glance, and on quartz, accompanied with liver-pyrites, and common iron-pyrites.

Geographic

*. *Eſtner*, Mineralogie, 3. b.

Geographic Situation.

Joachimſthal, and Ratieborzitz in Bohemia; Schemnitz, Kremnitz, Felſobanya, Foghatgymas, in Hungary; Boitza and Nagybanya in Tranſilvania; Freyberg, Groſsvoightſberg, Braünſdorf, in the electorate of Saxony; Andreaſberg in the Hartz; and Kongſberg in Norway.

SECOND SUBSPECIES.

Light red Silver-Ore,

Lichtes Rothgiltigerz.—*Werner.*

Id. Werner, Pabſt. 1. b. ſ. 52.—*Id. Wid.* ſ. 706.—Light red Silver-ore, *Kirw.* vol. ii. p. 122.—Lichtes Rothgiltigerz, *Eſtner*, 3. b. ſ. 426.—*Id. Emm.* 2. b. ſ. 190.—L'Argent rouge clair, *Broch.* t. 2. p. 147.—Argent antimonié ſulphuré, *Hauy.*—Lichtes Rothgiltigerz, *Reuſs*, 3. b. ſ. 365.

External Characters.

Colour paſſes from carmine-red into a middle colour, between cochineal-red and lead-grey; ſometimes it is very pale, and approaches light blood-red, and nearly paſſes into it.

Its ſurface has ſometimes a tempered-ſteel tarniſh.

Occurs maſſive, diſſeminated, frequently in membranes, reniform, and cryſtallized: its cryſtallizations are,

1. A very acute ſingle ſix-ſided pyramid, having alternate obtuſe and acute lateral edges.
2. Same figure acuminated by three planes, which are ſet on the obtuſe edges of the pyramid.
3. Same figure acuminated by ſix planes, which are ſet on the lateral planes of the pyramid.
4. Alſo in acicular cryſtals.

Cryſtals are ſeldom middle-ſized, uſually ſmall, and very ſmall; and occur in druſes. The ſurface of the cryſtals is uſually ſmooth; ſometimes obliquely ſtreaked, and ſometimes druſy, and is ſplendent.

Internally, it alternates from ſplendent to gliſtening, and has uſually an adamantine luſtre; the varieties that incline to the foregoing ſubſpecies have a ſemimetallic luſtre.

Fracture uſually imperfect and ſmall conchoidal, and ſometimes it paſſes, on the one ſide, into coarſe and ſmall-grained uneven; on the other, into imperfect foliated, which latter has the greateſt degree of luſtre, and occurs only in the cryſtallized varieties.

Fragments indeterminately angular, pretty ſharp-edged.

Maſſive varieties are uſually tranſlucent on the edges; the cryſtallized commonly tranſparent.

It yields an aurora red ſtreak, with little change in luſtre.

Is ſoft, paſſing into very ſoft.

Sectile.
Uncommonly eaſily frangible.
Heavy.
Specific gravity, 5.443, *Gellert*; 5.5886, *Briſſon*; 5.592, *Vauquelin.*

Chemical Characters.

On charcoal, before the blow-pipe, it melts, blackens, and burns with a blue flame like ſulphur, diffuſing a white ſmoke and a feeble garlic ſmell; and leaves a globule of nearly pure ſilver.—*Vauquelin.*

Conſtituent Parts.

From the mine, called Catharina Neufang, at Andreasberg.		Mine, called Churprinz Friedrich Auguſt, near Freyberg.	
Silver,	60		62.
Antimony,	20.3		18.5
Sulphur,	14.7		14.2
Oxygen,	5.		5.3
Klaproth.	100.0	*Klaproth.*	100.0

Vauquelin's 1ſt Analyſis.		2d Analyſis.
Silver,	56.6748	54.2713
Antimony,	16.13	16.13
Sulphur,	15.0666	17.75
Oxygen,	12.1286	11.8487
	100	100

Thenard's

Thenard's Analyſis.		From Johanngeorgenſtadt.	
Oxide of Silver,	58.4	Silver,	61.
Oxide of Antimony,	23.5	Antimony,	19.
Sulphur,	16.	Sulphur,	11.1
	97.9	Sulphuric acid,	7.0
		Arſenic,	2.9
		Lampadius,	101

Geognoſtic Situation.

It always occurs in veins, and is uſually accompanied with native arſenic, cobalt-glance, alſo with orpiment, and heavy-ſpar.

At Joachimſthal, in Bohemia, it is accompanied with ſilver-glance, brittle ſilver-glance, copper-pyrites, common iron-pyrites, white cobalt-ore, orpiment, ſparry ironſtone, brown-ſpar, calc-ſpar, heavy-ſpar and hornſtone. In Saxony, it occurs almoſt always accompanied with native arſenic, ſilver-glance, lead-glance, calc-ſpar, brown-ſpar, lamellar heavy-ſpar and quartz; frequently alſo with native-ſilver, liver-pyrites, copper-pyrites, cobalt-glance, and ſparry ironſtone, and ſometimes with brittle ſilver-ore, fahl-glance, and fluor-ſpar. In the Hartz, it occurs on quartz mixed with calc-ſpar, lead-glance, and native arſenic; ſometimes alſo with calc-ſpar, quartz, and brown-ſpar. At Markirchen, in Alſace, it was formerly found with quartz, brown-ſpar, native arſenic, lead-glance, copper-pyrites, and ſilver-glance. At Guadalcanal,

Guadalcanal, in Spain, with arſenical ſilver and calc-ſpar *.

In the diſtrict of Porco, twelve German miles from Potoſi, light and dark red ſilver ore occur with native ſilver, blende, radiated and common iron-pyrites, in calc-ſpar and quartz.

Geographic Situation.

Bohemia; Schemnitz, Kremnitz and Konigſberg in Hungary; Himmelsfürſt and Kurprinz near Freyberg, Marienberg, Annaberg, Schneeberg, and Johanngeogenſtadt in the electorate of Saxony; Altwolfach, Wittichen in Fürſtenberg in Swabia; Clauſthal and Andreaſberg in the Hartz; Markirchen in Alſace; Guadalcanal in Spain; and in South America.

Uſe.

Both ſubſpecies are ſmelted on account of the ſilver they contain. The dark red is conſiderably more productive than the light red ore.

Obſervations.

1. The light red ſilver-ore, as already mentioned, occurs uſually with native arſenic, and cobalt-glance, alſo with orpiment and heavy-ſpar, but the dark, on the contrary, with lead-glance, white ſilver-ore, brittle ſilver-ore, quartz, calc-ſpar and iron-

* *Eſtner*, Mineralogie, 3. b.

iron-pyrites. They are thus, by theſe geognoſtic characters, well diſtinguiſhed from one another.

2. Werner is of opinion that there are ſeveral formations of this ore. The dark and light ores he conſiders as diſtinct formations; and the red ſilver-ore, which is accompanied with quartz and hornſtone, he believes to be a diſtinct and peculiar formation.

3. In the Hartz and Hungary, it is principally the dark red ſilver-ore which occurs.

4. The colour of the ſtreak diſtinguiſhes the two ſubſpecies from one another: the dark red affords a cochineal or brick-red coloured ſtreak, but the light red ore, an aurora coloured ſtreak.

5. Red ſilver-ore, cinnabar, and red copper-ore, have ſeveral characters in common: the following, however, ſufficiently diſtinguiſh them from one another.

Cinnabar has a ſpecific gravity of 7., and is almoſt always accompanied with native mercury and iron-ochre; whereas the ſpecific gravity of red ſilver-ore does not exceed 5.8; and its accompanying foſſils, as already mentioned, are very different from thoſe of cinnabar.

Red copper-ore has a ſpecific gravity of 3.9, and is uſually accompanied with native copper, malachite, and brown iron-ochre,—characters that diſtinguiſh it ſufficiently from red ſilver-ore.

6. It

6. It has a ſlight reſemblance to copper-glance and red orpiment. Copper-glance gives a blackiſh ſtreak; red orpiment a yellow ſtreak, and its ſpecific gravity is only 3·2,—characters that diſtinguiſh them at once from red ſilver-ore.

NINTH SPECIES.

White Silver-Ore.

Weiſs-Giltigerz.—*Werner.*

Id. Wern. Pab. 1. b. f. 58.—*Id. Wid.* f. 711.—Light Grey Silver-Ore, *Kirw.* vol. ii. p. 119.—Weiſs-Giltigerz, *Eſtner*, 3. b. f. 443.—*Id. Emm.* 2. b. f. 195.—La Mine blanche riche, *Broch.* t. 2. p. 150.—Weiſs-Gultigerz, *Reuſs*, 4. b. f. 193.

External Characters.

Its colour is very light lead-grey, but when it approaches to ſilver-glance it inclines ſomewhat to black.

Occurs maſſive and diſſeminated.

Internally it alternates from glimmering to ſhining, and its luſtre is metallic. The varieties that verge on ſilver-glance have the moſt luſtre; thoſe that paſs into plumoſe antimony the leaſt.

Fracture even, and fine-grained uneven. When fine-grained uneven, it is paſſing into brittle ſilver-glance; and when we obſerve intermixed in it de-

licate

licate fibres, it is paſſing to indurated plumoſe antimony: Therefore, the fracture of the true white ſilver-ore is even.

Fragments indeterminately angular, blunt-edged.

Streak ſhining, and retains its colour.

Is ſoft, approaching to very ſoft.

Slightly ſectile.

Eaſily frangible.

Heavy.

Conſtituent Parts.

It is a compound of antimony, ſulphur and ſilver. Klaproth found it to contain a very conſiderable portion of lead, but the exiſtence of that metal is doubted by Werner. Daubiſſon found it to contain, in the hundred parts, 16 parts of ſilver, and 30 of lead and antimony.

The following are the analyſes of Klaproth:

	Dark White Silver-Ore from Himmelsfürſt near Freyberg.	Light White Silver-Ore from Himmelsfürſt.
Lead,	41.	48.06
Silver,	9.25	20.40
Antimony,	21.50	7.88
Iron,	1.75	2.25
Sulphur,	22.0	12.25
Alumina,	1.0	7.0
Silica,	0.75	0.25
	97.26	99.09

Geognoſtic

Geognoſtic and Geographic Situations.

Always in veins, and accompanied with lead-glance, dark red ſilver-ore, brittle ſilver-ore, plumoſe antimony, brown-ſpar, and calc-ſpar.

It is found in conſiderable quantity in the mines of Himmelsfürſt and Beſchert Glück near Freyberg, but rarely in other countries.

It is ſaid to have been found in ſmall quantity in the Hartz, and alſo in Bohemia.

Obſervations.

1. It appears to be an intermediate ſpecies, between brittle ſilver-ore and plumoſe antimony.

2. By many mineralogiſts it is confounded with fahl-ore.

3. Compact lead-glance is diſtinguiſhed from it by its freſh lead-grey colour, and its leſs ſpecific gravity.

4. It occurs in a peculiar formation, which is termed by Werner the Argentiferous or ſilveriſh Lead-glance Formation (Silbereiche Bleizglanz Formation).

TENTH SPECIES.

Black Silver-Ore.

Schwarzgiltigerz.—*Werner.*

Colour iron-black, which ſometimes approaches to ſteel-grey.

Occurs maſſive, diſſeminated, and cryſtallized in three-ſided pyramids, which are bevelled on the edges, and acuminated on the angles by three planes.

The cryſtals are middle-ſized and ſmall.

Internally ſhining, inclining to gliſtening, and its luſtre is metallic.

Fracture imperfect and ſmall conchoidal, which ſometimes paſſes into uneven.

Fragments indeterminately angular, ſharp-edged.

Semihard, inclining to ſoft.

Sectile.

Eaſily frangible.

Heavy.

Obſervation.

By its affinity with fahl-ore or grey copper-ore, it connects together the ſilver and copper genus.

FIFTH GENUS.

COPPER GENUS.

FIRST SPECIES.

Native Copper.

Gediegen Kupfer.—*Werner.*

Cuprum nativum, *Wall.* t. 2. p. 274. — Cuivre natif, *Rom. de L.* t. 3. p. 305.—Gediegen Kupfer, *Werner*, Pabſt. 1. b. ſ. 62.—*Id. Wid.* ſ. 737.- Cuivre natif, *De Born*, t. 2. p. 303.—Native Copper, *Kirwan*, vol. ii. p. 118.—Gediegen Kupfer, *Eſtner*, 3. b. ſ. 459.—*Id Emm.* 2. b. ſ. 206.—Le Cuivre natif, *Broch.* t. 2. p. 158. — *Id. Hauy*, t. 3. p. 518.–529.—Gediegen Kupfer, *Reuſs*, 3. b. ſ. 392.

External Characters.

Colour copper-red, but is frequently tarniſhed browniſh, blackiſh, yellowiſh or ſilver-white.

Occurs maſſive, diſſeminated, in membranes, in plates, in angular pieces, in rolled pieces, in grains, capillary, filiform, moſslike, irregular dendritic, corroded, ramoſe; and pretty often cryſtallized,

1. Perfect cube.
2. Cube truncated on its angles, which is the middle cryſtal between the cube and the octahedron.
3. Cube truncated on its edges, which is the middle cryſtal between the cube and the rhomboidal or garnet dodecahedron.
4. Rhomboidal or garnet dodecahedron.

5. Perfect

5. Perfect octahedron; ſometimes truncated on its edges.
6. Simple acute three-ſided pyramid.
7. Simple acute ſix-ſided pyramid.
8. Very low equiangular and equilateral ſix-ſided priſm acuminated by ſix planes, which are ſet on the lateral planes.
9. Oblique four-ſided priſm, acuminated by four planes, which are ſet on the lateral planes.

Cryſtals ſeldom middle-ſized and ſmall, uſually very ſmall and microſcopic. Occur ſeldom ſingle imbedded and ſuperimpoſed, more commonly aggregated in a variety of external ſhapes.

The lateral planes of the cryſtals are ſometimes ſmooth, ſometimes druſy, and the ſimple ſix-ſided pyramids are tranſverſely ſtreaked. They are ſplendent; the other ſhapes are gliſtening.

Internally intermediate between gliſtening and glimmering, and its luſtre is metallic.

Fracture hackly.

Fragments indeterminately angular, blunt-edged.

Streak ſplendent, with a metallic luſtre.

Is intermediate between ſemihard and ſoft.

Completely malleable.

Common flexible.

Difficultly frangible.

Uncommon y heavy.

Specific gravity, 7.728, from Hungary, *Gellert*; 7.600 to 7.800, *Kirwan*; 8.5844, from Siberia *Hauy*.

Chemical

Chemical Characters.

When copper is allowed to ſtand for ſome time in ammonia, it communicates to it a blue colour, which is one of the beſt chemical characters for diſcovering this metal.

Geognoſtic Situation.

Occurs uſually in veins, and ſometimes in beds, and moſt commonly accompanied with red copper-ore, brown and red iron-ochre, malachite and copper-green. It is ſometimes alſo accompanied with copper-glance, fahl-ore or grey copper-ore, copper-pyrites, copper-black, lead-glance, (at Illowa in Upper Hungary); native ſilver, tinſtone, ſilver-glance, (at Marienberg); cobalt-glance, calc-ſpar, quartz, heavy-ſpar, and fluor-ſpar.

The Tyrolian occurs in chlorite and talc-ſlate; that found at Friedrichſminde in Norway, in grey hornſtone and limeſtone, with earthy copper-azure, and copper-green; at Gullardſrud Schurf, in ſame country, in ſerpentine; in Faroe, with radiated and fibrous zeolite, in amygdaloid; in the mine of Maria-Taferl at Moldowa in the Bannat, in ſyenitic porphyry; at Kamſdorf in Weſterwald in beds of ironſtone; at Herngrund in Hungary in grey-wacke ſlate; in England, in quartz and granite.

The

The Siberian occurs in granular limeſtone.

Geographic Situation.

Europe.—Cornwall, Angleſea, Cumberland, &c. in England; Shetland Iſlands, Scotland; Rudnobanya, Herngrund near Newſohl, and Schmolnitz near Einſiedel in Hungary; Dognaczka, Milowa, Moldawa, Saſka, and Peterſch, in the Bannat of Temeſwar; Deva, Kapnik, &c. in Tranſilvania; Schwatz, Gogel, Liniberg, in the Tyrol; Groſs Kamſdorf, Freyberg, Annaberg, Marienberg, Johanngeorgenſtadt, Glaſhütte, in the electorate of Saxony; Saalfeld and Blankenburg in Thuringia; Giern, Rudelſtadt, Janowitz, Kupferberg and Altenberg in Sileſia; Swabia; Heſſia; Deux Ponts; at Reichenbach in the valley of Oberſtein in the Palatinate; Lautenthal and Rammelſberg in the Hartz; Salſburg; France; Spain; Montalto in Tuſcany; Norberg, Fahlun, Sunnerſkog, and Smoland in Sweden; Friedrichſminde, and many other places in Norway; Nolfoe, one of the Faroe Iſlands; the Bear Iſlands in the White Sea.

Aſia.—In the Uralian Mountains, particularly on the eaſt ſide; in the Altain Mountains; Kaſan; Schlangenberg; Mednoi Oſtrow one of the Kurile Iſlands on the eaſtern coaſt of Kamſchatka; on the banks of the river Bolſchaja in Kamſchatka; Japan and China.

America.

America.—On the banks of the Ohio in Canada; Copper Mine river on the confines of the Arctic Ocean; Brafil; Chili.

Uſe.

The copper uſed for economical and other purpoſes is obtained from the ores of copper afterwards to be deſcribed, native copper ſeldom occurring in any conſiderable quantity. Combined with zinc it forms the uſeful compound called Braſs, and with tin, Bell-metal or bronze. It is alſo uſed in coinage, either pure, or when combined with gold or ſilver, to which it gives a greater degree of tenacity. Its oxide is employed in colouring glaſs and porcelain green; and when combined with acetic acid, it affords the well-known pigment called Verdigris. Great quantities of it are uſed for ſheathing the bottom of ſhips intended for long voyages into warm climates, to preſerve them from the attack of the *teredo navalis* and other deſtructive vermes; when covered with tin, for culinary veſſels. The ancients employed a compound of Cyprian copper, gold and ſilver, in unknown proportions, to form the famous Corinthian metal, to which the Greeks attached an extraordinary value.

Obſervations.

1. It is frequently found in great maſſes diſperſed over the ſurface of the earth, in uncultiva-

ted

ted countries; hence Werner conjectures, that it was the firſt metal worked by man. It is ſtill found in looſe maſſes in the uncultivated and thinly inhabited regions on the banks of the Ohio in Canada, and the Kurile Iſles; and Profeſſor Vandilli informs us, that a maſs weighing 2600 Portugueſe pounds was found in a valley near Cachoeira in the Brazils.

2. When iron-plates are put into a ſolution of copper vitriol, their ſurfaces ſoon become covered with a coating or cruſt of malleable copper, which is called Copper of Cementation. As copper thus formed is an artificial product, it cannot be included in a ſyſtem of oryctognoſy.

3. Native copper is diſtinguiſhed from copper-nickel by its malleability and inferior degree of hardneſs; copper-nickel being ſemihard, bordering on hard, and brittle.

SECOND SPECIES.

Copper-glance.

Kupferglas.—*Werner.*

This ſpecies contains two ſubſpecies. 1. Compact Copper-glance. 2. Foliated Copper-glance.

FIRST

FIRST SUBSPECIES.

Compact Copper-glance.

Dichtes Kupferglas.—*Werner.*

Id. Werner, Pabſt. 1. b. ſ. 71.—Compact vitreous Copper-ore, *Kirw.* vol. ii. p. 144.—Dichtes Kuper Glanzerz, *Eſtner*, 3. b. ſ. 476.—Kupferglas, *Emm.* 2. b. ſ. 223.—Cuivre ſulphuré, *Hauy*, t. 3. p. 551.-555.—Le Cuivre vitrieux compacte, *Broch.* t. 2. p. 162.—Dichtes Kupferglanz, *Reuſs*, 3. b. ſ. 401.

External Characters.

Colour dark lead-grey, which paſſes into blackiſh-grey; and has often a tempered-ſteel coloured tarniſh.

Occurs maſſive, diſſeminated, in membranes, and rarely cryſtallized, in

1. Low equiangular ſix-ſided priſms, which are either perfect or truncated in the terminal edges.
2. Double ſix-ſided pyramid, truncated on the extremities.
3. Octahedron.
4. Perfect cube, having convex lateral planes, and ſometimes truncated on its angles.
5. Three-ſided table, truncated on its angles.

The cryſtals are ſmall and very ſmall, ſeldom middle-ſized, and are in general very rare.

Externally ſhining.

Internally it is intermediate between ſhining and

and gliſtening, and ſometimes even paſſes into glimmering; it is moſt commonly gliſtening, and its luſtre is metallic.

Fracture, ſmall and fine-grained uneven, which paſſes into ſmall conchoidal, and large and flat conchoidal, and ſometimes into even.

Fragments indeterminately angular, more or leſs ſharp-edged.

Retains its colour, and is ſhining in the ſtreak.

Is ſoft.

Perfectly ſectile.

Eaſily frangible.

Heavy.

Specific gravity, 4.888 to 5.338, *Gellert*; 5.452, Corniſh, *Kirwan*; 4.129, Hungarian, *Kirwan*; 4.8648, *Hauy*.

Conſtituent Parts.

The Siberian, according to *Klaproth*,

Copper,	78.5
Iron,	2.25
Sulphur,	16.5
Sllica,	0.75

SECOND SUBSPECIES.

Foliated Copper-glance.

Blättriches Kupferglanz.—*Werner*.

Id. Werner, Pabſt. 1. b. ſ. 73.—Foliated vitreous Copper-ore, *Kirw.* vol. ii. p. 146.—Blättriges Kupferglanzerz, *Eſtner*,

3. b. f. 477.—Blättriches Kupferglas, *Emm.* 2. b. f. 225.—Le Cuivre vitreuſe lamelleux, *Broch.* t. 2. p. 164. — Blättriches Kupferglanz, *Reuſs*, 3. b. f. 403.

External Characters.

Colour is the ſame as that of the preceding ſubſpecies.

Occurs maſſive and diſſeminated. Werner has never obſerved it cryſtallized ; but he ſuppoſes, from its fracture, that it may exiſt in regular figures.

Principal fracture ſhining ; croſs-fracture glimmering, with a metallic luſtre.

Principal fracture pretty ſtraight foliated, with a ſingle cleavage ; croſs-fracture fine-grained uneven.

Fragments indeterminately angular, blunt-edged.

Occurs always in coarſe and fine granular diſtinct concretions.

In the remaining characters, it agrees with the preceding ſubſpecies.

Chemical Characters of the Species.

Before the blow-pipe, on charcoal, it melts very eaſily, and yields a globule of copper, covered with a blackiſh-coloured ſcoria. When melted with borax, it communicates to it a green colour ; and when digeſted with ammonia, it tinges it blue.

Geognoſtic

Geognoſtic Situation of the Species.

It occurs in veins and beds, in primitive and floetz mountains, and is uſually accompanied with malachite and red and brown iron-ochre; frequently alſo with copper-green.

It occurs in primitive limeſtone at Saſka in the Bannat of Temeſwar; in talc-ſlate at Blanſko in Moravia; in beds and veins in bituminous marl-ſlate in Thuringia; in amygdaloid in Deux Ponts.

Geographic Situation.

It is found at Poldice, Cookſkitchen, Carrarach, Wheal Virgin, Redruth, Doleſath in Cornwall; Atwod and Sunners-Kog in Sweden; Swapawary in Lapland; Kongſberg in Norway; the Bear Iſlands in the White Sea; Lautenthal in the Hartz; Limberg, Klucken, Pieſendorf, Schwarzleogang in Salzburg; Kupferberg, Haſel and Prauſnitz, Streckenbach, Dittmanſdorf and Rudelſtadt in Sileſia; Nohfelden in Deux Ponts; Schiltach in Würtemberg; Rheinbreitenbach in the electorate of Cologne; Frankenberg, and Thalliter in Heſſia; Saalfeld, Bottendorf, Eiſleben and Sangerhauſen in Thuringia; Freyberg, Marienberg, Schneeberg, Glaſhütte, Berggieſhübel, Deutch-Neudorf in the electorate of Saxony; Falkenſtein near Schwatz, and Ringenwechel in the Tyrol; Deva in Tranſilvania; Newſohl, Iglo,

Iglo, Schmolnitz and Schwedeln in Hungary; Blanſko in Moravia; Graupen, Zinnwald and Catharinenberg in Bohemia.

Uſe.

It affords upwards of ſixty pounds of copper in the hundredweight, and hence is worked as an ore of copper.

Obſervations.

1. The tarniſhed varieties of copper-glance incline, and even paſs into variegated copper-ore.

2. It is rather a ſcarce ore of copper, and although it is found in many different places, it does not occur in very great abundance.

3. It is ſometimes confounded with fahl-ore.

4. The Frankenberg, or Heſſian corn-ears, are ſometimes aggregations of ſmall cryſtals of copper-glance; ſometimes, according to Mr Monch, true petrifactions of the *phalaris pulpoſa*, compoſed of copper-glance, white copper-ore and fahl-ore. They have ſometimes a thin covering of native ſilver.

5. Copper-glance is ſectile, but fahl-ore is brittle,—characters which diſtinguiſh theſe ſpecies from one another. Red copper-ore yields a red ſtreak, and has a red colour,—characters which diſtinguiſh it from this ſpecies. It has been confounded with ſilver-glance, from which it is diſtinguiſhed by many characters, and, in particular, by its inferior

degree

degree of tenacity; filver-glance cutting into flices with a knife, whereas copper-glance feparates into fmall grains.

THIRD SPECIES.

Variegated Copper-Ore.

Buntkupfererz.—*Werner.*

Cuprum lazureum, *Wall.* t. 2. p. 278.—Bunt Kupfererz, *Wern.* Pab. 1. b. f. 73.—*Id. Wid.* f. 744.—Cuivre fulphuré violet, *De Born.* t. 2. p. 311.—Purple Copper-Ore, *Kirw.* vol. ii. p. 142.—Bunt Kupfererz, *Eſtner*, 3. b. f. 489.—*Id. Emm.* 2. b. f. 228.—La Mine de Cuivre panachée ou violette, *Broch.* t. 2. p. 166.—Cuivre pyriteux hepatique, *Hauy*, t. 3. p. 536.—Buntkupfererz, *Reuſs*, 3. b. f. 410.

External Characters.

Its freſh colour is intermediate between copper red and pinchbeck-brown; it however ſoon acquires a tarniſh, which is firſt reddiſh, then the red paſſes ſucceſſively into violet-blue, azure-blue and ſky-blue, and laſtly into green; yet ſeveral of theſe colours are to be obſerved on the ſame maſs, ſo that it has a variegated aſpect, and of theſe colours the blue is uſually the predominant, and the green occurs only in ſpots.

Occurs maſſive, diſſeminated, in plates, in membranes, and, it is ſaid, alſo cryſtallized in octahedrons.

Internally

Internally ſhining or gliſtening, and its luſtre is metallic.

Fracture ſmall and rather imperfect conchoidal, which ſometimes approaches to fine-grained uneven.

Fragments indeterminately angular; not particularly ſharp-edged.

Neither colour nor luſtre are changed in the ſtreak.

Is ſoft.

Sectile in a ſlight degree.

Eaſily frangible.

Heavy.

Specific gravity, from the Bannat, 4.956, *Kirwan*; from Lorraine, 4.983, *Kirwan*; 4.300, *La Metherie*; 5.467, *Wiedenman*.

Chemical Characters.

Before the blow-pipe, it is affected nearly in the ſame manner as copper-glance.

Conſtituent Parts.

	From Hitterdahl in Norway.	From Rudelſtadt in Sileſia.
Copper,	69.50	58
Sulphur,	19.0	19
Iron,	7.50	18
Oxygen,	4.0	5
	100	100

Klaproth, b. 2. ſ. 281.

Geognoſtic Situation.

Occurs in beds, veins, and diſſeminated in rocks of different formations. It would appear to occur in greateſt quantity in primitive mineral beds. It is uſually accompanied with copper-pyrites and copper-glance, but rather more frequently with the firſt, and ſometimes alſo with malachite, copper-azure, fahl-ore, iron-ochre, and iron-pyrites.

At Rezbanya it occurs with aſbeſtous tremolite, olive-green coloured garnet, in calc-ſpar; at Dognaczka with pale olive-green and browniſh coloured common garnet, ſmall granular blende, copper-pyrites, copper-green, and malachite, in calc-ſpar or quartz; at Saſka with maſſive calc-ſpar and fahl-ore; at Oravicza in aſbeſtous tremolite, with calc-ſpar; at Deva in greyiſh-white cryſtallized amethyſt; at Rudelſtadt with heavy-ſpar and copper-pyrites; at Friedrickſminde with calc-ſpar and chlorite-ſlate; at Aardal with quartz, actynolite, fibrous malachite, copper-pyrites, and copper-green, ſeldom with native-gold and felſpar; at Moſs with iron-ſhot copper-green and browniſh-red garnet; in the mines of Arendal with brown iron-ochre, fibrous malachite, and reddiſh-brown garnet; at Kongſberg with native ſilver; in the diſtrict of Mansfeld, it occurs in bituminous marl-ſlate; in Sweden in mica-ſlate.

Geographic

Geographic Situation.

Cornwall; Friedrickſminde, Aardal, Omdal, Moſs, Arendal, Hitterdahl, Guldnaes, and Kongſberg in Norway; Wärmeland, Smoland, Dalecarlia, and Weſt Gothland in Sweden; Petrowſkoi Zawod in Finnland; in the Woizer Mines in the mountains of Olnetz in Ruſſia; France; Catharinenberg in Bohemia; Groſs-kamſdorf, Marienberg, Berggieſhübel, Wolkenſtein and Freyberg in the electorate of Saxony; Eiſleben, Bottendorf, Sangerhauſen, Saalfeld and Ilmenau in Thuringia; Schiltach and Bulach in Würtemberg; Thalitter in Heſſia; Leogang in Salzburg; Lautenthal in the Hartz; Kupferberg, Rudelſtadt, and Altenberg in Sileſia; Deva in Tranſilvania; Dognaczka, Saſka, Oravicza, and Moldavia, in the Bannat; Rezbanya in Hungary.

Uſe.

Copper is extracted from it, but it is not ſo eaſily reduced as copper-glance. It yields from 50 to 70 *per cent.* of copper.

Obſervations.

1. It is, by its external characters and chemical compoſition, an intermediate ſpecies between copper-glance and copper-pyrites.

2. It occurs equally abundant with copper-glance, but not in ſuch great quantity as copper-pyrites.

3. It

3. It was formerly confounded with copper-glance, copper-pyrites, and red copper-ore; but Werner aſcertained it to be a diſtinct ſpecies, and gave it its preſent name from its tarniſh, which is one of the moſt ſtriking features in its external aſpect.

4. Mr Brochant ſuppoſes it to be identical with copper-glance, and that therefore the characters which Werner conſiders as diſtinguiſhing it from that ſpecies are not ſufficiently characteriſtic.

FOURTH SPECIES.

Copper-Pyrites.

Kupferkies.—*Werner.*

Minera Cupri flava, *Wall.* t. 2. p. 282.—Mine de Cuivre jaune, *Rom. d. L.* t. 3. p. 309. — Kupferkies, *Wern.* Pabſt. b. 1. ſ. 75.—*Id. Wid.* ſ. 746. — Copper-Pyrites, or Yellow Copper-Ore, *Kirw.* vol. ii. p. 140. — Mine de Cuivre jaune, *De Born* t. 2. p. 313.—Kupferkies, *Eſtner*, b. 3. ſ. 494.—*Id. Emm.* b. 2. ſ. 232.—Cuivre pyriteux, *Lam.* t. 1. p. 197.—La Pyrite cuivreux, *Broch.* t. 2. p. 169. — Kupferkies, *Reuſs*, b. 3. ſ. 415.

External Characters.

On the freſh fracture, its colour is braſs-yellow, of different ſhades: that which contains the greateſt quantity of copper has a deep-yellow colour, approaching to gold-yellow; the poorer va-

rieties approach to greyiſh braſs-yellow and ſteel-grey.

It is uſually tarniſhed, either with variegated colours, as pavonine, columbine, and ſometimes tempered ſteel-coloured, or with ſimple colours, as blue and black.

The tarniſhed colours occur ſometimes on the mineral in the boſom of the earth, ſometimes by the expoſition of the recent fracture to the action of the air.

Occurs maſſive, diſſeminated, and in membranes; alſo dendritic, reniform, botryoidal, ſtalactitic, ſpecular, amorphous; and cryſtallized as follows:

1. Tetrahedron. It is either perfect, or its angles are acuminated by three planes, which are ſet on the lateral planes; or they are truncated. When the angles on the baſe are ſlightly, but thoſe of the ſummit deeply truncated, there is formed a
2. Six-ſided table, in which the terminal planes are ſet alternately oblique and ſtraight on the lateral planes.
3. Octahedron, either perfect, or truncated on its edges, thus forming the intermediate cryſtal between the octahedron and garnet dodecahedron.
4. Garnet dodecahedron.
5. Twin cryſtal, reſembling that of the ſpinelle, which is formed by the unition of two ſegments

ments of deeply truncated tetrahedrons, joined baſe to baſe, ſo that the conjoined trunca-
tures form three re-entering angles, and the lateral planes three ſalient angles.

The cryſtals are uſually ſmall and very ſmall, and generally ſuperimpoſed.

Externally intermediate between gliſtening and ſhining, often ſplendent.

Internally ſhining, which in ſome varieties paſſes into glimmering; luſtre metallic.

Fracture moſt commonly coarſe and ſmall-grained uneven: the coarſe-grained paſſes on the one hand into imperfect and ſmall conchoidal, and from this into imperfect foliated: the ſmall-grained paſſes into fine-grained uneven, and into even, and large and flat conchoidal. The luſtre varies with the fracture; the foliated has the ſtrongeſt luſtre, and its colour approaches to gold-yellow: the next in intenſity of luſtre is the conchoidal; and the large conchoidal and even, have the leaſt luſtre, being only glimmering.

Fragments indeterminately angular, not particularly ſharp-edged.

It is intermediate between ſemihard and ſoft.

Brittle.

Eaſily frangible.

Heavy.

Specific gravity, 4.160, *Gellert*; 4.080, *Kirwan*; 4.344, *Briſſon*; 4.3154, *Hauy*.

Chemical

Chemical Characters.

Before the blow-pipe, on charcoal, it decrepitates, emits a greeniſh-coloured ſulphureous ſmoke, and melts into a black globule, which, by continuing the fire gradually, aſſumes the metallic luſtre of copper. It imparts to borax a green tinge.

Conſtituent Parts.

Copper,	40	41.
Iron,	40	17.1
Sulphur,	20	45.1
	100	103.2
	According to *Sage.*	*Lampadius.*

It ſometimes alſo contains ſmall portions of gold or ſilver.

Geognoſtic Situation.

It is one of the moſt abundant ores; it occurs in almoſt every kind of repoſitory, and in all the great claſſes of rocks. In primitive mountains it is found both in beds and in veins; and the beds are ſometimes of great thickneſs. It occurs even in the oldeſt metalliferous formations, as with tin; often alſo with lead-glance and other ores, among which the moſt common are malachite and tile-ore, ſeldomer iron pyrites, ſparry ironſtone, magnetic ironſtone and blende. It forms a great bed in gneiſs at Graupen in Bohemia, ſmall beds in mica-ſlate at Gieren and Queerbach, in clay-ſlate at Seichau, and in primitive trap at Kupferberg in Bohemia. It is found in tranſition mountains at

Rammelsberg

Rammelſberg in the Hartz, and in beds and veins accompanied with variegated copper-ore and copper-glance, in bituminous marl-ſlate in the diſtrict of Mansfeld in Thuringia.

Geographic Situation.

At Poldice, and Dolcoath, &c. in Cornwall; Ecton Mine in Staffordſhire; in many places in Derbyſhire; the iſland of Angleſea in Wales, where it probably occurs as a lying maſs (liegende ſtöcke); Mainland, one of the Shetland iſlands, and in many other places in England and Scotland. Its continental localities are extremely numerous: of theſe I ſhall only mention in general Norway, Sweden, Ruſſia, Hanover, Heſſia, electorate of Saxony, Bohemia, Sileſia, Auſtria, Hungary, Spain, Siberia, and Chili in South America.

Uſe.

Nearly one-third of all the copper which is obtained by metallurgic operations, is extracted from this ſpecies; it is, however, a poor ore, ſeldom yielding above 36 pounds, more commonly only 20 pounds of copper in the hundred. Sulphur is frequently obtained from it by ſublimation.

Obſervations.

1. From gold, it is diſtinguiſhed by fracture, it having a conchoidal, uneven or imperfect foliated fracture,

fracture, whereas gold has a hackly fracture; by tenacity, it being brittle, whereas gold is completely malleable.

2. It is diſtinguiſhed from iron-pyrites by its hardneſs, it being only intermediate between ſemihard and ſoft, whereas iron-pyrites gives fire with ſteel; by colour, iron-pyrites being bronze-yellow, whereas it is braſs-yellow; and the cryſtallizations are alſo very different from thoſe of iron-pyrites; in particular, it occurs in tetrahedrons, a form never obſerved in iron-pyrites.

3. It paſſes into ſeveral other ſpecies of ore, particularly into white copper-ore, fahl-ore, and variegated copper-ore.

4. The ſofter varieties of copper-pyrites contain the greateſt quantity of copper, and the harder the greateſt proportion of iron. Among the ſofter varieties, thoſe having a tarniſhed ſurface are ſaid to contain the greateſt quantity of copper.

5. Thoſe varieties that contain the largeſt proportion of ſulphur, are the leaſt affected by expoſure to the air.

FIFTH SPECIES.

White Copper-Ore.

Weiſs Kupfererz.—*Werner.*

Minera Cupri alba, *Wall.* t. 2. p. 280.—Weiſs Kupererz, *Werner*, Pabſt. b. 1. ſ. 83.—*Id. Wld.* ſ. 750.—White Copper-ore, *Kirw.*

Kirw. v. ii. p. 152.—Weiſs-Kupererz, *Eſtner*, b. 3. ſ. 505.—*Id. Emm.* b. 2. ſ. 236.—Mine de Cuivre blanche arſenicale, *Lam.* t. 1. p. 201.—La Mine de Cuivre blanche, *Broch.* t. 2. p. 173.—Weiſs Kupererz, *Reuſs*, b. 3. ſ. 425.

External Characters.

Its colour is intermediate between ſilver-white and bronze yellow, which ſometimes inclines ſlightly to braſs-yellow. On the freſh fracture, it ſoon becomes tarniſhed with a greyiſh-yellow colour.

Occurs maſſive and diſſeminated *.

Internally gliſtening, with a metallic luſtre.

Fracture ſmall and fine-grained uneven.

Fragments indeterminately angular, not particularly ſharp-edged.

Soft, paſſing into ſemihard.

Brittle.

Eaſily frangible.

Heavy.

Specific gravity, 4·500.—*La Metherie.*

Chemical Characters.

Before the blow-pipe, it yields a white ſmoke, which has an arſenical ſmell, and laſtly melts into a greyiſh-black ſlag.

Conſtituent

* According to Karſten and Ullman, it occurs cryſtallized in octahedrons.

Conſtituent Parts.

Henkel, who gave the firſt notice reſpecting this ore, informs us, that it contains 40 parts of copper, and the remainder conſiſts of iron, arſenic, and ſulphur.

Geognoſtic Situation.

It occurs in veins and mineral beds in primitive mountains. It is uſually accompanied with copper pyrites and copper-glance, ſeldomer with fahlore.

Geographic Situation.

In the mine, called Huel Gorland in Cornwall; in the mines Lorenz Gegentrum and Elias near Freyberg in the electorate of Saxony; Rudelſtadt, Altenberg, and Kupferberg in Sileſia; Frankenberg in Heſſia; Chriſtophſthal near Freüdenſtadt in Wurtemberg; Strazena behind the Creuzberg in Upper Hungary; Catharinenburg in Siberia; and Chili in South America.

Obſervations.

1. It has been frequently confounded with copper-pyrites, copper-glance, grey copper-ore, and arſenical pyrites. It is however eaſily diſtinguiſhed from copper-pyrites, copper-glance and grey copper-ore, by its colour, and from arſenical pyrites by its leſs ſpecific gravity.

2. It

2. It is one of the rareſt ſpecies of copper-ore.
3. It is an intermediate ſpecies between copper-pyrites and fahl-ore or grey copper-ore, into both of which it probably paſſes.

SIXTH SPECIES.

Grey Copper-Ore, or Fahl-Ore.

Fahlerz.—*Werner.*

Minera Cupri griſea, *Wall.* t. 2. p. 281. — Mine d'Argent griſe, et Mine de Cuivre griſe, *Rom. de L.* t. 3. p. 315.—Fahlerz, *Werner*, Pabſt. b. 1. ſ. 83.—*Id. Wid.* ſ. 751.—Grey Copper-ore, *Kirw.* vol. ii. p. 146. — Fahlerz, *Eſtner*, b. 3. ſ. 509.—*Id. Emm.* b. 3. ſ. 238. — Argent gris, *Lam.* t. 1. p. 133.—Mine d'une couleur fauve, ou le Cuivre gris, ou le Fahlerz, *Broch*, t. 2. p. 175.—Cuivre gris, *Hauy*, t. 3. p. 536,-556.—Fahlerz, *Reuſs*, b. 4. ſ. 198.

External Characters.

Its moſt common colour is ſteel-grey, which paſſes on the one hand into iron-black, (this variety contains the greateſt proportion of ſilver); on the other hand, into a colour which is intermediate between ſteel-grey and lead-grey, (and this variety contains the greateſt proportion of antimony): it ſometimes alſo inclines towards yellow, when it is paſſing to copper-pyrites; and varieties with this colour contain the greateſt proportion of copper.

It occurs rarely with a tempered-ſteel coloured tarniſh.

Occurs maſſive, diſſeminated, ſeldom in membranes, and often alſo cryſtallized; its cryſtallizations are the following:

1. Tetrahedron, or ſimple three-ſided pyramid, which is either
   a. Perfect.
   b. Truncated on the edges.
   c. Bevelled on the edges. When the bevelling edges increaſe ſo much as to cauſe the faces of the tetrahedron to diſappear, there is formed a tetrahedron, having each plane divided into three, or there is formed on each of the planes a very obtuſe acumination.
   d. Truncated on the angles. When the ſummit and the edges of the baſis are very deeply truncated, there is formed a three-ſided table, having its terminal planes bevelled.
   e. Each of its angles acuminated by three planes, which are ſet on the lateral planes; ſometimes the edges and the extremities of theſe acuminations are truncated. When theſe acuminations increaſe ſo much, that the original planes of the tetrahedron diſappear, there is formed
2. The garnet dodecahedron.
3. When the truncations on the angles of the tetrahedron meet, the octahedron is formed,—

a figure, however, which has ſcarcely been obſerved in this ſpecies.

Cryſtals ſmall and ſeldom middle-ſized; uſually heaped on one another, ſometimes alſo ſuperimpoſed.

Their ſurface is ſhining and ſplendent.

Internally it is uſually gliſtening; ſometimes, however, it paſſes into ſhining, and has a metallic luſtre.

Fracture coarſe and ſmall-grained uneven; ſometimes it inclines to imperfect conchoidal, and ſuch varieties have a black colour, the ſtrongeſt luſtre, and contain the greateſt proportion of ſilver, and the leaſt of copper.

Fragments indeterminately angular, pretty blunt-edged.

Is more or leſs ſemihard.

Gives a reddiſh-brown ſtreak: ſome varieties do not produce any alteration of colour*.

Brittle.

Eaſily frangible.

Heavy.

Specific gravity, 4·594, *Wiedemann.*
4.8648, *Hauy.*
4·4460 to 4560, *Bournon.*

Chemical

* According to Count de Bournon, thoſe varieties that afford a reddiſh-brown ſtreak, may be preſumed to contain a mixture of ſilver and antimony, generally combined together, in the ſtate of red ſilver-ore.

Chemical Characters.

Before the blow-pipe, it firſt decrepitates, and then melts into a greyiſh-coloured brittle metallic globule. During fuſion it diſengages a white ſmoke: to borax it communicates a yellowiſh colour inclining to red. Some varieties are difficult of fuſion.

Conſtituent Parts.

From *Andreaſberg.*		*Piedmont.*	
Copper,	16.25		29.3
Sulphur,	10.00		12.7
Antimony,	16.00		36.9
Silver,	2.25		0.7
Iron,	13.75		12.1
Silica,	2.50	Alumina,	1.1
Lead,	34.50	Arſenic,	4.0
Loſs,	4.75		3.2
	100		100
Klaproth.		*Napione.*	

Mr Chenevix examined ſpecimens of this ore, from Kapnick in Tranſilvania, Markirch in Alſace, Andreaſberg in the Hartz, Groſſmandorf in Saxony, Freyberg in Saxony, Heſſia, and from the Alps of Dauphiny, but not one of them contained a particle of lead or of ſilver, but they all contained antimony, although in ſuch various proportions as to exhibit the following differences: viz. $\frac{38}{100}$, $\frac{28}{100}$, $\frac{17}{100}$, $\frac{10}{100}$, and $\frac{5}{100}$. The ſame excellent chemiſt

miſt examined ſeveral ſpecimens of maſſive fahlore, and which he found to contain nothing but ſulphur, copper and iron, without any trace of antimony. He alſo analyzed ſeveral tetrahedral cryſtals of this ore found in Cornwall, and theſe he found to contain nothing but copper, iron and ſulphur, in the following proportions: namely, $\frac{52}{100}$ of copper, $\frac{33}{100}$ of iron, $\frac{14}{100}$ of ſulphur. From theſe analyſes, Count de Bournon concludes, that fahlore is nothing more than a ſimple combination of ſulphur with copper and iron, and that the other ingredients which are ſometimes met with in it, are to be conſidered as accidental, and introduced into the ſpecies by what he terms the heterogeneous attraction of aggregation.

Geognoſtic Situation.

It occurs in the newer primitive rocks, as in clay-ſlate, alſo in tranſition and floetz rocks. In primitive rocks it occurs uſually in veins, but in tranſition and floetz rocks moſt commonly in beds. It is often accompanied with copper-pyrites, lead-glance, manganeſe, ſparry ironſtone, heavy-ſpar, fluor-ſpar and quartz; more ſeldom with malachite, copper-azure and other ores of copper.

In the Saxon Erzgebirge it occurs uſually with copper-pyrites, ſparry ironſtone, quartz, calc-ſpar, heavy-ſpar and fluor-ſpar; in the Hartz with copper-pyrites, ſparry-ironſtone, in grey-wacke and clay-

clay-ſlate; in Dauphiny with malachite, calc-ſpar and quartz.

Geographic Situation.

In ſeveral mines in Cornwall, and in Ayrſhire in Scotland; at Catharinenberg and Skalka near Kuttenberg in Bohemia; in Upper and Lower Hungary; Tranſilvania; Bannat; Stiria; the Tyrol; Salzburg; at Freyberg, Gerſdorf, Scharfenberg, Kamſdorf, in Saxony; Saalfeld in Thuringia; at Kupferberg, Dittmansdorf, Rudelſtadt, Gablau, and Leipe in Sileſia; Heſſia; Wurtumberg; Deux Ponts; at Clauſthal, Zellerfeldt, and Andreaſberg in the Hartz; Weſt Gallicia; France; Bagony in Navarre in Spain; Poſtua in Piedmont, Savoy, Bergamo in the Venetian territory, Seravezza in Tuſcany, Fondachelli in Sicily, in Italy; Sweden; Norway; Siberia; Chili.

Uſe.

It is uſually worked on account of the copper which it contains; ſometimes alſo when it contains ſilver, as an ore of ſilver.

Obſervations.

1. Black ſilver-ore is diſtinguiſhed from this ſpecies, by its darker colour, ſtronger luſtre and conchoidal fracture.

2. It

2. It paſſes ſometimes into copper-pyrites, and ſometimes into copper-glance.

3. It is the moſt compounded of all the ores of copper.

SEVENTH SPECIES.

Copper-Black.

Kupferſchwärze.—*Werner.*

Ochra Cupri nigra, *Wall.* t. 2. p. 291.—Kupferſchwärtze, *Wern.* Pabſt. b. 1. ſ. 88.—*Id. Wid.* ſ. 755. — Black Copper-ore, *Kirw.* vol. ii. p. 143. — Kupferſchwärtze, *Emm.* b. 2. ſ. 244. — *Id. Eſtner*, b. 3. ſ. 525. — Oxide noir de Cuivre, *Lam.* p. 312.—Le Cuivre noir, *Broch.* t. 2. p. 180. — Kupferſchwärtze, *Reuſs*, b. 3. ſ. 431.

External Characters.

Its colour is uſually intermediate between bluiſh and browniſh-black, but rather more inclining to browniſh-black.

Is friable.

Occurs maſſive, ſometimes diſſeminated, and ſometimes thinly coating other ores of copper.

Is compoſed of dull duſty particles, which ſcarcely ſoil.

Is almoſt always more or leſs cohering.

Is heavy.

Chemical

Chemical Characters.

Before the blow-pipe it emits a ſulphureous odour, and melts into a ſlag, which communicates a green colour to borax.

Conſtituent Parts.

It is ſaid to contain from 40 to 50 parts in the hundred of copper.

Geognoſtic Situation.

It occurs uſually with copper-pyrites, malachite, copper-green, and copper-glance; ſometimes alſo with native-copper, red copper-ore, copper-azure, quartz, fluor-ſpar, heavy-ſpar, and brown-ſpar.

Geographic Situation.

It is found very beautiful at Kupferberg and Rudelſtadt in Sileſia. It is alſo found at Roſenau and Schmölnitz in Hungary; at Moldawa, Dognatſka, and Saſka in the Bannat; at Falkenſtein in the Tyrol; Stiria; in the mine called Lorenzgegentrum near Freyberg, and at Kamſdorf in the electorate of Saxony; Franconia; Swabia; Heſſia; Salzburg; France; Sweden; Norway; Siberia.

Obſervation.

It is probably formed by the decompoſition of copper-glance and copper-pyrites.

EIGHTH

EIGHTH SPECIES.

Red Copper-Ore.

Rothkupfererz.—*Werner.*

Rothkupfererz, *Wid.* f. 757.—Florid red Copper-Ore, *Kirw.* vol. ii. p. 135.—Roth Kupfererz, *Eſtner*, b. 3. f. 530.—*Id. Emm.* b. 2. f. 213.—Mine de Cuivre rouge, ou le Cuivre Oxide rouge, *Broch.* t. 2. p. 181.

This ſpecies is, by Werner, divided into three ſubſpecies: 1. Compact: 2. Foliated: 3. Capillary.

FIRST SUBSPECIES.

Compact Red Copper-Ore.

Dichtes Rothkupfererz.—*Werner.*

Id. Werner, Pabſt. b. 1. f. 66.—Compact florid, or Cochineal-red Copper-Ore, *Kirwan*, vol. ii. p. 135.—Dichtes Roth Cupfererz, *Eſtner*, b. 3. f. 530.—*Id. Emm.* b. 2. f. 213.—Le Cuivre Oxide rouge compacte, *Broch.* t. 2. p. 181.—Dichtes Rothkupfererz, *Reuſs*, b. 3. f. 433.

External Characters.

Colour dark cochineal-red, faintly inclining to lead-grey.

Occurs maſſive, in membranes, corroded, amorphous, and alſo diſſeminated.

Internally glimmering, inclining to gliſtening, and its luſtre is ſemimetallic.

Fracture even.

Fragments indeterminately angular, not particularly ſharp-edged.

Is almoſt always unſeparated.

Is opaque.

Gives a tile-red ſtreak, and loſes thereby a little of its luſtre.

Is ſemihard.

Brittle.

Eaſily frangible.

Heavy.

SECOND SUBSPECIES.

Foliated Red Copper-Ore.

Blättriches Rothkupfererz.—*Werner.*

Id. Wern. Pabſt. b. 1. ſ. 66.—Foliated florid-red Copper-Ore, *Kirw.* vol. ii. p. 136.—Blätteriges Rothkupfererz, *Eſtner*, b. 3..ſ. 533.—*Id. Emm.* b. 2. ſ. 214.—Le Cuivre Oxide rouge lamelleux, *Broch.* t. 2. p. 183.—Blättriches Rothkupfererz, *Reuſs*, b. 3. ſ. 436.

External Characters.

Colour dark cochineal-red, which ſometimes inclines to lead-grey. Its cryſtals are redder, and paſs ſometimes into dark carmine-red.

Occurs

Occurs maſſive, diſſeminated, in membranes, corroded, amorphous, and cryſtallized. Its cryſtallizations are the following:

1. The cube, which is either perfect or truncated, ſometimes on its angles, ſometimes on its edges.
2. The octahedron, which is either perfect or truncated, ſometimes on its angles, and ſometimes on its edges. It is ſometimes alſo lengthened or cuneiform.

The cryſtals are uſually ſmall and very ſmall, ſeldom middle-ſized: they occur ſometimes aggregated on one another, ſide by ſide, and ſcalarwiſe.

The planes are ſmooth and ſplendent.

Internally it alternates from ſhining to gliſtening, and its luſtre is adamantine.

Fracture imperfect foliated, ſometimes alſo coarſe and ſmall-grained uneven.

Fragments indeterminately angular, not particularly ſharp-edged.

It is almoſt always unſeparated; ſometimes, however, it occurs in coarſe, ſmall, and fine granular diſtinct concretions. The fine granular paſſes into compact.

The maſſive varieties are uſually opaque, or very faintly tranſlucent on the edges. The cryſtals are tranſparent and ſemitranſparent, and ſometimes ſtrongly tranſlucent.

It yields a dirty tile-red ſtreak.

Is ſemihard.
Brittle.
Eaſily frangible.
Heavy.
Specific gravity 3.950.—*Wiedemann.*

THIRD SUBSPECIES.

Capillary Red Copper-Ore.

Haarförmiges Kupfererz.—*Werner.*

Kupferblüthe, *Werner*, Pabſt. b. 1. ſ. 68.—Fibrous red Copper-Ore, *Kirw.* vol. ii. p. 137.—Kupferblüthe, *Eſtner*, b. 3. ſ. 538.—*Id. Emm.* b. 2. ſ. 216.—Le Cuivre Oxide rouge capillaire, *Broch.* t. 2. p. 184.—Haarförmiges Rothkupfererz, *Reuſs*, b. 3. ſ. 439.

External Characters.

Its colour is moſt commonly carmine-red, which ſometimes approaches to cochineal-red.

Occurs in ſmall capillary cryſtals, alſo in thin tables, which are ſometimes aggregated into amorphous and ſcopiform flakes.

Is ſhining, and its luſtre is adamantine.

Is tranſlucent; but its internal aſpect, and the other external characters, cannot be determined, on account of the ſmallneſs of the parts of the mineral.

Chemical Characters of the whole Species.

It is eaſily reduced before the blow-pipe, and without

without emitting either ſmell or ſmoke. It diſſolves in muriatic acid without effervescence, but in nitrous acid with a briſk effervescence. We can thus diſtinguiſh it from cinnabar, which does not diſſolve, and from red ſilver-ore, which diſſolves with effervescence.

Conſtituent Parts.

Chenevix analyzed ſeveral Corniſh ſpecimens, and found them compoſed of about

88.5 Copper.
11.5 Oxygen.

Phil. Tranſ. for 1801.

Geognoſtic Situation.

It is found in almoſt every kind of repoſitory, but moſt frequently in veins; and it appears to be peculiar to the primitive mountains. It is uſually accompanied with native copper, malachite, and brown iron-ochre. It is ſometimes alſo found with copper-green, tile-ore, copper-pyrites, copper-glance, copper-azure, copper-black, and quartz, heavy-ſpar, and calc-ſpar.

Geographic Situation.

It is found in ſeveral of the mines in Cornwall; in Upper Hungary; Bannat; Saxony; Sileſia; Salzburg; Weſterwald; Rheinbreidenbach near Cologne; Hartz; Italy; Sweden; Norway; Siberia; Peru; Chili.

Uſe.

Uſe.

As it contains about 90 *per cent.* of copper, it is ſmelted as an ore of copper.

Obſervations.

1. The name of the *ſpecies* is derived from its colour; that of the *ſubſpecies* from the kind of fracture.

2. It is diſtinguiſhed from copper-glance by its colour; from red ſilver-ore by its cryſtallizations, and accompanying minerals; from cinnabar by its colour, weight, and accompanying minerals; from red antimony, by its colour, red antimony having a cherry-red colour.

NINTH SPECIES.

Tile-Ore.

Ziegelerz.—*Werner.*

Id. Wid. ſ. 760.—Brick-red Copper-Ore, *Kirw.* vol. ii. p. 137.—Ziegelerz, *Eſtner*, b. 3. ſ. 549.—*Id. Emm.* b. 2. ſ. 219.—Mine de Cuivre couleur de brique, ou le Ziegelerz, *Broch.* t. 2. p. 187.—Ziegelerz, *Reuſs*, b. 3. ſ. 443.

It is ſubdivided into two ſubſpecies: 1. Earthy: 2. Indurated.

FIRST SUBSPECIES.

Earthy Tile-Ore.

Erdiches Ziegelerz.—*Werner.*

Id. Wern. Pabſt. b. 1. ſ. 70.—Earthy Brick-red Copper-Ore, *Kirw.* vol. ii. p. 137.— Erdiges Ziegelerz, *Eſtner*, b. 3. ſ. 550.— *Id. Emm.* b. 2. ſ. 219.—Le Ziegelerz terreuſe, *Broch.* t. 2. p. 187.—Erdiges Ziegelerz, *Reuſs*, b. 3. ſ. 443.

External Characters.

Colour hyacinth-red, ſometimes alſo browniſh-red, which paſſes into a reddiſh-brown, that borders on yellowiſh-brown.

Is intermediate between friable and ſolid.

Occurs maſſive, diſſeminated, and incruſting copper-pyrites.

Is compoſed of dull duſty particles; but of earthy particles, when it is maſſive.

Soils ſlightly.

Is almoſt always coherent; ſome varieties incline to ſolid.

Heavy.

Geognoſtic and Geographic Situations.

Occurs in veins, and is uſually accompanied with native-copper and malachite, and ſometimes with red copper-ore.

At Rezbanya it occurs along with earthy copper-green, malachite and calc-ſpar; in mines in the Bannat, with copper-pyrites, compact and foliated red copper-ore, fahl-ore or grey copper-ore, compact malachite, ochrey ironſtone, flaggy iron-ſhot copper-green and native copper; at Falkenſtein in the Tyrol, with flaggy copper-green, malachite, fahl-ore or grey copper-ore, copper-azure, calc-ſpar and quartz.

SECOND SUBSPECIES.

Indurated Tile-Ore.

Feſtes Ziegelerz.—*Werner.*

Its colour is intermediate between hyacinth-red and browniſh-red, which paſſes on the one hand into a kind of lead-grey, and even into dark ſteel-grey; on the other hand, into a middle colour between blackiſh-brown and reddiſh-brown.

Occurs maſſive and diſſeminated.

Internally glimmering.

Fracture intermediate between even and large conchoidal, and ſometimes paſſes into ſmall conchoidal.

The reddiſh variety, which has the weakeſt luſtre, is uſually flat conchoidal; the darker variety, which has the ſtrongeſt luſtre, (it is called Pecherz), paſſes into ſmall conchoidal.

Fragments

Fragments indeterminately angular, more or lefs ſharp-edged.

Streak ſomewhat ſhining.

Semihard, paſſing into ſoft.

Rather brittle.

Pretty eaſily frangible.

Slightly heavy.

Chemical Characters.

Before the blow-pipe it becomes black, but is infuſible without addition. To borax it communicates a dirty-green colour.

Conſtituent Parts.

Werner conſiders it to be an intimate combination of red copper-ore and brown iron-ochre. It contains from 10 to 50 *per cent.* of copper.

Geognoſtic Situation.

Occurs in veins, and is uſually accompanied with copper-pyrites, fibrous malachite and iron-ochre.

Geographic Situation.

It is found at Rudnobanya, Dopſchau, &c. in Hungary; Bannat; at Saalfeld and Blankenberg in Thuringia, and Voightland in the electorate of Saxony; Naila in Bareuth; Rheinbreitenbach in the former archbiſhopric of Cologne; Weſterwald; Kupferberg in Sileſia; Lauterberg in the

Hartz; Höllenthal near Werfen in Salzburg; Aradals copper-work in Norway; Siberia; Chili.

Obſervations.

1. The red varieties contain the greateſt quantity of copper, and the brown the greateſt quantity of iron.

2. It is rather a common ore of copper, and occurs almoſt always where red copper-ore is found.

3. It paſſes ſometimes, by increaſe of the quantity of brown iron-ochre, into brown ironſtone.

4. Its name is derived from its colour, and that of the ſubſpecies from its ſtate of coheſion.

5. The dark-brown variety of indurated tile-ore, on account of the reſemblance of its fracture to pitch, has been denominated *Pitch-ore*, (Pecherz), and is, although unneceſſarily, deſcribed by Eſtner as a diſtinct ſpecies of copper-ore.

TENTH SPECIES.

Copper-Azure.

Kupferlazur.—*Werner.*

This ſpecies is divided into two ſubſpecies; 1. Earthy; 2. Indurated.

FIRST

FIRST SUBSPECIES.

Earthy Copper-Azure.

Erdiche Kupferlazur.—*Werner.*

Erdiche Kupferlazur, *Werner*, Pabſt. b. 1. ſ. 92. — *Id. Wid.* ſ. 762. — Earthy Mountain-blue, *Kirw.* vol. ii. p. 129.— Erdiche Kupferlazur, *Eſtner*, b. 3. ſ. 560. — *Id. Emm.* b. 2. ſ. 246.—L'Azur de Cuivre terreux, *Broch.* t. 2. p. 191.— Gemeine Kupferlazur, *Reuſs*, b. 3. ſ. 449.

External Characters.

Colour ſmalt-blue.

Is uſually friable, ſeldom maſſive, often diſſeminated and thinly coating.

Is compoſed of dull and fine duſty particles.

Does not ſoil, or at moſt very faintly.

Is almoſt always cohering.

Not particularly heavy, approaching to heavy.

Chemical Characters.

Before the blow-pipe it becomes black, but does not melt; it diſſolves in glaſs of borax with violent ebullition, and communicates to it a green colour. It diſſolves in acids with much effervescence.

Conſtituent Parts.

Copper,	69
Carbonic acid,	29
Water,	2
	100

Kirwan.

... *Geognoſtic*

Geognoſtic Situation.

It occurs in ſmall quantity, and is uſually accompanied with malachite and copper-green. In Sileſia, it is found incruſting bituminous marl ſlate; in Thuringia, coating varieties of the old red ſandſtone; and in Siberia, diſſeminated in ſandſtone.

Geographic Situation.

Bannat; Tranſilvania; Tyrol; Thalitter in Heſſe; Darmſtadt; at Saalfeld, Sangerhauſen, Bottendorf, and Eiſleben in Thuringia; Leogang, Brexenthal in Salzburg; Haſel, Praufnitz, &c. in Sileſia; Weſt Galicia; Norway; Siberia.

SECOND SUBSPECIES.

Indurated or radiated Copper-Azure.

Feſte Kupferlazur.—*Werner.*

Strahlige Kupferlazur, *Wern.* Pabſt. b. 1. ſ. 89. — *Id. Wid.* ſ. 764. — Striated Mountain-blue, *Kirw.* vol ii. p. 130.— Strahlige Kupferlazur, *Eſtner*, b. 3 ſ. 564.—*Id. Emm.* b. 2. ſ. 249.—L'Azur de Cuivre rayonné, *Broch.* t. 2. p. 192.— Strachliche Kupferlazur, *Reuſs*, b. 3. ſ. 453.

External Characters.

Its principal colour is azure-blue; it occurs alſo Berlin blue, and blackiſh blue, and very ſeldom inclines to ſmalt-blue. Theſe colours are of dif-

ferent

ferent degrees of intenſity, and they all appear to poſſeſs a ſlight tinge of red.

Occurs ſeldom maſſive, diſſeminated, and as a coating; ſometimes in membranes, more frequently botryoidal, ſmall reniform, ſtalactitic, cellular, but moſt frequently cryſtallized.

Its cryſtallizations are the following:

1. Broad rectangular four-ſided priſm, pretty acutely acuminated on both extremities by four planes, which are ſet on the lateral edges, and the lateral edges are ſometimes truncated.
2. Oblique four-ſided priſm, with two oppoſite ſmaller and two larger lateral planes, which is either perfect or acuminated by four planes, which are ſet on the lateral planes. Sometimes the priſm is ſo broad, that figures reſembling four or ſix ſided tables are formed. When the truncations on the lateral edges of the priſm become large, an eight-ſided priſm is formed, in which the acuminating planes are ſet on the ſmaller lateral planes. When two of the acuminating planes are ſmall in compariſon with the others, the acumination terminates in a line or edge; and if two of theſe planes entirely diſappear, a bevelment is formed, in which the bevelling planes are ſet on the diagonally oppoſite lateral edges.

3. Werner

3. Werner mentions alſo a broad rhomboidal cryſtal, as occurring in this mineral.

The cryſtals are ſometimes ſingly ſuperimpoſed, more frequently aggregated on one another, interſecting one another, alſo in thin druſy veſicles, and are ſaid alſo to occur aggregated in ſcopiform, globular, and budlike ſhapes.

The ſmaller lateral planes of the rectangular four-ſided priſm are longitudinally ſtreaked; the broader tranſverſely ſtreaked: the lateral planes of the oblique four-ſided priſm are longitudinally ſtreaked, but the planes of alteration in the truncating planes are ſmooth.

The particular external ſhapes have always a druſy ſurface.

Externally, the cryſtallized varieties are ſhining, but the maſſive and particular external ſhapes are dull.

Internally, it is ſhining and gliſtening, and its luſtre is intermediate between vitreous and reſinous.

Fracture narrow, ſtraight, and ſcopiform radiated, and ſometimes imperfect foliated. Said alſo to occur with ſmall conchoidal fracture.

The fragments of the radiated varieties are wedge-ſhaped; thoſe of the foliated and conchoidal ſplintery.

It is uſually unſeparated. It ſometimes, however, ſhews diſtinct concretions; the foliated occurs in ſmall and fine granular diſtinct concretions;

tions; and the reniform, botryoidal and ſtalactitic in curved lamellar diſtinct concretions, which are bent in the direction of the external ſurface.

The cryſtals are tranſlucent, paſſing into ſemi-tranſparent, and are ſometimes only tranſlucent on the edges.

It retains its colour in the ſtreak, only becomes a little lighter.

Soft.

Rather brittle.

Heavy in a low degree, approaching to not particularly heavy.

Specific gravity, 3.6082, *Briſſon*; 3.231, *Wiedemann*; 3.400, *Bindheim*.

Chemical Characters.

Soluble in nitrous acid with effervescence. Before the blow-pipe, it is nearly infuſible without addition, but with glaſs of borax it is eaſily reduced, and we obtain a globule of pure copper. The borax acquires a beautiful green colour.

Conſtituent Parts.

Copper, from	66	to	70
Carbonic acid,	18	to	20
Oxygen,	8	to	10
Water,	2	to	2
	94	to	102

According to *Pelletier*.

Geognoſtic

Geognoſtic Situation.

The minerals of this ſpecies occur more frequently in floetz than primitive mountains, and in the latter caſe more in thoſe of a newer formation. Thus, at Catharinenburg in Bohemia, and in the electorate of Triers, it occurs in gneiſs; at Kleingabel near Pries in Lower Hungary, in mica-ſlate, paſſing to clay-ſlate; at Zellerfeld in the Hartz in grey-wacke; in the limeſtone mountains of the Tyrol; in the floetz limeſtone of Krakau in Lower Saxony, and in the ſandſtone of the Uralian mountains.

There are two principal formations of this ſpecies; the one occurs at Saalfeld and in the Tyrol; and the other in the dutchy of Wurtemberg, and in the principality of Naſſau, and in ſeveral other places.

At Leadhills, in Scotland, it is accompanied with lead-glance, ochre of manganeſe, lead-earth, ſparry ironſtone, calamine, ochrey brown ironſtone, iron-pyrites, brown hematite, green lead-ore, white lead-ore and lead-vitriol.

In Hungary, it is accompanied with copper-pyrites, malachite, copper-green, grey copper-ore, and iron-ochre; in the Bannat, which produces very beautiful ſpecimens, it is accompanied with fibrous malachite, earthy tile-ore, compact red copper-ore, iron-ochre, copper-green, and aſbeſtous actynolite; near

near Laak in Upper Carniola, with quartz and malachite: In the diſtrict of Kamſdorf, in Saxony, it is accompanied with yellow and brown iron-ochre, iron-ſhot copper-green, and other ores of copper; at Saalfeld in Thuringia, with ſtraight lamellar heavy-ſpar, fahl-ore or grey copper-ore, malachite, iron-ſhot copper-green, tile ore, and iron-ochre; at Kupferberg, in Sileſia, with brown-ſpar and malachite: the Siberian, which rivals that of the Bannat in beauty, is accompanied with copper-green, malachite, tile-ore, green and white-lead ores, brown-ironſtone, heavy-ſpar and quartz.

Geographic Situation.

Beſides the preceding localities, the following are mentioned by mineralogiſts: Wheal Virgin and Carrarch in Cornwall; Moſchellandsberg in Deux Ponts; Thalitter in Heſſia; Zellerfeld and Blankenberg in the Hartz; Schwartzleogang and Brixenthal, in Salzburg; Miedziana Gora in Weſt Gallicia, where ſpecimens of great beauty are found; Arendahl in Norway; in the government of Olnetz in Ruſſia; Chili.

Uſe.

This ſpecies is not only uſed as an ore of copper, but alſo as a blue colour, (called Mountain-Blue), of which there is a manufactory at Schwatz in the Tyrol.

Observations.

1. The Armenian Stone of the Ancients, which was brought from Armenia, is a limeſtone impregnated with earthy copper azure, and in which copper and iron pyrites are ſometimes diſſeminated.

2. This ſpecies is known, in the beſt Engliſh works on mineralogy, under the name *Mountain Blue*, a term which intimates that it has a blue colour, and is found in mountains, or that it has a blue colour, reſembling that of diſtant mountains. I prefer the name *Copper-Azure*, not only becauſe it is more expreſſive, but alſo becauſe it is conformable with the nomenclature I have adopted. Copper-azure ſignifies, that the moſt ſtriking feature in the external aſpect of the mineral is its azure-blue colour, and that from its external characters, and affinities with other minerals, that it belongs to the copper genus.

ELEVENTH SPECIES.

Malachite.

Malachit.—*Werner.*

This ſpecies is divided into two ſubſpecies. 1. Fibrous. 2. Compact.

FIRST SUBSPECIES.

Fibrous Malachite.

Faſricher Malachit.

Ærugo nativa cryſtalliſata, *Wall.* t. 2. p. 287.—Faſrige Malachit,

chit, *Werner*, Pabſt. b. 1. ſ. 92.—*Id. Wid.* ſ. 768.—Fibrous Malachite, *Kirw.* vol. ii. p. 131.—Faſriger Malachit, *Eſtner*, b. 3. ſ. 577.—*Id. Emm.* b. 2. ſ. 254.—Cuivre vert ſoyeux, *Hauy*, t. 3. p. 571.-575.—La Malachite fibreuſe, *Broch.* t. 2. p. 197.—Faſriger Malachit, *Reuſs*, b. 3. ſ. 461.

External Characters.

Its moſt common colour is perfect emerald green, ſometimes inclining to graſs-green, and ſometimes paſſing to dark leek-green.

Is ſeldom maſſive, ſometimes diſſeminated, moſt frequently as a coating, and frequently cryſtallized in ſhort, capillary and acicular cryſtals, which appear to be priſms *. When they are very ſhort, they form velvety druſy pellicles; and when longer, they are ſcopiformly aggregated.

Internally, it is intermediate between gliſtening and glimmering, and its luſtre is pearly or ſilky.

Fracture extremely delicate, and uſually ſcopiform, fibrous; ſometimes it is coarſe fibrous. In ſome varieties, the coarſe fibrous borders on, and even paſſes into narrow radiated.

Fragments

* *Eſtner* adds, that it occurs, 1. In oblique four-ſided priſms, which are, *a*, perfect; but ſometimes ſo thin, that they have a tabular appearance. *b*. Bevelled on the extremities, and the bevelling planes ſet either on the oppoſite lateral planes, or the obtuſe lateral edges; and the bevelling planes are ſometimes ſo large, that they reach to the middle of the cryſtal.

2. Six-ſided priſms bevelled on the extremities.

3. Acute three-ſided priſms, which have their terminal edges truncated.

Fragments, wedge-ſhaped and ſplintery.

It occurs in large and coarſe, ſometimes long-iſh, granular diſtinct concretions, which ſometimes paſs into thick and ſhort wedge-ſhaped diſtinct concretions.

The cryſtals are ſtrongly tranſlucent, but the maſſive varieties only tranſlucent on the edges.

Is ſoft, and very ſoft.

Streak ſomewhat lighter.

Not particularly brittle, approaching to ſectile.

Is not particularly heavy.

Specific gravity, 3·5718, *Briſſon.*

Chemical Characters.

Before the blow-pipe, it decrepitates and becomes black, but is infuſible without addition. It melts with borax, to which it communicates a dark yellowiſh-green colour: It effervesces with acids, and forms a blue-coloured ſolution with ammonia.

Conſtituent Parts.

Copper,	58.	Oxide of copper,	60
Oxygen,	18.	—— of iron,	10
Carbonic acid,	12.5	Carbonic acid,	5
Water,	11.5	Water,	5
	——	Silica,	20
Klaproth.	100		——
		Tromſdorf.	100

Geognoſtic Situation.

It occurs moſt frequently in the newer primi-

tive

tive and floetz mountains; and is very frequently accompanied with copper-azure.

In Hungary, it is found accompanied with copper-pyrites, copper-azure, compact red copper-ore, compact and fibrous brown ironstone, quartz and calc-spar; in the Bannat, with copper-azure, and tile-ore; at Lauterberg in the Hartz, with copper-pyrites, compact brown ironstone, and tile-ore; on the Buchberg, near Landshut, it occurs, although very seldom, with calc-spar in basalt; in the mine of Ulve in Norway, with magnetic ironstone, copper-pyrites, and fahl-ore: the Siberian fibrous malachite, which is very beautiful, is accompanied with tile-ore, foliated red copper-ore, copper-azure, compact copper-glance, copper-green, brown ironstone, green lead-ore, brown-spar, and amethyst.

Geographic Situation.

Besides the localities already mentioned, the following may be added. Several mines in Cornwall and Derbyshire, and those near Sandlodge in the Mainland, one of the Shetland islands; also in Upper Hungary; at Freyberg, Groskamsdorf, Voightsberg and Falkenberg in the electorate of Saxony; Bareuth; Nassau; Bulach in Wurtemberg; Trarbach in Deux Ponts; Zellerfeld and Clausthal in the Hartz; Salzburg; in the government of Olnetz in Russia; in the gold mines of Beresowski in Siberia; Chili.

SECOND

SECOND SUBSPECIES.

Compact Malachite.

Dichter Malachit.—*Werner.*

Ærugo nativa fiſſilis, ſtalactitica, ſolida, *Wall.* t. 2. p. 287.—Dichter Malachit, *Werner*, Pabſt b. 1. ſ. 94. — *Id. Wid.* ſ. 770.—Compact Malachite, *Kirw.* vol. ii. p. 132.—Dichter Malachit, *Eſtner*, b. 3. ſ. 586. — *Id. Emm.* b 2. ſ 256.—Cuivre carbonaté vert concretioné, *Hauy* —La Malachite compacte, *Broch.* t. 2. p. 199.—Dichter Malachit, *Reuſs*, b. 3. ſ. 467.

External Characters.

Its moſt common colour is emerald-green, which inclines to verdigris-green, and even in the ſame ſpecimen is of different degrees of intenſity. Its external ſurface, and that of the diſtinct concretions, is commonly tarniſhed greeniſh-white, (or covered with a very thin rind or cruſt,) and is more or leſs marked with ſtripes of a darker colour.

Occurs ſometimes maſſive, diſſeminated, and in membranes; moſt frequently reniform and botryoidal, frequently tuberoſe, ſtalactitic, fruticoſe and alſo cellular and amorphous, and cryſtallized in rectangular four ſided priſms, acutely acuminated by four planes, which are ſet on the lateral planes.

Externally rough and dull, and ſometimes marked with dendrites.

Internally

Internally it paſſes, according to the kind of fracture, from ſhining, through gliſtening to glimmering; it is even ſometimes dull, but it is moſt commonly glimmering. Its luſtre is ſilky.

Fracture ſometimes extremely delicate and ſcopiform fibrous, which paſſes into even, and this into flat and ſmall conchoidal, which ſometimes paſſes into ſmall-grained uneven.

The conchoidal varieties are ſhining and gliſtening, and appear to paſs into copper-green, but the fibrous border on fibrous malachite.

Fragments indeterminately angular, not particularly ſharp-edged.

Occurs almoſt always in thin lamellar diſtinct concretions, which are bent in the direction of the external ſurface; alſo in large, coarſe and ſmall granular diſtinct concretions.

The ſurface of the concretions is rough and dull, and apparently covered with a thin green film. The intenſity of the colour is different in the individual lamellar diſtinct concretions, and hence this ſubſpecies has uſually a ſtriped aſpect.

It is opaque, or very faintly tranſlucent on the edges.

Soft, paſſing into ſemihard.

Not particularly brittle.

Eaſily frangible.

It retains its colour in the ſtreak, only becomes ſomewhat paler.

It is heavy in a low degree, approaching to not particularly heavy.

Specific gravity, 3.500, 3.994, *Muſchenbröck*; 3.653, *Kirwan*; 3.6412, *Briſſon*.

Its chemical characters and conſtituent parts are nearly the ſame with the preceding ſubſpecies.

Geognoſtic Situation.

It occurs in ſimilar formations with the fibrous malachite. At Herrngrund it occurs uſually in grey-wacke; in the Bannat it is accompanied with compact and foliated red copper-ore, earthy tile-ore, copper-azure, copper-black, iron-ochre; in the Tyrol it occurs in compact limeſtone, and is accompanied with copper-azure.

Geographic Situation.

At the Land's End, Carrarch, and other places in Cornwall; Mieſs in Bohemia; Stiria; Salzburg; Kamſdorf, &c. in the electorate of Saxony; Kupferberg, Rudelſtadt, Konradſwaldau, &c. in Sileſia; Weſterwald; Blankenburg in the Hartz; Dauphiny in France; Arragon in Spain; Weſt Gallicia; Sweden; Norway; in the Uralian Mountains in Siberia, where the cryſtallized variety, and moſt beautiful ſpecimens of the other varieties are found; in the land of the Namaquas in Southern Africa; Chili.

Uſe.

Independent of its uſe as an ore of copper, it is alſo

alſo when pure employed as a green pigment. The compact varieties receive a beautiful poliſh, and preſent an agreeable colour, and hence are uſed in jewellery. Its ſoftneſs, however, renders it leſs valuable than it would otherwiſe have been.

Obſervations.

1. Both ſubſpecies uſually occur together.

2. The name of the ſpecies is derived from its reſemblance in colour to the leaves of the Mallow or Poplar; and that of the ſubſpecies from the aſpect of the fracture.

3. The minerals of this ſpecies are almoſt always mixed with other ores of copper, as copper-azure, copper-pyrites, red copper-ore, copper-glance, tile-ore, &c.

4. Mr Patrin obſerved at Peterſburg a plate of malachite about 32 inches long, and 17 inches broad, which was valued at 20,000 livres.

TWELFTH SPECIES.

Copper-Green.

Kupfergrün.—*Werner.*

Ærugo nativa granulata et ſuperficialis, *Wall.* t. 2. p. 287. & 288.—Kupfergrün, *Wern.* Pabſt. 1. b. ſ. 96.—*Id. Wid.* ſ. 772. —Mountain Green, *Kirw.* vol. ii. p. 134.—Kupfergrün,

Eſtner, b. 3. f. 595.—*Id. Emm.* b. 2. f. 260.—Oxide vert de Cuivre, *Lam.* t. 1. p. 187.—Cuivre carbonaté vert pulverulent, *Hauy*, t. 3. p. 573.—Le vert de Cuivre, ou la Chryſocolle, *Broch*, t. 2. p. 203. — Kupfergrün, *Reuſs*, b. 3. f. 477.

External Characters.

Its principal colour is verdigris-green, of different degrees of intenſity, which in ſome varieties paſſes into emerald-green, and ſometimes, in the varieties that paſs into the next ſpecies, inclines to leek-green.

Occurs uſually maſſive, diſſeminated, and coating malachite, and ſometimes ſmall reniform and ſmall botryoidal.

Internally ſhining, paſſing into gliſtening, and its luſtre is reſinous.

Fracture ſmall conchoidal.

Fragments indeterminately angular, more or leſs ſharp-edged.

It is always unſeparated.

It is ſometimes more or leſs tranſlucent, ſometimes even ſemitranſparent; ſometimes only tranſlucent on the edges.

Is ſoft and very ſoft.

Not particularly brittle.

Eaſily frangible.

It is intermediate between heavy and not particularly heavy.

Chemical Characters.

It blackens before the blow-pipe, but without being

being fuſed. It communicates a green colour to borax; is ſoluble in acids, with a very feeble or no effervescence.

Conſtituent Parts.

It has not hitherto been carefully analyzed: by ſome it is conſidered to be a compound of oxide of copper, alumina, and calcareous earth; others aſſert that it is carbonat of copper.

Geognoſtic Situation.

It is found in the ſame geognoſtic ſituation as malachite, and is uſually accompanied with copper-pyrites, tile-ore, fahl or grey copper ore, and malachite. It is often alſo mixed with ochre of iron and quartz; in Cornwall it is accompanied with oliven-ore; at the Kupferhügel near Kupferberg in Bohemia, with iron-pyrites, copper-pyrites, magnetic pyrites, arſenical pyrites, ochrey and compact brown ironſtone, and iron-ſhot copper-green; at Catharinenberg with copper-pyrites, variegated copper-ore, black-blende, common iron-glance, compact and ochrey red ironſtone, brown-ſpar, copper-glance, fahl or grey copper ore, and native ſilver; at Zinnwald with tinſtone, wolfram, tungſten, copper and iron pyrites, arſenical pyrites, copper-glance, common lead-glance, fluor-ſpar, quartz, &c.; at Spitz in Auſtria, it occurs along with indurated tile-ore: in Upper Hungary with tile-ore, compact malachite, compact red copper-ore,

and

and white lead-ore; at Herrngrund in Lower Hungary with fahl or grey copper ore, malachite and gyps, in grey-wacke; in the Bannat, where it formerly occurred in great beauty, it was accompanied with copper-azure, malachite, copper-black, foliated-red copper-ore, tile-ore, and copper-pyrites in clay-porphyry; at Falkenſtein in the Tyrol, it is found in compact limeſtone, with fahl or grey copper-ore, and earthy tile-ore; in Siberia with copper-azure, compact and foliated red copper-ore, native-copper, copper-black, malachite, tile-ore, iron-ochre, and brown-ſpar in ſandſtone.

Geographic Situation.

Beſides the localities already mentioned, the following may be added: Krieglach in Stiria; Kamſdorf, Altenberg, and Voightberg in the electorate of Saxony; Neudorf in the principality of Liegnitz; Kupferberg, Prauſnitz in Sileſia; Miedziana Gora in Weſt Gallicia; Chriſtophſthal in Wurtemberg; Andreaſberg in the Hartz; Aardal in Norway; Alcoraya in America; and China.

Obſervations.

1. It is often confounded with malachite, from which, however, it is well diſtinguiſhed by colour, conchoidal fracture, and tranſparency; its ſcarcely obſervable effervescence with acids, alſo diſtinguiſhes it from malachite.

2. It

2. It passes sometimes to malachite, and sometimes to iron-shot copper-green.

3. *Cronsted* was not acquainted with true Malachite: what he describes under that name is Copper-Green.

4. It is one of the rarest species of copper-ore.

THIRTEENTH SPECIES.

Iron-Shot Copper-Green.

Eisenschüssiges Kupfergrün.—*Werner.*

It is divided into two subspecies: 1. Earthy Iron-shot Copper-green: 2. Slaggy Iron-shot Copper-green.

FIRST SUBSPECIES.

Earthy Iron-Shot Copper-Green.

Erdiches eisenschüssiches Kupfergrün.—*Werner.*

Id. Werner, Pabst. t. 1. s. 96.—*Id. Wid.* s. 773.—Earthy Iron-shot Mountain-green, *Kirw.* vol. ii. p. 151.—Erdiches eisenschüssiches Kupfergrün, *Estner*, b. 3. s. 605.—*Id. Emm.* b. 2. s. 262.—Le vert de Cuivre ferrugineux terreux, *Broch.* t. 2. p. 205.—Erdiges eissenschuslig-Kupfergrün, *Reuss*, b. 3. s. 482.

External

External Characters.

Colour olive-green, which ſometimes paſſes into piſtachio-green.

Occurs maſſive and diſſeminated.

Dull.

Fracture earthy.

Soils a little.

Fragments indeterminately angular, blunt-edged.

Opaque.

Retains its colour in the ſtreak, only it becomes ſomewhat paler.

Very ſoft, paſſing into friable.

Not particularly brittle.

Eaſily frangible.

Not particularly heavy.

SECOND SUBSPECIES.

Slaggy Iron-Shot Copper-Green.

Schlackiges eiſenſchuſſiges Kupfergrün.--*Werner.*

Id. Werner, Pabſt. b. 1. ſ. 97.—*Id. Wid.* ſ. 775.—Glaſſy Iron-ſhot Mountain-green, *Kirw.* vol. ii. p. 152.—Schlackiges eiſenſchuſſiges Kupfergrün, *Eſtner*, b. 3. ſ. 606.—*Id. Emm.* b. 2. ſ. 263.—Le Vert de Cuivre ferrugineux ſcoriacé, *Broch.* t. 2. p. 206. — Schlackiges eiſenſchüſſiges Kupfergrün, *Reuſs*, b. 3. ſ. 483.

External

External Characters.

Colour dark-olive and piſtachio-green, which paſſes into dark blackiſh-green, verging on greeniſh-black.

Occurs maſſive and diſſeminated.

Internally ſhining and gliſtening, and its luſtre is reſinous.

Fracture ſmall conchoidal.

Fragments indeterminately angular, more or leſs ſharp-edged.

Is opaque.

Becomes paler in the ſtreak.

Soft verging on very ſoft.

Not particularly brittle.

Eaſily frangible.

Not particularly heavy.

Conſtituent Parts.

No exact analyſis has been hitherto made of this ſpecies. According to Werner, it is an intimate combination of copper-green and ochrey-brown ironſtone.

Geognoſtic Situation.

Both ſubſpecies uſually occur together, and they frequently paſs into each other. They are uſually accompanied with copper-green, copper-azure and malachite; frequently alſo with fahl or grey

copper

copper ore, foliated copper-glance, tile-ore, ochrey and compact brown ironſtone, compact red copper-ore, native copper, quartz, and ſtraight lamellar heavy-ſpar.

At Saalfeld, in Thuringia, it occurs along with malachite, copper-azure, copper-green, copper-pyrites, fahl or grey copper ore, yellow and brown cobalt-ochre, cobalt-bloom, cobalt-cruſt and ſtraight lamellar heavy-ſpar: In Cornwall, it is uſually accompanied with oliven-ore; at Saſka in the Bannat, with copper-green, compact and red copper-ore; and in Siberia with tile-ore, brown ironſtone, malachite, fahl or grey copper ore, red copper-ore, native copper, green and white lead ores, and native ſilver.

Geographic Situation.

Huelcarpenter in Cornwall; Kupferhugel in Bohemia; Kleingabel, near Pries in Lower Hungary; Ringelweſchel in the Tyrol; Kamſdorf and Saalfeld in Thuringia, in the electorate of Saxony; Lauterberg in the Hartz; Bulach and Freudenſtadt in Wurtemberg; Brixenthal, Leogang, Brunnalpe in Salzburg; Iſland of Elba; Miedziana Gora in Weſt Gallicia; in the government of Olnetz in Ruſſia; in ſeveral of the Siberian mines; Chili.

Obſervations.

1. Mr Kirwan ſuſpects, from its olive-green colour, that it may contain arſenic acid. Heorgen ſays,

fays, that he convinced himfelf of the preſence of this acid in many varieties, and propoſes to conſider it as a ſubſpecies of oliven-ore.

FOURTEENTH SPECIES.

Copper-Emerald.

Kupfer-Schmaragd.—*Werner.*

Emeraudine, *Lam.* t. 2. p. 230.—Dioptaſe, *Hauy*, t. 3. p. 136. —*Id. Broch.* t. 2. p. 511.—Kupferſchmaragd, *Reuſs*, b. 3. f. 472.

External Characters.

Colour emerald-green.

Occurs cryſtallized in ſix-ſided priſms, which are pretty acutely acuminated on both extremities by three planes, which are ſet, unconformably wiſe, on the alternate lateral edges.

The lateral planes are ſmooth.

Externally and internally it is ſhining, and its luſtre is vitreous.

Has a threefold cleavage, and the folia are parallel with the lateral edges of the acumination.

Fragments indeterminately angular, blunt-edged.

It is tranſlucent, paſſing to ſemitranſparent.

Semih rd.

Brittle.

Not particularly heavy.

Specific gravity, 2.850, *La Metherie*; 3.300. *Hauy.*

Chemical Characters.

According to Vauquelin, it becomes chefnut-brown before the blow-pipe, communicates to the flame a greeniſh-yellow colour, reſembling that produced by copper, and is infuſible without addition. When melted with borax, it gives a globule of copper.

Conſtituent Parts.

Oxide of copper,	25.57
Carbonat of lime,	42.85
Silica,	28.57
	98

Vauquelin.

Geognoſtic and Geographic Situations.

It is found, according to Hermann, in the land of the Kirguiſe, ſome hundred werſts from the Ruſſian frontier. According to Pallas, it is found in the mountain arm, called Altin-de-Karaſſu, which ſtretches weſtwards from the Altai. According to Patrin, it is alſo found on the Chineſe frontiers. Inguerſen informs us, that it occurs in a vein, accompanied with malachite.

Obſervation.

The name *Copper-Emerald* intimates that this mineral, in its general, aſpect reſembles emerald; and in its natural characters and affinities, foſſils of the copper genus.

FIFTEENTH

FIFTEENTH SPECIES.

Copper-Mica.

Kupferglimmer.—*Werner.*

Blättriges Olivenerz, *Karſten, Journ. de Phyſ.* an 10. p. 348. —Arſeniate of Copper in hexahedral laminæ, with inclined ſides, *Bournon, Phil. Tranſ.* Part I. 1801. — Blättriches Olivenerz, *Reuſs*, b. 3. ſ. 504.

External Characters.

Colour emerald-green, which in ſome varieties inclines to verdigris-green.

Occurs maſſive, diſſeminated, ſeldom cryſtallized in very thin ſix-ſided tables, which are bevelled on the terminal planes.

Externally ſmooth and ſplendent.

Internally it is ſplendent, and its luſtre is pearly.

Fracture perfect foliated, with a ſingle cleavage.

Fragments indeterminately angular and tabular.

Occurs in coarſe and ſmall granular diſtinct concretions.

The maſſive varieties are tranſlucent; the cryſtallized tranſparent.

Soft, ſcratches gyps ſlightly, but not calc-ſpar.

Sectile.

Not particularly brittle.

Not particularly heavy.

Specific gravity, 2.5488.

Conſtituent Parts.

Oxide of copper,	39
Arſenic acid,	43
Water,	17
	99

Vauquelin.

Geognoſtic

Geognoſtic and Geographic Situations.

It has hitherto occurred only in veins in Cornwall, where it is accompanied with copper-pyrites, copper-glance, variegated copper-ore, copper-black, compact and fibrous malachite, iron-ſhot copper-green, copper-green, copper-azure, indurated tile-ore, and brown iron-ochre.

Obſervations.

This mineral is known in Engliſh works on Mineralogy under the name Foliated Arſeniat of Copper. To preſerve uniformity in the nomenclature, chemical names, wherever it is poſſible, ſhould be rejected; therefore, in the preſent caſe, I uſe the term *Copper-mica*, which implies that the mineral in its external aſpect reſembles mica, and that from its natural alliances it belongs to the copper genus. It may be ſaid that this mineral might, with more propriety, be denominated Micaceous Copper-ore. To this I anſwer, that, independent of the ſhortneſs and diſtinctneſs of the term here employed, and its uniformity with the language uſed throughout this work, it is ſanctioned by the practice and authority of the firſt Engliſh mineralogiſt, who uſes Iron-Sand in place of Arenaceous Iron-ore, Martial or Iron-earth in place of Earthy Iron-ore, and Mountain-green in place of Green Copper-ore.

SIXTEENTH

SIXTEENTH SPECIES.

Lenticular Ore.

Linſenerz.—*Werner.*

Arſeniate of Copper, in the form of an obtuſe octahedron, *Phil. Tranſ.* Part I. 1801.

External Characters.

Colour ſky-blue, which ſometimes paſſes into verdigris-green.

Occurs cryſtallized in ſmall and very ſmall, and very flat double four-ſided pyramids.

Externally ſhining.

Fracture foliated in the direction of the planes.

Is tranſlucent.

Very ſoft *.

Rather brittle.

Uncommonly eaſily frangible.

Specific gravity, 2.8819, *Bournon.*

Geographic Situation.

Has been hitherto found only in Cornwall.

SEVENTEENTH SPECIES.

Oliven-Ore.

Olivenerz.—*Werner.*

This ſpecies is divided into two ſubſpecies, 1. Foliated; 2. Fibrous.

FIRST

* *Count de Bournon* ſays, that it is harder than calc-ſpar, but ſofter than fluor-ſpar.

FIRST SUBSPECIES.

Foliated Oliven-Ore.

Blättriches Olivenerz.—*Werner.*

Colour perfect olive-green, ſometimes inclining to oil-green and leek-green, and rarely paſſing to piſtachio-green.

Occurs ſeldom maſſive, uſually in druſy cruſts, and in ſmall cryſtals which preſent the following varieties:

1. Very acute rhomboid, either perfect or with truncated angles.
2. Oblique four-ſided priſm.

The planes of the cryſtals are ſmooth, ſhining and ſplendent.

Internally it is gliſtening, paſſing into ſhining, and its luſtre is adamantine.

Fracture imperfect foliated.

Fragments indeterminately angular.

The maſſive varieties occur in coarſe and ſmall granular diſtinct concretions.

Tranſlucent, but the cryſtals are ſometimes ſemitranſparent.

It gives a ſtraw-yellow ſtreak.

Is very ſoft.

Sectile.

Heavy in a low degree.

Specific gravity, 4.2809, *Bournon.*

Conſtituent

Conſtituent Parts.

Arſenic acid,	30
Oxide of copper,	54
Water,	16
Chenevix.	100

Geographic Situation.

Has been hitherto found only in Cornwall.

SECOND SUBSPECIES.

Fibrous Oliven-Ore.

Faſriges Olivenerz.—*Werner.*

External Characters.

Its colour is olive-green of different degrees of intenſity. The darker varieties border on blackiſh-green, the lighter paſs into piſtachio-green and liver-brown. The maſſive varieties paſs, on the one ſide, into liver-brown; on the other ſide, into greeniſh-white.

It ſometimes preſents ſpotted and ſtriped colour delineations.

Occurs maſſive, reniform, and cryſtallized in acicular and capillary cryſtals. The acicular cryſtals are in the ſhape of very oblique four-ſided priſms, which are bevelled on both extremities, and the bevelling planes are ſet on the acuter lateral edges.

The

The cryſtals are ſmall and very ſmall, and externally ſhining.

Internally the maſſive varieties are gliſtening, with an adamantine luſtre.

Fracture delicate and ſcopiform fibrous.

Fragments indeterminately angular, wedge-ſhaped.

It occurs ſometimes in coarſe granular, ſometimes in curved lamellar, diſtinct concretions, which traverſe the former; and ſuch varieties have a ſtrong reſemblance to brown hematite and Corniſh tin-ore.

Tranſlucent on the edges.

Soft, verging on ſemihard. Some varieties, according to Bournon, are ſo hard as to ſcratch fluor-ſpar.

Rather brittle.

Heavy in a low degree.

Specific gravity, 4.2809, *Bournon.*

Conſtituent Parts.

Cryſtallized varieties.

Arſenic acid,	39.7
Oxide of copper,	60.0
Chenevix.	99.7

	Capillary.	Hæmatitiform.
Arſenic acid,	29	29
Oxide of copper,	51	50
Water,	18	21
Chenevix.	98	*Chenevix.* 100

Geographic

Geographic Situation.

Has been hitherto found only in Cornwall.

Obſervations.

1. The name of the ſpecies is derived from its colour, that of the ſubſpecies from the aſpect of the fracture.

2. I uſe the name *Oliven-Ore*, in place of Olive Copper-ore, to preſerve uniformity in the nomenclature.

SIXTH GENUS.

IRON GENUS.

FIRST SPECIES.

Native Iron.

Gediegen Eiſen.—*Werner.*

Ferrum nativum, *Wall.* t. 2. — Fer natif, *Rom. de L.* t. 3. p. 165. — Gediegen Eiſen, *Wern.* Pabſt. b. 1. ſ. 129.—*Id. Wid.* ſ. 781.—Native Iron, *Kirw.* vol. ii. p. 156.—Gediegen Eiſen, *Emm.* b. 2. ſ. 271.—Fer natif, *La Meth.* t. 1. p. 216. — *Id. Hauy*, t. 4. p. 1.–9. — *Id. Broch.* t. 2. p. 214.—Gediegen Eiſen, *Reuſs*, b. 4. ſ. 9.

External Characters.

Colour light ſteel-grey, which inclines to ſilver-white, almoſt like platina. It is uſually covered with a browniſh cruſt of iron-ochre.

Has been hitherto found only ramoſe.

Its ſurface is ſmooth and gliſtening.

Internally it is intermediate between glimmering and gliſtening, and its luſtre is perfect metallic.

Fracture hackly.

Fragments indeterminately angular, blunt-edged.
Yields a ſplendent ſtreak.

It is intermediate between ſoft and ſemihard, but more inclining to the firſt.

Is perfect malleable.
Common flexible.
Difficultly frangible.
Uncommonly heavy.

Conſtituent Parts.

According to Mr Howard, the native iron found in Siberia, South America, and Senegal, contains a portion of nickel. The American contains 0.10; the Siberian 0.17; Senegambian 0.5 to 0.6.

Klaproth has communicated the following analyſes of what he terms Meteoric and True Native Iron.

1. Meteoric Iron.

1. Sclavonian,	96.5	iron.
	3.5	nickel.
	100.0	

2. Siberian,	98.5	iron.
	1.5	nickel.
	100.0	

2. True Native Iron,

from the mine, called Johannes, near Kamſdorf in Saxony:

Iron,	92.5
Lead,	6.0
Copper,	1.50
	100.0

Geognoſtic

Geognoſtic Situation.

It has been hitherto found only in looſe maſſes on the ſurface of the earth, and is uſually covered with a browniſh-coloured ruſt, and has intermixed an aſpargus-green coloured mineral, which is ſuppoſed to be of the nature of olivine *. It is ſaid alſo to have been found imbedded in brown ironſtone, ſparry ironſtone, and heavy-ſpar, at Kamſdorf †, with clay and hematite at Eibenſtock ‡, and with brown ironſtone, and quartz, in a vein in the mountain of Oulle, in the vicinity of Grenoble §; but none of theſe inſtances are ſufficiently ſupported by accurate obſervation.

Geographic Situation.

Pallas diſcovered a maſs of native iron about 1680 pounds weight, on the ſummit of a mountain, on which there was a conſiderable bed of magnetic ironſtone, on the banks of the great river Jeniſei in Siberia. The Indians in the diſtrict of St Jago del Eſtro in South America, diſcovered a maſs of native iron, which is calculated to weigh about three hundredweight. This remarkable maſs

* This olivine-like mineral, according to *Howard*, affords the following conſtituent parts:

Silica 54; Magneſia 27; Oxide of iron 17; Oxide of nickel 1.

† Charpentier, Mineralog. Geographie der Churſächs Lande, ſ. 343.

‡ *Werner's* Pabſt. b. 1. ſ. 130.

§ Schreiber, Journal de Phyſique, Juillet 1792.

maſs is deſcribed in the London Tranſactions by Don Rubin de Celis. *Barrow* mentions a maſs of iron, which he obſerved on the banks of the Great Fiſh River in the country of the Caffres, but its true nature is very problematical. There is preſerved in the imperial cabinet of minerals at Vienna, a maſs of native iron, which weighs ſeventy-one pounds, which was found in Sclavonia, and is ſaid to have fallen from the atmoſphere.

Obſervations.

1. It was formerly diſputed whether or not it was a natural or artificial product. The magnitude of the maſſes which have been diſcovered in America and Siberia, the olivine-like mineral with which they are intermixed, and which has no reſemblance to iron-ſlag*, and their chemical compoſition demonſtrate, that it is not artificial. It therefore remains to be determined, whether it has been formed by aqueous depoſition, volcanic alteration, or if it be the produce of meteors. Its meteoric formation appears, at preſent, to be ſomewhat plauſible; yet there is ſtill ſo great a want of accurate information, that no opinion on the ſubject is of much value.

2. Should the exiſtence of the Kamſdorf, Eibenſtock and Oulle native iron be confirmed, we muſt alſo admit the formation of native iron by aqueous depoſition.

SECOND

* I do not know if the American iron contains the olivine-like mineral.

SECOND SPECIES.

Iron-Pyrites.

Schwefelkies.—*Werner.*

This ſpecies is divided into five ſubſpecies, viz. 1. Common Iron Pyrites. 2. Radiated Pyrites. 3. Liver-Pyrites. 4. Cellular Pyrites. 5. Hair-Pyrites.

FIRST SUBSPECIES.

Common Iron-Pyrites.

Gemeiner Schwefelkies.—*Werner.*

Id. Wern. Pab. b. 1. ſ. 130.—*Id. Wid.* ſ. 794.—Common Sulphur-Pyrites, *Kirw.* vol. ii. p. 76.—Gemeiner Schwefelkies, *Emm.* b. 2. ſ. 289.—Fer ſulphuré, *Hauy*, t. 4. p. 65.-97.—La Pyrite martiale commune, *Broch.* t. 2. p. 221.—Gemeiner Schwelfelkies, *Reuſs*, b. 4. ſ. 14.

External Characters.

Colour perfect bronze-yellow; ſeldom tarniſhed, reddiſh and browniſh.

Occurs moſt commonly maſſive, diſſeminated, and in membranes; frequently alſo cryſtallized.

Its cryſtallizations are as follow:

1. Cube in which the planes are either ſtraight or convex. It is the moſt common cryſtallization of this ſpecies.
2. Cube having all its angles truncated, and ſometimes ſo deeply, that the cryſtal is intermediate between the cube and the octahedron.

3. Cube

3. Cube truncated on its edges, in ſuch a manner that each truncation is more inclined towards one face than the other, and each face ſupports two oppoſite truncating planes.
4. Cube in which each angle is acuminated by three planes, which are ſet on the lateral edges. The ſummits of the acuminations are ſometimes truncated.
5. Octahedron, which is either perfect, or more or leſs deeply truncated on all its angles; ſometimes alſo bevelled on its angles.
6. Common dodecahedron.
7. Dodecahedron in which ſix oppoſite and parallel edges are truncated. It is the paſſage to the cube.
8. Dodecahedron in which ſix angles are truncated. It forms the paſſage to the icoſahedron.
9. Icoſahedron. This is very rare.
10. Leuzite cryſtallization, or the very acute double eight-ſided pyramid, in which the lateral planes of the one are ſet on thoſe of the other, and both extremities are acuminated by four planes, which are ſet on the alternate lateral edges.

The cube is middle-ſized and ſmall. The icoſahedron and dodecahedron only ſmall.

The cryſtals are ſeldom ſingle, particularly the cube which is variouſly aggregated.

The ſurface of the cryſtals is ſometimes ſmooth, ſometimes ſtreaked, and it alternates from ſpecular ſplendent to gliſtening.

Internally,

Internally, it is uſually ſhining and gliſtening, and its luſtre is metallic.

Fracture coarſe, ſmall, and fine-grained uneven.

Fragments indeterminately angular, not particularly ſharp-edged.

It is uſually unſeparated; ſometimes, however, the maſſive varieties preſent fine granular diſtinct concretions.

It is hard.

Brittle.

Not particularly difficultly frangible.

Heavy.

When rubbed, or ſtruck with ſteel, it emits a ſtrong ſulphureous ſmell.

Specific gravity,

Dodecahedral pyrites,	48.30,	*Hatchett.*
Pyrites in ſmooth-planed cubes,	4.831,	*Id.*
Pyrites from Freyberg,	4.682,	*Gellert.*
——— Cornwall,	4.789,	*Kirwan.*
Cubic pyrites,	4.600,	*Briſſon.*
Id.	4.7016,	

Chemical Characters.

Before the blow-pipe it emits a ſtrong ſulphureous odour, and burns with a bluiſh flame. It afterwards changes into a browniſh-coloured globule, which is attractable by the magnet, and, by continuance of the heat, paſſes into a blackiſh ſlag, which communicates a dirty-green colour to borax.

Conſtituent

Conſtituent Parts.

Dodecahedral Pyrites.		Pyrites in ſtriated Cubes.
Sulphur,	52.15	52.50
Iron,	47.85	47.50
	100	100

Pyrites in ſmooth Cubes.

Sulphur,	52.70
Iron,	47.30
	100

The above analyſes were made by *Mr Hatchett*, with his uſual conſummate ſkill.

Some varieties, particularly thoſe in ſtriated cubes and dodecahedrons, contain a portion of gold, and hence have been named Auriferous Pyrites; other varieties contain ſilver.

Geognoſtic and Geographic Situations.

It occurs in almoſt every ſpecies of mineral repoſitory, and there is ſcarcely a rock in which it is not found. It occurs moſt commonly in granite.

Its geographic diſtribution is equally extenſive, and therefore it would be ſuperfluous to inſtance particular localities.

Uſe.

It is never worked as an ore of iron: it is principally valued on account of the ſulphur which can be obtained from it by ſublimation, and the iron

iron-vitriol, which it affords by expoſure to the air, or gentle roaſting. It was formerly cut into ornaments, but they are now out of uſe.

Obſervations.

It is diſtinguiſhed from pale-yellow native gold by its brittleneſs, the gold being malleable; from copper-pyrites, by colour, cryſtallization, fracture, and hardneſs; from arſenical pyrites, by colour.

SECOND SUBSPECIES.

Radiated Pyrites.

Strahlkies.—*Werner.*

Id. Wern. Pabſt. b. 1. ſ. 136.—*Id. Wid.* ſ. 797. — Striated Pyrites, *Kirw.* vol. ii. p. 78. — Strahlkies, *Emm.* b. 2. ſ. 293.— Fer ſulphuré radié, *Hauy*, t. 4. p. 89. — La Pyrite rayonnée, *Broch.* t. 2. p. 225.—Strahlkies, *Reuſs*, b. 4. ſ. 25.

External Characters.

Colour bronze-yellow, (which is uſually paler than in common pyrites), which ſometimes inclines to braſs-yellow; its ſurface is tarniſhed.

Occurs maſſive, but moſt commonly reniform, tuberoſe, globular, botryoidal, and alſo cryſtallized in octahedrons, which are ſometimes equilateral and equiangular; ſometimes acute and lengthened, and ſometimes with deeply truncated angles,

thus forming a cryſtal which is intermediate between the cube and octahedrom.

The cryſtals are uſually ſmall and often very ſmall; externally ſhining and gliſtening, which inclines to glimmering.

Fracture narrow, ſhort, ſtraight, almoſt always ſcopiform, and ſometimes ſtellular diverging, radiated.

It paſſes ſometimes into fibrous, ſometimes into compact.

Fragments wedge-ſhaped.

It occurs in coarſe and large granular diſtinct concretions, and in each concretion the radia proceed from a point; alſo in thin and curved lamellar diſtinct concretions, which are bent in the direction of the external ſurface, and traverſe the granular concretions; and, laſtly, in thin columnar diſtinct concretions.

Hard.

Brittle.

Very eaſily frangible, and it breaks more eaſily in the direction of the lamellar than the granular concretions.

When rubbed, or ſtruck with ſteel, it emits a ſulphureous odour.

Heavy.

Specific gravity, from 4.698 to 4.775, *Hatchett*; 4.729, *Wiedemann*.

Conſtituent

Conſtituent Parts.

Sulphur,	53.60	54.34
Iron,	46.40	45.66
	100	100
	Hatchett.	*Hatchett.*

Geognoſtic Situation.

It is much rarer than common iron-pyrites, occurs principally in ſmall maſſes, and in veins, which contain lead and ſilver ores. It is of an intermediate age between common and capillary or hair pyrites.

Geographic Situation.

Cornwall, Iſle of Sheppey, Derbyſhire, &c.; Freyberg, Gerſdorf, Schneeberg, Annaberg, Johanngeorgenſtadt in Saxony; Bohemia; Zellerfeld and Goſlar in the Hartz; Arendal in Norway; the Iſlands of Morn and Seeland in Denmark; Schlangenberg in Siberia.

Obſervations.

1. It decompoſes more readily than common pyrites, particularly when it is expoſed to a varying temperature in damp places, and then its ſurface becomes covered with greyiſh-white capillary iron-vitriol.

" Mr *Prouſt* is of opinion, that the pyrites which contain the ſmalleſt quantity of ſulphur, are

are thoſe which are moſt liable to vitriolization; and, on the contrary, that thoſe which contain the largeſt proportion, are the leaſt affected by the air or weather. This opinion of the learned Profeſſor, by no means accords with ſuch obſervations as I have been able to make; for the cubic, dodecahedral, and other regularly cryſtallized pyrites, are liable to oxidizement, ſo as to become what are called hepatic iron-ores, but not to vitriolization; whilſt the radiated pyrites (at leaſt thoſe of this country) are by much the moſt ſubject to the latter effect: and therefore, as the reſult of the preceding analyſes ſhow that the cryſtallized pyrites contain leſs ſulphur than the radiated pyrites, I might be induced to adopt the contrary opinion. But I am inclined to attribute the effect of vitriolization, obſerved in ſome of the pyrites, not ſo much to the proportion as to the ſtate of the ſulphur in the compound; for I much ſuſpect, that a prediſpoſition to vitriolization in theſe pyrites, is produced by a ſmall portion of oxygen being previouſly combined with a part, or with the general maſs of the ſulphur, at the time of the original formation of theſe ſubſtances, ſo that the ſtate of the ſulphur is tending to that of oxide, and thus the acceſſion of a farther addition of oxygen becomes facilitated." *Hatchett*, Phil. Tranſ. 1804.

THIRD

THIRD SUBSPECIES.

Liver-Pyrites, or Hepatic Pyrites.

Leberkies.—*Werner.*

Pyrites fuſcus, *Wall.* b. 2. p. 133.—Pyrite hepatique, *Rom. d. L.* t. 3. p. 265.—Leberkies, *Wern.* Pabſt. b. 1. ſ. 139.—*Id. Wid.* ſ. 800.—Hepatic Pyrites, *Kirw.* vol. ii. p. 83.—Leberkies, *Emm.* b. 2. ſ. 298.—Fer ſulphuré decompoſé, *Hauy*, t. 4. p. 95, 96.—La Pyrite hepatique, *Broch.* t. 2. p. 228.—Leberkies, *Reuſs*, b. 4. ſ. 29.

External Characters.

Colour very pale braſs-yellow, which inclines more or leſs to ſteel-grey.

It changes its colour in the freſh fracture, and becomes brown, or acquires a columbine tarniſh.

Occurs maſſive, diſſeminated, globular, tuberoſe, reniform, ſtalactitic, and ſtraight and ſmall cellular. Alſo cryſtallized in

1. Six-ſided priſms; ſometimes the lateral planes converge towards one extremity, and then there is formed a
2. Simple ſix-ſided pyramid.

Internally it is uſually glimmering, ſeldom approaching to gliſtening, and its luſtre is metallic.

Fracture even, which ſometimes paſſes into ſmall-grained uneven, ſometimes into flat conchoidal.

Fragments

Fragments indeterminately angular, ſharp-edged.

Occurs in diſtinct concretions.

In other characters it agrees with the preceding ſubſpecies.

Geognoſtic Situation.

It is nearly of the ſame age as common pyrites, but it does not occur ſo frequently. It is found only in veins, and is uſually accompanied with red ſilver-ore, native ſilver, lead-glance, common pyrites, black and brown blende, ſparry-iron-ſtone, iron-ochre, feldomer with cobalt-glance, cobalt-cruſt, cinnabar and grey antimony ore: the accompanying vein-ſtones are quartz, heavy-ſpar, brown-ſpar, fluor and calc ſpars.

The ſtalactitic varieties occur principally in the Neue Morgen Stern at Freyberg, and all the other varieties at Johanngeorgenſtadt.

Geographic Situation.

Derbyſhire; Freyberg, Johanngeorgenſtadt in the electorate of Saxony; Wolfstein in the Palatinate; Salzburg; Goſlar in the Hartz; Hungary; Tranſilvania; Bohemia; Iceland; Norway; Sweden; and Siberia.

Obſervation.

It is very ſubject to decompoſition.

FOURTH SUBSPECIES.

Hair or Capillary Pyrites.

Haarkies.—*Werner.*

Id. Wern. Pabſt. t. 1. p. 143.—Capillary Pyrites, *Kirw.* vol. ii. p. 79.—Haarkies, *Emm.* b. 2. ſ. 297. — Fer ſulphuré capillaire, *Hauy*, t. 4. p. 89.—La Pyrite capillaire, *Broch.* t. 2. p. 227.—Haarkies, *Reuſs*, b. 4. ſ. 33.

External Characters.

Colour dark bronze-yellow, which ſometimes paſſes into ſteel-grey.

It occurs in very delicate capillary cryſtals, which are either promiſcuous or ſcopiform aggregated.

Luſtre metallic.

It is brittle.

Slightly flexible.

Geognoſtic Situation.

It is the neweſt of all the ſubſpecies of pyrites, and is alſo the moſt rare. It is uſually accompanied with fahl-ore, lead-glance, quartz, calc-ſpar, and fluor-ſpar. In the Hartz it occurs in druſen with zeolite, croſs-ſtone, and native ſilver.

Geographic Situation.

Johanngeorgenſtadt, Annaberg, and Schneeberg

in

in the electorate of Saxony; Joachimſthal in Bohemia; Andreaſberg in the Hartz; Leogang, and Brennthal near Mühlbach in Salzburg.

FIFTH SUBSPECIES.

Cellular Pyrites.

Zellkies.—*Werner.*

Zellkies, 2. Unterart, *Reuſs*, b. 4. f. 34.

External Characters.

Colour bronze-yellow, which inclines very much to ſteel-grey, and a little to green.

By expoſure it acquires a grey tarniſh.

Occurs maſſive, but moſt frequently cellular, and of this hexagonal, polygonal, and indeterminate cellular.

The ſurface of the cells is druſy.

Internally ſtrongly glimmering; ſeldom, and only when it paſſes into common pyrites, gliſtening.

Fracture even and flat conchoidal, ſeldom paſſing into fine-grained uneven.

Fragments indeterminately angular, pretty ſharp-edged.

In other characters it agrees with the foregoing ſubſpecies.

Geognoſtic and Geographic Situations.

It occurs in veins at Johanngeorgenſtadt in the electorate of Saxony, where it is accompanied with liver-

liver or hepatic pyrites, common pyrites, lead-glance, ſparry ironſtone, nickel, iron-ochre, brown-ſpar, heavy-ſpar, fluor-ſpar, and quartz.

Obſervation.

It is the leaſt liable to decompoſition of all the ſubſpecies of pyrites.

THIRD SPECIES.

Magnetic Pyrites.

Magnetkies.—*Werner.*

Id. Werner, Pabſt. b. 1. ſ. 144.—*Id. Wid.* ſ. 792.—Magnetic Pyrites, *Kirw.* vol. ii. p. 79.—Magnet-kies, *Emm.* b. 2. ſ. 286.—La Pyrite magnetique, *Broch.* t. 2. p 232.—Magnetkies, *Reuſs*, b. 4. ſ. 35.

External Characters.

Its colour is intermediate between bronze-yellow and copper-red, and ſometimes inclines to pinchbeck-brown.

On expoſure to the air it gradually loſes its luſtre, and acquires a browniſh tarniſh.

Occurs only maſſive and diſſeminated.

Internally ſhining, gliſtening, and ſeldom borders on ſplendent. Its luſtre is metallic.

Fracture fine and coarſe-grained uneven, which ſometimes paſſes into imperfect conchoidal.

Fragments indeterminately angular, blunt-edged.

It is unſeparated.

It paſſes from hard to ſemihard.

Is brittle.

Eaſily frangible.

Heavy.

Specific gravity, 4.518,—*Hatchett.*

It is attracted by the magnet.

Conſtituent Parts.

According to *Hatchett* it contains in the hundred parts,

Sulphur,	36.50
Iron,	63.50
	100

Chemical Characters.

Before the blow-pipe it emits a feeble ſulphureous ſmell, and melts eaſily into a greyiſh-black globule, attractable by the magnet, and which, when heated with borax, colours it black.

Geognoſtic Situation.

It is a mineral of the oldeſt formation, and has been hitherto found only in primitive mountains. It occurs only in beds *, and is accompanied with common

* It is mentioned by the Hon. Robert Greville, in Mr Hatchett's Memoir on this ſpecies, that there is a *vein* of it ſome yards

common iron-pyrites, copper-pyrites, arſenical pyrites, lead-glance, brown and black blende, magnetic ironſtone, garnet, hornblende and actynolite.

At Kupferhugel near Kupferberg in Bohemia, there is a bed of magnetic pyrites, which lies between gneiſs and primitive greenſtone, at Orpes in the ſame country it lies between gneiſs and primitive limeſtone; and at Newſtädtl in mica-ſlate.

Geographic Situation.

Beſides the localities already mentioned, the following may be mentioned: Moel Elion in Caernarvonſhire in Wales; Breitenbrunn, Geyer, Marienberg, Ottendorf, and Meſſerſdorf in Saxony; Queerbach, Reichenſtein, Schreiberau, Eule, Wofshau and Kupferberg in Sileſia; Bodenmais in Bavaria; Reinkaar and Gehlalpe in the Muhrwinke, Schwarzenbach and Mühlbachthal in Salzburg; Illebeck and Kongſberg in Norway; Siberia.

Uſe.

It is uſed for the ſame purpoſes as common pyrites.

Obſervations.

yards in depth and breadth, near the baſe of the mountain called Moel Elion in Caernarvonſhire. I ſuſpect ſtrongly that in this inſtance, as in all others hitherto diſcovered, the ore occurs in a *bed*, not in a vein.

Observations.

1. It is intermediate between iron-pyrites and magnetic ironſtone.

2. It was formerly conjectured that the iron in it was leſs oxidized than that in iron-pyrites, and in this way its magnetic property was accounted for. Mr Hatchett has ſhewn, however, that iron when combined naturally or artificially with 36.50 or 37 of ſulphur, is not only ſtill capable of receiving the magnetic fluid, but is alſo rendered capable of retaining it, ſo as to become in every reſpect a permanent magnet; and the ſame he thinks may, in a great meaſure, be inferred reſpecting iron which has been artificially combined with 45.50 *per cent.* of ſulphur.

3. Mr Hatchett has alſo ſhewn that the magnetic pyrites agrees in chemical properties with the artificial ſulphuret of iron or pyrites.

FOURTH SPECIES.

Magnetic Ironſtone.

Magneteiſenſtein.—*Werner.*

This ſpecies is divided into two ſubſpecies: 1. Common Magnetic Ironſtone: 2. Ironſand.

FIRST

FIRST SUBSPECIES.

Common Magnetic Ironſtone.

Gemeiner Magneteiſenſtein.—*Werner.*

Ferrum mineraliſatum cryſtalliſatum, et Ferrum mineraliſatum, minera ferrum trahente et polos mundi oſtendente, *Wall.* t. 2. p. 234.–235. — Æthiops martial natif, *Rom. de L.* t. 3. p. 176. — Magnetiſcher Eiſenſtein, *Wern.* Pabſt. b. 1. ſ. 144.— *Id. Wid.* ſ. 787. — Common magnetic Ironſtone, *Kirw.* vol. ii. p. 158. — Gemeiner magnetiſcher Eiſenſtein, *Emm.* b. 2. ſ. 278. — Fer oxidulé, *Hauy*, t. 4. p. 10.–38.—Le Fer magnetique commun, *Broch.* t. 2. p. 235. —Gemeiner Magneteiſenſtein, *Reuſs*, b. 4. ſ. 38.

External Characters.

Its colour is iron-black, and in ſome varieties it is variouſly tarniſhed.

Beſides maſſive and diſſeminated, it occurs alſo cryſtallized.

Its cryſtallizations are the following:

1. Cube, ſometimes perfect, ſometimes more or leſs deeply truncated on its angles.
2. Octahedron, ſometimes perfect, ſometimes truncated on its edges, and ſometimes lengthened, and then it forms an oblique four-ſided priſm, bevelled on both extremities, and the bevelling planes are ſet on the lateral edges.
3. Garnet dodecahedron.
4. Rectangular

4. Rectangular four-ſided priſm, acuminated by four planes, which are ſet on the lateral edges, reſembling that of the hyacinth.

The two laſt-mentioned cryſtals uſually occur in druſes.

The planes of the garnet dodecahedron are ſtreaked in the direction of the larger diagonal of the rhomb; the planes of the four-ſided priſm are tranſverſely ſtreaked, and thoſe of the octahedron are ſmooth.

The cryſtals are uſually imbedded, aggregated on one another, and are ſmall and middle-ſized.

Externally ſhining.

Internally it is intermediate between ſhining and gliſtening, which ſometimes, on the one hand, paſſes into ſplendent, and on the other into weakly glimmering. Luſtre metallic.

Fracture ſmall and coarſe-grained uneven, which ſometimes approaches to even, ſometimes to imperfect and ſmall conchoidal. Occurs alſo imperfect ſtraight foliated, which has the ſtrongeſt luſtre, as the even has the weakeſt.

Fragments indeterminately angular, not particularly ſharp-edged.

It is ſometimes unſeparated, ſometimes in ſmall and fine, ſeldom in coarſe granular diſtinct concretions. The concretions are ſometimes ſo looſe, that they can be ſeparated by the finger.

Its colour is not altered in the ſtreak.

It

It is intermediate between semihard and hard, and some varieties pass into hard.

Is brittle.

The crystals are very difficultly frangible; the granular on the contrary more or less easily frangible.

Is heavy, inclining to uncommonly heavy.

Specific gravity from 4.200 to 4.939.

It is attracted by the magnet, and it also attracts iron-filings.

Chemical Characters.

Before the blow-pipe it becomes brown, and communicates to glass of borax a dark-green-colour.

Constituent Parts.

It is conjectured to be nearly a pure oxide of iron, and is said to afford from 80 to 90 *per cent.* of metallic iron.

Geognostic Situation.

It occurs most frequently in primitive mountains, and principally in gneiss, mica-slate, chlorite slate and primitive limestone; also in serpentine, but seldom and in small quantities, as at Hohenstein and Zöblitz in Saxony; and in the floetz trap formation, as in greenstone at Taberg near Jönkioping,

ping, in hornblende rock, in Smoland, and in baſalt at the Plaſterkeule near Markſuhl, not far from Eiſenach. It occurs in beds, and ſometimes in mountain maſſes (Stück Gebirge). It is accompanied with common garnet, common hornblende, granular limeſtone, amianth, aſbeſt, actynolite, fluor-ſpar, iron-pyrites, magnetic pyrites, arſenical pyrites, blende, tin-ſtone (at Brietenbrunn), copper-azure and malachite (Berggieſhübel), lead-glance (Geier), coccolite, ſahlite, augite, ſeldom with felſpar, quartz and ſparry-iron-ſtone (Norway).

Geographic Situation.

In ſerpentine in the iſland of Unſt, one of the Shetlands; at Orpes, Kremſger, Hohenſtein in Bohemia; Hungary; Dognatſka in the Bannat; Tyrol; Salzburg; Berggieſhübel, Breitenbrunn, Ehrenfriederſdorf, Frauenberg, Marienberg, Altenberg, Dorfſchemnitz, Sayda, and Wolkenſtein in the electorate of Saxony; in the Saxon part of the dutchy of Henneberg; Meſſerſdorf in Upper Luſatia; Queerbach, Schreiberau, Reichenſtein, Schmiedeberg, Kupferberg, Gieren, &c. in Sileſia; Rehberg in the Hartz; Gothard in Switzerland; Piedmont; Puy in France; Monte Somma, &c. iſlands of Elba and Corſica in Italy; Arendal, Langoe, &c. in Norway; Dannemora, Fahlun, the Taberg;

Taberg *; Hogberg in Gagnäs, Suhlberg in Weſtermannland, Tornæo, and Jelliware in Lapland, in Sweden; Nertſchinſk, and many places in the Uralians in Siberia; the mountain Puchamanche in Chili; Siam and the Philippine iſlands in the Eaſt Indies.

Uſe.

When pure, it affords excellent bar-iron, but indifferent caſt-iron; and as it is eaſily fuſible, it requires but little flux. When it happens to have intermixed copper or iron pyrites, it affords a red-ſhot iron. Careful roaſting of ore, thus mixed, diminiſhes the bad effects of the ſulphur, which is evidently the cauſe of the deterioration of the iron. In Sweden, particularly at Roſlager, the ore is quite pure, and affords excellent bar-iron, which is imported into Great Britain, for the purpoſe of ſteelmaking.

* The hill of Taberg, which very probably belongs to the neweſt floetz-trap formation, is ſaid to be almoſt entirely compoſed of magnetic ironſtone. Dr Steffens informs us, that the looſe maſſes alone, which are found at the baſis of the hill, have afforded materials for extenſive iron-works for 150 years.

SECOND SUBSPECIES.

Iron-Sand.

Eiſenſand.—*Werner.*

Id. Werner, Pabſt. b. 1. ſ. 147.—*Id. Wid.* ſ. 790.—Magnetic Sand, *Kirw.* vol. ii. p. 161.—Eiſenſand, *Emm.* b. 2. ſ. 284.—Le Fer magnetique ſablonneux, *Broch.* t. 2. p. 241.—Sandiger Magneteiſenſtein, *Reuſs*, b. 4. ſ. 48.

External Characters.

Its colour is very dark iron-black.

Occurs in ſmall and very ſmall, ſometimes angular, and ſometimes roundiſh, grains; alſo in octahedral cryſtals.

The grains have a feeble glimmering, and rough ſurface.

Internally, it is intermediate between ſhining and ſplendent; and its luſtre is metallic.

Fracture perfect conchoidal; and very rarely imperfect foliated.

Fragments indeterminately angular, and ſharp-edged.

Is ſemihard.

Brittle.

Eaſily frangible.

Heavy.

Specific gravity, 4.600, *Kirwan.*

It is ſtrongly attracted by the magnet.

Chemical

Chemical Characters and Compoſition.

Same as the preceding ſubſpecies.

Geognoſtic Situation.

It occurs imbedded in baſalt and wacke, and looſe in the beds of rivers.

At Herzogſwalde, and on the Heulenberg and the great Winterberg near Hohenſtein in Saxony, it is found imbedded in baſalt; ſaid alſo to occur in porphyry-ſlate in the Dick and Klotzberge at Milleſchau in Bohemia; at Trziblitz and Podſedlitz, alſo in Bohemia, it is found along with rolled pieces of baſalt, and pyrope, ſapphire, and hyacinth.

Geographic Situation.

In many of the hills belonging to the neweſt floetz-trap formation in Bohemia; in the bed of the river Elbe near Schandau in Saxony; in the Tyrol; county of Glatz; Swediſh Pomerania; Norway; France; Piedmont, the neighbourhood of Puzzuolo, Solfatara, and the iſland of Iſchia in Italy; iſland of Milo in the Archipelago; Lake Baikal: St Domingo; Cayenne; Guadaloupe; Virginia; and Greenland.

Uſe.

It is, although rarely, ſmelted as an ore of iron. In the Tyrol, near Naples, and in Virginia, it is

ſmelted

ſmelted in conſiderable quantity, and, owing to its purity, affords moſt excellent bar-iron.

Obſervations on the Species.

1. Werner was the firſt who obſerved that this ſpecies of ironſtone is not magnetic when at a depth in the earth, but that it acquires this property after expoſure to the influence of the atmoſphere.

2. It is diſtinguiſhed from iron-glance, with which it is often confounded, by the colour of its ſtreak, which is black, whereas that of iron-glance is cherry-red; by being powerfully magnetic, whereas iron-glance is ſcarcely affected by the magnet; and the cryſtallizations of magnetic ironſtone are different from thoſe of iron-glance.

FIFTH SPECIES.

Iron-Glance.

Eiſenglanz.—*Werner.*

This ſpecies is divided into two ſubſpecies.
1. Common iron-glance. 2. Iron-mica.

FIRST SUBSPECIES.

Common Iron-glance.

Gemeiner Eiſenglanz.—*Werner.*

Minera Ferri griſea, *Wall.* t. 2. p. 239.—Minera Ferri cœruleſcens, *Ibid.* p. 241.—Mine de Fer griſe ou ſpeculaire, *Rom. de Lile*, t. 3. p. 186.—Fer ſpeculaire, *De Born.* t. 2. p. 265.—Gemeiner Eiſenglanz, *Werner*, Pabſt. b. 1. ſ. 147.—*Id. Wid.* ſ. 802.—Specular Iron-ore, *Kirw.* vol. ii. p. 162.—Gemeiner Eiſenglanz, *Emm.* b. 2. ſ. 301.—Fer ſpeculaire, *Lam.* t. 1. p. 220. to 225.—Fer oligiſte, *Hauy*, t. 4. p. 38,-56.—Le Fer ſpeculaire commun, *Broch.* t. 2. p. 242.—Gemeiner Eiſenglance, *Reuſs*, b. 4. ſ. 61.

External Characters.

Its moſt common colour is dark ſteel-grey, but which ſometimes (in thoſe varieties that approach to red ironſtone) falls into browniſh red: It ſeldom (and almoſt only in the cryſtallized varieties) paſſes into iron-black. It occurs very frequently tarniſhed on the rents and external ſurface. The tarniſh is either that of tempered-ſteel, or is pavonine or irideſcent.

Occurs moſt commonly maſſive, and diſſeminated, and very frequently cryſtallized.

The following are its cryſtallizations:

1. Flat double three-ſided pyramid, in which the lateral planes of the one are ſet on the lateral edges of the other. It is the fundamental cryſtal of this ſpecies.
2. Double three-ſided pyramid, in which the angles on the common baſe are truncated, and the truncating planes obliquely ſet on the lateral edges.
3. Sometimes the truncations on the angles of the

the baſe become ſo large that they nearly touch each other, and then a *cube* is formed, in which the remains of the pyramidal planes become truncations on its edges.

4. When the ſummits of the double three-ſided pyramid are deeply truncated, there is formed a *ſix-ſided table*, in which the terminal planes are ſet alternately oblique and ſtraight on the lateral planes; and the lateral planes are ſometimes ſtraight, and ſometimes ſpherical convex.
5. The lens, which is the double three-ſided pyramid, having its ſummits and lateral edges rounded.
6. Sometimes the terminal planes of the table are replaced by a bevelment, in which caſe a double ſix-ſided pyramid, the extremities of which are very deeply truncated, is formed. Sometimes the alternate lateral edges are truncated; ſometimes alſo the angles on the common baſe.
7. When the figure 4. becomes thicker, there is formed a low equiangular ſix-ſided priſm, in which the terminal edges and angles are ſlightly truncated.

The planes of the cryſtals are ſometimes ſmooth, ſometimes ſtreaked; in the cube always diagonally ſtreaked.

Externally, it alternates from ſplendent to gliſtening,

ing, but is moſt commonly ſplendent: Its luſtre is metallic.

Internally, moſt commonly gliſtening, but ſometimes paſſes into ſhining and ſplendent; its luſtre is metallic.

Its fracture is ſometimes compact, ſometimes foliated; the compact is coarſe, ſmall and fine grained uneven, and ſeldom paſſes into imperfect and ſmall conchoidal; the foliated has a fourfold rectangular cleavage, and the folia are triply ſtreaked. The conchoidal and foliated varieties have the ſtrongeſt, the uneven the leaſt luſtre.

Fragments octahedral or pyramidal; ſometimes alſo indeterminately angular, and rather blunt-edged.

It is uſually unſeparated *, yet ſometimes it occurs in large, coarſe, and ſmall granular diſtinct concretions, alſo in imperfect wedge-ſhaped columnar, and more frequently in thick, and ſometimes ſtraight, ſometimes curved, lamellar diſtinct concretions. The ſurface of the concretions is ſometimes ſmooth, ſometimes tranſverſely ſtreaked, and is ſhining, which inclines to gliſtening.

It yields a cherry-red ſtreak.

Is

* The terms *compact* and *unſeparated* are by ſome conſidered as ſynonymous, which, however, is not the caſe. *Compact* refers to fracture ſurface; *unſeparated* to the maſs itſelf: ſo that a mineral may be compact, and alſo in diſtinct concretions.

Is hard.
Brittle.
Uſually rather difficultly frangible.
Heavy.
Specific gravity, 5.158, *Gellert;* 4.6770 to 5,0116, *Briſſon;* 4.793 to 5.2180, *Kirwan.*

Phyſical Character.

When pulverized, it is magnetic in a ſlight degree, but it does not, like magnetic ironſtone, attract filings of iron.

Chemical Characters.

Before the blow-pipe, without addition, it is infuſible; melted with borax, it gives a dirty yellow-coloured ſcoria.

Conſtituent Parts.

According to *Mr Kirwan*, it contains from 60 to 80 *per cent.* of iron, and from 20 to 30 of oxygen. A more complete analyſis is ſtill wanting.

Geognoſtic Situation.

It occurs in beds and veins in primitive and tranſition mountains, but has never been diſcovered in floetz mountains. It is uſually accompanied with magnetic ironſtone, compact red ironſtone, iron-pyrites and quartz; ſometimes it occurs with arſenical pyrites, copper-pyrites, ſparry ironſtone, lead-

lead-glance, tin-ſtone, brown-ſpar, heavy-ſpar, calc-ſpar, fluor-ſpar, quartz, and hornſtone.

Geographic Situation.

It is found in very conſiderable quantity in Sweden, as at Norberg, Bitſberg, Wärmeland, &c.; alſo pretty abundantly in Norway, as at Nordfield, Bergen, Bierke, Ulefoſs and Langoen; it is found in the greateſt quantity in the iſland of Elba, where it has been worked upwards of three thouſand years; in the Auſpaner mountains near Preſnitz, and Catharinenberg in Bohemia; at Altenberg, Berggieſhübel, Freyberg, Schneeberg, Henneberg in Thuringia, in the electorate of Saxony; Kupferberg, Queerbach, Oberſchmiedeberg in Sileſia; Geiſbach in Rauris, Windau in the valley of Brixen, &c. in Salzburg; Gothard in Switzerland; Framont in Lothringen, Valois, &c. in France; Roſenau in Hungary; government of Olnetz in Ruſſia; Bereſowſkoi in the Uralian mountains in Siberia; Chili.

Uſe.

When it occurs in quantity, it is ſmelted as an ore of iron. It affords an excellent malleable iron, which is, however, harder than that obtained from magnetic ironſtone. It affords alſo good caſt iron, but which is not ſo much valued as that obtained from other ores of iron.

Obſervations.

1. It paſſes, on the one hand, into common magnetic ironſtone; and on the other, into red ironſtone.

2. It is eaſily diſtinguiſhed from magnetic ironſtone by its ſtreak; magnetic ironſtone yielding a black, whilſt iron-glance affords a cherry red ſtreak.

3. It ſhould be divided into two kinds, *compact* and *foliated*.

SECOND SUBSPECIES.

Iron Mica.

Eiſenglimmer.—*Werner.*

Mica ferrea, *Wall.* t. 2. p. 242.—Mine de Fer micacée griſe, *Rom. d. L.* t. 3. p. 205.—Eiſenglimmer, *Wern.* Pabſt. b. 1. ſ. 152.—*Id. Wid.* ſ. 805.—Micaceous Iron-ore, *Kirw.* vol. ii. p. 184.—Mine de Fer micacée griſe, *Lam.* t. 1. p. 241.—Eiſenglimmer, *Emm.* b. 2. ſ. 306.—Fer oligiſte ecailleux, *Hauy*, t. 4. p. 45.—Le Fer micace, *Broch.* t. 2. p. 247.—Schuppiger Eiſenglimmer, *Reuſs*, b. 4. ſ. 71.

External Characters.

Its colour is iron-black, of different degrees of intenſity: thin plates or folia, when held between the eye and the light, appear blood-red.

Occurs

Occurs moſt commonly maſſive and diſſeminated; alſo cryſtallized in ſmall thin ſix-ſided tables, in which the terminal planes are ſet alternately oblique and ſtraight on the lateral planes.

Theſe tables ſometimes interſect each other ſo as to form cells.

The ſurface of the cryſtals is ſmooth and ſplendent.

Internally, it is ſplendent, which in ſome varieties paſſes into ſhining, and its luſtre is metallic.

Fracture perfect and curved foliated, with a ſingle cleavage.

Fragments ſometimes indeterminately angular, ſometimes tabular.

The maſſive occurs in large, coarſe, ſmall and fine granular diſtinct concretions.

Slightly tranſlucent on the edges; tranſlucent in thin plates.

Its ſtreak is cherry-red.

Is ſemihard, approaching to ſoft when it paſſes to iron froth.

Is brittle.

Uncommonly eaſily frangible.

Heavy.

Specific gravity, 4.500 to 5.070, *Kirwan.*

Geognoſtic Situation.

It occurs always in primitive mountains, and more in thoſe of a newer or middle age than in the older rocks. It occurs in beds and veins, and is uſually accompanied with red and brown iron-

ſtone,

ſtone, and iron-pyrites, ſometimes alſo with cop-per-pyrites, ſparry ironſtone, calc-ſpar, fluor-ſpar, quartz, hornſtone, indurated clay and lithomarge, and very ſeldom cinnabar?

Geographic Situation.

Near Dunkeld in Perthſhire, and Fitfulhead in Mainland, the largeſt of the Shetland iſlands; Dartmoor in Devonſhire; Nordfield, Bergen, Bierke, Langoen, and Ulefoſs in Norway; Sweden; government of Olnetz in Ruſſia; Ehrenberg near Waldheim, Dorfschemnitz, Johanngeorgenſtadt, Altenberg, Suhl in Thuringia, Teichwolframſdorf in Voighland in Saxony; Oſterrode in the Hartz; Sileſia; Farmanſreit in that part of the Fichtelgebirge which belongs to Bareuth; Schwarzenfeld in the Upper Palatinate; Oberhals in Bohemia; Salzburg; Dauphiny; Piedmont and iſland of Elba; Hungary; Chili.

Uſe.

It melts better than common iron-glance, but requires a greater addition of limeſtone. The iron which it affords is ſometimes cold-ſhort, but is well fitted for caſt ware.

Obſervations.

1. It paſſes into red iron-froth.

2. It

2. It affords from 70 to 80 *per cent.* of iron.

3. Iron-glance occurs usually with quartz; whereas magnetic ironstone is principally accompanied with limestone.

SIXTH SPECIES.

Red Ironstone.

Rotheisenstein.—*Werner.*

This species is divided into four subspecies: 1. Red Iron-froth. 2. Ochrey Red Ironstone. 3. Compact Red Ironstone. 4. Red Hematite.

FIRST SUBSPECIES.

Red Iron-froth.

Rother Eisenrahm.—*Werner.*

Hæmatites micaceus, *Wall.* t. 2. p. 248.—Rother Eisenrahm, *Wern.* Pabst. b. 1. s. 153.—*Id. Wid.* s. 807.—Red scaly Iron-ore, *Kirw.* vol. ii. p. 172.—Rother Eisenrahm, *Emm.* b. 2. s. 308.—Fer oxide rouge luisant, *Hauy*, t. 4. p. 106.—Le Eisenrahm rouge, *Broch.* t. 2. p. 249.—Rother Eisenrahm, *Reuss*, b. 4. s. 76.

External Characters.

Its colour is intermediate between cherry-red and

and brownish-red, and sometimes passes into steel-grey.

Occurs most commonly friable; in some varieties it approaches to coherent.

Occurs sometimes massive, sometimes coating, and disseminated, and is composed of scaly particles, which are glimmering, bordering on glistening, and have a semimetallic lustre.

It soils strongly.

Feels greasy.

Not particularly heavy, approaching to heavy.

Chemical Characters.

Is infusible before the blow-pipe without addition, but it communicates to borax an olive and asparagus green colour.

Constituent Parts.

Iron,	66.
Oxygen,	28.50
Silica,	4.25
Alumina,	1.25
	100

Henry.

Geognostic Situation.

It occurs usually in veins, and principally in primitive mountains, sometimes also in transition mountains, and probably also in floetz mountains. It is usually accompanied with compact and ochrey red ironstone, red hematite, iron-mica, sometimes also sparry-ironstone, and brown-spar?

Geographic

Geographic Situation.

Ulverſtone, and ſeveral other places on the borders of Lancaſhire, Luxillian in Cornwall; the mine called Oerve-Aaſe in Norway; Iberg and Blankenberg in the Hartz; Schmalkalden in Heſſia; Schneeberg, Ehrenfriederſdorf, Eibenſtock, Berggieſhübel, Freyberg, Sahl in the dutchy of Henneberg in Saxony; in the county of Naſſau; Landeck, Kupferberg, Jaurnick in Sileſia; Rathhauſberg in Gaſtein, Thurmberg in Salzburg; Schemnitz in Hungary; Chili.

Uſe.

At Sahl in the dutchy of Henneberg, where it occurs in very conſiderable quantity, it is melted, and yields good iron.

Obſervation.

The literal tranſlation of the German word *Rahm* is *cream*; I prefer, however, the word *froth*, as more expreſſive of the aſpect of the mineral.

SECOND SUBSPECIES.

Ochrey-red Ironſtone, or Red Ochre.

Ockricher Rotheiſenſtein.—*Werner.*

Ochra Ferri rubra, *Wall.* t. 2. p. 259.—Rotheiſenokker, *Wid.* ſ. 813.—Red Ochre, *Kirw.* vol. ii. p. 171.—Rothe Eiſenokker,

okker, *Emm.* b. 2. f. 317.—Fer oxidé rouge groſſier, *Hauy*, t. 4. p. 106, 107 —L'Ocre de Fer rouge, *Broch.* t. 2. p. 256. —Ochriger Rotheiſenſtein, *Reuſs*, b. 4. f. 83.

External Characters.

Colour light blood-red, which inclines to brownish-red.

Is uſually friable, but in ſome varieties it approaches and even paſſes into ſolid, and occurs as a coating on the other ores of iron; alſo diſſeminated, and ſometimes maſſive.

It conſiſts of dull duſty particles, which are very faintly glimmering.

It ſoils more or leſs ſtrongly.

It feels more meagre than greaſy.

Not particularly brittle.

Eaſily frangible.

Not particularly heavy.

Specific gravity, 2.952, *Wiedemann.*

Geognoſtic and Geographic Situations.

It occurs in veins, and is almoſt always accompanied with compact red ironſtone and red hematite, and ſometimes ſparry ironſtone, but it is ſeldom quite pure, being uſually mixed with other ſpecies of iron-ore.

Its geographic ſituation is nearly the ſame as that of the other ſpecies of red ironſtone. It occurs particularly abundant in the Irrgang near Platte in Bohemia.

Uſe.

Uſe.

It melts the moſt eaſily of all the ores of iron, and affords excellent malleable iron.

THIRD SUBSPECIES.

Compact Red Ironſtone.

Dichter Rotheiſenſtein.—*Werner.*

Hæmatites ruber ſolidus, *Wall.* t. 2. p. 246.—Dichter Rotheiſenſtein, *Wern.* Pabſt. b. 1. ſ. 154. — *Id. Wid.* ſ. 807. — Hématite compacte rouge, *De Born.* t. 2. p. 267.—Compact red Ironſtone, *Kirw.* vol. ii. p. 170.—Dichter Rotheiſenſtein, *Emm.* b. 2. ſ. 310.—La Mine de Fer rouge compacte, *Broch.* t. 2. p. 251. — Dichter Rotheiſenſtein, *Reuſs*, b. 4. ſ. 79.

External Characters.

Its colour is intermediate between dark ſteel-grey and browniſh-red; ſometimes, however, inclining more to the one, ſometimes more to the other.

Occurs moſt commonly maſſive, ſometimes alſo diſſeminated, ſpecular, with impreſſions, in pyramidal ſuppoſititious cryſtals, and ſeldom cryſtallized in cubes, which are either perfect, or truncated on all their angles, or very deeply on the two diagonally oppoſite angles.

The cryſtals are middle-ſized, ſmall, and ſometimes very intimately grown together.

The ſurface of the true cryſtals is ſmooth; that of the ſuppoſititious cryſtals is rough.

Externally, the true cryſtals are gliſtening; the ſpecular external ſhape ſplendent: the ſuppoſititious cryſtals dull; luſtre metallic.

Internally, it is commonly only glimmering; but the ſlaty borders on gliſtening; luſtre ſemimetallic.

Fracture uſually even, from which, although but ſeldom, it paſſes into coarſe-grained uneven and into large conchoidal; it occurs alſo, but rarely, ſlaty.

Fragments indeterminately angular, more or leſs ſharp-edged.

It yields a blood-red ſtreak.

It is commonly intermediate between hard and ſemihard; it ſometimes, however, paſſes from hard into ſemihard, and nearly into ſoft.

Not particularly brittle.

More or leſs eaſily frangible.

Heavy.

Specific gravity, 3.423, *Kirwan*; Cubic from Siberia, 3.760, *Kirwan*; from Lancaſhire, 3.5731, *Briſſon*; 3.863, *Wiedemann*.

Chemical Characters.

It becomes darker before the blow-pipe, but is infuſible either alone or with glaſs of borax; to which however it communicates an olive-green colour.

Conſtituent

Conſtituent Parts.

Oxide of iron,	65.4
Silica,	20.7
Alumina,	9.3
Oxide of manganeſe,	2.7

Lampadius.

Geognoſtic Situation.

It occurs in beds and veins, and uſually with red hematite and ochrey red ironſtone. This, and alſo its occurrence with quartz, hornſtone, red jaſper, and ſometimes with red iron-flint, may be conſidered as empyrical characters of it.

Geographic Situation.

It occurs in conſiderable quantity in Lancaſhire; in the mine called Oevre-Aaſe in Norway; at Leerbach, Elbingerode, Andreaſberg in the Hartz; Konigſberg near Gieſſen in Heſſia; remarkably fine at Schellerhau near Altenberg, Schneeberg, Johanngeorgenſtadt, alſo at Schwarzburg, Eibenſtock, Soſa, Suhl, Saalfeld and Reichmanſdorf in Thuringia, Voightberg in Voightland, in Saxony; Rudelſtadt, Jauernick, Reinerz, Hermannſwaldau, Kalendorf in Sileſia; Platten, Sudelheide, Kremſger, Hammerberg near Schmiedeberg, Glieden, Oberhals, where the cryſtallizations already deſcribed are found, Schmiedeberg, Hadorf, Kleinthal in Bohemia; Schreckenberg, Alpe Linde, Schöfferitz, Windingſberg near Werfen in Salzburg;

burg; ironworks of Kolywan, thoſe of Catharinenberg, &c. in Siberia.

Uſe.

As it affords good caſt-iron, and pretty malleable, although ſomewhat ſoft bar-iron, it is often ſmelted at ironworks.

Obſervations.

1. It paſſes, on the one ſide, into iron-glance; on the other, into clay ironſtone, and ſometimes alſo into common jaſper.

2. *Count de Bournon* deſcribes, in the Philoſophical Tranſactions of the Royal Society of London for 1803, a Cubic Iron-Ore as a new ſpecies, which, however, appears to agree in colour, cryſtallization, luſtre, fracture, colour of its ſtreak and ſpecific gravity, with the cubic variety of compact red ironſtone: hence I ſuſpect that it is the ſame.

FOURTH SUBSPECIES.

Red Hematite.

Rother Glaſkopf.—*Werner.*

Hæmatites ruber, *Wall.* t. 2. p. 247.—Rother Glaſkopf, *Wern.* Pabſt. b. 1. ſ. 156. — *Id. Wid.* ſ. 811. — Hématite rouge, *De Born.* t. 2. p. 288. — Red Hæmatites, *Kirw.* vol. ii. p. 168.—Rother Glaſskopf, *Emm.* b. 2. ſ. 313. — L'Hématite rouge, *Broch.* t. 2. p. 254. — Fer oxidé hématite, *Hauy,* t. 4. p. 105. 109. 111, 112.—Faſriger Rotheiſenſtein, *Reuſs,* b. 4. ſ. 85.

External

External Characters.

Its colour is uſually intermediate between brownish-red and dark ſteel-grey. Some varieties incline to blood-red, others to ſteel-grey, and others to bluiſh.

Occurs moſt frequently maſſive and reniform; alſo botryoidal, ſtalactitic and globular.

The external ſurface is commonly rough and glimmering, ſeldom ſmooth and ſhining.

Internally, it is uſually gliſtening, which ſometimes paſſes into glimmering, and its luſtre is ſemimetallic.

Fracture always ſtraight, delicate or coarſe, and parallel, or ſtellular, and ſcopiform diverging fibrous.

Fragments commonly cuneiform; ſeldom, as in the coarſe fibrous, ſplintery.

It occurs almoſt always in large, coarſe, ſmall or fine angulo-granular diſtinct concretions. In every concretion the fibres of the fibrous fracture diverge from one point, and when they reach the ſurface, become ſpherically curved, and thus form the globular external ſhape. Theſe concretions are uſually accompanied by curved lamellar diſtinct concretions, which are bent in the direction of the external ſurface, and which interſect them. It ſeldom occurs in cuneiform columnar concretions. The ſurface of the concretions is either

either ſmooth or ſtreaked; its colour inclines to iron-black, and its luſtre is ſhining and metallic.

Streak always blood-red.

Is hard, paſſing into ſemihard.

Brittle.

Not particularly eaſily frangible.

Heavy, inclining to uncommonly heavy.

Specific gravity, 4.740, *Gellert*; 5.005, *Kirwan*; 4.8983, *Briſſon*; 4.840, *Wiedemann*.

Conſtituent Parts.

It affords, in the ſmelting furnace, about ſixty pounds in the hundred, and is the richeſt of the ſubſpecies of red ironſtone. Its conſtituent parts have not been accurately aſcertained; beſides iron, it is ſaid to contain alumina, ſilica and manganeſe. It is to be regretted that chemiſts have hitherto paid ſo little attention to the analyſis of iron-ores.

Geognoſtic Situation.

It occurs in every ſituation where the compact ſubſpecies is found, and like it in veins, beds, and lying maſſes (*liegende Stöcke*) that approach in magnitude to mountain maſſes, principally in primitive mountains, but alſo in tranſition and floetz mountains.

Geographic Situation.

It is found in very conſiderable quantity in Saxony,

Saxony, from Berggieſhübel to Voightland; in Bohemia, but not ſo abundantly as in Saxony; Bareuth; Wolfftein in the Palatinate; Sileſia; Lauterberg, Walkenried, Andreaſberg, Wernigerode in the Hartz; Salzburg; Siberia.

Uſe.

It affords excellent malleable and caſt iron; and when ground, it is alſo uſed for poliſhing tin, ſilver, and gold veſſels, and for colouring iron brown.

Obſervations.

The word *Hematite* is derived from the Greek αἷμα, *ſanguis*, which was given to it from the frequent red colour of the ſubſtances included under this name.

Obſervations on the Species in general.

1. Reſpecting its geographic ſituation, it is to be obſerved, that it occurs in great quantity in the electorate of Saxony, leſs abundantly in the eaſt ſide of the Hartz, and Bohemia; not ſo abundantly in the Fichtelgebirge, and ſcarcely at all in Norway, Sweden, Poland, Hungary, and Ruſſia. In England it occurs particularly abundant in Lancaſhire, where Werner ſuſpects it to lie in floetz mountains.

2. As a teſt of the goodneſs of the iron obtained from this ſpecies of ore, it may be mentioned, that plate-iron and wire are prepared from it.

3. It

3. It is one of the moſt common ſpecies of iron-ſtone.

SEVENTH SPECIES.

Brown Ironſtone.

Braun Eiſenſtein.—*Werner.*

This ſpecies is divided into four ſubſpecies: 1. Brown Iron-froth. 2. Ochrey brown Iron-ſtone. 3. Compact Brown Ironſtone. 4. Brown Hematite.

FIRST SUBSPECIES.

Brown Iron-froth.

Brauner Eiſenrahm.—*Werner.*

Id. Wern. Pabſt. b. 1. ſ. 159.—*Id. Wid.* ſ. 814.—Brown ſcaly Iron-Ore, *Kirw.* vol. ii. p. 166.—Brauner Eiſenrahm, *Emm.* b. 2. ſ. 318.—Le Eiſenrahm brun, *Broch*, t. 2. p. 258.—Brauner Eiſenrahm, *Reuſs*, b. 4. ſ. 90.

External Characters.

Its colour is intermediate between ſteel-grey and clove-brown, ſometimes inclining more to the one, ſometimes more to the other.

It is intermediate between friable and ſolid; ſome varieties are completely friable.

Occurs

Occurs maſſive, coating, ſpumous, ſometimes alſo fruticoſe, and irregular dendritic.

It is compoſed of ſcaly particles, which are intermediate between ſhining and gliſtening, and which have a metallic luſtre.

The fracture ſurface of the maſſive varieties is glimmering, with a ſemimetallic luſtre.

It ſoils ſtrongly.

It is more or leſs cohering, ſometimes verging on ſolid.

Feels greaſy.

Is ſometimes light, ſometimes ſwimming.

Chemical Characters.

It blackens before the blow-pipe, but does not melt, and gives to glaſs of borax a yellowiſh-green colour.

Conſtituent Parts.

It has never been analyzed.

Geognoſtic Situation.

It occurs almoſt always lining druſy cavities in brown hematite. Theſe cavities occur more frequently in hematite which is found in veins, than in that which is found in beds.

Geographic Situation.

It is found near Sandlodge in the Mainland, one of the Shetland Iſlands; Schmalkalden in

Heſſia; Clauſthal in the Hartz; Bredgangs Mine in Norway; Schmottſeifen in Sileſia; Groſskamſdorf, and Voightſberg in Saxony; Nebra and Naila in Bareuth; Lautereck in the Palatinate; Rathhauſberg in Salzburg; Carinthia; Carniola; Stiria; Chili.

Obſervations.

1. At Kamſdorf, it is known under the names Eiſennann and Eiſenblüthe.

2. The whole ſpecies contains a conſiderable portion of manganeſe in its compoſition, and this ſubſpecies a greater proportion than the others.

SECOND SUBSPECIES.

Ochrey Brown-Ironſtone.

Ockricher Brauneiſenſtein.—*Werner.*

Ochra Ferri flava? *Wall.* t. 2. p. 258.—Ochra Ferri fuſca, *Ibid.* p. 344.—Braune Eiſenokker, *Wid.* ſ. 819.—Brown Iron Ochre, *Kirw.* vol. ii. p. 167.—Braune Eiſenokker, *Emm.* b. 2. ſ. 327.—L'Ocre de Fer brune, *Broch.* t. 2. p. 263.—Ockriger Brauneiſenſtein, *Reuſs*, b. 3. ſ. 96.

External Characters.

Colour very light yellowiſh-brown, which in ſome varieties inclines to ochre-yellow, in others to clove-brown.

Occurs

Occurs maſſive and diſſeminated.
Is intermediate between ſolid and friable.
Is compoſed of dull, ſeldom very faintly glimmering, coarſe earthy particles.
Soils ſtrongly.
It is more or leſs cohering.
Intermediate between brittle and ſectile.
Not particularly heavy, approaching to heavy.

Chemical Characters.

It burns black, which diſtinguiſhes it from yellow earth, which burns red; it communicates to glaſs of borax an olive-green colour.

Geognoſtic Situation.

For the geognoſtic ſituation, ſee the obſervations on the ſpecies in general.

Geographic Situation.

It is found at Kongſberg and Arendal in Norway; Groſskamſdorf in Saxony; Modrzan, Briezan, Woznitz, Orpes and Kupferberg in Bohemia; Upper Palatinate; Rott in Bavaria; Hüttenberg in Carinthia; Salzburg.

THIRD SUBSPECIES.

Compact Brown Ironſtone.

Dichter Brauneiſenſtein.—*Werner.*

Id. Werner, Pabſt. b. 1. ſ. 160. — *Id. Wid.* ſ. 815. — Compact brown Ironſtone, *Kirw.* vol. ii. p. 165.—Dichter Brauneiſenſtein, *Emm.* b. 2. ſ. 321.—La Mine de Fer brune compacte, *Broch.* t. 2. p. 259.—Dichter Brauneiſenſtein, *Reuſs*, b. 4. ſ. 93.

External Characters.

Colour clove-brown of different degrees of intenſity.

Occurs moſt commonly maſſive and diſſeminated, frequently alſo cylindrical, ſmall reniform, parallel circo-cellular, with pyramidal impreſſions, and very rarely in ſuppoſititious cryſtals, of which the following are known:

1. Small cube.
2. Rhomb; and is ſaid alſo in
3. Lenſes.

It occurs frequently alſo in the following extraneous external ſhapes, viz. corallite, madreporite, fungite and ſcrewſtone.

Internally, uſually ſemimetallic glimmering.

Fracture moſt commonly even, ſometimes alſo large and flat conchoidal; ſometimes fine-grained uneven and fine earthy.

Fragments

Fragments indeterminately angular, more or leſs blunt-edged.

Streak yellowiſh-brown, paſſing into ochre-yellow.

Is ſemihard, ſometimes inclining to ſoft.

Not particularly brittle.

Eaſily frangible.

Heavy.

Specific gravity, 3.5027 the cubic, } *Briſſon.*
3.4771

3.551, from Bayreuth, } *Kirwan.*
3.753, from the Tyrol, }

3.073, *Wiedemann.*

Chemical Characters.

Before the blow-pipe its colour darkens, and it becomes magnetic: to glaſs of borax it communicates an olive-green colour.

Geognoſtic Situation.

It occurs in the ſame geognoſtic ſituation as the following ſubſpecies. It is always accompanied with ochrey and fibrous brown ironſtone.

Geographic Situation.

It is found near Sandlodge in Mainland, the largeſt of the Shetland iſlands; Lauterberg, and Blankenburg in the Hartz; Schmalkalden in Heſſia; Saye and Altenkirchen in Weſterwald;

Schwarzenberg,

Schwarzenberg, Schneeberg, Scheibenberg, Groſskamſdorf, Voightſberg in Voightland, Sahlberg, Konitz and Suhl in Thuringia, in Saxony; Kupferberg, Aufpaner mountains near Preſsnitz, Wifterſchan near Töplitz, Stiahlan near Rakowa in Bohemia; gold mine near Schreiberau, Muchaſtein near Schönau and Gorifseifen in Silefia; Upper Palatinate; Lower Palatinate; Dutchy of Deux Ponts; Naila in Bayreuth; Suabia; Tyrol; Salzburg; Stiria; Vellach, Hüttenberg and Eifenbach in Carinthia; Hungary; Tranſilvania; France; in the diſtricts of Catharinenberg, of Orenburg and Kolywan? in Siberia; New York in America.

FOURTH SUBSPECIES.

Brown Hematite.

Brauner Glaſskopf.—*Werner.*

Id. Werner, Pabſt. b. 1. ſ. 161.—*Id. Wid.* ſ. 817. — Brown Hematite, *Kirw.* vol. ii. p. 163. — Brauner Glaſkopf, *Emm.* b. 2. ſ. 323.—Fer oxidé hématite brun, *Hauy.* t. 4. p. 105.—L'Hematite brune, *Broch.* t. 2. p. 261. — Faſriger Braun-eiſenſtein, *Reuſs*, b. 4. ſ. 98.

External Characters.

The ſurface of the freſh fracture is clove-brown, which in ſome varieties paſſes into ſteel-grey; in others, into blackiſh-brown, and browniſh-black; in

in others, into light yellowiſh brown and ochre yellow. The external ſurface is tarniſhed velvet black and bluiſh-black; ſometimes alſo ſteel-grey, pinchbeck-brown, pavonine and irideſcent.

It occurs ſeldom maſſive, more frequently ſtalactitic, coralloidal, reniform, botryoidal, tuberoſe; ſometimes alſo cylindrical, fruticoſe, dendritic, large and ſmall cellular, in ſuppoſititious ſix-ſided pyramids, and in true cryſtals, but which are ſo minute, that their figure cannot be aſcertained.

The external ſurface of the particular external ſhapes is ſometimes ſmooth, ſometimes granulated, but ſeldom rough or druſy.

Externally, uſually ſplendent.

Internally, it is only gliſtening, which ſometimes, however, paſſes into glimmering, ſometimes even into ſplendent: Its luſtre is intermediate between ſilky, pearly and reſinous.

Fracture long and delicate, or ſhort and coarſe, and either ſtraight or curved, ſeldom parallel, and almoſt always ſtellular and ſcopiform diverging fibrous. The long fibrous is ſometimes extremely delicate fibrous, and even paſſes into ſmall conchoidal; the ſhort fibrous paſſes into narrow radiated. The conchoidal varieties have the ſtrongeſt luſtre, the delicate fibrous the darkeſt colour *.

Fragments

* The following agreements of colour and fracture are deſerving of attention:

1. Clove-brown, is long and delicate fibrous.

2. The

Fragments ſometimes ſplintery; ſometimes wedge-ſhaped; ſeldom indeterminately angular.

The long and delicate fibrous occurs in curved lamellar and longiſh granular diſtinct concretions; the lamellar concretions interſect the granular: it occurs alſo in cuneiform columnar diſtinct concretions.

The concretions are not ſo diſtinct as thoſe in red hematite.

It is commonly opaque; the browniſh black is weakly tranſlucent on the edges.

Streak ochre yellow.

Is ſemihard.

Brittle.

Very eaſily frangible.

Heavy.

Specific gravity, 3.789, *Gellert*; 3.951, *Kirwan*; 4.029, *Wiedemann*.

Chemical Characters.

It becomes black before the blow-pipe, and diſſolves with ſome ebullition in glaſs of borax, to which it communicates an olive-green colour.

Conſtituent

2. The varieties that incline to blue, are ſhort and coarſe fibrous.

3. Black, is extremely delicate fibrous, verging on conchoidal.

4. Blackiſh brown, is radiated.

Conſtituent Parts.

The conſtituent parts of this ſubſpecies have not hitherto been accurately aſcertained: they appear to be iron, manganeſe, and oxygen.

Geognoſtic and Geographic Situations.

Theſe are contained in the following obſervations

ON THE SPECIES IN GENERAL.

A. *Chemical Properties, &c.*

1. This ſpecies of ironſtone melts eaſily, and affords uſually from 40 to 60 *per cent.* of iron. The caſt-iron which it affords is indifferent, and the veſſels made of it are not ſo fine as thoſe manufactured from the caſt-iron of red ironſtone, and other ores of iron. The wrought iron obtained from it is very malleable, and at the ſame time hard; hence it is advantageouſly uſed in caſes where ſofter iron would not anſwer. It alſo affords excellent ſteel, which is conjectured to be owing to the manganeſe it contains.
2. When it is intermixed with quartz, it affords a cold-ſhort iron; but if with copper-pyrites, a red-ſhort iron. It would appear, however, to require a greater quantity of ſulphur to produce red-ſhort iron from this ſpecies than

from moſt of the other ores of iron, and this is conjectured to be owing to the manganeſe which it contains.

3. It melts uſually without a flux; and when one is neceſſary, clay-ſlate is that which is generally uſed.

4. It is ſuppoſed to contain a portion of calcareous earth, which is indeed rendered very probable from its geognoſtic ſituation and accompanying minerals.

5. It alſo contains manganeſe, which appears to be in leaſt quantity in brown hematite, and in largeſt quantity in brown iron-froth.

6. The brown hematite affords the greateſt quantity of iron of any of the ſubſpecies.

B. *Geognoſtic Situation.*

It occurs in primitive, tranſition, and floetz mountains, but more frequently in the two latter; and when in primitive mountains, in thoſe only which are of newer formation. Its repoſitories are veins, beds, lying maſſes (liegende Stöcke), and mountain maſſes (Stück Gebirge.) When it occurs in veins and lying maſſes, the compact and ochrey ſubſpecies form the principal maſs. The brown hematite occurs often in cavities in theſe veins or beds, but it does not fill them up, it only lines their walls, and is again covered by brown iron-froth; ſo that here ochrey and compact

brown

brown ironſtone are the oldeſt, and iron-froth the neweſt formation. It is uſually accompanied with black ironſtone, ſparry ironſtone, calc-ſpar, brown-ſpar and heavy-ſpar, and more ſeldom with quartz.

It paſſes, on the one ſide, into clay ironſtone; on the other, into red ironſtone, and frequently alſo into ſparry ironſtone. Werner obſerves, that it appears to bear the ſame relation to ſparry ironſtone that red ironſtone does to iron-glance.

C. *Geographic Situation.*

It occurs in Voightland; at Schneeberg, Scheibenberg and Raſchau in the Erzgebirge; alſo at Kamſdorf, where it (principally the ochrey ſubſpecies) occurs in floetz rocks, in beds, which are ſometimes ſo thick that they nearly form lying maſſes. A part of this depoſition paſſes into Schwarzburg, as far as Pönitz, and even reaches to Henneberg, where there are very extenſive ironworks. Further, it is found in very conſiderable quantity all around the Fichtelgebirge, and there are ironworks for ſmelting this ore on the Saxon and Bohemian ſides, and in that part of it which belongs to Bayreuth. It is found in beds in the Upper Palatinate, and in Franconia. It is leſs abundant in the Hartz, where at Iberg near Grün, the ochrey brown ironſtone occurs in *Putzenwerke* in limeſtone. Very conſiderable mines of it occur in Naſſau, Heſſia, and Weſterwald; and it alſo

ſo occurs in the Tyrol, Carinthia, Stiria, Upper Italy, and in the ſouthern provinces of France.

It is remarked by *Werner*, that this very abundant ſpecies ſcarcely occurs in Norway, Sweden, or Ruſſia; in very ſmall quantity in England, and there only in veins in Cornwall. To this we may add the ſmall portion found in the Shetland iſlands.

EIGHTH SPECIES.

Sparry Ironſtone.

Spatheiſenſtein.—*Werner.*

Minera Ferri alba, *Wall.* t. 2. p. 251.—Mine de Fer ſpathique, *Rom. de Liſle*, t. 3. p. 281.—Spathiger Eiſenſtein, *Wern.* Pabſt. b. 1. ſ. 164.—*Id. Wid.* ſ. 820.—Calcareous or Sparry Iron-Ore, *Kirw.* vol. ii. p. 190.—Fer ſpathique, ou Mine de fer blanche, *De Born.* t. 2. p. 290.—Fer ſpathique, *Lam.* t. 1. p. 263.—Chaux carbonatée ferrifere avec Manganeſe, *Hauy*, t. 4. p. 117, 118.—La Mine de Fer ſpathique, ou le Fer ſpathique, *Broch.* t. 2. p. 264.—Spatheiſenſtein, *Reuſs*, b. 4. ſ. 107.

External Characters.

Colour light yellowiſh-grey, which paſſes through pea-yellow and cream-yellow into yellowiſh-brown and clove-brown, and further into blackiſh-brown and browniſh-black. It occurs very

very ſeldom intermediate between yellowiſh-brown and greeniſh-grey.

On expoſure to the action of the air, or to heat, the colours change into brown and black. It occurs very ſeldom with a columbine or pavonine tarniſh.

Occurs maſſive, diſſeminated, with pyramidal impreſſions, in plates, and cryſtallized.

The cryſtailizations are the following:

1. The rhomb, which is either perfect, or truncated on the two diagonally oppoſite obtuſe angles, and the planes are either ſtraight, or curved; and when curved, either convex or concave.
2. The lens, and this either ſpherical or ſaddle ſhaped.
3. The octahedron, in which the planes are either ſtraight or convex, and ſometimes truncated on the angles.
4. Garnet dodecahedron, which is formed by an aggregation of rhombs.

The cryſtals are ſeldom large, commonly middle ſized and ſmall, ſometimes even very ſmall.

The ſurface of the octahedron is ſmooth, ſpecular, and ſplendent; that of the other cryſtallizations is rough, or druſy and gliſtening.

Internally it varies from ſplendent to gliſtening and glimmering, and its luſtre is pearly.

Fracture more or leſs perfect foliated, ſometimes ſtraight, often curved foliated. Cleavage is threefold, and the folia interſect each other obliquely.

The

The imperfect foliated fracture is sometimes conjoined with the splintery, and this occurs principally in the greenish-grey variety.

Fragments very oblique rhombs, like those of calc-spar.

Commonly translucent on the edges, also translucent; but the black varieties are opaque.

Occurs in granular distinct concretions, which are of all degrees of magnitude, from large to fine.

Streak yellowish-brown.

Is semihard, (harder than calc-spar), which in the darker varieties inclines to soft.

Not particularly brittle.

Easily frangible.

Heavy.

Specific gravity, 3.784, *Gellert;* 3.640–3.810, *Kirwan;* 3.672, *Brisson;* 3.300 to 3.600, the decomposed.—*Kirwan.*

Chemical Characters.

Before the blow-pipe it becomes black. By exposure to heat the crystallized varieties lose from 0.35 to 0.40 in weight. It dissolves with ebullition in glass of borax, to which it communicates a dirty green colour. It always effervesces more or less with acids.

Constituent

Conſtituent Parts.

	From Stiria.	From Sweden.
Oxide of iron,	38	22
Oxide of manganeſe,	24	28
Lime,	19	26
Carbonic acid,	10	17
Water,	9	6
	Bergman. 100	*Bergman.* 99

Geognoſtic Situation.

It occurs in primitive and floetz mountains.

In primitive mountains it occurs in veins, frequently accompanying lead, ſilver and copper ores. Thus at Prizbram it occurs along with native ſilver, white ſilver-ore, lead-glance, brown blende, green lead-ore, and iron-pyrites. At Freyberg it occurs in veins of different formations, accompanied with copper-pyrites, iron-pyrites, lead-glance, arſenic pyrites, and black blende.

In floetz mountains it occurs in beds, where it is uſually accompanied with brown ironſtone, brown ſpar, and calc-ſpar, as at Eiſenerz in Stiria, and Schmalkalden in Heſſia, where there is a bed from 25 to 30 fathoms thick.

Geographic Situation.

It is found in ſmall quantities in different places of England, Scotland, and Ireland; Saxony, Bohemia, Bayreuth, Upper Palatinate, Sileſia, Koburg,

burg, Savoy, Switzerland, Sweden, Norway, Greenland, and Siberia: but it is only in the following countries where it is found in ſuch quantity as to be employed as an ore of iron: In the Fichtelgebirge; at Schmalkalden in Heſſia it occurs (the black variety) in great quantity, where it has been mined and ſmelted for many centuries; in the Hartz, as at Clauſthal, Iberg, Blankenburg, and Stollberg, it occurs more ſparingly; in Weſtphalia the light coloured is mined in great quantity; Eiſenerz and Schladinrig in Stiria; Hüttenberg in Carinthia; Schwatz in the Tyrol; Jauberling in Carniola; many places in Salzburg; in Hungary as at Schemnitz, Schmolnitz, Dopſhau, and Siowinka, it occurs in ſmall quantity; in Piedmont; France; at Somororſtro, in the province of Biſcay in Spain, there is a whole hill compoſed of this ſpecies of ironſtone, which has been worked for ſeveral thouſand years. It is there accompanied with red ironſtone, which renders the ſmelting very advantageous.

Uſe.

It affords an iron which is excellently ſuited for ſteel making. The black variety is ſaid to afford the beſt kind of iron.

Obſervations.

1. It is nearly allied to brown ironſtone, and brown-

brown-ſpar, and there is a tranſition from calc-ſpar through brown-ſpar, ſparry ironſtone to brown ironſtone.

2. Caſt-iron obtained from this ſpecies, or from brown ironſtone, preſents a whitiſh colour and radiated fracture; whereas that obtained from red ironſtone, and ſeveral other ores of iron, has a dark-grey colour, and a granular fracture. Further, the caſt-iron obtained from this ſpecies can be converted into ſteel, but a great portion of that obtained from red ironſtone, &c. paſſes to the ſtate of malleable iron, long before the maſs in the furnace has become ſteel. The ſteel obtained from this ore is ſaid to contain a ſmall portion of manganeſe, which is ſuppoſed to be the cauſe of its durability in the fire, and what renders it leſs liable to become ſoft and irony.

NINTH SPECIES.

Black Ironſtone.

Schwarzeiſenſtein.—*Werner.*

This ſpecies is divided into two ſubſpecies: 1. Compact Black Ironſtone: 2. Black Hematite.

FIRST SUBSPECIES.

Compact Black Ironſtone.

Dichter Schwarzeiſenſtein.—*Werner.*

Dichter Schwarzeiſenſtein, *Reuſs*, b. 4. ſ. 103.

External Characters.

Its colour is intermediate between bluiſh-black and dark ſteel grey, but more inclining to the firſt.

Occurs maſſive, tuberoſe, ſmall reniform, botryoidal, fruticoſe, and claviform.

The external ſhapes have a rough glimmering, or faintly gliſtening ſurface.

Internally, it is glimmering, paſſing into gliſtening, and its luſtre is ſemimetallic.

Fracture uſually conchoidal, but ſometimes paſſes into fine and ſmall-grained uneven.

Fragments indeterminately angular; more or leſs ſharp-edged.

It ſometimes preſents thin and concentric curved lamellar diſtinct concretions, which are bent in the direction of the external ſurface.

The ſtreak is ſhining, but its colour remains unchanged.

Is ſemihard.

Brittle.

Eaſily frangible.

Heavy.

Specific gravity, 4.076, *Wiedemann.*

SECOND

SECOND SUBSPECIES.

Black Hematite.

Schwarzer Glaskopf.—*Werner.*

Faſriger Schwarzeiſenſtein, *Reuſs*, b. 4. ſ. 105.

External Characters.

Its colour inclines more to ſteel-grey than the preceding ſubſpecies.

Occurs maſſive and reniform.

Internally it is glimmering, often even gliſtening, and its luſtre is ſemimetallic.

Fracture extremely delicate fibrous, which paſſes into even ; the fibrous is either curved or ſtraight, and ſcopiform, or ſtellular diverging.

Fragments cuneiform.

Occurs in large and coarſe granular diſtinct concretions.

Streak ſhining.

In other characters agrees with the preceding ſubſpecies.

Chemical Characters.

When melted before the blow-pipe with borax, it yields a violet-blue coloured glaſs.

Conſtituent Parts.

Its compoſition is not known. It is ſuppoſed to contain

contain manganeſe in a larger proportion than brown ironſtone, alſo alumina and calcareous earth.

Geognoſtic Situation.

It occurs in primitive and floetz mountains, and is uſually accompanied with brown ironſtone, ſparry ironſtone and quartz.

Geographic Situation.

Blumenthal, Geier, Scheibenberg, Johanngeorgenſtadt, and in the level called the Drei Brüder, near Raſchau in Saxony; Naila in the principality of Bayreuth; Schindelloh in the Upper Palatinate; Broterrode and Sahlberg near Schmalkalden in Heſſia; the Hollertſzug in the dutchy of Sayn-Altenkirchen; Blankenburg in the Hartz.

Uſe.

It is very eaſily fuſible, and yields a good iron; but it has the inconvenience of acting very powerfully on the ſides of the furnace.

Obſervations.

1. It was for a long time confounded with the Compact Grey Manganeſe Ore, to which it bears a conſiderable reſemblance. It was firſt accurately deſcribed and aſcertained to be a diſtinct ſpecies by Werner.

2. It

2. It is a rare mineral, and the Black Hematite has been hitherto found only at Schmalkalden.

3. It appears to pafs into Brown Iron-froth.

TENTH SPECIES.

Clay Ironftone.

Thoneifenftein.—*Werner.*

This fpecies comprehends feven fubfpecies. 1. Reddle; 2. Columnar Clay Ironftone; 2. Lenticular Clay Ironftone; 4. Jafpery Clay Ironftone; 5. Common Clay Ironftone; 6. Iron Kidney, or Kidney-fhaped Iron-ore; 7. Pea Ore, or Pea-fhaped Iron-ore.

FIRST SUBSPECIES.

Reddle.

Roethel.—*Werner.*

Ochra Ferri rubra, cretacea folida, rubrica, *Wall.* t. 2. p. 260. — Rother Eifenokker, *Wid.* f. 813.—Argile martiale rouge, Sanguine ou Crayon rouge, *De Born.* t. 2. p. 230.—Röthel, *Emm.* b. 2. f. 350.—Argile ocreufe graphique, *Hauy* t. 4. p. 445, 446.—Le Crayon rouge, *Broch.* t. 2. p. 271.—Röthel, *Reufs*, b. 4. f. 124.

External

External Characters.

Colour light browniſh-red, which paſſes into cherry-red.

Occurs only maſſive.

Principal fracture glimmering, croſs fracture dull.

Principal fracture fine ſlaty, croſs fracture earthy.

Fragments ſometimes tabular, ſometimes ſplintery.

Streak lighter and more ſhining than that of the fracture ſurface.

It ſoils ſtrongly, and writes.

Is ſectile.

Eaſily frangible.

Adheres ſtrongly to the tongue.

Feels meagre.

Heavy, paſſing into not particularly heavy.

Specific gravity, 3.931, *Blumenbach.* 3.1391, *Briſſon.*

Chemical Characters.

Expoſed to a red heat it decrepitates and becomes black; at the temperature of 159° it melts into a greeniſh-grey ſpumous enamel.

Geognoſtic Situations.

It occurs principally and moſt commonly in newer clay-ſlate; at Saalfeld it forms a whole bed;

bed, and in other places it is found in large maſſes imbedded in the clay-ſlate. In Sileſia it is ſaid to occur in compact limeſtone.

Geographic Situation.

Kamſdorf, Blankenburg, Konitz and Saalfeld in Thuringia, and Upper Luſatia in Saxony; Thalitter in Heſſia; Haſel, Prauſnitz, Conradſwaldau in Sileſia; Filzmoos, Unterſberg, Hohlvegen in Salzburg; Jelſchanſka in Siberia.

Uſe.

It is principally uſed for drawing. The coarſer varieties are uſed by the carpenter, the finer by the painter. It is either uſed in its natural ſtate, or it is pounded, waſhed, and mixed with gum, and caſt into moulds. The crayons thus formed, when intended for coarſe drawings, are mixed with but a ſmall portion of gum; but thoſe which are to be uſed for ſmall and delicate drawings, with a much greater proportion, in order to give them ſufficient hardneſs.

Obſervations.

1. It is uſually called *Red Chalk.*
2. It is never ſmelted as an ore of iron.

SECOND

SECOND SUBSPECIES.

Columnar Clay Ironſtone.

Stänglicher Thoneiſenſtein.—*Werner.*

Id. Wern. Pabſt. b. 1. f. 167.—Var. of Gemeiner Thoneiſenſtein, *Wid.* f. 825.—Columnar or Scapiform Iron-Ore, *Kirw.* vol. ii. p. 176.—Fer oxydé rouge bacillaire, *Hauy*, t. 4. p. 107.—Le Fer argilleux ſcapiforme, *Broch.* t. 2. p. 273.—Stänglicher Thoneiſenſtein, *Reuſs*, b. 4. f. 115.

External Characters.

Colour browniſh-red, which ſometimes paſſes into cherry-red.

Occurs maſſive and in angular pieces.

Internally dull.

Fracture fine earthy.

Occurs almoſt always in columnar diſtinct concretions, which are ſtraight or curved, and thick or thin; uſually parallel; and ſometimes, although rarer, ſcopiform diverging. Sometimes alſo jointed.

The ſurface of the concretions is rough and dull.

Streak blood-red.

Is ſoft.

Brittle.

Uncommonly eaſily frangible.

Adheres a little to the tongue.

In ſingle pieces, it gives a ringing ſound?
Not particularly heavy.

Chemical Characters.

Becomes black before the blow-pipe, bubbles up with borax, and it communicates to it an olive green and blackiſh colour.

Conſtituent Parts.

It has not hitherto been carefully analyzed. According to Sage, it affords but 17 *per cent.* of iron.

Geognoſtic and Geographic Situations.

It is a rare mineral, and is probably in ſome caſes a pſeudo-volcanic product; for it is found along with earthy-ſlag, porcelain-jaſper, and burnt-clay, in the neighbourhood of pſeudo-volcanoes. It is alſo found in other countries where there are no volcanoes, as in the iſland of Arran in the frith of Clyde.

Beſides the iſland of Arran, already mentioned, it is alſo found at Hoſchnitz and Delau in the Saatzer circle, Straſka and Schwintſchitz in the circle of Leutmeritz in Bohemia; Amberg in the Upper Palatinate; Dutweiler in Saarbrücken.

THIRD SUBSPECIES.

Lenticular Clay Ironſtone.

Linſenförmiger Thoneiſenſtein.—*Werner.*

Id. Werner, Pabſt. b. 1. ſ. 167.—*Id. Wid.* ſ. 826.—Acinoſe Iron-ore, *Kirw.* vol. ii. p. 177.—Körniger Thoneiſenſtein, *Emm.* b. 2. ſ. 342.—Le Fer argileux grenu ou lenticulaire, *Broch.* t. 2. p. 274.—Körniger Thoneiſenſtein, *Reuſs*, b. 4. ſ. 120.

External Characters.

Its colour is browniſh-red, which paſſes on one ſide into ſteel-grey, on the other into reddiſh-brown, yellowiſh-brown, and blackiſh-brown.

Occurs maſſive.

Internally, it is always ſtrongly ſemimetallic glimmering, which paſſes into gliſtening.

On account of the ſmallneſs of the concretions, it is difficult to aſcertain the kind of fracture, yet it appears to be ſometimes fine earthy, and ſometimes (particularly the red varieties) ſlaty.

Fragments indeterminately angular, blunt-edged.

It occurs ſometimes in ſmall, fine and round granular, but more frequently in lenticular and flattiſh diſtinct concretions.

The red yields a light red-coloured ſtreak; the yellowiſh

yellowiſh a light yellowiſh-brown ſtreak; and the black a greyiſh black ſtreak.

Is ſoft; ſome varieties paſs into very ſoft; others into ſemihard.

Sectile. Some varieties incline to brittle.

Very eaſily frangible.

Heavy.

Specific gravity, 2.673? *Kirwan.*

Conſtituent Parts *.

From Radnitz.

Oxide of iron,	64.
Alumina,	23.
Silica,	7.5
Water,	5.
Lampadius.	99.5

Geognoſtic Situation.

The red and brown varieties appear to occur in different geognoſtic ſituations.

The red variety, which is uſually in lenticular diſtinct concretions, occurs, according to the obſervations of Werner, in mountain maſſes or lying maſſes, in tranſition mountains. The brown variety, which has uſually round granular diſtinct concretions, occurs in beds between the variegated ſandſtone and the ſhelly (Muſchel) limeſtone; thus occupying

* The red Bohemian ore affords 60 *per cent.* of iron; the brown from 30 to 36 *per cent.*

occupying the place of the ſecond floetz-gyps formation. The black variety appears to occur in the ſame geognoſtic ſituation as the brown.

Geographic Situation.

The red occurs particularly abundant in Bohemia; the brown is found in Franconia, Bavaria, Salzburg, and extends into Switzerland, France, and even to the Netherlands. The black has been hitherto found only in the canton of Bern.

Uſe.

The red variety melts excellently, and affords a malleable iron nearly as good as that obtained from the beſt kinds of red ironſtone. It alſo affords excellent caſt-iron.

The brown variety melts excellently, and affords both good caſt and malleable iron.

The black variety, which is ſaid to afford 90 *per cent.* of iron, melts badly and affords an indifferent iron.

Obſervations.

1. The black variety appears to be the link which connects brown ironſtone with magnetic ironſtone. It is alſo magnetic.

2. The brown and red varieties appear to be intermediate between red and brown ironſtone, and to form, as it were, the links that connect them.

FOURTH SUBSPECIES.

Jaſpery Clay Ironſtone.

Jaſpiſartiger Thoneiſenſtein.—*Werner.*

Jaſpiſartiger Thoneiſenſtein, *Reuſs*, b. 4. f. 126.

External Characters.

Colour browniſh-red.

Occurs maſſive.

Internally feeble glimmering.

Fracture flat conchoidal, which ſometimes paſſes into even.

Fragments rhomboidal, and ſometimes cubical and trapezoidal.

In the ſtreak it becomes ſomewhat lighter.

It is ſoft, paſſing into ſemihard.

Brittle.

Pretty eaſily frangible.

Heavy.

Geognoſtic and Geographic Situations.

It is found in the country between Vienna and Hungary, in a large bed, which probably belongs to the floetz mountains.

Obſervations.

1. The hardneſs and ſhape of the fragments diſtinguiſh it from the other ſubſpecies of ironſtone.

2. It

2. It is termed *jaſpery*, by reaſon of its reſemblance in external aſpect to jaſper.

FIFTH SUBSPECIES.

Common Clay Ironſtone.

Gemeiner Thoneiſenſtein.—*Werner.*

Id. Wern. Pabſt. b. 1. ſ. 165.—*Id. Wid.* ſ. 823.—Common argillaceous Iron-Ore, *Kirw.* vol. ii. p. 173.—Gemeiner Thoneiſenſtein, *Emm.* b. 2. ſ. 337. — Le Fer argileux commun, *Broch.* t. 2. p. 276.—Gemeiner Thoneiſenſtein, *Reuſs*, b. 4. ſ. 127.

External Characters.

Colour light yellowiſh-grey, which inclines to light aſh-grey, which paſſes on the one ſide into bluiſh-grey, on the other into yellowiſh, reddiſh and clove-brown, and into browniſh-red.

The lighteſt coloured varieties change their colour on expoſure to the air; they become firſt yellowiſh, then browniſh, dark-brown, and laſtly black. Some varieties (from Poland) change, on expoſure, to bluiſh-grey and pearl-grey. This change of colour is not confined to the ſurface, but extends to the centre of the maſs.

Occurs maſſive, and frequently in extraneous ſhapes,

ſhapes, as in that of bivalves, multivalves, with vegetable impreſſions, &c.

Internally dull.

Fracture uſually earthy; ſometimes however it is flat conchoidal and even; and other varieties ſhow a tendency to the ſlaty fracture.

Fragments indeterminately angular and blunt-edged.

Soft, and often very ſoft, and ſometimes inclines to ſemihard.

Rather brittle.

More or leſs eaſily frangible.

Adheres a little to the tongue.

Feels meagre.

Heavy.

Specific gravity, 2.936, from Cathma at Raſchau, *Kirwan;* 3.471, county of Roſcommon in Ireland, and 3.205 to 3.357, Carron in Scotland. *Dr Rotheram.*

Chemical Characters.

It becomes black before the blow-pipe, and gives with glaſs of borax, after a little ebullition, a dark red or blackiſh-green glaſs.

Conſtituent

Conſtituent Parts.

Two varieties from Brandau in Bohemia, afforded to *Lampadius*,

Oxide of iron,	35	39
Alumina,	39	40
Silica,	11	5
Magneſia,	2	6
Sulphur,	3	1
Water,	10	9
	100	100

Geognoſtic Situation.

It occurs in beds in floetz mountains.

At Wehrau in Upper Luſatia, it occurs along with limeſtone, in a very new formation, which lies over alluvial land; in the Faröe iſlands it is found in the neweſt floetz trap formation; in many parts of Scotland and England, in immenſe quantity in the independent coal formation; and in Upper Sileſia and Poland, in a particular limeſtone formation, whoſe age has not as yet been aſcertained, but which is certainly older than any of thoſe we have already mentioned.

Geographic Situation.

In vaſt quantity in different parts of Scotland and England, and always in the independent coal formation? the Faröe iſlands; Weſtphalia; Saxony, only at Wehrau; Sileſia; Bohemia; Franconia;

nia; Upper Palatinate; Salzburg; Poland; Ruſſia; Siberia.

Uſe.

It is ſmelted as an ore of iron, and affords from 30 to 40 *per cent.* of good iron.

Obſervations.

1. It ſometimes paſſes into compact brown ironſtone, particularly that found in Poland.

2. It bears conſiderable reſemblance to compact limeſtone and indurated clay, but is diſtinguiſhed from them by its greater ſpecific gravity and complete opacity.

3. The change of colour obſerved to take place in ſome varieties, appears to depend on the preſence of a quantity of manganeſe.

SIXTH SUBSPECIES.

Reniform Iron-Ore, or Iron Kidney.

Eiſenniere.—*Werner.*

Ætites, *Wall.* t. 2. p. 614. — Pierre d'Aigle, *Rom. de L.* t. 3. p. 300.—Eiſenniere, *Wern.* Pabſt. b. 1. ſ. 167. — Var. of Bohnerz, *Wid.* ſ. 827. — Nodular Ironſtone, *Kirw.* vol. ii. p. 178.—Fer limoneux ſpheroidal, *De Born.* t. 2. p. 283.—Eiſenniere, *Emm.* b. 2. ſ. 344. — Pierre d'Aigle, *Lam.* t. 1. p. 245.—Fer Oxyde rubigineux geodique, *Hauy*, t. 4. p. 107, &c.—La Fer reniforme, *Broch.* t. 2. p. 278. — Eiſenniere, *Reuſs*, b. 4. ſ. 132.

External Characters.

Its colour is yellowiſh-brown, but it ſhews various degrees of intenſity even in the ſame ſpecimen; externally it is darker, approaching to blackiſh brown: internally the colour is very light, and ſometimes it includes an ochre-yellow kernel.

It occurs in roundiſh maſſes, from the ſize of a walnut to that of a man's head, which uſually lie in clay.

Fracture, towards the interior, fine earthy; towards the exterior, even; in the dark yellowiſh-brown varieties, nearly conchoidal; that of the ochre-yellow, even.

The external layers are ſemimetallic glimmering, but towards the centre it is dull.

Fragments indeterminately angular.

Occurs in concentric lamellar diſtinct concretions, which incloſe a nodule, which is often looſe.

The ſurface of the concretions is rough and glimmering.

External layers are ſoft, ſometimes inclining to ſemihard; the internal very ſoft, ſometimes inclining to friable.

Brittle.

Eaſily frangible.

Adheres to the tongue.

Heavy, bordering on not particularly heavy.

Specific gravity, 2.574, *Wiedemann.*

Geognoſtic

Geognoſtic Situation.

It occurs imbedded in iron-ſhot clay in floetz rocks of the neweſt formation, and alſo in loam and clay beds that lie over black coal.

Geographic Situation.

Is found in different places in the counties of Mid-Lothian and Eaſt-Lothian; at Colebrook-dale in England; Norway; Denmark; at Wehrau, in Upper Lauſitz; Bohemia; Upper Palatinate; Oppeln, Beuthen, Tarnowitz, in Sileſia; Mountains of Cracau in Poland; Tranſylvania; France; Siberia.

Uſe.

It is one of the beſt kinds of ironſtone, yields an excellent iron, and is ſmelted in many places.

SEVENTH SUBSPECIES.

Pea-Ore, or Piſiform Ironſtone.

Bohnerz.—*Werner.*

Minera Ferri ſubaquoſa globoſa, *Wall.* t. 2. p. 257.—Mine de Fer en grains, *Rom. de L.* t. 3. p. 300.—Bohnerz, *Werner*, Pabſt. b. 1. ſ. 168.—*Id. Wid.* ſ. 827.—Piſiform or granular Ironſtone, *Kirw.* vol. ii. p. 178.—Bohnerz, *Emm.* b. 2. ſ. 347.—Fer oxydé rubigineux globuliforme, *Hauy*, t. 4. 111.—Le Fer piſiforme, *Broch.* t. 2. p. 280. — Kuglicher Thoneiſenſtein, *Reuſs*, b. 4. ſ. 135.

External

External Characters.

Internally its colour is yellowiſh brown, of different degrees of intenſity, which ſometimes paſſes into blackiſh brown. Externally it is reddiſh, yellowiſh, and liver brown, and ſometimes yellowiſh grey, which are however accidental, as they depend on the kind of clay in which it is imbedded.

Occurs in ſmall, round and ſpherical grains.

Internally it paſſes from dull to gliſtening, in ſuch a manner that the centre of the grain is dull, and the luſtre increaſes in ſtrength towards the ſurface; luſtre reſinous.

Fracture fine earthy in the centre of the grain, but towards the ſurface even.

Fragments indeterminately angular, not particularly ſharp-edged.

Occurs in thin concentric lamellar diſtinct concretions, in which the ſurface is uſually ſmooth and gliſtening.

Streak yellowiſh brown.

Is ſoft.

Not very brittle.

Eaſily frangible.

Heavy in a middling degree.

Specific gravity, 5.207, *Mollinghof.*

Conſtituent

Conſtituent Parts.

From Penné, in the diſtrict of Gaillac, according to *Vauquelin.*

Iron,	30
Oxygen,	18
Alumina,	31
Silica,	15
Water,	6
	100

From Creuſot on Mount Cenis.

Iron,	30
Alumina,	20
Lime,	50
	100

From Mardorf, according to *Mollinghof.*

Iron,	45
Oxygen,	15
Alumina,	13
Silica,	12
Water,	15
	100

Geognoſtic Situation.

Werner is of opinion, that it occurs in the ſecond floetz-limeſtone formation, and alſo in clay-beds. Its repoſitory is deſerving of attention: It appears to fill hollows in the limeſtone, and the individual grains are connected together by calc-ſinter, ſo that the whole maſs appears as if compoſed of diſtinct concretions. Buffon named this kind of repoſitory *Mine en Sac;* and Werner *Putzenwerke.* It occurs alſo in flat beds immediately under the ſoil. According to the obſervations of

Mr

Mr Mine-Counſellor Frieſleben, it occurs in an extenſive bed of clay, which lies on the compact Jura limeſtone.

Geographic Situation.

At Eichſtadt in Franconia, it occurs in *Putzenwerke*; Mardorf near Homburg in Heſſia; Nardern, Duttlengen, Heerbrechtlingen in Swabia; Baſle, Cantera, Aarau near Bern, &c. in Switzerland; Salzburg; Alſace, Burgundy, Languedoc, &c. in France; Dalmatia.

Uſe.

It yields from 30 to 40 *per cent.* of iron; and at Arau it ſupplies very conſiderable ironworks. In Dalmatia, it is ſaid to be uſed by the inhabitants in place of ſhot.

ELEVENTH SPECIES.

Bog Iron-Ore.

Raſeneiſenſtein.—*Werner.*

This ſpecies is ſubdivided into three ſubſpecies.
1. Moraſs-Ore. 2. Swamp-Ore. 3. Meadow-Ore.

FIRST

FIRST SUBSPECIES.

Moraſs-Ore.

Morafterz.—*Werner.*

Id. Werner, Pabſt. b. 1. ſ. 168.—*Id. Wid.* ſ. 830.—Moraſſy Iron-ore, *Kirw.* vol. ii. p. 183.—Morafterz, *Emm.* b. 2. ſ. 352.—Fer oxydé rubigineux maſſif, *Hauy*, t. 4. p. 138. —La Mine des Marais, ou le Morafterz, *Broch.* t. 2. p. 283. Morafterz, *Reuſs*, b. 4. ſ. 138.

External Characters.

Colour yellowiſh-brown.

It is ſometimes friable, ſometimes nearly coherent.

The coherent varieties occur maſſive, corroded, in grains, and ſometimes tuberoſe. The friable is compoſed of dull duſty particles.

The coherent varieties are externally and internally dull.

Fracture earthy.

Soils pretty ſtrongly.

Feels meagre, but fine.

Light, and extending to not particularly heavy.

SECOND

SECOND SUBSPECIES.

Swamp-Ore.

Sumpferz.—*Werner.*

Id. Wern. Pabſt. b. 1. ſ. 168.—*Id. Wid.* ſ. 831.—Swampy Iron-Ore, *Kirw.* vol. ii. p. 183.—Sumpferz, *Emm.* b. 2. ſ. 353.—La Mine des Lieux bourbeux, ou le Sumpferz, *Broch.* t. 2. p. 283.—Sumpferz, *Reuſs*, b. 4. ſ. 140.

External Characters.

Colour dark yellowiſh-brown, ſometimes paſſing into dark yellowiſh-grey.

Occurs corroded and veſicular, alſo amorphous.

Internally it is commonly dull, but the darker varieties are glimmering, and ſometimes even gliſtening.

Fracture earthy, ſometimes paſſing into fine grained uneven.

Fragments indeterminately angular, and blunt-edged.

Streak yellowiſh-brown.

Is very ſoft.

Sectile.

Eaſily frangible.

Not

Not particularly heavy, approaching to heavy.

Specific gravity, 2.944, from Sprottau,—*Kirwan.*

THIRD SUBSPECIES.

Meadow-Ore.

Wiesenerz.—*Werner.*

Id. Wern. Pabst. b. 1. s. 168.——*Id. Wid.* s. 832.—Meadow Iron-ore, *Kirw.* vol. ii. p. 182.—Wiesenerz, *Emm.* b. 2. s. 354.—La Mine des Prairies, ou le Wiesenerz, *Broch.* t. 2. p. 284.—Wiesenerz, *Reuss*, b. 4. s. 142.

External Characters.

On the fresh fracture it is blackish-brown, which sometimes passes into browniſh-black. Externally it has different colours, according to the earth in which it is found.

Occurs massive, in roundish grains, perforated, tuberose, and amorphious.

Internally it is from shining to glistening, and its lustre is resinous.

Fracture usually imperfect and small conchoidal, from which it sometimes passes into small-grained uneven; the uneven sometimes inclines to earthy.

Fragments indeterminately angular, blunt-edged.

Gives a light yellowiſh-grey ſtreak.

Is ſoft.

Rather brittle.

Very eaſily frangible.

Heavy, bordering on not particularly heavy.

Conſtituent Parts of the Species.

It affords uſually about 30 *per cent.* of iron, ſeldom riſes ſo high as 36 *per cent.* Along with the iron there is phoſphoric acid, alumina, ſilica, and a little vegetable extractive matter.

Geognoſtic Situation.

This ſpecies belongs to the neweſt formation. According to *Werner* it is formed in the following manner: The water which flows into marſhy places is impregnated with a vegetable acid, formed from decaying vegetables, which enables it to diſſolve the iron in the rocks over which it flows, or over which it ſtands. This water having reached the lower points of the country, or being poured into hollows, becomes ſtagnant, by degrees evaporates; and the diſſolved iron being accumulated in quantity by freſh additions of water, there follows ſucceſſive depoſitions, which at firſt are yellowiſh, earthy, and of little conſiſtence, and this is Moraſs-ore; but in courſe of time they become harder, their colour paſſes to brown, and thus

Swamp-

Swamp-ore is formed. After the water has completely evaporated, and the ſwamp is dried up, the ſwamp-ore becomes much harder, and at length paſſes into Meadow-ore, which is already covered with ſoil and graſs.

From the preceding obſervations, it is evident that there is a complete tranſition of the different ſubſpecies of bog iron-ore into each other, and that maſſes may be found in which we can obſerve the different degrees of induration. It is alſo evident that of theſe ſubſpecies the meadow-ore is the oldeſt, and marſh-ore the neweſt.

Geographic Situation.

It is found in various places in the Highlands of Scotland, in the Hebrides, and Orkney and Shetland iſlands. In Saxony it occurs at Torgau, in Upper and Lower Luſatia, in a part of the Mark Brandenburg, in Mecklenburg, Pomerania; and in the electorate of Hanover. It alſo extends through Pruſſia, Poland, Courland, Liefland, into Ruſſia and the ſouthern parts of Sweden, particularly in Smoland, where it is found in very conſiderable quantity. It is alſo found in ſmall quantity in the northern parts of Weſtphalia, in Sileſia, in the iſland of Seeland in the Baltic, in the Upper Palatinate, and Hungary.

It occurs in general more abundantly in the northern than in the weſtern and ſouthern European countries.

Uſe.

Uſe.

The three ſubſpecies of ore appear different in working. The moraſs-ore is the moſt eaſily fuſible, and alſo affords the beſt iron. The meadow-ore is more difficultly fuſible. When melted with other ores of iron, red and brown ironſtone are to be preferred. Of theſe the ochrey ſubſpecies ſmelt the moſt advantageouſly; but where theſe cannot be obtained, and we are obliged to uſe the compact and hematitical ſubſpecies, we muſt be careful that they be previouſly well roaſted. Even in the firſt melting, bog-ore affords excellent iron for the fineſt kinds of caſt ware. It is however not ſo tenacious as that obtained from ſome other ores, owing to the phoſphoric acid it contains. The malleable iron prepared from this ore has always a tendency to be cold-ſhort, and can ſcarcely be uſed for plate iron, and never for ironwire. It is however well fitted for nails, becauſe it takes a good point and welds well. The uſual flux is limeſtone.

TWELFTH SPECIES.

Blue Iron-Earth.

Blaue Eiſenerde.—*Werner.*

Cœruleum berolinenſe naturale, *Wall.* t. 2. p. 260.—Ocre martiale bleue, Bleu de Pruſſe natif, *Rom. d. L.* t. 3. p. 295.—Pruſſiate de Fer natif, *De Born.* t. 2. p. 275.—Blaue Eiſenerde,

ſenerde, *Werner*, Pabſt. b. 1. ſ. 169 —*Id. Wid.* ſ. 835.—Blue martial Earth, *Kirw.* vol. ii. p.185.—Blaue Eiſenerde, *Emm.* b. 2. ſ. 359.—Pruſſiate de Fer natif, *Lam.* t. 1. p. 247.—Fer azure, *Hauy*, t. 4. p. 119.–122.—Le Fer terreux bleu, *Broch.* t. 2. p. 288.—Blau Eiſenerde, *Reuſs*, b. 4. ſ. 146.

External Characters.

In its original repoſitory it is ſaid to be white, but afterwards becomes indigo-blue of different degrees of intenſity, which ſometimes paſſes into ſmalt-blue.

Is uſually friable, ſometimes looſe, and ſometimes cohering.

Occurs maſſive, diſſeminated, and thinly coating.

Particles are dull and duſty.

Soils ſlightly.

Feels fine and meagre.

Light, paſſing into not particularly heavy.

Chemical Characters.

Before the blow-pipe it immediately loſes its blue colour, and becomes reddiſh-brown, and, laſtly, melts into a browniſh-black coloured ſlag, which is attracted by the magnet.

It communicates to glaſs of borax a brown colour, which at length becomes dark yellow; diſſolves rapidly in acids.

Conſtituent Parts.

According to *Hauy*, it is compoſed of iron, and

a ſmall portion of phoſphoric acid and alumina: *Vauquelin*, on the contrary, finds it to be compoſed of oxide of iron, alumina, lime, but without a trace of phoſphoric acid. Probably the foſſil analyzed by Vauquelin was not true Blue iron-earth.

Geognoſtic Situation.

It occurs in neſts in clay-beds, alſo diſſeminated in bog iron-ore, or incruſting turf and peat.

Geographic Situation.

On the ſurface of peat-moſſes in ſeveral of the Shetland iſlands; Iceland; Helſingor on the Iſland of Seeland; Schonen in Sweden; Ruſſia; Maſchen in Hanover; Steinbach, Oberlichtenau, and Weiſſig in Upper Luſatia; Sileſia; Swabia; Upper Palatinate; Bavaria; Carniola; on the borders of the lake Baikal in Siberia.

THIRTEENTH SPECIES.

Green Iron-Earth.

Grüne Eiſenerde.—*Werner.*

This ſpecies is divided into two ſubſpecies: 1. Friable Green Iron-earth. 2. Coherent Green Iron-earth.

FIRST

FIRST SUBSPECIES.

Friable Green Iron-Earth.

Zerreibliche grüne Eiſenerde.—*Werner.*

External Characters.

Colour ſiſkin-green.
Occurs maſſive and diſſeminated.
Particles dull and duſty.
Fracture fine earthy, which paſſes into even.
Fragments indeterminately angular.
Occurs more or leſs cohering.
Is ſoft, and very ſoft.
Not very brittle.
Feels fine, but meagre.
Eaſily frangible.
Is intermediate between not particularly heavy and heavy.

SECOND SUBSPECIES.

Coherent Green Iron-Earth.

Feſte grüne Eiſenerde.—*Werner.*

External Characters.

Colour ſame as that of the preceding ſubſpecies, only a little darker.

Occurs

Occurs maſſive and corroded.

Internally dull.

Fracture fine earthy, ſometimes paſſing into even, ſometimes into ſplintery.

Fragments indeterminately angular, not particularly ſharp-edged.

Soft, paſſing into very ſoft.

Not particularly brittle.

Not particularly heavy, inclining to heavy.

Chemical Characters.

Before the blow-pipe it becomes firſt red, then brown, but is infuſible without addition: colours glaſs of borax yellowiſh-green.

Conſtituent Parts.

Has not been regularly analyzed, but is ſaid to conſiſt of iron united to phoſphoric acid.

Geognoſtic and Geographic Situations.

The friable is found at Schneeberg, the coherent at Braünſdorf, and both in veins. It is ſaid by Flurl alſo to occur in the Upper Palatinate.

It is a rare mineral.

FOUR-

FOURTEENTH SPECIES.

Cube-Ore.

Wurfelerz.—*Werner.*

Wurfelerz, *Reuſs*, b. 4. ſ. 153.

External Characters.

Colour olive-green, of different degrees of intenſity.

Occurs maſſive, and cryſtallized in ſmall and very ſmall cubes.

The planes of the cryſtals are ſmooth and ſplendent.

Internally it is gliſtening, and its luſtre is intermediate between pearly and adamantine.

Fracture imperfect foliated; has probably a threefold cleavage, parallel with the lateral planes.

Fragments indeterminately angular.

Occurs in ſmall granular, which ſometimes approach large granular diſtinct concretions.

Is tranſlucent.

Streak ſtraw-yellow.

Is ſoft, inclining to very ſoft.

Brittle, and

Not particularly heavy, approaching to heavy.

Specific gravity, 3.000, *Bournon.*

Conſtituent Parts.

Vauquelin.		*Chenevix.*	
Iron,	48	Arſenic acid,	31.0
Arſenic acid,	18	Oxide of iron,	45.5
Water of cryſtallization,	32	—— of copper,	9.
Carbonat of lime,	2 to 3	Silica,	4.
	100	Water,	10.5
			100

Geognoſtic and Geographic Situations.

It is found in veins accompanied with iron-ſhot quartz, and copper-glance.

Has been hitherto found only at Carrarach in Cornwall.

SEVENTH GENUS.

LEAD GENUS.

FIRST SPECIES.

Lead-Glance.

Bleiglanz.—*Werner.*

This ſpecies is divided into two ſubſpecies: 1. Common Lead-glance. 2. Compact Lead-glance.

FIRST SUBSPECIES.

Common Lead-Glance.

Gemeiner Bleiglanz.—*Werner.*

Id. Wern. Pabſt. b. 1. ſ. 97.—*Id. Wid.* ſ. 841.—Common Galena, *Kirw.* vol. ii. p. 216.—Gemeiner Bleiglanz, *Emm.* b. 2. ſ. 369.—Plomb ſulphuré, Galene, *Lam.* t. 1. p. 289.-292. —Plomb ſulphuré, *Hauy*, t. 3. ſ. 456. — La Galene commune, *Broch.* t. 2. p. 295.—Gemeiner Bleiglanz, *Reuſs*, b. 4. ſ. 174.

External Characters.

Colour freſh lead-grey, of different degrees of intenſity; in ſome varieties it inclines to blackiſh lead-grey. The freſh lead-grey varieties contain the greateſt proportion of ſilver. On the ſurface, it ſometimes ſhows a tempered ſteel or irideſcent tarniſh.

Occurs maſſive, diſſeminated, in membranes, in angular pieces, and in grains; alſo reticulated, ſpecular, corroded, and amorphous; ſeldom fuſed-like and cylindrical; frequently cryſtallized,

1. Perfect cube, in which the planes are either ſtraight or ſpherical convex.
2. Cube having its angles more or leſs deeply truncated.
3. Cube having its edges and angles truncated at the ſame time, but of theſe the latter the moſt deeply. Sometimes the edges of the truncations are alſo truncated.

4. Octahedron,

4. Octahedron, either perfect, (which is rather rare), or truncated on all its angles.
5. Octahedron, having all its angles and edges truncated at the ſame time. Sometimes the edges are bevelled, and ſometimes the edges formed by the meeting of the bevelling planes with one another are truncated.
6. Rectangular four-ſided priſm acuminated on both extremities by four planes, which are ſet on the lateral edges.
7. Six-ſided priſm, acuminated by four planes, of which two are ſet on the oppoſite lateral edges, and two on the oppoſite lateral planes.
8. Three-ſided table, in which the terminal planes are bevelled, and the angles of the bevelment alſo bevelled. It is formed by the flattened octahedron.

The cryſtals are uſually middle-ſized, ſmall, and very ſmall; ſeldom large. Are moſt commonly ſuperimpoſed, ſeldom imbedded and in druſes.

The planes of the cryſtals are ſometimes ſmooth, ſometimes druſy, and ſometimes rough.

Externally it alternates from ſpecular ſplendent to weak glimmering, according as its ſurface is ſmooth, druſy or rough.

Internally it alternates from ſpecular ſplendent to glittening, and its luſtre is metal ic.

Fracture more or leſs perfect foliated; commonly plain, ſometimes alſo floriform foliated, which

which ſometimes paſſes into narrow or broad, and ſtellular diverging radiated. Cleavage threefold and rectangular *.

Fragments cubic.

The maſſive varieties occur in granular diſtinct concretions, of all degrees of magnitude, from large to very fine granular. The latter often paſſes into compact, conſequently into the following ſubſpecies. It occurs alſo in ſtraight, thin and thick lamellar diſtinct concretions, which are very much grown together, and whoſe croſs fracture has a radiated aſpect. Sometimes, although very rarely, it preſents columnar diſtinct concretions.

Streak rather more ſhining than that of the ſurface of the fracture.

Is ſoft.

Perfect ſectile.

Externally eaſily frangible.

Uncommonly heavy.

Specific gravity, 7.220, *Muſchenbröck*; 7.290, *Gellert*. The cryſtallized, 7.5873, *Briſſon*. The radiated, 5.500, *Lametherie*; 6.565 to 7.786, *Watſon*. From the Hartz, 7.448, *Kirwan*. From Kautenbach, 6.140, *Vauquelin*. From Kirſchwalder, 6.820, *Vauquelin*. From Kampffteiner, 7.100, *Vauquelin*. From Eckleſberg, from 7.300 to 7.600, *Vauquelin*.

Chemical

* The radiated variety uſually contains a portion of antimony: It is the *plomb ſulphuré ſtrié*, or *antimonifere*,—*Havy*.

Chemical Characters.

Before the blow-pipe it flies into pieces, then melts and emits a ſulphureous odour. It is in general eaſily fuſible, and eaſily reducible on coal before the blow-pipe. When it is alternately heated and cooled, it at length diſappears entirely; and if it be argentiferous, a grain of ſilver remains behind.

Conſtituent Parts.

According to *Vauquelin*, lead-glance contains the following ingredients:

	From Kirſchwald in Deux Ponts.	Kampfſtein.	Ecklefberg.	Kantenbach.
Lead,	54	69	68.69	64
Sulphur,	8	16	16.18	18
Calcareous earth and ſilica,	38	15	16.13	18

	Weſtrumb.	*Kirwan.*	Durham.	
Lead,	83.	77	Lead,	85.13
Sulphur,	16.41	20	Sulphur,	13.02
Silver,	0.08	1	Iron,	0.50
		98		98.65 *

The proportion of lead, as appears from the above reſults of different analyſes, varies from 54 to 83 *per cent.* The proportion of ſilver alſo varies conſiderably, and it appears to have an effect on the external aſpect of the varieties; for it has been obſerved, that thoſe which contain much ſil-

ver

* For the analyſis of the lead-glance of Durham, I am indebted to my friend Dr Thomſon.

ver have not ſo freſh a colour as others which are poorer; that the octahedral contain more ſilver than the cubical, and that the floriformly foliated contain little or none. It ſometimes alſo contains a ſmall portion of iron, and ſometimes alſo of gold. The radiated varieties are ſaid to contain antimony.

Geognoſtic Situation.

It occurs in veins and beds, in primitive, tranſition and floetz mountains. It occurs in many different formations, and of theſe Werner has given a highly intereſting deſcription in his claſſical work on *Veins*.

It occurs almoſt always with blende and calamine, with which it appears to have a ſtrong geognoſtic affinity. It is frequently alſo accompanied with ſilver-ores, and ſometimes with copper-ores.

At Lead-hills, in Lanarkſhire, it occurs in veins that traverſe tranſition rocks, and is accompanied with friable manganeſe-ochre, lead-earth, ſparry-ironſtone, calamine, ochrey brown ironſtone, brown hematite, iron-pyrites, copper-azure, green lead-ore, white lead-ore, lead-vitriol, quartz, lamellar heavy-ſpar, calc-ſpar, brown-ſpar, and mountain-rock. The ſame formation extends into the upper part of Dumfriesſhire, where it forms the mines of Wanlockhead.

At Mies, in Bohemia, it occurs in veins that traverſe clay-ſlate, and it is accompanied with white,

black,

black, and green lead-ores, blende, copper-pyrites, malachite, iron-pyrites, quartz, and heavy-ſpar; at Prizbram, alſo in Bohemia, where it occurs in veins that traverſe clay-ſlate, it is accompanied with black and green lead-ores, blende, white ſilver-ore, native-ſilver, ſparry-ironſtone, grey and white antimony ores, iron-pyrites, heavy-ſpar, calc-ſpar, and quartz. At Bleyberg, in Carinthia, it is accompanied with white, yellow and black lead-ores, calamine, yellow and brown blende, rock-cork and gyps. At Offenbanya, in Tranſylvania, it is found along with fahl or grey copper ore, grey antimony, iron-pyrites and brown-blende, in a bed in granular limeſtone; at Nagyag, with red antimony-ore and amethyſt, in clay-porphyry. At Gablau in Sileſia it occurs with quartz cryſtals and calc-ſpar, in porphyry; at Upper Schmeideberg and Kloſter Liebenthal, diſſeminated in primitive limeſtone; at Weiſtritz, with yellow and brown blende, calc-ſpar and quartz; at Altenberg, with iron-pyrites, copper-pyrites, arſenic pyrites, copper-glance, calc-ſpar and quartz; at Queerbach, with black-blende, cobalt glance, magnetic ironſtone, iron-pyrites, copper-pyrites, arſenic pyrites, garnet and calc-ſpar. At Rammelſberg, in the Hartz, it is found diſſeminated in tranſition-ſlate; at Clauſthal, it occurs in veins that traverſe grey-wacke, and is accompanied with black and brown blende, iron-pyrites, ſparry-ironſtone, copper-pyrites, white lead-ore, light red ſilver-ore, brittle ſilver-

glance,

glance, fahl or grey copper ore; in the vein, called Samſon, at Andreaſberg, where it occurs alſo in tranſition rocks, it is accompanied with copper-pyrites, iron-pyrites, native arſenic, red ſilver-ore, arſenical ſilver, native ſilver, ſilver-glance, ſilver-black, fahl or grey copper ore, native antimony, cobalt-glance, copper-nickel, blende, orpiment, capillary pyrites, calc-ſpar, zeolite, croſs-ſtone, and quartz.

Geographic Situation.

Derbyſhire, county of Durham, Flintſhire, Denbighſhire, Cornwall, &c. in England; Lanarkſhire, Dumfriesſhire, Ayrſhire, Argyleſhire (Strontian), Fifeſhire, Eaſt-Lothian, Mid-Lothian, Orkney Iſlands, iſland of Iſla one of the Hebrides, &c. in Scotland; at Konigſberg, &c. in Norway; in Weſtermannland, Schonen, Upland and Lapland in Sweden; iſland of Bornholm in Denmark; Zellerfeld, Clauſthal, Goſlar, Lautenthal, Andreaſberg in the Hartz; Freyberg, Gerſdorf, Johanngeorgenſtadt, Schneeberg, &c. in Saxony; Tarnowitz, where it occurs in beds, Merzberg, Reichenſtein, Krummhübel, &c. in Sileſia; Olkuſch in Weſt Gallicia; Catharineburg, Niclaſberg, Graupen, Zinnvald, &c. in Bohemia; Upper Palatinate; Furſtenberg in Swabia; Deux Ponts; Bavaria; Stiria; Tyrol; Salzburg; Carinthia; Upper Auſtria; Hungary; Tranſylvania; Bannat; France; Italy; Spain; Nertſchinſk, Catharinenberg, and Schlangenberg in Siberia; the

Spaniſh part of Chili in South America; and in Greenland in North America.

Uſe.

It is moſt frequently worked as an ore of lead, and very frequently alſo as an ore of ſilver. It is the moſt abundant, and almoſt the only ore of lead which is worked. It is alſo uſed in the ſmelting of ſilver-ores, and for glazing pottery.

Obſervations.

1. The name *Lead-glance*, which I uſe in preference to the more common but leſs ſignificant one Galena, is derived from the luſtre, which forms ſo ſtriking a feature in the external aſpect of this mineral.

2. Lead-glance, which occurs in beds, contains leſs ſilver than that found in veins. Indeed, ſilver appears in general to be more abundant in veins than beds: thus, argentiferous pyrites which is found in veins, contains a greater quantity of ſilver than that found in beds.

SECOND SUBSPECIES.

Compact Lead-Glance.

Bleiſchweif.—*Werner.*

Plumbum Plumbago, *Wall.* t. 2. p. 305.—Bleiſchweif, *Werner*, Pabſt. b. 1. ſ. 114.—*Id. Wid.* ſ. 845.—Galene compacte, *De Born.* t. 2. p. 355.—Compact Galena, *Kirw.* vol. ii. p. 218. —Bleiſchweif,

—Bleiſchweif, *Emm.* b. 2. ſ. 377.—Plomb ſulphuré compacte, *Hauy*, t. 3. p. 461.—La Galena compacte, *Broch.* t. 2. p. 301.—Bleiſchweif, *Reuſs*, b. 4. ſ. 188.

External Characters.

Colour freſh lead-grey, and a very little lighter than that of the preceding ſubſpecies; ſometimes it inclines to black, but only in ſuch varieties as are paſſing into blue lead-ore.

Occurs maſſive, diſſeminated, and ſpecular *.

The ſpecular variety is externally ſmooth, ſhining and ſplendent.

Internally it is only ſtrongly glimmering, and its luſtre is metallic.

Fracture even, which in ſome varieties paſſes into flat conchoidal.

Fragments indeterminately angular, not particularly ſharp-edged.

Is always unſeparated.

Streak ſhining, almoſt ſplendent.

Not ſo eaſily frangible as the preceding ſubſpecies; but agrees with it in the remaining characters.

Geognoſtic Situation.

Occurs in veins, and is uſually accompanied with common lead-glance. It is worthy of remark, that when the two ſubſpecies occur together, the compact always forms the ſides of the vein, and this probably owing to its having been in a leſs perfect

* The ſpecular varieties are the *ſlikenſides* of Derbyſhire.

perfect ſtate of ſolution. It is alſo accompanied with black-blende, common iron-pyrites, copper-pyrites, quartz, and heavy-ſpar.

Geographic Situation.

Leadhills in Lanarkſhire; Derbyſhire; Sahlberg in Weſtermannland; Lautenthal, Zellerfeld, Clauſthal, Andreaſberg and Goſlar in the Hartz; Freyberg and Gerſdorf in the electorate of Saxony; Rauſchenberg in Upper Bavaria; Weiding in the Upper Palatinate; Leogang in Salzburg; Servoz in the valley of Chamouni in Switzerland; Siberia.

SECOND SPECIES.

Blue Lead-Ore.

Blaubleyerz.—*Werner.*

Id. Wern. Pabſt. 1. b. ſ. 115.—*Id. Wid.* ſ. 847.—Blue Lead-ore, *Kirw.* vol. ii. p. 220.—Blau Bleierde, *Emm.* b. 2. ſ. 380.—La Mine de Plomb bleue, *Broch.* t. 2. p. 303.—Blaubleierz, *Reuſs*, b. 1. ſ. 209.

External Characters.

Its colour is intermediate between dark indigo blue and lead-grey.

Occurs maſſive, and cryſtallized in perfect ſix-ſided priſms, which are uſually ſmall, low, ſometimes

times bulging, and whoſe ſurface is rough and dull.

Internally, it is feebly glimmering, and its luſtre is metallic.

Fracture even; ſometimes it approaches ſmall and flat conchoidal.

Fragments indeterminately angular.

Streak ſhining and metallic.

Is ſoft, inclining to very ſoft.

Sectile.

Eaſily frangible.

Heavy, bordering on uncommonly heavy.

Specific gravity, 5.461, *Gellert.*

Chemical Characters.

Melts eaſily before the blow-pipe, burns with a weak blue flame, emits a ſtrong ſulphureous vapour, and is reduced to pure lead.

Conſtituent Parts.

It is conjectured to be a compound of lead, oxide of lead, and ſulphur, and is ſuppoſed by Werner to be intermediate between lead-glance, and black lead-ore. Klaproth diſcovered in it phoſphoric acid.

Geognoſtic and Geographic Situations.

Occurs in veins, accompanied with black lead-ore, brown lead-ore, white lead-ore, malachite, radiated copper-azure, quartz, fluor-ſpar, and heavy-ſpar.

It

It is a rare foſſil, and has been hitherto found only at Zſchoppau in Saxony: it is ſaid alſo to have been found at Schemnitz in Hungary, and Brittany in France.

THIRD SPECIES.

Brown Lead-Ore.

Braun Bleyerz.—*Werner.*

Id. Wern. Pabſt. b. 1. ſ. 115.—*Id. Wid.* ſ. 848.—Brown Lead-ore, *Kirw.* vol. ii. p.222.—Braun Bleierz, *Emm.* b. 1. ſ. 383.—La Mine de Plomb brune, *Broch.* t. 2. p. 305. — Braun Bleierz, *Reuſs*, b. 1. ſ. 212.

External Characters.

Colour hair-brown, of different degrees of intenſity, ſometimes ſo pale that it inclines to grey, and ſometimes it paſſes into clove-brown.

Occurs maſſive, and cryſtallized in ſix-ſided priſms.

The ſurface of the cryſtals is blackiſh and rough.

Internally, it is gliſtening, and its luſtre is reſinous.

Fracture ſmall and fine-grained uneven, and ſometimes paſſes into ſmall ſplintery.

Fragments indeterminately angular.

The cryſtallized varieties ſhow a tendency to thin columnar diſtinct concretions, whoſe ſurface is ſmooth and ſhining.

Feebly

Feebly tranſlucent.

Soft.

Not particularly brittle.

Eaſily frangible.

Is intermediate between heavy and uncommonly heavy.

Specific gravity, 6.974, *Wiedemann*; 6.600 from Huelgoët, according to *Klaproth*; 6.909 from Huelgoët, *Hauy*.

Chemical Characters.

It melts pretty eaſily before the blow-pipe without being reduced, and during cooling ſhoots into acicular cryſtals. It does not effervesce with acids.

Conſtituent Parts.

From Huelgoët in Brittany,

Oxide of lead,	78.58
Phoſphoric acid,	19.73
Muriatic acid,	1.65

Klaproth.

Geognoſtic and Geographic Situations.

It is found at Mieſs in Bohemia; near Schemnitz in Hungary; Saſka in the Bannat; Zſchoppau in Saxony; Huelgoët in Lower Brittany.

At Meiſs in Bohemia, it is uſually accompanied with lead-glance, white, black and green lead-ores, copper-pyrites, malachite, blende, iron-pyrites, quartz and heavy-ſpar; at Zſchoppau with white and

black

black lead-ores, iron-ochre, quartz and heavy-ſpar; at Huelgoët with lead-glance. In all theſe places it occurs in veins.

FOURTH SPECIES.

Black Lead-Ore.

Schwarz Bleyerz.—*Werner.*

Id. Werner, Pabſt. 1. b. ſ. 116.—*Id. Wid.* ſ. 850.—Black Lead-Ore, *Kirw.* vol. ii. p. 221.—Schwarz Bleyerz, *Emm.* b. 2. ſ. 385.—La Mine de Plomb noire, *Broch.* t. 2. p. 307.—Schwarz Bleyerz, *Reuſs*, 4. b. ſ. 241.

External Characters.

Colour greyiſh-black of different degrees of intenſity.

Occurs maſſive, diſſeminated and cryſtallized in ſix-ſided priſms.

The ſurface of the cryſtals is ſometimes druſy, ſometimes ſmooth, and ſometimes longitudinally ſtreaked.

Externally uſually ſplendent, alſo ſhining.

Internally it is only ſhining, ſometimes paſſing into gliſtening, and its luſtre is adamantine.

Fracture ſmall-grained uneven, which ſometimes paſſes into imperfect conchoidal and ſplintery.

Fragments indeterminately angular.

Tranſlucent on the edges.

Streak greyiſh-white.

Rather

Rather brittle.
Eaſily frangible.
Heavy.

Conſtituent Parts.

According to *Lampadius*, it contains

Lead,	72	75.
Carbonic acid,	18	18.
Oxygen,	7	3.5
Carbon,	2	1.5
Water,		2.
	99	100

Geognoſtic Situation.

Occurs in veins, and is almoſt always accompanied with white lead-ore and lead-glance, and uſually in the upper part of veins, and in new lead-glance formations. It uſually encruſts lead-glance, and is covered by white lead-ore, and ſometimes by green lead-ore. This, in the opinion of Werner, ſhows an oryctognoſtic affinity of theſe ores with one another.

Geographic Situation.

Leadhills in Scotland; Mieſs and Prizbram in Bohemia; Freyberg and Zſchopau in Saxony; Schwarzleogang in Salzburg; Poullaoven in Lower Brittany in France; Schlangenberg in Siberia.

Obſervations.

1. It paſſes into lead-glance and white lead-ore.

2. Hauy is of opinion that it is a phoſphat of lead, and Werner ſuſpected that it was a compound of lead, carbonic and ſulphuric acids.

FIFTH SPECIES.

White Lead-Ore.

Weis-Bleierz.—*Werner.*

[1]Minera Plumbi alba ſpathoſa, *Wall.* t. 2. p. 307. — Mine de Plomb blanche, *Rom. de L.* t. 3. p. 380. — Weiſs Bleyerz, *Wern.* Pabſt. 1. b. f. 118.—*Id. Wid.* f. 852.—Plomb ſpathique blanc, *De Born.* t. 2. p. 368. — White Lead-ore, *Kirw.* vol. ii. p. 203.—Weiſs Bleyerz, *Emm.* 2. b. f. 388. — Plomb blanc, *Lam.* t. 1. p. 305. — Plomb carbonaté, *Hauy*, t. 3. p. 475.—La Mine de Plomb blanche, ou le Plomb blanc, *Broch.* t. 2. p. 309.—Weiſsbleierz, *Reuſs*, 4. b. f. 245.

External Characters.

Colour ſnow-white, greyiſh-white and yellowiſh-white; from this it paſſes into yellowiſh-grey, cream-yellow, and laſtly into clove-brown. It is dark aſh-grey when it borders on black lead-ore.

Occurs maſſive, diſſeminated, and in membranes; but moſt commonly cryſtallized,

1. Equiangular ſix-ſided priſm, rather obtuſely acuminated by ſix planes, which are ſet on the lateral planes. The extremities are ſometimes truncated.
2. Short ſix-ſided priſm, obtuſely acuminated on

on both extremities by four planes, of which the two largeſt are ſet on the two lateral planes, and the other two on two oppoſite lateral edges. It uſually terminates in a line.

3. Four-ſided priſm, acuminated on both extremities by four planes, which are ſet on the lateral planes: the ſummits and the edges of acumination are often truncated.
4. Very oblique four-ſided priſm, bevelled on both extremities, the bevelling planes ſet on the acute lateral edges.
5. Double ſix-ſided pyramid, either perfect, or truncated on the common baſe.
6. Four-ſided table bevelled on the terminal planes; ſometimes two or three cryſtals interſect one another, and form twin or triple cryſtals.
7. Six-ſided table.
8. Long acicular and capillary cryſtals, which are columnarly aggregated, and interſect one another, thus reſembling columnar heavy-ſpar.

The cryſtals are uſually ſmall and very ſmall; ſeldom middle-ſized.

Externally, it is ſpecular ſplendent; ſeldom gliſtening.

Internally, it alternates from highly ſplendent to gliſtening, and its luſtre is adamantine, ſometimes inclining to ſemimetallic, ſometimes to reſinous.

Fracture commonly ſmall conchoidal; but it ſometimes

ſometimes paſſes into fine-grained uneven, and even into fine ſplintery.

Fragments indeterminately angular.

It alternates from tranſlucent to tranſparent; and is duplicating.

Is ſoft.

Brittle.

Very eaſily frangible.

Heavy.

Specific gravity, 6.480, from Leadhills, according to *Klaproth;* 7.2357, *Chevenix;* 6.0717–6.5586, *Hauy.*

Chemical Characters.

Before the blow-pipe it flies into pieces, becomes firſt red, then yellow, and laſtly melts into a globule of metallic lead. It makes a ſtrong effervescence with acids, and is almoſt entirely diſſolved. Its ſurface blackens when expoſed to the vapour of ſulphuret of ammonia; a character which diſtinguiſhes it from heavy-ſpar.

Conſtituent Parts.

From Zellerfeld.			From Ildekanſkoi.		
Lead,	81.2	80.25	Lead,	74.0	77.50
Carbonic acid,	16.0	16.0	Carbonic acid,	15.0	15.0
Oxide of iron,	0.3	0.18	Oxide of iron,	0.25	1.25
Alumina,		0.75	Alumina,	1.0	
Lime,	0.9	0.50	Lime,	1.0	
			Silica,	0.25	0.50
			Water,	4.0	
According to *Weſtrumb.*			According to *Bindheim.*		

From

From Siberia.		From Leadhills.	
Lead,	67	Lead,	77
Carbonic acid,	24	Carbonic acid,	16
Oxygen,	6	Oxygen,	5
Water,	13	Water,	2
	100		100
Macquart.		*Klaproth.*	

Geognoſtic Situation.

It is almoſt always accompanied with lead-glance, and occurs in the ſame kind of repoſitory. It is alſo very often accompanied with green and black lead-ores, lead-earth, ochrey-brown iron-ſtone, common iron-pyrites, copper-pyrites, mala-chite, copper-azure, brown-blende, and compact grey manganeſe-ore. Its moſt frequent vein-ſtones are quartz, heavy-ſpar, calc-ſpar, and fluor-ſpar.

At Leadhills, it occurs in veins that traverſe tranſition-rocks, and is accompanied with lead-glance, lead-earth, lead-vitriol, green lead-ore, ſparry-ironſtone, iron-pyrites, brown-hematite, ca-lamine, and copper-azure; and the vein-ſtones are quartz, lamellar heavy-ſpar, calc-ſpar, brown-ſpar, and rock-cork.

At Mieſs in Bohemia it occurs in quartz veins that traverſe clay-ſlate, and is accompanied with black, green, and brown lead ores, lead-earth, cop-per-pyrites, malachite, copper-azure, blende, iron-pyrites, and columnar heavy-ſpar; at Prizbram alſo in veins that traverſe clay-ſlate, which are

compoſed

compoſed of ſparry ironſtone, calc-ſpar, heavy-ſpar and quartz, accompanied with lead-glance, black and green lead-ores, blende, ſparry-ironſtone, white antimony-ore, iron-pyrites, native ſilver, and white ſilver-ore.

At Bleyberg in Carinthia it is accompanied with lead-glance, yellow and black lead-ores, calamine, yellow and brown blende, calc-ſpar, gyps, and rock-cork.

Geographic Situation.

Derbyſhire, Somerſetſhire, Wales in England; Leadhills, Wanlockhead in Scotland; Ireland; Freyberg, Zſchopau, Johanngeorgenſtadt, Annaberg in Saxony; Prizbram, Mieſs and Bleiſtadt in Bohemia; Tarnowitz and Janowitz in Sileſia; Naſſau; Langehecke in the biſhopric of Triers; Eichelberg in the Upper Palatinate; in the floetz mountains of Cracau in Weſt Gallicia; Huelgoet and Poullavuen in Brittany, La Croix in Lothringen, St Sauveur in Languedoc, and Geroldſeck in Alſace in France; Bleyberg in Carinthia; Freiburg in the Briſgau; Blutner, Tauern in Rauris in Salzburg; Saſka and Dognatſka in the Bannat; near Schemnitz in Hungary; in the Crimea; Nertſchinſkoi, Frolowſkoi, &c. in Siberia; Chili in South America.

Obſervation.

Next to lead-glance it is the moſt common ore of lead, but it does not occur ſo abundantly, nor ever

ever in ſuch quantity as to be an object of conſequence to the metallurgiſt.

SIXTH SPECIES.

Green Lead Ore.

Grün Bleierz.—*Werner.*

Minera Plumbi viridis, *Wall.* t. 2. p. 308. — Grün Bleyerz, *Wern.* Pabſt. 1. b. ſ. 123.—*Id. Wid.* ſ. 857.—Phoſphorated Lead-ore, *Kirw.* vol. ii. p. 207.—Oxide de Plomb ſpathique verte, Phoſphate de Plomb, *De Born.* t. 2. p. 377. — Grün Bleyerz, *Emm.* b. 2. ſ. 394.—Plomb phoſphaté, *Hauy*, t. 3. p. 490.—La Mine de Plomb verte, ou le Plomb verte, *Broch.* t. 2. p. 314.—Grunbleierz, *Reuſs*, 4. b. ſ. 216.

External Characters.

Its colour is graſs-green, which paſſes on the one ſide through piſtachio-green, olive-green and ſiſkin-green, into ſulphur-yellow ; on the other ſide, through aſpargus green into greeniſh-white. Some varieties approach to leek-green. The olive and piſtachio-green colours are the moſt common.

Occurs ſeldom maſſive, ſometimes reniform and botryoidal ; but moſt commonly cryſtallized,

1. Six-ſided priſm, having ſometimes its lateral and terminal edges truncated. When the truncations on the terminal edges increaſe, a ſix-planed acumination is formed, in which the

the acuminating planes are ſet on the lateral planes.

2. When the lateral edges of the priſm converge towards their extremities, an acute double ſix-ſided pyramid is formed.

The priſms are uſually low, ſometimes bulging, and hollow at their extremities.

Sometimes it occurs in velvety druſes.

The cryſtals are ſmall and very ſmall, ſeldom middle-ſized, and are often ſcalarwiſe aggregated.

Externally it is ſmooth and ſhining, internally gliſtening, and its luſtre is reſinous.

Fracture ſmall-grained uneven.

Fragments indeterminately angular, blunt-edged.

Is always tranſlucent.

Soft (ſcratches white lead-ore).

Rather brittle.

Very eaſily frangible; and

Heavy.

Specific gravity, 6.560, from Wanlockhead, *Klaproth;* 6.270, Zſchoppau, *Klaproth;* 6.9411, from the Breiſgaw, according to *Hauy.*

Chemical Characters.

Before the blow-pipe it does not fly into pieces; it becomes white, and melts very eaſily into a greyiſh globule, but witnout being reduced, even with charcoal. It diſſolves in acids without effervescence.

Conſtituent

Conſtituent Parts.

According to *Klaproth*,

	Zſchoppau.	Hoffsgrund.	Wanlockhead.
Oxide of lead,	78.4	77.10	80
Phoſphoric acid,	18.37	19.	18
Muriatic acid,	1.7	1.54	1.62
Oxide of iron,	0.10	0.10	a trace.

From Erlbach.

Oxide of lead,	79	Lead,	45.18
Phoſphoric acid,	18	Phoſphoric acid,	18.17
Oxide of iron,	1	Oxygen,	4.05
Water,	2	Silica,	32
Fourcroy.		*Vauquelin.*	

Obſervations.

1. Green lead-ore, when it has a very pale greeniſh-white colour, is apt to be confounded with the preceding ſpecies, but we can always diſtinguiſh them by the following characters: 1. The fracture in this ſpecies is fine-grained uneven, but in white lead-ore is more or leſs perfect conchoidal. 2. Its luſtre is reſinous, but that of white lead-ore is adamantine. 3. It is harder than white lead-ore. 4. It poſſeſſes greater ſpecific gravity than white lead-ore. 5. Its cryſtals are often ſcalarwiſe aggregated, which is never the caſe with white lead-ore: And 6. Its priſms are generally ſhorter than thoſe of white lead-ore.

2. Mr Klaproth having diſcovered phoſphat of lead, or green lead-ore of a greyiſh-white colour, propoſes it as an objection to the naming of minerals from their colours. It muſt be remembered, however, that the name does not imply the conſtant occurrence of a green colour; it only intimates, that the green colour is the moſt ſtriking feature in the external aſpect of the mineral, and that it occurs more frequently than any other colour.

SEVENTH SPECIES.

Red Lead-Ore.

Roth Bleierz.—*Werner.*

Minera Plumbi rubra, *Wall.* t. 2. p. 309. — Rothes Bleierz, *Werner*, Pabſt. 1. b. ſ. 127. — *Id. Wid.* ſ. 861.—Red Lead Spar, *Kirw.* t. 2. p. 214.—Oxide de Plomb ſpathique rouge, *De Born.* t. 2. p. 376.—Rothes Bleyerz, *Emm.* b. 2. ſ. 399. —Oxide rouge de Blomb, *Lam.* t. 1. p. 287.—Plomb chromaté, *Hauy*, t. 3. p. 476.—La Mine de Plomb rouge, ou le Plomb rouge, *Broch.* t. 2. p. 318.—Rothbleierz, *Reuſs*, b. 4. ſ. 228.

External Characters.

Colour hyacinth-red; ſometimes inclines to aurora or morning red.

Occurs very rarely maſſive and diſſeminated, ſeldom in membranes, moſt commonly cryſtallized in broad

broad, rather oblique four-ſided priſms, whoſe terminal planes are ſet on obliquely, ſo that the cryſtal has the aſpect of a lengthened rhomb, which appears to be very acute angled *.

The cryſtals are middle-ſized.

The ſurface of the cryſtals is uſually ſmooth, ſometimes longitudinally ſtreaked.

Externally and internally it is ſplendent, and its luſtre is intermediate between adamantine and reſinous.

Fracture foliated, and the folia are probably parallel with the lateral planes of the priſm.

Fragments indeterminately angular, rather blunt-edged.

It is tranſlucent, paſſing into tranſparent, even ſometimes inclining to tranſparent.

Streak lemon-yellow, nearly paſſing to brownish-yellow.

Is very ſoft.

Is intermediate between very brittle and ſectile.

Eaſily frangible.

Heavy.

Specific gravity, 5.750, *Bindheim*; 6.0269, *Briſſon*.

Chemical

* *Hauy* mentions the following cryſtallizations of red lead-ore: 1. Rectangular four-ſided priſm, acuminated by four planes, which are ſet on the lateral planes.

2. Same figure with its lateral edges truncated.

Chemical Characters.

Before the blow-pipe it melts into a blackiſh ſcoria. With borax it is partly reduced. It does not effervesce with acids.

Conſtituent Parts.

Siberian red lead-ore, according to *Vauquelin* and *Thenard*:

Lead,	57.10	Oxide of lead,	64
Oxygen,	6.86	Chromic acid,	36
Chromic acid,	36.04		
	100		100

Geognoſtic and Geographic Situations.

It occurs in veins in gneiſs and mica ſlate, where it is accompanied with lead-glance, green lead-ore, iron-pyrites, brown ironſtone, native gold, and quartz. It is found in the mine of Berezof, near Catharinenberg in Siberia; Annaberg in Auſtria; and Trapettes in Upper Faucigny in Savoy.

Uſe.

On account of its beautiful aurora-red colour, its durability in the air, and its mixing eaſily with oil, it is uſed as a pigment.

EIGHTH

EIGHTH SPECIES.

Yellow Lead-Ore.

Gelbes Bleierz.—*Werner.*

Gelbes Bleierz, *Werner*, Pabſt. 1. b. ſ. 127.—*Id. Wid.* 864.—Oxide de Plomb ſpathique jaune, *De Born.* t. 2. p. 379.—Yellow Lead-Spar, *Kirw.* vol. ii. p. 212.; *Hatchett.*—Gelbes Bleyerz, *Emm.* b. 2. ſ. 403.—Plomb molybdaté, *Hauy*, t. 3. p. 498.—La Mine de Plomb jaune, ou le Plomb jaune, *Broch.* t. 2. p. 322.—Gelb Bleierz, *Reuſs*, 4. b. ſ. 236.

External Characters.

Its moſt frequent colour is wax-yellow; from which it paſſes, on the one ſide, into lemon-yellow and orange-yellow; on the other ſide, into yellowiſh-brown and yellowiſh-grey: ſometimes of a colour which is intermediate between yellowiſh-white and greyiſh-white.

Occurs very ſeldom maſſive; principally cryſtallized,

1. In rectangular four-ſided tables, which are either perfect, or bevelled on the terminal planes. When the perfect table increaſes in thickneſs, it paſſes into the
2. Cube, which has ſometimes ſtraight, ſometimes convex planes.
3. Octahedron, which is ſometimes truncated

on

on its extremities, ſometimes on its lateral edges, and ſometimes on both at once.

4. Equiangular eight-ſided table, bevelled on the terminal planes, and the bevelling planes ſet on the lateral planes. This paſſes into the

5. Double eight-ſided pyramid.

The tables are uſually broad and thin, and alternate from ſmall to very ſmall, but are ſeldom middle-ſized. They are ſometimes grown together, and frequently interſect one another, and thus form the cellular external ſhape.

Externally ſhining and ſmooth.

Internally it is gliſtening, and its luſtre is reſinous.

Fracture ſmall-grained uneven, and paſſes into the imperfect and ſmall conchoidal.

Fragments indeterminately angular, pretty ſharp-edged.

Is tranſlucent.

Soft.

Intermediate between brittle and ſectile.

Eaſily frangible.

Heavy.

Specific gravity, 5.092.

Chemical Characters.

It decrepitates before the blow-pipe, and then melts into a dark greyiſh-coloured maſs, in which globules of lead-ore are diſperſed. With borax it forms a browniſh-yellow globule; but when in ſmall proportion, and heated by the interior flame, it

it occaſionally produces a glaſs, which is greeniſh-blue, and ſometimes deep blue.

Conſtituent Parts.

Klaproth was the firſt who made us acquainted with the chemical compoſition of this ore; but we are indebted to our celebrated countryman *Hatchett* for the moſt complete and accurate analyſis of it. It has been alſo analyzed by *Macquart*, under the immediate inſpection of Vauquelin.

Klaproth's Analyſis.

Oxide of lead,	64.42
Oxide of molybdena,	34.25

Hatchett's Analyſis.

Oxide of lead,	58.40
Molybdic acid,	38.0
Oxide of iron,	2.08
Silica,	0.28

Macquart's Analyſis.

Lead,	58.75
Molybdena,	28.0
Oxygen,	4.76
Carbonat of lime,	4.50
Silica,	4

Geognoſtic Situation.

It occurs on compact limeſtone which is much traverſed by veins of calc-ſpar, and is accompanied with molybdena, and yellow lead-earth; ſometimes alſo with lead-glance, white, black and green lead-ore, calamine, blende, calc-ſpar, fluor-ſpar, &c.

Geographic

Geographic Situation.

Bleiberg near Villach in Carinthia; faid alſo to have been found at Saſka in the Bannat; Annaberg in Auſtria; Rezbanya in Hungary; Freudenſtein near Freyberg in the electorate of Saxony; Janowitz in Sileſia; and Burgundy in France.

NINTH SPECIES.

Lead Vitriol or Vitriol of Lead.

Blei Vitriol.—*Werner.*

Id. Wid. ſ. 870.—Native Vitriol of Lead, *Kirw.* vol. ii. p. 211.—Natürlicher Bleyvitriol, *Emm.* b. 2. ſ. 413. & b. 3. ſ. 366.—Sulphate de Plomb, *Lam.* t. 1. p. 211.—Le Vitriol de Plomb natif, *Broch.* t. 2. p. 325.—Plomb ſulphaté, *Hauy*, t. 3. p. 503.—Bleivitriol, *Reuſs*, b. 4. ſ. 264.

External Characters.

Colour yellowiſh-grey and greyiſh-white, which ſometimes paſſes into ſmoke and aſh grey; the lighter varieties incline very much to white.

Occurs only cryſtallized. The following are the cryſtallizations hitherto obſerved:

1. Octahedron.
2. Lengthened octahedron.
3. Octahedron, in which two oppoſite planes are

are larger than the others, ſo that it terminates in a line.

4. Octahedron, in which the common baſe is truncated.

5. Octahedron, in which the angles on the common baſe are bevelled, and the bevelling planes ſet on the lateral edges; ſometimes the edges of the bevellment are truncated.

Externally it is ſhining, and its luſtre is adamantine, which ſometimes inclines to reſinous.

Internally it is ſplendent, and its luſtre adamantine.

Fracture compact.

Is more or leſs tranſparent, often ſemitranſparent.

Intermediate between ſoft and very ſoft.

Rather brittle.

Heavy.

Specific gravity, 6.300, from Angleſea.—*Klaproth.*

Chemical Characters.

It is eaſily reduced, when expoſed to the flame of the blow-pipe. Is inſoluble in nitrous acid.

Conſtituent Parts.

	From Angleſea.	Wanlockhead.
Oxide of lead,	71	70.50
Sulphuric acid,	24.8	25.75
Water of cryſtallization,	2	2.25
Oxide of iron,	1	
	Klaproth.	*Klaproth.*

Geognoſtic and Geographic Situations.

It occurs in lead-glance veins at Wanlockhead, and in brown ironſtone at Paris Mount in the iſland of Angleſea. Prouſt found it in lead-glance veins in Andaluſia in Spain.

TENTH SPECIES.

Lead-Earth.

Bleierde.—*Werner.*

This ſpecies is divided into two ſubſpecies. 1. Coherent. 2. Friable.

FIRST SUBSPECIES.

Coherent Lead-Earth.

Verhärtete Bleierde.—*Werner.*

Id. Wid. ſ. 868.—Le Plomb terreux endurci, *Broch.* t. 2. p. 329.—Verhärtete gelbe und graue Bleyerde, *Reuſs*, b. 4. ſ. 270. & 272.

External Characters.

Its moſt frequent colour is yellowiſh-grey, from which it paſſes, on the one ſide, into ſtraw-yellow, greeniſh-grey, and very rarely into ſiſkin-green and

and apple-green; on the other ſide, into yellowiſh-brown. It occurs alſo ſmoke-grey, bluiſh-grey, and light-browniſh red. The ſtraw-yellow ſometimes paſſes into ſulphur-yellow.

It ſeldom preſents ring-ſhaped colour delineations.

Occurs maſſive.

Internally it is glimmering, paſſing into gliſtening; and its luſtre is reſinous.

Fracture ſmall and fine-grained uneven, which ſometimes paſſes into fine ſplintery and earthy; ſometimes into even and flat conchoidal.

Fragments indeterminately angular.

It ſeldom ſhews imperfect concentric lamellar diſtinct concretions.

Is uſually opaque, or extremely faintly tranſlucent on the edges.

Yields a brown-coloured ſtreak.

Soft, paſſing into very ſoft, even into friable, particularly the yellowiſh-grey, and yellow varieties.

Not very brittle, inclining to ſectile.

Eaſily frangible.

Heavy, inclining to uncommonly heavy.

Chemical Characters.

It is very eaſily reduced before the blow-pipe; effervesces with acids, and becomes black with ſulphuret of ammonia.

Conſtituent

Conſtituent Parts.

Has not been hitherto analyzed: It is ſuppoſed to be an intimate combination of white lead-ore, alumina, and lime.

Geognoſtic Situation.

The yellow-coloured varieties occur in a bed in primitive limeſtone, accompanied with lead-glance and other ores of lead, in the Bannat; the grey-coloured varieties occur ſometimes in veins, ſometimes in beds, and either in tranſition or floetz rocks, and are uſually accompanied with lead-glance, white lead-ore, iron-ochre, iron-pyrites, malachite, and quartz.

Geographic Situation.

The yellow varieties are found in Derbyſhire; Andreaſberg and Zellerfeld in the Hartz; La Croix in France; Saſka in the Bannat; Nertſchinſk in Siberia. The greyiſh-coloured varieties occur in lead-glance veins at Wanlockhead and Leadhills in Scotland; Zellerfeld in the Hartz; Johanngeorgenſtadt in the electorate of Saxony; Tarnowitz in Sileſia; the Eichelberg, near Innzell, in the Upper Palatinate; Chentzin in *ci-devant* Poland; Blutner, Tauern in Rauris in Salzburg; Nertſchinſkoi in Siberia.

SECOND SUBSPECIES.

Friable Lead-Earth.

Zerreibliche Bleierde.—*Werner.*

Le Plomb terreux friable, *Broch.* t. 2. p. 328.—Zerreibliche gelbe Bleierde, und zerreibliche grüne Bleierde, *Reuſs*, 4. b. f. 268, 269. 271, 272.

External Characters.

Colour yellowiſh-grey and ſtraw-yellow, which ſometimes approaches to ſulphur-yellow and lemon-yellow.

Occurs friable; ſometimes maſſive and diſſeminated, and as a coating.

It is compoſed of dull duſty particles, which are more or leſs cohering, and ſoil a little.

Is meagre and rough to the feel.

Heavy.

Geognoſtic Situation.

It occurs on the ſurface or in the hollows of other minerals, and is uſually accompanied with lead-glance and other ores of lead.

Geographic Situation.

It is found at Wanlockhead and Leadhills in Scotland; Zellerfeld in the Hartz; Zſchopau, and near Freyberg in the electorate of Saxony;

in

in the mountains of Kracau in *ci-devant* Poland; La Croix in Lothringen in France; Berefowſkoi and Nertſchinſkoi in Siberia.

Obſervations.

1. It is to be obſerved paſſing into ſolid lead-earth.

2. It is probably ſometimes formed by the decompoſition of lead-glance, as it occurs very often as a cruſt on it.

3. *Native Lead* is mentioned by ſeveral mineralogiſts, but its exiſtence is ſtill highly problematical.

EIGHTH GENUS.

TIN GENUS.

FIRST SPECIES.

Tin-Pyrites.

Zinnkies.—*Werner.*

Id. Wid. ſ. 875.—Tin Pyrites, *Kirw.* vol. ii. p. 200.—Zinnkies, *Emm.* 2. b. ſ. 418.—Etaine ſulphuré, *Lam.* t. 1. p. 279.—*Id. Hauy*, t. 4. p. 154.—La Pyrite d'Etain, ou l'Etain pyriteux, *Broch.* t. 2. p. 332.—Zinnkies, *Reuſs*, 4. b. ſ. 286.

External Characters.

Colour intermediate between ſteel-grey and braſs-yellow, but uſually more inclined to the firſt.

Occurs maſſive and diſſeminated.

Internally

Internally it is gliſtening, ſometimes ſhining, and ſeldom paſſes into ſplendent, and its luſtre is metallic.

Fracture ſometimes ſmall and coarſe grained uneven; ſometimes, but rarely, inclining to ſmall and imperfect conchoidal, and imperfect foliated.

Fragments indeterminately angular, blunt-edged.

Is ſemihard, paſſing into ſoft.

Brittle.

Eaſily frangible.

Heavy.

Specific gravity, 4.350, *Klaproth*; 4.785, *La Metherie*.

Chemical Characters.

Before the blow-pipe it gives a ſulphureous odour, and melts eaſily, without being reduced, into a black ſcoria.

It communicates a yellow or green colour to borax.

Conſtituent Parts.

Tin,	34
Copper,	36
Iron,	3
Sulphur,	25
Earthy matter,	2
Klaproth.	100

Geogneſtic

Geognoſtic and Geographic Situations.

It has been hitherto found only at Wheal-rock and St Agnes in Cornwall, where it occurs in a vein about nine feet wide, accompanied with copper-pyrites and brown-blende.

Obſervation.

It was formerly confounded with Magnetic Pyrites.

SECOND SPECIES.

Tin-Stone.

Zinnſtein.—*Werner.*

Stannum Arſenico et Ferro mineraliſatum, *Wall.* t. 2. p. 319. et ſeq.—Zinnſtein, *Werner*, Pabſt. 1. b. ſ. 171.—*Id. Wid.* ſ. 880.—Common Tin-ſtone, *Kirw.* vol. ii. p. 197.—Etain vitreux, *De Born.* t. 2. p. 238.—Zinnkeis, *Emm.* b. 2. ſ. 420. Oxide d'Etain, *Lam.* t. 1. p. 274.—Etain oxidé, *Hauy*, t. 4. p. 137.—La Pierre d'Etain, ou la Mine d'Etain commune, *Broch*, t. 2. p. 334.—Zinnſtein, *Reuſs*, 4. b. ſ. 288.

External Characters.

Its moſt common colour is blackiſh-brown; from which it paſſes, on the one ſide, into browniſh-black and velvet-black; on the other ſide, into hair-brown and reddiſh-brown, from which it paſſes further into yellowiſh-green, yellowiſh-white, and greeniſh-white.

Occurs

Occurs maſſive, diſſeminated, in rolled pieces, in grains as ſand; but moſt frequently cryſtallized, and the cryſtals are in general very indiſtinct:

1. Rectangular four-ſided priſm, rather flatly acuminated by four planes, which are ſet on the lateral planes; ſometimes the lateral edges, ſometimes the edges of the acumination, and the angles, are more or leſs deeply truncated.
2. Double four-ſided pyramid (octahedron), in which the lateral planes of the one are ſet on the lateral planes of the other. This figure is very rarely complete, being uſually more or leſs deeply truncated on the common baſe, and ſometimes the edge of the common baſe is bevelled, and the edge of the bevelment truncated. The angles on the common baſe are ſometimes alſo truncated.
3. Long rectangular four-ſided priſm, acuminated on both extremities by eight planes, of which two and two always meet together, under very obtuſe angles, and are ſet on a lateral plane, and again flatly acuminated by four planes, which are ſet on the obtuſe edges of the firſt acumination. The edges of the ſecond acumination are ſometimes truncated.
4. Rectangular four-ſided priſm, acuminated by four planes, which are ſet on the lateral edges. Sometimes the lateral edges of the priſm are truncated, ſometimes alſo the edges of the

acumination; and in ſome varieties the edges of the priſm and acumination are firſt bevelled and then truncated.

5. Twin cryſtals, compoſed of two cryſtals obliquely incorporated with each other by one of their ſummits, in ſuch a manner as to form on the one ſide a re-entering angle. This angle is large and ſmall; ſometimes it is ſo ſmall that it appears only like a line, and thus is formed a kind of thick ſix-ſided tabular cryſtal. The twin cryſtal is the moſt common figure of tinſtone, and it is uſually formed by the octahedron with truncated baſe.

The ſurface of the cryſtals is uſually ſmooth, ſeldom more or leſs ſtrongly ſtreaked, and it is commonly ſplendent.

Internally it is only ſhining and gliſtening, and its luſtre is intermediate between reſinous and adamantine, but more inclining to the latter.

Fracture coarſe and ſmall grained uneven, inclining to imperfect conchoidal; ſeldom imperfect foliated, and extremely ſeldom perfect foliated, and then it is highly ſplendent.

Fragments indeterminately angular, pretty blunt edged.

The maſſive varieties occur commonly in coarſe, ſmall and fine granular diſtinct concretions.

It alternates from ſemitranſparent to opaque; the darker coloured varieties are opaque, the lighter

er tranſlucent and ſemitranſparent, often even inclining to tranſparent; the intermediate varieties are only tranſlucent and tranſlucent on the edges.

Yields a greyiſh-white ſtreak.

Is hard.

Eaſily frangible.

Brittle.

Uncommonly heavy.

Specific gravity, 6.300 to 6.989, *Gellert;* 6.750, *Brunnich;* 6.880, *Leyſſer;* 6.9009, the black, 6.9348, the red, *Briſſon;* 5.845 to 6.970, *Klaproth.*

Chemical Characters.

Before the blow-pipe, it decrepitates, becomes paler, and where it reſts on the charcoal is reduced. When roaſted, it is converted into a grey oxide. Acids diſſolve the iron it contains, but only a very minute portion of the tin.

Conſtituent Parts.

	From Alternon.	Schlackenwald.	Ehrenfriederſdorf.
Tin,	77.50	75.0	68
Iron,	0.25	0.50	9
Oxygen,	21.50	24.50	16
Silica,	0.75		7
	100	100	100
	Klaproth.	*Klaproth.*	*Lampadius.*

Geognoſtic Situation.

It occurs only in primitive rocks, as granite, gneiſs,

gneiſs, mica-ſlate and clay-ſlate, and is the oldeſt of all the metals. It occurs either diſſeminated in the rock, or in *ſtöckwerks*, beds, or veins. It is uſually accompanied with quartz, mica, lithomarge, ſteatite, wolfram, tungſten, arſenic pyrites, copper-pyrites, iron-pyrites, molybdena, black and brown blende; leſs frequently with fluor-ſpar, topaz, appatite, felſpar, ſchorl, magnetic ironſtone, copper-glance, lead-glance, and white lead-ore. It is found alſo in great quantity in alluvial land. The greater part of the Engliſh, much of the Spaniſh, and the greater proportion of that in India, occurs in that ſituation.

Geographic Situation.

Tin is not found in many countries, but where it does occur, it is in very conſiderable quantity. In the moſt northern countries it is entirely awanting. In *Europe* there are only three tin diſtricts. The firſt is in the Erzgebirge, on the Saxon and Bohemia ſides, and extends as far as the Rieſengebirge and Fichtelgebirge. The ſecond diſtrict is in Cornwall. The third is that of Galicia on the borders of Portugal.

In *Aſia* it is found, in vaſt quantity, in the peninſula of Malacca, Siam, and in the iſland of Banka.

In *America* it is ſaid to occur near Cochimbo, and in Chili.

Uſe.

Use.

It is worked as an ore of tin, and from it all the tin of commerce is obtained.

Observations.

1. Its name is derived from the great quantity of tin which it affords, and its unmetallic-like aſpect.

2. It is diſtinguiſhed from Wolfram by its inferior hardneſs, as it does not give fire with ſteel; and by the ſtreak, which in tinſtone is greyiſh-white, but in wolfram reddiſh-brown: from Blende by its inferior hardneſs and uneven fracture.

THIRD SPECIES.

Corniſh Tin-Ore, or Wood-Tin.

Korniſch Zinnerz.—*Werner.*

Mine d'Etain mamelonnée, ou en Stalactites, *Rom. de L.* t. 3. p. 428. — Korniſch Zinnerz, *Werner*, Pabſt. 1. b. ſ. 183.—*Id. Wid.* ſ. 877. — Wood Tin-Ore, *Kirw.* vol. ii. p. 198.—Etain limoneux, *De Born.* t. 2. p. 248.—Korniſch Zinnerz, *Emm.* 2. b. ſ. 427. — Mine d'Etain ferrugineuſe, *Lam.* t. 1. p. 281.—Etain oxidé concretionné, *Hauy*, t. 4. p. 147.—La Mine d'Etain grenue, ou l'Etain grenu, *Broch.* t. 2. p. 340. —Holzzinnerz, *Reuſs*, p. 4. ſ. 300.

External

External Characters.

Its moſt common colour is hair-brown, of different degrees of intenſity, which paſſes into wood-brown, and nearly into yellowiſh-grey, ſometimes into reddiſh-brown. In ſingle pieces it is ſometimes ſtriped.

Occurs uſually in rolled pieces; ſometimes we can obſerve its original ſhape, which appears to be ſmall reniform; and with impreſſions.

The reniform is black on the ſurface, and bears a conſiderable reſemblance to hematite.

Externally gliſtening.

Internally it is gliſtening and glimmering, and its luſtre is reſinous, inclining to adamantine.

Its fracture is delicate, ſtraight, ſcopiform and ſtellular diverging fibrous.

Fragments wedge-ſhaped and ſplintery.

It occurs uſually in large and coarſe granular diſtinct concretions, which are interſected by curved and thin lamellar concretions, and the colour delineation is in the direction of the latter.

The ſtreak is ſhining and yellowiſh-brown.

Is opaque.

Hard.

Brittle.

Eaſily frangible.

Uncommonly heavy.

Specific gravity, 5.800, *Brunnich*; 6.450, *Klaproth*.

Chemical

Chemical Characters.

Before the blow-pipe, it becomes brownish-black, but is infusible or irreducible, either alone or with borax. In a charcoal crucible, *Klaproth* obtained 0.6333 of tin. It is little affected by acids.

Constituent Parts.

Klaproth found it to contain in the hundred parts, 63 parts of tin, with iron and arsenic.

Geognostic and Geographic Situations.

Has been hitherto found only in Cornwall, and there in alluvial land, accompanied with tinstone.

Observations.

It bears a strong resemblance to Brown Hematite; from which, however, it is distinguished by its hair-brown colour, its rolled pieces, greater hardness, and higher specific gravity *.

NINTH

* Several mineralogists have described *Native Tin*, but its actual existence is far from having been rendered probable.

NINTH GENUS.

BISMUTH GENUS.

FIRST SPECIES.

Native Biſmuth.

Gediegen Wiſmuth.—*Werner.*

Wiſmuthum nativum, *Wall.* t. 2. p. 205. — Gediegen Wiſmuth, *Wern.* Pabſt. 1. b. ſ. 183.—*Id. Wid.* ſ. 887. — Native Biſmuth, *Kirw.* vol. ii. p. 264. — Biſmuth natif, *De Born.* t. 2. p. 214.—Gediegen Wiſmuth, *Emm.* b. 2. ſ. 434.—Biſmuth natif, *Lam.* t. 2. p. 331.—*Id. Hauy*, t. 4. p. 184. — *Id. Broch.* t. 2. p. 343. — Gediegen Wiſmuth, *Reuſs*, 4. b. ſ. 310.

External Characters.

Its colour is ſilver-white, which inclines to red; on the freſh fracture it acquires a pavonine tarniſh, particularly thoſe varieties that contain cobalt.

Occurs maſſive, diſſeminated, in leaves whoſe ſurface is plumoſely ſtreaked; reticulated; and cryſtallized, in

1. Small, and very ſmall four-ſided tables.
2. Very ſmall and indiſtinct cubes.
3. Three-ſided pyramids, with truncated angles.

Internally it is ſplendent, and its luſtre is metallic.

Fracture perfect foliated, and to appearance with

with a twofold cleavage, which however appears to be obliquely interſected by a third.

Fragments indeterminately angular, blunt-edged.

Occurs in ſmall and fine granular, and very ſeldom in coarſe granular diſtinct concretions.

Is ſoft.

Sectile, paſſing into malleable.

Rather difficultly frangible.

Uncommonly heavy.

Specific gravity, 9.0202, *Briſſon;* 9.570, *Kirwan.*

Chemical Characters.

It melts even by the flame of a candle; before the blow-pipe it melts very quickly to a ſilver-white globule, which, by continuance of the heat, is volatilized, and depoſites a white covering on the charcoal. It diſſolves with effervеſcence in nitrous acid; but if we add water to the ſolution, it is precipitated in the form of a white powder.

Geognoſtic Situation.

It occurs in veins in primitive mountains, and it is ſaid alſo diſſeminated in wacke. It is uſually accompanied with ores of cobalt, particularly white cobalt-ore, and grey cobalt-ore; alſo copper-nickel, iron-pyrites, and brown-blende; ſometimes alſo native ſilver, and very ſeldom lead-glance; the vein-ſtones are quartz, hornſtone, calc-ſpar, brown-ſpar, and heavy-ſpar.

Geographic Situation.

It occurs more frequently in the electorate of Saxony at Johanngeorgenſtadt and Schneeberg, than in any place in Europe; it is found alſo in conſiderable quantity at Joachimſthal in Bohemia; and in leſs abundance in the Black Foreſt (Schwarzwald) in Swabia. It has been alſo obſerved at Zalathna in Tranſilvania; Temeſwar in the Bannat; at Biber in Hanau; St Saveur and in the mines of Brittany in France; Dalecarlia and Nerike in Sweden.

It is ſaid alſo to have been found in England.

Uſe.

It enters as an ingredient into the compoſition of types, pewter, is uſed as ſolder, in the conſtruction of mirrors, and for the refining of gold and ſilver; its oxide is uſed as a white pigment, as an eſſential ingredient in a kind of ſalve, which is uſed for giving a black colour to the hair, and as an ingredient in ſympathetic ink.

Obſervations.

It is diſtinguiſhed from Biſmuth-Glance by its colour and regular external figures; the reticulated varieties from reticulated Native Silver, by their colour and inferior malleability.

SECOND

SECOND SPECIES.

Bifmuth-Glance.

Wifmuth-Glanz.—*Werner.*

Galena Wifmuthi, *Wall.* t. 2. p. 206.—Minera Wifmuthi cinerea--verficolor--martialis, *Id.* p. 207. and 208.—Wifmuth-Glanz, *Wern.* Pabft. 1. b. p. 187.—*Id. Wid.* f. 890.—Sulphurated Bifmuth, *Kirw.* vol. ii. p. 266. — Bifmuth fulphuré, *De Born.* t. 2. p. 217.—Wifmuth-Glanz, *Emm.* 2. b. f. 438, —Bifmuth fulphuré, *Lam.* t. 1. p. 333. — *Id. Hauy*, t. 4. p. 190.—La Galena de Bifmuth, ou le Bifmuth fulphuré, *Broch.* t. 2. p. 346.—Wifmuth-Glanz, *Reufs*, b. 4. f. 314.

External Characters.

Colour light lead-grey; lighter than that of antimony.

Occurs maffive, diffeminated, and in acicular and capillary cryftals.

Internally the foliated fracture is fplendent; the radiated fracture only fhining.

Fracture perfect foliated, fingle cleavage; fometimes alfo narrow and promifcuous radiated.

Fragments indeterminately angular.

The foliated varieties fometimes fhew large and coarfe granular diftinct concretions.

It foils.

Is foft and very foft.

Brittle inclining to fectile.

Eafily

Eaſily frangible.

Heavy.

Specific gravity, 6.4672, *Briſſon;* 6.131, *Kirwan.*

Chemical Characters.

Melts even by the flame of a candle. Before the blow-pipe it melts very eaſily, with a blue flame, and diſengagement of a ſulphureous odour. If the heat be continued, it is almoſt entirely volatilized, without being reduced to the metallic ſtate.

Conſtituent Parts.

According to the analyſis of *Sage,*

Biſmuth,	60
Sulphur,	40
Iron,	a trace.

Geognoſtic Situation.

Occurs always in veins, and is uſually accompanied with native biſmuth, ſparry ironſtone, arſenic pyrites, copper-pyrites, tinſtone, quartz, and fluor-ſpar.

Geographic Situation.

Joachimſthal, Schlackenwald in Bohemia; Johanngeorgenſtadt, Schwarzenberg, and Altenberg in the electorate of Saxony; Baſtnäs near Riddarhytta in Sweden; Deutſchpilſen in Hungary.

Obſervation.

Observation.

It is distinguished from Grey Antimony-ore by its lighter lead-grey colour, and its greater specific gravity.

THIRD SPECIES.

Bismuth-Ochre.

Wismuthocker.—*Werner.*

Ochra Wismuthi, *Wall.* t. 2. p. 209.—Wismuthocker, *Wern.* Pabst. 1. b. s. 188.—*Id. Wid.* s. 891.—Bismuth-Ochre, *Kirw.* vol. ii. p. 265.—Ocre de Bismuth, *De Born.* t. 2. p. 194.—Wismuth-Ocker, *Emm.* 2. b. s. 440.—Oxide de Bismuth, *Lam.* t. 1. p. 332.—Bismuth oxidé, *Hauy*, t. 4. p. 194, 195.—L'Ocre de Bismuth, *Broch.* t. 2. p. 348.—Wismuth-Ochre, *Reuss*, 4. b. s. 318.

External Characters.

Colour straw-yellow, which sometimes passes into light yellowish-grey and ash-grey; sometimes even verges on apple-green.

Occurs sometimes massive, sometimes disseminated.

It is glimmering and glistening when its fracture is fine and small-grained uneven; shining when it is foliated; and dull when it is earthy. Its lustre is adamantine.

Fracture

Fracture fine and ſmall grained uneven, which paſſes on the one ſide into foliated, on the other into earthy.

Fragments indeterminately angular, rather blunt-edged.

Is opaque.

Soft, and very ſoft verging on friable.

Not very brittle.

Eaſily frangible.

Heavy.

Specific gravity, 4·3711, *Briſſon.*

Chemical Characters.

Before the blow-pipe, on charcoal, it is eaſily reduced, but is alſo volatilized if the heat be continued. It diſſolves with effervescence in acids.

Conſtituent Parts.

Oxide of biſmuth,	86.3
Oxide of iron,	5.2
Carbonic acid,	4.1
Water,	3·4
Lampadius.	99.0

Geognoſtic and Geographic Situations.

It occurs along with native biſmuth, and is alſo accompanied with quartz and brown-ſpar.

It is found at Schneeberg and Johanngeorgenſtadt in Saxony, and Joachimſthal in Bohemia, but is a very rare mineral.

Obſervation.

Observation.

It has been often confounded with Green Iron-earth, from which it is well distinguished not only by its external aspect, but by its accompanying minerals.

TENTH GENUS.

ZINC GENUS.

FIRST SPECIES.

Blende.

Blende.—*Werner.*

This species is divided into three subspecies: 1. Yellow-Blende: 2. Brown Blende: 3. Black Blende.

FIRST SUBSPECIES.

Yellow Blende.

Gelbe Blende.—*Werner.*

Id. Wern. Pabst. 1. b. s. 188.—*Id. Wid.* 898.—Yellow Blende, *Kirw.* vol. ii. p. 238.—Gelbe Blende, *Emm.* 2. b. s. 443.—La Blende jaune, *Broch.* t. 2. p. 350.—Gelbe Blende, *Reuss,* 4. b. s. 326.

External

External Characters.

Colour dark wax-yellow, and ſulphur-yellow; which paſſes, on the one ſide, into aſparagus-green, oil-green, and olive-green; on the other, into hyacinth-red, aurora-red, browniſh-red, even into reddiſh and yellowiſh brown. All theſe colours incline more or leſs to green.

Occurs uſually maſſive, and diſſeminated; alſo cryſtallized in rectangular four-ſided priſms, which are truncated on the lateral edges, and acuminated by four planes, which are ſet on the lateral planes.

The cryſtals are middle-ſized and ſmall, but uſually very much grown together, which renders it difficult to determine their figure.

The cryſtals have a ſmooth ſurface.

Externally and internally it is ſhining and ſplendent, and its luſtre is adamantine.

Fracture more or leſs perfect and ſtraight foliated, with a ſixfold cleavage; ſhews alſo a conchoidal croſs fracture.

Fragments dodecahedral, but on account of the diſtinct concretions can ſeldom be obtained perfect, and are therefore moſt commonly indeterminately angular, and pretty ſharp-edged.

Occurs in large and coarſe, but ſeldom in ſmall granular diſtinct concretions.

Is uſually only tranſlucent, but the lighter coloured

loured varieties are ſemitranſparent inclining to tranſparent.

Is duplicating tranſlucent.

It yields a yellowiſh-grey and yellowiſh-white ſtreak.

Is ſemihard.

Brittle.

Eaſily frangible.

Heavy.

Specific gravity, 4.044 to 4.048, *Gellert*; 4.067, *Kirwan*.

Phyſical Characters.

When rubbed with a hard body, it phoſphoreſces in the dark, and as powerfully under water as in the air.

Chemical Characters.

It decrepitates before the blow-pipe, becomes grey, but is infuſible either alone or with borax. It is almoſt wholly diſſolved in nitrous acid.

Conſtituent Parts.

Yellow-Blende from Scharfenberg.

Zinc,	64
Sulphur,	20
Iron,	5
Fluoric acid,	4
Silica,	1
Water,	6
Bergman.	100

Geognoſtic Situation.

Like the other ſubſpecies of blende, it occurs more frequently in tranſition than in primitive and floetz mountains. It is the rareſt ſubſpecies, and the moſt beautiful varieties are found at Ratieborziz in Bohemia. It is accompanied with lead-glance, fahl-ore, iron-pyrites, brown-ſpar, and quartz; ſometimes alſo with native ſilver and ſilver-glance.

Geographic Situation.

Ratieborziz and Prizbram in Bohemia; Bleyberg in Carinthia; Kapnik and Boitza in Tranſilvania; Schemnitz and Felſobanya in Hungary; Scharfenberg in Saxony; Merzburg, Reichenſtein and Kupferberg. in Sileſia; Claufthal in the Hartz; Salzburg; Fauſtgny in Savoy; Kongſberg in Norway; and Kolyvan in Siberia.

SECOND SUBSPECIES.

Brown-Blende.

Braune Blende.—*Werner.*

This ſubſpecies is divided into two *kinds*: 1. Foliated Brown-Blende: 2. Fibrous Brown-Blende.

FIRST KIND.

Foliated Brown-Blende.

Blättrige Braune-Blende.—*Werner.*

Id. Wern. Pabſt. 1. b. ſ. 191.—*Id. Wid.* ſ. 896.—Brown Blende, *Kirw.* vol. ii. p. 239.—Braune Blende, *Emm.* 2. b. ſ. 447.—La Blende brune, *Broch.* t. 2. p. 353.—Braune blende, *Reuſs*, 4. b. ſ. 330.

External Characters.

Its colour is reddiſh and yellowiſh-brown; from yellowiſh-brown it paſſes into blackiſh-brown, and from reddiſh-brown into hyacinth-red.

It is ſometimes tarniſhed with variegated colours.

Occurs uſually maſſive, and diſſeminated; often alſo cryſtallized,

1. Simple three-ſided pyramid, either perfect, or with truncated angles, and the planes are ſometimes convex.
2. Double four-ſided pyramid or octahedron, either perfect or truncated on the edges, or angles, or on both at once.
3. Garnet dodecahedron, either perfect or truncated on the alternate lateral and acuminating edges.
4. Rectangular four-ſided priſm acuminated by four

four planes, which are set on the lateral edges.

5. Acicular crystals.

6. Twin-crystals like those of spinelle.

The crystals are small, very small and middle-sized. Their lateral planes are commonly conical convex.

Externally drusy and shining.

Internally it alternates from specular splendent to weak glimmering, and its lustre is intermediate between resinous and adamantine.

The fracture is more or less perfect foliated, with a sixfold cleavage.

It occurs in granular distinct concretions of all degrees of magnitude, until extremely fine granular, which nearly passes into even.

It is more or less translucent, commonly strongly translucent on the edges. The extremely fine granular is opaque. The large and coarse granular is translucent, sometimes bordering on perfect transparent.

Yields a yellowish-grey and yellowish-brown streak.

Is semihard.

Brittle.

Easily frangible.

Heavy.

Specific gravity, 3.770 to 4.048, *Gellert*; 3.963, *Kirwan*.

Constituent

Conſtituent Parts.

From Sahlberg.		Holzapfel.		Allanheads, Northumberland.	
Zinc,	44	Oxide of zinc,	54·5	Zinc,	58.8
Iron,	5	Iron,	5.	Sulphur,	23.5
Sulphur,	17	Sulphur,	16.	Iron,	8.4
Silica,	24	Water,	4.	Silica,	7.0
Alumina,	5				
Water,	5	*Schaub.*	79·5	*Dr Thomſon.*	97·7
Bergman.	100				

Blende, like all other ores, often contains what, chemically conſidered, may be viewed as accidental ingredients. The blende of Prizbram frequently contains ſilver; that from Nagyag manganeſe, lead, arſenic, and auriferous ſilver. The iron is, even by chemiſts, viewed as an accidental ingredient; but it muſt be remembered, that they are all of importance to the oryctognoſt, becauſe they materially influence the external aſpect of the mineral.

Geognoſtic Situation.

Its geognoſtic ſituation is the ſame as the preceding ſubſpecies, and, like it, is almoſt always accompanied with lead-glance.

At Leadhills it is accompanied by lead-glance, white lead-ore, green lead-ore, lead-vitriol, lead-earth, ſparry-ironſtone, iron-pyrites, brown iron-ochre, brown hematite, copper-azure, earthy manganeſe-ore, calamine; and the vein-ſtones are quartz,

quartz, lamellar heavy-ſpar, calc-ſpar, brown-ſpar, and rock-earth. At Prizbram in Bohemia, it occurs with lead-glance, white lead-ore, green lead-ore, black lead-ore, ſparry ironſtone, grey antimony-ore, white antimony-ore, iron-pyrites, white ſilver-ore, and native ſilver. At Mieſs, alſo in Bohemia, with lead-glance, white, green and black lead ores, lead-earth, copper-pyrites, malachite, earthy copper-azure, iron-pyrites, quartz, and heavy ſpar. At Bleyberg in Carinthia, with lead-glance, white and yellow lead-ores, calamine, calc-ſpar, gyps, and rock-cork. At Offenbanya in Tranſilvania with graphic ore, iron-pyrites, fahl, or grey copper-ore, and very ſeldom with native gold. At Clauſthal in the Hartz with lead-glance, iron-pyrites, ſparry ironſtone, copper-pyrites, white lead-ore, light red ſilver-ore, brittle ſilver-ore, fahl-ore, calc-ſpar, and lamellar heavy-ſpar.

Geographic Situation.

Cornwall, Derbyſhire, Staffordſhire, Northumberland, Cumberland, Angleſea, in England, and Lanarkſhire, Dumfriesſhire and Argyleſhire in Scotland; Bohemia; Carinthia; Hungary; Tranſilvania; Freyberg, Scharfenberg and Marienberg in the electorate of Saxony; Sileſia; Bavaria; Salzburg; Hartz; Holzapfel in Anhalt-Bernburg-Schaumburg; Savoy; Spain; Sweden; Siberia.

SECOND KIND.

Fibrous Brown-Blende.

Faſrige Braune-Blende.—*Werner.*

Colour reddiſh-brown.

Occurs maſſive and reniform.

Is gliſtening, paſſing into ſtrongly glimmering.

Fracture intermediate between even and extremely delicate ſcopiform and ſtellular diverging fibrous.

It conſiſts of large and coarſe granular diſtinct concretions, which are interſected by curved lamellar diſtinct concretions, which are bent in the direction of the external ſurface.

Is opaque, or very feebly tranſlucent on the edges.

In other characters, it agrees with foliated brown blende.

Geographic Situation.

Has been hitherto found only at Geroldſeck in the Breiſgau.

THIRD SUBSPECIES.

Black-Blende.

Schwarze-Blende.—*Werner.*

Id. Wern. Pabſt. 1. b. ſ. 193.—*Id. Wid.* ſ. 893.—Black Blende, *Kirw.*

Kirw. vol. ii. p. 241.—Schwarze Blende, *Emm.* 2. b. f. 451. La Blende noire, *Broch.* t. 2. p. 357.—Schwarze Blende, *Reuſs*, 4. b. f. 337.

External Characters.

Its colour is intermediate between greyiſh and velvet black; ſometimes it is browniſh-black. When tranſlucent, it appears blood-red. Is ſometimes tarniſhed with variegated colours.

Occurs maſſive, diſſeminated, and cryſtallized in the ſame figures as brown-blende.

The cryſtals are ſmall; and ſo much grown together, that it is very difficult to aſcertain their figure.

Internally it is ſhining, ſometimes ſplendent, and and its luſtre is metallic.

Fracture foliated, with a ſixfold cleavage, which in this ſubſpecies is very indiſtinct.

Fragments indeterminately angular; pretty ſharp edged.

Occurs in coarſe, ſmall and fine granular diſtinct concretions.

Is almoſt always opaque, excepting the reddiſh-coloured, which is tranſlucent on the edges and angles.

The ſtreak is intermediate between yellowiſh-grey and light yellowiſh-brown, which inclines much to grey.

Is ſemihard.

Brittle.

Eaſily

Eafily frangible.
Heavy.

Specific gravity, 3.967 to 3.930, *Gellert*; 4.1665, *Briſſon*; 5.398, auriferous from Nagyag, according to *Von Müller*.

Conſtituent Parts.

From Dannemora.		Bowallon.	
Zinc,	45	52	53
Iron,	9	8	12
Lead,	6	—	—
Arſenic,	1	—	5
Copper,	—	4	—
Sulphur,	29	26	26
Silica,	4	6	—
Water,	6	4	4
	Bergman.	*Bergman.*	*Lampadius.*

The black-blende from Nagyag, beſides zinc, iron, and manganeſe, contains a portion of auriferous ſilver. The lead and copper obtained from blende by Bergman, were probably derived from very minutely mixed lead-glance and copper-pyrites, and the ſilica from the vein-ſtone.

Geognoſtic Situation.

It occurs in the ſame geognoſtic relations as the preceding ſubſpecies, and is always accompanied with lead-glance, and frequently with grey copper-ore, white ſilver-ore, dark red ſilver-ore, and ſeveral other ſpecies of ſilver-ore; alſo with ſpar-

ry ironſtone, magnetic ironſtone, tin-ſtone, &c. The vein-ſtones are quartz, calc-ſpar, brown-ſpar, and ſeldom aſbeſtous actynolite, and garnet.

Geographic Situation.

Cornwall, Derbyſhire, Cumberland, &c.; Norway; Sweden; Hartz; electorate of Saxony; Bohemia; Sileſia; Upper Palatinate; Bavaria; Salzburg; Hungary; Tranſilvania.

Uſe of the Species.

Is ſometimes, although extremely rarely, worked as an ore of zinc.

Obſervations on the Species.

1. The different ſubſpecies characterize different formations: the black is the neweſt; the yellow the oldeſt; and the brown is of an intermediate age.

2. The brown ſubſpecies is the moſt frequent, and unites in it all the variety of diſtinct concretions and luſtre that occurs in the yellow and black.

3. The different ſubſpecies occur principally in tranſition mountains; leſs frequently in primitive and floetz mountains.

SECOND SPECIES.

Calamine.

Galmey.—*Werner.*

Id. Wid. ſ. 904.—Compact Calamine, *Kirw.* vol. ii. p. 234.—Striated Calamine, *Id.* p. 236.—Gemeiner Galmei, und Blättriger Galmei, *Emm.* 2. b. ſ. 454. & 458.—Calamine, *Lam.* t. 1. p. 322. Zinc oxidé concretionné; et Zinc oxidé cryſtalliſé, *Hauy*, t. 4. p. 159. & 161.—La Calamine commune, et la Calamine lamelleuſe, *Broch.* t. 2. p. 361. & 364.—Gemeiner Galmei, und Blättricher Galmei, *Reuſs*, 4. b. ſ. 345. & 349.

External Characters.

Its colour is yellowiſh-grey, which paſſes into yellowiſh and greyiſh white, that inclines to aſh-grey. The yellowiſh-grey ſometimes inclines much to ochre-yellow, which approaches to cream-yellow and yellowiſh-brown.

Occurs maſſive, diſſeminated, cellular, corroded, botryoidal, reniform, ſtalactitic, coating other minerals, and druſy; and cryſtallized, in the following forms:

1. Longiſh rectangular four-ſided table, which is either perfect, or bevelled on the terminal planes, and the angles of the bevelment are ſometimes more or leſs deeply truncated.
2. Cube, either with ſtraight or ſpherical con-

vex

vex planes, and more or leſs deeply truncated on its angles.

3. Double four-ſided pyramid, or octahedron.
4. Flat ſix-ſided priſm, bevelled on both extremities, the bevelling planes ſet on the edges formed by the meeting of the ſmaller lateral planes; ſometimes the bevelling planes are ſet on the broader lateral planes.

The cryſtals are ſmall and very ſmall.

The lateral planes of the tables are uſually longitudinally ſtreaked; the particular external ſhapes have uſually a rough, the botryoidal only has a druſy ſurface.

Externally the cryſtals are ſplendent and ſhining.

Internally it alternates from ſhining to glimmering, and even verges on dull; and its luſtre is intermediate between reſinous and adamantine.

Its fracture is ſmall and imperfect foliated, which ſometimes paſſes into coarſe, ſmall and fine-grained uneven, which latter inclines to earthy; ſometimes into narrow, ſhort and ſtellular, or ſcopiform diverging radiated, which ſometimes approaches to fibrous, and ſometimes to ſplintery.

Fragments are indeterminately angular, and rather blunt-edged.

Occurs in ſmall and fine granular diſtinct concretions, which are uſually very indiſtinct; ſometimes alſo in thin and curved lamellar concretions.

The

The whitiſh coloured radiated and fibrous varieties are tranſlucent; the greyiſh feebly tranſlucent; the earthy opaque; but the cryſtals paſs into ſemitranſparent.

Is ſemihard, paſſing to ſoft.

Not particularly brittle.

Rather difficultly frangible.

Heavy.

Specific gravity, 3.5236, *Briſſon*; 4.1000, *La Metherie*.

Chemical Characters.

When ſuddenly heated before the blow-pipe, it flies into pieces and becomes white, but it is infuſible either alone or with borax. Some varieties effervеſce with acids, others do not; but they all form a jelly with acids.

Conſtituent Parts.

Holywill.		Fribourg.		Wanlockhead.
Oxide of zinc,	65	Oxide of zinc,	36	66
Oxide of iron,	1	Silica,	52	33
Carbonic acid,	28	Water,	12	
Water,	6			
	Bergman.		*Pelletier.*	*Klaproth.*
Derbyſhire.		Somerſetſhire.		Bleyberg.
Oxide of zinc,	0.652		0.648	0.714
Carbonic acid,	0.348		0.352	0.135
Water,				0.151
Mr Smithſon.	1.000	*Id.*	1.000	*Id.* 1.000

Geognoſtic Situation.

It occurs moſt frequently in beds in a floetz limeſtone formation, whoſe geognoſtic characters and relations remain ſtill unaſcertained. It is there accompanied with iron-ochre, lead-glance, blende, grey lead-earth, calc-ſpar, compact brown-ironſtone, white and black lead-ore, and clay-ironſtone.

It is found alſo in lead-glance veins.

Geographic Situation.

Derbyſhire, Cumberland, Northumberland and ſeveral other counties in England; Lanarkſhire and Dumfriesſhire in Scotland; Brelen, Aachen in Weſtphalia; Stolberg in the Hartz; Breiſgau; Tarnowitz in Sileſia; Cracou in Poland; Bleyberg in Carinthia; Tirnitz in Stiria; Bavaria; Salzburg; France; Crimea; Nertſchinſk in Siberia.

Uſe.

When purified and roaſted, it is uſed for the fabrication of braſs, which is a compound of zinc and copper.

Obſervation.

Native zinc is ſaid to have been found at Schneeberg in Saxony; alſo at Bonſal in Derbyſhire; in the iſland of Naxos, and at Rammelſberg in the Hartz; but none of theſe aſſertions have been confirmed.

NINTH

NINTH GENUS.

ANTIMONY.

FIRST SPECIES.

Native Antimony.

Gediegen Spiefglas.—*Werner.*

Regulus Antimonii nativus, *Wall.* t. 2. p. 196. — Gediegen Spiefglas, *Werner*, Pabſt. 1. b. ſ. 197.—*Id. Wid.* ſ. 909.—Native Antimony, *Kirw.* vol. ii. p. 245.—Antimonie natif, *De Born.* t. 2. p. 137. — Gediegen ſpiefglas, *Emm.* 2. b. ſ. 464.—Antimonie natif, *Hauy*, t. 4. p. 252. — L'Antimonie natif, *Broch.* t. 2. p. 369.—Gediegen Spiefglance, *Reuſs*, 4. b. ſ. 362.

External Characters.

Its colour is perfect tin-white. On the freſh fracture it ſometimes becomes covered with a blackiſh or yellowiſh tarniſh.

Occurs maſſive, diſſeminated, reniform, and probably alſo cryſtallized.

On the freſh fracture it is ſplendent, and its luſtre is metallic.

Fracture perfect, uſually ſtraight, ſometimes alſo curved foliated, with a fourfold cleavage, the folia of which interſect each other obliquely.

Fragments ſometimes very oblique rhomboidal, more uſually indeterminately angular, and blunt-edged.

Occurs

Occurs in coarſe, ſmall and fine granular diſtinct concretions; ſometimes in thin and curved lamellar diſtinct concretions.

Is ſoft, paſſing into ſemihard.

Rather ſectile.

Eaſily frangible.

Heavy in a low degree.

Specific gravity, 6.720, *Klaproth.*

Chemical Characters.

Before the blow-pipe it melts eaſily into a metallic globule, which, like arſenic, diſengages a ſmoke which has a faint garlic ſmell; if the heat is continued, the globule is entirely diſſipated.

Conſtituent Parts.

According to *Klaproth*, the native antimony of Andreaſberg affords

Antimony,	98
Silver,	1
Iron,	0.25

Geognoſtic and Geographic Situations.

It is found in veins, as in the mountains of Chalalanches in Dauphiny, where it is accompanied by grey antimony-ore, white antimony-ore, red antimony-ore, cobalt-glance, and quartz; at Andreaſberg in the Hartz, by red ſilver-ore, calc-ſpar and

and quartz; at Sahlberg, in Weſtermannland in Sweden, diſſeminated in calc-ſpar.

Obſervations.

1. It appears to be very nearly allied to native arſenic, as the curved lamellar variety paſſes into it.

2. It is a rare mineral.

3. It is diſtinguiſhed from all other foſſils with which it might be confounded, by colour, fracture, hardneſs and weight.

SECOND SPECIES.

Grey Antimony-Ore.

Grauſpieſsglaſerz.—*Werner.*

This ſpecies contains four ſubſpecies. 1. Compact; 2. Foliated; 3. Radiated; 4. Plumoſe or Featheroſe.

FIRST SUBSPECIES.

Compact Grey Antimony-Ore.

Dichtes Grauſpieſsglaſerz.—*Werner.*

Minera Antimonii ſolida, *Wall.* t. 2. p. 198.—Dichter Grauſpieſsglaſerz, *Wern.* Pabſt. 1. b. ſ. 197.—*Id. Wid.* ſ. 912.—Compact ſulphurated Antimony, *Kirw.* vol. ii. p. 247.—Dichter Grauſpieſsglaſerz, *Emm.* 2. b. ſ. 468.—L'Antimoine gris compacte, *Broch.* t. 2. p. 372.—Dichter Grauſpieſsglanzerz, *Reuſs*, 4. b. ſ. 367.

External Characters.

Its colour is perfect light lead-grey, and it has ſometimes a pavonine or ſteel-coloured tarniſh.

Occurs uſually maſſive, diſſeminated, and ſeldom in membranes.

Internally, ſhining and gliſtening, and luſtre metallic.

Fracture ſmall and fine grained uneven, which latter ſometimes paſſes into even.

Fragments indeterminately angular, blunt-edged.

Very ſeldom ſhows ſmall granular diſtinct concretions.

Is ſoft.

Not particularly heavy.

Eaſily frangible.

Soils.

Becomes more ſhining in the ſtreak.

Heavy.

Specific gravity, 4.368, *Kirwan.*

Geographic Situation.

It is found at Sahlberg in Sweden; Braunſdorf near Freyberg in Saxony; Hungary; Baireuth; Salzburg; Auvergne in France; Siberia; and Chili.

This is the rareſt ſubſpecies, and occurs almoſt always with the following ſubſpecies.

SECOND

SECOND SUBSPECIES.

Foliated Grey Antimony-Ore.

Blättriches Grauſpiefglaſerz.—*Werner.*

Id. Wern. Pabſt. 1. b. ſ. 197:—Foliated ſulphurated Antimony, *Kirw.* vol. ii. p. 248. — Blättriches Grauſpieſglaſerz, *Emm.* 2. b. ſ. 470. — L'Antimonie gris lamelleux, *Broch.* t. 2. p. 373. — Blättriches Grauſpieſglanſerz, *Reuſs*, 4. b. ſ. 368.

External Characters.

Colour ſame as that of the preceding ſubſpecies.

Occurs maſſive and diſſeminated.

Internally, it alternates from ſhining to ſplendent, and its luſtre is metallic.

Fracture foliated, which ſometimes paſſes into broad radiated. It appears to have a ſingle cleavage.

Fragments indeterminately angular, not particularly ſharp-edged.

Occurs in coarſe, ſmall, fine, and uſually longiſh granular diſtinct concretions.

Is ſoft.

Not particularly brittle.

Eaſily frangible.

Heavy.

Specific gravity, 4.368, *Kirwan.*

THIRD

THIRD SUBSPECIES.

Radiated Grey Antimony Ore.

Strahliches Grauſpieſglaſerz.—*Werner.*

Id. Werner, Pabſt. 1. b. ſ. 198.—*Id. Wid.* ſ. 914. — Striated ſulphurated Antimony, *Kirw.* vol. ii. p. 249. — Strahliches Grauſpieſglaſerz, *Emm.* 2. b. ſ. 374. — L'Antimonie gris rayonné, *Broch.* t. 2. p. 374.—Strahliches Grauſpieſglaſerz, *Reuſs*, 4. b. ſ. 370.

External Characters.

Colour light lead-grey, and ſometimes tarniſhed with an azure-blue colour, with that of tempered ſteel, and alſo pavonine.

Occurs maſſive, diſſeminated; and very often cryſtallized,

1. In rather obtuſe four-ſided priſms, acuminated on both extremities by four planes, which are ſet on the lateral planes. Sometimes the obtuſe lateral edges are bevelled or rounded off, ſo that the cryſtal receives a reed-like ſhape.
2. In ſix-ſided priſms, acuminated by four, and ſometimes by ſix planes, which are ſet on the lateral planes.
3. In acicular and ſometimes in capillary cryſtals.

The cryſtals uſually interſect one another, or are ſcopiformly aggregated. Their ſurface is ſtrongly

ſtrongly longitudinally ſtreaked, and uſually ſhining.

Internally, it alternates from ſplendent to gliſtening, and its luſtre is metallic.

Fracture very broad, broad, or narrow, ſtraight, and ſometimes ſcopiform and ſtellular diverging radiated; ſometimes promiſcuous radiated. The very narrow radiated paſſes into fibrous, and the very broad into foliated.

Fragments uſually indeterminately angular, not particularly ſharp-edged, ſometimes alſo ſplintery.

Occurs ſometimes in thin and imperfect columnar, and ſometimes in coarſe and ſmall longiſh granular diſtinct concretions.

Is ſoft.

Not particularly brittle.

Eaſily frangible.

Heavy.

Specific gravity, 4.200, *Bergman*; 4.229, *Gellert*; 4.1327 to 4.5165, *Briſſon*; 4.440, *Kirwan*.

Chemical Characters.

It melts very eaſily before the blow-pipe, emits a ſulphureous odour, and yields a white ſmoke; if the heat is continued, it is entirely diſſipated, excepting a ſmall whitiſh reſidue. Aqua regia diſſolves the antimony, and the ſulphur remains behind.

Conſtituent

Conſtituent Parts.

Antimony,	74
Sulphur,	26
	100

Bergman.

Geognoſtic Situation.

Occurs always in veins, and either in primitive or tranſition mountains.

At Glendinning, in the upper part of Dumfrieſſhire, it occurs in veins that traverſe tranſition rocks, accompanied with fine granular lead-glance, brown-blende, iron-pyrites, quartz, and calc-ſpar*; at Offenbanya in Hungary with lead-glance, grey copper-ore, iron-pyrites, and brown-blende in granular limeſtone; at Felſobanya with grey copper-ore, plumoſe antimony, red orpiment, red antimony-ore, roſe-red brown-ſpar, calc-ſpar, and quartz; and the antimony appears of all theſe to be the neweſt: the Norwegian occurs diſſeminated in olive-green and blackiſh-brown coloured garnet.

Geographic Situation.

Cornwall; Glendinning in Dumfrieſſhire; Sahlberg in Sweden; Narverud and Hillebeck near Eger in Norway; Stollberg in the Hartz; Prizbram, &c. in Bohemia; Braunſdorf, Voigtſberg, and Rochlitz in the electorate of Saxony; Sileſia; Baireuth; Black Foreſt in Swabia; Scharzleo-

gang,

* Mineralogical Deſcription of Dumfrieſſhire, p. 74.

gang, Rathhauſberg in Gaſtein, Goldberg in Rauris in Salzburg; Allemont in Dauphiny. Lubillac in Auvergne, Poitou in France; Alkraraz in the Sierra Morena in Spain; Tuſcany; Savoy; Corſica; Oravicza in the Bannat; Tranſilvania; Hungary.

Uſes.

The pure metal is obtained from this and the preceding ſubſpecies. It poſſeſſes the property of giving to lead and tin a very conſiderable degree of hardneſs; hence it is employed in the fabrication of types and optical mirrors. It is alſo uſed as an emetic and purgative medicine, and enters into the compoſition of the colour called *Naples Yellow*, and into certain brown colours.

Obſervations.

1. It is the moſt common ſubſpecies of grey antimony-ore, and it is from it that the greater quantity of the antimony of commerce is obtained.

2. It paſſes into White Silver-ore, and Fahl or Grey Copper Ore.

FOURTH SUBSPECIES.

Plumoſe Grey Antimony-Ore.

Federerz.—*Werner.*

Minera Antimonii plumoſa, *Wall.* t. 2. p. 197.—Federerz, *Wern.* Pabſt. 1. b. ſ. 201.—*Id. Wid.* ſ. 916.—Plumoſe antimonial Ore, *Kirw.* vol. ii. p. 250.—Federerz, *Emm.* 2. b. ſ. 474.—L'Antimoine en Plumes, *Broch.* t. 2. p. 377.—Haarförmiges Grauſpieſsglanzerz, *Reuſs*, 4. b. ſ. 375.

External

External Characters.

Its colour is intermediate between blackiſh lead-grey and ſteel-grey. The lighter coloured varieties have ſometimes a tempered-ſteel coloured tarniſh.

Occurs ſometimes maſſive; moſt commonly, however, in thin capillary cryſtals, which are almoſt always promiſcuous, and very much grown together.

Externally, the cryſtals are gliſtening.

Internally, it is glimmering, and its luſtre is from ſemimetallic to metallic.

Fracture delicate, and promiſcuous fibrous.

Fragments indeterminately angular, blunt-edged.

Is opaque.

Is very ſoft, paſſing into ſoft.

Not particularly brittle.

Eaſily frangible.

Intermediate between not particularly heavy and heavy.

Conſtituent Parts.

According to *Bergman*, it is compoſed of antimony, ſulphur, arſenic, iron, and ſilver.

Geognoſtic Situation.

Is found always in veins in primitive mountains, and is uſually accompanied with quartz.

In

In the mines in the neighbourhood of Freyberg, where it occurs in conſiderable quantity in veins that contain much white ſilver-ore, it is uſually accompanied with quartz, brown-ſpar, calc-ſpar, lead-glance, iron-pyrites, black-blende, and ſeldom argentiferous arſenic pyrites. At Nagyag, it occurs in veins from five to ſix inches wide, with native ſylvan, lead-glance, iron-pyrites, native arſenic, black-blende, red manganeſe-ore, brown-ſpar, and quartz. At Felſobanya, with radiated and foliated grey antimony-ore, red orpiment, quartz, and heavy-ſpar.

Geographic Situation.

Andreaſberg and Claufthal in the Hartz; Freyberg and Braunſdorf in the electorate of Saxony; Rathhauſberg in Gaſtein and Schwarzleogang in Salzburg; Schemnitz in Hungary; Nagyag and Felſobanya in Tranſilvania; Mexico.

THIRD SPECIES.

Black Antimony-Ore.

Schwarz-ſpieſglaſerz.—*Werner.*

External Characters.

Colour, iron-black.

Occurs only cryſtallized, and that in rectangu-

lar four-ſided tables, which are truncated on the edges, and ſometimes alſo on the angles.

The planes of the cryſtals are uſually ſmooth, and they are middle-ſized and ſmall.

Internally it is ſhining, and its luſtre is metallic.

Fracture ſmall conchoidal.

Fragments indeterminately angular.

Soft.

Rather ſectile, and

Heavy.

Geographic Situation.

It is found particularly beautiful in Cornwall.

FOURTH SPECIES.

Red Antimony-Ore.

Roth-ſpieſglaſerz.—*Werner.*

Minera Antimonii colorata, *Wall.* t. 2. p. 199.—Roth-ſpieſglaſerz, *Wern.* Pabſt. 1. b. ſ. 202.—*Id. Wid.* ſ. 918.—Red antimonial Ore, *Kirw.* vol. ii. p. 250.—Rothſpieſglaſerz, *Emm.* 2. b. ſ. 477.—Antimoine rougeâtre, mineraliſé par le Soufre, *Lam.* t. 1. p. 343.—Antimoine hydro-ſulphuré, *Hauy*, t. 4. p. 276.—L'Antimoine rouge, *Broch.* t. 2. p. 379. Rothſpieſglanzerz, *Reuſs*, 4. b. ſ. 379.

External Characters.

Its colour is cherry-red, and it has ſometimes a tempered ſteel-coloured tarniſh.

Occurs

Occurs maſſive, often in membranes, but moſt frequently in delicate capillary cryſtals, which are ſometimes promiſcuous, ſometimes ſcopiformly aggregated.

Externally and internally it is ſhining, and its luſtre is nearly adamantine.

Fracture delicate, ſcopiform, and ſtellular diverging fibrous, which paſſes into narrow radiated.

Fragments wedge-ſhaped and ſplintery.

Occurs in coarſe, ſmall and longiſh granular diſtinct concretions, which ſometimes approach the wedge-ſhaped columnar.

Is opaque.

Colour not changed in the ſtreak.

Very ſoft, paſſing into friable.

Not very brittle.

Eaſily frangible.

Not particularly heavy.

Specific gravity, 3.750, *La Metherie*; 4.090, *Klaproth*.

Chemical Characters.

Melts very eaſily before the blow-pipe; emits a weak ſulphureous odour, and is at length totally volatilized; it depoſites a white powder in nitric acid.

Conſtituent

Conſtituent Parts.

From the mine called Neue Hoffnung Gottes at Braünſdorf:

Antimony,	67.5
Oxygen,	10.8
Sulphur,	19.7
Klaproth.	98.0

Geognoſtic Situation.

This rare ſpecies of ore occurs in veins along with quartz, and grey antimony-ore; ſometimes alſo with native antimony and white antimony-ore.

FIFTH SPECIES.

White Antimony-Ore.

Weiſs-ſpieſglaſerz.—*Werner.*

Id. Wern. Pabſt. 2. b. ſ. 203.—*Id. Wid.* ſ. 920.—Muriated Antimony, *Kirw.* vol. ii. p. 251. — Muriate d'Antimoine, *De Born.* t. 2. p. 147.—Weiſs-ſpieſglaſerz, *Emm.* 2. b. ſ. 480.—Antimoine muriatique, *Lam.* t. 1. p. 348. — Antimoine oxydé, *Hauy*, t. 4. p. 273. — Antimoine blanc, *Broch.* t. 2. p. 381.—Weiſs-ſpieſglanzerz, *Reuſs*, 4. b. ſ. 382.

External Characters.

It paſſes from ſnow-white, through greyiſh-white, light aſh-grey into yellowiſh-white, which latter colour is the moſt common.

Occurs ſeldom maſſive, ſometimes in membranes, commonly cryſtallized,

1. In

1. In longiſh and thin perfect rectangular four-ſided tables, from which there is a tranſition into
2. The cube.
3. In acicular and capillary cryſtals.

The tables are ſmall and very ſmall, uſually adhering by their lateral planes, and ſometimes, although ſeldom, manipular aggregated, and often interſect each other in ſuch a manner as to form the cellular external ſhape.

The cryſtals are ſometimes ſmooth, ſometimes feebly longitudinally ſtreaked and ſplendent.

Internally it is ſhining, and its luſtre is intermediate between pearly and adamantine.

Fracture foliated, ſingle cleavage; ſometimes alſo narrow, ſcopiform, and ſtellular diverging radiated.

Fragments indeterminately angular, not particularly ſharp-edged.

Occurs in coarſe and ſmall granular diſtinct concretions; the foliated ſhews ſometimes wedge-ſhaped columnar, and the radiated thin columnar diſtinct concretions.

It is tranſlucent.

Soft.

Not particularly brittle; rather ſectile.

Heavy.

Chemical Characters.

Before the blow-pipe it melts very eaſily, gives a white ſmoke, and is at length totally volatilized.

Conſtituent

Conſtituent Parts.

Hacquet firſt conjectured that it contained a conſiderable portion of muriatic acid, and ſome experiments led *Klaproth* to nearly the ſame opinion; *Lampadius's* analyſis gave him as its conſtituent parts, 0.80 antimony, and 0.20 muriatic acid. Klaproth more lately has aſcertained it to be a pure white oxide of antimony; and *Vauquelin* has found that from Allemont in Dauphiny, to contain

Oxide of antimony,	86
Oxides of antimony and lead,	3
Silica,	8
	97

Geognoſtic and Geographic Situations.

It occurs in veins, and is uſually accompanied with the other ores of antimony.

At Prizbram in Bohemia it occurs along with cryſtallized lead-glance; at Allemont with native antimony, and grey and red antimony-ores.

Beſides the places already mentioned, it is ſaid to have been found at Malaczk in Hungary, and in the Neue Hoffnung Gottes, at Braunſdorf in the electorate of Saxony.

SIXTH

SIXTH SPECIES.

Antimony-Ochre.

External Characters.

Colour ſtraw-yellow of various degrees of intenſity, which inclines to yellowiſh-brown.

Occurs ſeldom maſſive and diſſeminated; uſually as a coating on cryſtals of grey antimony-ore.

Is dull.

Fracture earthy, and ſometimes inclines to radiated.

Is ſoft, paſſing into very ſoft.

Not particularly brittle.

Not particularly heavy.

When it is long incloſed, it emits a weak bitter ſmell.

Chemical Characters.

It does not melt before the blow-pipe, only becomes white and evaporates. With borax it intumeſces, and is partly reduced to the metallic ſtate.

Geognoſtic and Geographic Situations.

It occurs always in veins, and accompanied with grey antimony-ore, and ſometimes with red antimony-ore.

It is found at Dublowitz near Seltſchaw in Bohemia; Telkebanya in Hungary; Toplitza in Tranſilvania;

Transilvania; Braunsdorf, in the electorate of Saxony; on the Sonnenberg near Mitterfill in Salzburg; and in Siberia.

Observation.

It is evidently formed by the decomposition of Grey Antimony-Ore.

TWELFTH GENUS.

COBALT GENUS.

FIRST SPECIES.

White Cobalt-Ore.

Weiffer-Speiscobold.—*Werner.*

External Characters.

On the fresh fracture its colour is tin-white, sometimes tarnishes a little grey; and in the bosom of the earth, or in its original repository, it has a pavonine tarnish.

Occurs massive, disseminated, globular, botryoidal, thin cylindrical, frequently reticulated, fruticose; and crystallized, in

1. Cubes, which have sometimes spherical convex planes, and in which the angles and edges are sometimes truncated. They are often burst.

2. Double

2. Double four-ſided pyramids or octahedrons.

The external ſurface of the cryſtals is ſmooth, and ſplendent, and its luſtre is metallic.

Internally gliſtening, and luſtre metallic.

Fracture coarſe and fine-grained uneven, but often paſſes into imperfect foliated, alſo into ſcopiform and ſtellular diverging fibrous and radiated.

Fragments indeterminately angular, rather blunt-edged; in the varieties with a radiated fracture, wedge-ſhaped.

Occurs in coarſe, ſmall and fine granular diſtinct concretions; ſometimes alſo in lamellar fortifications-wiſe bent concretions.

Semihard in a high degree.

Brittle.

Not very difficultly frangible.

Heavy.

Chemical Characters.

It melts eaſily before the blow-pipe, and diſengages a thick ſmoke and ſtrong arſenical ſmell; it yields a white metallic globule; it colours glaſs of borax blue.

Conſtituent Parts.

From Tunaberg in Sweden.

Cobalt,	44		36.66
Arſenic,	55·5		49.00
Sulphur,	0.5		6.50
Iron,	—		5.66
Loſs,	—		2.18
	Klaproth. 100	*Taſſaert.*	100

Geognoſtic and Geographic Situations.

It occurs uſually in beds, and always in primitive mountains, and is by *Werner* conſidered to be the oldeſt formation of cobalt.

It is found at Tunaberg and Los in Sweden, and at Modum in Norway, in both places in beds which lie in mica-ſlate; alſo in a ſimilar repoſitory and rock at Giern in Sileſia.

SECOND SPECIES.

Grey Cobalt-Ore.

Grauer Speiskobold.—*Werner.*

External Characters.

On the freſh fracture its colour is light ſteel-grey, which inclines to white; but by expoſure it gradually acquires a tempered-ſteel and greyiſh-black tarniſh.

Occurs only maſſive, diſſeminated, tubiform, and ſpecular.

Internally ſtrongly glimmering or gliſtening, and luſtre metallic.

Fracture even, which ſometimes paſſes into flat and large conchoidal, ſometimes into fine-grained uneven.

Fragments

Fragments indeterminately angular, pretty ſharp-edged.

Occurs ſeldom in thick and curved lamellar diſtinct concretions.

Streak is metallic ſhining, without changing the colour.

Is ſemihard.

Very brittle.

Eaſily frangible.

Uncommonly heavy.

Specific gravity, 5.503, *Gellert*; 5.309, *Kirwan*; 5.511 to 7.7207, *Hauy*.

Conſtituent Parts.

From Dolcoath in Cornwall.

Cobalt,	20
Iron,	24
Arſenic,	33
Klaproth.	77

Geognoſtic Situation.

It occurs frequently with cobalt-glance, and in the ſame kind of repoſitories. It is, however, rarer. It is uſually accompanied with cobalt-cruſt, native biſmuth, copper-nickel and nickel-ochre. It occurs alſo along with rich ſilver-ores.

Geographic

Geographic Situation.

Dolcoath in Cornwall; Norway; Annaberg. Schneeberg, and Freyberg in the electorate of Saxony; Joachimſthal in Bohemia; Krobſdorf, Hindorf, and Kupferberg in Silefia; Wittichen in Swabia; Naſſau; Salzburg; Allemont in France; Stiria; and Hungary.

THIRD SPECIES.

Cobalt-Glance.

Glanz-Kobold.—*Werner.*

Colour ſilver-white, ſlightly inclining to reddiſh. The ſurface of the freſh fracture becomes gradually greyiſh; and it has even ſometimes a columbine tarniſh in its original repoſitory.

Commonly maſſive and diſſeminated; alſo fruticoſe, cylindrical, and reticulated; ſometimes cryſtallized,

1. Cube, either perfect or truncated on the edges.
2. Dodecahedron.
3. Icoſahedron?
4. Octahedron?

The cryſtals are ſmall, ſeldom middle-ſized, and their planes are ſmooth.

Externally

Externally ſplendent.

Internally it is intermediate between ſhining and gliſtening, and its luſtre is metallic.

Fracture fine-grained uneven, ſeldom ſcopiform and ſtellular diverging radiated, and imperfect foliated, which preſents a threefold rectangular cleavage.

Fragments indeterminately angular, rather blunt-edged.

Is uſually unſeparated, but ſometimes in coarſe, ſmall and fine granular diſtinct concretions, and alſo in fortifications-wiſe bent lamellar diſtinct concretions.

Is ſemihard.

Brittle.

Not very eaſily frangible.

From heavy to uncommonly heavy.

When ſtruck with ſteel, it emits an arſenical ſmell.

Geognoſtic Situation.

It occurs in veins, not only in primitive but alſo in tranſition and floetz mountains. It is almoſt always companied with copper-nickel, nickel-ochre and cobalt-cruſt. It is ſometimes alſo accompanied by native biſmuth, native ſilver, red ſilver ore, arſenic pyrites, native arſenic, &c.

Geographic Situation.

Schneeberg, Annaberg, and Johanngeorgenſtadt in Saxony; Saalfeld in Thuringia; Sileſia; Heſſia;

Heſſia; Swabia; Hartz; France; Spain; Norway; Sweden.

Uſes.

This is the moſt common ſpecies of cobalt, and is that from which the cobalt of commerce is principally obtained. When roaſted and melted in certain proportions with pounded quartz, it forms *ſmalt*, a compound which is highly uſeful in the manufacturing of porcelain and glaſs, and for painting.

The other ſpecies of cobalt are employed for ſimilar purpoſes.

FOURTH SPECIES.

Black Cobalt-Ochre.

Schwarz Erdkobold.—*Werner.*

This ſpecies contains two ſubſpecies: 1. Earthy Black Cobalt-Ochre: 2. Indurated Black Cobalt-Ochre.

FIRST SUBSPECIES.

Earthy Black Cobalt-Ochre.

Schwarzer Kobold Mulm.—*Werner.*

Id. Wern. Pabſt. 1. b. ſ. 205.—Zerreiblicher ſchwarzer Erdkobold,

bold, *Wid.* f. 933.—Looſe black Cobalt-ochre, *Kirw.* vol. ii. p. 275.—Schwarzer Kobold Mulm, *Emm.* 2. b. f. 498.—Le Cobalt terreux noire friable, *Broch.* t. 2. p. 397.—Zerreiblicher ſchwarzer Erdkobold, *Reuſs*, 4. b. f. 411.

External Characters.

Its colour is intermediate between browniſh and bluiſh black; the bluiſh-black is eſſential, the browniſh-black it derives from iron.

Is compoſed of dull duſty particles, which ſoil very little.

Uſually cohering, ſometimes alſo looſe.

Streak ſhining.

Meagre to the feel.

Light, almoſt ſwimming.

Chemical Characters.

Before the blow-pipe it gives a white ſmoke, which has an arſenical ſmell, and it colours borax blue.

It diſſolves in muriatic acid.

SECOND SUBSPECIES.

Indurated Black Cobalt-Ochre.

Feſter Schwarz Erdkobold.—*Werner.*

Verhärteter ſchwarzer Erdkobold, *Wid.* f. 933.—Indurated black Cobalt-ochre, *Kirw.* vol. ii. p. 275.—Verhärteter

ſchwarzer

ſchwarzer Erdkobold, *Emm.* 2. b. ſ. 499.—Le Cobalt terreux noir endurci, *Broch.* t. 2. p. 397.–Verhärteter Schwarzer Erd-cobalt, *Reuſs*, 4. b. ſ. 413.

External Characters.

Its colour is almoſt always bluiſh-black; ſeldom inclines to browniſh-black.

Occurs maſſive, diſſeminated, as a coating, ſmall botryoidal, and ſmall reniform.

Surface feebly glimmering.

Internally dull.

Fracture fine earthy.

Fragments indeterminately angular, blunt-edged.

The botryoidal varieties ſhow thin and curved lamellar diſtinct concretions.

Streak ſhining and reſinous.

Is very ſoft.

Rather ſectile.

Eaſily frangible.

Light.

Specific gravity, 2.019 to 2.425, *Gellert.*

Conſtituent Parts.

It is conſidered as a very pure oxide of cobalt.

Geognoſtic Situation.

Both ſubſpecies uſually occur together, and in the ſame kind of repoſitory; but the firſt ſubſpecies is by far the moſt rare. They are found ſometimes

ſometimes in primitive mountains, but moſt frequently in floetz mountains, where they are accompanied with ochrey-brown ironſtone, red, brown, and yellow cobalt-ochres, native-ſilver, ſeveral other ores of ſilver and of copper, and heavy-ſpar, calc-ſpar, and quartz.

Geographic Situation.

Riechelſdorf in Heſſia; Schneeberg, Soſa, Kamſdorf, Saalfeld, and Glückſbrunn in Saxony; Bohemia; Wittichen in Furſtenberg, Alpirſbach in Wurtemberg in Swabia; Bockſdorf and Schachten in the Upper Palatinate; Fuyen in Zillerthal in Salzburg; Kleinzell in Auſtria; Kitſbichl in the Tyrol; Allemont in France; the valley of Giſtain in Spain.

Uſe.

It affords a moſt excellent blue colour; hence is highly valued as an ore of cobalt.

FIFTH SPECIES.

Brown Cobalt-Ochre.

Brauner Erdkobold.—*Werner.*

Id. Wern. Pabſt. 1. b. ſ. 206. —*Id. Wid.* ſ. 935. —Brown Cobalt-ochre, *Kirw.* vol. ii. p. 276.—Brauner Erdkobalt, *Emm.* 2. b. ſ. 503.—Le Cobalt terreux brun, *Broch.* t. 2. p. 400.—Brauner Erdkobalt, *Reuſs*, 4. b. ſ. 415.

External Characters.

Colour liver-brown, which ſometimes paſſes into yellowiſh-brown, ſometimes into black, and ſometimes into aſh-grey.

The yellowiſh-grey makes the tranſition into the yellow, and the black into black cobalt-ochre.

Occurs maſſive, and diſſeminated.

Internally dull.

Fracture fine earthy.

Fragments indeterminately angular, blunt-edged.

Streak ſhining, but does not change its colour.

Is very ſoft.

Sectile.

Eaſily frangible.

Light.

Geognoſtic Situation.

It appears to be peculiar to the floetz mountains, and is uſually accompanied with red and black cobalt-ochre. It is uſually mixed with iron-ochre, which renders it one of the leaſt valued ores of cobalt.

Geographic Situation.

It is found at Kamſdorf and Saalfeld in Saxony; Alpirſbach in Wurtemberg; and in the valley of Giſtain in Spain.

Obſervation.

Observation.

We muſt be careful not to confound it with Iron-Ochre, with which it is uſually accompanied.

SIXTH SPECIES.

Yellow Cobalt-Ochre.

Gelber Erdkobold.—*Werner.*

Ochra Cobalti lutea et alba, *Wall.* t. 2. p. 183.—Gelber Erdkobold, *Wid.* ſ. 936. — Yellow Cobalt-ochre, *Kirw.* vol. ii. p. 277. — Gelb Erdkobold, *Emm.* 2. b. ſ. 504.—Le Cobalt terreux jaune, *Broch.* t. 2. p. 401.—Gelber Erdkobalt, *Reuſs*, 4. b. ſ. 417.

External Characters.

Colour dirty ſtraw-yellow, which in ſome varieties paſſes into light yellowiſh-grey; which latter colour is frequently conſidered as white.

Occurs maſſive, frequently very much burſten and corroded.

Internally dull.

Fracture fine earthy.

Fragments indeterminately angular, blunt-edged.

Streak ſhining.

Is ſoft, paſſing into friable.

Sectile.

Sectile.
Eafily frangible.
Light.

Geognoftic Situation.

It occurs in the fame geognoftic fituation as the preceding fpecies, and is almoft always accompanied by cobalt-cruft, and fometimes by cobalt-bloom, nickel-ochre, iron-fhot copper-green, and copper-azure.

Geographic Situation.

Saalfeld in Thuringia; Kupferberg in Silefia; Wittichen in Furftenberg and Alpirfbach in Wurtemberg in Swabia; Allemont in France.

Obfervations.

1. It is the rareft fpecies of cobalt-ore, but is one of the moft valued, on account of its great purity.

2. It is characteriftic for the ochres of cobalt, that they are all light, foft, nearly fectile, and yield a fhining refinous ftreak.

SEVENTH SPECIES.

Red Cobalt-Ochre.

Rother Erdkobold.—*Werner.*

This fpecies contains two fubfpecies: 1. Cobalt-Cruft. 2. Cobalt-Bloom.

FIRST

FIRST SUBSPECIES.

Cobalt-Cruſt.

Koboldbeſchlag.—*Werner.*

Id. Wid. ſ. 938.—Cobaltic Incruſtations, *Kirw.* vol. ii. p. 279.—Kobaldbeſchlag, *Emm.* 2. b. ſ. 509.—Le Cobalt terreux rouge, pulverulent, *Broch.* t. 2. p. 405.—Erdiger rother Erdcobalt, *Reuſs*, 4. b. ſ. 419.

External Characters.

Colour peach bloſſom-red, of different degrees of intenſity, which ſometimes inclines to crimſon-red, ſometimes verges on cochineal-red, and alſo paſſes into reddiſh-white.

Occurs ſeldom maſſive, often in velvety druſy coatings, and diſſeminated, and alſo ſmall botryoidal and ſmall reniform.

It is very feebly glimmering, bordering on dull.

Fracture fine earthy.

Fragments indeterminately angular, blunt-edged.

Scarcely ſoils.

Streak ſhining.

Is very ſoft, ſometimes paſſing into friable.

Light.

SECOND

SECOND SUBSPECIES.

Cobalt-Bloom.

Koboldblüthe.—*Werner.*

Id. Wern. Pabſt. 1. b. ſ. 206.—*Id. Wid.* ſ. 939.—Cobaltic Germinations, Flowers of Cobalt of ſome, *Kirw.* vol. ii. p. 278.—Koboldblüthe, *Emm.* 2. b. ſ. 507.—Fleurs de Cobalt, ou Cobalt terreux rayonné rouge, *Broch.* t. 2. p. 403.—Strahlicher rother Erdkobalt, *Reuſs*, 4. b. ſ. 420.

External Characters.

Colour peach-bloſſom red, often alſo cochineal and crimſon red, pearl-grey, greeniſh-grey, and by decompoſition it paſſes into cherry-red.

Occurs maſſive, diſſeminated, often in membranes, ſmall reniform; and alſo cryſtallized,

1. In ſhort acicular cryſtals, which appear to be perfect four-ſided priſms.
2. In acute double ſix-ſided pyramids, in which the lateral planes of the one are ſet on the lateral planes of the other, and uſually ſomewhat compreſſed.
3. Rectangular four-ſided priſms, with beveled terminal planes.

Externally ſhining, paſſing into ſplendent.

Internally ſhining and gliſtening, and its luſtre is pearly.

Fracture narrow, and ſometimes ſtellular and ſcopiform

ſcopiform diverging radiated; extremely ſeldom ſtraight radiated, and ſometimes it paſſes into fibrous.

Fragments ſplintery and wedge-ſhaped.

Sometimes it occurs in thin columnar diſtinct concretions, which are collected into coarſe and ſmall granular diſtinct concretions.

Is more or leſs tranſlucent; ſometimes tranſlucent on the edges.

Colour not changed in the ſtreak.

Is ſoft.

Not particularly brittle.

Rather ſectile.

Eaſily frangible.

Light.

Chemical Characters.

Before the blow-pipe it becomes grey, and emits a garlic ſmell, but without ſmoke: to borax it communicates a blue colour.

Conſtituent Parts.

Its conſtituent parts are ſtill undetermined; it is ſuppoſed to be an arſeniat of cobalt.

Geognoſtic Situation.

It occurs in veins, and is accompanied with cobalt-glance, grey cobalt-ore, and other ſpecies of cobalt-ore. It is found alſo along with nickel-

ochre,

ochre, copper-pyrites, native biſmuth, grey copper-ore, copper-azure, iron-ſhot copper-green, quartz, heavy-ſpar, hornſtone, calc-ſpar, and brown-ſpar.

Geographic Situation.

Cornwall; Alva in Scotland; Modiem in Norway; Riechelſdorf in Heſſia; Schneeberg, Annaberg, Saalfeld and Glückſbrunn in Saxony; Kupferberg in Sileſia; Wittichen in Furſtenberg and Alpirſbach in Wurtemberg in Swabia; Rathhauſberg in Gaſtein, Zinkwand in Salzburg; and Dopſchau in Hungary.

THIRTEENTH GENUS.

NICKEL GENUS.

FIRST SPECIES.

Copper-Nickel.

Kupfernickel.—*Werner.*

Niccolum Ferro et Cobalto mineraliſatum,--Cuprum Niccoli, *Wall.* t. 2. p. 188.—Kupfernickel, *Rom. D. L.* t. 3. p. 135.—*Id. Wern.* Pabſt. 1. b. ſ. 206.—*Id. Wid.* ſ. 943.—Sulphurated Nickel, *Kirw.* vol. ii. p. 286.—Kupfernickel, *Emm.* 2. b. ſ. 513.—*Id. Lam.* t. 1. p. 384.—Nickel arſenical, *Hauy*, t. 3. p. 503. — Le Kupfernickel, *Broch.* t. 2. p. 408.—Kupfernickel, *Reuſs*, 4. b. ſ. 430.

External

External Characters.

Colour copper-red of different degrees of intenſity.

Occurs uſually maſſive and diſſeminated; extremely ſeldom reticulated; fruticoſe; ſmall globular and botryoidal.

Internally gliſtening; ſometimes ſhining bordering on ſplendent, and its luſtre is metallic.

Fracture uſually imperfect conchoidal, ſometimes paſſing into coarſe, ſmall and fine grained uneven: The uneven has the leaſt, the conchoidal the greateſt degree of luſtre.

Fragments indeterminately angular and ſharp-edged.

Is uſually unſeparated, ſometimes alſo in coarſe and ſmall granular diſtinct concretions.

Semihard in a high degree.

Brittle.

Not very eaſily frangible.

Uncommonly heavy.

Specific gravity, 7.560, *Gellert*; 6.6086--6.6481, *Briſſon*.

Chemical Characters.

Before the blow-pipe, it emits an arſenical ſmoke and odour: it afterwards melts, although with difficulty, into a ſcoria mixed with metallic grains. Its ſolution in acids is green.

Conſtituent Parts.

According to *Bergman*, it is compoſed of nickel, iron, cobalt, arſenic, and ſulphur. *Vauquelin* is of opinion, that it is an alloy of nickel and arſenic. Sage found in it,

Nickel,	75
Arſenic,	22
Sulphur,	2
	99

Geognoſtic Situation.

It occurs not only in primitive, but alſo in floetz mountains, and always in veins.

It is almoſt always accompanied by nickel-ochre and cobalt-glance: it is ſometimes alſo found along with grey cobalt-ore, different ores of ſilver, and heavy-ſpar, calc-ſpar, brown-ſpar, and quartz.

Geographic Situation.

Cornwall; Norway; Los in Helſingeland in Sweden; Andreaſberg in the Hartz; Riechelſdorf and Biber in Heſſia; Schneeberg, Annaberg, Freyberg, &c. in the electorate of Saxony; Querbach in Sileſia; Joachimſthal in Bohemia; Wittichen in Swabia; Salzburg; Stiria; Allemont in France; Giſtain in Arragon in Spain; Koliwan in Siberia.

Obſervations.

1. It is very nearly allied to Cobalt, and Werner ſuſpects that it paſſes into it.

2. It

2. It has a ſtriking reſemblance to copper, but is well diſtinguiſhed from it by its brittleneſs.

3. In ſeveral Engliſh mineralogical works, the German name *Kupfernickel* is very unneceſſarily retained.

4. Its name is derived from its copper-red colour, and its conſtituent parts.

SECOND SPECIES.

Nickel-Ochre.

Nickelockér.—*Werner.*

Flos Niccoli, *Wall.* t. 2. p. 300.—Nickelocker, *Werner*, Pabſt. 1. b. f. 207.—*Id. Wid.* f. 945.—Nickel Ochre, *Kirw.* vol. ii. p. 283.—Oxide de Nikel, *De Born.* t. 2. p. 210.—Nickelocker, *Emm.* 2. b. f. 516.—Oxide de Nikel, *Lam.* t. 1. p. 383.—Nickel oxidé, *Hauy*, t. 3. p. 516.—L'Ocre de Nikel, *Broch.* t. 2. p. 411.—Nickelochre, *Reuſs*, 4. b. f. 435.

External Characters.

Colour apple-green.

Occurs almoſt always as a thin coating or efflorescence; ſeldom maſſive or diſſeminated.

Is compoſed of dull duſty particles, which ſcarcely ſoil.

Looſe, or very little cohering.

Feels meagre.

Light.

Chemical

Chemical Characters.

Infusible, without addition, before the blow-pipe; colours borax light hyacinth red, and is thereby reduced: is insoluble in nitrous acid.

Constituent Parts.

Oxide of nickel,	67.
Oxide of iron,	23.2
Water,	1.5

Geognostic and Geographic Situations.

Are the same with those of copper-nickel.

Observation.

Some mineralogists describe Native Nickel and Arseniat of Nickel; but their existence remains still so doubtful, that any detail of the very imperfect accounts of them would be misplaced in a System of Oryctognosy.

FOURTEENTH GENUS.

MANGANESE GENUS.

FIRST SPECIES.

Grey Manganese-Ore.

Grau Braunsteinerz.—*Werner.*

This species contains four subspecies. 1. Radiated. 2. Foliated. 3. Compact. 4. Earthy.

FIRST

FIRST SUBSPECIES.

Radiated Grey Manganeſe-Ore.

Strahliges grau Braunſteinerz.—*Werner.*

Id. Werner, Pabſt. 1. b. ſ. 216.—*Id. Wid.* ſ. 948.—Striated grey Ore of Manganeſe, *Kirw.* vol. ii. p. 291.—Strahliges grau Braunſteinerz, *Emm.* 2. b. ſ. 522.—Le Manganeſe gris rayonné, *Broch.* t. 2. p. 414.—Strahliches Graubraunſteinerz, *Reuſs*, b. 1. ſ. 448.

External Characters.

Colour dark ſteel-grey, which inclines more or leſs to iron-black.

Occurs maſſive, diſſeminated; and cryſtallized in,

1. Longiſh oblique four-ſided priſms, which are either,
   a. Flatly bevelled on the extremities, and the bevelling planes ſet on the obtuſe lateral edges; or
   b. Acuminated by four planes, which are ſet on the lateral planes; and ſometimes
   c. The lateral planes are truncated, and the truncating edges bevelled.
2. Sometimes the priſms are acicular; and when the obtuſe lateral edges are rounded off, they are reed-like.

The ſurface of the cryſtals is longitudinally ſtreaked, and it is ſhining, paſſing to ſplendent.

Internally

Internally it is gliſtening and ſhining, and its luſtre is metallic.

Fracture narrow, ſtraight, ſcopiform and ſtellular diverging radiated; and the ſurface of the fracture is alſo ſtreaked.

Fragments wedge-ſhaped and ſplintery, but, in the great, indeterminately angular and blunt-edged.

Occurs in coarſe, large, and ſmall granular diſtinct concretions, which are ſomewhat longiſh and wedge-ſhaped.

Colour not changed in the ſtreak.

When it is rubbed it ſoils ſtrongly.

Is ſoft, inclining to very ſoft.

Brittle.

Rather difficultly frangible.

Not particularly heavy.

Specific gravity, 3.530 to 4.325, *Muſchenbröck*; 4.143, *Hagen*; 4.2491 to 4.7563, *Briſſon*; 4.181, *Rinmann*.

Conſtituent Parts.

	From Germany.	Piedmont.	Thaley in France.
Yellow oxide of manganeſe,	45.5	40.0	45.5
Oxygen,	36.5	42.0	38.0
Red oxide of iron,	0.0	3.0	2.0
Charcoal,	0	1.5	0
Carbonat of lime,	8.5	0	0
Baryte,	3.0	0	1.5
Silica,	7.0	5.0	7.5
Loſs,	0.5	4.5	5.5
	100.0	100.0	100.0

The

The above analyſes were made by *Cordier* and *Beaunier*. *Klaproth* analyzed an ore of this kind from Ilefeld in the Hartz, which he found to be compoſed of

92.75 oxide of manganeſe.
7.00 water.

99.75

Another ſpecimen contained

99.25 oxide of manganeſe.
0.25 water.

99.75

Geographic Situation.

Cornwall, Devonſhire, Somerſetſhire and Derbyſhire in England; near Aberdeen in Scotland; Ilefeld in the Hartz; Langeberg near Annaberg, Johanngeorgenſtadt, Kamſdorf, Saalfeld in Thuringia, in Saxony; Konradſwaldau, Kupferberg, &c. in Sileſia; Mieſs in Bohemia; St Gothard in Switzerland; Piedmont and Iſchio near Vicenza in Italy; and Koliwan in Siberia.

SECOND SUBSPECIES.

Foliated Grey Manganeſe-Ore.

Blättriges grau Braunſteinerz.—*Werner.*

Id. Wern. Pabſt. 1. b. ſ. 218.—*Id. Emm.* 2. b. ſ. 525.—Le Manganeſe gris lamelleux, *Broch.* t. 2. p. 417. — Blattriches Graubraunſteinerz, *Reuſs*, 4. b. ſ. 453.

External

External Characters.

It has the ſame colour as the preceding ſubſpecies.

Occurs almoſt always maſſive and diſſeminated, or cryſtallized in longiſh rhombs.

Internally it alternates from ſhining to gliſtening, and its luſtre is metallic.

Fracture foliated and delicately ſtreaked.

Fragments indeterminately angular and blunt-edged.

Occurs in coarſe and ſmall, ſometimes alſo in fine granular diſtinct concretions.

Yields a black dull ſtreak.

Soils.

Is ſoft.

Brittle.

More eaſily frangible than the preceding ſubſpecies.

Not particularly heavy.

Specific gravity, 3.742, *Hagen.*

Geognoſtic Situation.

Devonſhire in England; Ilefeld in the Hartz; many places in the electorate of Saxony; Bohemia; Salzburg; and Tranſilvania.

THIRD SUBSPECIES.

Compact Grey Manganese-Ore.

Dichtes Grau Braunſteinerz.—*Werner.*

Id. Werner, Pabſt. 1. b. ſ. 219. — Indurated grey Ore of Manganeſe, *Kirw.* vol. ii. p. 249.—Le Manganeſe gris compacte, *Broch.* t. 2. p. 418,—Dichtes Graubraunſteinerz, *Reuſs*, 4. b. ſ. 454.

External Characters.

Colour ſame as that of the preceding ſubſpecies.

Occurs maſſive and diſſeminated.

Internally it is gliſtening, paſſing into glimmering, and its luſtre is metallic.

Fracture even, ſometimes inclining to flat conchoidal.

Fragments indeterminately angular; not very ſharp-edged.

Uſually unſeparated; ſometimes however ſhews thick curved lamellar diſtinct concretions.

In the remaining characters it reſembles the preceding ſubſpecies.

Conſtituent Parts.

The four following analyſes, made by *Cordier*, *Beaunier*, *Vauquelin* and *Dolomieu*, are ſaid by Brochant to be of this ſubſpecies.

	Of St Micaud.	Of Perigueux.	Of Romaneche.	Of Lavelline.
Yellow oxide of manganeſe,	35	50	50	65
Oxygen,	33	17	33.7	17
Red oxide of iron,	18	13.5	0	0
Charcoal,	0	0	0.4	0
Lime with magneſia,	7	6	0	0
Iron and manganeſe,				
Carbonat of lime,	0	0	0	7
Baryte,	4	5	14.7	9
Silica,	3	7	1.2	6
Loſs,	0	1.5	0	6
	100	100	100	100

FOURTH SUBSPECIES.

Earthy Grey Manganeſe-Ore.

Erdiches grau Braunſteinerz.—*Werner.*

Ochre of Manganeſe, *Kirw.* vol. ii. p. 293. — Erdiches Grau-braunſteinerz, *Emm.* 2. b. ſ. 529.

External Characters.

Colour dark ſteel-grey, which inclines a little to bluiſh.

Occurs maſſive.

Is compoſed of delicate ſcaly particles, which are ſtrongly glimmering with a metallic luſtre.

Soils ſtrongly.

Occurs more or leſs cohering, ſo that it ſometimes paſſes into coherent.

Feels

Feels fine but meagre.
Hard in a low degree.

Geographic Situation.

Cornwall and Somerſetſhire in England; Ilmenau, Rotha, Ehrenſtock, &c. in Saxony; Orpes, Oberhals, &c. in Bohemia; Lower Bavaria; Periguex, &c. in France; and Nertſchinſk in Siberia.

Chemical Characters of the Species.

Is infuſible, without addition, before the blowpipe. It is converted into a blackiſh-brown coloured oxide. When melted with borax, it communicates to it a violet-blue colour.

Geognoſtic Situation of the Species.

Werner has aſcertained two formations of this ore; the one occurs in veins in porphyry, and is accompanied with heavy-ſpar; the other in veins of red ironſtone, and brown ironſtone. The radiated ſubſpecies occurs principally in the firſt formation, whilſt the earthy and foliated occur in the ſecond. The firſt formation occurs near Aberdeen? alſo at Ilmenau in Saxony. The ſecond formation occurs at Johanngeorgenſtadt and Eibenſtock.

Uſes of the Species.

It is uſed in glaſs-manufactories to purify the glaſs

glaſs of all the ſubſtances that colour it. When mixed with muriatic acid, it affords oxygenated muriatic acid, ſo uſeful in bleaching. It is alſo uſed for obtaining oxygen gas.

SECOND SPECIES.

Black Manganeſe-Ore.

Schwarz Braunſteinerz.—*Werner.*

Id. Wern. Pabſt. 1. b. ſ. 220.—*Id. Emm.* 2. b. ſ. 532.—Le Manganeſe noir, *Broch.* t. 2. p. 424. — Schwarzbraunſteinerz, *Reuſs*, 4. b. ſ. 459.

External Characters.

Its colour is intermediate between browniſh-black and dark greyiſh-black.

Occurs maſſive, diſſeminated, and in octahedral cryſtals, which are aggregated in rows, and are ſmall and very ſmall.

The ſurface of the cryſtals is ſmooth and ſhining.

Fracture imperfect foliated, ſingle cleavage; ſometimes it inclines to uneven, and is alſo ſmall and ſcopiform diverging radiated.

Fragments indeterminately angular, blunt-edged.

Occurs in ſmall and fine granular diſtinct concretions.

Is opaque.

Gives a reddiſh-brown ſtreak.

Is ſemihard.
Brittle.
Heavy.

Geognoſtic and Geographic Situations.

It is a rare mineral, and occurs uſually along with grey antimony-ore. It is found at Ehrenſtock near Ilmenau, on grey antimony-ore. It has been alſo obſerved at Rabenſtein in Bavaria; at Fuhrbach near Wagrain in Salzburg; and at Miedzian or Gora in Weſt Gallicia.

Obſervations.

1. It is often confounded with Grey Antimony-Ore and Black Hematite.

2. Dr *Reuſs* deſcribes, as a ſubſpecies of Black Manganeſe-Ore, the *Black Wad*. The following deſcription is from his Syſtem of Mineralogy:

" *Friable Black Manganeſe Ore, or Wad.*

Colour ſometimes dark ſteel-grey, and ſometimes blackiſh-brown.

Occurs maſſive, and diſſeminated, ſometimes as a coating.

Internally dull, ſometimes feebly glimmering.

Fracture fine earthy.

Fragments indeterminately angular, blunt-edged.

Soils ſtrongly.

Is very ſoft, often completely friable; in which latter caſe it is compoſed of duſty or delicate ſcaly particles, which are more or leſs cohering.

Feels

Feels meagre, and
Is light, bordering on not particularly heavy.
Specific gravity, 2.000–3.000, *Dolomieu*."

Chemical Characters.

When dry and mixed with one-fourth of its weight of linſeed oil, and gently heated, it inflames. At 95° of *Wedgwood* it melts to a flag, and at 144° into a perfect glaſs. Diſſolves in borax, to which it communicates a violet-blue colour.

Conſtituent Parts.

According to *Wedgwood* it affords

Oxide of manganeſe,	43	
——— iron,	43	
Lead,	4.5	Accidental.
Mica,	5	

From the Hartz.

Brown oxide of manganeſe,	68
——— iron,	6.5
Carbon,	1
Baryte,	1
Silica,	8
Water,	17.5

Klaproth.

Geographic Situation.

Devonſhire, Derbyſhire, &c. in England; Leadhills in Scotland; Johanngeorgenſtadt, &c. in Saxony; Bohemia; Hartz; Bavaria; France.

THIRD

THIRD SPECIES.

Red Manganese-Ore.

Rother Braunſtein.—*Werner.*

Colour light roſe-red; by weathering becomes light yellowiſh-brown.

Occurs maſſive and diſſeminated.

Internally dull.

Fracture even, which paſſes ſometimes into flat conchoidal.

Fragments indeterminately angular, pretty ſharp-edged.

Is tranſlucent in a ſlight degree.

Hard.

Brittle.

Eaſily frangible.

Heavy, inclining to not particularly heavy.

Specific gravity, 3.233, from Kapnick, *Kirwan.*

Chemical Characters.

Before the blow-pipe it becomes greyiſh-black, but is infuſible without addition. It tinges borax violet-blue, and ſometimes nearly hyacinth-red. In a ſtream of oxygen gas, it melts very eaſily into a dark-brown, glaſſy, tranſlucent bead, which is attractable by the magnet.

Conſtituent

Conſtituent Parts.

Oxide of manganeſe,	48
Carbonic acid,	49.2
Oxide of iron,	2.1
Silica,	9

Lampadius.

Geognoſtic and Geographic Situations.

It occurs in veins, and is accompanied with black ſilver-ore, blende, brown-ſpar, calc-ſpar, and quartz.

It is found at Kapnic in Tranſilvania; Alafiord near Chriſtianſand in Norway; and it is ſaid to occur at preſent at Markirch in Alſace, and at Sem in the dutchy of Foix in France.

Obſervations.

1. Several other ores of manganeſe, beſides thoſe deſcribed in the preceding pages, are mentioned in works on mineralogy, but none of them are admitted by *Werner*.

2. *La Perouſe* found a ſubſtance in the mines of Sem, which he conſiders to be Native Manganeſe; but more accurate and complete information is required before it can be admitted as a ſpecies into the Syſtem.

FIF-

FIFTEENTH GENUS.

MOLYBDENA GENUS.

FIRST SPECIES.

Molybdena.

Wafferblei.—*Werner.*

Ferrum Molybdæna pura membranacea nitens, *Wall.* t. 2. p. 249.—Wafferblei, *Wern.* Pabſt. 1. b. ſ. 221.—*Id. Wid.* ſ. 962.—Molybdena, *Kirw.* vol. ii. p. 322. — Sulphure de Molybdene, *De Born.* t. 2. p. 119.—Wafferbley, *Emm.* 2. b. ſ. 541.—Molybdene ſulphurée, *Lam.* t. 1. p. 397.—*Id. Hauy,* t. 4. p. 289.—Le Molybdene ſulphuré, *Broch.* t. 2. p. 432. —Wafferblei, *Reuſs,* 4. b. ſ. 478.

External Characters.

Colour freſh burning lead-grey.

Occurs uſually maſſive and diſſeminated, and ſometimes cryſtallized in the following figures:

1. Six-ſided table, ſometimes equilateral.
2. Very ſhort ſix-ſided priſm flatly acuminated on both extremities by ſix planes, which are ſet on the lateral planes.

The cryſtals are ſometimes ſmall, and ſometimes middle-ſized, and always imbedded, or in druſes.

Internally it is ſplendent, ſometimes paſſing into ſhining, and its luſtre is metallic.

Fracture perfect foliated, ſingle cleavage, almoſt always curved, and ſometimes floriform foliated.

Fragments in the ſmall flaty, but in the great indeterminately angular, blunt-edged.

Occurs in large and coarſe granular diſtinct concretions, which approach to ſmall granular.

It writes.

Retains its luſtre in the ſtreak.

Soils a little.

Is very ſoft.

Eaſily frangible.

Splits eaſily.

In thin leaves is common flexible.

Sectile, approaching to malleable.

Feels greaſy.

Is heavy.

Specific gravity, 4.7385, *Briſſon*; 4.048, *Kirwan*; 4.569, *Karſten*; 4.667, *Schumacher*.

Chemical Characters.

When expoſed to a gentle heat it loſes nothing of its weight or luſtre. When expoſed to a violent heat it begins to ſmoke, at laſt flows, and ſhews a blue flame on its ſurface. If the heat is ſtill continued, it begins to ſhoot into needles, and is at laſt converted into a delicately cryſtallized yellow maſs. When it is expoſed to high temperature in confined veſſels, it is not altered. It is infuſible before the blow-pipe, but it yields a ſulphureous odour. Nitrous acid changes it into a white oxide.

Conſtituent

Conſtituent Parts.

According to *Lampadius*:

Molybdena,	76
Iron,	1
Sulphur,	23
	100

Geognoſtic Situation.

It is one of the oldeſt of the metals. Occurs only in primitive mountains, and is either diſſeminated or in veins. In Norway, Sweden and Bohemia, it is found diſſeminated in granite. In Bohemia and Saxony in veins of the oldeſt formations, and uſually accompanied with tinſtone. It is ſometimes alſo accompanied with wolfram, quartz and mica; ſeldom with native arſenic, heavy-ſpar, fluor-ſpar, and topaz. In the ſmall ſnow-pit, ſituated high in the Reiſengebirge, it is found diſſeminated in granite. In the county of Glatz in gneiſs and mica-ſlate. In chlorite ſlate with common actynolite, in Glenelg in Inverneſsſhire.

Geographic Situation.

Beſides the localities already mentioned, the following are deſerving of notice: Hitterdahl, Riſithyen, Arendal, Friedrichſwärn in Norway; Norberg in Weſtmannland, Gerſdriem in Calmarlehn,

lehn, and Baſtnäs in Sweden; Altenberg, Geier, Ehrenfriederſdorf, Schneeberg, and Zinnwald in Saxony; Schlackenwald and Zinnwald in Bohemia; Mont Blanc in Savoy; France; Adontſchelon in Nertſchinſk in Siberia; Greenland.

Obſervation.

It has been frequently confounded with Graphite, from which it is ſufficiently diſtinguiſhed by colour and fracture.

SIX-

SIXTEENTH GENUS.

ARSENIC GENUS.

FIRST SPECIES.

Native Arſenic.

Gediegen Arſenik.—*Werner.*

Arſenicum nativum, *Wall.* t. 2. p. 161.–Gediegen Arſenik, *Wern.* Pabſt. 1. b. ſ. 207.—*Id. Wid.* ſ. 965.—Native Arſenic, *Kirw.* vol. ii. p. 255.—Arſenic teſtacé, *De Born.* t. 2. p. 194.—Gediegen Arſenik, *Emm.* 2. b. ſ. 548.—Arſenic natif, *Lam.* t. 1. p. 353. — *Id. Hauy*, t. 4. ſ. 220. — *Id. Broch.* t. 2. p. 435. — Gediegen Arſenik, *Reuſs*, 4. b. ſ. 494.

External Characters.

On the freſh fracture it is light whitiſh lead-grey, which approaches very near to tin-white; it however tarniſhes very quickly, firſt yellowiſh and browniſh, and then greyiſh-black, and by this loſes part of its luſtre.

Beſides maſſive and diſſeminated, it occurs alſo reniform, in plates, with pyramidal, cubical, and conical impreſſions, alſo reticulated.

Externally it is either rough or granulated, and very feebly glimmering.

Internally, on the freſh fracture, it is uſually gliſtening,

gliſtening, ſometimes paſſing into glimmering, ſometimes into ſhining, and its luſtre is metallic.

Fracture ſmall and fine grained uneven, ſometimes imperfect, and curved foliated with a ſingle cleavage; and ſometimes, although rarely, narrow, ſtraight, and ſcopiform diverging radiated.

Fragments indeterminately angular, not particularly ſharp-edged.

Occurs in thin, curved lamellar diſtinct concretions, and ſeldom in ſmall and fine granular concretions.

In the ſtreak it becomes ſhining and metallic.

Semihard in a high degree.

Uncommonly eaſily frangible.

Sectile to malleable.

Uncommonly heavy.

Specific gravity, 5.7249–5.7633, *Briſſon*; 5.670 *Kirwan*.

When ſtruck or rubbed, it emits an arſenical ſmell.

Chemical Characters.

Before the blow-pipe it gives a white ſmoke, diffuſes an arſenical odour, burns with a blue flame, is gradually volatilized, and leaves a white coating on the coal.

Conſtituent Parts.

It uſually contains a ſmall portion of iron, and when it occurs with gold or ſilver-ores, a little gold or ſilver.

Geognoſtic

Geognoſtic Situation.

Occurs only in primitive mountains, and in veins of a newer formation, accompanied with ſilver-ores. It is uſually accompanied with light red ſilver-ore, orpiment, and lead-glance; ſometimes with native-ſilver, cobalt-glance, copper-nickel, ſparry ironſtone, iron-pyrites, fahl-ore, copper-pyrites, heavy-ſpar, calc-ſpar, brown-ſpar, fluor-ſpar, and quartz.

Geographic Situation.

Andreaſberg in the Hartz; Freyberg, Annaberg, Schneeberg, Marienberg, Johanngeorgenſtadt in Saxony; Reichenſtein in Sileſia; Joachimſtal, Gotteſgab in Bohemia; Wittichen in Furſtenberg, Alpirſbach in Wurtemberg in Swabia; Markirch in Alſace; Chili.

SECOND SPECIES.

Arſenic Pyrites.

Arſenikkies.—*Werner.*

This ſpecies is divided into two ſubſpecies: 1. Common Arſenic Pyrites. 2. Argentiferous Arſenic Pyrites.

FIRST

FIRST SUBSPECIES.

Common Arſenic Pyrites.

Gemeiner Arſenikkies.—*Werner.*

Id. Wern. Pabſt. 1. b. ſ. 212.—*Id. Wid.* ſ. 968.—Arſenical Pyrites or Marcaſite, *Kirw.* vol. ii. p. 256.—Gemeiner Arſenikkies, *Emm.* 2. b. ſ. 553.—La Pyrite arſenicale commune, — *Broch.* t. 2. p. 438. — Fer arſenical, *Hauy*, t. 4. p. 57. — Gemeiner Arſenikkies, *Reuſs*, 4. b. ſ. 505.

External Characters.

On the freſh fracture it is ſilver-white, but by expoſure it acquires a yellowiſh tarniſh; ſometimes it has a pavonine, columbine or irideſcent tarniſh, in its natural repoſitory.

Occurs maſſive, diſſeminated, often alſo cryſtallized in the following figures:

1. Oblique four-ſided priſm, with ſtraight or cylindrical convex or cylindrical concave lateral planes, either perfect, or (what is the moſt frequent) bevelled either acutely or flatly on both extremities, and the bevelling planes are ſet on the acuter lateral edges. When theſe priſms become ſo low, that the bevelments nearly or actually meet, there is formed
2. A very acute or flat double four-ſided pyramid;

ramid; when it becomes lower and thicker, it acquires the appearance of a

3. Cube.

4. When the prifms become very long in comparifon of their breadth, there is formed acicular cryftals.

The cryftals are middle-fized, fmall, and fometimes very fmall; they have fmooth lateral planes, but the bevelling planes are ufually tranfverfely ftreaked, and are externally fplendent.

Internally it is fhining, feldom gliftening, and its luftre is metallic.

Fracture coarfe and fmall grained uneven.

Fragments indeterminately angular, pretty blunt-edged.

Occurs ufually unfeparated; fometimes alfo in thick or thin and ftraight columnar diftinct concretions, which are fometimes diverging, and fometimes promifcuous. The furface of the concretions is fmooth and fhining. The concretions fometimes terminate in cryftals.

It is hard.

Brittle.

Rather difficultly frangible.

Heavy.

When rubbed it emits an arfenical fmell.

Specific gravity, 5.753, *Gellert;* 6.5223, *Briffon;* 5.600 *Lametherie;* 4.791, *Stütz.*

Chemical Characters.

Before the blow-pipe it emits an arſenical ſmell, and leaves a reddiſh-brown oxide of iron behind.

Conſtituent Parts.

Arſenic,	42.1
Iron,	57.9
	100

Vauquelin analyzed arſenic pyrites, and found it to contain a conſiderable portion of ſulphur; but it is evident, from the obſervations of *Hauy*, that the ſpecimens he uſed contained intermixed iron-pyrites.

Geognoſtic Situation.

It occurs only in primitive mountains, and belongs to the older formations. It occurs in beds, as at Kupferhügel in Sileſia; ſometimes alſo in veins, in gneiſs, mica-ſlate, clay-ſlate, chlorite-ſlate, but never in granite. It occurs ſometimes, although rarely, in the oldeſt ſerpentine formation, when it is auriferous.

It is uſually accompanied with tin-ſtone, lead-glance, black-blende, ſparry-ironſtone, copper-pyrites, iron-pyrites, magnetic pyrites, and alſo quartz, brown-ſpar, fluor-ſpar, calc-ſpar, common horn-blende, and garnet. At Gotteſgab, in Bohemia, it occurs in beds in clay-ſlate, accompanied with tin-

ſtone,

ſtone, copper-pyrites, magnetic pyrites, magnetic ironſtone, native ſilver, quartz, praſe, garnet, and actynolite; at Leipe, in Sileſia, in mica-ſlate, with iron-pyrites, quartz, and calc-ſpar.

Geographic Situation.

Cornwall; Kongſberg in Norway; Loſos and Sahlberg in Sweden; Altenberg, Freyberg, Ehrenfriederſdorf, and Geyer in Saxony; Reichenſtein, &c. in Sileſia; Bohemia; Upper Palatinate; Salzburg; Stiria; Hungary; the Bannat; Siberia.

Uſe.

It is from this ore that the White Oxide of Arſenic is principally obtained, and artificial Orpiment is prepared from it.

SECOND SUBSPECIES.

Argentiferous Arſenic Pyrites.

Weiſerz.—*Werner.*

Id. Werner, Pabſt. 1. b. ſ. 216.—*Id. Wid.* ſ. 970.—Argentiferous Arſenical Pyrites, *Kirw.* vol. ii. p. 257.—Weiſerz, *Emm.* 2. b. ſ. 557.—La Pyrite arſenicale argentifere, *Broch.* t. 2. p. 442.—Fer arſenical argentifere, *Hauy*, t. 4. p. 63.—Weiſerz, *Reuſs*, 4. b. ſ. 503.

External Characters.

Colour ſilver-white, but always tarniſhed yellowiſh on the ſurface.

Occurs

Occurs ſeldom maſſive, almoſt always diſſeminated, in ſmall parties, and in very ſmall acicular oblique four-ſided priſms.

Externally it is ſhining; internally it is gliſtening, ſometimes glimmering, and its luſtre is metallic.

Fracture fine-grained uneven.

Fragments indeterminately angular.

Sometimes a tendency to fine granular diſtinct concretion is to be obſerved.

In the remaining characters, it agrees with the preceding ſubſpecies.

Conſtituent Parts.

Beſides arſenic and iron, it contains from 0.1 to 0.10 parts of ſilver.

Geognoſtic and Geographic Situations.

Its geognoſtic ſituation is the ſame as that of common arſenic pyrites, with which it is uſually accompanied. It is alſo accompanied with dark red ſilver-ore, lead-glance, and copper-pyrites; ſometimes with white ſilver-ore, brown-blende, and commonly with quartz and brown-ſpar.

It is a rare foſſil, and has been hitherto found only at Braunſdorf and Freyberg in Saxony; Rathhauſberg in Gaſtein in Salzburg; and in Chili.

Uſe.

Uſe.

It is uſed as an ore of ſilver.

Obſervations.

1. It is diſtinguiſhed from the firſt ſubſpecies by its inferior luſtre, ſmallneſs of its cryſtals, fineneſs of the grain in its fracture, and its granular diſtinct concretions.

2. The name of the ſpecies is derived from its reſemblance to pyrites, and from its conſtituent parts.

THIRD SPECIES.

Orpiment.

Rauſchgelb.—*Werner.*

This ſpecies contains two ſubſpecies. 1. Red Orpiment. 2. Yellow Orpiment.

FIRST SUBSPECIES.

Red Orpiment.

Rothes Rauſchgelb.—*Werner.*

Arſenicum riſigallum, *Wall.* t. 2. p. 163.—Realgar et Soufre rouge des Volcans, *Rom. de L.* t. 3. p. 33.—Rothes Rauſchgelb, *Werner*, Pabſt. 1. b. ſ. 210.—*Id. Wid.* ſ. 975.—Realgar, *Kirw.* vol. ii. p. 261.—Realgar, Sandarac, Rubine d'Arſenic,

d'Arſenic, *De Born.* t. 2. p. 199.—Rothes Rauſchgelb, *Emm.* 2. b. ſ. 562.—Arſenic ſulphuré, *Lam.* t. 1. p. 358.—Arſenic ſulphuré rouge, *Hauy*, t. 4. p. 226.—Le Realgar rouge, *Broch.* t. 2. p. 447.—Rothes Rauſchgelb, *Reuſs*, 4. b. ſ. 516.

External Characters.

Colour aurora or morning red, of different degrees of intenſity.

Occurs maſſive, diſſeminated, in membranes; and cryſtallized, in

1. Oblique four-ſided priſms, in which the terminal planes are uſually rather obliquely ſet on the lateral planes: ſometimes the lateral edges are bevelled; ſometimes the obtuſe edges are truncated, and then it paſſes into

2. A very oblique ſix-ſided priſm *.

The cryſtals are ſeldom middle-ſized, uſually ſmall, very ſmall and minute.

It is always longitudinally ſtreaked and ſhining, paſſing into ſplendent.

Internally

* *Hauy* enumerates the following cryſtallizations:

1. Oblique broad four-ſided priſm, acuminated on both extremities by four planes, which are ſet on the lateral planes.
2. Same figure, only truncated on the acuter lateral edges.
3. Same figure, truncated on all its lateral edges.
4. Same figure, truncated on the obtuſer lateral edges, and bevelled on the acuter lateral edges.
5. Figure 4. in which the bevelling edges are truncated.
6. Oblique four-ſided priſm, acuminated by four planes, which are ſet on the lateral planes, and truncated on all the angles, on the extremities of the acuminations, and on the edges which the acuminating planes make with the lateral planes.

Internally it is ſhining, and its luſtre is intermediate between adamantine and pearly.

Fracture coarſe and ſmall-grained uneven.

Fragments indeterminately angular, and blunt-edged.

It is tranſlucent, but the cryſtals are ſemitranſparent.

It yields a lemon or orange yellow coloured ſtreak.

It is very ſoft.

Not particularly brittle.

Eaſily frangible.

Not very heavy.

Specific gravity, 3.223, *Muſchenbröck*; 3.225, *Bergman*; 3.3384, *Briſſon*.

Chemical Characters.

Before the blow-pipe it gives a blue flame, a white arſenical ſmoke, and it volatilizes in the form of a white oxide. It uſually leaves an earthy reſidue.

Conſtituent Parts.

Arſenic,	80		84
Sulphur,	20		16
Weſtrumb.	100	*Kirwan.*	100

Geognoſtic Situation.

It occurs both in primitive and floetz mountains, but more frequently in the former.

It

It is uſually accompanied with native arſenic, light red ſilver-ore, lead-glance; ſometimes alſo with cobalt-glance, iron-pyrites, grey copper-ore, brown-blende, grey and red antimony-ore, quartz, heavy-ſpar, and ſeldom mineral pitch.

At Nagyag it occurs in veins that traverſe ſand-ſtone and clay-ſlate; and on St Gothard in dolomite.

Geographic Situation.

Andreaſberg in the Hartz; Ehrenfriederſdorf, Schneeberg, and Johanngeorgenſtadt in Saxony; Joachimſthal in Bohemia; Schwarzwald in Swabia; the Tyrol; Hungary; the Bannat; Tranſilvania; Lothringen and Markirch in France; Sicily, Veſuvius, and Solfatara in Italy; Guadaloupe.

Uſe.

It is uſed as a pigment. The Chineſe faſhion veſſels of different ſhapes, and their pagodas, of this mineral.

Obſervations.

This foſſil has been confounded with Red Silver-ore and Red Lead-ore. It is diſtinguiſhed from the former by its leſs ſpecific gravity and its orange-coloured ſtreak; from the latter, by its leſs ſpecific gravity.

SECOND

SECOND SUBSPECIES.

Yellow Orpiment.

Gelbes Rauſchgelb.—*Werner.*

Arſenicum auripigmentum, *Wall.* t. 2. p. 163. — Orpiment, Orpin, *Rom. de L.* t. 3. p. 39. — Gelbes Rauſchgelb, *Wern.* Pabſt. 1. b. f. 210.—*Id. Wid.* f. 972.—Orpiment, *Kirw.* vol. ii. p. 260. — Oxide d'Arſenic ſulphuré jaune, *De Born.* t. 2. p. 202.—Gelbes Rauſchgelb, *Emm.* b. 2. f. 559. — Arſenic ſulphuré jaune, *Hauy*, t. 4. p. 234. — Le Realgar jaune, *Broch.* t. 2. p. 444.—Gelbes Rauſchgelb, *Reuſs*, 4. b. f. 512.

External Characters.

Colour perfect lemon-yellow.

Occurs maſſive, and in very minute cryſtals.

On the freſh fracture it is ſplendent, and its luſtre is intermediate between adamantine and ſemimetallic.

Fracture curved foliated, with a ſingle cleavage.

Fragments indeterminately angular, and blunt-edged in the great, but flaty in the ſmall.

Occurs uſually in large, coarſe and ſmall longiſh angular granular diſtinct concretions.

Is tranſlucent; in ſmall leaves tranſparent.

Colour not altered in the ſtreak.

Is very ſoft.

Sectile.

Perfect and common flexible.

Splits eafily.

Heavy in a low degree, paffing into not particularly heavy.

Specific gravity, 3·313, *Muſchenbröck;* 3·315, *Bergman;* 3.048 to 3·435, *Kirwan.*

Geognoſtic and Geographic Situations.

It occurs principally in floetz mountains, and appears to be of a newer formation than the red orpiment.

It is found at Moldawa and Saſka in the Bannat; Ohlapian, Nagyag and Felſobanya in Tranſilvania; Tajoba near Neuſohl in Hungary; Wallachia; Servia; Natolia; China.

Obſervations.

1. It was formerly the general opinion of chemiſts, that Yellow Orpiment differed from Red, in containing a greater proportion of ſulphur: *Hauy* is of opinion, that Red Orpiment is converted into Yellow by an increaſe in its proportion of oxygen, and that the yellow paſſes into red when it is deprived of a portion of its oxygen.

2. It is diſtinguiſhed from Natural Sulphur by its foliated fracture.

FOURTH

FOURTH SPECIES.

Arſenic-Bloom.

Arſenickblüthe.—*Werner.*

Pharmacolite, *Karſten*, Tabellen. *Id. Broch.* t. 2. p. 523. —
Chaux arſeniateé, *Hauy*, t. 2. p. 293.

External Characters.

Colour reddiſh-white and ſnow-white; ſeldom yellowiſh-white.

Occurs as a coating, in ſmall balls, ſmall reniform, botryoidal, with a druſy ſurface; frequently in very delicate capillary ſhining cryſtals, which are ſcopiformly aggregated.

Internally it is glimmering, and its luſtre is ſilky.

Fracture very delicate, ſtraight, ſcopiform and ſtellular diverging radiated, and ſometimes paſſes into fibrous.

Fragments indeterminate angular, alſo wedge-ſhaped.

Occurs in coarſe and ſmall granular diſtinct concretions.

Tranſlucent on the edges.

Very ſoft, paſſing into friable.

Eaſily frangible.

Soils.

Light, bordering on not particularly heavy.

Specific gravity, 2.536, *Selb*; 2.640, *Klaproth.*

Conſtituent

Conſtituent Parts.

Lime,	23
Arſenic acid,	46.5
Oxide of cobalt,	0.5
Silica and alumina,	6
Water,	22.5

Klaproth.

Geognoſtic Situation.

It occurs in rents of a granitic rock, accompanied with cobalt-cruſt and cobalt-bloom. There appears to be an uninterrupted tranſition from this ſpecies into Cobalt-cruſt.

Geographic Situation.

Has been hitherto found only in the mine Sophia, at Wittichen in Suabia.

SEVENTEENTH GENUS.

SCHEELE GENUS *.

FIRST SPECIES.

Tungſten.

Schwerſtein.—*Werner*

Minera Ferri lapidea graviſſima, *Wall.* t. 2. p. 254 —Wolfram de

* *Werner* gave the name *Scheele* to this genus, in honour of the illuſtrious Swediſh chemiſt *Scheele*, who diſcovered the peculiar metal which characteriſes it.

de couleur blanche, *Rom. d. L.* t. 3. p. 264.—Schwerſtein, *Wern.* Pabſt. 1. b. ſ. 222.—Weiſſer Tungſten, *Wid.* ſ. 980. —Tungſten, *Kirw.* vol. ii. p. 314.—Tungſtate calcaire, Mine d'Etain blanche, *De Born.* t. 2. p. 230.—Schwerſtein, *Emm.* 2. b. ſ. 570.—Tungſtene, *Lam.* t. 1. p. 402.—Scheelen calcaire, *Hauy*, t. 4. p. 320.—La Pierre peſante, ou le Tungſtene, *Broch.* t. 2. p. 453.—Scheelerz, *Reuſs*, 4. b. ſ. 534.

External Characters.

Its colour is uſually yellowiſh and greyiſh-white, which ſometimes verges on ſnow-white; from theſe it paſſes into yellowiſh-grey, and light yellowiſh-brown, which approaches to orange-yellow.

The white varieties are ſometimes tarniſhed on the ſurface, either dark pearl-grey or plumb-blue.

Occurs maſſive, diſſeminated, and very frequently cryſtallized in rather acute double four-ſided pyramids, which are either perfect, or the common baſe is bevelled; ſometimes they terminate in a line.

The cryſtals are middle-ſized, ſmall and very ſmall, and are ſometimes heaped on one another.

The lateral planes of the cryſtals are ſmooth, the bevelling planes are ſlightly ſtreaked tranſverſely; they are ſhining and ſplendent, and their luſtre inclines to adamantine.

Internally it is ſhining, and its luſtre is vitreous.

Fracture imperfect foliated, probably with a fourfold cleavage.

Fragments

Fragments indeterminately angular, rather blunt-edged.

Sometimes it occurs in large, coarſe, and ſmall granular diſtinct concretions, with ſtreaked and ſhining ſurfaces.

It is more or leſs tranſlucent, ſeldom ſemitranſparent.

Soft, paſſing into ſemihard.

Not particularly brittle.

Eaſily frangible.

Uncommonly heavy.

Specific gravity, 4.355, *Leyſſer*; 5.800 to 6.028, *Kirwan*; 6.0665, *Briſſon*; 6.000, *Gellert*; 6.015 and 5.570, *Klaproth*.

Chemical Characters.

Is infuſible without addition before the blow-pipe. It melts with borax, but ſcarcely changes its colour. When pulverized and digeſted with nitrous or muriatic acid, it leaves a lemon-yellow reſidue, which is the oxide of tungſten.

Conſtituent Parts.

Tungſten, from Bitſberg in Sweden, according to *Scheele*:

Yellow oxide of tungſten,	65
Lime,	31
Silica,	4

Tungſten,

Tungſten, from Schlackenwald, according to *Elhuyar*:

Yellow oxide of tungſten,	68
Lime,	30

Tungſten from Schlackenwald, according to *Klaproth*:

Yellow oxide of tungſten,	77.75
Lime,	17.60
Silica,	3

Tungſten, from Pengilly in Cornwall, according to *Klaproth*:

Yellow oxide of tungſten,	75.25
Lime,	18.70
Oxide of iron,	1.25
—— manganeſe,	0.75
Silica,	1.50

Geognoſtic Situation.

It occurs in primitive mountains, and belongs to the oldeſt metalliferous formations. It is uſually accompanied with tinſtone, wolfram, quartz, mica, ſteatite, fluor-ſpar, lithomarge, &c. The Corniſh is accompanied with ochrey brown ironſtone and brown hematite.

Geographic Situation.

Cornwall; Sweden; Saxony; and Bohemia.

Obſervation.

Obſervation.

It is diſtinguiſhed from Tinſtone by its octahedral cryſtals, the intenſity and kind of its luſtre, its hardneſs, and its greater ſpecific gravity.

SECOND SPECIES.

Wolfram.

Wolfram.—*Werner.*

Magneſia criſtallina,--Spuma Lupi, *Wall.* t. 2. p. 344.—Wolfram, *Wern.* Pabſt. 1. b. f. 223.—*Id. Wid.* 983.—*Id. Kirw.* vol. ii. p. 316.—*Id. De Born.* t. 2. p. 227.—*Id. Emm.* b. 2. f. 574.—*Id. Lam.* t. 1. p. 404.—*Id. Broch.* t. 2. p. 456.—Sheelen ferruginé, *Hauy*, t. 4. p. 314.—Wolfram, *Reuſs*, 4. b. f. 541.

External Characters.

Its colour is intermediate between dark greyiſh-black and browniſh-black, which ſometimes inclines to velvet-black.

Occurs maſſive; and cryſtallized in the following figures:

1. Broad ſix-ſided priſm, with two very broad oppoſite, two ſmaller, and two very ſmall lateral planes, which is pretty acutely acuminated by four planes, of which the two broader are ſet on the broader lateral planes, and the two ſmaller on the lateral edges formed by

by the meeting of the ſmaller lateral planes. The acumination ends in a line, which is ſometimes bevelled, and the bevelling planes are ſet on the broader acuminating planes.

2. Rectangular four-ſided table, having two oppoſite terminal planes bevelled, and its angles truncated.

3. Rectangular longiſh four-ſided table, having the edges of its longeſt planes truncated.

The cryſtals are middle-ſized and large, and occur ſometimes imbedded, ſometimes interſecting one another, but are ſeldom diſtinct.

The lateral planes are uſually longitudinally ſtreaked and gliſtening.

Principal fracture ſhining, croſs-fracture gliſtening.

Fracture ſtraight foliated, with a ſimple cleavage, and ſometimes paſſes into broad, and ſcopiform diverging radiated.

Croſs-fracture coarſe and ſmall-grained uneven.

Fragments indeterminately angular, blunt-edged.

Occurs in thin fortifications-wiſe curved lamellar diſtinct concretions, whoſe ſurface is ſometimes ſmooth, and ſometimes ſtreaked.

Is opaque.

Yields a reddiſh-brown coloured ſtreak.

Is ſoft.

Brittle.

Uncommonly heavy.

Specific gravity, 6.835, *Elhuyar*; 7.130, *Gellert*; 7.1195, *Briſſon*; 5.705, *Gmelin*; 7.000, *Leonardi*; 7.3333, *Hauy*; 7.006, *Kirwan*; 6.955, *Hatchett*.

Chemical Characters.

It decrepitates before the blow-pipe, and is infuſible even with borax.

Conſtituent Parts.

According to

	Delhuyart.	*Wiegleb.*	*Klaproth.*	*Vauquelin.*
Molybdic acid,	65	35.75	46.9	67
Oxide of manganeſe,	22	32		6.25
Oxide of iron,	13.5	11	31.2	18
Silica,				1.50
Loſs,		21.25	21.9	7.25
	100.5	100	100	100

Geognoſtic Situation.

It occurs in primitive mountains, and in the oldeſt formations. It is almoſt always accompanied with tin.

Geographic Situation.

Cornwall; Wärmeland in Sweden; Puy in France; Zinnwald, Ehrenfriederſdorf, Geyer and Altenberg in the electorate of Saxony; Zinnwald, Schlackenwald and Graupen in Bohemia.

Obſervation.

Observation.

It is distinguished from Tinstone among other characters by its streak, which is reddish-brown; whereas that of Tinstone is grey.

EIGHTEENTH GENUS.

MENACHINE GENUS*.

FIRST SPECIES.

Menachanite.

Menacan.—*Werner.*

Menachanite, *Kirw.* vol. ii. p. 326. — Le Menakanite, *Broch.* t. 2. p. 468. — Titane oxidé ferrifere, *Hauy*, t. 4. p. 306.— Manacan, *Reuss*, 4. b. f. 54.

External Characters.

Colour greyish-black, inclining to iron-black.

Occurs only in very small flattish angular grains, which have a rough glimmering surface.

Internally it is glistening and glimmering, and its lustre is adamantine, passing into semimetallic.

Fracture

* The peculiar metal which characterizes this genus, was first discovered by our countryman Mr GREGOR in the Menachanite of Cornwall. He bestowed on it the appellation *Menachine*, from the valley of Manachan, where he found the particular fossil which afforded it. Some time afterwards, the celebrated Klaproth noticed it in other fossils, and denominated it Titanium. Werner, however, with a due regard to the claim of Mr Gregor, and from a conviction that the name he had given to the genus was the most proper, rejected the mythological term Titanium, and adopted that proposed by the original discoverer.

Fracture imperfect foliated, approaching to flaty.

Fragments indeterminately angular and ſharp-edged.

Perfectly opaque.

Is ſoft.

Brittle.

Retains its colour in the ſtreak.

Eaſily frangible.

Heavy in a moderate degree.

Specific gravity, 4.427, *Gregor*; 4.270, *Lampadius*.

Phyſical Character.

It is attractible by the magnet, but in a much weaker degree than iron-ſand or magnetic ironſtone.

Chemical Characters.

It is infuſible, without addition, before the blow-pipe: it tinges borax of a greeniſh colour, which inclines to brown.

Conſtituent Parts.

Oxide of iron,	50.4
Oxide of menachine,	43.5
Silica,	3.3
Alumina,	1.4
Oxide of manganeſe,	0.9
Lampadius.	

Magnetic oxide of iron,	51
Oxide of menachine,	45.25
Oxide of manganeſe,	0.25
Silica,	3.50
Klaproth.	

From

From Botany Bay.

Oxide of iron,	49
Oxide of menachine,	40
Silica,	11
Chenevix.	——

Geognoſtic and Geographic Situations.

Is found, accompanied by fine quartz ſand, in the bed of a rivulet which enters the valley of Manachan in Cornwall; on the ſhores of the iſland of Providence in America; and at Botany Bay in New South Wales.

Obſervation.

It has been confounded with Iron-Sand, from which it may be readily diſtinguiſhed by the fracture, luſtre, and inferior hardneſs.

SECOND SPECIES.

Octahedrite.

Octaedrit.—*Werner.*

Schorl bleu, *Rom. de L.* t. 2. p. 406.—Schorl octaedre rectangulaire, *Bournon*, Journ. de Phyſ. 1787, Mai.—Oiſanite, *Lam.* t. 2. p. 269.—Octaedrite, *Sauſſure*, Voyages dans les Alpes, t. 7. p. 139. § 1901.—Anataſe, *Hauy*, t. 3. p. 129. 136.—*Id. Broch.* t. 2. p. 548.—*Id. Reuſs*, 4. b. f. 580.

External

External Characters.

Its colour paſſes from indigo-blue, through many ſhades, to dark reddiſh-brown and yellowiſh-brown.

It occurs only cryſtallized, and that in high and very acute octahedrons, which are either perfect or truncated on the extremities. Sometimes they are acuminated on the extremities by four planes, which are ſet on the lateral planes, and ſometimes the extremities of this ſecond acumination are truncated: in ſome varieties the extremities of the octahedron are acuminated by eight planes, of which two and two are ſet on each lateral plane.

The cryſtals are ſmall and very ſmall, and are uſually ſuperimpoſed.

Their ſurface is tranſverſely ſtreaked, and is ſplendent, and its luſtre is ſemimetallic.

Internally it is alſo ſplendent, and its luſtre is moſt diſtinctly adamantine.

Fracture foliated.

Fragments indeterminately angular and ſharp-edged.

It is ſtrongly tranſlucent and ſemitranſparent, approaching very near to tranſparent.

Semihard (ſcratches glaſs).

Brittle.

Not particularly heavy, bordering on heavy.

Specific gravity, 3.8571, *Hauy*.

Chemical

Chemical Characters.

It is infuſible before the blow-pipe. When melted with borax, a reddiſh-brown coloured glaſs is formed. When this glaſs is brought to the extremity of the flame, the reddiſh-brown colour changes into blue, and becomes opaque. If the action of the blow-pipe be ſtill continued, it at length becomes white. In a higher temperature, the reddiſh-brown colour again appears; and according as the temperature is altered, the appearance and diſappearance of the colours can be produced.

Conſtituent Parts.

According to the lateſt experiments of Vauquelin, it appears to be an oxide of menachine, mixed with ſilica.

Geognoſtic and Geographic Situations.

It occurs ſuperimpoſed on quartz, and accompanied with felſpar; hence it is probably an inmate of primitive mountains.

It is found in Dauphiny.

THIRD SPECIES.

Rutile.

Rutil.—*Werner.*

Rother Schorl, *Klapr.* 1. b. ſ. 233.—Schorl criſtallizé opaque rouge, *De Born.* t. 1. p. 168.—Titanite, *Kirw.* vol. ii. p. 329.—Sagenite,

—Sagenite, ou Schorl rouge, *Sauſſure*, t. 4 .§ 1894.—Oxide rouge de Titanium, *Lam.* t. 1. p. 414.—Criſpite, *Id.* t. 2. p. 233.—Titane oxidé, *Hauy*, t. 4. p. 296.—Le Ruthile, *Broch.* t. 2. p. 470.—Titanſchorl, *Reuſs*, 4. b. ſ. 569.

External Characters.

Its colour is dark blood-red, of various degrees of intenſity, which paſſes into light hyacinth-red and dark browniſh red.

It occurs always cryſtallized, in

1. Slightly obtuſe four-ſided priſms, obtuſely acuminated by four planes, which are ſet on the lateral planes.
2. Six-ſided priſms, which ſometimes ſhew a tendency to a ſix-planed acumination.
3. In compreſſed acicular and capillary cryſtals, whoſe regular ſhape is no longer determinable, owing to their minuteneſs.

Sometimes two cryſtals are joined by their terminal planes under a very obtuſe angle, thus forming a kind of twin cryſtal; ſometimes they are curved; have frequent tranſverſe rents, and are ſometimes broken entirely acroſs, the ends removed to ſome diſtance from one another, and the interſtice filled up with the ſubſtance of which the matrix conſiſts.

The cryſtals are uſually ſmall and very ſmall, ſeldom middle-ſized; the capillary cryſtals are frequently ſcopiformly aggregated; the capillary cryſtals are often reticulated, and the interſtices have the ſhape of equilateral triangles.

The

The cryſtals are longitudinally ſtreaked.

Externally it is ſhining and gliſtening.

Internally its principal fracture is ſplendent; croſs-fracture ſhining and gliſtening, and its luſtre is adamantine.

Principal fracture foliated, and the folia interſect each other at right angles, and are parallel with the lateral planes: croſs-fracture imperfect and ſmall conchoidal, which ſometimes inclines to uneven.

Fragments cubical.

It is tranſlucent in a ſlight degree.

Sometimes ſhews ſlender columnar diſtinct concretions.

Hard, inclining to ſemihard.

Brittle.

Yields a pale yellow or orange yellow coloured ſtreak.

Is eaſily frangible.

Heavy in a low degree.

Specific gravity, 4.180, *Klaproth*; 4.246, *La Metherie*; 4.1025, *Hauy*.

Chemical Characters.

Without addition, or even with phoſphoric ſalts, it is infuſible before the blow-pipe; with borax or alkali, it affords a hyacinth-red tranſparent glaſs.

Conſtituent Parts.

According to the analyſis of Klaproth, it is a pure oxide of menachine: Abildgaard found, beſides oxide of menachine, .03 of ſilica.

Geognoſtic Situation.

It is found imbedded, and in druſy cavities, in granite, mica-ſlate, and chlorite-ſlate.

In Hungary, it occurs imbedded in conchoidal quartz, and rock-cryſtal, which lies in neſts in mica-ſlate; at St Gothard, in thoſe druſy cavities that ſo often occur in old granite, reſting on the rock-cryſtal, adularia, and foliated chlorite, with which they are lined: that found at Aſchaffenburg is ſaid to occur in granite: the Salzburgian occurs imbedded in common tremolite; the Siberian in a vein of felſpar, three fathoms wide, which traverſes granite, accompanied with topaz and common ſchorl.

Dr *Reuſs* is of opinion, that he has obſerved it in the floetz-trap of Bohemia: Were this confirmed, we would have an example of a mineral, an inmate at once of the neweſt as well as of the oldeſt rock we are acquainted with; but the extreme minuteneſs of the cryſtals obſerved by Dr Reuſs renders it next to impoſſible to ſubject them to a ſatisfactory examination.

Geographic

Geographic Situation.

Near Roſenau at Murany in Upper Hungary; the hill Ezugul in Tranſilvania; the hills Criſpalt and Tuneda in St Gothard, and the Breven at Chamouni; in the high mountains of Salzburg; near St Yrieux in France; in the province of Burgos in Spain; in the foreſt of Speſſart by Aſchaffenberg in Franconia; at the town of Sarapulka, twelve werſts from Murſinka in Siberia; on the ſummit of Sierra de Avila in New Granda in South America; and it is ſaid alſo to have been found in South Carolina.

Obſervation.

In the Norwegian iron-ores, Menachine appears to occupy the place of manganeſe.

FOURTH SPECIES.

Nigrine.

Nigrin.—*Werner.*

External Characters.

Colour dark browniſh-black, paſſing to velvet-black.

Occurs in larger and ſmaller angular grains, and rolled pieces.

Externally it is moderately gliſtening.

Internally

Internally the principal fracture is gliſtening; the croſs-fracture moderately gliſtening; and its luſtre is adamantine.

Principal fracture imperfect and ſtraight foliated, with a ſingle cleavage; croſs-fracture flat and imperfect conchoidal.

Fragments indeterminately angular, and ſharp-edged.

Opaque.

Semihard.

Brittle.

Yields a yellowiſh-brown ſtreak.

Heavy in a moderate degree.

Specific gravity, 4.445, *Klaproth*; 4.605, *Eſmark*; 4.543, *Lampadius*; 4.673, *Lowitz*; 3.700, *Vauquelin* and *Hecht*.

Phyſical Character.

Is not attracted by the magnet.

Chemical Characters.

It is infuſible, without addition, before the blow-pipe: with borax, it melts to a tranſparent hyacinth-red globule: it yields its menachine readily to acid of ſugar.

Conſtituent

Conſtituent Parts.

	Tranſilvania.	Uralian mountains.	Bavaria.	Tranſilvania.
Oxide of menachine,	84	53	49	87
Oxide of iron,	14	47	35	9
Oxide of manganeſe,	2	—	2	3
Oxygen combined with the iron and manganeſe,	—	—	14	—
	100	100	100	99
	Klaproth.	*Lowitz.*	*Vauquelin* and *Hecht.*	*Lampadius.*

Geognoſtic and Geographic Situations.

At Ohlapian in Tranſilvania it is found in alluvial hills, conſiſting of yellow ſand, intermixed with fragments of granite, gneiſs, and mica-ſlate, and from which gold is extracted by working. It comes to us uſually intermixed with grains of precious garnet, rutile, kyanite, and common ſand. It is alſo found at Bodenmais in Bavaria; Hohenſtein in Saxony? Uralian mountains in Siberia; and Iſland of Ceylon, where it occurs in alluvial land with iron-ſand, hyacinth, zircon, &c.

Obſervations.

1. Its name is derived from is black colour.

2. It is eaſily diſtinguiſhed from Menachanite by its ſtronger luſtre, ſuperior hardneſs, the colour of its ſtreak, and by its not being in the leaſt magnetic, which alſo diſtinguiſhes it from Iron-Sand.

3. As

3. As it is uſually found with fragments of dark-coloured Rutile, they have been frequently confounded under the ſame name: but the red colour, perfect foliated fracture, twofold rectangular cleavage, and cubical fragments of Rutile, diſtinguiſh it at once from Nigrine.

4. It has ſome reſemblance to Wolfram, but it is harder, lighter, and has a higher luſtre, and darker colours.

FIFTH SPECIES.

Iſerine.

Iſerin.—*Werner.*

L'Iſerine, *Broch.* t. 2. p. 478.—Iſerine, *Reuſs*, 4. b. f. 598.

External Characters.

Colour iron-black, inclining a little to browniſh-black.

Occurs in ſmall, ſeldom middle-ſized, obtuſe angular grains, and in rolled pieces, with a ſomewhat rough, ſtrongly glimmering ſurface.

Internally it is gliſtening, and its luſtre is ſemimetallic.

Fracture is more or leſs perfect conchoidal.

Fragments are indeterminately angular and ſharp-edged.

Completely opaque.

Is hard.

Brittle.

Brittle.
Retains its colour in the ſtreak.
Is heavy in a moderate degree.
Specific gravity, 4.5.

Chemical Characters.

Before the blow-pipe it melts into a blackiſh-brown coloured glaſs, which is ſlightly attracted by the magnet. The mineral acids have no ſenſible effect on it: but the acid of ſugar extracts a portion of the menachine.

Conſtituent Parts.

Oxide of menachine,	59.1
——— iron,	30.1
——— uran,	10.2
	99.4

Geognoſtic and Geographic Situations.

It has been hitherto only found in the lofty Rieſengebirge, near the origin of the ſtream called the Iſer, diſſeminated in granite-ſand. It is ſtill uncertain whether it belongs to the granite or floetz-trap formation; from its affinity with iron-ſand, and its occurring in the neighbourhood of the baſalt hill, the Buchberg, it is ſuſpected to be an inmate of the neweſt floetz-trap formation *,

Obſervations.

* The Buchberg is the higheſt baſalt hill in Germany, being 2921 feet above the level of the ſea, and the higheſt baſalt

except

Obſervations.

1. It bears a very great reſemblance to Iron-Sand, into which it even paſſes. It is diſtinguiſhed from iron-ſand by the ſhade of brown in its colour, by its ſuperior external, and inferior internal luſtre, by its leſs ſpecific gravity, and very ſtrikingly by its being very ſlightly attractable by even a powerful magnet.

2. It is diſtinguiſhed from Nigrine and Menachanite by fracture and luſtre.

NINE-

except that ſmall portion lodged in the cavity of the Schneegrube, which is ſituated near 4000 feet above the level of the ſea. The hill itſelf is elevated about 500 above the Iſer, that waters its baſe, which conſiſts of granite, and at ſome diſtance below which the Iſerine is found. Whilſt travelling through Sileſia with Dr Mitchell, we aſcended to the Buchberg, with the view of aſcertaining more particularly the geognoſtic ſituation of the Iſerine; but after a very careful examination, we could diſcover it neither in the granite nor baſalt, but only looſe in the granitic ſand,

NINETEENTH GENUS.

URAN GENUS.

FIRST SPECIES.

Pitch-Ore.

Pecherz.—*Werner.*

Pecherz, *Wern.* Pabſt. 1. b. ſ. 170.—Pech-Blende, *Wid.* ſ. 987. Sulphurated Uranite, *Kirw.* vol. ii. p. 305.—Pech-Blende, ou Blende de Poix, *De Born.* t. 2. p. 159.—Schwarz Uranerz, *Emm.* 2. b. ſ. 580.—Mine d'Uranit ſulphuré, *Lam.* t. 1. p. 408.—Urane oxydulé, *Hauy*, t. 4. p. 280.—Le Pecherz, ou L'Urane noir, *Broch.* t. 2. p. 460. — Pecherz, *Reuſs*, 4. b. ſ. 551.

External Characters.

Colour velvet-black, or dark greyiſh-black, which inclines to iron-black.

Occurs almoſt always maſſive, and diſſeminated, ſeldom ſmall reniform.

Internally it is ſhining, inclining to gliſtening, and its luſtre is reſinous.

Fracture imperfect and flat conchoidal.

Fragments indeterminately angular, and ſharp-edged.

Occurs ſometimes in thick and curved lamellar, ſometimes in coarſe and angulo-granular diſtinct concretions, reſembling red hematite.

In the ſtreak, neither colour nor luſtre is changed.

It is ſoft, approaching to very ſoft.

Brittle.

Uncommonly heavy.

Specific gravity, 6.3785, *Guyton*; 6.5304, *Hauy*; 7.500, *Klaproth*.

Chemical Characters.

Is completely infuſible, without addition, before the blow-pipe. With ſoda or borax it forms a grey, muddy, ſlaggy-like globule; with phoſphoric ſalts a tranſparent green-bead. It diſſolves imperfectly in ſulphuric and muriatic acids; but is nearly diſſolved in nitrous and nitro-muriatic acids; and from this ſolution, which has a pale orange-yellow colour, the uran is precipitated browniſh-red by pruſſiat of potaſh, and yellow by the alkalies.

Conſtituent Parts.

From Joachimſthal.

Uran,	86.5
Black attractable oxide of iron,	2.5
Sulphurated lead,	6.0
Silica,	5.0
Klaproth,	100

Lampadius analyzed pitch-ore from Johanngeorgenſtadt, and found it to contain only uran and iron, but neither ſulphurated lead nor ſilica. In another

another he found with ſulphur a ſmall portion of copper, but both were from interſperſed copper-pyrites.

Geognoſtic Situation.

It occurs in veins in primitive mountains along with lead and ſilver ores.

It is uſually accompanied with lead-glance, copper-pyrites, iron-ochre, calc-ſpar; feldomer with cobalt-glance, red cobalt-ochre, ſilver-glance, uran-mica and uran-ochre. At Gotteſgab it occurs along with native ſilver, ſilver-glance, red ſilver-ore, corneous ſilver-ore, ſilver-black, and native arſenic.

Geographic Situation.

It is found at Johanngeorgenſtadt, Schneeberg and Wieſenthal in Saxony; Joachimſthal in Bohemia; and Kongſberg in Norway.

Obſervations.

It is diſtinguiſhed from Brown-Blende by colour, ſpecific gravity, fracture and ſtreak; from Wolfram by its ſtreak and fracture.

SECOND

SECOND SPECIES.

Uran-Mica.

Uran-Glimmer.—*Werner.*

Chalkolith, *Wern.* Pabſt. 1. b. ſ. 290.—Grün Uranerz, *Widd.* ſ. 990.—Micaceous uranitic Ore, *Kirw.* vol. ii. p. 304.—Grün Uran-erz, *Emm.* 2. b. ſ. 584.—Oxide d'Uranit avec Cuivre, *Lam.* t. 1. p. 410.—Urane oxidé, *Hauy*, t. 4. p. 283.—L'Urane micacé, *Broch.* t. 2. p. 463.—Uranglimmer, *Reuſs*, 4. b. ſ. 556.

External Characters.

Its chief colour is graſs-green, which paſſes on the one ſide into apple-green and emerald-green, and on the other into ſiſkin-green.

Occurs ſometimes in membranes; commonly alſo cryſtallized, in

1. Rectangular four-ſided tables, which are either perfect, or bevelled on the terminal planes.
3. When the perfect rectangular four-ſided table becomes thicker, a cube is formed.
3. When the bevelling planes on the terminal planes increaſe very much, an octahedron having truncated apices is at length formed.

The cryſtals are ſmall and very ſmall, and ſuperimpoſed, and form druſes.

The

The terminal planes are ſtreaked, but the lateral planes are ſmooth.

Externally it is uſually ſhining and ſometimes ſplendent.

Internally it is ſhining, approaching to gliſtening, and its luſtre is pearly.

Fracture foliated, with a ſingle cleavage; and the folia are parallel with the lateral planes of the table.

The fragments and diſtinct concretions, on account of the ſmallneſs of the parts, cannot be determined. Probably the maſſive varieties occur in ſmall and fine granular diſtinct concretions.

It is more or leſs tranſlucent, paſſing into tranſlucent on the edges.

Soft, and very ſoft.

Sectile.

Eaſily frangible.

Not particularly brittle.

Not particularly heavy.

Specific gravity, 3.1212, *Champeaux.*

Chemical Character.

It diſſolves in nitrous acid without effervеſcence, and communicates to it a lemon-yellow colour.

Conſtituent Parts.

It is an oxide of uran, which ſometimes contains a ſlight admixture of copper.

Geognoſtic

Geognoſtic Situation.

It occurs uſually in ironſtone veins, and is very frequently accompanied with ochrey and compact brown ironſtone, compact red ironſtone, pitch-ore, uran-ochre, quartz, hornſtone, indurated clay, rarely with olivine-ore, and black and yellow cobalt-ochre.

Geographic Situation.

Carrarach in Cornwall; Johanngeorgenſtadt, Eibenſtock, and Schneeberg in Saxony; Saſka in the Bannat; in the former Biſhopric of Cologne; alſo in France.

Obſervation.

It is not, like Mica, to which it has much reſemblance, elaſtic flexible.

THIRD SPECIES.

Uran-Ochre.

Uranocker.—*Werner.*

This ſpecies is divided into two ſubſpecies: 1. Friable Uran-Ochre. 2. Indurated Uran-Ochre.

FIRST

FIRST SUBSPECIES.

Friable Uran-Ochre.

Zerreiblicher Uranocker.—*Werner.*

External Characters.

Its colour is ſtraw-yellow, which paſſes ſometimes into ſulphur-yellow and lemon-yellow; ſometimes into yellowiſh-brown and orange-yellow, and ſometimes borders on aurora-red.

It occurs uſually as a coating or efflorescence on pitch-ore.

It is friable, and compoſed of dull, duſty, weakly ſoiling, and weakly-cohering particles.

Feels meagre, and is

Not particularly heavy.

Geognoſtic Situation.

Occurs always on pitch-ore.

SECOND SUBSPECIES.

Indurated Uran-Ore.

Feſte Uranocker.—*Werner.*

External Characters.

It has the ſame colours as the preceding ſubſpecies.

Occurs

Occurs maſſive and diſſeminated.

Internally it is dull, but in ſome varieties it paſſes into glimmering and gliſtening.

Fracture ſmall-grained uneven, which ſometimes paſſes into earthy, ſometimes into ſmall conchoidal.

Fragments indeterminately angular.

Is opaque.

Soft and very ſoft, ſometimes paſſing into ſemihard.

Is brittle.

Soils very little.

Specific gravity, 3.1500, *La Metherie*; 3.243[8], *Hauy*.

Chemical Characters.

According to *Klaproth*, the yellow varieties are pure oxide of uran, but the browniſh and reddiſh contain alſo a little iron.

Geognoſtic and Geographic Situations.

It occurs along with the other ores of uran.

It is found at Joachimſthal, and Gotteſgab in Bohemia; Johanngeorgenſtadt in Saxony; and alſo in France.

TWEN-

TWENTIETH GENUS.

SYLVAN GENUS.

FIRST SPECIES.

Native Sylvan.

Gediegen Sylvan.—*Werner.*

Tellure natif aurifere et ferrifere, *Hauy*, t. 4. p. 325.—Le Silvane natif, *Broch.* t. 2. p. 480.—Gediegen Tellur, *Reuſs*, 4. b. ſ. 604.

External Characters.

Its colour is intermediate between tin white and ſilver white, but more inclined to the firſt.

Occurs maſſive and diſſeminated; and, it is ſaid, alſo in

1. Four and ſix ſided priſms.
2. Very ſmall three-ſided pyramids.
3. In cubes; and,
4. In ſhort acicular cryſtals.

Internally it is ſhining, and its luſtre is metallic.

Fracture foliated: but the cleavage has not been aſcertained.

Occurs in ſmall and fine granular diſtinct concretions.

Is ſoft, approaching to ſemihard.

Not particularly brittle.

Eaſily frangible, and

Heavy.

Specific gravity, 5.723, *Müller*; 4.107, *the younger Jacquin*; 5.730, *Kirwan*; 6.115, *Klaproth*.

Chemical Characters.

Before the blow-pipe it melts as eaſily as lead, emits a thick white ſmoke, and burns with a light-green colour, and a ſharp diſagreeable odour. When expoſed to a low heat, it is converted into a yellow or blackiſh coloured oxide: by an increaſe of temperature, it melts into a dark-brown or blackiſh coloured glaſs, in which gold grains are interſperſed: at a ſtill higher heat, the oxide is entirely volatilized. In concentrated nitric acid, it is converted into a yellow oxide, and a ſmall portion is diſſolved, but which is precipitated in yellow flakes, on addition of water.

Conſtituent Parts.

Sylvan,	92.55
Iron,	7.20
Gold,	0.25

Geognoſtic Situation.

According to Eſmark, it occurs in veins that traverſe grey-wacke and tranſition limeſtone, and it is accompanied with iron-pyrites, blende, lead-glance, quartz, and lithomarge.

Geographic

Geographic Situation.

It has been hitherto only found at Facebay in Tranſilvania.

Obſervations.

1. It bears a very ſtriking reſemblance to Antimony, from which, however, it is well diſtinguiſhed by leſs ſpecific gravity, and its ſmaller granular diſtinct concretions.

2. It is known in older works on Mineralogy under the names *Aurum problematicum, paradoxum,* and White Gold-ore.

3. I uſe the name *Sylvan,* which was firſt given to this genus by Mr Kirwan, becauſe it is the name it firſt received, after it had been aſcertained to be a new metal, and as it is more expreſſive than the term *Tellurium* propoſed by Klaproth.

SECOND SPECIES.

Graphic Ore.

Schrifterz.—*Werner.*

Weiſs Golderz, *Wid.* ſ. 673.—Schrifterz, *Eſmark,* N. Bergm. Journ. t. 2. p. 10.—Or blanc d'Offenbanya, ou graphique, Aurum graphicum, *De Born.* t. 2. p. 470.—Schrifterz, *Emm.*

b. 3. f. 405.—Tellure natif graphique, *Hauy*, t. 4. p. 327. —Le Silvane graphique, *Broch.* t. 2. p. 482.—Schrifterz, *Reuſs*, 4. b. f. 608.

External Characters.

Colour light ſteel-grey.

Occurs maſſive ; and cryſtallized,

In broad ſix-ſided priſms, with two oppoſite broader and four oppoſite ſmaller lateral planes, of which two and two meet under an acute angle, and acutely accuminated on both extremities by four planes, which are ſet on the ſmaller lateral planes.

The cryſtals are ſmall, and very ſmall.

Sometimes the cryſtals are ſo reticulated that they have ſome reſemblance to the lines in writing.

The planes of the cryſtals are ſmooth.

Externally it is ſplendent, and its luſtre is metallic.

Internally it is gliſtening, and its luſtre is metallic.

Fracture fine-grained uneven.

Fragments indeterminately angular, ſharp-edged. When maſſive it ſhows a tendency to fine granular diſtinct concretions.

It is ſoft.

Brittle.

Sectile.

Heavy.

Heavy.

Specific gravity, 5.723, *Müller*.

Chemical Characters.

Before the blow-pipe it burns with a green flame, and is volatilized.

Conſtituent Parts.

Sylvan,	60
Gold,	30
Silver,	10
Klaproth,	100

Geognoſtic Situation.

It is ſaid to occur in veins in clay-porphyry, accompanied with iron-pyrites, grey or fahl copper ore, blende, and very ſeldom native gold.

Geographic Situation.

Has been hitherto only found at Offenbanya in Tranſilvania.

Uſe.

It is worked as an ore of gold.

Obſervation.

Its name is derived from the particular appearance formed by the aggregation of the capillary cryſtals.

THIRD

THIRD SPECIES.

Yellow Sylvan-Ore.

Weiſs Silvananerz.—*Werner.*

Var. de Nagyagerz, *Wid.* ſ. 671.—Or gris jaunâtre, *De Born.* t. 2. p. 464.—Var. de Nagyagerz, *Emm.* 2. b. ſ. 121.—Mine jaune de Nagyag, *Journ. de Min.* No. 38. p. 150.—Gelberz, *Karſt.* Tabell. ſ. 56.—Tellure natif aurifere et plombifere, *Hauy*, t. 4. p. 327.—Le Silvane blanc, *Broch.* t. 2. p. 484.—Gelberz, *Reuſs*, 4. b. ſ. 612.

External Characters.

Colour ſilver white, which inclines pretty ſtrongly to braſs-yellow, and ſometimes to grey.

Occurs diſſeminated (ſcarcely maſſive), and cryſtallized in very ſmall, rather broad four-ſided priſms.

The principal fracture is intermediate between ſplendent and ſhining; croſs-fracture gliſtening, and luſtre metallic. The principal fracture is foliated, the croſs-fracture is ſmall-grained uneven.

Soft.

Rather ſectile.

Uncommonly heavy.

Specific gravity, 10.678, *Müller.*

Chemical Characters.

In nitrous acid it diſſolves, and during the ſolution

lution much nitrous gas is evolved: the ſolution is graſs-green, and the precipitate formed by the addition of an alkaline carbonat, is pale-yellow.

Conſtituent Parts.

Sylvan,	44·75
Gold,	26.75
Lead,	19·5
Silver,	8.5
Sulphur,	0.5

Geognoſtic and Geographic Situations.

It occurs along with the following ſubſpecies; blende, grey copper or fahl ore, and copper-pyrites, with quartz, and brown-ſpar.

Has been hitherto found only at Nagyag in Tranſilvania.

Uſe.

As it contains a conſiderable portion of gold and ſilver, it is worked on account of both theſe metals.

Obſervation.

I give to this ſpecies the name *Yellow Sylvan-Ore*, as it is more correct and diſcriminative than *White Sylvan-Ore*.

FOURTH

FOURTH SPECIES.

Nagyker-Ore, or Black Sylvan-Ore.

Nagyagererz.—*Werner.*

Id. Wid. f. 671. — Qr gris lamelleux, *De Born.* t. 2. p. 463.— Blättererz, *Karſt.* Tabell. 56. — Nagyagererz, *Emm.* 2. b. f. 121.—Mine d'Or de Nagyag, *Lam.* t. 1. p. 110.—Tellure natif aurifere et plombifere, *Hauy*, t. 4. p. 327. — La Mine de Nagyag, ou le Silvane lamelleux, *Broch.* t. 2. p. 486.— Blättererz, *Reuſs*, 4. b. f. 615.

External Characters.

Its colour is intermediate between iron-black and blackiſh lead-grey.

Occurs maſſive, and in ſmall thin and longiſh ſix-ſided tables, which are uſually imbedded.

Externally ſplendent and luſtre metallic.

Internally ſhining.

Fracture foliated, with a ſingle cleavage, and the folia are curved.

Fragments tabular.

Occurs in coarſe and ſmall granular diſtinct concretions.

Soils a little.

Is very ſoft.

Is ſectile.

Splits eaſily.

In thin leaves it is common flexible.

Heavy,

Heavy, approaching to uncommonly heavy.

Specific gravity, 8.919, *Müller*; 6.157, *the younger Jacquin.*

Chemical Characters.

It melts very eafily before the blow-pipe; the fulphur and fylvan are foon volatilized, and a blackifh-brown coloured globule remains, which being melted with borax, an argentiferous gold grain appears; the flag which remains, tinges borax violet-blue. It diffolves with effervefcence in acids; the nitrico-muriatic acid extracts the gold from it.

Conftituent Parts.

Sylvan,	18.8
Lead,	24,8
Gold,	4.15
Silver,	0.25
Copper,	0.6
Sulphur,	1.4
Oxide of manganefe,	9.2
Quartz,	43.7

Klaproth.

Geognoftic and Geographic Situations.

It occurs in veins which are compofed of red manganefe ore, brown-fpar and quartz. It is ufually accompanied with lead-glance, iron-pyrites, native arfenic, black blende, plumofe antimony; feldom grey copper-ore, and red orpiment

It has been hitherto found only at Nagyag in Tranſilvania.

Uſe.

As it affords gold and ſilver, it is worked both as a gold and ſilver ore.

Obſervation.

I have denominated this ſpecies *Black Sylvan-Ore*, on account of its colour.

TWENTY-FIRST GENUS.

CHROME GENUS.

FIRST SPECIES.

Acicular or Needle Ore.

Nadelerz.—*Werner.*

External Characters.

Colour dark ſteel-grey, becoming readily tarniſhed yellow on the ſurface, which is very characteriſtic for this mineral.

It occurs in imbedded acicular cryſtals.

Internally it is ſhining, and its luſtre is metallic.

Fracture ſmall-grained uneven, which ſometimes approaches to conchoidal.

Is ſoft, approaching to ſemihard.

Not particularly brittle.

Heavy.

It is always accompanied with chrome-ochre, and ſometimes alſo with native gold.

It is found in Siberia.

SECOND SPECIES.

Chrome Ochre.

Chromocker.—*Werner.*

External Characters.

Its colour is verdigris-green, which paſſes thro' piſtachio-green into ſtraw-yellow.

Occurs maſſive, diſſeminated and in membranes.

Is dull.

Fracture ſometimes uneven, ſometimes fine earthy.

Is ſoft, and very ſoft.

Not particularly heavy.

It occurs along with acicular ore.

END OF THE SECOND VOLUME.

APPEN-

APPENDIX.

APPENDIX

APPENDIX I.

FOSSILS LATELY DESCRIBED BY *WERNER*, AND ADMITTED INTO HIS SYSTEM.

IN this Appendix, I include all the *New Species* deſcribed by WERNER ſince the publication of the Firſt Volume of this Work, and thoſe alſo which have come to my knowledge ſince the preſent volume was put to the preſs.

For the greater number of theſe I am indebted to an intelligent mineralogiſt Mr H. MEUDER of Freyberg.

ZIRCON GENUS.

To this genus *Werner* has added one new ſpecies, which is denominated

Cinnamon Stone.

Kanelſtein—*Werner*.

External Characters.

Colour yellowiſh-brown, which approaches to hyacinth-red, and orange-yellow.

Occurs ſeldom in angular pieces, oftener in ſplintery fragments.

Internally

Internally it is ſhining, and its luſtre is intermediate between reſinous and vitreous.

Fracture imperfect ſmall conchoidal.

Fragments indeterminately angular, pretty ſharp-edged.

It alternates from tranſparent to tranſlucent.

Is hard.

Not particularly heavy.

Geographic Situation.

It is found at Columbo in the iſland of Ceylon.

Obſervation.

It is known in Holland under the name *Kanelſtein*, which ſignifies Cinnamon Stone, probably from its reſemblance in colour to that ſpice.

FLINT GENUS.

To this genus *Werner* has made many additions, of which I ſhall now give deſcriptions in the order of the Syſtem.

Coccolite.

Kokkolith.—*Werner.*

Id. Journ. de Phyſ. an 8. t. 2. p. 242.—*Karſten*, Min. Tabell. f. 20.—*Hauy*, t. 4. p. 355.—*Id. Reuſs*, 1. b. f. 86.—*Id. Broch.* t. 2. p. 504.

External

External Characters.

Colour mountain-green, grafs-green, and olive-green.

Occurs maffive.

Internally it is fhining, and its luftre is vitreous.

Fracture foliated, with a fingle cleavage.

Fragments indeterminately angular.

Occurs in large, coarfe, and fmall granular diftinct concretions.

It is tranflucent.

Yields a grey or greyifh-white ftreak.

Hard, fcratches glafs, and gives a few fparks with fteel.

Not particularly heavy.

Specific gravity, 3.316, *Dandrada.*

Chemical Characters.

It is infufible without addition. With carbonat of foda it melts into an olive-green veficular flaggy-glafs, and with borax into a pale-yellow femitranfparent glafs.

Conftituent Parts.

Silica,	42
Alumina,	15
Calcareous earth,	13
Oxide of iron,	8
——— manganefe,	14
Water,	3

Abilgaard.

Geographic Situation.

In the Helleſta and Aſſebro iron-mines in Sudermannland, and Nerika in Sweden; Arendahl in Norway.

Obſervations.

1. Its name is derived from its diſtinct concretions.

2. It is placed by *Werner* in the Flint Genus immediately after Olivine and before Augite.

Piſtazite.

Piſtazit.—*Werner.*

Acanticone, Arandalite and Thallite of other mineralogiſts.

External Characters.

Its colour is dark and light piſtachio-green, which paſſes into olive-green and blackiſh-green.

Occurs maſſive; and cryſtallized,

1. In ſix-ſided priſms, in which the lateral edges are ſometimes truncated and ſometimes bevelled; and the terminal edges and angles truncated.
2. In very oblique four-ſided priſms, which have a reed-like aſpect; ſometimes they are acuminated by four planes, and ſometimes bevelled on the extremities, and the bevelling planes are ſet on the obtuſe lateral edges.
3. In acicular cryſtals.

The

The cryſtals are often very indiſtinct, and the ſix-ſided priſms have many truncations and bevelments on the lateral edges, terminal edges and angles, and are therefore difficult to aſcertain.

The cryſtals are deeply longitudinally ſtreaked; ſometimes promiſcuous, ſometimes ſcopiform and ſcalarwiſe aggregated.

Internally ſhining.

Fracture ſometimes foliated, ſometimes narrow, parallel, ſcopiform, and ſtellular diverging radiated.

Fragments ſometimes indeterminately angular, ſometimes wedge-ſhaped and ſplintery.

Occurs in coarſe granular diſtinct concretions.

Is tranſlucent, which, in the cryſtallized varieties, paſſes into tranſparent.

Is hard.

Eaſily frangible.

Not particularly heavy.

Geognoſtic and Geographic Situations.

It occurs in beds in primitive mountains, in Norway; Saxony; France; and Bavaria.

Obſervation.

This ſpecies will probably afterwards be arranged with Actynolite.

Ceylanite.

Zeilanit.—*Werner.*

Ceylanite, *La Metherie*, Journ. de Phyſ. 1793, p. 23.—Pleonaſte, *Hauy*, t. 3. p. 17.

External

External Characters.

Its colour is dark indigo-blue, which paſſes into bluiſh-black, but, when more nearly examined, appears greeniſh-black.

Occurs ſometimes in rolled pieces and angular pieces, and ſometimes alſo cryſtallized as follows:

1. Octahedron, either perfect or with truncated angles.
2. Garnet dodecahedron, and ſeveral of the intermediate figures between it and the octahedron.

External ſurface rough, and nearly dull.

Internally it is ſhining, paſſing into ſplendent, and its luſtre is reſinous.

Fracture perfect but flat conchoidal.

Fragments indeterminately angular, very ſharp-edged.

Tranſlucent on the edges.

Scratches quartz, but not ſo eaſily as ſpinelle.

Eaſily frangible.

Not particularly heavy, approaching to heavy.

Specific gravity, 3·7647–3·7931, *Hauy*.

Geographic Situation.

It is found in the iſland of Ceylon, in ſand, along with tourmaline and other foſſils.

Obſervation.

In the firſt volume, it is deſcribed as a variety of ſpinelle, from which, however, it differs in co-

lour,

lour, in having always a conchoidal fracture, in luſtre, hardneſs, and ſpecific gravity.

Euclaſe.

Euclas.—*Werner.*

Id. Hauy, t. 2. p. 531.—*Id. Lam.* t. 2. p. 254.—*Id. Broch.* t. 2. p. 508.

External Characters.

Its colour is mountain-green.

Occurs only cryſtallized; and, according to Karſtern, in unequiangular broad ſix-ſided priſms, in which the acuter edges are truncated, the moſt obtuſe bevelled, and acuminated by three planes; the angles above the bevelled edges are bevelled, and the terminal edges above the truncated lateral edges are truncated. Brochant gives the following deſcription of this complicated cryſtal:

"Oblique four-ſided priſm, but which is never perfect: each of its lateral edges are bevelled, and, beſides, the edges of the bevelment on the acuter edges are truncated. The termination of the priſm is very complicated: we may conſider it as principally formed by three acuminations of four planes each, which are ſet on each other, and correſpond to the lateral planes of the priſm; but theſe planes are modified by a ſuite of bevelments, which are placed on their obtuſe lateral edges: there is alſo a bevelment (with triangular planes) between theſe and the bevelment on the obtuſe lateral edges of the priſm; and, laſtly, a truncation

on

on each of the ſuperior edges of the truncations on the acute lateral edges of the priſm."

The cryſtals are longitudinally ſtreaked.

Externally and internally it is ſplendent, and its luſtre is vitreous.

The longitudinal fracture is foliated, with a twofold cleavage, of which the folia interſect each other obliquely; the croſs-fracture is conchoidal.

Fragments indeterminately angular.

It is duplicating tranſparent.

Is hard: it ſcratches quartz.

Very eaſily frangible.

Not particularly heavy.

Specific gravity, 3.0625, *Hauy*.

Chemical Characters.

Before the blow-pipe, it firſt loſes its tranſparency, and then melts into a white enamel.

Conſtituent Parts.

Silica,	35	to	36
Alumina,	18	to	19
Glucina,	14	to	15
Iron,	2	to	3
Loſs,	31	to	27
Vauquelin.	100		100

Geographic Situation.

It was brought from Peru by Dombey.

Obſervation.

It is a beautiful foſſil; but on account of its very

very eaſy frangibility, it cannot be uſed in jewellery.

Hyalite.

Hyälith.—*Werner.*

Hyalite, *Kirw.* vol. i. p. 296.—Müller Glas, or Lava Glaſs, of other Mineralogiſts.

External Characters.

Colour yellowiſh and greyiſh white.

Occurs in thin cruſts on other minerals, and in ſmall reniform and ſmall botryoidal external ſhapes, which are very much cracked.

Externally and internally it is ſhining, and its luſtre is vitreous.

Fracture ſmall and flat conchoidal.

Fragments indeterminately angular, ſharp-edged.

Tranſlucent, paſſing into ſemitranſparent.

Is intermediate between ſemihard and hard.

Is brittle.

Very eaſily frangible.

Not particularly heavy, paſſing into light.

Geognoſtic and Geographic Situations.

It occurs on wacke, and principally at Frankfort on the Mayn.

Obſervation.

It has much reſemblance to Gum, and is very nearly allied to Opal.

Menilite.

Menilite.

Menilit.—*Werner.*

External Characters.

Its colour is chefnut-brown, (falling into grey), which inclines flightly to liver-brown: externally it is marked with narrow ftripes of reddifh-brown and pearl-grey, which alternate with each other.

It occurs in tuberofe imbedded maffes, whofe furface is fmooth and ribbed, and fometimes covered with a white cruft.

Internally gliftening.

Fracture fometimes perfect but flat conchoidal, fometimes pretty coarfe fplintery.

Fragments indeterminately angular, fharp-edged.

Occurs in flattened, large and fmall longifh granular diftinct concretions: the furface of the concretions is dull, and fometimes covered with a white cruft.

Strongly tranflucent on the edges, paffing into tranflucent.

Semihard, approaching to hard.

Eafily frangible.

Brittle, and

Not particularly heavy, approaching to light.

Conftituent Parts.

Silica,	85.50
Alumina,	1
Oxide of iron,	0.50
Calcareous earth,	0.50
Water and carbonaceous matter,	11
Klaproth.	98.50

Geognoftic

Geognoſtic and Geographic Situations.

It occurs imbedded in a particular ſpecies of rock, called *Adheſive Slate*, at Menil Montagne near Paris.

Obſervation.

It is well diſtinguiſhed from its congenerous ſpecies by its external ſhape, colour, luſtre, and weight.

Egyptian Jaſper.

Egyptiſcher Jaſpis.—*Werner.*

Werner now divides this ſubſpecies into two *kinds*. *a*. Brown. *b*. Red.

FIRST KIND.

Brown Egyptian Jaſper.

Brauner Egyptiſcher Jaſpis.—*Werner.*

External Characters.

Colour cheſnut-brown, ſometimes alſo yellowiſh-brown, cream-yellow and yellowiſh-grey. It is characteriſtic for this foſſil, that the interior or centre has a yellowiſh grey colour, which often paſſes into cream-yellow, but towards the exterior its colour becomes yellowiſh-brown and cheſnut-brown.

The brown colour forms concentric circular delineations, and between theſe it is ſpotted with black, and between the ſpots are ſmall arboreſcent delineations of the ſame colour.

Occurs in rolled pieces, which are moſtly ſpherical, and their ſurface is intermediate between uneven and rough.

Externally it is gliſtening, approaching to glimmering; internally it is gliſtening.

Fracture pretty perfect conchoidal.

Fragments indeterminately angular, ſharp-edged.

Tranſlucent on the edges.

Hard.

Pretty eaſily frangible.

Not particularly heavy.

Specific gravity, from 2.600 to 2.564.

Geognoſtic and Geographic Situations.

It probably occurs in a brown ferruginous ochrey maſs.

It is found at Grand Cairo in Egypt. A jaſper, which may be conſidered as a variety of the Egyptian, is found in an iron-mine at Stetingen in Auſtria.

Obſervation.

It ſometimes paſſes into flint.

SECOND KIND.

Red Egyptian Jaſper.

Rother Egyptiſcher Jaſpis.—*Werner.*

External Characters.

Its colour is intermediate between blood-red and ſcarlet-

ſcarlet-red; on the ſurface it is often ochre-yellow, alſo ſmoke and bluiſh grey. Theſe colours form ring-ſhaped delineations, which are conformable with the external ſurface.

Occurs in ſimilar external ſhapes as the brown kind.

Internally gliſtening or dull.

Fracture large conchoidal.

Fragments indeterminately angular, ſharp-edged.

It is ſeldom tranſlucent on the edges, uſually opaque.

Hard.

In other characters it agrees with the preceding kind.

Geognoſtic and Geographic Situations.

It occurs in a bed of red clay ironſtone, to which it alſo owes its colour. It has been hitherto found only in the electorate of Baden.

Lomonite.

Lomonit.—*Werner.*

Zeolithe efflorescente, *Hauy*, t. 4. p. 410.

External Characters.

Colour ſnow-white, with a ſlight tendency to reddiſh-white.

Occurs maſſive.

The fracture is foliated, and the ſurface of the folia

folia are ſtreaked, which gives a peculiar glimmering aſpect to the ſurface of the foſſil.

It is ſhining, and its luſtre is pearly.

It conſiſts of coarſe and ſmall longiſh granular diſtinct concretions.

Is tranſlucent in a ſlight degree.

Is very ſoft.

Sectile.

Eaſily frangible; and

Not particularly heavy, approaching to light.

When preſerved from the air, it has a ſlight degree of coherence; but if we expoſe it to the action of that fluid, the folia ſpontaneouſly ſeparate from each other, and it is ſoon reduced to a heap of unconnected parts. *Hauy* compares it to the detritus of cryſtals of ſelenite, which have been heated and afterwards broke in pieces by the blow of a hard body.

Chemical Character.

It forms a jelly with acids.

Geographic Situation.

It was found, towards the end of the year 1785, by Mr Gillet Laumont, in the lead-mines of Huelgoët in Lower Brittany.

Obſervation.

Werner named it *Lomonite*, in honour of the diſcoverer.

Natrolite.

Natrolite.

Natrolit.—*Werner.*

External Characters.

Colour yellowiſh-white, cream-yellow which inclines to ochre-yellow, and light yellowiſh-brown. Theſe colours form ſtriped delineations, which are curved in the direction of the external ſurface.

Occurs maſſive and reniform.

Its ſurface is druſy, owing to its being covered by very ſmall, apparently rhomboidal cryſtals.

Internally glimmering.

Fracture delicate, ſtraight and ſcopiform diverging fibrous.

Occurs in large, coarſe and ſmall granular diſtinct concretions. When the concretions have free extremities, thoſe extremities are rounded conformable with the reniform external ſhape, and the fibres of each concretion iſſue from one point.

It is ſemihard in a high degree: it is harder than cubizite.

Is tranſlucent on the edges.

Eaſily frangible; and

Not particularly heavy.

Chemical Characters.

Before the blow-pipe, on charcoal, it fuſes quickly into a tranſparent glaſs, full of ſmall air-bubbles.

Conſtituent

Conſtituent Parts.

Silica,	48
Alumina,	24.25
Oxide of iron,	1.75
Soda,	16.50
Water,	9
	99.50

Geographic and Geognoſtic Situations.

According to *Werner*, it is found in a variety of wacke; but *Klaproth* obſerved it moſt frequently in porphyry-ſlate. It has been hitherto found only in the mountains of Hohentwiel, Hohenkrähen and Magdeberg in Swabia, where it borders on Switzerland.

Obſervations.

It was firſt deſcribed and analyzed by *Klaproth*, who gave it the name *Natrolit*, on account of the great quantity of natron which he found it to contain.

Azurite.

Lazulith.—*Werner.*

External Characters.

Colour light indigo-blue, which is intermediate between ſmalt-blue and indigo-blue.

Occurs diſſeminated, ſeldom maſſive, and in imbedded cryſtals, that appear to be rectangular four-ſided priſms.

The

The cryſtals are ſmall and very ſmall, and are very indiſtinct.

It is gliſtening and ſhining; the latter only on the foliated fracture.

Longitudinal fracture imperfect foliated, croſs-fracture uneven.

Fragments indeterminately angular.

Is tranſlucent on the edges.

Is ſoft?

Not particularly heavy.

Chemical Characters.

It is infuſible without addition, only it loſes its colour, and becomes earthy and grey. With borax it yields a yellow-coloured glaſs. It is very freely acted on by acids. *Klaproth.*

Conſtituent Parts.

Klaproth found it to be compoſed of ſilica, alumina, and oxide of iron. It neither contains copper, nor is it, as had been ſuſpected, native Pruſſian blue.

Geognoſtic Situation.

It is found in mica-ſlate, but its repoſitory has not been accurately aſcertained.

Geographic Situation.

It occurs at Vorau in Stiria, but the moſt beautiful ſpecimens are found in the biſhopric of Salzburg.

Obſervations.

Obſervations.

It is diſtinguiſhed from Azureſtone, that although it occurs in quartz, it is never accompanied with iron-pyrites: beſides this, azureſtone has a dark colour, foliated fracture, ſcarcely occurs cryſtallized, and is ſemihard in a high degree.

Andaluſite, or Hardſpar.

Andaluſit auch Hartſpath.—*Werner.*

External Characters.

Colour fleſh-red, which ſometimes approaches to roſe-red.

Occurs maſſive, and cryſtallized in rectangular four-ſided priſms.

Fracture imperfect foliated: *Werner* has not aſcertained its cleavage, and the obſervations of *Hauy* are ſtill not ſufficiently preciſe.

Fragments indeterminately angular.

It is tranſlucent.

Hard in a high degree: According to *Hauy*, ſcratches quartz, and ſometimes even ſpinelle.

Eaſily frangible; and

Not particularly heavy, but heavier than felſpar.

Specific gravity, 3.165, *Hauy.*

Chemical Character.

It is infuſible, without addition, before the blow-pipe.

Geognoſtic

Geognoſtic and Geographic Situations.

It is found in Spain and France in primitive mountains, along with quartz and mica; and alſo, although rarely, in mica-ſlate at Braunſdorf near Freyberg in Saxony.

Obſervations.

It is diſtinguiſhed from Felſpar by its greater hardneſs, and higher ſpecific gravity, and from Corundum by its inferior ſpecific gravity and its form.

Hollow-Spar or Chiaſtolite.

Hohlſpath.—*Werner.*

Macle baſaltique, ou Shorl en Priſmes quadrangulaires rhomboidaux, *Romé de Liſle*, t. 2. p. 440. — Crucite, *Lam.* t. 2. p. 292.—Chiaſtolith, *Karſten.* Tabell. p. 28. and 73.—Macle, *Hauy*, t. 3. p. 267.—*Id. Broch.* t. 2. p. 514.

External Characters.

Colour greyiſh, yellowiſh, and reddiſh-white, which paſſes on the one ſide into pale greeniſh-grey, on the other into fleſh-red.

It has been hitherto found only cryſtallized, and that in nearly rectangular four-ſided priſms.

The cryſtals, when viewed on their extremities, appear to be compoſed of four parts, which have in their centre a priſmatic ſpace, the ſides of which are parallel with thoſe of the lateral planes of the priſm. From this central ſpace, four lines run to the angles of the priſm, and in each angle there is commonly a more or leſs perfect rhomboidal

boidal empty ſpace. Theſe ſpaces are uſually filled with blackiſh-coloured clay-ſlate.

The cryſtals are ſometimes middle-ſized, ſometimes ſmall and acicular, and frequently interſect each other.

Fracture foliated with a double cleavage, and the folia are parallel with the lateral planes.

It is tranſlucent, but opaque when it is decompoſed, which is often the caſe.

The larger cryſtals are hard; the ſmaller, on the contrary, are ſofter, and of the nature of felſpar.

Not particularly heavy.

Specific gravity, 2.9444.

Chemical Characters.

Before the blow-pipe it is converted into a whitiſh ſcoria; the clay-ſlate which fills up the ſpaces, yields a black glaſs.

Geognoſtic Situation.

It has been hitherto found embedded only in clay-ſlate.

Geographic Situation.

Is found in that part of the Fichtelgebirge that belongs to Baireuth; in Brittany in France, where the largeſt cryſtals occur; and near to St Jacques de Compoſtella in Spain *.

Obſervations.

* Mr Davy informed me he obſerved it in clay-ſlate in the mountains of Cumberland.

Obſervations.

1. According to *Werner*, the colour, cryſtallization, fracture, and eaſy weathering of this mineral, are proofs that it is only a ſubſpecies of felſpar, and that it cannot be viewed as a diſtinct ſpecies.

2. The French mineralogiſts deſcribe it as a particular ſpecies under the name *Macle ;* and *Karſten*, on account of the reſemblance of its ſurface to the Greek letter χ, has denominated it *Chiaſtolith*. *Werner's* name is derived from the hollow ſpaces by which it is ſo well characterized.

3. It is placed in the ſyſtem as a Subſpecies of Felſpar, immediately after Common Felſpar, and before Compact Felſpar.

Scapolite.

Scapolith.—*Werner.*

Id. Dandrada, Journ. de Phyſ. an 8. t. 2. p. 246.—*Id. Hauy*, t. 4. p. 393.—*Id. Broch.* t. 2. p. 526.—*Id. Reuſs*, 2. b. ſ. 483.

External Characters.

Colour greyiſh-white, yellowiſh-white, and greeniſh-white, which ſometimes paſſes into greeniſh-grey.

Occurs maſſive, but moſt commonly cryſtallized in long, thin, often acicular, rather oblique four-ſided priſms, in which the lateral edges are ſometimes truncated.

The cryſtals are ſlightly longitudinally ſtreaked, and aggregated into thick faſciculi, which are again grown together.

Externally

Externally it is gliſtening; internally it is ſhining and gliſtening, and its luſtre is intermediate between reſinous and pearly.

It appears to have an imperfect foliated longitudinal fracture; but its croſs-fracture is ſmall and fine-grained uneven.

Fragments indeterminately angular.

It is more or leſs tranſlucent.

Is intermediate between ſemihard and hard.

Is brittle.

Eaſily frangible; and

Not particularly heavy, approaching to heavy.

Specific gravity, 3.68 to 3.70, *Dandrada.*

Chemical Character.

Before the blow-pipe it intumeſces, and melts into ſhining white enamel. *Dandrada.*

Geographic Situation.

It has been hitherto found only in ironſtone mines near to Arendal in Norway. Its cryſtals are ſometimes mixed with mica, calc-ſpar, and felſpar.

Arctizite or Wernerite.

Arktizit.—*Werner.*

Wernerite, Journ. de Phyſ. an 8. t. 2. p. 244. — *Id. Hauy*, t. 3. p. 119.—*Id. Broch.* t. 2. p. 529.

External Characters.

Its colour is greeniſh-grey, but the ſurface of the

the cryſtals is intermediate between ſky-blue and ſeladon-green.

Occurs maſſive; and cryſtallized, in low equiangular eight-ſided priſms, which are flatly acuminated by four planes, which are ſet conformably-wiſe on the alternate lateral planes.

The cryſtals are middle-ſized, inclining to ſmall, and their planes are ſmooth.

Internally it is gliſtening, inclining to ſhining, and its luſtre is pearly, inclining to reſinous.

Fracture foliated, but of a very particular kind, to which *Werner* has given the name *tore foliated*; in all caſes a twofold cleavage is to be obſerved.

Fragments indeterminately angular, not particularly ſharp-edged.

Is tranſlucent.

Hard; it ſcratches glaſs, but is ſcratched by felſpar.

Not particularly heavy, approaching to heavy.

Specific gravity, 3.6063, *Dandrada.*

Chemical Character.

Before the blow-pipe it intumeſces, and melts eaſily into an imperfect white and opaque enamel.

Geographic Situation.

It is found in the mines of Nortſto and Ulrica in Sweden; at Bouoen near Arendal in Norway; it is ſaid alſo to have been found at Campo-Longo in Switzerland.

Obſervations.

Obſervations.

1. *Werner* gave it its preſent name from its occurring in arctic countries.

2. It was diſcovered and deſcribed by *Dandrada*, a pupil of Werner, who gave it the name *Wernerite*, in honour of his illuſtrious maſter.

CLAY GENUS.

Adheſive Slate.

Klebſchiefer.—*Werner.*

Polier Schiefer, *Eſtner*, 2. b. ſ. 635.—*Id. Emm.* 3. b. ſ. 334.—*Id. Klap.* 2. b. ſ. 170.—Le Schiſte à polir, ou le Polierſchiefer, *Broch.* t. 1. p. 376.—Schiſte à polir, *Hauy*, t. 4. p. 449.

External Characters.

Its colour is light yellowiſh-grey, which inclines to greeniſh.

Occurs maſſive.

Internally it is dull.

Fracture in the large ſlaty, in the ſmall fine earthy.

Fragments ſlaty.

Is opaque.

Its ſtreak is ſhining.

Is ſectile.

Very ſoft.

Eaſily frangible.

Exfoliates eaſily.

Adheres

Adheres ſtrongly to the tongue.
Is light, paſſing to ſwimming.
Specific gravity, 2080, *Klaproth.*

Chemical Characters.

When plunged into water, it abſorbs it with avidity; and bubbles of air are ſeparated with an audible noiſe. Pulverized and calcined, it loſes 19 in the 100 parts of its weight. In a furnace it paſſes into a greyiſh-black and yellowiſh coloured porous ſcoria.

Conſtituent Parts.

Silica,	66.50
Alumina,	7
Magneſia,	1.50
Lime,	1.25
Oxide of iron,	2.50
Water,	19
Klaproth.	97.75

Geognoſtic Situation.

It occurs in beds, but the formation to which it belongs remains ſtill undetermined.

Geographic Situation.

It is found at Menil Montagne near Paris.

Obſervations.

1. It is named *Adheſive Slate*, on account of its ſtrong adheſive property, and its flaty fracture.

2. It

2. It is described by Klaproth, Eftner, Emmerling and Brochant, under the name *Polier Slate*, a name which belongs to a very different foffil, and of which I have given a defcription in the firft volume of this work, p. 315.

Floatftone.

Schwimmftein.—*Werner.*

External Characters.

Its colour is light yellowifh-grey, which inclines to yellowifh and greyifh-white.

It occurs tuberofe, and is internally porous.

Is dull.

Fracture earthy.

Fragments indeterminately angular and blunt-edged.

Is very foft.

Rather brittle.

Feels rough, and emits a creaking found.

Is very light, paffing into floating.

Geographic Situation.

Has been hitherto found only at St Omer near Paris.

Pinite.

Pinet.—*Werner.*

Micarelle, *Kirw.* vol. i. p. 212.—La Pinite, *Broch.* t. 1. p. 456.

External

External Characters.

Its colour is blackiſh-grey, which is, however, often covered, on the ſurface and in rents, with iron-ochre.

Occurs ſeldom maſſive; almoſt always cryſtallized, and that in ſix-ſided priſms with truncated lateral edges and angles; ſometimes the truncating edges are ſo numerous that the cryſtal acquires a roundiſh aſpect.

The cryſtals are ſometimes middle-ſized, ſometimes ſmall, and frequently interſect each other.

The planes of the cryſtals are pretty ſmooth.

The external luſtre is accidental; internally it is gliſtening, and its luſtre is reſinous.

Its longitudinal fracture is ſmall-grained uneven; the croſs-fracture, on the contrary, is imperfect foliated.

Fragments indeterminately angular, ſometimes blunt-edged.

Slightly tranſlucent on the edges.

Soft, paſſing into very ſoft.

Sectile.

Eaſily frangible; and

Not particularly heavy.

Specific gravity, 2.980, *Kirwan.*

Chemical Characters.

It experiences no alteration before the blow-pipe, either alone or with addition of borax. With carbonat

carbonat of ſoda it forms an opaque ſcoriaceous globule; and with microcoſmic ſalt, a tranſparent opaleſcent glaſs.

Conſtituent Parts.

Alumina,	63.75
Silica,	29.50
Oxide of iron,	6.75
Klaproth,	100

Geographic Situation.

Has been hitherto found only in the mine level, called Pini, at Schneeberg in Saxony.

Obſervations.

1. Its name is derived from the name of the mine gallery where it is found.

2. It is uſually accompanied with quartz, felſpar, and mica.

Umber.

Umber.—*Werner.*

External Characters.

Its colour is intermediate between liver-brown and dark yellowiſh-brown.

Occurs maſſive.

Fracture large conchoidal.

Fragments more or leſs blunt-edged.

Is very ſoft.

Adheres a little to the tongue.

Feels

Feels meagre, and is
Light.

Geographic Situation.

It occurs in beds in the iſland of Cyprus.

TALC GENUS.

Sahlite.

Sahlit.—*Werner.*

External Characters.

Colour light greeniſh-grey.

Occurs maſſive.

Internally it is ſhining and ſplendent.

Its principal fracture is foliated, with a three-fold cleavage, of which one of the cleavages is perfect, and two rather imperfect; and they interſect each other obliquely.

Fragments frequently rhomboidal.

Conſiſts of very coarſe granular diſtinct concretions.

Is tranſlucent on the edges.

Semihard, approaching to ſoft?

Is brittle.

Eaſily frangible; and

Not particularly heavy.

Specific gravity, 3.2368, *Dandrana.*

Geographic

Geographic Situation.

It is found at Sahlberg (hence its name) in Weſtermannland in Sweden.

CALC GENUS.

Phoſphorite.

Phoſphorit.—*Werner.*

External Characters.

Colour yellowiſh-white, and is often ſpotted yellowiſh-grey.

Occurs maſſive.

Internally it is ſometimes gliſtening, ſometimes dull.

Fracture imperfect and curved foliated, which inclines to floriform foliated, and in ſome varieties paſſes into coarſe earthy.

Fragments indeterminately angular, pretty blunt-edged.

Has a tendency to thick and curved lamellar diſtinct concretions.

Is tranſlucent on the edges.

Soft, approaching to ſemihard.

Brittle; and

Not particularly heavy, approaching to heavy.

Geographic Situation.

It forms a great bed in the province of Eſtremadura in Spain.

Obſervation.

Obſervation.

It has much reſemblance to Curved Lamellar Heavy-Spar, but it is harder, and lighter than this kind of heavy-ſpar.

Anhydrite.

Anhydrit.—*Werner.*

Çhaux ſulphatée anhydre, *Hauy*, t. 4. p. 348.

External Characters.

Colour ſmalt-blue, which paſſes into milk-white.

Occurs maſſive.

Fracture imperfect and curved foliated, which in ſome places paſſes into radiated; and it is beſides coarſe and fine ſplintery.

It is ſhining, paſſing into gliſtening, and its luſtre is pearly.

Fragments indeterminately angular, ſharp-edged.

Shews a tendency to ſmall and fine granular diſtinct concretions.

Is ſoft.

Not particularly brittle.

Not very difficultly frangible; and

Not particularly heavy, but heavier than calc-ſpar.

Geographic Situation.

It is found at Salz on the Neckar, in the dutchy of Wurtemberg.

Obſervation.

Observation.

It differs from cube-ſpar in colour, fracture, ſhape of fragments, and in having a higher ſpecific gravity.

HALLITE GENUS.

Cryolite.

Kryolit.—*Werner.*

Id. Journ. de Phyſ. an 8. t. 2. p. 245. *Id. Karſt.* Tabell. ſ. 28. & 72.—Alumine fluatée alkaline, *Hauy*, t. 2. p. 398. —Cryolithe, *Broch.* t. 2. p. 505.

External Characters.

Colour greyiſh-white.

Occurs maſſive.

Internally gliſtening, and luſtre vitreous?

Fracture imperfect foliated, with a rectangular threefold cleavage.

Fragments cubical, but more frequently tabular.

Has a tendency to ſtraight lamellar diſtinct concretions.

Is tranſlucent.

Soft; is ſcratched by fluor-ſpar.

Brittle; and

Not particularly heavy.

Specific gravity, 2.949, *Hauy*; 2.957, *Karſten.*

Chemical

Chemical Characters.

Melts extremely eafily before the blow-pipe: it afterwards hardens, and then changes into a ſcoria, which has a ſlight degree of cauſticity. It diſſolves in the ſulphuric acid with effervescence, and diſengages white vapours that corrode glaſs.

Conſtituent Parts.

Fluoric acid and water,	40.5		47
Soda,	36.		32
Alumina,	23.5		21
	Klaproth. 100	*Vauquelin.*	100

Geographic Situation.

Has been hitherto found only in Greenland.

Obſervation.

The generic name *Hallite*, which is formed from the Greek word ἅλς, *ſalt*, intimates that the foſſils comprehended under it bear a ſtriking reſemblance to foſſil-ſalts.

II.

MISCELLANEOUS APPENDIX.

IN this Appendix, I include deſcriptions of ſuch foſſils as have not hitherto been noticed by WERNER; and of others, which although admitted into his Syſtem, have not been publicly deſcribed by him.

EARTHY FOSSILS.

Foliated Prehnite?

Blättricher Prehnite.—*Werner.*

Koupholite, *Hauy*, t. 4. p. 373.—*Id. Broch.* t. 2. p. 513.

External Characters.

Its colour is yellowiſh-white, and it occurs in ſmall tranſlucent folia, which are gliſtening, and have a pearly luſtre; they are grouped together, and appear to have a tendency to the rhomboidal form.

Chemical Characters.

It melts before the blow-pipe, with intumeſcence and phoſphoreſcence, into a ſpongy enamel. Nitrous acid has no action on it, either concentrated or when diluted with water.

Geognoſtic and Geographic Situations.

Mr Gillet Laumont firſt diſcovered this foſſil near Barreges in a vein of calc-ſpar. It has ſince been diſcovered by Mr Picot Lapeyrouſe on the Pic d'Erdlitz, in a chlorite rock, accompanied with actynolite.

Obſervation.

I ſuſpect, from the preceding deſcription, which is extracted from *Hauy's* Mineralogy, that this foſſil is the Foliated Prehnite of *Werner*.

Schmelzſtein.—*Werner.*

Dipyre, *Hauy*, t. 3. p. 242.—Leucolite de Mauleon, *Lam.* t. 2. p. 275.—Dipyre, *Broch.* t. 2. p. 508.

External Characters.

Colour greyiſh white, and reddiſh white, which paſſes into pale roſe red.

Occurs diſſeminated in ſmall faſcicular maſſes, or in ſmall priſmatic cryſtals.

It is ſhining, and its luſtre is vitreous.

Its longitudinal fracture is foliated, and the folia, according to Hauy, are parallel with the planes of the regular hexahedron.

It is ſemihard.

Eaſily frangible.

Specific gravity, 2.630, *Hauy.*

Chemical Character.

It intumeſces before the blow-pipe.

Conſtituent

Conſtituent Parts.

Silica,	60
Alumina,	24
Calcareous earth,	10
Water,	2
Loſs,	4
Vauquelin.	100

Geographic Situation.

It has been hitherto found only near to Mauleon in the Pyrenees, where it is imbedded in ſteatite.

Spodumene.

Spodumen.—*Werner.*

Spodumene, *Dandrada*, Journ. de Phyſ. an 8. t. 2. p. 240.—Triphane, *Hauy*, t. 4. p. 407.—*Id. Broch.* t. 2. p. 528.

External Characters.

Colour greeniſh-white, which paſſes into apple-green.

It occurs in ſmall maſſes, that preſent the appearance of cryſtallization.

It is ſhining, and its luſtre is pearly.

Fracture is radiated, and the radia have a three-fold cleavage, and all the folia are parallel to the axis.

It is ſemihard, paſſing to hard.

Brittle.

Tranſlucent on the edges.

Heavy

Heävy in a middling degree.
Specific gravity, 3.192, *Hauy*; 3.218, *Dandrada.*

Chemical Characters.

Before the blow-pipe it ſplits into ſmall yellowiſh folia, and at laſt melts into a greyiſh-white tranſparent glaſs.

Geographic Situation.

Has been hitherto found only in the mines of Uton, near to Dalero, in Sweden. It is uſually accompanied with quartz and black-mica.

Obſervation.

Werner places it in the ſyſtem immediately after Arcticite.

Meionite.

Meionite.—*Hauy.*

Hauy, t. 2. p. 586.—Hyacinth blanche de Somma, *Romé de Liſle*, t. 2. p. 290.—Hyacinthine, *La Metherie*, t. 2. p. 326. Meionite, *Broch.* t. 2. p. 519.

External Characters.

Its colour is greyiſh-white.

Occurs cryſtallized in rectangular four-ſided priſms, in which the lateral edges are truncated, (thus forming an eight-ſided priſm): and it is obtuſely acuminated on both extremities by four planes, which are ſet on the lateral edges. Sometimes

times the edges of the truncatures are truncated, and thus a ſix-ſided priſm is formed. The edges ſituated between the acuminating and lateral planes are alſo ſometimes truncated.

The cryſtals are ſmall, and adhere together.

It is ſhining, and its luſtre is vitreous.

The longitudinal fracture is foliated, and the folia are parallel with the four ſides of the priſm; the croſs-fracture is ſlightly conchoidal.

It is faintly tranſlucent, but is traverſed by fiſſures.

Is ſemihard; ſcratches glaſs.

Chemical Characters.

It melts very eaſily before the blow-pipe, and yields a ſpongy white glaſs.

Geognoſtic and Geographic Situations.

It is found at Monte Somma in the vicinity of Veſuvius, adhering to fragments of granular limeſtone.

Sommite.

Id. Lam. t. 2. p. 271.—Schorl blanc volcanique *of Ferber, and other Mineralogiſts.*—Nepheline, *Hauy*, t. 3. p. 186.

External Characters.

Its colour is greyiſh-white.

It occurs diſſeminated, or cryſtallized in ſix-ſided priſms, which are uſually perfect, more rarely truncated on the lateral edges.

The

The lateral edges are ſmooth and ſhining, and have a vitreous luſtre.

The longitudinal fracture is foliated, parallel with the faces of the priſm; the croſs-fracture is conchoidal.

Is tranſlucent, and more rarely ſemitranſparent.

Eaſily frangible.

Semihard.

Specific gravity, 3.2474, *Hauy.*

Chemical Characters.

Before the blow-pipe it melts with ſome difficulty into a compact glaſs. Nitrous acid does not diſſolve it, but it becomes opaque and cloudy.

Conſtituent Parts.

Silica,	46
Alumina,	9
Lime,	2
Oxide of iron,	1
Loſs,	2
Vauquelin.	100

Geognoſtic and Geographic Situations.

It lines the cavities of certain rocks, (by ſome called lavas), of which the Monte Somma is compoſed.

Glaſſy Felſpar.

Glaſiger Feldſpath.—*Karſten.*

External Characters.

Its colour is uſually aſh-grey and yellowiſh-grey:

grey: from the firſt it paſſes into greyiſh-white, from the latter into yellowiſh-white.

Occurs cryſtallized in the following figures:

1. Longiſh ſix-ſided tables.
2. Oblique four-ſided priſms, which are ſometimes bevelled on the extremities.

The cryſtals are middle-ſized, and ſmall, ſeldom very ſmall.

The external ſurface is ſometimes longitudinally ſtreaked, and gliſtening, or glimmering.

Internally it is ſhining and ſplendent, and its luſtre is vitreous, which in ſome varieties approaches to pearly.

The principal fracture is ſtraight and perfect foliated, with a double rectangular cleavage; the croſs-fracture is fine-grained uneven, and from this it paſſes into ſplintery, and ſeldom into ſmall conchoidal.

The fragments are rhomboidal, and only ſpecular on four ſides.

It is tranſlucent and ſemitranſparent.

Hard.

Brittle.

Eaſily frangible, and

Not particularly heavy.

Specific gravity, 2.518.—2.589.

Chemical Characters.

In a charcoal crucible, it is converted into a greyiſh-white, almoſt tranſparent veſicular glaſs; in

in a clay crucible into a ſemitranſparent, grey-coloured foamy glaſs.

Geognoſtic Situation.

It occurs imbedded in porphyry ſlate.

Geographic Situation.

It is found in Bohemia; at Drachenfels near Bonn on the Rhine; and Solfatara in Italy.

Obſervation.

1. It has its name from its glaſſy or vitreous luſtre.

2. *Werner* ſuſpects that Meionite, Sommite, and Glaſſy Felſpar, ought to be conſidered as forming but one ſpecies. He will probably arrange them in his ſyſtem under the name *Glaſſy Felſpar*.

Spinthere.

Hauy, t. 4. p. 398.

External Characters.

Its colour is greeniſh.

Occurs cryſtallized in very irregular double four-ſided pyramids, which are obliquely truncated.

The cryſtals are ſmall, and at firſt ſight have a conſiderable reſemblance to green cryſtals of axinite, and they are ſplendent.

Fracture foliated.

Hard

Hard in a low degree; and
Slightly tranſlucent on the edges.

Chemical Characters.

It melts very eaſily before the blow-pipe.

Geographic Situation.

It was firſt deſcribed by *Hauy*, who found it adhering to cryſtals of calc-ſpar from Dauphiny.

METALLIC FOSSILS.

Pitchy Iron-Ore.

Eiſen-Pecherz.—*Werner.*

Fer phoſphite, *Journ. de Mines*, No. 64. p. 295.—*Id. Broch.* t. 2. p. 533.

External Characters.

Its colour is very deep reddiſh-brown, which ſometimes paſſes into black.

Occurs maſſive.

Its ſurface rough, owing to a covering of iron-ochre.

Internally it is gliſtening, and its luſtre is ſemimetallic, paſſing to reſinous.

The fracture is compact, and ſometimes foliated.

Is opaque.

Semihard.

Rather difficultly frangible.

Brittle.

Specific gravity, 3.956.

Chemical Characters.

Melts very eaſily into a black enamel before the blow-pipe.

Conſtituent Parts.

Phoſphoric acid,	0.27
Oxide of iron,	0.31
Oxide of manganeſe,	0.42

Geographic Situation.

Is found at Limoges in France.

Chromate of Iron.

This has been deſcribed as a new ſpecies of iron-ore by *Hauy* and *Brochant*. Its external characters are however ſo nearly allied to thoſe of Magnetic Ironſtone, that we may probably conſider it but as a ſubſpecies, or kind of that ſpecies.

Gadolinite.

Gadolinit.—*Werner.*

Id. Chem. Annal. 1796. — *Id. Hauy*, t. 3. ſ. 141. — *Id. Broch.* t. 2. p. 512.

External Characters.

Colour velvet-black, which ſometimes paſſes into browniſh-black.

Occurs maſſive.

It is ſhining, and its luſtre is vitreous.

Fracture conchoidal.

Is hard, ſcratches quartz ſlightly.

Opaque.

Brittle.

Brittle.
Eafily frangible.
Heavy.
Specific gravity, 4.0497, *Hauy.*
It attracts the magnetic needle.

Chemical Characters.

When pulverized and heated with diluted nitric acid, it is converted into a yellowiſh-grey thick jelly. Before the blowpipe, it decrepitates, aſſumes a reddiſh-white colour, and remains unfuſed if the fragments are not very minute: with borax it is converted into a yellow-coloured glaſs. A new earth, to which the name of *Yttria* has been given, has been diſcovered in it.

Conſtituent Parts.

Eckeberg.

Yttria,	47·5
Silica,	25.0
Iron,	18.0
Alumina,	4·5
Loſs,	5
	100

Vauquelin.

Yttria,	35
Silica,	25·5
Iron,	25.0
Oxide of manganeſe,	2.0
Lime,	2
Water and carbon,	10.5
	100

Geographic Situation.

It has been hitherto found only at Ytterby in Sweden.

Obſervation.

1. It was firſt diſcovered by Dr *Gadolin*, hence the

the name *Gadolinite:* the name *Yttria* is derived from Ytterby, where this mineral is found.

2. *Werner* places it in his Syſtem between Pitchy Iron-ore, and Green Iron-earth.

Copper Sand, or Muriat of Copper.

Salzkupfererz.—*Werner.*

Sable vert du Perou, *Mém. de l'Acad. des Scienc. an* 1786, p. 465.—Cuivre mineraliſé par l'Acide marin ſous form de Sable vert, *Sciagr.* t. 2. p. 135.—Copper mineralized by the Muriatic Acid, Green Sand of Peru, *Kirw.* vol. ii. p. 149.—Cuivre muriaté, *Hauy*, t. 3. p. 560.—*Id. Broch.* t. 2. p. 545.—Kupfer Sand, *Reuſs*, 3. b. ſ. 486.

External Characters.

Colour ſometimes intermediate between leek and emerald green, ſometimes between emerald and olive-green.

Occurs maſſive, diſſeminated; and cryſtallized in the following figures:

1. Thin ſix-ſided priſm, with four broader and two ſmaller lateral planes, bevelled on the extremities, and the bevelling planes ſet on the ſmaller lateral planes.
2. Rather oblique four-ſided priſm, perfect or bevelled in the extremities, and the bevelling planes ſet on the obtuſe lateral edges; and ſometimes theſe obtuſe edges are at the ſame time truncated.

The cryſtals are ſmall and very ſmall, and often interſect one another in ſuch a manner that it is difficult to aſcertain their true figure.

The

The ſurface of the cryſtals is commonly ſmooth, and ſplendent and adamantine.

Internally it is ſhining, and its luſtre is reſinous.

Fracture foliated.

Fragments indeterminately angular, not very blunt-edged.

Occurs in coarſe and ſmall granular diſtinct concretions.

The maſſive varieties are opaque, but the cryſtals are tranſparent.

Is ſoft.

Streak pale apple-green.

Rather ſectile.

Eaſily frangible; and

Not particularly heavy, approaching to heavy.

Specific gravity, 3·750, *Lametherie*; 4·4308, *Herrgen.*

Chemical Characters.

When projected on the flame of burning coal, it communicates to it a green and blue colour. Before the blow-pipe on coal, it tinges the flame of a very lively azure and emerald blue colour, but the muriatic acid is ſpeedily diſſipated, and a metallic grain remains behind. It diſſolves in nitrous and muriatic acids without effervescence, and forms a green-coloured ſolution. Ammonia nearly diſſolves the whole, and forms a blue-coloured ſolution.

Conſtituent

Conſtituent Parts.

From Peru.		Chili.	Chili.	
Black oxide of copper,	76.595	70.482	Oxide of copper,	73
Muriatic acid,	10.638	11.446		10.1
Water,	12.767	18.072		16.9
	Prouſt.	*Prouſt.*		*Klaproth.*

Geognoſtic Situation.

It is found looſe, and ſometimes in the ſand of rivers. At Remolinos it is ſaid to be accompanied with foliated gyps, ſchorl, quartz, red copper-ore, copper-glance, tile-ore, malachite, corneous ſilver-ore, iron-ochre, and magnetic ironſtone.

Geographic Situation.

It is found in Chili near to Remolinos; alſo at San Felix and Veta Negra de la Pampa Larga. It has been alſo diſcovered in a ſmall river in the province of Lipes, 200 miles from Copiapo, on the ſandy deſert of Atacama, from whence it was firſt brought by *Dombey* to Europe.

Phoſphat of Copper.

Phoſphorſaures-Kupfer, *Karſten.*—*Id. Reuſs*, 3. b. ſ. 507.—
Cuivre phoſphaté, *Broch.* t. 2. p. 544.

External Characters.

Externally it is greyiſh-black, internally intermediate between verdigris-green and emerald-green.

Occurs

Occurs maſſive, diffeminated, and cryſtallized in oblique cubes, with convex lateral planes.

The cryſtals are ſmall and very ſmall, and their ſurface is druſy and ſplendent, with a luſtre which is intermediate between vitreous and adamantine.

Internally it is ſtrongly glimmering, and its luſtre is ſilky.

Fracture extremely delicate, and diverging fibrous.

It has a tendency to thick and curved lamellar diſtinct concretions.

Is opaque.

Soft, approaching to ſemihard.

Yields an apple-green coloured ſtreak.

Is pretty ſectile.

Conſtituent Parts.

Oxide of copper,	68.13
Phoſphoric acid,	30.95
	99.08 *Klaproth.*

Geographic Situation.

Has been hitherto found only at Firneberg near Rheinbreidenbach in the former archbiſhopric of Cologne, where it occurs in a white druſy quartz.

Obſervation.

From its colour and fibrous fracture it was formerly conſidered as a variety of Malachite.

Corneous

Corneous Lead-Ore.

Hornblei.—*Karſten.*

Analyſis of a new variety of Lead-Ore, *by Richard Chenevix, Eſq; Nicholſon's Journal,* vol. iv. p. 219. *et ſeq.*—Hornblei, *Karſten,* Tabell. f. 50. and 78.—*Id. Reuſs,* Min. 4. b. f. 261.—Plomb muriaté, *Broch.* t. 2. p. 547.

External Characters.

Its colour is intermediate between aſparagus-green and wine-yellow.

Occurs cryſtallized in

Cubes, (which, according to *Bournon,* are ſometimes very oblique), either perfect, or more or leſs deeply truncated on all the angles; ſometimes the lateral edges, (the cube conſidered as a priſm), but more frequently the terminal edges, are truncated; ſometimes the truncation on the terminal edges are ſo deep, that a four-planed acumination is formed; ſometimes the lateral edges are bevelled.

The cryſtals are middle-ſized and ſmall, and externally gliſtening.

Internally it is ſplendent, and its luſtre is adamantine.

The principal fracture is foliated, with a rectangular double cleavage; croſs-fracture is conchoidal.

Is ſemitranſparent.

Streak ſnow-white, and completely dull.

Soft, (ſofter than white lead-ore), which ſcratches it.

Sectile, and

Heavy.

Heavy.

Specific gravity, 6.0651, *Chenevix.*

Conſtituent Parts.

Oxide of lead,	85.5		85
Muriatic acid,	8.5		8
Carbonic acid,	6.0		6
	Klaproth. 99.0	*Chenevix.*	99

Geographic Situation.

Has been hitherto found only at Matlock in Derbyſhire.

Obſervations.

1. It is principally diſtinguiſhed from White Lead-ore, by its colour, cryſtallization, fracture inferior hardneſs, and leſs ſpecific gravity.

2. The name *Hornblei* or *Corneous Lead-Ore*, given to this ſpecies by *Karſten*, is not from its reſemblance in certain external characters to Corneous Silver ore, but from its chemical compoſition.

Reniform Lead-Ore.

Bleiniere.—*Karſten.*

Bleiniere, *Karſten*, Tabell. f. 50. 77. 78.—*Id. Reuſs*, 4. b. f. 225. —Plomb arſenie, *Hauy*, t. 3. p. 464.— *Id. Broch.* t. 2. p. 546.

External Characters.

On the freſh fracture its colour is browniſh-red,

but by expoſure paſſes into ochre and ſtraw-yellow.

Occurs in reniform-ſhaped maſſes, which have a rough or uneven ſurface.

Internally it is gliſtening, and its luſtre is reſinous.

Fracture conchoidal.

Fragments indeterminately angular.

Occurs in coarſe granular diſtinct concretions, which are, towards the ſurface, curved lamellar.

Is opaque.

Yields an orange-yellow dull ſtreak.

Is ſoft.

Brittle, and

Heavy.

Specific gravity, 3.920, *Bindheim.*

Chemical Characters.

When heated on coal before the blow-pipe it melts, and emits an arſenical ſmell; and if the heat is continued, it is converted into a black ſhining globule, in which ſome grains of lead are to be obſerved. It makes no ſenſible effervescence with nitrous acid. Theſe characters diſtinguiſh it ſufficiently from all other ores of lead.

Conſtituent

Conſtituent Parts.

Lead,	35
Arſenic acid,	25
Silver,	1.5
Iron,	14
Silica,	7
Alumina,	3
Water,	10

Bindheim.

Geographic Situation.

It has been hitherto found only at Nertſchinkſk in Siberia.

Obſervations.

Mr *Champeaux* diſcovered in France an Arſeniat of Lead, which has a yellowiſh-green colour, and occurs in ſilky fibres not unlike amianth; and Mr *Prouſt* informs us, that he found in Andaluſia a green-coloured Arſeniat of Lead: but both of theſe minerals require to be more correctly deſcribed.

Bournonite.

Sulphuret of Lead, Antimony, and Copper, of *Count de Bournon* and *Hatchett*, Phil. Tranſ. for 1804.

External Characters.

Colour dark grey, inclining to black.

Occurs cryſtallized in the following figures:

1. Low rectangular four-ſided priſm, the lateral planes of which are pretty deeply ſtreaked.

2. Same

2. Same figure, in which the lateral edges are truncated, and thus form an eight-ſided priſm.
3. Same figure with truncated angles.
4. Same figure, in which the terminal edges only are truncated, or in which all the edges are truncated at the ſame time.
5. Same figure, in which all the angles and edges are truncated at the ſame time.
6. Twin cryſtal, formed by the interſection of two cryſtals, of which only two oppoſite terminal edges are truncated.

The original planes of the cryſtals are longitudinally ſtreaked *, but the truncating planes are ſmooth.

The cryſtals are large and middle-ſized, and their ſurface is ſplendent.

Internally it is ſplendent, and its luſtre is metallic.

Fracture coarſe-grained uneven.

Semihard; eaſily cuts calc-ſpar, but does not ſcratch fluor-ſpar.

Brittle.

Eaſily frangible.

Leaves a black trace on paper, but not ſo readily as lead and grey antimony-ore.

Specific gravity, 5.5765; it is conſequently ſuperior to that of copper-glance or grey antimony-ore, but very inferior to that of lead-glance.

Chemical

* *Count De Bournon* conſiders the ſtreaked planes to be thoſe of the ſecondary cryſtals.

Chemical Characters.

If ſuddenly heated on charcoal by the blow-pipe, it crackles and ſplits; but, when gradually expoſed to the flame, it liquefies, and, upon cooling, aſſumes a dull grey colour. When the globule is longer expoſed to heat, white fumes, (which at firſt have a ſulphureous odour) are evolved, and partly ſettle on the charcoal. Ebullition prevails during the diſcharge of theſe white fumes; and the globule gradually ſuffers a conſiderable diminution, remaining at length tranquil, and of a very dark grey colour. This globule is compoſed of malleable copper, ſurrounded by a cruſt of ſulphuret of lead. *Hatchett.*

Conſtituent Parts.

Sulphur,	17.
Antimony,	24.23
Lead,	42.62
Iron,	1.20
Copper,	12.80
	97.85
Loſs,	2.15
Hatchett.	100.00

Geographic Situation.

Has been hitherto found only in the mine called Huel Boys in Cornwall.

Obſervations.

Obſervations.

1. It may probably be placed in the Syſtem after Lead-Glance.

2. As it has received no name, it may, in honour of the diſtinguiſhed mineralogiſt who firſt deſcribed it, be denominated *Bournonite.*

Columbite.

Columbium, *Hatchett*, Phil. Tranſ. for 1802. — Columbium, *Broch.* t. 2. p. 550.—Columbeiſen, *Reuſs*, 4. b. f. 632.

External Characters.

Colour dark ſteel-grey, which inclines to iron-black.

Occurs maſſive.

Internally it is ſhining, and its luſtre inclines to ſemimetallic.

Longitudinal fracture imperfect foliated; croſs fracture fine-grained uneven.

Is ſemihard.

Yields a dark yellowiſh-brown ſtreak.

Is brittle.

Eaſily frangible; and

Heavy.

Specific gravity, 5.918, *Hatchett.*

Chemical Characters.

Mineral acids act but feebly on it, and extract a portion of its iron. Melted with five times its weight

weight of potaſs, an ebullition follows, and the mixture melts into a greeniſh-coloured maſs.

Conſtituent Parts.

Columbic oxide,	78
Oxide of iron,	21
	99

Geographic Situation.

This foſſil was found by Mr Hatchett in the Britiſh Muſeum, amongſt a collection of minerals ſent from the province of Maſſachuſſet in North America.

Obſervations.

1. Mr *Hatchett* found it to contain a metal, which, from its properties, could not be referred to any hitherto known; hence he was of opinion that it ſhould be conſidered as a new genus, to which he gave the name *Columbium*, in honour of the diſcoverer of America.

2. As it does not contain the metal in a metallic ſtate, I have, with Dr Thomſon, denominated it *Columbite*.

3. Although this ſpecies contains a new metal, and that in great proportion, yet I doubt much if it can be conſidered as a diſtinct genus. Its external characters bear ſo great a reſemblance to ſeveral ores of iron, that it would probably not be improper, for the preſent to place it in the Iron Genus.

Tantalite.

Tantalite.—*Eckeberg.*

Eckeberg in "Kongl. Vetenſkaps Academiens Handlingar," for 1802, *Quart.* 1. p. 98.--83.—Alſo in *Scherer's* "Allgem. Journal der Chemie," 9. b. f. 610. and 613.—*Id. Reuſs*, 4. b. f. 635.—*Id. Broch.* t. 2. p. 673.

External Characters.

Externally its colour is iron black: on the freſh fracture it is intermediate between bluiſh-grey and iron-black.

It occurs imbedded, in maſſes of the ſize of a hazel-nut, which have a tendency to the octahedral form.

Externally it is ſmooth and glimmering.

Internally it is ſhining, and its luſtre is metallic.

It is ſemihard, bordering on hard.

Yields a blackiſh grey ſtreak; and is

Uncommonly heavy.

Specific gravity, 7·953, *Eckeberg.*

Conſtituent Parts.

Its conſtituent parts are tantalium, iron, and manganeſe.

Geognoſtic and Geographic Situations.

Occurs imbedded in quartz, which forms veins that traverſe a red granular felſpar.

Has been hitherto found only in Sweden.

Obſervation.

Observation.

Its name is derived from the new metal called *Tantalium*, which it contains.

Yttertantalite.

Yttertantal.—*Eckeberg.*

Id. Eckeberg, in "Kongl. Vetenſcaps Academiens Handlingar," for 1802.—*Id. Reuſs*, 4. b. ſ. 637.—*Id. Broch.* t. 2. p. 674.

External Characters.

On the freſh fracture it is iron-black.

Occurs imbedded in maſſes which are the ſize of a hazel-nut, and ſometimes ſmaller.

Internally it is ſhining, and its luſtre is metallic.

Fracture uneven.

Semihard.

Yields a grey ſtreak; and is

Heavy.

Specific gravity, 5.130, *Eckeberg.*

Conſtituent Parts.

According to *Eckeberg*, it is compoſed of tantalium, the new earth called yttria, and iron.

Geognoſtic and Geographic Situations.

It occurs, along with gadolinite, in a rock compoſed of mica, quartz, and felſpar.

Obſervations.

1. Its name is derived from its conſtituent parts.

2. The preceding imperfect deſcriptions of theſe ſpecies are extracted from *Eckeberg's* Memoir: it is almoſt impoſſible, from them, to determine whether this foſſil ſhould conſtitute a new genus, or be arranged under ſome of thoſe already known.

APP. III.

APPENDIX III.

I AM happy to be able to communicate to the public, through the goodneſs of my friend Mr MEUDER, a Tabular View of the Oryctognoſtic Syſtem, which exhibits the improvements and additions made to it by *Werner* in 1803. In its preſent form, it approaches ſtill nearer to the natural, and is farther removed from the chemical method than heretofore, a deciſive proof of the excellence of the improvements which it has lately experienced.

MINERAL SYSTEM

IN

1803.

CLASS I.

EARTHY FOSSILS.

1. DIAMOND GENUS.

1. Diamond.

2. ZIRCON GENUS.

Zircon Family.

2. Zircon.
3. Hyacinth.
4. Cinnamon-ſtone.

3. FLINT GENUS.

Chryſolite Family.

5. Chryſoberyl.
6. Chryſolite.
7. Olivine.
8. Coccolite.
9. Augite

9. Augite.
10. Piſtazite.
11. Veſuvian.

Garnet Family.

12. Leucite.
13. Melanite.
14. Garnet.
    a. Precious.
    b. Common.
15. Staurolite or Grenatite.
16. Pyrope.

Ruby Family.

17. Spinelle.
18. Sapphire.
19. Emery.
20. Corundum.
21. Diamond ſpar.

---

22. Ceylanite.
23. Topaz.

Schorl Family.

24. Euclaſe.
25. Emerald.
26. Beryl.
    a. Precious.
    b. Schorlous.
27. Schorl.
    a. Common.
    b. Tourmaline.

---

28. Axinite or Thumerſtone.

Quartz Family.

29. Quartz.
    a. Amethyſt.
        α. Common.
        β. Thick fibrous.
    b. Rock cryſtal.
    c. Milk quartz.
    d. Common quartz.
    e. Praſe.
30. Iron flint.
31. Hornſtone.
    a. Splintery.
    b. Conchoidal.
    c. Woodſtone.
32. Flinty ſlate.
    a. Common.
    b. Lydian ſtone.
33. Flint.
34. Chalcedony.
    a. Common.
    b. Carnelian.
35. Hyalite.
36. Opal.
    a. Precious.
        α. Tranſlucent.
        β. Paſſing from tranſlucent into ſemi-tranſparent.
        γ Semi-tranſparent, approaching to tranſparent.
    b. Common opal.
    c. Semi opal.
    d. Wood opal.
37. Menilite.
38. Jaſper.
    a. Egyptian.
        α. Red.
        β. Brown

β. Brown.
b. Striped jaſper.
c. Porcelain jaſper.
d. Common jaſper.
α. Conchoidal.
β. Earthy.
e. Opal jaſper.
f. Agate jaſper.
39. Heliotrope.
40. Chryſopraſe.
41. Plaſma.
42. Cat's eye.

Pitchſtone Family.

43. Obſidian.
44. Pitchſtone.
45. Pearlſtone.
46. Pumice.

Zeolite Family.

47. Prehnite.
a. Fibrous.
b. Foliated.
48. Zeolite.
a. Mealy.
b. Fibrous
c. Radiated
d. Foliated
} Zeolite.
49. Cubizite.
50. Croſs ſtone or Cruzite.
51. Lomonite.
52. *Schmelzſtein.*
53. Natrolite.
54. Azurite.
55. Azure ſtone.

Felſpar Family.

56. Andaluzite.
57. Felſpar.
a. Adularia.
b. Labrador.
c. Common felſpar.
α. Freſh.
β. Diſintegrated.
d. Hollow ſpar.
e. Compact felſpar.
58. Scapolite.
59. Arctizite or Wernerite.
60. Spodumene.
61. *Fiſchaugenſtein.*

4. CLAY GENUS.

Clay Family.

62. Pure clay.
63. Porcelain earth.
64. Common clay.
a. Loam.
b. Pipe clay.
c. Potter's clay.
a. Earthy.
d. Variegated clay.
e. Slate clay.
65. Clayſtone.
66. Adheſive ſlate.
67. Poliſhing or polier ſlate.
68. Tripoli.

---

69. Floatſtone.
70. Alum ſtone.

Clay

Clay-Slate Family.

71. Alum ſlate.
    a. Common
    b. Gloſſy.
72. Bituminous ſhale.
73. Drawing ſlate.
74. Whet ſlate.
75. Clay ſlate.

Mica Family.

76. Lepidolite.
77. Mica.
78. Pinite.
79. Potſtone.
80. Chlorite.
    a. Chlorite earth.
    b. Common chlorite.
    c. Chlorite ſlate.
    d. Foliated chlorite.

Trap Family.

81. Hornblende.
    a. Common.
    b. Labradore.
    c. Baſaltic.
    d. Hornblende ſlate.
82. Baſalt.
83. Wacke.
84. Clinkſtone.
85. Iron clay.

86. Lava.

Lithomarge Family.

87. Green earth.
88. Lithomarge.
    a. Friable.
    b. Indurated.
89. Rock-ſoap.
90. Umber.
91. Yellow earth.

5. TALC GENUS.

Soapſtone Family.

92. Native magneſia, or talc-earth.
93. Bole.
94. Meerſchaum.
95. Fuller's earth.
96. Steatite.
97. Bildſtein.

Talc Family.

98. Nephrite.
    a. Common nephrite.
    b. Axe-ſtone.
99. Serpentine.
    a. Common.
    b. Precious.
        α. Conchoidal.
        β. Splintery.

100. Schillerſtone.

100. Schillerſtone.
101. Talc.
  a. Earthy.
  b. Common.
  c. Indurated.
102. Aſbeſt.
  a. Rock-cork.
  b. Amianth.
  c. Common aſbeſt.
  d. Rock-wood.

Actynolite Family.

103. Kyanite.
104. Actynolite.
  a. Aſbeſtous.
  b. Common.
  c. Glaſſy.
105. Tremolite.
  a. Aſbeſtous.
  b. Common.
  c. Glaſſy.
106. Sahlite.

6. CALC GENUS.

A. *Carbonats.*

107. Rock milk.
108. Chalk.
109. Limeſtone.
  a. Compact.
    α. Common.
    β. Roeſtone.
  b. Foliated.
    α. Granular.
    β. Calcſpar.
  c. Fibrous.
    α. Common.
    β. Calc-ſinter.
  d. Pea-ſtone.
110. Calc-tuff.
111. Schum earth, or foam-earth.
112. Slate ſpar.
113. Brown ſpar.
  a. Foliated.
  b. Fibrous.
114. Schaalſtone.
115. Dolomite.
116. Rhomb-ſpar.
117. Stink ſtone.
118. Marl.
  a. Marl earth.
  b. Indurated marl.
119. Bituminous marl-ſlate.
120. Arragon.

B. *Phoſphats.*

121. Appatite.
122. Aſparagus ſtone.
123. Phoſphorite.

C. *Fluats.*

124. Fluor.
  a. Compact.
  b. Fluor-ſpar.

D. *Sulphats.*

125. Gips.
  a. Gyps earth.
  b. Compact gyps.
  c. Foliated gyps.
  d. Fibrous gyps.
126. Selenite.
127. Anhydrite.
128. Cube ſpar.

7. BARYTE GENUS.

129. Witherite.
130. Heavy ſpar.
  a. Heavy ſpar earth.
  b. Compact heavy ſpar
  c. Granular

c. Granular heavyſpar.
d. Curved lamellar heavy ſpar.
e. Straight lamellar heavy ſpar.
α. Freſh.
β. Diſintegrated.
f. Columnar ſpar.
g. Priſmatic ſpar.
h. Bologneſe, or Bolognian ſpar.

8. STRONTIAN GENUS.

131. Strontian.
132. Celeſtine.
a. Fibrous.
b. Foliated.

9. HALLITE GENUS.

133. Boracite.
134. Cryolite.

CLASS SECOND.

FOSSIL SALTS.

1. *Carbonats.*
135. Natural ſoda or natron.
2. *Nitrats.*
136. Natural nitre.
3. *Muriats.*
137. Natural rock ſalt.
a. Stone ſalt.
a. Foliated.
b. Fibrous.
b. Lake ſalt.
138. Natural ſal-ammoniac.
4. *Sulphats.*
139. Natural vitriol.
140. Hair ſalt.
141. Rock butter.
142. Natural Epſom ſalt.
143. Natural Glauber ſalt.

CLASS THIRD.

INFLAMMABLE FOSSILS.

1. SULPHUR GENUS.

144. Natural ſulphur.
a. Common.
b. Volcanic.

2. BITUMINOUS

2. BITUMINOUS GENUS.

145. Mineral or foſſil oil.
146. Mineral pitch.
  a. Elaſtic.
  b. Earthy.
  c. Slaggy.
147. Brown coal.
  a. Bituminous wood.
  b. Earth coal.
  c. Alum earth.
  d. Common brown coal.
  e. Moor coal.
148. Black coal.
  a. Pitch coal.
  b. Columnar coal.
  c. Slate coal.
  d. Cannel coal.
  e. Foliated coal.
  f. Coarſe coal.

3. GRAPHITE GENUS.

149. Glance-coal.
  a. Conchoidal.
  b. Slaty.
150. Graphite.
  a. Scaly.
  b. Compact.
151. Mineral charcoal.

4. RESIN GENUS.

152. Amber.
  a. White.
  b. Yellow.
153. Honey-ſtone.

FOURTH CLASS.

METALLIC FOSSILS.

1. PLATINA GENUS.

154. Native platina.

2. GOLD GENUS.

155. Native gold.
  a. Gold yellow.
  b. Braſs yellow.
  c. Greyiſh yellow.

3. MERCURY GENUS.

156. Native mercury.
157. Natural amalgam.
  a. Semifluid.
  b. Solid.
158. Mercurial horn-ore.
159. Mercurial liver-ore.
  a. Compact.
  b. Slaty.
160. Cinnabar.
  a. Dark red.
  b. Light red.

4. SILVER GENUS.

161. Native silver.
  a. Common.
  b. Auriferous.
162. Antimonial silver.
163. Arsenical silver.
164. Corneous silver-ore, or horn-ore.
165. Silver-black.
166. Silver-glance.
167. Brittle silver-glance.
168. Red silver-ore.
  a. Dark.
  b. Light.
169. White silver-ore.
170. Black silver-ore.

5. COPPER GENUS.

171. Native copper.
172. Copper-glance.
  a. Compact.
  b. Foliated.
173. Variegated copper-ore.
174. Copper pyrites.
175. White copper-ore.
176. Fahl or grey copper-ore.
177. Copper black.
178. Red copper-ore.
  a. Compact.
  b. Foliated.
  c. Capillary.
179. Tile ore.
  a. Earthy.
  b. Indurated.
180. Copper azure.
  a. Earthy.
  b. Indurated or radiated.
181. Malachite.
  a. Fibrous.
  b. Compact.
182. Copper green.
183. Ironshot copper green.
  a. Earthy.
  b. Slaggy.
184. Copper emerald.
185. Copper mica.
186. Lenticular ore.
187. Oliven-ore.
188. Muriat of copper, or copper muriat.

6. IRON GENUS.

189. Native iron.
190. Iron pyrites.
  a. Common.
  b. Radiated.
  c. Liver or hepatic.
  d. Hair or capillary.
191. Magnetic pyrites.
192. Magnetic ironstone.
  a. Common.
  b. Iron-sand.
193. Iron-glance.
  a. Common.
    α. Compact.
    β. Foliated.
  b. Iron mica.
149. Red ironstone.
  a. Red iron-froth.
  b. Ochrey red ironstone.
  c. Compact.
  d. Red hematite.
195. Brown ironstone.
  a. Brown iron-froth.
  b. Ochrey brown ironstone.
  c. Compact.
  d. Brown hematite.
196. Sparry ironstone
197. Black ironstone.
  a. Compact.
  b. Black hematite.
198. Clay ironstone.
  a. Reddle.

a. Reddle.
b. Columnar clay iron ſtone.
c. Lenticular clay iron-ſtone.
d. Jaſpery clay iron-ſtone.
e. Common clay iron-ſtone.
f. Reniform clay iron-ſtone.
g. Pea-ore, or piſiform ironſtone.

199. Bog iron-ore.
a. Moraſs-ore.
b. Swamp-ore.
c. Meadow-ore.

200. Blue iron-earth.
201. Pitchy iron-ore.
202. Gadolinite.
203. Green iron-earth.
204. Cube-ore.

7. LEAD GENUS.

205. Lead-Glance.
a. Common.
b. Compact.
206. Blue lead-ore.
207. Brown lead-ore.
208. Black lead-ore.
209. White lead-ore.
210. Green lead-ore.
211. Red lead-ore.
212. Yellow lead-ore.
213. Lead vitriol.
214. Lead-earth.
a. Coherent.
b. friable.

8. TIN G

215. Tin pyrites.
216. Tinſtone.
217. Corniſh tin-ore.

9. BISMUTH GENUS.

218. Native biſmuth.
219. Biſmuth-glance.
220. Biſmuth-ochre.

10. ZINC GENUS.

221. Blende.
a. Yellow.
b. Brown.
c. Black.
222. Calamine.

11. ANTIMONY GENUS.

223. Native antimony.
224. Grey antimony-ore.
a. Compact.
b. Foliated.
c. Radiated.
d. Plumoſe.
225. Black antimony-ore.
226. Red antimony-ore.
227. White antimony-ore.
228. Antimony-ochre.

12. COBALT GENUS.

229. White cobalt-ore.
230. Grey cobalt ore.
231. Cobalt-glance.
232. Black cobalt ochre.
a. Earthy

a. Earthy.
b. Indurated.
233. Brown cobalt-ochre.
234. Yellow cobalt-ochre.
235. Red cobalt-ochre.
a. cobalt cruſt.
b. cobalt bloom.

13. NICKEL GENUS.

236. Copper nickel.
237. Nickel ochre.

14. MANGANESE GENUS.

238. Grey manganeſe-ore.
a. Radiated.
b. Foliated.
c. Compact.
d. Earthy.
239. Black manganeſe-ore.
240. Red manganeſe-ore.

15. MOLYBDENA GENUS.

241. Molybdena.

16. ARSENIC GENUS.

242. Native arſenic.
243. Arſenic pyrites.
a. Common.
b. Argentiferous.
244. Orpiment.
a. Yellow.
b. Red.
245. Arſenic bloom.

17. SCHEELE GENUS.

246. Tungſten.
247. Wolfram.

18. MENACHINE GENUS.

248. Menachan.
249. Octahedrite.
250. Rutile.
251. Nigrine.
252. Iſerine.

19. URAN GENUS.

253. Pitch ore.
254. Uran mica.
255. Uran ochre.

20. SYLVAN GENUS.

256. Native Sylvan.
257. Graphic ore.
Yellow ſylvan-ore.
259. Black ſylvan-ore.

21. CHROME GENUS.

260. Acicular-ore.
261. Chrome-ochre.

INDEX

INDEX

TO THE

FIRST AND SECOND VOLUMES.

INDEX

TO THE

FIRST AND SECOND VOLUMES.

INDEX.

(The Numerals refer to the Volume, the Figures to the Pages.)

A

Acanticone, ii. 530
Actynolite, i. 455
asbestous, i. 456
common, i. 458
glassy, i. 462
Adhesive slate, ii. 550
Adularia, i. 286
Agate, i. 181
Alum stone, i. 319
Alum earth, i. 321, and ii. 61
Alum slate, i. 323
common, i. 324
glossy, i. 326
Amalgam, ii. 116
fluid, ii. 117
solid, ii. 118
Amber, ii. 91
white, ii. ib.
yellow, ii. 92
Amethyst, i. 136
common, i. 137
fibrous, i. 141
Amianth, i. 442
Ammoniac, ii. 19
Andalusite, ii. 544
Anhydrite, ii. 557
Antimony, ii. 415
native, ii. 415
grey, ii. 417
black, ii. 425
red, ii. 426
white, ii. 428
Antimony ochre, ii. ib.
Antimonial silver, ii. 141
Appatite, i. 536
Arandalite, ii. 530
Arctizite, ii. 548
Arragone, i. 533
Arsenic (native), ii. 469
Arsenic pyrites, ii. 471
common, ii. 472
argentiferous, ii. 475
Arsenical silver, ii. 145
Asbest, i. 446
Asparagus stone, i. 540
Asphaltum, ii. 49
Augite, i. 50
Axestone, i. 416
Azurestone, i. 225
Azurite, ii. 542

B

Basalt, i. 369
Beryl, i. 110
precious, i. ib.
schorlous, i. 116
Bismuth, ii. 392
native, ii. ib.
glance, ii. 395
ochre, ii. 397
Bituminous wood, ii. 54
Bituminous marl-slate, i. 529
Bituminous shale, i. 325
Black coal, ii. 66

Black

Black ſilver-ore, ii. 177
Blende, ii. 399
yellow, ii. ib.
brown, ii. 402
black, ii. 407
Bog iron-ore, ii. 334
Bole, i. 399
Bologneſe ſpar, i. 596
Boracite, i. 544
Borax, ii. 36
Bournonite, ii. 579
Brown coal, ii. 54
common, ii. 62
Brown ſpar, i. 510
foliated, i. 511
fibrous, i. 515

C

Calamine, ii. 411
Calc-ſpar, i. 488
Calc-ſinter, i. 499
Calc-ſhaum, i. 505
Calc-tuff, i. 531
Cannel coal, ii. 75
Carnelian, i. 178
Cat's eye, i. 200
Celeſtine, i. 602
fibrous, i. 603
foliated, i. 605
Ceylanite, ii. 531
Chalcedony, i. 173
Chalk, i. 473
Chiaſtolite, ii. 545
Chlorite, i. 347
earth, i. 348
common, i. 349
ſlate, i. 351
foliated, i. 353
Chromate of iron, ii. 570
Chryſoberil, i. 38
Chryſolite, i. 42
Chryſopraſe, i. 191
Cinnabar, ii. 127
dark red, ii. ib.
Cinnabar,
bright red, ii. 130
Cinnamon-ſtone, ii. 527
Clay, i. 301
potters, i. 303
pipe, i. 307
variegated i. 308
ſlate, i. 312
Clay ironſtone, ii. 317
columnar, ii. 320
common, ii. 326
jaſpery, ii. 325
lenticular, ii. 322
Clay-ſlate, i. 334
Clay ſtone, i. 310
Clink-ſtone, i. 380
Coal, ii. 54
earth, ii. 57
common brown, ii. 62
moor, ii. 65
pitch, ii. 67
columnar, ii. 69
ſlate, ii. 72
cannel, ii. 75
foliated, ii. 77
coarſe, ii. 78
glance, ii. 81
Cobalt-ore,
white, ii. 432
grey, ii. 434
Cobalt-glance, ii. 436
Cobalt-ochre,
black, ii. 438
brown, ii. 441
yellow, ii. 449
red ii. 444
Coccolite, ii. 528
Columbite, ii. 582
Columnar coal, ii. 69
Columnar clay iron-
Columnar heavy ſpar, ii. 592
ſtone, ii. 320
Copper,
native, ii. 178
Copper-azure, ii. 218
Copper

Copper-azure, ii. 219
a. earthy, ii. 220
b. radiated, ii. 207
Copper-black, ii. 241
Copper-emerald, ii. 233
Copper-green, ii. 183
Copper-glance, ii. 184
compact, ii. 185
foliated, ii. 243
Copper-mica, ii. 448
Copper-nickel, ii. 193
Copper-pyrites, ii. 201
Copper-ore, ii. 209
grey, ii. 198
red, ii. 189
white, ii. 572
variegated, ii. 389
Copper-sand, i. 90
Cornish tin-ore, i. 222
Corundum, ii. 558
Cross-stone, ii. 345
Cryolite, i. 571
Cube-ore, i. 451
Cube spar,
Cyanite,

D

Diamond. i. 1
Diamond-spar, i. 93
Drawing slate, i. 328

E

Earth-coal, ii. 57
Emerald, i. 105
Emery, i. 96
Epsom salt, ii. 22
Euclase, ii. 533

F

Fahl or grey copper ore, ii. 201
Felspar or Feldspar, i. 275
compact, i. 276
common, i. 278
glassy, ii. 5'6
Flint, i. 169
Flint-slate, i. 194
common, i. 195
Floatstone, ii. 552
Fluor-spar, i. 550
Fossil or mineral oil, ii. 44
Fullers' earth, i. 409

G

Gadolinite, ii. 570
Galena, ii. 347
Garnet,
precious, i. 64
common, i. 69
Glance-coal,
conchoidal, ii. 81
slaty, ii. 83
Glauber salt, ii. 24
Gold, native, ii. 104
gold-yellow, ii. ib.
brass-yellow, ii. 109
greyish yellow, ii. 111
Graphic sylvan ore, ii. 515
Graphite, ii. 86
scaly, ii. 87
compact, ii. 88
Grenatite, i. 76
Green earth, i. 388
Green iron earth, ii. 342
friable, ii. 343
coherent, ii. ib.
Green lead-ore, ii. 367
Grey antimony-ore, ii. 417
cobalt-ore, ii. ib.
copper-ore, ii. 201
manganese-ore, ii. ib.
Gyps,
compact, i. 559
foliated, i. 561
fibrous, i. 563
Gyps earth, i. 557

H

Hair-salt, ii. 29

Heavy ſpar,
compact, i. 580
columnar, i. 592
curved lamellar, i. 584
granular, i. 582
ſtraight lamellar, i. 586
priſmatic, i. 594
Heavy-ſpar earth, i. 578
Heliotrope, i. 187
Hematite,
black, ii. 315
brown, ii. 302
red, ii. 292
Hollow-ſpar, ii. 545
Honeyſtone, ii. 96
Horn-ore, ii. 148
Hornblende. i. 356
baſaltic, i. 365
common, i. 357
Labradore, i. 361
Hornblende ſlate, i. 363
Hornſtone, i. 161
conchoidal, i. 164
ſplintery, i. 161
Hyalite, ii. 535
Hyacinth, i. 33

I

Jaſper, i. 229
agate, i. 242
common, i. 239
Egyptian, i. 230 ii. 537
opal, i. 243
porcelain, i. 236
ſtriped, i. 233
Iron earth,
blue, ii. 340
green, ii. 342
Iron flint, i. 134
Iron froth,
brown, ii. 296
red, ii. 285
Iron-glance,
common, ii. 276
Iron-mica, ii. 282
Iron, native, ii. 249
Iron pyrites,
cellular, ii. 264
common, ii. 253
hair, ii. 263
liver, ii. 261
radiated, ii. 257
Iron-ſand, ii. 274
Ironſhot copper-green, ii. 237
Ironſtone,
black, ii. 313
brown, ii. 296
clay, ii. 317
red, ii. 285
magnetic, ii. 268
pitchy, ii. 569
ſparry, ii. 308
Iron vitriol, ii. 32
Iſerine, ii. 502

K

Kyanite or cyanite, i. 451

L

Labradore ſtone, i. 290
Lake ſalt, ii. 17
Lapis lazuli, i. 225
Lava,
ſlag, i. 383
foam, i. 385
Lead glance,
common, ii. 347
compact, ii. 354
Lead-earth,
coherent, ii. 378
friable, ii. 381
Lead-ore,
black, ii. 360
blue, ii. 356
brown, ii. 358
corneous, ii. 576
green, ii. 367
red, ii. 370
reniform, ii. 577
white, ii. 362
yellow, ii. 373
Lead-vitriol, ii. 576

Lenticular clay iron-
stone, ii. 322
Lenticular-ore, ii. 245
Lepidolite, i. 388
Leucite, i. 57
Limeſtone,
compact, i. 476
foliated, i. 484
fibrous, i. 497
Lithomarge,
friable, i. 391
indurated, i. 392
Loam, i. 302
Lomonite, ii. 539
Lydian ſtone, i. 197

M

Magnetic ironſtone, ii. 268
Magnetic pyrites, ii. 265
Malachite,
fibrous, ii. 226
compact, ii. 230
Manganeſe-ore,
grey, ii. 452
black, ii. 460
red, ii. 463
Marl, i. 524
indurated, i. 526
Marl-earth, i. 525
Meadow-ore, ii. 337
Meionite, ii. 564
Melanite, i. 61
Menachine, ii. 491
Menachanite, ii. ib.
Menilite, ii. 536
Meerſchaum, i. 405
Mercury, (native) ii. 113
Mercurial horn-ore, ii. 120
Mercurial liver-ore,
compact, ii. 123
ſlaty, ii. 125
Mica, i. 341
Milk-quartz, i. 149
Mineral oil, ii. 44
Mineral-pitch,
earthy, ii. 47
ſlaggy, ii. 49
elaſtic, ii. 52
Molybdena, ii. 465
Moor-coal, ii. 65
Moraſs-ore, ii. 335

N

Native antimony, ii. 415
arſenic, ii. 469
biſmuth, ii. 392
copper, ii. 178
gold, ii. 104
iron, ii. 249
mercury, ii. 113
platina, ii. 100
ſilver, ii. 133
ſylvan, ii. 513
talc-earth, i. 403
Natrolite, ii. 541
Natron, ii. 2
Natural amalgam, ii. 116
fluid, ii. 117
ſolid, ii. 118
Natural alum, ii. 27
Epſom ſalt, ii. 22
glauber ſalt, ii. 24
lead-vitriol, ii. 376
nitre, ii. 7
rock-ſalt, ii. 10
ſal ammoniac, ii. 19
ſoda, ii. 2
ſulphur, ii. 38
vitriol, ii. 31
Nephrite, i. 413
Nickel ochre, ii. 451
Nigrine, ii. 499

O

Obſidian, i. 265
Olivine, i. 246
Oliven-ore, ii. 245
Opal, i. 245

Opal, precious, i. 246
common, i. 250
semi- i. 254
wood, i. 258
Opal jaſper, i. 243
Orpiment,
yellow, ii. 481
red, ii. 477

P

Pea-ore, ii. 331
Pearlſtone, ii. 269
Phoſphat of copper, ii. 574
Phoſphorite, ii. 556
Pinite, ii. 552
Pipe-clay, i. 307
Piſtazite, ii. 530
Pitch-coal, ii. 67
Pitch-ore, ii. 505
Pitchſtone, i. 260
Pitchy iron-ore, ii. 569
Plaſma, i. 189
Platina, ii. 100
Polier ſlate, i. 315
Porcelain earth, i. 297
Porcelain jaſper, i. 236
Praſe, i. 157
Prehnite, i 204
foliated, ii. 561
Potſtone, i. 345
Potters' clay, i. 303
Pure clay, i. 294
Pyrites,
arſenic, ii. 471
copper, ii. 193
iron, ii. 264
magnetic, ii. 265
tin, ii. 382
Pyrope, i. 73

Q

Quartz,
common, i. 152
milk, i. 149

R

Reddle, ii. 317
Rhomb ſpar, i. 516
Rock butter, ii. 30
cork, i. 439
cryſtal, i. 143
milk, i. 471
ſalt, ii. 10
ſoap, i. 395
wood, i. 449
Roeſtone, i. 480
Rutile, ii. 495
Rutilite, ii. 606

S

Sal ammoniac, ii. 19
Sahlite, ii. 555
Sapphire, i. 84
Scapolite, ii. 547
Schalſtone, i. 519
Schaum earth, i. 505
Schillerſtone, i. 428
Schmelzſtein, ii. 562
Schorl,
common, i. 121
electric or tourmaline, i. 125
Selenite, i. 567
Serpentine,
common, i. 422
precious, i. 426
Silver,
antimonial, ii. 142
arſenical, ii. 145
Silver-black, ii. 152
Silver-glance, ii. 155
brittle, ii. 160
Silver (native) ii. 133
Silver-ore,
black ii. 177
red, ii. 164
white, ii. 174
corneous, ii. 148
Slaggy mineral pitch, ii. 49

Slate-

Slate-coal, ii. 72
Slate-clay, i. 312
Slate ſpar, i. 508
Soda (natural), ii. 2
Sommite, ii. 565
Spargel ſtone, i. 540
Spar,
brown, i. 510
cube, i. 571
diamond, i. 93
felſpar, i. 275
fluor, i. 550
heavy, i. 580
rhomb, i. 516
Sparry ironſtone, ii. 308
Spinelle, i. 78
Spinthere, ii. 568
Spodumene, ii. 563
Staurolite or grenatite, i. 76
Steatite i. 418
Stinkſtone, i. 521
Strontian i. 598
Sulphur (natural),
common, ii. 38
volcanic, ii. 42
Swamp ore, ii. 336
Sylvan (native), ii. 513
Sylvan-ore,
black, ii. 520
graphic, ii. 515
yellow, ii. 518

T

Talc,
earthy, i. 431
common, i. 433
indurated, i. 436
Talc earth (native), i. 403
Tantalite, ii. 584
Thumerſtone, i. 131
Tile-ore,
earthy, ii. 215
indurated, ii. 216
Tin pyrites, ii. 382
Tinſtone, ii. 384
Topaz, i. 99
Tourmaline, i. 125
Tremolite,
aſbeſtous i. 464
common, i. 466
glaſſy, i. 468
Tripoli, i. 317
Tungſten, ii. 484

U

Umber, ii. 545
Uran mica, ii. 508
Uran ochre, ii. 510

V

Variegated clay, i. 308
Variegated copper-ore, ii. 189
Veſuvian, i. 54
Vitriol (natural), ii. 31

W

Wad, ii. 461
Wacke, i. 376
Wernerite, ii. 548
Whet ſlate, i. 331
White cobalt ore, ii. 432
White copper ore, ii. 198
White ſilver-ore, ii. 174
Witherite, i. 573
Wolfram, ii. 488
Woodſtone, i. 166
Wood tin, ii. 389

Y

Yellow earth, i. 397
Yttertantalite, ii. 585

Z

Zeolite,
cubic, i. 218
fibrous, i. 211
foliated, i. 216
mealy, i. 209
radiated, i. 213
Zircon, i. 28

FINIS.

WORKS Published by Mr JAMESON, *and to be had as above.*

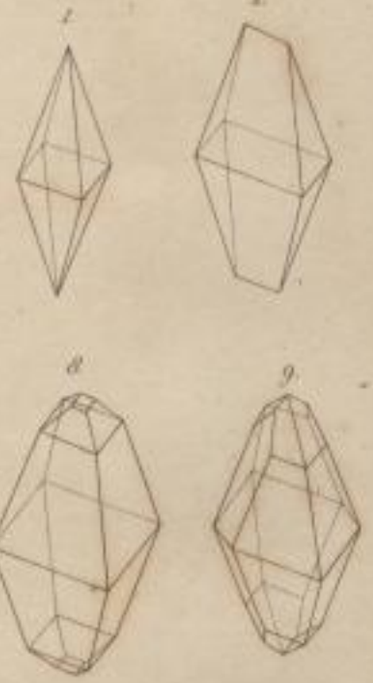
---

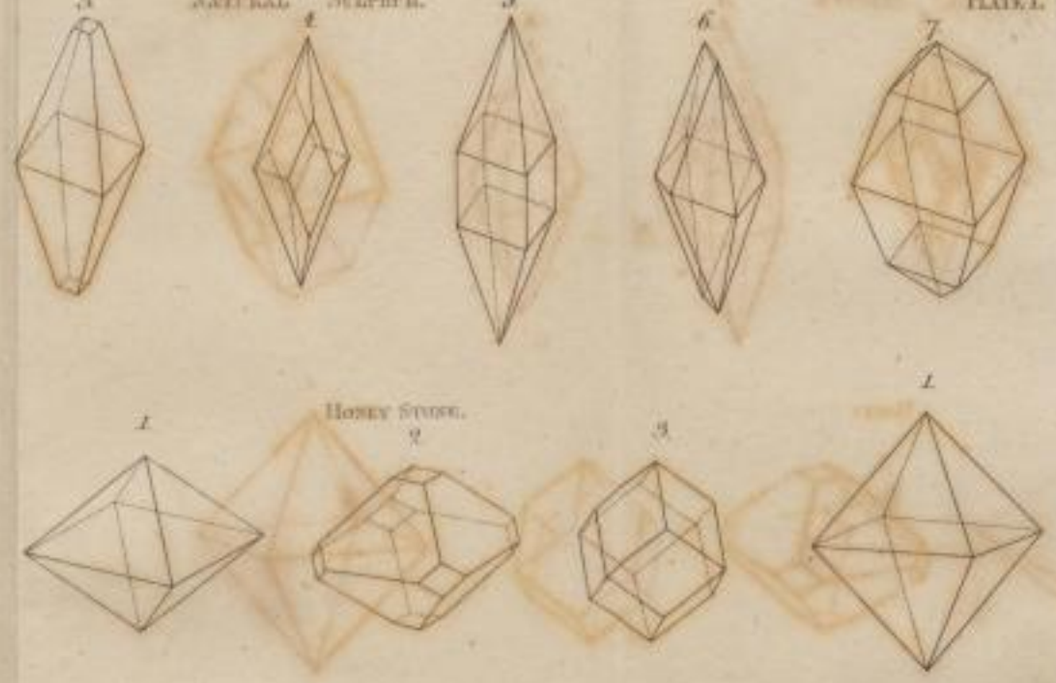
1. OUTLINE of the MINERALOGY of the SCOTTISH ISLES, with Mineralogical Obfervations made in different parts of the Mainland of Scotland, and Differtations on Peat, and Kelp: illuftrated with Maps, Plates, and Mineralogical Plans. 2 vols. 4to. L. 1 : 11 : 6.

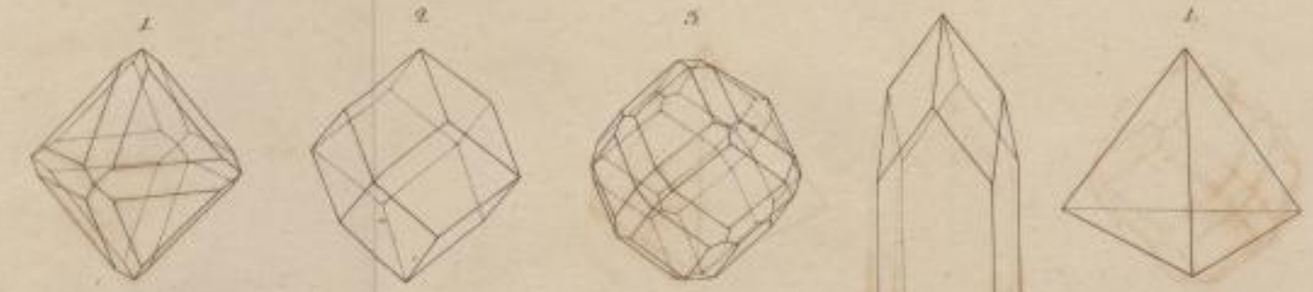
2. MINERALOGICAL DESCRIPTION of the COUNTY of DUMFRIES, with a Map of the County, and feveral Mineralogical Plans, illuftrative of the internal ftructure of the County, and of the method of fearching for Coal, &c. 8vo. 6 s.

N. B.—*This work forms the firft part of Volume I. of a Mineralogical Defcription of Scotland, and contains an Outline of the Plan to be followed in conducting the examination of Mineral Diftricts.*

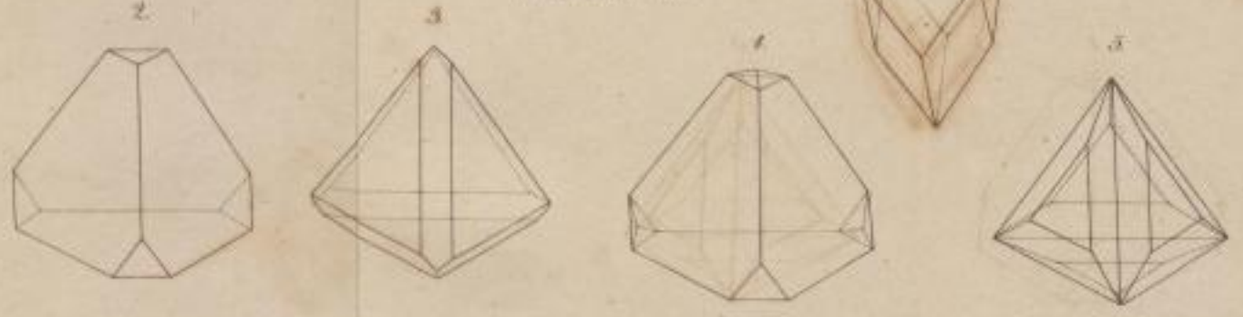
3. TREATISE on the EXTERNAL CHARACTERS of MINERALS, with Plates. 8vo. (In the prefs).







Grey Copper Ore.



Iron Pyrites.

Iron Pyrites.

5

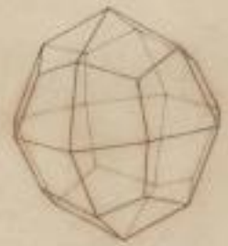
6

7

8

Common Magnetic Iron Stone.

9



1

2

3

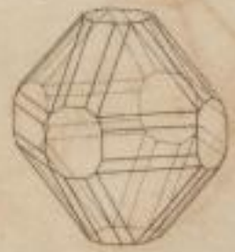
4

Common Lead Glance.

2

3

4



5

6