deposited — Descent into the Mine — Native Mineral Carbon — Crystallized Native Silver — Erroneous notions entertained with regard to the Crystallization of Minerals — Metallurgical operations for the treatment of the Kongsberg *Ores — Public Seminary for Mineralogy — Professor* Esmark *— Collection of Minerals belonging to the* Kongsberg *Academy — Customs shewing the common origin of the* Teutons *and* Greeks *— Superiority of the* Norwegian *Women — Medical Properties of the* Linnæa Borealis *— Condition of the Peasants — Alum Works — Synthesis which takes place in the production of Alum — Return to* Christiania *— Public Balls — Rage for* English *Fashions — Further account of* Bernard Anker *— Timber Trade — State of Religion in* Norway *— Fortress of* Christiania.

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Want of Booksellers' Shops.

THERE is not in all *Norway* one bookseller's shop. In *Christiania* and in *Trönÿem* there are, it is true, bookbinders and stationers, who sell a few Bibles, Prayer-books, and Almanacks; but it is in vain to look for other publications. The chief articles in the shops are, grocery, *Manchester*-cottons, *Birmingham* and *Sheffield* wares of the cheapest and worst kind, woollen drapery, buckles and buttons, iron ware, hinges and locks, and such other common articles as may be observed in the shops of the poorest villages in *England*. The widest streets of *Christiania* are not so broad as *Bond Street*; and in these, the shops, though numerous, make no

General aspect and condition of the Streets.

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figure. The pavement, as in some of our old towns where improvement has not been attended to, slopes towards a filthy sewer in the midway. Into this middle channel, of course, is cast all the dirt and drainage of the houses, where it is left to stagnate. Towns in which such nuisances are tolerated cannot be wholesome; yet of this nature were many of the cities of the *Greeks* and *Romans*[1]. The streets intersect at right-angles, and in all other respects *Christiania* has been built after a regular and uniform plan: at the intersections of the streets there are conduits for supplying the town with fresh water. The outsides of the houses are not so neat as those of *Trönijem;* neither has the town by any means so cleanly an aspect; nor can it boast of so much picturesque beauty, although its situation among inlets of the sea

(1) That the present state of *Constantinople* exhibits what the city was under the *Roman* Emperors, has been already shewn, in that Part of these Travels which relates to TURKEY. In the plates of the magnificent edition of *Banduri's Imperium Orientale*, (*Paris*, 1711,) there is a series of engravings made from the bas-reliefs of the *Historical Pillar*, which exhibit the streets of *Constantinople* as they existed in the time of *Arcadius:* and in these engravings the *Roman* infantry is represented upon a high causeway, serving, as it does now, for the foot-passengers; while the cavalry occupy the deep midway channel, which, at present, is always filled with all the ordure and refuse cast from the houses. Here also the wretched captives, dragged in triumph after the chariots of the *Roman* army, were made to walk.

give it a pleasing appearance. The approach to all the houses is by a flight of steps. The lower story seems to be half buried, like the offices for menials of the houses in *London;* and the windows of these subterraneous apartments are protected from the snow by a shed built of wood, which is made to cover and close over them. The Cathedral is a plain building, remarkable only for the resemblance which is exhibited, in its interior decoration, to some of our old churches in *England;* where the pews of the principal families, like so many separate oratories, are surrounded by high clumsy partition sides, containing casement-windows, glazed[2]. Such pews are suspended over the aisles in the church at *Christiania.* We visited

Cathedral.

(2) Many years, in all probability, will not elapse before every trace of these old *Gothic* pews will have disappeared from our churches. They were constructed in times of feudal splendour, when the persons of high-born dames were deemed too sacred to become the gaze of the profane vulgar. Even during the solemnities of public devotion, a certain degree of seclusion from the rest of the congregation was resorted to as a mark of their distinction; and their appearance in the church was like that of *Turkish* ladies in a mosque, being shut up in cages fronted with trellis-work. Some of these cages yet exist in old *English* churches. There is one in the Church of *Hothfield* in *Kent*, belonging to the noble family of the *Tuftons*, Earls of *Thanet*. The remains of others may be seen in various parts of our island. Another mark of the striking similarity of manners between the inhabitants of the two countries, is the practice which exists in *England* and in *Norway* of dividing the lower orders of the congregations according to their sexes; making the men sit apart from the women, during divine service.

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this building during divine service, upon a Sunday, in the morning. It was a very fine day, yet there were not twenty persons assembled: and, judging from our casual visit upon this occasion, we concluded that the duties of the Sabbath are less regarded here than in any other town of equal size in *Europe*. Over the altar we observed a representation of the Last Supper, in very barbarous wooden sculpture. The figures were as large as life; and, among these, an image of *St. John* had been squeezed in between the table and the effigy of our Saviour, in a most ludicrous manner, as if about to be strangled. Being at a loss to reconcile this situation of the Evangelist with any thing related of him in the Gospels, we applied for information to others who were better informed; who told us that it was necessary he should be so placed, that he might appear as in the bosom of *Jesus*.

State of Literature

The literature of *Christiania*, although an Episcopal See, is at a low ebb. It cannot be otherwise, separated as this place is from the mother country, without a University, and without the common convenience even of a Bank for its commerce: consequently, it has produced no eminent literary characters. But *Norway*, in general, has produced many; as, for example, the

celebrated *Baron Ludwig Holberg*, who founded the Academy of *Söröe*, and was the author of works in history and poetry; Bishop *Pontoppidan*, who wrote the History of *Norway*, a very jejune performance, and unfortunately the only one that has been translated into *English*; Professor *Schönning*, who wrote the best history, and several dissertations upon the Antiquities of *Norway*; Bishop *Gunnerus*, who founded the Royal Society of Sciences at *Trönÿem*, and wrote upon the Natural History of *Norway*; Professor *Vahl*, one of the best botanists in *Europe*: add to these, the old historians, *Tormadus Torfæus* and *Snorro Sturleson*. But although *Christiania* may have been deficient in the higher walks of literature, it has not been without poets, as in the instance of *Tullin*; nor without men of eloquence, as in the examples of the Bishops *Hersleb* and *Deichmann*. In the rest of *Norway*, poets have been numerous; as in the examples afforded by *Nordahl Brunn*, *Hans Bull*, *Pram*, *Stockfletts*, *Vibe*, *Zellitz*, *Fasting*, *Rein*, *Schmidt*, *Vessel*, *Steenersen*, *Storm*, &c. — names familiar among "old *Douvre*'s Echoes," although hitherto unheard in *Britain*; and as little known in any other part of *Europe*, as the Songs of the *Scalds*, who accompanied the armies of their ancestors, and were as necessary to the prowess of a *Nor-*

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wegian, as either *Druid,* or *Bard,* among the *Celts.* Poetry has been long cultivated in *Norway,* and it was held in esteem among the inhabitants from the earliest periods of their history. "The Muse had broke the twilight gloom," long before they had any literary communication with more civilized nations. Their poetry, therefore, such as it is, must be regarded as their own: it may be compared indeed to the streams from their native mountains, rolling impetuously along their valleys, but unmixed with a single drop from any of the waters of *Helicon.*

Public Library.

As connected with this subject, the literature of *Christiania,* we shall now mention its Public Library. It was the legacy of Mr. *Deichmann,* a native of *Norway.* The anti-room contains a curious painting by *John de Mabeuse,* well worth the notice of those who are interested in viewing the early productions of the art; also a complete set of antient and valuable engravings from the Cartoons of *Raphael.* Within the library there are no classic authors: it consists chiefly of modern historians; but there are some copies of more antient writers upon *Denmark* and *Norway.* We saw a very fine edition of the *Latin* translation of *Snorro,* which was printed, in folio, at *Copenhagen,* in the year 1777: also a copy of

the *French* folio *Encyclopédie*; and the superb *Danish* botanical work, entitled *Flora Danica*. Among the rest, amounting to some thousand volumes, there were few worth notice. They had no *Icelandic* manuscripts; but we saw here a curious collection of medals, and many valuable minerals. In the mineralogical series there were three hundred different specimens of *silver* from the works of *Kongsberg* and other *Norwegian* mines. But every thing of this kind, in *Norway*, is eclipsed by the cabinet of minerals belonging to Dr. *Müller*; to which, as we had free access, during our stay here, we often resorted. We shall, therefore, now add a few observations concerning this valuable collection, and its very worthy owner.

Dr. *Müller's* Collection of Minerals.

Dr. *Müller* is a native of *Denmark*. He was once well known in *London*, where he distinguished himself by his talents, as a physician, a chemist, and a mineralogist. In our country, he was the friend and follower of *Hunter*; and was the first person who publickly delivered lectures in *Mineralogy* in our metropolis. Dr. *Babington*, who has since composed a System of *Mineralogy*, was one of his pupils. Upon the continent, he was successively the disciple of *Lavoisier*, *Klaproth*, and others: in *Germany*, he studied under *Werner*; and in *Holland* obtained

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the prize-medals for his compositions in *Latin* poetry. His collection of *minerals* at *Christiania*, which he has annually augmented, and kept with uncommon neatness and care, is the most beautiful, and, if we except that of Assessor *Esmark*, at *Kongsberg*, also the most geognostic of any in all the north of *Europe*. It amounted, at this time, to upwards of 4000 specimens. But what rendered it particularly valuable in our estimation, was, that it contained many specimens illustrating the mineralogy of our island, which cannot be seen in our own country, because they are not now found in *Britain*. The interesting varieties of *tin oxide*, in the form of *stalactites*, whether as *wood-tin*, or under any other trivial name, together with a copious series of crystals from the mines of *Cornwall*, were the finest specimens we had ever seen. To these were added a beautiful series of bituminous bodies, selected under circumstances of association, all of which were calculated to illustrate some fact in the natural history of the mineral, or to confute some prevailing error. Among the *English* minerals we also saw varieties of *actynolite*, and of *asbestus*, from the western coast of *Scotland*; extraneous fossils from our *limestone* quarries; and varieties of *granite*, and other compound minerals, from the quarries

of *Aberdeen*. Among the foreign minerals were specimens of the utmost rarity; such as *rubies* and *diamonds* in their matrices; together with an important series from the *Swedish* and *Norwegian* mines, identifying many substances which have been separated in all the most celebrated systems of mineralogy[1]. Add to these the most magnificent specimens of *native gold*, *silver*, *antimony*, *iron*, and *copper*, which any collection in *Europe* can boast; and some idea may be formed of the importance and riches of this remarkable cabinet. Dr. *Müller* has also an extensive knowledge of *botany*, and possesses a valuable *Herbarium*.

Journey to *Kongsberg*.

It was in company with this gentleman, and our *English* friends, Messrs. *Kent* and *Jarret*, together with a little boy, the son of Dr. *Müller*, that we set out for the *Kongsberg* mines. We left *Christiania* upon the twentieth of *October*, in a coach and four, followed by our phaëton drawn by a pair of horses. The roads were very bad, and at this season of the year rendered

(1) For the *mineralogical* reader it will be proper to mention a few instances of this nature; tending to simplify the science of *mineralogy*, and to curtail it of many superfluous names. Dr. *Müller* has succeeded in identifying *amphibole* with *tremolite* or *grammatite*; also *pyroxene* with all the substances called *kokkolite*, *sahlite*, *mussite*, *alalite*, and *diopside*; and again, *Gabronite* with *Scapolite* and *Wernerite*.

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almost impassable by the depth of the mud which covered them. Our route lay along the coast upon the western side of the bay, affording beautiful views of the distant islands. We changed horses at *Ravensbörg* and *Gilljebek*[1]. After passing *Gilljebek*, at the distance of about an *English* mile, we came to the marble quarries upon *Paradise Hill*. Here we halted; and collected from the quarries a few very interesting minerals, for which this vein of transition marble[2] is remarkable; namely, *asbestiform tremolite*, containing imbedded crystals of dodecahedral *green garnets*, and also dodecahedral crystals of *green carbonated lime*, which seem to have owed their form to cavities left by the *garnets*: they were not, however, hollow, as pseudomorphose crystals

Marble Quarries of *Gilljebek*.

(1) These places are named as they appear in *Pontoppidan*'s large map. They are pronounced *Ravensburg* and *Giellebeck*.

(2) All the rocks here have been described by *Von Buch* as belonging to the *transition* formation; otherwise this *marble* is, to all appearance, of the kind called *primitive marble*. It has the same crystalline structure, and the same whiteness. Speaking of the rocks in the neighbourhood of CHRISTIANIA, *Von Buch* says, "I found here stones which were never supposed to be in the *transition* mountains, but which were here seen with such a distinctness of stratification, that not a doubt could remain as to their relations in this respect: * * * * *Porphyry* in immense mountains reposing on *limestone* full of petrifactions; a *syenite* over this *porphyry*, consisting almost entirely of coarse-granular *feldspar*; and in the same manner, a *granite* not different throughout in its composition from the *granite* of the oldest mountains. *Granite* above *transition limestone!* Granite as a member of the *transition* formation!"—*Von Buch's Travels through Norway, &c. p. 45. Lond.* 1813.

generally are; and might easily be confounded with the *garnets*, from their resemblance, in size, colour, and form. The *geological* features exhibited by the rocks at *Gilljebek* are indeed remarkable: the *marble* lies upon a stratum of *granite*, and beneath the *granite* occurs a schistose *porphyry*. This *porphyry* in several places rises to the surface; the basaltic hills near *Drammen*, mentioned by *Linnæus* as a species of *trap*, being composed of it. Many varieties of *porphyry* are found upon *Paradise Hill*; also *red* and *grey granite*; *green-jasper*, and *ribbon-jasper*; and *red* and *yellow feldspar*. In the pavement of the streets of *Christiania*, there had been found, by Dr. *Müller*, blocks of *ribbon-jasper*; but in our own observations upon the *jasper* found here, and also near *Christiania*, we should, in some instances, almost hesitate to consider it as *jasper*; that is to say, as a pure *hydrate of silica*. It seemed rather a kind of *roch-flint*, approaching in its degree of hardness to that of *jasper*, but having a more earthy fracture, and not being susceptible of so high a polish. The proportion of *alumina* in the stone seemed to be very considerable; and so it is indeed in some of the varieties of *jasper* said to have been analyzed by *Kirwan*[3] and *Rose*[4]; but the fact is, we

(3) See *Allan's* Synoptic Tables, Tab. xxii. *Edin.* 1814. (4) Ibid.

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have no good analysis of the substance commonly called *jasper*; and hence the ambiguity attached to all the descriptions of this mineral. The name is sometimes applied to veined *agate*, a compound mineral consisting of *chalcedony* and *quartz*; sometimes to striped *chalcedony*; and even in some instances to *greenstone trap*, where the paste is fine, and the particles of this aggregate too minute to be discerned by the naked eye. Still more frequently has the name been applied to *hornstone*; especially when the layers of *hornstone* are of different colours, so as to occasion the striped appearance which gives rise to the appellation of *ribbon-jasper*.

View from Paradise Hill.

From *Paradise Hill* we had a delightful view of the whole of *Leer* Valley, with the towns of *Tangen*, *Strömsoe*, and *Bragernæs*; which go under one common name of *Drammen*, owing to the river *Drammen*, whereon these towns are situate. The descent upon *Drammen*, as it is thus called, may be reckoned among the finest things in *Norway*. To the right of the spectator rise mountains of basaltic *porphyry*; towards the left and in front extends a magnificent valley, combining almost every thing that nature and art can contribute to render such a prospect pleasing to the eye; upland and dale, and rocks and woods and water, decorating the smiling

Drammen.

scenes of human industry, and appearing with an aspect of greater cheerfulness, because garnished with many picturesque buildings, denoting a numerous and thriving population[1]. The people of *Drammen* are said to be richer than those of *Christiania*; but they lead a more private and retired life. The principal resident foreigners are from *Holland*; and these *Dutch* families may be considered as holding a station at *Drammen* similar to that of the *English* in *Christiania*. There are also some *Italians* settled here, who are in a flourishing way. The timber of *Drammen* does not find a market in *England*; the deal planks being short and bad: but it goes to *Holland*, and is there sold.

Hogsund.

We changed horses at *Bragernæs*, and came to *Hogsund*; having pursued our course through a populous and delightful valley, along the banks of the *Drammen*. The situation of *Hogsund*, on the river and near to a cataract which turns some saw-mills, gives it considerable beauty. The clouds were now low, and hung in various fantastic shapes upon the mountains. Hence the distance to *Kongsberg* is two *Norwegian*

(1) "So thickly peopled," says Mr. *Coxe*, "that every fifty yards we observed a cottage, and for several miles together seemed to pass through a continued village."—*Travels into Norway, vol.* V. *p.* 232. *Lond.* 1791.

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miles, over a very hilly road. Leaving *Hogsund*, we were ferried over the river, and continued our route to *Kongsberg*, upon the *Louven*[1]. We passed a small but pleasing lake upon our left. Towards *Kongsberg* the mountains became higher, and more denuded towards their summits. We descended a long and steep hill into the town of *Kongsberg*, entering it by a wooden bridge over a roaring cataract of the river *Louven*, which made a most tremendous appearance at this season; perhaps owing to the late rains, which might have given a character of more terrific grandeur to this fall of water than it usually possesses.

River *Louven*.

Kongsberg.

A man must be indifferent indeed to natural history, who does not feel some degree of curiosity respecting *Kongsberg*, in whose mines a mass of *native silver* was found, in one entire piece, weighing nearly six hundred pounds[2]. But, independently of its mineral celebrity, *Kongsberg*, as a handsome town, is a place of

(1) See the Map.

(2) "Quid Norvegiæ in fodinis Kongsbergensibus, ubi jam per seculum vix nisi argentum nativum et semel iterumque etiam aurum, tanquam auræ melioris progenies, in lucem et diem gelidissimum plenissimo sæpe cornu prodierat, cujus annuum proventum ab anno 1711, ad 1724, sistere volupe est, ut inde miranda naturæ phænomena in regno subterraneo existentia luculentius contemplari liceat."—*Svedenborg in præfat.* "*Regni Subterranii.*"

considerable distinction in *Norway*. The streets are wide, and many of the houses are neat and well-built. Its very existence, however, is owing to the excavations carried on here, in search of precious ore; for when this was first discovered, there was hardly a cottage near the spot. This event took place in the year 1623[3], by means of a boy, whose foot, in pursuing some cattle, was arrested and caught by a hook or thread of native silver projecting above the surface of the rock. Very different accounts are given respecting the profits which the *Danish* Government has derived from the *Kongsberg* mines: the general opinion, however, seems to be, that the undertaking is attended with loss. It was stated to us, upon authority which we were inclined to credit, because coming from those who had the principal management of the works, that the annual loss to Government amounted to 240,000 rix-dollars: and when we inquired, why, under such circum-

Original discovery of the silver ore.

(3) *Pontoppidan* is agreed as to the date of the discovery, but differs as to the manner of its being made. He relates a somewhat improbable story of the herdsmen pelting each other with the ore. (*See Nat. Hist. of Norway, vol.* I. *p.* 183. *Lond.* 1755.) And the story of the boy, whose foot was caught by a thread of *native silver*, is too much of a piece with the circumstance related as to the origin of the famous *Peruvian mine*, not to suppose that the two narratives had, at the least, a common origin. —The discovery of the rich mine of *Potosi* is said to have happened on the 24th of April, 1545.

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stances, the excavations were continued, we were told that the employment given to a great number of inhabitants, who would otherwise be without the means of subsistence, induced the *Danish* Government to persevere. But that an endeavour is making to contract the works, is plain from this circumstance, that every miner is encouraged to leave *Kongsberg* by a premium offered to him of a year's pay after his departure. The very nature of the mine must have given rise to extraordinary vicissitudes of hope and disappointment; because, as the search is carried on in pursuit of imbedded masses of native metal, dispersed for the most part in capillary forms and unconnected laminæ, rather than in any regular veins, it must happen that the labour will frequently prove abortive for a considerable length of time, and, at intervals, be perhaps attended with sudden and unexpected success. *Pontoppidan*, whose account of the works here was written in 1751, calls it[1] "the present flourishing mine at *Kongsberg*." He says, that, to the best of his knowledge, it is "the most considerable and of the greatest profit of any mine in *Europe*; and in respect of pure massy silver veins, quite inexhaustible."

State of the Works.

(1) Nat. Hist. of *Norway*, Vol. I. p. 183. *Lond.* 1755.

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First Settlers.

The first inhabitants of the new-built town of *Kongsberg*, when the works commenced under the auspices of *Christian the Fourth*, were miners from *Germany*; and they were the ancestors of the many thousands now living there. In process of time, the German settlers mixed with the other inhabitants; and now all of them are under the direction and government of the College of Miners. The *silver*, as it was before stated, occurs in lumps of native metal: but so unusual is this circumstance, that when the mine was first discovered, many refused to give credit to the fact of such masses being actually brought to light. We shall mention some of the most considerable. The first, is that preserved in the Royal Museum at *Copenhagen*[2]; its weight being five hundred and sixty *Danish* pounds, and its value five thousand rix-dollars[3]. It is a

Remarkable Specimens of the Native Metal.

(2) See the account of *Copenhagen*, in the preceding Volume of these Travels, p. 95.

(3) *Pontoppidan* says it is the same of which the measure in *Danish* feet, &c. is thus given by *Olig. Jacobeus*, in his *Museum Regium*, p. 31. "*Minera ingens argenti ex fodinis Norvegiæ, pedum quinque et pollicum sex longitudinem æquat, crassitiem verò in circumferentia pedum quatuor.*" And the dimensions, as here stated, seem to coincide with our own measurement of the specimen now preserved in the Royal Cabinet. "*Anno* 1666, *d.* 24. *Augusti ex fodina Norv. Regiomontana, quæ Novæ Spei appellatur vulgò, extracta est* 560 *librarum pondere, et a præfecto fodinæ memoratæ, pretio* 5000 *Imperialium estimata. Huic non dissimilis massa, anno* 1630, *regnante in Dania divo Christiano Quarto, ex fodina Norvegica quæ Benedictio Divina vulgò, eruta est, quæ* 3272 *Imperialium pretio estimata.*"

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mass of native silver nearly six feet in length, and in one part above eighteen inches in diameter. Similar masses were discovered in the year 1630, and in 1719, and in 1727, which severally weighed from two hundred and fifty, to two hundred and eighty, and three hundred pounds, each. In the shaft called *St. Andrew*, a piece of pure silver was found, in 1727, weighing two hundred and seventy-nine pounds; and, in the same year, another, weighing three hundred and four pounds, was found in *God's-Blessing* shaft. These occasional masses, occurring casually in the rock, and being soon interrupted in their passage through it, or dwindling gradually to nothing, the miner must continue to dig through the barren stone until he has the good fortune to meet with more of the same nature, which in one day may reward the fruitless labour of months, and perhaps of years. *Pontoppidan* says, that after the discouragements of a long and fruitless toil through the barren interstices of the mine, "it suddenly exhibits several thousand pounds weight of silver, and thus discharges all arrears and embarrassments, and animates to further prosecution." Such was the statement made by a writer in the middle of the eighteenth century. According to the account given to us by the present Governor,

Wages of the Mines.

130,000 dollars are coined annually from the produce of three mines. In general, 2300 men are employed, who earn each about a shilling a day of our money. This seems very little; but, in addition, the King always supplies the miners with corn at a fixed price, much below the average value. At this time, the price of rye, per ton, was six dollars and a half, and the miners were allowed rye at two dollars. The miners work from five to one o'clock, summer and winter. When they work in the afternoon, they are paid an extra allowance. There is generally employment for the children of the miners at twelve years of age. The principal bed of this mineral treasure is a mountain between two small rivers, the *Kongsberg* and the *Jordal*, which fall from the westward *Blee-Field* Alps into the *Louven*[1]. But the *silver* is not limited to this mountain; it extends its deposits for some miles throughout all the adjacent districts: this is proved by the new mines which from time to time have been undertaken in several places. The mine, or shaft, called Old *God's Blessing*, one of the most antient and most rich, has sometimes within a week yielded some hundreds of pounds of pure native metal. It is

(1) See the Map.

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nearly two hundred fathoms in depth, and the circumference at the bottom forms a clear space of several hundred fathoms[1]. When *Pontoppidan* drew up his account of the *Kongsberg* mines, the annual produce amounted in value to "a tun of gold and a half, and sometimes three quarters." The number of the officers of all ranks, the daily miners, labourers, and pensioners, exclusive of their children and families, who had their daily support here, according to the establishment, amounted to near five thousand persons[2]; and the number of all the inhabitants of *Kongsberg*, to between ten and eleven thousand souls. To the great number of officers, under the names of Intendants and Assessors, possessing salaries from Government, is owing the vast expense of these works to the nation. These officers, in fact, engross a considerable part of the profits; and if, as it is very possible, their number were to be reduced, the profits from the mines would be more sensibly felt. By dismissing a number of such persons, half of whom can only be considered as *drones*, and augmenting the number of miners, the *working-bees*—that is to say, of those actually

Present Establishment.

Cause of the loss sustained by Government.

(1) *Pontoppidan's* Nat. Hist. of *Norway*, vol. I. chap. 8. sect. iv.
(2) Ibid.

employed in useful labour—the finances of the *Kongsberg* establishment would soon begin to wear a more promising appearance. From the lavish expenditure of the public money, the want of economy visible in every part of the establishment, and the want also of that vigilance which is necessary to prevent embezzlement where precious metal is brought to light in a state actually ready for the mint, it was easy to perceive, during our own examination of what was going on here, that the works were not the property of individuals; but that, as they belonged to the crown, so they were open to all manner of peculation, no one feeling a sufficient degree of interest in their prosperity to prevent waste, or even robbery.

The mountain on which the mines nearest to the town are situate is about 1295 *French* feet (1498 *Danish* feet) above *Kongsberg*, which itself lies 926 feet above the level of the sea. Many of the neighbouring mountains are much higher. The base of those, in general, in which the *silver* is found, is chiefly *hornblende* and *mica*, but the veins of ore are contained in *red transition granite*. The deepest of the *Kongsberg* mines measures 375 fathoms perpendicular from the surface. The richest of them all now affords very little ore: its appellation is nevertheless

The different excavations.

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curious—"*God's help, in time of need:*" and it will become "*a time of need*" in reality to these poor people, if the mines should altogether fail. No less than 14,000 families are either immediately dependent upon them for their support, or collaterally derive from the mines their means of subsistence. Of this number, 2300 are miners: but there are 7000 families in *Kongsberg* maintained entirely by the works; and also an equal or greater number in the country, who, either by procuring fuel for the smelting-houses, or in some other way contributing by their industry to the maintenance of the mining establishment, are entirely indebted to it for a livelihood.

Approach to the Works.

We visited one of the mines which they were now working. Like the others, its situation is between the rivers we have mentioned in that alpine barrier of mountains which separate the provinces of *Christiansand* and *Aggerhuus*. The approach to the works is by a continued ascent the whole way: and were it only for the striking view afforded, in this ascent, of the town of *Kongsberg*, the mountains, and the beautiful valley of the *Louven*, it would be worth the journey required. All the mountains, among which the *Kongsberg* mines are situate, are stratified: the strata occur in regular beds extend-

Geological nature of the Mountains.

ing from *north* to *south*, but having always a dipping inclination towards the *east*. These strata are moreover intersected by the veins of *slate* and *calcareous spar*, which serve as the matrices of the *silver* ore, in fissures bearing across the strata from *east* to *west*, and dipping towards the *south*. From all this, it would be evident that the whole formation belongs to the class of *transition rocks* which *Von Buch* has described as being so remarkable in this part of *Norway;* namely, *transition granite* reposing on *transition limestone*, and being itself intersected by veins of *slate* and *limestone*. But *Von Buch* speaks of "the primitive mountains which surround *Kongsberg*[1]:" and if we were to judge from detached specimens of the *red granite*, in which the veins of *silver* are found, we should be disposed to consider this kind of *granite* as belonging to the oldest class of primary rocks. We will endeavour to shew, by a rude cut, the manner in which the *Kongsberg silver* is found. The more antient or primitive fissures inter-

Manner in which the *Kongsberg* silver is deposited.

(1) "The primitive mountains which surround *Kongsberg* stretch much less southward than we might well believe. Scarcely two *English* miles down, beyond the *Dal-Elv*, under the Church of *Hedingstad*, and before we come to *Hellestad*, the *gneiss* disappears under the dark bluish-grey fine granular *limestone*." *Travels through Norway, &c. p.* 419. *Lond.* 1813.

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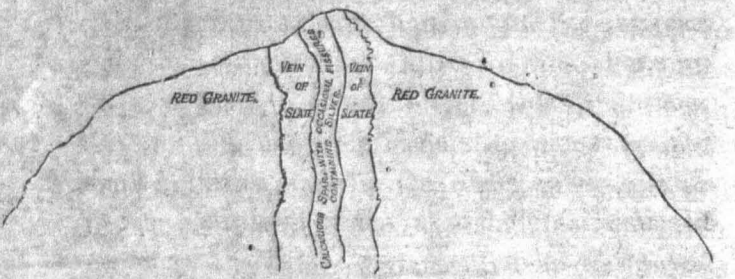
secting the strata are perpendicular; but those which are now worked have an inclination towards the *south*. By the cut here afforded, it



will be seen that the *silver*, as it generally lies, is found in a vein of *calcareous spar*, and that this again occurs in a vein of *schifver* of *slate*. But there is a remarkable leader to the ore, without the presence of which the miners have little hope; namely, *iron pyrites* and *iron oxide:* whenever the intersecting fissures contain these minerals, then *silver* is found; but if the *pyrites* and the *iron* disappear, the *silver* also fails; which is a very remarkable fact, as connected with the history of mining. Every thing indeed belonging to the nature of these mines is worth the most scrupulous attention; because mines of *native silver*, although not unfrequent in *America*, are the most rare in *Europe:* and among the very few instances in which such a

deposit has been observed, this of *Kongsberg* is the most conspicuous. When we came to the mouth of the shaft, a basket filled with the ore had just then been raised, which we eagerly examined. It consisted of native silver, disseminated in laminæ throughout masses of *limestone spar*, with dark veins of *schistus*; containing, in some instances, *sulphuretted silver*, and *sulphate* of *barytes*: the specimens were poor in precious metal, but served to give some idea of the produce of the mine; which is now an ore almost too poor for the operation of stamping; and now so rich, that the *silver*, as if it had been fused and drawn out into threads and capillary fibres, is seen in native masses, protruding beyond the surface of the stone[1]. Sometimes the most beautiful *arborisations*, as they are called, of the native metal, are exhibited by contiguous crystals of *native silver*, in octahedral and in cubic forms.

Descent into the Mine.

We descended into the mine by means of ladders, as into the *Cornish* mines; being everywhere struck by the proofs of the same inconsiderate expenditure of the public money, and the same waste among the works. There can

(1) See the *Vignette* to this Chapter; made from a specimen now in the author's collection, which he brought from the *Kongsberg* mines.

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be little doubt but that these mines would become very profitable, if they were in private hands: and perhaps the best thing the Government can do, is to farm them out to individuals.

Besides *native silver*, these mines produce that very rare substance, the *native electrum*, or *auriferous native silver*. We found it a very difficult thing to procure any tolerable specimens of this curious native alloy of *gold* and *silver*. When it occurs, the metal has a *brassy* aspect. We had a specimen of it, which we analyzed, containing, besides *silver*, nearly thirty per cent. of *gold*. Like the *native silver*, it is found in laminary and capillary forms; and sometimes, but very rarely indeed, it is crystallized in cubes. The other minerals found here are noticed below, in the note[1]: with the

(1) 1. Sulphuret of silver, massive and crystallized.
2. Red antimonial sulphuret of silver, ditto.
3. Argentiferous sulphuret of lead.
4. Sulphurets of copper and iron.
5. Sulphurets of zinc, brown and yellow.
6. Fluate of lime, of various colours.
7. Lime spar, in great variety of forms.
8. Quartz, ditto.
9. Sulphate of barytes.
10. Comolite, or pot-stone.
11. Asbestus, in the forms of *mountain-leather* and *mountain-cork*.
12. Anthracite.
13. Iron ores—magnetic iron—*loadstones*, &c.

exception of the ores of *copper*, the specimens of which are exceedingly rich; but they are not sufficiently abundant to make this metal an object of research, otherwise than for the *silver* with which it is combined[2].

We descended into the mine by ladders nearly perpendicular; meeting with occasional landing-places, in our way down. At the depth of a few hundred feet, the veins of *silver* were occasionally pointed out to us; but those which we saw were so poor, that they could scarcely be discerned by any but a miner's eye. The richest veins are those which dip towards the *south:* and they are especially rich when they occur associated with the *sulphuret of iron*, or *pyrites;* called, by our *Cornish* miners, *Mundic*. The ore, and all the rubble of the mine, were drawn up by a water-wheel, at the distance of four or five hundred yards from the mouth of the shaft; the communication being carried on the whole way by cumbrous machinery. From the spot where this shaft has been opened, we had a fine view of *Kongsberg* and of the surrounding country.

After a most laborious investigation of the

(2) It is nevertheless collected, after being separated, and in considerable quantities, from the basons in the smelting-works: the pure *copper* being made into *cakes* of the same size and form as are those of the *silver*.

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different parts of the mine,—which only served to convince us, as it often happens to travellers, that as much knowledge of the real nature of these subterraneous deposits may be obtained by studying the ores above ground,—we were again conducted to the surface. It was here we saw, for the first time, a mineral, then rare in cabinets of mineralogy, but which has since become very common; namely, *anthracite*, or *native mineral carbon*, which frequently occurs in the *Kongsberg* mines, associated with the silver ore. That a substance so nearly related to *diamond*, containing the same elementary body, almost in a state of equal purity, should externally resemble a piece of common *pit-coal*, will not appear so surprising as it might otherwise do, when we know that the *diamond* itself has been found to exhibit a similar appearance[1]: but it may serve, among many other phænomena, to manifest the absurdity of ascribing the presence of *carbon* and its compounds, when in a mineral state, and in primary and transition rocks, to the decomposition of vegetable matter. It would be a much wiser way of reasoning

Native Mineral Carbon.

(1) Opake jet-black diamonds, although rare, are known to diamond-merchants; and the black flaws or specks, which are sometimes seen in diamonds, are nearly allied in their nature to *anthracite*.

upon the operations of nature, if we were rather to consider the vegetable produce of the earth as deriving its existence from the minerals which supply it with the alimentary principles of life. The only difference between *anthracite* and *bituminous coal* is, that, in the first, *carbon* is almost in an uncombined state[2]; whereas, in the second, it has entered into combination with one of the constituents of *water*; in which state it may very possibly mineralize *wood*, or any other organic body, just as they become mineralized by other native compounds;—for example, by the *hydrates of silica*. But to infer from such accidental circumstances that the native compound has owed its origin to a change sustained by the vegetable body, is taking too narrow a view of the subject, and building a theory upon fortuitous and partial phænomena[3]. We

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(2) The following analysis of *conchoidal anthracite* will be found very nearly to agree with that of the *native mineral carbon* of *Kongsberg*:

Carbon	96 . 66
Alumina	2 . 0
Silica and iron . .	1 . 33
	99 . 99

(3) Among the absurdities urged in support of the vegetable origin of *coal*, is that of *wood* thus mineralized by the bituminous body. The author was once directed to a specimen of fossil timber, part of which was of *coal* and the rest of *wood*, as to a proof that the origin of *pit-coal* was thereby plainly demonstrated, and that it was owing to decayed vegetables. With just as much reason did the *French Savans* insist upon deriving all the

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were surprised at the difficulty we experienced in procuring fine specimens of the *native silver*; but it seems they are sent, as soon as found, by the Assessors, who have the first selection, to the dealers and principal collectors in *Copenhagen*; insomuch, that the resident mineralogists at *Christiania*, and even at *Kongsberg*, are under the necessity of procuring their own specimens, at very advanced prices, from that capital. Our good friend Dr. *Müller*, by his acquaintance with a widow of one of the Assessors, obtained for us permission to purchase a few varieties; in some of which, the crystals of *native silver* were very perfect, and in the octahedral form. There are few things less obvious in the natural history of minerals, than the manner in which Nature conducts her operations for the developement of the native metals; although there be evidences which tend, at least, to prove that these phænomena result from the decomposition of ores by chemical affinities. *Capillary native silver* is often a result of the decomposition of the *sulphuret of silver*; and in the *Hungarian* mines it is found

Crystallized Native Silver.

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the *aluminous* rocks of the globe from decomposed plants, because the impressions of the leaves of *ferns* are seen in *slate*; and all the *limestone* from the decomposition of animal bodies, because it contains the impressions of *shells* and other organic remains.

upon decomposing sulphurets. *Native silver* is also developed in the *Peruvian* mines, by the action of *iron* and other metals upon the *muriates of silver*. The same may be said of the developement of *native gold*, which results from the decomposition of the *sulphurets;* as may be proved by the action of heat upon the auriferous ores of *tellurium*, and by the spontaneous decomposition of the auriferous *sulphurets of iron* found in the mine of *Berezow*, in *Siberia*. But then the crystallization of these metals! — the perfect crystalline forms assumed by both of them! by the *native silver* at *Kongsberg!* and by the *native gold* of *Hungary* and of the *Brazils!*—how are these phænomena to be explained; without supposing that the two metals have been previously held in a state of solution, and that the crystals have been deposited from a liquid state; being held in solution, either by the fluid matter of heat, or by some other fluid? "*The particles of bodies,*" it will be urged, "*in order to crystallize, must be at liberty to move;*"—all of which is very easily said, and is, perhaps, after all, mere sophistry; it having been already proved, and beyond dispute, in another Part of these Travels[1], that the particles of precipitated bodies, or sedi-

Erroneous notions entertained with regard to the crystallization of Minerals.

(1) See Vol. VI. p. 128. Octavo Edit.

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ments, do combine according to the laws of cohesion; that is to say, do assume the utmost regularity of crystalline form and structure; the most perfect symmetrical arrangement; and even change from a state of opacity, to a certain degree of transparency (as in the example of the crystallized alabaster of *Antiparos*), after the original deposit from the fluid state has taken place, and in cases where the molecules were precluded from the possibility of motion. These are surprising facts: and they deserve the more attention, because, as they seem to militate against the theory which has been long established respecting a regularity of structure in minerals, so they may perhaps serve to explain, whenever they are satisfactorily accounted for, the hidden laws by which crystallization is effected.

Metallurgical operations for the treatment of the *Kongsberg* Ores.

Upon our return to *Kongsberg*, we visited the smelting-houses, and inspected the metallurgical operations for the reduction of these remarkable ores. The process is very simple: it is that which the *French* writers call *imbibition*, by means of *lead*[1]. They melt together, in nearly equal parts, *lead* and *native silver*, divested

(1) See "Traité de Min. par *Alexandre Brongniart*," tome II. (Article *Métallurgie*), p. 337. *Paris*, 1807.

as much as possible of its matrix; and thereby obtain an alloy, consisting of *lead*, combined with from thirty to thirty-five per cent. of *silver*. The *lead* is afterwards separated, by the usual process of cupellation. We were amazed at the facility with which all manner of persons obtain admission to these works, when the rich ore brought from the mines is lying about in heaps, covering the floor. Persons disposed to pilfer, would find no difficulty in removing large portions of it. The ore is of four kinds; which severally bear the following appellations:

1. *Gedieget Sölv.*
2. *Meddel Ertz.*
3. *Skeide Ertz.*
4. *Slig.*

The *first* of these consists of pure *native silver*.

The *second* of *native silver*, with a portion of stony matrix; *i. e.* lying in laminæ, which cannot be altogether separated from the mother-rock.

The *third* of a poorer ore, in which only detached specks and minute grains of *native silver* are visible.

The *fourth*, of the sand and rubble of the mines.

The two first, that is to say, the richer ores, are smelted with the greatest facility, being only mixed with a proportionate quantity of *lead*;

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but the two last, whose manipulation constitutes the principal work of the furnaces, requires a longer process, which we shall now describe. The *slig* is mixed with *pyrites*, and smelted; when the latter enters into combination with the *silver*, forming a *sulphuret*: but the superfluous portion, during this process, becomes *slag*, and is separated. This mixture of *silver* with *pyrites* is called *raasten*. It is then calcined, by which process the volatile part is sublimed. After calcination, the *raasten* is mixed with *sheide ertz*, with a portion of the richest *slig*, and also with a small quantity of *slag*; and these four ingredients are then smelted together. When in a state of fusion, the whole is suffered to run into a bason, where it is further mixed with *lead*, which combines with the *silver*. Afterwards, the alloy is removed to another furnace; in which, as the *lead* rises to the surface, it there floats, and is gradually drawn off. Then the *silver* undergoes the last process; in which, by the degree of heat communicated to the mass, it becomes divested of any small portions, either of *lead* or of *copper*, which may remain.

The business of mining is confined to the same families: no strangers are allowed to work. There is generally employment for the children of the miners, at an early age. They are now,

however, increasing rather faster than the employment for them. We saw many children in the streets, and much apparent distress and poverty; many beggars, both of children and grown persons: but the houses were tolerably neat.

Public Seminary for Mineralogy. Professor *Esmark.*

There is a Public Seminary at *Kongsberg*, in which Lectures on Mineralogy are delivered by Professor *Esmark*, who is also one of the Assessors, and the most scientific mineralogist, perhaps, in all *Europe*. This gentleman is well known in all Foreign Academies, for the works which he has published. He has done more towards the overthrow of the wild systems of the *Plutonists* than even *Werner* himself; and this simply by his own personal observations in his travels; by opposing the results of actual experience, and matters of fact, to mere visionary and speculative opinions. It was he who discovered *pumice* and *obsidian* regularly stratified in porphyritic rocks; thereby refuting the notions that were entertained of the origin of such phænomena by means of volcanic fire; and as satisfactorily accounting for their formation by the humid process, as did the discovery of a cave in *Iceland*[1] with dripping stalactites of

(1) See Blackwood's Edinb. Mag. No. X. p. 379.

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obsidian pendent from the roof. Dr. *Müller* introduced us to this gentleman. His collection of minerals is one of the most *geognostic* we ever saw; and it is filled with specimens tending to illustrate the real origin of the substances which have been improperly termed *volcanic*. He exhibited to us masses of *porphyry* containing imbedded layers of *obsidian;* and this, again, containing *pumice;* together with a regular series of transitions, shewing by what changes *obsidian* passes into the state of *pumice*. Considering *trap* as a generic name applied to a great variety of rocks, especially those of *porphyry*, the Professor comprehended under this genus, *schistus*, and all the rocks called *schifver* by the *Germans*, and many of the substances which, owing to their porous aspect, are often considered as lavas; for example, *mandelstein*, or *almond-stone*, of which there are so many varieties in the islands of *Rum* and *Skye*, in the *Hebrides*, containing *zeolotic nuclei;* and all the *basaltic porphyries* of *Drammen*, with which *mandelstein* is found, as it is also in *Hungary* and *Transylvania*. Upon examining the *basaltic porphyry* of *Drammen* with a lens, we perceived that it was full of small spheroïdal concretions, like those which appear in the basaltic rocks of *Canna* in the *Hebrides*, and which have been by some tra-

Collection of Minerals belonging to the *Kongsberg* Academy.

vellers ascribed to an igneous operation. Professor *Esmark* conducted us to the grand chamber of the *Kongsberg* Academy, where we saw a collection of minerals, in beautiful order, and most scientifically arranged. The very sight of such a collection affords of itself an edifying lesson for mineralogists; but we were willing to forego some of the advantage which might be derived from its inspection, that we might enjoy the valuable conversation of the Professor. From him we learned, that the School of this Academy is a Royal Institution for the instruction of the children of the miners, in *mineralogy*, *chemistry*, *physic*, *mathematics*, and other branches of science. There are three Professors, among whom Professor *Esmark* holds the *mineralogical* and *geological* department. Any of the miners, or children of the miners, may attend this institution. Two days in every week, and two hours in each day, are dedicated to the instruction of the miners, and all other persons who choose to attend. FOR THESE LECTURES, NO PAYMENT WHATSOEVER IS REQUIRED. Of the advantages of such an institution, where there are profitable mines, it would be vain to attempt to speak. We felt, at the moment, an inward sense of shame for our own country, in which such studies have hitherto met with so little

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encouragement. We could but turn our thoughts homeward, and ask, what the Government of GREAT BRITAIN had ever done towards the advancement of *mineralogical* knowledge. At this moment there was not a single Professor of *Mineralogy* in any of our Universities: and it will be long indeed before the eyes of pedants, who bear so much sway in our places of public education, will be open to the importance of establishing Schools of Mineralogy. The very science itself, and all that belongs to it, is to them as a sense which they never enjoyed: whence it follows, that to reason with such persons of its advantages, is like talking of the blessing of light to one who has the misfortune to be born blind[1].

The appearances of squalid poverty which disgrace the streets of *Kongsberg* were before alluded to: this place, like *Christiania*, swarms with beggars; who beset the door of the inn at which travellers arrive, forming together a mob

(1) These reflections are given as they occur in the author's Journal. They will, he hopes, be read with a reference to the time in which they were written. A very considerable alteration is now beginning to take place with regard to the study of *mineralogy* in *Great Britain*: but it is not too much to say, that the prodigious source of wealth which its due encouragement might open to our nation has not yet been adequately weighed by our Rulers. There is not one school established for the instruction of *miners*, in any of our mining districts.

of most disgusting objects; each endeavouring to extort money, as in *France* and *Italy*, and as it used to be in *Ireland*, especially in the streets of *Dublin*[2], by exposing to view distorted limbs, and deformity, and open sores; thrusting these revolting sights in the very faces of every stranger they meet. We were glad to get away from them; and set out again for *Christiania*; returning by the same road that we came, and sleeping the first night at *Drammen*.

In the church-yard at *Drammen* we observed that almost every grave was covered with a bed of flowers. Dr. *Müller* told us, that, in the summer season, these flower-beds upon the tombs have a very pleasing appearance; and that it is also customary, during the summer months, to scatter flowers upon the tombs. There is every reason to believe that the same customs prevailed among all the antient families of the *Goths* and *Getæ*, and their descendants; because they are so strictly *Grecian*. Offerings of flowers were among the honours paid to the dead in *Greece*; and we have before noticed a similarity of customs between the Antient *Greeks* and the present *Norwegians*, in describing the

Customs, shewing the common origin of the *Teutons* and *Greeks*.

(2) This nuisance in *Dublin* has been lately put a stop to.

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marriage-ceremonies of the latter[1]. So, with regard to this practice of strewing the places of sepulture, we find that it was customary to strew the *Grecian* tombs with herbs and flowers; with amaranths[2]; with roses[3]; with myrtle[4]; and most profusely with parsley[5]. Future travellers, pursuing this subject of the common origin of the *Teutons* and *Greeks*, will, in all probability, have to notice other more remarkable points of coincidence.

There are many good houses in *Drammen*. The whole valley from *Hogsund* to this place is beautiful, and the soil seems very good. The mountains are covered with firs. We met a great number of fine-looking country-girls upon the road; most of them above the ordinary stature, and very handsome. In *Sweden*, we had remarked that the men were much superior to the women; but here we should make the contrary observation, and particularly among the higher classes. At *Christiania* we had met with many elegant-looking women; but scarcely any among the men, excepting the *Ankers*, who,

Superiority of the *Norwegian* Women.

(1) See p. 235 of this Volume.
(2) Philostrat. Heroïc. cap. 19. p. 741.
(3) Anacreon. Od. liii. 25. Aristænet. I. Ep. 36. p. 162.
(4) Euripides, Electr. v. 323.
(5) Polyæn. Stratag. v. 12. sect. 1. Suidas, in voc. Σελίνου στέφανος.

being natives, had the air of gentlemen. The custom of smoking, so universally prevalent, greatly contributes to their slovenly and dirty appearance. As we proceeded in our journey, we observed that most of the houses have little porches, which are generally ornamented with boughs of birch or of fir. The country-women, when engaged in their labours,—and they work harder than the generality of the men in our country,—wear nothing upwards but their shifts, which however are made higher than in *England*. Sometimes a coloured handkerchief is thrown loosely over their shoulders; but they have no stays, nor any other covering for the waist. The women, in many parts of *Sweden*, work in the same time attire, and look exactly like men toiling in their shirts.

Medical properties of the *Linnæa Borealis*.

Near *Drammen*, that elegant plant, the *Linnæa Borealis*, may be found in great plenty at an earlier season of the year. Its flowers, at this time, were all gone, but we found the remains of its seed-vessels in sufficient abundance to testify its situation here. It flowers in *Norway* in the months of *June* and *July*. Its medical properties are mentioned by *Linnæus*; but according to *Gunner*, whose *Flora Norvegica* was printed at *Trönijem* in 1766, the inhabitants of that city make use of an infusion of the *Linnæa*

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Borealis as an antidote in fevers. The same author also speaks of it as affording a remedy in other disorders[1]. The *Norwegians* call it *Norisle; Noretle;* and *Narisle-grass.*

Condition of the Peasants.

The food of the labourers who work for gentlemen, or large farmers, in this country, consists of black rye-bread and salted butter or cheese, for breakfast; and boiled barley and a herring, or some other fish, with beer, for dinner. Once in a week, and sometimes twice, they have fresh meat. The common people in general live nearly in the same way, only not quite so well. Instead of beer, they have sour milk. Some, who have large families, are often in great distress. The men who work for gentlemen, or farmers, have generally a house found for them, rent free; for which they are always obliged to work for the master from whom they receive it, in preference to any other. These receive tenpence a day in summer, and eight-pence in winter; and, in harvest, a shilling, or fourteen-

(1) "Nidrosienses infuso contra febrem scarlatinam, vernacula *Narisle* (*Norisle, Noretle,* vel *Narild*) non sine salutari effectu utuntur. In *Norvegia* Australiori decoctum in usu est contra scabiem. Externe etiam vel *fotu* vel *fumo* febrem scarlatinam tollunt. Svecis foliorum infusum cum lacte specificum est in doloribus ischiadicis et rheumaticis, et fotu dolores pedum in ovibus tollunt." *Flora Norvegica Gunneri,* lxvii. *p.* 37. *Nidrosiæ,* 1766.

pence. Those who have no houses, are paid a shilling in summer, and ten-pence in winter. The state of the labouring poor is improving in *Norway:* they are not so dirty as they used to be; and, consequently, there are not so many children who die young.

There is not a pound of fresh butter to be bought in *Christiania.* All persons use what they make themselves, or they salt it for keeping. The farmers who live higher up the country, go for two months, from *June* to *August,* up the mountains, to pasture their cattle. They then live in little temporary wooden sheds; and it is during these two months that they make the greatest part of their butter, which is salted, and brought to the fair at *Christiania,* in the winter, upon sledges. This butter is bought by the families in the neighbourhood, for the use of their servants; but the better sort of people eat the butter imported from *Holstein.* So little has the custom of selling fresh butter prevailed, that if a person wished to dispose of any, he would hardly find purchasers. The cattle, during winter, besides hay and straw, where these may be had, are chiefly foddered with the leaves and small branches of a species of poplar, gathered at the end of the summer, and stored for winter-provision. We were assured by

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persons who had most attended to the keeping of cattle, that these leaves, stripped from the branches, are excellent food for horses, and that this kind of fodder gives them a very fine coat. By all that we could hear or see, the lower orders appeared to live as well as those in *England;* with this difference, that they eat rye-bread instead of wheaten-bread: but they are so accustomed to rye-bread, that they prefer it to that which is made of wheat, and reckon it a heartier food. Wheat is sometimes cheaper than rye. A flat cake, much in use, which is made of rye, and sometimes of oatmeal, is called *flad brü.* In the neighbourhood of *Christiania* the *house-men* have seldom land to keep a cow. Among the higher orders, the business of house-keeping, from its peculiar nature, and the large-ness of the establishments, takes up so much time, that the mistresses of families, after their marriage, have no leisure to attend to any thing else. The number of servants in these families is always great; and those servants are, for the most part, an idle set, never liking to do any thing out of their peculiar department; which is, in fact, the principal reason why so many more servants are required than would be wanted in *England* for the same work.

In our return to *Christiania*, we visited the

Alum Works.

Alum Works, which are near the town; and their inspection only served to convince us of what we had often suspected, from the sight of alum-works in our own country; namely, that *alum* is the result of a synthesis which takes place during the decomposition of the substance considered as its *ore:* that is to say, that *alum* does not exist ready formed in the *schistus* and other mineral aggregates from which it is supposed to be obtained; but that these rocks being exposed to decomposition by the action of extraneous bodies, a new chemical combination takes place, which is exhibited in the salt called *alum*. As the subject is really curious, its illustration, as applied to a description of these *alum-works*, will not be irrelevant. They belong to Mr. *John Collet*, whose hospitality we had lately occasion to notice. The sort of *slate*, called the *ore*, is a dark *schistus*, distinguished from *clay-slate*[1] by its streak always remaining unaltered in its colours. In its exfoliations, it separates with polished surfaces, having a higher degree of natural lustre. Its dark colour is entirely owing to the *bitumen* which it contains; but it also contains embedded nuclei of *iron-*

Synthesis which takes place in the production of Alum.

(1) See Jameson's Mineralogy, Vol. I. p. 433. *Edin.* 1816.

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pyrites. The workmen affirm, that the ore is richest when these nuclei are most abundant; and the reason why this *pyritous slate* is fitter for making *alum*, we shall presently shew. If a piece of this *slate* be submitted to analysis, when taken from its native bed, it will not be found to contain *alum*: hence it is evident, that the *alum* is, as to its formation, the result of a subsequent process, which takes place in the following manner; something of a similar nature being applicable to all other works carried on for the same purpose of extracting *alum*. The ore containing the elementary constituents of *alum*, when it has been taken from the alum-rocks, where it occurs in veins, is disposed in heaps: here, being acted upon by air and moisture, a spontaneous decomposition begins, which is from time to time aided and accelerated by water, and also by urine cast upon the heaps. The *iron-sulphuret*, thus acted upon by moisture, also undergoes decomposition. As this decomposition commences, the *pyrites* becomes heated: the sulphur which it contains becomes *sulphuric acid*; and this acid entering into chemical union with the *alumina* of the decomposing slate, and the *alkali* of the urine, an *alkaline sulphate of alumina* is the result, which is, in fact, the *alum*. This salt then begins to appear, in white delicate fibres,

between the exfoliating laminæ of the slate. For its separation, and also to further the progress of decomposition requisite in effecting this synthesis, other operations are necessary: and wherever *alum-works* have been established, the process is nearly the same; that is to say, the ore is calcined; and the particles of *alumina*, being reduced to a state of greater division, are the more readily acted upon by the acid. It is then lixiviated, or soaked for a certain time: after this, the liquor, being separated, is boiled in leaden caldrons, and suffered to evaporate: the concentrated solution containing the salt being then collected into pans, deposits the *alum*, as it cools, in large and beautiful octahedral crystals, or two tetrahedral crystals applied base to base. Commonly, however, only one tetrahedral pyramid appears as the crystalline form; the pyramids being constantly turned downwards towards the bottom of the vessel, especially those which fix themselves to the rods which are put into the liquor to multiply the surfaces. Sometimes the angles of the crystals are truncated; and these truncations take place most frequently when the *lixivium* is slightly acid. We had never seen such fine crystals of *alum* as those which we brought from this manufactory. To obtain a good crystalliza-

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tion, some precaution is necessary in attending to the degree of heat applied for the concentration of the *lixivium*. If the liquor be urged by a violent degree of heat, it loses part of its acid, becomes tasteless, and the residue is then no longer susceptible of crystallization; but the *alum* is precipitated, in the form of a very fine adhesive powder, in proportion as the water is dispersed by evaporation. To ascertain this temperature, methods of greater or less accuracy have been adopted: such as, the immersion of an egg into the liquid; the affusion of some drops of the *lixivium* upon a plate; and some other[1]. We brought away many specimens, both of the *ore* and of the *alum*. The balls of *iron-pyrites* contained in the slate have a spheroïdal form; and, in some instances, these balls are as big as a man's head.

Return to *Christiania*.

After our return to *Christiania*, the same round of hospitable entertainments again took place which we have before noticed. We were not a single day in the place without receiving invitations, either to some magnificent dinner or supper. There are public balls on a Sunday evening, once in every fortnight. These are held in a large room belonging to the principal

Public Balls.

(1) See Chaptal's Chemistry, Vol. II. p. 64. *Lond.* 1775.

inn; and the ball is followed by a supper. Tickets are given to the different persons as they enter, to regulate their places in the dance; a different set of tickets being distributed for a similar purpose at supper. The dances are, the waltz, which has always the preference, and the common *English* country-dance: but even in the country-dance the waltz is introduced: indeed it is so great a favourite, that our *English* dance would probably not be tolerated, but in compliment to the *English* who may happen to be present. Some of our popular dances were performed by the band, but in so slow and solemn a manner, that the effect became truly ludicrous. The dresses of the women are entirely *English*, and of the latest *ton*. At this time, the Governor's lady, and one or two more, made their appearance in curled crop perukes, imported from *London;* and by the buzz, which the display of the new fashion excited, the admiration and the envy it called forth, it was evident that a fresh importation would soon be the means of making these wigs a very general costume among the higher class of females. Any alteration that takes place in *London*, with regard to dress, is instantly transmitted to *Christiania:* and these changes are watched and adopted in *Norway* with a degree of avidity which is quite

Rage for *English* Fashions.

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amusing to foreigners. Nothing would be easier than to practise the most extravagant hoax, by making it to be believed that some strange grotesque mode of attire had been introduced among the fashionable belles of *London*. If a lady arrive from *England*, she has hardly set foot in *Christiania* before her toilette is beset by all the principal women, anxious to inspect and to imitate every article of her apparel.

Literary female characters are unknown: even the men rarely pretend to follow any scientific pursuit. The most learned of the inhabitants are foreigners. *Bernard Anker* was almost the only man who, as a native, engaged in and patronized literature. He was familiarly acquainted with the best *English* authors in almost every department of science, and not ill versed in the writings of other nations. He had, at the same time, some degree of knowledge of the antient classic authors. He was, indeed, in all respects, a very extraordinary man. Some travellers have spoken of his vanity: to us, this foible, if it deserved so harsh a name, served only to render his company the more amusing: not that we were amused at his expense, but because we discerned, through all his supposed egotism, a playfulness of disposition, which seemed to say, "I will be any thing, from the

Further Account of *Bernard Anker*.

loftiest statesman to the merriest member of a party at blind-man's-buff, sooner than my guests shall suffer *ennui* for want of conversation or amusement!"—and we felt convinced, that the loss of such a man, in such a place as *Christiania*, could never be supplied.—Alas! before our tribute can be paid to his distinguished worth, and these acknowledgments of the kindness we received from him publickly rendered, this loss has been sustained!—Of the extent of his commercial speculations it is hardly possible to convey an idea, without making a complete staistical survey of the commerce of *Norway*. His ships went to sea in whole fleets; and of the wealth of their freightage some notion may be entertained, by an account of his dealing in a single export; namely, timber. He took us to see his deal-yards, which were indeed prodigious. The present stock in them was worth 50,000*l*. From *Christiania* and *Moss* he exported deals to the amount, annually, of 180,000*l*.; and of this sum, above 100,000*l*. must be placed to the amount of the deals from *Christiania*. The deals that are sold in one year are cut three years before; and as every thing is paid for in ready money, an immense capital is required to carry on this trade in deals alone; which is, in fact, the reason that it is so profitable, and in such

Timber Trade.

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few hands. At *Frederickstadt*, from the facility of floating the timber to the saw-mills, and from the saw-mills immediately to the port; a whole year is saved, and the clear profit is thereby made much greater. The timber that comes to *Christiania* is brought by sledges, in winter. The carrying timber on sledges forms one of the principal winter employments of the farmers and *house-men*. By this it will be seen what the out-goings must have been of a merchant, engaged, as Mr. *Anher* was, in commerce. But, besides this, he had extensive iron-foundries, and three copper-mines. The number of his stewards, or clerks, amounted to forty; each of whom, upon an average, enjoyed a yearly salary of a thousand dollars. Yet, in the midst of his vast undertakings, he was so much of a philosopher, that if he could have found any other individual capable of superintending the whole, he would have consented to a loss of 50 per cent., that he might have been able to retire.

State of Religion in *Norway*.

Of the state of religion in *Norway* we had not an opportunity of making many observations. The morals of the people, especially of the lower orders, are good; and thus judging of the tree by its fruits, we saw no reason for complaint. Formerly there were many different sects in the country; and among these, some

like our Methodists: but, at present, all are united. There is nothing, therefore, of that sourness which is caused by dissent; and which, as it tends to separate the members of society from each other, tends also to sap the very foundations of Christianity;—thereby proving the truth of an observation of *Montesquieu*[1], that "the most true and holy doctrines may be attended with the very worst consequences, where they are not connected with the principles of society." One of the most essential objects of religion, when a State has many causes for hatred, is to produce many ways of reconciliation. Perhaps we ought to assign as a reason for the religious unanimity of *Norway*, that the same degree of ardour in religious matters which is found in our own country, and which in *Great Britain* has of itself given birth to the schisms that divide the members of its Christian community, has not yet been excited here. A great deal of what may be called *indifferentism* prevails on religious subjects among the *Norwegians*.

Upon the 28th of *October*, after taking leave of many of the inhabitants, Mr. *B. Anker* accom-

(1) Esprit des Lois, liv. xxiv. ch. 19. p. 161.

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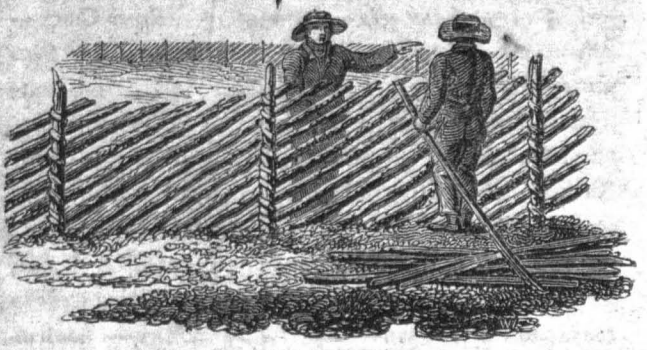
Fortress of *Christiania.*

panied us in a boat round the Bay. We visited the fortress, and saw the slaves at work. This fortress is almost impregnable by land. We were much delighted with the view of the river and the country from the ramparts. The water is so land-locked, that its appearance is that of a fine extensive lake, ornamented with islands, and surrounded by blue mountains in very pleasing shapes: but as far as we could judge of their elevation by the view of them, they have not the height of the mountains which surround the lakes of *Westmoreland* and *Cumberland.* The fortress seems to be strong; and there are some fine brass cannon upon the ramparts. The garrison consisted of twelve hundred men, including some chasseurs; and there were, besides, four companies of artillery. Afterwards, having dined privately with Mr. *Anker*, we retired with him to another apartment, where an elegant dessert had been set forth in the *English* way, with decanters of wine and glasses. We conversed with our intelligent host respecting the mines we had so lately visited; and he presented to us a specimen of *native gold*, found at a mine belonging to himself at *Nummedalen* near *Kongsberg*. In the evening, to gratify our curiosity, he put on his magnificent winter-dress, consisting of a pelisse, collar,

and boots, of the choicest black furs. The pelisse was made entirely of the skins of sables, and the collar and boots of bear's-skin. We had examined the fur-shops, in the hope of finding the skins of the *Cat-Gaub*, or *Norwegian Lynx*; but the animal, although sometimes taken, is certainly very rare in the country; and it is fortunate for the inhabitants that its visits are not more frequent. We spent the last evening of our stay in *Christiania* with this benevolent man; and having supped with him in the presence of his family, bade them farewell.



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FROM CHRISTIANIA IN NORWAY, TO FAHLUN IN SWEDEN.

The Author again sets out for SWEDEN—*Execrable state of the Roads before the snow falls*—Holen—*Change in the Roads in approaching* Sweden—*Spires of* Norwegian *Churches*—Kiölstad—Hæberg—*Cataract of* Fon Fossen—Ous—Sindby—*Appearance made by a Fair at* Kongswinger—*Money of the Country*—Edsbroen—Magnor—*Boundary between* NORWAY *and* SWEDEN—*Singular instance of honesty in a Peasant*—Morast—Haga—Strand—*Homeric Torches*—*Extraordinary Costume of the Natives of* WERMELAND—*Aspect of the Country*—*Conse-*

Consequences of a recent Dearth—Hogsalla—Leerhol—Skamnäs—*Improved appearance of the land*—CARLSTAD—*Exports and Imports*—*Population*—*River* Clara—Brästegård—Molkem—*Change in the dress of the Peasants*—*Manner of keeping the Roads in repair*—Brättefors—*Boulders*—*Trees*—*Animals*—Philipstad—*Uniform appearance of the* Swedish *Towns*—*Dress of the Natives*—*Enclosures*—*Juniper-trees*—Onshytta—*Two species of* Tetrao *or Black-Cock*—Persberg—*Descent into the Iron-Mines*—*Catastrophe which befell a Female Miner*—*Bottom of the* Persberg *Mine*—*Striking scene in the Great Cavern*—*Imbedded state of the Ore*—Långbanshytta—*Machinery for the Mine-Pumps*—Saxån—WESTMANIA—Hälleforss—Nytorp—Nyakopparberg—*Minerals*—Laxbro—*Beauty of the Lakes—diminution of their waters*—Hogforss—Hellsion—Ostanbo—Smedbacka—*Blood-Cakes*—*Entrance of* DALECARLIA—*Varieties and luxuriance of the* Fungi *and* Musci—Bommarsbo—*Home Manufacture of Candles*—Russ-Gården—Naglarby—*General Features of* DALECARLIA—*Character of the Natives*—*Dialect*—*Antient Dance*—*Original use of the* Runic Staves—*Retreat of* Gustavus Vasa—*Approach to* Fahlun—*External Aspect of its famous Copper-Mine.*

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The author again sets out for *Sweden.*

IN the morning of the 29th of *October*, we left *Christiania* in our phaëton, and once more began our journey towards SWEDEN. For this purpose, it was necessary that we should retrace our former steps as far as *Moe*, before we took a different route; but the roads were so

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Execrable state of the Roads before the snow falls.

execrable, that we were actually employed the whole day in getting to this place, although distant only three *Danish* miles and a half from *Christiania*. We passed through a beautiful valley between *Romsaas* and *Schesmoe*, as before. The inns were bad; and this being added to the wretched state of the roads, and the little progress we were able to effect, made us think that we had acted perhaps unwisely in not waiting for the winter season, which is the best time for travelling in *Scandinavia*, especially when the country is not likely to offer any thing in its scenery remarkable either for its grandeur or picturesque beauty. When the snow has once fallen, and the sledge-way is open, a traveller, wrapped up in his furs, may prosecute his journey in the open air, not only with the utmost expedition, but with comfort. But we intended to visit mines; and, in our search for minerals and plants, wished to see as much as possible of the uncovered earth, before the woodlands of *Norway* and *Sweden*, their hills and their valleys, rocks, mountains, lakes, and rivers, were all shrouded in one vast sheet of ice and snow.

The next morning, *Oct.* 30, after a stormy night, dawned most merrily; the sun burst forth in splendour; even the feathered songsters, in

this autumnal day, were still heard upon the dripping branches:—

"And forth they passe, with pleasure forward led,
Joying to heare the birds' sweet harmony,
Which, whilom shrouded from the tempests dred,
Seem'd in their song to scorne the cruell sky.
Much can they praise the trees so straight and hie,
The sayling *pine*, the *cedar* proud and tall,
The vine-prop *elme*, the *poplar* never dry,
The builder *oake*, sole king of forrests all,
The *aspine* good for staues, the *cypresse* funerall.

"The *laurell*, meed of mightie Conquerors
And Poets sage, the *firre* that weepeth still,
The *willow*, worne of forlorne paramours,
The *eugh*, obedient to the benders will,
The *birch* for shaftes, the *sallow* for the mill,
The *myrrhe* sweet, bleeding in the bitter wound,
The warlike *beech*, the *ash* for nothing ill,
The fruitful *olive*, and the *platane* round,
The carver *holme*, the *maple* seldom inward sound."

Holen.

In our first stage, this day, to a place called *Holen*, we turned out of the *Trönÿem* road, about half-a-mile from *Moe*, into another, upon our right, leading towards the frontier of SWEDEN: and we could but remark, at the time—as if anything which had a reference to that country should in some degree manifest a *Swedish* aspect—that, from the moment this deviation occurred in our route, the roads began to

Change in the Roads in approaching *Sweden*.

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improve; becoming better and better afterwards, as we drew nearer to the *Swedish* barrier. The country here is pretty well cultivated: although undulant, when compared with the rest of *Norway* it is of a level nature. The road lay partly through forests. In viewing the churches of this country, if we might judge from mere similarity of form and structure, it would seem that all our spires, commonly called *Gothic*, with the fashion and shape of their wooden shingles, were borrowed from *Norway*. In every part of this country through which we have passed, they reminded us of *England*.

Spires of *Norwegian* Churches.

Kiölstad.

From *Holen* to *Kiölstad*, one *Danish* mile and a half, we journeyed over plains with good roads. The oats and peas were still standing. We observed near *Holen* several heaps, which we thought were antient *tumuli*; but could obtain no information, either from the tradition of the inhabitants, or from the history of the country, to confirm us in this belief. Before we reached *Kiölstad*, the prospect of an extensive rich level, highly cultivated, reminded us of parts of *Surrey*. From *Kiölstad*, where there is a good inn, we proceeded to *Hæberg*, through a level country, having crossed a ferry. Near *Hæberg* there is a Cataract, which we had every reason to believe would be well worth seeing: but the storm came on again; the rain fell in

Hæberg.

Cataract of *Fon Fossen.*