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HAND-BOOK

OF THE

ECONOMIC PRODUCTS

OF THE

PUNJAB,

WITH A COMBINED INDEX AND GLOSSARY OF TECHNICAL VERNACULAR WORDS.

VOL. I.

ECONOMIC RAW PRODUCE.

PREPARED UNDER THE ORDERS OF GOVERNMENT,

BY

BADEN. H. POWELL,

H. M. BENGAL CIVIL SERVICE.

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NOTICE.

It is necessary that a word or two should be said in explanation of the system of spelling adopted in this book.

From typographical and other difficulties, the varieties of consonants in the vernacular, have not been distinguished by the diacritical points sometimes adopted. To this, indeed, an exception is to be found in the nasal "n" which often closes Punjabí words, this is represented by "ṅ."

The vowels in all purely vernacular words are either accented or unaccented. Of the accented vowels—

á is always broad, as in the French "gâteau."
e is always pronounced "ay," or as "é" in French.
í is long, as "ee."
ó is long, like "ó" in depôt.
ú is long, as "oo."
y is a consonant, as in "yes."

The unaccented vowels are—

a always like the "a" in "organ."
i like "i" in "pit."
u like the "u" in "full."

The varieties of consonants need not, for the mere understanding of the terms in this book, be nicely attended to.

Indeed, in any case, it is rare to find an European who really distinguishes between the س and the ص; or between ض, ز, ذ, ظ.

The only thing I could have wished would have been to distinguish the guttural غ ghain, and the khe خ; but this was impracticable for want of type.

I may add in the āin ع is represented by an apostrophe (') before the vowel to which it is attached.

Any reader who will remember the vowel list, just given, will find no difficulty in correctly pronouncing the vernacular words in the book.

I have not, however, thought it necessary to alter the received spelling of such common words as "Calcutta," "Punjab," "Lahore;" but in the case of the technical names of trees, &c., every one's experience of the defects of such an uncertain method as that adopted in Piddington's and other lists, will tell him that there is no other system which secures accuracy but the "letter for letter" system.

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CLASS IV. SUBSTANCES USED IN MANUFACTURES.

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„ 472 (top of 2nd column), *for* "bhán," *read* "bán."
„ 503, No. 1751, *dele* † from the word "Kangra," and place it against "ROYLE," further down.
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„ 541 (near bottom), *for* "*seorrata*" *read* "*serrata*."
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„ 591, „ 2018, *add* "(or *P. arya* ?)"

INTRODUCTION.

When the Exhibition of 1864 closed, it was designed to publish a Catalogue of the articles exhibited, together with a brief description, such as was published after the International Exhibition of 1862.

But gradually as the work progressed, it was found that the materials available could be worked up into something more complete than a mere Catalogue; and, consequently, the original design was abandoned, and I set myself to the task of endeavouring to prepare a "Hand-Book of the Economic Products of the Punjab."

For writing such a Hand-book, it would have been necessary either to adopt an alphabetical arrangement of the names of articles described, or else to classify the specimens and describe the products according to classes. This latter plan was adopted, partly because it was easier in the state in which the materials then were; partly because the principle of classification is more scientifically correct, and helps to give a better idea of the groups of products which the province supplies; and partly also, because adopting a classified plan, and taking the individual specimens for description from the Exhibition collection, the original design of preparing a Catalogue would not be altogether overthrown.

Moreover, in preparing the collection of the Central Museum at Lahore, in the Economic Department, the specimens have been so selected and arranged, as to illustrate this Hand-book; and now any visitor going round with the volume in his hand will be able to examine in substance, any specimen he reads a verbal description of.

A collection properly grouped together becomes to the intelligent spectator, a perfect history of the social condition of the country it represents. The peculiarities of various tribes are revealed by their clothing, by their arms, and their trade implements, which are represented in appropriate sections of the collection,—while the prevalence of peculiar classes of manufactures, the specimens of their fine arts, and their musical instru-

ments, give an insight into the tastes and habits of the people, and indicate to a certain extent, the phenomena of their mental and moral condition. Nor is this all; the grouping together of series of products of different localities, especially in a provincial Exhibition, gives us more information about the trade resources of the country and shows more what it is capable of producing, than the most detailed accounts of travellers and observers, be they never so acute; for, provided only that the district collections be made with ordinary intelligence, we have the inestimable advantage of taking a comparative view of several regions rather than an isolated view, however perfect, of any one. Nor does our knowledge of language pass without benefit; the interesting synonyms that occur as we review the same substances produced by different districts and note the names that each district gives them, furnish us with a fund of information that dictionaries and text books can never supply.

The Exhibition of the Punjab of 1864, was the first of the kind in Upper India, and was opened almost simultaneously with the Agricultural Exhibition of Calcutta, and was closely followed by an Exhibition held at Roorkee, in the N. W. Provinces.

The Exhibition was primarily for the products of the Punjab, including Kashmír and adjacent States, and the hill districts of Simla and Kangra, as far as Spiti, Lahaul, and the borders of Thibet. The political boundaries of the Punjab were taken for the purposes of the Exhibition rather than the natural or geographical, and accordingly the gold tinsel work and ivory miniatures of Delhi and the indigos of Hansi, were allowed to compete as Punjab produce. Accordingly the present work includes the products of all these territories.

It will be observed, that apart from those articles which are confessedly foreign, or derived from other parts of India, there are a large number, and especially in the raw produce department, which, though found in every bazar, or commonly used in particular districts, are not the actual produce of the places from which they are exhibited, but are in fact collected from a variety of external sources. In not a few districts, the imported articles are quite equal in number to the indigenous. If a district is specially productive of any particular commodity, it is sure to be deficient in some other, which it has to import. If, for instance, the district produce all the grain it consumes, it is likely to import the greater part of its other requisites,—if it is a dye-producing district, or a mineral

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yielding one, like the Hill States, its grain will be imported. It may be interesting therefore briefly to review the principal sources whence the various articles, raw and manufactured, which are in use in the Punjab, are derived. The various commodities may be conveniently grouped as follows:—

I.—Articles produced either in the place where they are found or in some other adjacent district within the Punjab—these may be subdivided into two marked classes, as the produce of the Plains, and of the Hills. II.—Goods derived from Kábul, Kandahár, Bukhára, and Bádákshán, &c.; through the Bolan, Khaibar, and other passes and routes of the West and North West Frontier. III.—Articles direct from Kashmír and its provinces, and with them may be classed the Thibetan products, coming *viâ* Yarkand. IV.—Articles brought from Hindústán, by Delhi &c. V.—Articles imported from Bombay, Káráchí, and from Calcutta. The substances included in this last division are in their turn the products of a variety of countries, European, Asiatic, and African; it will be sufficient however, for our purpose, to trace them to their great marts, with which alone the merchants who bring these products northward have any connection; merely distinguishing European goods from those of Africa, Asia, and the Persian Gulf. A few articles from the Straits Settlements have to be included in this division, still fewer from China, and some from Ceylon, such as gems, pearls, and spices. This completes the list. I now proceed to notice the various classes of articles in the order in which they are enumerated.

I.—Articles produced within the Punjab, comprising the produce (1st) of the Plains; and (2nd) of the Hills.

The Plain districts of the Punjab, greatly resemble one another in their general physical features,—the main difference consists in the fact that some are better irrigated than others, and that some include large tracts of sandy unproductive country, like the desert portion or "thal" of Múltán or Muzaffargarh. The climate of such districts is hot and sultry; the amount of rain that falls is at its minimum and cultivation is almost entirely dependent on canals and artificial irrigation. In this respect no doubt these districts differ widely from the rich plains of the Jálandhar and Bári Doabs, where not only do the great rivers fertilize the soil, but the periodical rainy season seldom fails to yield an abundant increase to the summer sown crops of the "kharíf."

Exclusively consisting of an alluvial clay soil, more or less intermixed with sand, which has been either washed down by the great rivers or collected together by the effect of wind-storms, the plains contain but few mineral products.* In almost all districts "kankar," consisting of irregular and fantastically shaped pieces of calcareous concrete, abounds; this forms the principal material for road-making, and this is the substance, of which is constructed, for more than two-thirds of its whole length, that gigantic roadway, which connects the capital of our Indian Empire with its farthest outpost on the Khaibar frontier: this mineral also yields when burnt, an excellent lime for mortar, a quality not a little valuable in districts where for miles round, the plough of the farmer never strikes upon a stone, and which would be otherwise dependent upon the imports of other districts before a single house could be erected.

Coarse pottery clay is found in every district, sufficiently plastic to produce the rude vessels in common use, and generally fit for brick-making; while the relics of these manufactures again furnish a material for road-making, or ground into powder form the "surkhi" used to mix with lime for building purposes. Some white clays occur in several parts, which are only useful as washes for houses and walls. Common salt is produced by evaporation from brine pits in the Gurgaon district, and together with the produce of the "Sámbhar" and other salt lakes of the Jaipúr territory, forms an important article of export eastward; while all the Punjab proper, down to the southern Deraját is supplied from the mines of the Salt Range, where vast beds of pure rock salt are either worked in open quarries or by galleries and shafts cut in the salt rock itself. Saltpetre is made in most of the plain districts, particularly in Múltán, Dera Ghází Khán, Jhang, and Gugaira, where it effloresces spontaneously about old ruins, and is collected and purified by boiling and re-crystallization. It forms a considerable article of export both inland, beyond the frontier, and also to the seaports. A company for the manufacture of saltpetre has recently been established at Múltán. Crude soda, called "sajji," is produced in Sirsa and Gugaira, &c., by burning various saline

* Speaking of the "plains" in this place, I of course exclude, not only those districts which contain portions of the great Himálayan chain or its abutments, but also those which contain the inferior ranges, such as the Jhilam and Shahpúr districts intersected by the Salt Range, or the Delhi and Gurgaon districts, into which branches of the Aravalli hills extend; the mineral products of such are far more varied and interesting.

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plants of the *Salsola* tribe, which abound in the "thals" or deserts during the rainy season; it is exported principally to the other districts within the province.

Alum forms a very important product and article of commerce at Kálábágh, whence it is exported to all parts of the Punjab, and is taken also to Hindústán.

In several of the large cities some chemical preparations are manufactured more or less imperfectly; at Lahore for instance, mineral acids—sulphuric, nitric, mixed nitric or *Aqua regia*, and hydrochloric, are made. Sulphate of copper, and acetate of copper ("zangár"), are produced at Amritsar, at which place, as well as at Jagádri in Ambálah, borax, brought down in a crude state from Ladákh, is refined and crystallized. At Lahore, a salt, termed "lota khár," which is a very impure cyanide of potassium, is prepared for the purpose of electro-plating; and some of the impure salts of mercury, "raskapúr," (mixture of calomel and corrosive sublimate,) and "dár chigna" (corrosive sublimate), are occasionally manufactured; as also the sulphurets of arsenic, "naushádar káni" and "hartál," and also the oxide of lead, "múrdá sang;" though the processes are unwillingly disclosed by the manufacturers. Salammoniac forms a considerable article of trade in Karnál, where the manufacture has been known for ages. "Kasís" and "kahi,"—earths containing iron in the form of an anhydrous protosulphate of iron in white satin-like crystals and in the form of a sesquisulphate, are obtained from certain bituminous shales, and are found extensively mixed with the alum shales, at Kálábágh and at Pind Dádan Khán; they form a considerable article of internal trade, being much used for dyeing purposes, and as a styptic and astringent in medicine. These are almost the only mineral products of the plain districts.

We turn next to the products of the vegetable kingdom. The rich and fertile tracts that border on the great rivers,—extending inland towards the centres of the "doabs," as far as the fecundating influences of their waters are felt,—yield annually an abundant harvest of grains of all kinds and pulse, which form the staple articles of food to the great majority of the population. As a rule, the cultivators do not consume the wheat they produce, but keep it for sale, and subsist on the pulses, barley, and inferior grains. Rice is grown in many of the plain districts, especially along the banks of the rivers. The rices of the Kangra Valley

and of Peshawur are celebrated. Of fruits that are dried as articles of trade, the number is few: the berries of the *Capparis aphylla*, the *Salvadora persica*, and some others are dried or pickled, but only for local consumption. The districts of Múltán, Dera Ghází Khán and Muzaffargarh, produce dates in large quantities; which are, however, of an inferior kind; they are preserved, either by being dried or else by being boiled in oil and water, and then dried. The dates are the produce of *Phœnix sylvestris*; unless indeed those at Multán be considered as *P. dactylifera*.

The fruits grown in the Punjab are too numerous to be inserted here, but mangoes, peaches, plums and grapes, melons, strawberries introduced from Europe, oranges, lemons, limes and citrons, are among the best.

Of spices, red pepper, turmeric, cummin, anise and coriander, are the commonest products.

Sugar-cane in several varieties is grown abundantly in well irrigated places, and the manufacture and export of molasses and sugar is large. Tobacco, cotton, and flax, also, must not be forgotten among the agricultural products which the Punjab can show.

Of dye stuffs, almost every district produces some. Indigo is cultivated in most districts, but in very small quantities and of inferior quality, except in Múltán, where it always has been in considerable repute, and is now likely to be still more so under the auspices of the Punjab Indigo Company recently established, whose out-turn of indigo promises soon to equal the manufacture of Bengal. The "Múltání nil" is an established quality of indigo with the dyers throughout the Province. Dera Ghází Khán still continues to produce this dye, it is said to have once had a very large trade in it with Khorásán; which, however, was diminished owing to the adulteration practised in the manufacture.* Another dye stuff, that is an article of trade in many of the districts, is kussumbha, or safflower (*Carthamus tinctorius*). The best is brought from the Hills, but Hushyarpúr kussumbha is a recognized variety, as second in quality, and Gujrát kussumbha is also to be had in the Lahore bazars. Other dyes, such as pomegranate-rind, dhák flowers, túm flowers, mehndi (*Lawsonia*), are produced in various districts and will receive special notice in their appropriate place.

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* Major Pollock's Report on Dera Ghází Khán.

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The galls produced on *Tamarix indica*, or "farás tree," used for dyeing purposes, are largely gathered in the Jhang, Gugaira and Muzaffargarh districts, as also in the Dera Ghází Khán districts, where as much as 500 maunds are annually collected.*

Oils are largely manufactured in every district. The "assu" or tárá-amírá *(Sinapis sp.)*, "saróñ" *(Sinapis racemosa)*, "til" *(Sesamum orientale)*, and "alsi," or linseed oil, being the commonest. Almond oil is manufactured in small quantities at a very high price, and oils expressed from the seeds of cotton, from various species of gourd and melon, from the seeds of the safflower, and from poppy seed, are also to be obtained; the other oils are prepared principally for medicinal purposes by the druggists of the larger cities.

Gums are produced, but not in any thing like the variety in which they occur in the southern provinces. Most of these that are medicinal or fragrant are imported, and will be noticed in our account of the Hindústán and North West Frontier produce. Gum of the *Acacia arabica* is common, the best comes from Delhi, though it is capable of being produced of excellent quality in other districts. The "siris" *(Acacia serissa)*, yields a coarse gum used by calico printers. The "dhák" yields an astringent gum much used in medicine, and is said to be produced about Thanesar, Ambálah, and some adjacent localities where there are large jungles covered with dhák trees. Lac is produced in many districts, especially in Núrpúr, in the Kangra valley, and in Kapúrthalla, where the insect lives on the dhák tree, just mentioned.

Of drugs used by the native practitioners, not a few are the common produce of nearly all districts in the Punjab, but a considerable number are brought from the Hills, and others come from Afghánistán, Kábul, and Turkistán, as far as the borders of Russian territory.† The remaining drugs in use are imported from Central and Southern India, from the islands, or from the Persian Gulf. Delhi and Amritsar are the central markets for imported medicines.

Of wools and silks, the finer kinds are not the produce of the Plains,

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* MAJOR POLLOCK'S Report on Dera Ghází Khán.

† The "gillar patr," a sea weed (*Laminaria*), used as a drug, is an instance of this. It is obtained solely *vid* Yarkand, from the shores of the Caspian sea. CUNNINGHAM, in his "Ladákh," has made a great mistake about this drug; he calls it a stone! the word is "*patr*," a leaf, not "*pat-thar*," a stone.

but goats' hair and common sheeps' wool, form articles of internal production and distribution.

The cultivation of silk in Gúrdaspur and Peshawur may still be said to be experimental,—but there is every hope of this product becoming a staple one of the sub-montane, if not of several of the Plain, districts. Already Gujrát, Shahpúr, Lahore, and Amritsar, have taken up the subject; and the experiments, as far as they have gone, have been most promising.

Of Manufactured Articles in use in the province, the great majority are produced within the Punjab, a few are however brought in by the N. W. Frontier trade. The demand for European piece goods, and for various other articles of European manufacture, useful and ornamental, is daily increasing.

Within the province, several cities and districts have become celebraed for particular manufactures; and native society, ever slow to change, maintains the distinction, although many other places might, and indeed to some extent do, produce equally well the very same articles.

Cotton goods are of universal manufacture, but the Jálandhar Doab is especially celebrated for its cotton fabrics, and among them the "ghâti," or diaper cloth. The fine cotton "lungis," of Peshawur and the carpets of the Deraját, are also remarkable. Umbrellas are manufactured in the Jálandhar Doab.

Múltán, Bahâwalpúr, and Lahore, have long been celebrated for silks; Bahâwalpúr especially for its figured and fancy silks, and Lahore for striped and plain silk pieces. Pattiala, Gúrdaspúr, Shahpúr, Peshawur, Ludhiana and Amritsar, also manufacture silks.

Woollen fabrics are not much made in the plains except coarse blankets. The best come from Rohtak, but the produce of Sirsa and Leia is by no means despicable.

Pashmina fabrics, embroidered with silk, and plain pashmina cloths, are produced extensively at Amritsar and Ludhiana, and a few at Lahore. Shawl weaving, an art introduced by emigrated colonies of Kashmíris, is practised at the same cities, as also at Núrpúr and Adínanagar, but with greatest success at Amritsar; none of these cities, however, equal either in fineness of texture or beauty of colors and design, the genuine fabrics of Kashmír. The shawl weaving of Gujrát and Gúrdaspúr is quite inferior. In Lahore, shawls are made from "Kâbuli pashm," a wool which

is inferior to the Thibetan shawl wool. These shawls are plain and not patterned like the others. They are called "Lahorí châddar."*

Lahore and Delhi are noted for their gold woven fabrics, and light silk muslin fabrics interwoven with gold threads, as well as for all kinds of work in tinsel or kalábatún.

The art of embroidery is one very consonant with the habits of the people; their patience and delicate handling render success certain, and there is scarcely a town or city where creditable embroidery cannot be found. But Delhi† is the great place for embroidered fabrics both in silk and gold threads. In Lahore and Amritsar the manufacture of "kalábatún," or gold thread, is extensively carried on.

Most of the large cities manufacture vessels of brass and other alloyed metals; for smaller work they prepare the alloy in their own "kuthális," or crucibles; for making the larger sizes they perfer the fine sheet metals imported from Europe.

The manufacture of armour,—swords, guns, and the like,—once had its grand centre at Lahore; but when the Sikh rule passed away, the demand ceased. Of the cutlers some are still in existence and can work; many of them have settled at Nizámábád in the Gujranwalla district (their manufactures were well represented in the Exhibition), others have gone to Gujrát, the cutlery of which place is noted; and the "koftgars," who used to inlay with gold the shields and armour of the Sikh chieftains, by hammering, with consummate skill, gold wire in various patterns into the steel surface, have mostly left Lahore for the Kotli Lohárán in the Sealkot district. They have recently also gone into the Gujrát and Gujranwalla districts, where they develope their art in works of peace; and now instead of Sikh armour, inlay caskets, studs, vases, paper-cutters, letter weights, and other fancy articles. There are still persons at Lahore who can work magnificently in inlaid armour, and do so occasionally at the call of the collectors of articles of vertu; but in Lahore it is almost impossible to get the articles above enumerated as made at Sealkot, Gujrát or Nizámábád.

Much encouragement has recently been given to this beautiful art; and

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* The wool is the produce of the Dumba sheep.

† This is said only with reference to the Punjab itself; the embroidery and needle-work, "amlikar," of Kashmír, both in gold thread, silk, and pashmina, is quite unequalled.

the subject is well worthy the attention of European merchants, as these articles find a ready sale at home. Most of the native workmen are however poor, and require the assistance of pecuniary advances to carry on the work; and, as they have but little originality as to the *form* of articles, it is desirable to furnish them with full size drawings, such as of caskets, candlesticks, vases, inkstands, &c.; with the help of these the most beautiful specimens of this art may be produced.

Ivory painting is carried on with unequalled success at Delhi, as is also the art of making jewellery in the European fashion. Enamelling of great beauty is executed at Múltán, and also in the Kangra district. Here, as in all other countries, the localization of peculiar manufactures in districts and even within the confines of a single village is observable.

A more minute account of the most remarkable of these manufactures will be found in the appropriate class and section in the following Handbook, they are only mentioned here in passing, with a view to afford an idea of the general products of the province.

2nd.—The produce of the Hills next demands attention; it is not very extensive in either raw or manufactured departments, but nevertheless the articles of hill trade are of considerable value and importance. They come by those routes which are most practicable, and where the extreme difficulty or cost of carriage does not render their import unremunerative. The districts taken into consideration under this head are the Himálayan districts, Chamba, Kúlú, Lahaul, Kanáwar, Spiti, and the Simla States; the other districts traversed by inferior ranges, are Peshawur, the Deraját, Rawalpindi, Jhilam, Shahpúr, Delhi, Gurgaon, Hissár, &c.

One of the most valuable imports is the Thibetan shawl wool, which supplies the shawl weaving cities of Amritsar, Gujrát, &c., this comes from Chángthán *viâ* Lé and Rámpúr. Wool, the produce of Rámpúr itself, is also imported.

From the Himalayan range comes iron, principally from the Suket and Mandi mines, the road for the Chamba iron being not yet sufficiently easy to make the import remunerative; some antimony is imported also. Copper is found in Kashmír, but is not yet an article of trade. Lead is also worked at Jammú, and large quantities of galena or lead ore are imported from Kábul and Kandahár; this is principally imported in lieu of antimony, (from which natives do not distinguish it), and being reserved for medicinal purposes, finds its way only to the druggists.

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Slates are occasionally brought down, and will be more frequently so as the roads are improved and the quarries worked more cheaply; they are of excellent quality.

Of edible products, ginger, the best turmeric, walnuts, apples, and pears, apricots, the nuts of the edible pine, *(Pinus gerardiana,)* the 'zira siya," or carraway, *(Carum nigrum)*; and a considerable number of vegetable drugs, consisting of plants, ferns, and even lichens, form the staple articles of import. Among these may be mentioned chiretta, "sálip," rhubarb, extract of berberry, ("rasaut,") the pachet root or costus, violets, aconite, nux vomica, and spikenard.

The Kangra district has a great export trade in rice, of which the most esteemed kind is the "básmati." Peshawur is similarly productive, but it is principally celebrated for the "bára" or scented rice, grown on the banks of the Bára river, which is exported and commands a high price.

Of dyes, the best kussumbha or safflower, akal-bír (the root of *Daliscus cannabinas*), kamela, (the powder from the capsules of *Rottlera tinctoria*), and harsinghár (flowers of *Nyctanthes tristis*), are the most important. A madder root is also common; it is, however, doubtful if this will equal the Ghazni madder. European enterprize has begun to take notice of the valuable fibres yielded by many hill plants, the nettle, the rozelle, the hill hemp, and others. Many other valuable plants are being tried, among which hops may be mentioned. It will be almost unnecessary to add to the list of Hill products the huge logs of deodar cedar, of the *Pinus excelsa*, and a few others upon which the districts of the plains, the railways and factories are entirely dependent. They are floated down on the great rivers, from the mountain forests that are within reach of their banks.

The pine forests also yield tar, resin, and might yield turpentine, except that by the native process of preparation, this most valuable product of the crude resin is allowed to evaporate.

The tea plantations now flourishing in many parts of the Hills must not be forgotten: nor will it be easy to over-estimate the value of their produce, if only it can be made to find favor in Kashmír and other parts, so as to supplant the costly and deficient import of Chinese tea across the frontier of Thibet.

Kúlú produces opium. The British districts of Spiti and Lahaul have

but little trade. Spiti appears well suited in every respect for the production of shawl wool; but its sterility is a drawback as to pasturage.* Kanáwar is just to the south of Spiti, having as its capital Rámpúr, a place noted for its wools.† An annual fair is held there. Rámpúr is also an emporium for borax which passes thence to Kárachí; and also, as before mentioned, for the shawl wool which supplies the Punjab.

The manufactures of the Himálayan hill districts consist almost exclusively of woollen fabrics, and the samples exhibited show that they are of very considerable excellence. At Kangra, enamelling on silver is a trade practised with great success, and the goldsmiths are skilful, especially in the imitation of European articles. At Simla, embroidery in leather is practised.

The Hills in the other parts of the Punjab are not without their products. The low ranges around Delhi and Gurgaon, yield building stone, sandstone, and marble. At Aurangpúr crystal is found. In Gurgaon there is iron, in Hissár there is copper, the small ingots of which are rarely to be met with in the bazars of the upper districts; a handsome gray mottled marble, and a curious flexible sandstone are produced in the same Hills. The products of the Salt Range are well known; the name is derived from those wonderful mines and quarries of solid rock salt which supply the whole province; besides this, the same range produces limestones suitable for building, iron,‡ coal or lignite, pure sulphur (made at Kuhát), gypsum,§ convertible into plaster of Paris, and also alum at Kutkí and Kálábágh, and "kahi," or sulphate of iron earth, and gold dust. Petroleum also is attracting attention in these hills.

Of the products of the Sulaimaní Hills, we have but little information;

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* Spiti has a peculiar importance as being the only portion of British Territory bordering on Chinese Thibet. MR. PHILIP EGERTON has discussed the possibilities of a trade route through this province, in the Appendix to his "Journal of a Tour through Spiti" (Cundall and Downes, London, 1864,) a book which will well repay perusal, both from the interest of its subject matter and the beauty of the large photographs which illustrate it.

† Fine samples of iron, hill hemp, and also a good tobacco from Rámpúr have been exhibited by MR. TER ARRATOON of Lahore. Much information respecting the interesting district of Kanáwar, will be found in GERRARD'S "Account of Kanáwar," 1833.

‡ A new discovery of a first-class iron, in hills belonging to this series, is due to the energy of DR. HENDERSON, Civil Surgeon of Shahpúr, who not only found out the ore, but did not rest till he had experimentally smelted a quantity and forged bars of the metal. The Engineers of the Railway have pronounced this iron excellent.

§ Gypsum, occurs as selenite,—as fibrous gypsum,—as a hard granular gypsum, which takes a polish like marble,—and as a softer stone useful for calcination to form plaster of Paris.

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at Dera Ghází Khán a kind of ochreous marl, called Múltání matti, is imported from the Hills, to the extent of 10,000 maunds a year.* Some lignite and some crystals of sulphur, gypsum, limestone, and iron ore are among the samples contributed from hills belonging to this range. Of vegetable products, some madder is grown in the hills of the Dera Ismaíl Khán border.

The "khair," (*Acacia catechu*,) which yields "kath," or catechu, grows in several Hill States. This tree is noticed by CAPTAIN BARNES, as a tree of the Kangra district, and it grows also in greater or less abundance in the lower hills, † as also in the Yusufzai and Peshawur, but the manufacture of the astringent extract is confined almost entirely to the eastern Himálaya at Kumaon, and other places beyond the Punjab. The other hill products of Ladákh, &c., are included under the head of Kashmír imports.

In concluding the notice of products directly referable to the Punjab itself, it will be interesting to examine the lists of the articles imported into the larger trading cities, both in the upper and the lower parts of the province—this will give a good idea of the interchange of articles of commerce. I have obtained for this purpose returns from Lahore, Amritsar, and Ludhiana, as representing the upper and lower portions of the province: the other great cities situated at the extremes of the country are less satisfactory for this purpose. Take for instance, Peshawur and Delhi;—the former receives almost exclusively the imports of the North Western trade, to be noticed hereafter, and only such things from the Punjab as are only obtainable southward. Delhi again is the mart for all the Hindústán trade from Jhansi, Ulwar, Patna, Gwalior, and other places, as also for commodities imported *viâ* Calcutta.

The characteristics of the internal trade of the Punjab will therefore best be ascertained from the import lists of the more central cities, which are not specially devoted to trade from one quarter more than another.

To commence with Amritsar. The following list of articles imported

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* POLLOCK'S Report on Dera Ghází Khán. It would seem that several descriptions of earth are included in this account, one being the yellow marl alluded to, another being a kind of fuller's earth; *see*, however the sequel in Class I., under head of "Earths."

† I have seen this tree all up the lower valley of the Rávi. In the Kangra district there are not a few catechu trees around Núrpúr, in which city there is a great trade in red leather; the astringent wood of the tree is used in the manufacture.

has been compiled from the Octroi papers of the city. The list is not exhaustive, and merely gives the principal articles.

Alum.
Antimony.
Drugs.
Glass beads, &c., from Delhi.
Gums, principally katíra and kíkar.
"Kharya mitti" (fireclay, used for making crucibles), from Múltán.
Charcoal.
Horse hair.
Lakh (lac-dye and resin).
Mats and punkahs of "patha," from Peshawur (in large quantites).
Madder (Affghánistán), *viá* Dera Ismaíl Khán, &c., and Múltán.
Fruits (Kábul).
Dye stuffs.
Fishing tackle.
Salt (Shahpúr, Pind Dádan Khán, from the Salt Range).
Raw silk (largely).
Wool.
Umbrellas (made towards Jálandhar Doab).
Soap.
Canes.
Sugar.
"Kalái," whiteing.
Tea (Calcutta). Hill tea is scarcely at all imported for native consumption. Thibet or China brick tea brought overland is a rarity.
Timber (Hills).
Tobacco.
Wax (Hills).
Vinegar (Delhi).

The Bombay and Calcutta goods are represented by—

European fabrics, such as cotton goods of sorts — prints, chintzes, muslins, long cloth, calico, Turkey red cloth, &c., broadcloth, silk, velvet, &c., &c.
Glass-ware and porcelain.
Window glass.
Gums and assafœtida (Bombay).
Tea and Coffee (Bombay and Calcutta).
Iron (Bombay) and other metals—brass, zinc, and copper.
Gunny bags and taut (Calcutta).
Spices (Bombay and Calcutta).
Cocoa-nuts and kernels called "naryel" and "khopa," respectively.
Ivory, probably from the Himáláyan 'tarai' but also from abroad.
Jewels, including pearls (Ceylon and Persian Gulf, *viá* Calcutta and Bombay).
Cowries (shells used as coin). Bombay, Calcutta and Kárachí.
Corks (Calcutta).
Indian rubber.
Cutlery (Bombay).
Safeda (carbonate of lead).
Chrome yellow, "peori wilayti."
Prussian-blue, "níl wilayti."
Bichromate of potash, "kahi surkh."
Caustic.
Sulphate of copper, "nila túlya."

The imports into the city of Lahore are here given, as they are in a very complete form, as to the locality whence they are imported. The Calcutta goods include both European imports and the produce of Bengal:—

Bengal or Southern and Central Indian Produce—

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Black pepper.
Long pepper or cubebs.
Betel nuts.
Cinnamon.
Cocoa-nuts, shells, and also the kernels (khopa).
Pán leaves, &c.
Nutmegs.
Cardamoms.
Mace.
Cochineal.
Bengal indigo.
Cloves.
Dates.
Coarse silk.

Foreign imports coming *viá* Calcutta—

Europe piece goods.
Fancy ware.
Glass.
Coffee.
Sago.
Tea.
Vitriol, blue.
Red lead.
Arsenic (white and yellow).
Safeda (white lead).
Thread.
Ivory.

From Bombay—

Tin.
Zinc.
Lead.
Copper.
Iron.
Brass (sheet).
Sulphur (vitreous and roll).
Lubán (benzoin), two kinds.
Sundras (Indian copal).
Bakam wood (red dyeing wood).
Drugs.
- "Akarkarha."
- Oak galls (májuphal).
- Surinján (*Colchicum*).
- Tirwi.
- "Samundar khág" (dorsal bone of cuttle fish).
- Gauzabán.

Sandal wool.
Cochineal.
Surma (antimony).

By the internal trade, including Kashmír, the imports are—

Saffron.
Sealkot paper.
Oil.
Native thread.
Drugs.
- "Kuth," or costus root.
- "Thotha," or spurious costus root.
- "Chok," " "

Native tabacco.
Mats and punkas, from Peshawur.
"Mauli surkh" (colored thread in skeins).
Sajji (soda).
Gach and pándo (whiteing).
Charcoal.
Silk pieces.
"Náfakasturí" (musk balls.)
Kashmír paper.
"Chikri" or boxwood.
Cotton.
Bamboos.
"Akal-bír" (yellow dye).
"Kussumbha" (safflower).
"Bán munj," leaves from the flower stalks of *Saccharum munja*.
"Sirki and kánná," stems of *S. munja*.
Hides (taurí).
Felt (namdah).
Willow flower water ('arak bed mushk).
Silken leashes and girdles.
Legs of charpoys (lacquered).

From Hindústán—

"Keora," a perfume (essence of *Pandanus odoratissimus.*)
Sandal wood oil.
"Attars."
Rosewater.
Iron from Gwalior.
Gil-i-zard, yellow earth from Gwalior.
Geru, red earth.
Kharú-mitti (a fire clay, like soapstone).

To add yet another list, the city of Ludhiana will fairly represent the cities near the Hindústán frontier. A very complete list showing the value of one year's import of each article as well as the localities of production, has been obligingly furnished by the Deputy Commissioner. It will be noticed that there is a large increase over the former list in Bengal and Hindústán imports, and a decrease in the Bombay goods.

The Kábul trade is represented by—

Imported yearly.	From	Value—Rupees.
Madder root, ...	Ghazní and Khandáhar,	15,000
Almonds, ...	" "	10,000
Kishmish* (small raisins without seeds), ...	" "	4,000
Munakka (raisins), ...	" "	1,000
Pistachio nuts, ...	" "	2,000

The internal trade with various districts of the Punjab, and including the various Hill States is as follows :—

Imported yearly.	From	Value—Rupees.
Rice of kinds, ...	Kangra, 1 lakh; Delhi, 40,000,	1,40,000
Leather and shoes, ...	Delhi, 6,000; Punjab, 8,000,	14,000
Alum, ...	Lahore, Kálábágh,	4,000
Dry ginger, ...	Hills,	2,000
Country indigo, ...	Punjab, Ludhiana district, Pattiala, and Nábha,	20,000
Turmeric, ...	Hills, 5,000; Bengal, 5,000,	10,000
Kussumbha (safflower), ...	Hills, 2,500; Bengal, 2,500,	5,000

* *Kishmish* are the small sweet seedless raisins which are so commonly seen in the Punjab, they are called sultana raisins by European grocers. *Munakka* are common dried grapes, or pudding raisins.

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Imported yearly.	From	Value—Rupees.
Bamboos, ...	Hills,	500
Bán munj, for string, &c., ...	Punjab *viâ* Firozpúr, ...	700
Vegetables of all kinds, ...	Punjab, 19,000; Bengal, 6,000,	25,000
Wood and timber, ...	Punjab, 3,500; Bengal, 2,000,...	5,500
"Charras," ...	Rámpúr, Bishahr, &c., ...	325
Bhang, ...	Hushyarpúr district, ...	125
Opium, ...	Rámpúr, Bishahr, ...	800
Poppy heads, ...	District of Ludhiana, ...	2,500
Grain of all kinds, ...	Punjab *viâ* Firozpúr, and District of Ludhiana, ...	2,00,000
Ghì, ...	Kurnál, &c., ...	25,000
Brown and pale molasses, ...	Jálandhar and Ludhiana districts,	50,000
Moist sugar (shakar tari), ...	Jálandhar and Ludhiana districts,	...
Oil (rape, &c., &c.), ...	Ludhiana district, ...	25,000
Seasamum (til), ...	Punjab *viâ* Firozpúr and Ludhiana district, ...	25,000
Cotton, ...	Ambálah, Pattiala, Nábha, and Ludhiana district, ...	6,00,000
Gold ribbons, lace, edging, &c.,	Delhi and Pattiala, ...	70,000
Tobacco, ...	District villages, 4,000; Bengal, 1,000, ...	5,000
"San" fibre, ...	The district villages, ...	25,000
Gums, ...	Punjab, ...	3,000
Ivory, ...	*Viâ* the Punjab (from Bombay?)	10,000
Lac, ...	Punjab, ...	10,000
"Má'ín," galls of tamarisk, ...	Múltán, ...	2,000
Blanket and woollen goods, ...	Punjab, ...	50,000
Cotton cloths (native), ...	Punjab, ...	50,000
Earthen and China vessels, ...	Punjab, 3,000; Bengal, 2,000....	5,000

The trade with Hindústán and Bengal is represented by the following list, which includes also European goods coming from Calcutta, and the reader should bear in mind that the term Bengal in this list is a translation of "Púrb," which is in the Punjab applied very loosely, and may signify all the countries near Bengal, and including even the North Western Provinces.

Imported yearly.	From	Value—Rupees.
European fancy goods, ...	From Bombay, 4,000; Calcutta and Delhi, 8,000, ...	12,000
Tea, ...	Calcutta and Bengal, ...	30,000
Black pepper, ...	Calcutta and Bengal, ...	5,000
Turmeric, ...	Half from Bengal and half from Punjab, hills *(vid. supra)*, Bengal, ...	19,000
Cocoa nut kernels (khopa), ...	Bengal, ...	2,000
Dates, ...	Bengal, ...	2,000
Indigo, prepared by European method, ...	Bengal and Khúrja, N.W. Provinces, ...	1,900
Betel nuts, ...	Bengal, ...	2,000
Cardamoms, ...	Calcutta, ...	20,000
Cloves, ..	Calcutta, ...	1,000
Long pepper, with spices generally, ...	Calcutta, ...	30,000
Kussumbha, ...	Half from the Punjab hills, and half from Bengal, ...	5,000
Copper vessels, ...	Bengal, ...	10,000
Iron and hardware, ...	Calcutta, ...	15,000
Gold mohurs, ...	Calcutta, ...	1,00,000
Silver coins, &c., ...	Calcutta, ...	1,00,000
Murádí pice, ...	Calcutta and from places where they are cheap, ...	50,000
Kauris (cowrie shells used as coin), ...	Bengal, ...	2,000
Corals and pearls, ...	*Viá* Calcutta, &c., ...	25,000
Coffee, ...	*Viá* Calcutta, ...	1,000
Babbar grass, for mats, &c., ...	Bengal, ...	1,590
European piece goods, ...	*Viá* Calcutta, ...	70,000
Vegetables of kinds, ...	Punjab, 19,000; Bengal, 6,000; *(vid. supra)*, ...	25,000
Wood and timber, ...	Punjab, 3,500; Bengal, 2,000,...	5,500
Lead, ...	Calcutta, &c., ...	5,000
Silk fabrics, ...	Bengal, ...	25,000
Tobacco, ...	1,000 from Bengal, rest from district villages *(vid. supra)*,	5,000
Earthen and China vessels, ...	3,000 from Punjab; 2,000 from Bengal *(vid. supra)*, ...	5,000
Precious stones, ...	Bengal, ...	10,000
" Attars " and perfumery, ...	Bengal, ...	500

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The total of these values (excluding articles repeated in the lists, as produced in different places) gives as one year's import to the city, Rs. 20,59,450, of which Rs. 14,46,450 comes by way of the Punjab, and Rs. 6,13,000, by Bengal, &c.

II.—We now come to the products imported by the Khaibar and other Passes on the N. W. Frontier, comprising the products of Kábul, Bukhára, &c., &c.

The trade and resources of these countries have already formed the subject of an able Report, by Mr. R. H. Davies, in 1862. The report is also illustrated by a number of appendices containing memoranda on particular products, and statistical tables of great value and interest.

In this place, therefore, it will be sufficient in taking a rapid glance at these sources of trade, to notice only the principal articles imported, referring the reader for detail to the work just alluded to.

The countries from which this trade is derived are seen on the map to skirt the whole of our Western Frontier, and extend northward one beyond the other, the northern boundary of the lowest forming the southern boundary of the next province, from the sea coast of Bilúchistán to the plains of Independent Tartary, bordering on the Orenburgh and Orusk frontiers of Western Siberia.

The products of these several regions find their way into the Punjab through the Passes of the Khaibar Hills, near the Safaid Koh, and also through those of the Sulaimání Range further south. The imports consist of the products of these localities as well as those commodities which come through them from Khokán, from Yarkand and China, and also from Russia,* and through the Kábul provinces from Persia. These

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* The following is a list of Russian articles found in 1838 in the Bazar at Kábul; but as this was 25 years ago, it is probable that a number of the articles have ceased to be imported, the trade from Europe by Bombay and Calcutta having supplied the demand more cheaply and more easily :—

Gold-dust.
Russia gold coin and ducats, called "budki."
Muskets, pistols.
Gunlocks.
Padlocks.
Knives and razors.
Iron and brass wares.
Cópper. (The import has been supplanted by European trade).
Russian snuff-boxes, &c.
Needles.
Glass, spectacles, and mirrors.
Porcelain.
Flints.
Beads and Corals (taken to India).
"Surapech" (fish-bone).
Paper.
Tea.
Kimsan (a kind of leather.)
Kirmiz (cochineal).
Sulphate of copper.
Iron trays.
Imitation gold wire, or kalábatún.
Broadcloth.

territories, beginning south on the shores of the Gulf of India and the Arabian Sea, and going northwards are first, Bilúchistán, with its Passes the Bolan, the Mulla, and the Guleri, by which the trade of Afghánistán, passes into Sindh. Above that comes Afghánistán, including the provinces of Kandahár, Kábul, Herát, and the provinces beyond the Hindú-Kúsh, —Bádákshán, Balhk, and Kundúz,—these receive the trade from Turkistán and Khorásán, from Persia, Tahrán and Yazd. Above these provinces are Khiva, Bukhára, and Khokán,—the great Azbak plains through which the river Sihún and Jihún (Oxus and Jaxartes) flow; these take in the products of Central Asia and Independent Tartary, and also from the centre to which the caravans from Troitska, Orenburgh, and Novo Iletsk, from Petropavolosk and Semapalatinsk introduce the iron, gold, porcelain, and other products of Russia, while the Khokán province represents the trade with Yarkand and China.

On the East of Bukhára and South of Khokán extends the Chinese frontier, represented by the provinces of Káshgár, Yarkand and Khutan, whose capital is Ilchí.

It now remains to enumerate the produce of these provinces, and to indicate the route by which they gain access to our territories.

The trade of Bilúchistán and Afghánistán comes to the valley of the Indus through the Bolan pass, which is below the Punjab and opens on to Sindh,—through the Guleri or Ghawelra, or Gúmmul pass, at Dera Ismaíl Khán,—and through the Tátra, Abkhána and Khaibar passes, at Peshawur. The last named pass is somewhat dreaded on account of the depredations of the Afrídí tribes, otherwise the road is quite practicable.

The principal Afghán traders are called Povindahs, of whom there are several grades or classes; the Lohanis also are a trading caste; they enter the Deraját, and carry on their merchandize to Múltán, from whence parties branch off to Delhi, Benares and Calcutta, and some to Lahore and Amritsar.

The greater part of the Bukhára trade comes by way of Peshawur;

Chints (of sorts).	"Nanka" (Nankin).
Velvet. (The import of this article has now ceased).	White cloth.
"Atlas," satin.	Handkerchiefs.
"Khudbaft," soft silk fabric made for shawls.	Chapan-i-kard (woollen jacket).
"Shirja" (colored cloth).	Bukhára silk, and silk from Kundúz.
"Kaitán" (muslin).	

[*Extracted from Appendix*, No. 1., *to Mr. Davies' Report.*]

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there is a trading tribe of Parachalis, and the merchandize is carried by Kábulis, Tájiks, and some of the Khaibar tribes.*

The Afghánistán trade produces the following articles—

From Bukhara and Turkistan.

Raw silk of various kinds, called "chilla jaidar," "vardanzwí," "lab-i-ábi," chúrkhí," from Khokán, Balkh, Kundúz, Akcha, Shibarghan, &c.
Horses.
Samarkand charras (hemp resin).
Turanjbín (manna).
Shawl wool, "pat."†
Kirmáni wool.
Bukhára gold coins, "budki" and "tilá."

Russian.

Furs.
Gold coins.
"Kalábatún" (imitation).

Kabul Produce.

Pistachio nuts.
Kishmish (small seedless raisins).
Munakka (dried grapes).
Almonds.
Pomegranates of Jalálábád.
Melons, "sardah."
Grapes, picked and packed in round boxes between cotton wool (called "angúr khattí").
Dried mulberries.
Nák (pears).
"Nandrámi" (rupees of Kábul).
"Bozgand" (galls of *Pistacia terebinthus*).
"Magz khumáni," apricot kernels.
"Sherkhisht" (kind of manna).
Asafœtida.
Alu bukhára (prunes).
Zira siya (carraways).
Safflower.
Pashmina pattú (cloth).
Postíns (sheep-skins).
"Bark," camel-hair cloth.
"Kark," goat's wool cloth.
"Dallah khafak" (skins).

Kandahar Produce.

Pomegranates.
Figs "(anjir)."
Dried fruits.
"Sherkhisht" (manna).
"S'alab misri" (salep).
Asafœtida (red and white).
"Kúlah arkchin," embroidered caps.

Produce of Herat, Mashad, and Persia, purchased at Kandahar.

Carpets, made at these places.
Turquoises (Persian).
"'Unáb," or jujube fruit, from Herat.
Zirishk (currants).
Pashm thread (used in shawl-weaving).
Saffron.
"Asbarg" (a dye, to produce a yellow for silk).
Herat piece silks (Kanáwez).
Cat-gut for bowstrings.

Drugs.

"Bíhidána" (quince seeds).
"Shakákul misrí" (a medicinal root).
"Gul-i-guláb" (rose-flowers).
"Gul-i-banafasha" (violet).
"Gau-zabán."
"Surma," antimony and lead ore (used only medicinally).
"Indarlatíb."
"Anárdána," pomegranate-seeds from Jalálábád.
"Bahman lál," a herb.
"Bahman safed."

* See Appendix XVI. of Mr. Davies' Report, where the most interesting information is given in a series of replies by Nawab Faujdar Khan.

† "Pat" is the wool of a goat abounding in these parts, but inferior to the real pashmina or shawl wool of Thibet.

Articles purchased at Ghazni.

Madder, "rodang" or "majíth."
Sheeps' wool.
Liquorice (mulatthí).
Alu Bukhára (prunes).
Kábul rice.
"Zúfa" (a drug).
"Simagh 'Arabi" (gum-arabic).
Ghí (clarified butter).
Chilgoza (seeds of *Pinus gerardiana*).
Pudína (mint).
"Shorapez" (fish-bone used for sword handles).
Rewand chíní (rhubarb).
"Kurt," dry milk curds.

Besides these, the drugs, kásní, shevadára, káhú, gháríkún (a kind of fungus), and the gums, mustagí rúmí (mastich) and katíra are brought from Kábul.

III. We have now to notice the Kashmír trade, including the produce of Yarkand and Khutan, and other remote provinces, which comes by the route of Lé, &c., and also the imports from Ladákh and Lahaul.

The Kashmír territory comprehends Jammú, Kashmír, Kishtwár, Zangskár, Ladákh, and Balti. Some valuable raw products are to be found in Jammú,* but commerce is chiefly carried on in the valley of Kashmír.

The principal routes by which the merchandize of Kashmir enters India are, from Srínagar, by the Bahnihál pass to Jammú and Amritsar; by the Pir Panjál and Bhimbar to Gujrát; also by Akhnúr and the Búdhil pass; and lastly, from Srínagar to Peshawur by Manserah, Muzafarábád and Báramullá.

The great Punjab mart for Kashmír is Amritsar.

The largest import is of pashmina goods, consisting of shawls, needle-worked goods (amlikár), embroidered chogas, &c., and plain pashmina cloth. The following is a list of the principal articles of export from Kashmír; it is followed by a list of those articles which are the produce of the remote provinces of Rudokh, Ladákh, Zangskár, Balti, Rúpshú, Chángthán, Khutan, and Yarkand, which come *viá* Lé.

Shawls of kinds—square, long, and double, both woven and worked by hand (the latter being called "amlikar").
Embroidered pashmina pattú, and plain piece pashminas of all kinds.
Ghafrán (saffron).
Bíhidána (quince seed).
Charas (garda bhang), the resin of the hemp plant from Yarkand.

Drugs.
- "Chob-kút," the *costus* or scented root.
- Barting (*Embilia ribes*).
- Kanaucha.
- Aftímún.
- Warch.
- Gul-í-banafsha, violet flowers.
- Guchchhí (a kind of morel).
- Zira siya (*Carum nigrum*).

Pears and apples of Kashmír.
"Gabba," carpets.

* Such as lead and coal.

Woollen chadars.
Shoes of "kimúkht leather (a green morocco like leather).
Kashmír paper.
Conserve of violets "gulkand banafsha," "'Ark bedmushk," or willow-flower distilled water.
Walnuts.
Dried grapes.
Singhára (fruit of the water caltrop, used like arrowroot).
Phúlí, a salt used with tea.
Currants.
Yarkand ponies, &c.
"Kalgis" (plumes of the black feather of a kind of heron, peculiar to Kashmír, called oṅkár.
Papier maché work, called "kár-i-kalamdání," and painted wooden articles.
Guns and pistols made of Bajaur iron.
"Bidri" work, hukas, &c.
Lac.
Tobacco.
Poppy heads.
Chintz.

The trade of Lé, Yarkand, and Khutan, is represented by the following articles—

Shawl wool, produced in a variety of districts in Thibet.
Chángthán wool.
Gold of Khutan and Bukhára.
Tea in cakes, both black and green (called "dhamún"—this goes to Kashmír only).
Khutan silk* and some brocades. Velvet used to be imported from Russia, but is not so now; the direct English imports having no doubt supplanted the trade.
Khutan carpets.
"Pattú," white woollen cloth.
Sulphur from Yarkand.
Soap from ditto.

Drugs.
- Gul-i-dár chiní.
- Mámirán-i-chiní.
- Chob chíní (*Smilax china*).
- Rewand chíní.
- Bádián khatai.
- Naushádar.
- Nirbisi (Zedoary).

Drugs.
- Shákh-i-'ambar, from Lhassa (aromatic sticks used as pastilles).
- Gillar-patr, Yarkand. 5 or 6 maunds are imported.
- Borax from Pugá in Ladákh (called Tsalé in Thibetan).

Kalábatún (imitation) Russian.
"Phúlí" from Nubra valley in Ladákh (a salt used in infusing tea).
Chángthán salt.
Chowries, or yak's tails from Yarkand.
Coral (Central Asia and China), from Chángthán.
Turquoises.
Jade, and lapis-lazuli from Bádákshán.
"Balghár," Russia leather.
"Kimúkht," turquoise green leather, Yarkand.
"Kimsana," bronze leather.
Copper tea-pots or vases, from Yarkand.
Tobacco, from Yarkand.

The route to Amritsar *viâ* Ladákh is that which brings the trade of Yarkand and Eastern Turkistán. There is also a route from Amritsar, Jálandhar or Ludhiana *viâ* Núrpúr, Mandi, and Kúlú, to the same places.

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* These silks are of the kinds bádsháhi (striped silk), ilchi (spotted), and mashrú (striped satin).

There is a trade with Lhassa, which now appears to have diminished exceedingly.

The chief imports from Eastern Turkistán and the Chinese territory are pashm, tea, charras, silk (not very much comes now), silver, gold, borax, sulphur, ponies. "The exports through Ladákh," writes CAPT. MONTGOMERIE, "used to amount to the value of about 3 lakhs; it is doubtful whether it now reaches 1½ lakhs. The goods exported are in excess of the imports, the difference being made up by the importation of gold and silver." A large portion of the traffic of Ladákh, he adds, is only diverted to other and more difficult roads; it is well known that the Chinese send a great many things down the Sutlej, avoiding the Jammú Maharaja's territories altogether.

The great articles of trade in Ladákh is the shawl wool, from the further provinces. The districts of Khutan produce jade, emeralds, copper, lead, and sulphur.

IV.—The articles imported from HINDUSTAN are next to be considered, excluding however the products of Delhi, Gurgaon, and Hissár, which are territorially within the Punjab, and which have been noticed under the first head.

This class does not include those articles which, albeit they are produced within some province of India, only reach the Punjab *viâ* Calcutta and Bombay, by sea. The class will therefore consist of but a few articles, such as the following:—

Iron is brought from Gwalior. The varieties are known as guléri and "khéri." Steel was once imported but has now ceased to be a regular article of trade. Geru, a red earth, and gil-i-zard, an ochre used in dyeing, are still imported; and orpiment, realgar (mansil), and cinnabar (shingarf), are said to come from Central India. The marbles and building stones, and the red sand stone so commonly seen in all ancient buildings from Benares up to Lahore, were formerly imported from these parts by the sovereigns who constructed them; and the magnificent mosques, tombs, and shrines, yet remain to tell us that such a trade was, but is no more. The architects of this period are satisfied with neat utility, and condescend to bricks, stucco, and chunam.

A few articles are brought from Bengal—such as dates, cocoa-nuts, both the kernels, called "khopa," and the hollow shells, called "gari" or naryel," and which are used for the water holder of a particular kind of "huka."

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Some dye stuffs, including indigo and kussumbha or safflower, are brought from Bengal.

The betel nut and pán,* are procured from the nearest places where they grow. A little turmeric may be included among the foods imported, though it scarcely gets beyond Delhi; black pepper and cardamoms are rather largely imported; also attars, especially of sandal wood and "keora," (*Pandanus odoratissimus,*) from Jaipúr; while drugs in considerable variety, catechu and several gums, complete the list.

Besides these, the following may be enumerated among things brought from Hindústán and Central India:—Diamonds, rubies, precious stones, &c., Dakhan silks, brocades, muslins, cotton goods, glass beads, and shoes.

The Naurya merchants, who bring up these commodities, assemble at Hátras between Agra and Allygurh, and thence these goods go on to Delhi and Amritsar.

Benares has ever been a great place of trade and is so at this day. Brocades (kamkháb†), gold woven scarves (dopatta), and silks are brought from this city to the Punjab; together with a kind of yellow silk dhoti, called "pitambar," and a dark-blue silk with white spots, called "búnd;" also silk sáris or scarves, exclusively for women's wear, forming both a skirt and a scarf.

Delhi is the market for a variety of products of Hindústán, Bengal, and the North Western Provinces; the drugs to be obtained here are more even than those of Amritsar. Several gums, including "katira" and gum-arabic, are obtained from this city; and among manufactured goods, shoes, jewellery, embroidered and spangled scarves, caps, and shawls are conspicuous.

V.—We now come to consider the imports *viâ* Bombay and Calcutta. A very large proportion of these consist of such European articles as find a sale in the country, and they are not difficult to distinguish. There is another class of imports which must not be forgotten—the articles not used by natives but by Europeans in India—provisions, beverages, spirits, teas, candles, soaps, perfumery, and a multitude of articles of vertu.

The goods introduced from Karáchí and Bombay, do not differ very

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* The leaves are taken the utmost care of by the merchants, and are moved every day lest one leaf should touch another decayed one; the decayed parts are carefully clipped away with scissors.

† This word is the original of the familiar "kincob."

much either in their nature or in the localities of their production. The imports find their way by land to the Punjab and also by the Indus route.

We find that the lists (given in several of the recent revenue reports) of articles brought up the Indus, include wheat, barley, rice, molasses, sugar, indigo, tobacco, and hemp, all in rather small quantities; while wool, hides, sulphur, madder, dates, almonds, spices, are brought by this route in considerable quantity. To these we must add a few cocoa-nuts, a large quantity of iron, with some pewter and copper; about 1,21,200 bales of cloth are also included in the list for the year 1862. It is, however, only a limited portion of the articles that comes from Kárachí, for the list would appear to include all merchandize that is taken on board country boats at all stations on the Indus and going up-stream.* We have no precise statements of the value of imports into the Punjab from Bombay or Sindh. It would be perhaps difficult to prepare such, but the kinds of articles are now easily ascertained, and that is more to our present purpose.

Judging from the Report for 1862-63 of the trade of Sindh,† by far the greater part of the merchandize landed at Kárachí is derived from Bombay and the British Isles. The Persian Gulf yields a few articles. The late CAPTAIN BRUCK'S Report on the Persian Gulf,‡ enumerates among articles produced by this trade,—silk, dried fruits, gums, dates, horses, pearls, and spices, to the amount of 60 or 80 lakhs annually. "Cowdas" (cowries), in number 16,52,000, valuing Rs. 1,020, are annually imported; together with some plain and colored cotton goods, drugs, asafœtida, the gums (copal and others), "patch leaves," senna, madder, fishmaws, almonds, and dates (to a very large amount); figs and several other fruits are also mentioned, as well as hides, skins, ivory ware, marble slabs, mother o'pearl and a little perfumery. These, with Rs. 21,700 worth of precious stones, and wool in considerable quantity,§ complete the list of of Persian Gulf articles. The Ports of Cutch bring hardly anything to Kárachí except "karbi" and other grass for forage, and a few other unimportant articles.

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* Punjab Revenue Report for 1862-63. Appendix IV.

† Page 58 of the Report.

‡ Bombay Selections, No. XXIV. 1856.

§ This wool is the Kirmáni wool, and finds its way to Amritsar pretty largely from both Kárachí and Bombay. It is one of the staples used in adulterating the "pashm," or genuine shawl wool.

The Calcutta trade to Kárachí is almost a blank, with the exception of the two items, rice and gunny bags. The Madras Presidency yields to it no imports. The trade from the ports of Malabar, Konkán, Mekran, and Sonmeaní is altogether unimportant. A small quantity of African ivory, I may add, is said to reach these ports.

The Bombay imports find their way to the Punjab no doubt to a much larger extent than the Kárachí imports, unless indeed an exception is to be made in favor of articles designed for European use. With regard to imports of this class, I may take the opportunity of observing that an enumeration or description of them would be here out of place, as they do not form a part of the Punjab products to illustrate which is my only aim in thus briefly describing the trade fountains which supply these provinces; but it is no less remarkable to see how some of these European materials have been introduced into many manufactures, which in themselves are purely native:—for instance, how in walking through the Courts of the Exhibition, we noticed an elaborate manuscript copy of some Persian work written on the imported foolscap paper of Europe, or the rich silks of Amritsar dyed with the "*rosaniline,*" or magenta dye so much in vogue at home,* or the embroidered saddle-cloths of Lahore, all wrought on crimson velvet from the looms of France; to say nothing of country woven fabrics of which the thread is English,—of hardware, of which the iron was forged at Glasgow or at Manchester, and of books neatly bound by native hands, in cloth, morocco, and calf, prepared in English workshops. The opening of our markets for articles of this description has not only influenced the manufactures of the province itself, but has been felt beyond the confines of Bukhára, to the very boundaries of Western Siberia. The import of Russian velvet has become a thing of the past. Almost the same is true of porcelain, and of satin (one kind of the latter is still imported)—and though Russian iron is no doubt to be found in the Provinces of Bukhára or Afghánistán, it is little that ever crosses our frontier, and certainly none that ever reaches our central cities.

Leaving then the exporting countries of Europe,† which are by far the

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* The people call these dyes "shishí ka rang," literally "bottle color," because the crystals are imported in little phials.

† In 1862-63 the value of Bombay imports from the United Kingdom was, Rs. 6,92,10,331, of merchandize only (exclusive of treasure and bullion), and if we add to this the total of other European countries, we have the grand total of Rs. 7,17,66,025, of which Rs. 21,42,125 worth comes France.

largest contributors, (supplying nearly two-thirds of the imports from ports not Indian, and nearly half of the aggregate imports from all ports together,)—we find that the imports of Bombay are next in degree of quantity derived from the port of Hongkong, which, together with those other ports of China, sends Rs. 1,20,32,972 in merchandize only. Then follow Ceylon, the Persian Gulf, the Coast of Africa, Aden, the Straits, Malacca, &c., Mauritius, the Arabian Gulf, the Red Sea, with a few others of less importance, these names being quoted here in the order of the magnitude of their trade as exhibited for the year 1862-63.

The principal articles to be met with as imports *viâ* Bombay are first—iron, both in plate, bar and rod; the native ironmongers have peculiar names for the various kinds, which are noticed under the head of "iron ores" in the sequel; next we find sheet-copper, brass, lead, pewter, and zinc (which is imported in flat oblong tablets).

Cotton fabrics of all kinds are imported in immense quantity. The bales consist of white cloths and muslins, of figured muslins,—often in peculiar gaudy patterns such as would find no sale in Europe,—and of chintzes and cotton prints, including the Turkey red-cloth, called "sálú," the art of dyeing which, is said once to have flourished in the very country in which it is now only seen as an imported product.* Many chemical substances and medicinal drugs are obtained here; among them may be mentioned the medicinal gums called jaushír (oppoponax), sundras (Indian copal), lúbán (benzoin), kápúr (camphor), kahruba (amber), mustagi rúmí (mastich), 'ushak (gum ammoniacum), sakbínaj (sagapenum), some spices and tea from Ceylon and China, ivory from coast of Africa, and cochineal.

In this class are included the imports of Calcutta. They are for the most part precisely similar to those of Bombay and Kárachí. This is a necessary result from the fact that the trading ports of both these places are nearly the same. European goods reach the Punjab both by Bombay and Calcutta, and the distinction seems slight. It is only a few articles that are now peculiarly associated with Bombay, viz., the iron of Europe, and those gems and medicinal substances which are the produce of countries bordering on the Persian Gulf.

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* This does not apply to all India, for instance, Madras. *See* Jury's Report to the Madras Exhibition of 1857, on Dyes.

From Calcutta, are brought precious stones, including sapphires and pearls from Ceylon, diamonds, coffee, spices, cloves, nutmegs, black pepper, the produce of Travankúr, gunny bags and "tát," cotton goods of all kinds, "atlas" or satin, and also velvet; iron is less imported from Calcutta to the Punjab, but with the exception of this and the other articles before alluded to, we have no need to draw out a list of articles from Calcutta as distinct from those of Bombay.

The annexed scheme of Classification has been adhered to in the following pages.

The first volume of the work contains all the Classes included in Section A. A second volume will contain a description of the Manufactures and Fine Arts, occupying Sections B., C. and D.

SECTION A.—RAW PRODUCE.

CLASS I.—PRODUCTS OF MINERAL KINGDOM.

Division I.—Metals.

Sub-class (A)—Metals and Ores,—with illustrations of modes of dressing and smelting, &c., also slags, &c., the result of such smelting processes.

„ (B)—Alloys.

„ (C)—Metals in process of adaptation to finished metal manufactures, such as plates of metal, wires, bars, &c.

Division II.—Mineral substances used in manufactures and for building purposes.

Sub-class (A)—Substances used in manufactures. *I. Miscellaneous; II. Glass making, and III. Pottery.*

„ (B)—Fuels, as coal, anthracite, lignite, &c.

„ (C)—Substances used in construction.—(1) *Stones, marble, and bricks;* (2) *Slates or roofing tiles and stones;* (3) *Cements and plaster, &c.*

Sub-class (D)—Minerals used as implements, *hones, grindstones, millstones, &c.*

„ (E)—Minerals used for decoration or ornamental purposes, such as *gems, agates, serpentine, &c.*

Division III.—Chemical substances used in manufactures.

Sub-class (A)—Mineral acids, &c.

„ (B)—Chemical substances used in arts and trades.

„ (C)—Salts, such as *barilla, sal-ammoniac, saltpetre, rock salt* (with illustrations of the process of preparation).

Division IV.—Chemico-Pharmaceutical substances.

Sub-class (A)—Medicinal substances, including mineral waters.

„ (B)—Rarer substances for the use of scientific chemists.

Division V.—Substances illustrative of the geology of the province.

Sub-class (A)—Fossils.

„ (B)—Samples of rocks, &c.

„ (C)—Soils.

CLASS II.—PRODUCTS OF ANIMAL KINGDOM.

Division I.—Animal substances used as food.

Gelatine, cheese, &c.

Division II.—Animal substances used as medicines.

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Division III.—Substances used in manufactures.

Sub-class (A)— { Skins and feathers. Leather and hides.
" (B)—Bones, horns, &c.
Sub-class (C)—Animal fats, including wax.
" (D)—Animal fibres—I. Silk. II. Wools.
" (E)—Substances for miscellaneous uses.

CLASS III.—PRODUCTS OF THE VEGETABLE KINGDOM USED FOR FOOD.

Division I.—Substances used as food for man or cattle.

Sub-class (A)—Agricultural produce.
1. *Cereals.*
2. *Millets.*
3. *Pulses.*
4. *Miscellaneous grains & seeds used as food.*
5. *Grasses.*
6. *Hops.*

" (B)—Miscellaneous products of the soil (other than grains) used as food.
Sub-class (C)—Dried, preserved, or pickled fruits, &c.
" (D)—Tea.
" (E)—Intoxicating drugs.
" (F)—Spices.
" (G)—Saccharine produce (including honey).
" (H)—Wines and spirits, and substances used in fermenting them, &c.

Division II.—Substances used in medicine.

Drugs.

CLASS IV.—PRODUCTS OF THE VEGETABLE KINGDOM USED IN MANUFACTURES.

Sub-class (A)—Gums, resins, oleo-resins, &c.
" (B)—Oils—including compounds obtained from oil, *e. g.*, soap.
1. *Essential and fragrant oils and "attars."*
2. *Burning and esculent oils.*
3. *Soaps.*

" (C)—Substances used for dyeing, including cloths dyed to illustrate the process,—printed fabrics and blocks for printing—also artists' or other trades' colors, and mordants.
Sub-class (D)—Substances used for tanning.
" (E)—Fibres.
1. *Cotton.*
2. *Other fibres suitable for weaving.*
3. *Fibrous substances not used for weaving, but for ropes, making paper, &c.*

" (F)—Woods and timbers.
" (G)—Charcoal.

SECTION B.—MANUFACTURES.

CLASS V.—COTTON MANUFACTURES.

CLASS VI.—WOOLLEN MANUFACTURES.

Division I.—Manufactures of wool.
Sub-class (A)—Carpets.
„ (B)—Other fabrics.

Division II.—Pashmina manufactures.
Sub-class (A)—Loom-wove shawls.
„ (B)—Plain pashmina goods; *e. g. pattú and alwán, &c.*

Division III.—Hair manufactures—goats' hair, camels' hair, &c.

CLASS VII.—SILK MANUFACTURES.

Division I.—Silk fabrics from the loom.

Division II.—Miscellaneous silk manufactures.
Tassels, nets, chenille work, sashes, &c., &c.

CLASS VIII.—FIBROUS MANUFACTURES.

Division I.—Fabrics of fibres other than cotton and wool.

Division II.—Paper.

Division III.—Other fibrous manufactures.
Mats, chicks, baskets, hats, &c., &c.

CLASS IX.—ARTICLES OF EMBROIDERY.

Articles embroidered with gold and silver thread, and articles embroidered with silk or thread, including hand embroidered, or "amlikar" shawls, &c.

CLASS X.—ARTICLES OF CLOTHING EXHIBITED AS SUCH.

(Including all ethnographic specimens).

CLASS XI.—LEATHER MANUFACTURES.

CLASS XII.—METALLIC MANUFACTURE.

Division I.—Works in non-precious metals.
Sub-class (A)—Brass and compound metal vessels, &c.
Sub-class (B)—Rough iron and hardware.
„ (C)—Cutlery, including swords and daggers of all kinds, exhibited for the sake of the blades.

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Division II.—Works in the precious metals.

Sub-class (A)—Works in gold and silver wire, "*mukesh*," "*anchal*," *gold lace, &c., &c.*

" (B)—Fabrics woven with gold and silver, *brocade*, "*kamkhab*," *cloth of gold, &c.*

Sub-class (C)—Vessels and articles of gold and silver for use or ornament.

" (D)—Specimens of plating with gold and silver.

CLASS XIII.—JEWELLERY AND ENAMELLING.

CLASS XIV—ARTICLES OF VERTU FOR USE OR ORNAMENT.

CLASS XV.—MANUFACTURES IN WOOD, USEFUL AND ORNAMENTAL.

Division I.—Furniture.

Division II.—Carved and inlaid wood-work.

Division III.—Turned and lacquered wood-work.

CLASS XVI.—IVORY MANUFACTURES.

CLASS XVII.—PAPIER-MACHE WORK.

CLASS XVIII.—PORCELAIN AND POTTERY, INCLUDING GLAZED TILES, &c.

Division I.—Glazed pottery.

Division II.—Un-glazed pottery including ornamented ceramic ware.

CLASS XIX.—GLASS MANUFACTURES.

CLASS XX.—ORNAMENTAL OR FANCY MANUFACTURES, NOT INCLUDED IN THE ABOVE.

SECTION C.—MACHINERY.

CLASS XXI.—PRIME MOVERS, INCLUDING PARTS OF MACHINES AND GEARING.

CLASS XXII.—MACHINES FOR MOVING OR RAISING BODIES.

Division I.—Machines for raising water.

Division II.—Do. for raising weights.

Pile drivers, cranes, &c.

Division III.—Carriages and vehicles, or models of them.

Division IV.—Railway plant.

Division V.—Models of boats, &c.

CLASS XXIII.—MACHINES FOR WEIGHING AND REGISTERING.

Division I.—Horological instruments.

Division II.—Weighing machines—as scales, &c.

CLASS XXIV.—MATHEMATICAL AND PHILOSOPHICAL INSTRUMENTS.

CLASS XXV.—SURGICAL INSTRUMENTS.

CLASS XXVI.—MUSICAL INSTRUMENTS.

CLASS XXVII.—LOCKS AND SMALL MACHINES FOR VARIOUS PURPOSES.

CLASS XXVIII.—ORDNANCE AND ARMS OF ALL KINDS, EXHIBITED AS SUCH.

CLASS XXIX.—MACHINERY AND IMPLEMENTS USED IN TRADES AND OCCUPATIONS.

Division I.—In manual trades.
Including workmen's tools of all kinds, and machinery used in trades, looms, lathes, &c., &c.

Division II.—In agriculture—including cotton cleaning machinery.

Division III.—In Horticulture.

CLASS XXX.—PHOTOGRAPHIC APPARATUS.

CLASS XXXI.—CONTRIVANCES USED IN ARCHITECTURE AND BUILDING, INCLUDING MODELS OF BRIDGES, CANAL FALLS, BARRACKS, &c., &c., &c.

SECTION D.—FINE ARTS.

CLASS XXXII.—PHOTOGRAPHS.

CLASS XXXIII.—SPECIMENS OF WRITTEN CHARACTERS, INCLUDING ORNAMENTAL AND COPPERPLATE WRITING, &c. WHETHER IN BOOKS OR SEPARATE SHEETS.

CLASS XXXIV.—PAINTING OF ALL KINDS, LANDSCAPE AND PORTRAIT, &c.

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CLASS XXXV.—MODELS EXHIBITED AS WORKS OF ART,

(as opposed to Engineering Models, which are included in Section C.)

CLASS XXXVI.—MISCELLANEOUS FINE ARTS, NOT INCLUDED IN THE ABOVE.

It now only remains to add that the illustrative letterpress appended to the names of the specimens has been derived from various sources, partly from the information obtained through district officers; largely also from books and records, published and unpublished, and from enquiries made by the author.

It should here be stated that almost the whole of the 2nd Division of Class III., viz., Drugs, is written by Dr. Burton Brown, who, together with Dr. J. L. Stewart, carefully examined the very large collection of drugs, and determined many previously unknown ones, as well corrected several erroneous botanical identifications which have hitherto passed unchallenged through many editions of such lists as Piddington's, O'Shaughnessy's and Honiberger's.

The illustrations are mostly executed from photographs taken at the time by Messrs: Howard and Bourne, with a few by Capt. Mercer. The botanical illustrations are from original drawings.

SECTION A.—RAW PRODUCE.

CLASS I.—PRODUCTS OF MINERAL KINGDOM.

Division I.—Metals.

SUB-CLASS (A). METALS AND ORES.

IRON.

THE iron ores of the Punjab are produced along its north-eastern mountain frontier, as well as in the lower hills of the Sulaimaní and Wazírí ranges, and those to the south-east of the Bunnoo district, and to some extent in the Salt range. On the other side of the province, in the hilly portions of Gurgaon district, iron is found, and although the hills in the Delhi district exhibit no specimens of iron ore as such, there is in them a ferruginous rock, samples of which have been forwarded; and the Máhrúli hill, which yields iron ore, is one of that group of outliers that forms a continuation as it were of the Aravalli range, and properly within the Delhi district.

Along the Himaláyan frontier, the principal places of production are the Hill States of the Simla district (Júbal, Dhámi, Bishahr, and Rámpúr). Again at Suket and Mandi, iron is largely produced, and the mines at Kot Khai, Fatihpúr, and Bhír Bangál of Kangra are famous. Pursuing the line of Hill States, the iron of the Chamba hills next demands notice, and the next division up to the Hazara district is included in the territories of H. H. the Maháraja of Kashmír. In these territories the best iron is found at Reyási in Jammú, while the iron found at Soñf and Kutyár in Kashmír Proper, is not so good. Iron of good quality, but inferior to that of Reyási occurs in Púnch, the territory of Raja Motí Singh, feudatory of Kashmír. Reverting once more to British territory, we find iron ore at Bakot in the Hazara district. Next to this, in the hills due north of Peshawur, is the source of the Bajaur iron, which is of fine quality, and is used in the manufacture of the gun barrels of Kuhát and Jammú; and not a little also, it may be presumed, in the formation of steel for the blades of Bukhára and Peshawur.

Nowhere within British territory is indigenous steel procurable, at all events such steel as would be of any use in the finer classes of manufacture; the cutlery of Nizámábád and Gujrát is exclusively manufactured with imported steel, while the inferior kinds are not steel at all but merely polished iron.

The iron ores of the Himaláyan districts are mostly magnetic oxides of singular purity, and exist in a great measure in the form of an iron sand or aggregate of particles of oxide of iron. These are no doubt produced in the detrition or disintegration of schistose and micaceous rock containing particles of metal; this kind of rock or ore is called "pathar dhoñ."

In other places the ore is found as a massive hæmatite, and is sometimes associated with copper. In Suket, and a few other localities, a glistening micaceous iron ore or glistening

hæmatite occurs, but the natives often call it "antimony of Ispahán" (surma Isfahání). In one or two instances it is exhibited as a hydrated peroxide.

The binding power of the hydrated oxide, as well as the quantities of iron that must exist in the upper hills, are well exhibited in the formation of the lower Sub-Himaláyan ranges. I may instance the cuttings for the road to the Dalhousie Sanitarium, where, in the lower hills, the traveller passes huge beds of a formation of nodules and debris of older rock held together by a ferruginous soil, and on the same road there is a small chalybeate spring, the iron of whose water is very sensible to the taste.

Iron exists at Kánigorum in the Wazírí hills; it is found also as a hæmatite in several parts of the Salt range, and in the Chichalli range, on the other side of the river. In a few places near the same ranges, and especially associated with shale, this metal is found in the form of a sulphuret, *i. e.*, iron pyrites, and the beds of the "kasís" and "kahi" (earth containing anhydrous proto-sulphate of iron) are said to result from the decomposition and oxidization of these pyrites. Hydrated peroxide, in the form of ochre, is procured in a number of places in the Punjab, and forms the coloring matter in the "gil-i-zard," or yellow earth, and in the "Múltáni mitti" used by the dyers.

The samples of iron in the collection are as follows:—

GURGAON.

1.—[114.] Iron ore from Firozpúr Hill. Deputy Commissioner of Gurgaon.

The box contains specimens of iron pyrites and a piece of micaceous iron ore.

2.—[112.] Block of hæmatite from Máhrowali or Máhrúli hills, bordering on the Delhi district.

3.—[110.] Siliceous iron stone, with a sample of the fused metal and a piece hammered. Firozpúr.

4.—[113]. A fused mass of slag, rich in metal. Fázilpúr.

The following account has been received from the Deputy Commissioner of Gurgaon: "The hill from which the iron is obtained in Firozpúr is known generally by the name "Jharkah," and the iron mines in it are called "búrá" mines, in which by digging to a depth of 6 feet, pieces of a red and slightly glistening hæmatite are obtained, called "búrá." From this ore iron is obtained. In digging for the ore, the miners first come upon a quantity of red earth and soft stone discoloured by iron, which is used to make roads with; below this the hæmatite is found. The ore is first pounded with stones into small fragments, and then taken to the smelting furnace, which is called "nándri." This furnace is of a round conical shape, narrow at the top and wide at the base, and about 9 feet high; into it is put 13 maunds of the ore (this quantity of ore is called a "gán") and 12 maunds of charcoal,—some of it above and some below the crushed ore. Each furnace is fitted with two pairs of bellows, which are worked to supply a blast of air to the fire during eighteen hours continuously,—the melted iron falls to the bottom. Thirteen maunds (= 1 gán) of ore yield 3 maunds of metallic iron,—this is taken out and repeatedly heated and hammered till it becomes pure, when about 1½ maunds of the unmixed metal remain; in thus bringing the iron to its pure state ("lohá pakká"), 5 maunds of charcoal are required besides the 12 consumed in the smelting furnace. Thus to completely work 13 maunds of ore, 17 maunds of charcoal are required, at a cost of Rs. 8-8, (at 2 maunds per rupee,) the total cost of the process is Rs. 10-10, thus:—

	R.	A.	P.
Charcoal, 17 maunds, ...	8	8	0
Wages of workmen at the smelting furnace, ...	0	10	0
Wages of workmen at the bellows and those who hammer out the iron, ...	0	12	0
Wages of workmen who work the metallic iron by repeatedly heating it, &c., ...	0	12	0
Total, Rs., ..	10	10	0

Pucka iron (*i. e.*, after being hammered) sells at Rs. 5 a maund, but iron is not now made at this place.

MANDI.

5.—[215-16-17]. Magnetic oxide, or

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iron sand; pig iron and vessel of iron, from the Mandi mines. RAJAH OF MANDI.

In the Mandi territory there are six villages at which iron is smelted; but of the six, two only could supply a sufficient quantity of magnetic oxide of iron for a work of importance, by following the usual system of pounding the mineral, to extract the grains of iron. Regarding the others the mineral appears too poor to offer any advantage. The natives of the two principal iron villages, Kurance-ka-hutee and Tanagui, draw the mineral from the two opposite sides of the same mountain.

The schist that furnishes the magnetic oxide of iron, varies much as to the quantity of grains of iron it contains, but the oxide seldom exceeds thirty per cent., nor falls below a minimum of from twelve to ten per cent.* The average may thus be stated at about twenty per cent.

The natives follow the same system of working, as has been already described, and the iron produced by this rough industry is paid for by the Raja, at the rate of one rupee per pucka maund. The natives only work these mines, so lucrative to their master, and so unproductive to themselves, when their presence is not required for the cultivation of their fields.

SIMLA HILL STATES.

6.—[174]. Iron ore. Júbal, Simla. RANA OF JUBAL.

7.—[281]. Iron ore from Dhámi. RANA OF DHAMI.

8.—[185]. Iron ore from Bishahr. RANA OF BISHAHR.

9.—[195]. Iron ore from Rámpúr (Bishahr). M. TER ARRATOON.

10 and **11.**—[359-60]. Samples of hammered Rámpúr iron. M. TER ARRATOON.

Most of these iron ores occur as iron sands, the grains of which are washed out of the schistose matrix in which they are enclosed. The nature of these ores is well described by MR. MARCADIEU in the following extract†:—

"Passing from the Kot Khai district to Júbal you arrive at Cheel, at about eight miles from Degwarí Júbar and in the possession of the Raja of Rámpúr. Near this village is situated a ferruginous mountain, composed of talcy schists, similar in every point to the mineral of the mountains of the Kot Khai district (*q. v.*) Ten small smelting furnaces work irregularly for the Raja's profit, and produce small quantities of iron, mostly consumed in the Raja's territories. I found that the specimens (without picking them) yielded from fifteen to thirty-seven per cent. of magnetic oxide of iron. Two hours journey beyond Cheel brings you into the possessions of the Rana of Júbal. The iron in these territories is found in three mountains, Jáchali, Panáti, and Paraunti. From Dehra, the residence of the Vana, on the Kot Khai road, at a distance of from five to six miles, are situated,—on the right Jáchali, on the left Paraunti, and on the opposite slope of Jáchali,—Panáti. From 20 to 25 smelting furnaces are worked at distant intervals, but these iron works are becoming profitless for want of combustible material. The proportions of magnetic oxide contained in the talc schists are as follows:—

Jáchali,	from	19 to 33 per cent.
Panáti,	„	17 to 22 „ „
Paraunti,	„	20 to 25 „ „

12.—[195-96]. Iron ore and crude iron resulting, from the Kot Khai mines, Simla. THE RANA OF KOT KHAI.

The Kot Khai mines are situated on two different mountains close to each other.

The first, near the village of Trola, at about six miles N. E. of Kot Khai, called Moltann.

The second, is called Túmbaran, and is situated at the foot of the village of Degwarí Júbal.

At Moltann there are three extensive subterranean galleries, from one of which the natives draw their mineral, whenever they can procure charcoal for the fabrication of a small quantity of iron. Though the schists of the surface are ferruginous, they are less so than those extracted from the interior of the galleries. These have the advantage of being of a much softer composition, and are more easily reduced to powder. This is owing to their being permanently exposed to the damp, which hastens their disintegregation. The ores from Moltann, yielded from 19 to 33 per cent. of magnetic oxide of iron. Those of Túmbaran, placed in the same conditions, yielded from 28 to 47 per cent. We must not from this difference, too hastily decide that the Túmbaran mine is richer than the other. A disproportion of this kind is often met with and is caused by the variableness of the specimens. The uniformity of the iron mines from Kangra to Kot Khai within a distance of 150 miles, is so striking that they may be classed together as one kind.

* These quantities are given on the authority of MR. MARCADIEU.

† Report on the Ferruginous Resources of the Hills around Dharmsala. Punjab Selections, vol. vi., No. xvii.

KANGRA.

Magnetic oxide of iron occurs in octahedral crystals, embedded, generally speaking, in an extremely friable mica schist throughout most of the spurs from the Snowy range to the East and North East of the Kangra district. It is likewise found in the beds of several of the streams, *e. g.*, the Menoni and Bán Gunga, which cross the Kangra district from the Snowy range. This ore is the same as that of the well known Dannemora mines of Sweden, and is worked as there, at its outcrop in open quarries. It is one of the most valuable ores of iron, being readily reduced in contact with charcoal, in furnaces of the simplest description, and yielding the best quality of iron.

The iron of these hills is preferred by the people for all purposes for which peculiar strength and tenacity are requisite, but in order to compete with English iron for ordinary purposes, any where out of the immediate neighbourhood of the mines, it must be manufactured on a more economical system. The ore is available in any quantity; water power likewise is practically unlimited in the immediate vicinity of most of the mines, and under a proper system of forest conservancy, there will be no need to apprehend a failure of fuel.

The obstacles to be contended in attempting to extend the manufacture, are the remoteness of the mines from the markets, the distance by which the fuel is in some instances separated from the mines, the imperfect means of communication, the reckless destruction of the forests without any measures being adopted for their renewal, the extravagant waste of wood in the manufacture of charcoal and of ore in the smelting and refining, owing to the rudeness of the furnaces and other appliances; and finally, the limited amount of labor available in these desolate regions, and the drunkenness and want of steadiness of the "Dhogrees," the only labourers available for this work; to meet these difficulties new roads have been constructed and others are under consideration; measures are being adopted for the conservation and renewal of the forests, and the expediency of introducing crushing machines and "*catalan*" furnaces has been debated. It seems clear, however, that any machinery adopted must be of the very simplest and least expensive description.

The idea, once suggested, of a grand central crushing and smelting house, to which the ore from all the mines would be carried, is obviously, from the very great distances to be traversed, out of the question. The ore must be reduced at all events to the form of crude iron at the mouth of the mine.

13.—[211-12-13-14]. Series of irons from Bhír Bangál mines, Kangra, consisting of—

a. Magnetic iron ore, in form of iron sand.
b. Crude iron, smelted.
c. Iron, once refined.
d. Iron, twice refined.

"I ascertained," says MR. MARCADIEU, "that each of the furnaces turned out, on an average, 4 maunds of pucka iron, monthly, making an allowance for loss of time, we will suppose that 100 furnaces are worked daily, they would yield monthly 400 maunds of iron or 32,000 pounds, which is purchased by the contractor at two different prices, according to the quality of the iron. He pays for the first quality Rs. 1-14-0, and the second quality, Rs. 0-15-0, which amount is partly paid in money, partly in grain."

In 1858, Kangra iron was sent home to England. The samples consisted of irons from Bhír Bangál. from Kúlú and Mandi.

The iron sent has been tested at the Atlas Works of Messrs. Sharp Stewart & Co., Manchester, and by Messrs. Lloyd, Forster & Co., of Wednesbury. At the former manufactory, while the best English iron yielded at a pressure of about 56,000 lbs. on the square inch, the Kangra iron in the state in which it was sent (it had been forged into 5 feet bars at Madhopúr) required a force of 61,300 lbs. per square inch to break it, while the same iron hammered at Manchester sustained a pressure of 71,800 lbs. per square inch before it gave way. The above results must be deemed highly satisfactory, and clearly indicative of the value of the iron. Messrs. Lloyd & Co., described the metal as of pure charcoal manufacture, quite equal to any of the usual metals of that description imported into England. The particulars of the trials to which the iron was submitted are given in the following statement:—

	Kind of Iron.	Section.	Sectional Diminution. In width.	Sectional Diminution. In thickness.	Greatest extension.	Breaking weight in lbs.	Equal to lbs. per square inch.
N.B.—S = Sharp & Stewart's best hammered scrap iron.	S	1 inch by ½ inch bore,	1/16	3/32	0/16	27,552	65,104
C = Do. do. charcoal iron.	S	Do.	1/8	1/16	0/16	28,056	56,112
P = Punjab iron, as it arrived.	S	Do.	1/8	1/8	0/16 full	29,184	58,368
P H = Punjab iron hammered at Manchester.							
		Average, ...				28,233	56,466
	C	1 inch by ½	3/16	1/16	0/16 bore	29,316	58,632
	C	Do.	1/4	1/8	0/16	28,056	56,112
	C	Do.	3/16	1/8	0/16	27,636	55,272
		Average, ...				28,336	56,672
	P	1 3/16 inch by 5/8	3	1/16	½ bore	29,120	58,240
	P	Do.	1/32	...	½	30,688	61,376
	P	Do.	1/16	1/16	½	32,144	64,288
		Average, ...				30,650	61,300
	P H	1 inch by ½	1/16	1/32	½	36,064	72,128
	P H	Do.	3/32	1/16	½	34,328	68,656
	P H	Do.	1/8	1/16	½ full	37,352	74,704
		Average, ...				35,913	71,826

(Signed) SHARP, STEWART, & Co.

All the irons had the fibre lengthwise, and were annealed at the Atlas Works.

Messrs. Sharp Stewart & Co., consider the iron to be similar in quality to Yorkshire iron, and they offer the following information as to the shape in which they think it should be imported from the Punjab, and the prices it would probably fetch :—

Shape in which it should be exported.	Probable price per ton.	Shape in which it should be exported.	Probable price per ton.
Round bars, 1 to 2½ inches in diameter.	£17.	Angle iron, from 2 to 3½ inches and ¼ to ⅜ in thickness.	£19.
Plates, from ¼ inch to ¾ inch thick.	£21, which increases in proportion to weight of plate ; the sizes of plate being according to requirements of the user.	Axles, according to specification of purchaser.	About £18.

The sample of iron cost 5 Rs. a maund = 140 Rs. a ton at Kangra. But this is probably too high a rate, and it could be produced for less, otherwise the rates above quoted would not be remunerative.

14.—[218]. Magnetic oxide of iron. LOCAL EXHIBITION COMMITTEE, KANGRA.

15.—[219-20-21]. Magnetic oxides, in form of iron sands, from the Menoni river between Kangra and Bán Gunga river, and from Suket.

16.—[222]. Bar of iron, from Suket. RAJA OF SUKET.

17.—[237]. Oxide of iron, glistening hæmatite. Suket. RAJA OF SUKET.

This is marked on the box as "supposed to be antimony," it resembles the mineral sold as *surma Isfahání* (Ispahán antimony) by the native druggists.

18.—[223-230]. Series from the Fatihpúr mines at Suráj, Kangra, and consisting of three samples of the rock around the Fatihpúr mine. LOCAL EXHIBITION COMMITTEE.

[224]. Is a rock called "chinohar," a brown micaceous schist, the mica in very small particles gives the stone a peculiar grey silvery lustre.

[225]. Another specimen called "nalohur." This is a grey mica schist.

[226]. A very fine-grained mica schist of a greyish brown colour called "chappar."

[228]. Rock called "bahor," is a micaceous schist with occasional veins of quartz.

The ores are as follows:—

(*a.*) Magnetic iron ore, in form of iron sand.

(*b.*) Massive ore, "pathar dháo."*

(*c.*) A schistose rock containing fragments of iron; when this rock is disintegrated, the particles of iron from the iron sand of the preceding samples.

(*d.*) Iron, obtained from ditto.

A sample of this iron was exhibited from the Lahore museum under the name of "loha chhichar," and of the same iron hammered, but called "loha kut." An anvil, made of hill iron, a pig of superior iron, and a mass of fused metal mixed up with the charcoal, used in smelting, completed the Museum series.

(*e.*) "Manohar," a slag from the furnaces.

* Indifferently written "dhon."

19.—[231-14]. Series from the Kot Kandi mines. Kúlú. LOCAL EXHIBITION COMMITTEE.

(*a.*) Iron sand.

(*b.*) Hæmatite or specular iron ore. This is very like in appearance to micaceous iron ore.

(*c.*) Crude iron, obtained from the ore.

(*d.*) Slag, the result of fusion.

At the Kumaon mines, four miles east of Pachind pass, the ore lies in thin layers and streaks in a dark micaceous sandstone. The stone is so soft that it is pounded by hand with small round boulder stones. It is then washed in wooden platters, and the sand is poured off with the water, leaving the ore in the shape of coarse black heavy grains at the bottom. One seer of this ore yields half a seer of iron. The metal is considered good, and is sold on the spot at Rs. 2½ a pucka maund, or Rs. 1 a kucha maund of 12 seers, which is cheaper than it was in Moorcroft's time, when the price was Rs. 3½ per pucka maund.*

20.—[234]. Charcoal, used in smelting at Kangra and Kúlú. LOCAL COMMITTEE.

The charcoal is made from the chil (*Pinus longifolia*). Oak charcoal is not found by the iron workers to answer.

21.—[266]. Iron pyrites, from Kangra.

22.—[239]. Iron pyrites in quartz, from Manikaran of Kúlú. LOCAL COMMITTEE.

This is erroneously called by natives silver ore. It appears to be the mineral, which they informed MR. MARCADIEU, had been worked in the Sikh times as a silver ore. MR. MARCADIEU states, that it consists of crystals of the sulphurets of iron and lead in quartz, and that on analysis it does not contain a trace of silver.†

AMRITSAR SERIES.

23—[329]. Crude iron, of variety, called "guléri."

This is imported from Gwalior; hence its name.

24.—[330]. Mandi iron.

* Cuningham's Trip to Kúlú and Lahaul, in Asiatic Society's Proceedings, March 1848.

† Kangra Local Committee.

LAHORE SERIES.

25.—[346-8]. Iron ores from Chamba. LAHORE MUSEUM.

One specimen is hæmatite.

26.—[347]. Clay nodule, containing iron. LAHORE MUSEUM.

27.—[350]. Hæmatite, Sangli hills, containing copper in small quantity. LAHORE MUSEUM.

The following are the kinds of iron to be met with in the Lahore bazars.

28.—[365-8]. 2nd class steel, "asbát," used for coarse cheap cutlery purposes.

29.—Iron, variety "khéri," used for agricultural and other implements.

Do. variety "barki."

Do. variety "guléri," comes from Gwalior in Hindústán, it is a tenacious metal and used for wire drawing, gun barrels, &c.

Besides these varieties the following kinds are met with in the shops of the "lohtis" or iron sellers, who are the persons who buy wholesale from the Nowrias and other merchants and then sell by retail to the blacksmiths or "lohars." Of Indian iron, the varieties are—the "khéri," noted above; this is said to be brought from Hindústán, it is an iron of unpromising appearance, but exhibits on being forged its superior quality; it is much employed for carpenters' tools, adzes, &c., and occasionally for swords. It values about 4 seers per rupee; its probable origin is the Jaipúr territory.

"Faulád" or steel, used to be imported from Hindústán for the manufacture of armour, shields, &c., at the present day when the manufacture of such armour is not carried on, the import has ceased, the steel used to be brought in "chaktis" or circular disks, about ¾ of an inch thick. "Guléri" iron, which is sold in pigs, and values Rs. 6-12 per maund, is a tenacious iron used also in wire drawing. The imported Indian irons are brought up by Naurias to Hátras between Allygurh "and Agra, and from thence taken to Amritsar, which is the Punjab mart. Of Punjab iron, the "bajauri," from Bajaur, north of Peshawur, is not much exported to the Central Plain districts, though it was formerly for the purposes of gun making. Bajauri iron is still largely used at Kuhát in the remarkable process of their gun barrel making, and is used also at Kálábágh and other places. The guns and cutlery made at Nizámábád, in the Gujranwala district, are of "guléri" iron or of "asbát." European steel is also employed for cutlery.

Barki iron is brought down from Suket and the Mandi mines, it values Rs. 6-12 to 7 a maund, and finds its way on backs of mules and donkeys to Dínanagar whence it comes to Amritsar: it is probable that other irons of the Kangra district mines are similary imported under this name. Attempts have been made by individual traders to bring down the iron of the Chamba territory, but the cost of carriage is too great to render it profitable, and it is seldom imported.

The other irons of the bazar are European, and brought from Bombay; the varieties are—

The "glâspatti," an iron sold in long flat bars; it is used for making tires of wheels, &c. Value Rs. 6-12 a maund.

"Gol sínk," thick pieces of iron, value Rs. 7 a maund; and also "Gol kandla," a similar iron, but in thinner bars; value Rs. 8 a maund.

"Chádar," or sheet iron, value at Rs. 8 a maund, is employed in making "tavas," large iron cauldrons, &c.

"Chakor sínk" and "chakor kandla,"—are varieties of iron, imported in long rods, 15 feet or so, about 3 inches broad and ½ thick,—this sells at Rs. 9 a maund. When the rods are thin, it is called "chakor kandla," and fetches Rs. 7 per maund.

These bars are stamped with a European trademark when of the first quality; these are the most approved, and are called "sacha chakor," (genuine "chakor") and fetch Rs. 9-8. If these bars are only the same in shape without the stamp, they fetch Rs. 9 and Rs. 7, as above-mentioned.

Another variety is "asbát," a hard but brittle kind of steel, selling at 3½ seers per rupee,; it is imported in bars, and is used for tools on account of its hardness.

A kind of iron is sold in the bazars called "fálli," being sold in pieces of a fusi-form shape, tapering at each end. This is probably a hill iron. I noticed this form of iron in all the shops of ironmongers of Núrpúr, in the Kangra district.

It is a remarkable fact, that iron smelted at a low temperature does not form into cast, but into an impure wrought-iron. In our ordinary smelting process adopted at home, the metal fused at a high temperature falls liquid to the bottom of the furnace, and thence, when the furnace is tapped, rushes forth into a series of shallow moulds formed in sand. The pigs thus formed are unmalleable brittle cast-iron, and require the action [except in the Bessemer process, which is different] of the "reverberatory" and "puddling" furnaces, before bars of malleable iron are procured, but in the native smelting process the temperature employed is low. At the end of two days

the metal, which is softened rather than liquefied, drops through the charcoal and slags to the bottom, and is raked out; it is simply reduced to the form of wrought malleable iron by being repeatedly heated and hammered till the fragments of charcoal and other impurities are expelled. This remarkable fact that the effect produced on the metal is different, according as it is smelted at a greater or less temperature, accounts for the existence of wrought-iron among the ancient Greeks and Romans, to whom of course the modern processes of the puddling furnace, &c., were unknown.

The art of forging or welding together several kinds of iron is noticed elsewhere; the principal variety of iron so forged is the sakela, consisting of khéri, asbát and faulád, hammered together; it is used for sword blades.

DERA ISMAIL KHAN.

30.—[523]. Iron ore. Sulaimaní hills. Local Exhibition Committee.

31.—[529]. Iron, from Wazírí hills.

The Wazírí hill iron, from Kanigorum, in the Dera Ismail Khán, supplies Deṛa Ghází Khán, to the extent of some 2,000 maunds. It is described as a very rough iron,—some of it is re-smelted at Kálábágh.

The iron mines in the Wazírí territory are in the hill called Kuh-i-Mas'úd, near Makbín and Bobra; there the metal is found as a blackish and slightly lustrous ore; it is dug out and crushed. The furnace is made like a lime-kiln beneath the shelter of a round-roofed shed called "mundáo." The furnace is charged with two parts charcoal and one of crushed ore; this being ignited is urged by bellows. When the ore is melted they insert an iron tool into the furnace and rake away the dross and slag which allows the melted metal to fall to the bottom. This iron is called "khám mátri," it sells at 20 seers per rupee; this iron again refined by melting is called locally "kára kai" and "pápoli," and sells at 10 seers per rupee. The proprietary right in the mines is defined only by mutual agreement; it is said that Rs. 25,000 worth of iron from the mine is sold per annum, but this is probably over-estimated; Rs. 10,000 would be nearly the mark. The inhabitants of Makbín and Shaikh 'Edli make vessels and plates of the iron and trade with them. The Firmáli tribe in the Wazírí Iláka carry these vessels into Kábul and Ghazní and sell them.

32.—[530]. Iron from Bajaur.

Brought down from the hills north of Peshawur. (See No. 39).

33.—[556]. Iron ore, found in the hills 25 or 30 miles south-east of Bunnoo.

Found in abundance, is in great demand at Kálábágh for nails, &c., in boat building, and for the manufacture of cooking utensils. The ore is abundant.

These hills are a portion or continuation of the Salt range group, and so these specimens may be said to represent the iron of that range, which is found in various places, but not much worked; the ore occurs as red peroxide and hæmatite, the red tint of many of the formations is owing to this, and it is stated, that in some parts of the Salt range, the rocks are so full of magnetic iron ore that they destroy the indications of the magnetic compass in the vicinity.

Dr. Henderson has recently produced some iron of most excellent quality from a blackish hæmatite ore, found in abundance in a large isolated hill of permian formation, called Kirána. It is just within the Jhilam district. Galena or lead ore is abundant in the same locality.

34.—[555]. Sample of rough iron, value Rs. 5 per maund.

35.—[954]. "Sonmakki" or iron pyrites in crystals. Kálábágh.

SHAHPUR.

36.—[911]. Iron pyrites, from Mukrach. Mr. Chill.

JHILAM.

37.—[462]. Iron pyrites in round nodules of crystals, Karúli mountain. Sadik Shah. (Erroneously called "impure copper" in the original list.)

The name "sonmakki," theoretically is copper pyrites, and "rupamakki," iron pyrites, but the two are not usually distinguished by natives.

PESHAWUR.

38.—[560] Fused iron, "aowah ospanah." Bajaur to the north of Peshawur; value Rs. 7 a maund. Local Committee of Peshawur.

39.—[569]. Hammered iron, "pukkah ospanah," from Bajaur; value Rs. 16 a maund. These samples do not represent the *best* produce of Bajaur.

Bajaur produces iron of good quality. At a place called Burowl, at foot of a range of hills subject to Ghazzan Khán of Dhir, it is said to be found in greatest quantity. The ore is not obtained by mining, but in a pulverized state, mixed up with black earth washed down by hill-streams, which is collected by the people and exported to Peshawur and other neighbouring markets, where it is sold after it has undergone the process of smelting. This process consists of mixing the black earth containing the ore with coal, and burning them together until the iron becomes a consistent mass, from which pieces are disposed of as may be necessary. The value of the ore mixed up with earth, as it leaves its native hills, has not been accurately ascertained; but it is believed the cost in its pristine state is very small. The carriage hire on donkeys and mules to Peshawur and other markets adds to it, and after smelting it sells, according to its quality, at Rs. 3 to 6 per maund.

HAZARA.

40.—[589]. Iron ore (red hæmatite), "matti loha." Bakōt. LOCAL COMMITTEE OF HAZARA.

KASHMIR.

41.—[599]. Siliceous iron stone, from Reyási, 20 miles above Jammú. H. H. THE MAHARAJA.

42.—[612]. "Sangi chamak." Massive magnetic ore, brought from Yarkand *viâ* Lahaul.

COPPER.

GURGAON.

43.—[105]. Copper ore with iron, (copper pyrites), from Singhána in Ferozpúr Tahsil. DEPUTY COMMISSIONER OF GURGAON.

With regard to No. 43 (105), in the time of Ahmad Baksh Khán Jaghirdar, some copper ore was found in the hill called Ghâta Shamsábád, but it is not worked.

HISSAR.

44.—[155]. Copper ore, "támbe ka pattar," from Laghánâ, Bhagúl, Ketari, and Buhai. LOCAL EXHIBITION COMMITTEE.

The ore is obtained by mining the hill side; the work is carried on only by day, and then with the aid of lamp light. Occasionally a rush of water causes the work to be stopped, and as there is no mechanical contrivance for controlling the flood, not unfrequently the particular spot has to be abandoned altogether. The ore obtained from the mine is broken into pieces and smelted sufficiently to make it cake; on this, wood and the common "úpla" (dry cow-dung) of the country are heaped, and the mass set on fire. The process of extracting the metal is similar to that of burning lime; the copper, contained in the pulverized and caked mass, percolates through the calcined refuse, and finally forms irregular shaped fragments at the base.* These fragments are cut up into pieces like the sample following.

45.—[156]. Copper obtained from the ore, No. 44. It is in little dice, or melted drops of about ½ an inch square.

The smelting of copper is barely remunerative on account of the utter absence of all mechanical appliances. The miners pay a royalty of one-sixth of the gross produce to the Khetari Râjah, feudatory of Jaipúr.

JHILAM.

46.—[462]. Copper pyrites.

This is not copper, but iron.

The terms "sona-makki" and "rúpa-makki," though, properly speaking, indicating copper and iron respectively, are, in practice, synonyms.

The Salt range contains copper, in the form of concretionary nodules in some of the calcareous and shale strata of the Devonian series; the nodules give by their decomposition a green colour to the sandy clay: the yield of metal, is from 12 to 20 per cent, but the quantity of the ore is inconsiderable; it exists as nodules, varying in size from mere grains up to as large as a walnut.

KANGRA.

47.—[240]. Copper ore, Pelang, Kúlú.

This box contains two specimens; one a quartz, containing a little copper pyrites and some silicate of copper, and the other, marked as from Manikaran, is a hard reddish grit, which has no appearance or probability of containing copper. MR. MARCADIEU noticed this ore, and thought it of no importance commercially, unless it indicated the propinquity of other richer ore.

* Hissar Local Committee.

48.—[296]. Quartz with blue carbonate of copper. Spiti. P. EGERTON, ESQ.

KASHMIR.

49.—[ ]. Copper glance. Rondu, 16 marches beyond Kashmír. Since the Exhibition closed, a very interesting specimen of copper, both as a copper glance, or sulphide, and in the form of pyrites, has been sent by F. H. COOPER, ESQ., C.B., Resident. A sample of fused copper of good quality accompanies it.

TIN.

50.—[7·971]. Specimen of melted tin in a disk. Lahore bazar. MISR MEG RAJ.

The metal is imported: it is principally used for making bright toys and imitation trinkets, as well as to tin copper vessels; it is beaten out into leaf, and used by the artist also for a silver paint; it is rather expensive as a metal. The value of the network disk of tin strips, which is the form exhibited, is Rs. 2-12.

ANTIMONY.

This metal occurs in various parts of the province as a black ore of antimony. In composition it is a ter-sulphide, and called "surma." It is fused by heating in a covered pot; the metal melts easily and runs off; the ore usually contains lead, and sometimes silver, iron, copper, and arsenic. The use of this metal, as an alloy or pure metal for scientific purposes is unknown in this province; but the ter-sulphide is reduced to a fine powder, and sold by druggists as a cosmetic for the eyes, in which case, it is supposed to act as a tonic to the nerves of the eye and strengthens the sight. This surma is in use in all Eastern countries.*

It is constantly confused by natives with galena or sulphuret of lead, as both yield, when ground up, a dark coloured powder. The natives have also applied to another substance, Iceland spar (carbonate of lime), the name "surma safaid," literally, "white antimony," though the substance has no analogy with the ter-sulphide except in the form and fracture of the lumps in which both are sold by the druggists. Native doctors however prescribe the "surma safaid" for the eyes, just like real antimony, and this keeps up the misapprehension.

The ore is much imported from Kandahár, but is produced in great abundance in the Himaláyan range, where it was noticed by Captain Hay at Spiti. "Surma" also is said to occur in the Salt range, but there is no sample of antimony sent from these mountains—all the specimens sent under the name of antimony are really *galena*, which natives confuse with surma, such samples are sent from Jhilam, Karangli, the Watli hills, and from Shahpúr at Khagúla; but as these metals are not unfrequently associated, it may be true that both are to be met with. Antimony also is found at Kúlú and at Bajaur, in the hills north of Peshawur. From Baila, in the province of Lus, to north of Khelat, antimony is imported to Shikarpúr in Sindh, to the extent of 15½ maunds a year. By far the greater part of the antimony (really galena) of the druggists is imported from Kábul and Bukhára.

LAHORE.

51.—[369-72] (*a*). Three samples of good antimony ore, (LAHORE MUSEUM,) probably from countries near Kábul, but no name is recorded.

(*b*). "Surma pahári."—Antimony from hills in the Punjab territory; price 12 annas per seer. Lahore bazar.

(*c*). "Surma Kandahári," from Kandahár, as its name imports, is a superior kind; value, Rs. 1-8 a seer. Lahore bazar. A sample exhibited and purchased from the bazar as "surma Kandahári," re-

* The Musulmans have a notion that the finest kind of surma comes from Arabia in the hills of Sinai, &c. The tradition is, that when Moses was on the Mount, he asked that the glory of the Almighty might be shown him; he was answered, that his mortal sight could not bear the glory, but through a chink of the rock a ray of the light was allowed to fall on him, and that the rock on which the ray fell became melted into antimony.

markable for its pure and brilliant appearance, proved to be sulphuret of lead.*

(*d*) [374]. "Surmi," an inferior hard kind of ore. Surmi is sometimes said to be sulphide of zinc, but this sample is not so.

KANGRA.

52.—[279]. Sulphuret of antimony, "rindi dowa" (meaning lead ore in Thibetan), from Lahaul. R. ELWES, ESQ.

This is found on the Chandra valley above Koksar.

53.—[236]. Sulphuret of antimony, "surmi ka pattar." Jagatsukh, Kúlú.

This is a good ore.

54.—[288 & 297]. Two samples of sulphuret of antimony. Spiti. KANGRA EXHIBITION COMMITTEE.

In one the ore is associated with iron pyrites.

HAZARA.

55.—[590]. Antimony ore, from Bakōt (erroneously called tin ore); it contains no tin, but a little iron; only a small quantity was discovered, and further excavations were made in search but without effect.

PESHAWUR.

56.—[567]. Antimony, "ranjah," from Bajaur. LOCAL COMMITTEE.

This is a very good ore, value Rs. 12 a maund.

SIMLA.

57.—[711]. Antimony, from Sirmúr. RAJAH OF SIRMUR.

DERA GHAZI KHAN.

58.—[929]. Antimony, from the Lower Hills. MUNICIPAL COMMITTEE.

LEAD.

Occurs in various places in the form of a sulphuret or galena, sometimes associated with quartz; it is used by natives indiscriminately for antimony, and is called surma with it, as before remarked.

But a large quantity of sulphuret of lead is brought down from Reyási in the Jammú territory to Amritsar, it is there melted up in pots with iron filings,—the small particles of iron combine with the sulphur, setting free the pure metallic lead.

KANGRA.

59.—[238]. Galena in quartz, from a vein at Kothi Harkandi, at Rúpi, on the Parbatí river, Kúlú. LOCAL EXHIBITION COMMITTEE.

It forms nests in the quartz beds, which rest on the mica schist strata on the left bank of the Parbatí.

LAHORE.

60.—[373]. Galena from Kandahár. Rs. 1-8 a seer.

This sample was bought in the bazar as antimony, "surma."

AMRITSAR.

61.—[333]. Sample of metallic lead as used in the bazar.

KASHMIR.

62.—[615]. Sulphide of lead (surma), from the Jammú hills. H. H. THE MAHARAJA.

JHILAM.

63.—[901-902]. Sulphide of lead, from the Karangli and Watli Hills. LOCAL EXHIBITION COMMITTEE. Value, from 7 tolahs 10 mashes to 10 tolahs for the rupee.

The lead (called antimony) of Karangli occurs in the most inaccessible precipices of the hills. Bowring gives the following account of the method of obtaining it. He says :*—

* All the species of what is called "surma Kandahári," that I have seen, prove to be lead, which is distinguishable to the eye, from the antimony, by its cubic crystallized appearance exhibited in fracture. There is another substance called "surma Ispáhani" (*i. e.*, Ispáhan antimony) of which the sample exhibited proved on analysis to be micaceous glistening iron ore.

* Bowring's Jhelum, Journal of the Asiatic Society. No. 1 of 1850, p. 50.

"The zemindars who search for it, let themselves down the face of the precipice, and pick the mineral out of a hole in which it occurs pierced in the side of the rock. In this perilous adventure, some unfortunates have lost their lives by falling down the cliff,—a height of more than 5,000 feet."

SHAHPUR.

64.—[904]. Sulphide of lead, in small fragments. Khagúla. MR. CHILL.

(Both the above are entered in the original lists as antimony).

These sulphides occur in small cubic crystals in limestone beds within the Karangli hill, and near the Kheura mine.

GOLD.

The metal occurs only in sand, washed down in greater or less abundance by the rivers of the Punjab. There is however no sample obtained from the Rávi. There is also no exhibited specimens of auriferous quartz, nor has any yet been discovered in any of the mountain ranges. There is a mineral sent from Thal Baland Khail in foreign territory near Bunnoo, called "sang-i-zardár," but its containing gold is imaginary. Native silver also does not appear; it is found in minute quantities associated with the ores of lead and antimony, but that is all. Gold-washing is taxed and becomes a source of revenue to the state, though not a very productive one. The revenue report, shows that the produce of the tax was for 1860-61, Rs. 444; in 1861-62, Rs. 530.

AMBALLA.

65.—[168-70]. (*a*) Sand; (*b*) do., washed to remove the first impurities; (*c*) Gold obtained from it. From Karrar, near the Markanda river.

KANGRA.

66.—[235]. Gold-sand and gold obtained from it. Beyás river, near Haripúr. LOCAL EXHIBITION COMMITTEE.

This sample sent has been obtained by numerous washings from several maunds of earth and sand taken from the river bed. The quantity of gold is so minute, that not more than 3 or 4 annas worth is obtained by a day's hard labour at washing.*

67.—[287]. A substance believed to contain gold by the natives, from Spiti. P. EGERTON, ESQ.

This is a soft red earth, like "gil irmani," there is no appearance or probability of its containing gold.

68.—[279]. Gold from Lahaul. REV. MR. JAESCHKE.

This is called "gser" (pronounced "ser") in Thibetan. It is obtained from the sand of larger rivers of Lahaul and Zangskar. Most of it is taken to Hindústán and sold, but the profit of goldworks are very small; it takes several months to collect even a tolah; the small grains are worked up into little lumps with the aid of mercury, value, 1 tolah for Rs. 15.

RAWAL PINDI.

69.—[238]. Gold-washings. Attock. MAJOR SANDILANDS.

70.—[ ]. Bar of pure gold. Weight 35½ tolahs; value, Rs. 655.

JHILAM.

71.—[379]. Gold washed from the river Jhilam. LAHORE MUSEUM.

72.—[460]. Gold, from Kas Gabhír. TEHSILDAR OF TALA GANJ.

73.—[461]. Gold, from Kas Soj. JAWALA KHATRI.

In the tertiary formations of the Salt range, gold is found in the shape of minute scales, and has doubtless been derived from plutonic and metamorphic rocks, the disintegration of which has furnished the material of which the strata of the series are composed.

And in the beds of numerous nullahs which flow through the "meiocene" formations, the sand is washed for gold. It seems to be obtained in the largest quantity towards the Indus, north of the Salt range.

The original beds whence gold is derived have not yet been found. The quartzites and quartzoze mica slate much developed in the Pír Panjál range near the Baramúla pass and other localities, have as yet failed to yield gold.

The process of washing the river sands for gold is as follows:—

When a likely spot in the bed of a nullah is fixed

* Kangra Local Committee.

upon, the superficial mud is scraped off and lower sand taken out with a wooden shovel and carried to the spot where it is to be washed, close at hand. The washing is effected in a long wooden box resembling a small flat-bottomed boat, wide at one end, and narrow at the other, where there is an opening for the escape of the water. The wide end of the cradle or "drún" as it is called, is slightly bent upwards so as to give its flat bottom a gentle inclination towards the fore part. A coarse sieve of reeds is then placed across the wide end of the tray; on this the sand is thrown, and water dashed upon it, till all the finer sand is washed through into the cradle, and the coarse gravel retained on the sieve. By continuing the washing with a gentle stream of water the lighter particles of fine sand are carried down the inclined floor of cradle and escape with the water, while the heavier and auriferous sand assumes the highest level next to the point where the water is applied. In a very short time nothing remains but a thin stratum of black iron sand, in which scales of gold may occasionally be seen to spangle.

By continuing the washing still further, the lighter particles are removed and the auriferous portion concentrated within narrow limits. When the washing in the cradle has been carried as far as is considered safe, the sand is removed by hand into a platter called a "karí," made of sisu or some other hard wood. In this, by a circular motion, it is agitated with water, and thus an additional portion of the black sand is got rid of, and washed away from the inclined sides of the plate by a stream of water skilfully applied. The residue is then rubbed up with a little mercury, which quickly amalgamates with the gold and leaves the black sand. The mercury is then removed from the platter and wrapped in a fragment of cloth, and placed on a bit of live charcoal, the mercury quickly sublimes, leaving the gold entangled only with the ashes of the cloth from which it is freed by rubbing. It is taken next to the goldsmith, who fuses it with borax, and thus it is cleaned. Grains of native platinum are found in the same way in the Indus, and in some places the natives call it "white gold," and despise it exceedingly.

In the gold-washing process just described, two or three individuals earn from 6 to 8 annas a day. It is said that in Hazara grains of gold are sometimes found of such a size as to allow of their being picked out of the sand.

The gold-washings of the Salt range are nearly all in the Jhilam district. In the year 1850, 158 cradles were at work, and they were taxed from Rs. 2 to 5 per "troon;" the total tax amounted to Rs. 525.

The Kardar of Mokhund told Dr. Fleming in 1848, that the production of gold was as follows:—

1844—409 tolahs (tolah = 165 grains.)
1845—272 ditto.
1846—332 ditto.

The gold-washers conceal the amount as much as possible to reduce the tax.*

PESHAWUR.

74.—[566]. Auriferous sand, "torah shigga." River Indus. LOCAL EXHIBITION COMMITTEE.

In both the Indus (above Attock) and the Kábul rivers, auriferous deposits are found, though not extensively. Some of the boatmen, during the cold weather, work as gold-washers in gangs of from five to seven, and collect on an average from 2 to 2½ tolahs each in the season. The gold sells at Peshawur at Rs. 15 per tolah, so this would yield them about two annas per diem, whilst actually employed. Their apparatus for washing the sand consists only of large wooden trays, six feet in length, and sieves. No tax is taken from them now, but under the Sikhs, one-fourth of the proceeds was paid to the Kardar, whose license was necessary before they plied their trade. In some places a tax was taken of Rs. 2 per tray, and the proprietors of the soil received another rupee. About 150 men may be thus annually employed, and it is not unusual for them to receive advances for the work from the gold purchasers at Peshawur. These deposits indicate the presence of gold in the hills, but the latter are beyond our reach: a mine has been lately discovered near Kandahár, but its value has not yet been fully tested by the Amír. Still the gold-washings of these rivers might be advantageously examined by those who possess the necessary qualifications.†

BUNNOO.

75.—[564]. Gold-dust, "reg-tilá," from the river Indus, where it occurs in small quantities. The value of the produce is probably Rs. 200 a year. DEPUTY COMMISSIONER OF BUNNOO.

HAZARA.

76.—[587-8]. Gold and gold-dust, from the river Indus. Value, Rs. 15 a tolah.

* Fleming's Report on the Salt Range. Select Correspondence of the Punjab Government. No. xxii., p. 343.

† Local Committee.

In the streams where gold-sand is washed, grains of platinum are occasionally found in small quantities; the gold-seekers call the metal "safed sona," and reject it as useless. Platinum has been found in the Tavi river of Jammú territory, and in the Kábal river at Naushera.

Of other rarer metals, bismuth has been obtained in small quantities in Kashmír from the Jammú territory.

SUB-CLASS (B). ALLOYS.

The class of alloys is but poorly represented; the compounded metals known to the natives are all more or less based on copper. The white metals and alloys of bismuth, antimony, and other substances, are quite unknown.

Brass is manufactured in the more important cities, but not in large quantities. The larger vessels, "gágars," "shamadáns," &c., are made of imported brass. The native brass is of different quality as to hardness, according to the proportion of zinc employed. Besides brass, a metal giving a beautiful sonorous ring when struck, and called "phúl" or "khánsi," is made. "Roín," a genuine bell metal, is also manufactured. If we add to these a compound called "barth," and another inferior one called "kuth," the list of alloys in common use will be complete. Pewter articles are occasionally to be met with, but the alloy is uncommon. The varieties of alloyed silver, known as "rúpa," are merely silver debased by the addition of copper or zinc, or both.*

LAHORE.

77.—[7954]. Sample of "phúl" or "khánsi," a kind of bell-metal. MISR MEG RAJ.

78.—[7854]. Sample of "barth" metal.

79.—[7954]. Sample of brass as sold in the bazar. MISR MEG RAJ.

AMRITSAR.

80.—[332]. "Khánsi," bell-metal. LOCAL COMMITTEE. Roín, is also a kind of bell-metal.

81.—[331]. (*a*) "Pital," brass, with the kuthálí, or earthen crucible in which it is melted. LOCAL COMMITTEE.

The crucible is made by beating together flocks of cotton wool and stiff clay till both are thoroughly combined; the whole is then dried; the cotton serves to bind the clay, and answers the same purpose as hair in mortar. The kuthálí exhibited is of very small size, such as is used for gold-melting; for brass, ordinarily, a much larger size would be used.

* A mixed metal formed by welding together different metals is not technically an alloy, but approaches so near that a mention of such metals may not be inappropriate.

A metal known as "sakela," is used for the manufacture of swords, &c., consisting of cast-iron, asbát and khéri iron, and fanlád or steel welded together. Occasionally, in Jammú, a small quantity of silver and sometimes tin, is beaten into and welded with the finest sword blades for the sake of texture and polish.

SUB-CLASS (C). METALS, IN THE PROGRESS OF ADAPTATION TO FINISHED MANUFACTURES.

The process of wire-drawing in various metals is carried on with considerable success, the gold wire-drawing in particular is very skilfully performed, and with very simple apparatus; the metal to be drawn being guaged as to the size of the wire by a perforated iron plate; the processes of flattening and producing a wave in the wire, for the purpose of making gold thread, tinsel, &c. (kalábátun), are performed with considerable ingenuity with the aid of a fine hammer and a tiny polished iron anvil.

LAHORE.

82.—[7973]. Coils of iron wire, thick and thin. MISR MEG RAJ.

Guléri iron is employed for wire-drawing.

83.—[7974]. Coils of brass wire, do.

84.—[7975]. Sample of copper wire.

85.—[7976]. Sample of zinc wire.

86.—[7972]. Case contained a series of specimens of metallic leaf; viz., silver, gold, tinfoil, and brass leaf, or "orsdew."

The silver and gold leaf are used for a variety of ornamental purposes, and silver leaf is much used in adorning festival sweetmeats. The orsdew is a cheap substitute for gold leaf, but is much thicker in substance.

87.—[7955]. Sample of sheet copper MISR MEG RAJ.

This is imported, as all copper used for the manufacture of large vessels or fine copper work is. The copper of Hissar, in small fragments or pigs, is also to be had in the bazars.

PATTIALA.

88.—[ ]. Sample of silver wire (fine).

89.—[ ]. Sample of gold and silver leaf.

Division II.—Mineral Substances used in Manufactures and for Building purposes.

SUB-CLASS (A). SUBSTACES USED IN MANUFACTURES.

PLUMBAGO.

THERE are several samples of this mineral which mark paper easily, but scarcely one that would be fit to manufacture lead pencils from. There are several black stones and carbonaceous shales, which are erroneously called graphites or plumbagos; for instance, a specimen from Simla, called graphite, is a sample of some rolled pebbles of a black grauwacke or hard rock of the older formation, which does not make a mark on paper.

KANGRA.

90.—[263]. Mineral supposed to be plumbago, called "kali mitti," from Haripúr. LOCAL EXHIBITION COMMITTEE.

This substance is used in cleaning colored pottery, also in cleaning the hair. It is not a plumbago, but a black clay full of organic matter; which, however, marks paper.

GURGAON.

91.—[106-7]. Plumbagos from Sonah and Bhúndi. DEPUTY COMMISSIONER.

Of these samples one is a shale, which marks paper. The other is a carbonaceous shale.

The box contains little cubic pieces to show its sectility. These mark paper, but are more like a drawing crayon than black lead.

92.—[375]. Mixed shale and plumbago.

93.—[377-88]. Plumbago of a dark shade.

94.—[377]. A dark talcose schist, used as plumbago, giving a deep black mark. LAHORE MUSEUM.

Accompanying these samples there is unfortunately no record of their locality. It is probable that they may have been sent from Gurgaon at the time when the report was made by DR. THOMSON, extracts from which are added. Exhibited along with them was a drawing of a butterfly, bird, and beetle, executed with points of these black leads.

DR. W. J. THOMSON describes the plumbago of Gurgaon as follows :—

While on duty at Sonah a few days ago, I made a cursory geological examination of the hills near the town. The most eastern point of the hill at Sonah is semi-detached from the principal range by a deep gorge. This portion is composed of sandstone much indurated by heat and mixed with eruptive quartzose and gneiss rock near the top. About half way up (100 feet) on the eastern slope of the gorge, where it is nearly precipitous, I found a bed of soft black stone easily friable and soiling the fingers when touched, and brought home some specimens. The bed was from 18 to 24 inches thick, and as far as traced it extended about 30 yards N. and S., and had a dip of nearly 10° to the N. Not having examined the stone minutely till I arrived in Gurgaon next day, I had only a conjecture as to its nature, and the great rarity of plumbago made me doubt its identity till tested; hence I did not examine the vein further from the surface, but as the specimens sent have been long exposed to air and moisture, I conjecture that a plumbago of an equally pure quality and more dense structure will be found further in.

The natives of Sonah were aware of the presence of a soft black stone in the hill, but had no idea of

its nature or use, so it has remained untouched. The specimen sent has a specific gravity of 1937·5, water being 1000. It is unchanged by a red heat in an open fire, and is not acted on by strong nitric acid. From these tests I infer that it is neither lignite, sulphuret of antimony, or bituminous slate. Not having chemical apparatus at my disposal here, I was unable to apply any other tests. I may add that when applied in powder moistened to black iron and subsequently polished, it gave to it a fine brilliant metallic gloss like genuine black lead.

I would recommend that specimens be sent for the inspection and opinion of some professional geologist, and also that its market value be ascertained: when this is determined, steps may be taken to work the mines. As the 2nd quality of Cumberland plumbago sells for about £100 per cwt., I think the value of this vein ought to be considerable.

On the western side of the gorge near its entrance is a great mass of what appears to be plumbago, reposing against a wall of eruptive trap rock, and much changed and indurated by the heat it has been subjected to. This mass appears to be about 40 tons as far as explored.

There is at the first sight an appearance of stratification owing to the deposit occurring between the beds of the stratified rock, but the plumbago itself is found in masses of variable size, and in general quite detached, though in some cases the rock all round is full of plumbago, mixed with finely divided micaceous particles.

These masses are of every variety as to quality; some are hard and compact of almost pure plumbago, and in my opinion of sufficiently good quality to be suitable for the manufacture of drawing-pencils; the second sort, equally pure, but of a softer texture and easily reduced to powder.* This variety might be used to mix with antimony for the manufacture of common pencils or along with the inferior varieties it would find a ready market in India as well as at home, for the manufacture of friction grease for machinery, especially for railway wheels where there is great heat. At present, plumbago is not much employed for this purpose, but it is only owing to its rarity and high price that this is the case. Its other uses as a powder are numerous; of it are made crucibles, cells for galvanic batteries for the electric telegraph, a good polishing powder for black iron, and when ground with oil it forms an excellent and permanent black paint. Were the present limited supply in the market somewhat increased, no doubt many more useful applications of it would follow.

The hills in the neighbourhood show such peculiarities that I am induced to believe that they contain metallic deposits of either copper or lead.

Specimens of the plumbago dug from different masses, exhibit great differences of appearance; some show a distinct crystalline form; others, and these are the largest in quantity, are filamentous in structure, while a considerable quantity is altogether morphous. The filamentous variety seems to be hardest, and likely to be of the greatest commercial value when also compact, but in many of the deposits of it there is a large admixture of micaceous sand, which gives it a loose and friable texture."*

The Chemical Examiner of the Punjab, to whom a specimen of this plumbago was referred, reports that on examination he finds it principally composed of carbon with iron, and resembles English plumbago very closely. The mineral sent presents the lamellar form, and its specific quantity varies from 2·2 to 2·6. Its analysis gave the following results:—

In grains 1000, the constituents are,—

Water, ...	43·54
Salts soluble in water, ...	0·80
Sulphates, ...	0·45
Chlorides, ...	0·35
Sesqui-oxide of iron, ...	32·94
Carbonate of lime,... ...	8·37
Silica and alumina, ...	129·89
Carbon, ...	784·52

Part of the iron appears to be in the form of a sesqui-oxide, and the rest combined with the carbon.

SULPHUR.

Sulphur is called "gandhak," "gogird," or "kibrít." When in vitreous state it is called aúnlásár, which term, means like the "aúnlá," (fruit of the *emblic Myrobalan,*)† This fruit (known to Europeans as the Indian gooseberry) is yellow when ripe, and semi-transparent, hence the vitreous sulphur is said to resemble it. It is sometimes called "chachya," when in the form of "flower of sulphur," in which state it is first obtained from the ore by sublimation: roll sulphur is occasionally imported. It is found extensively throughout the Salt range, and is manufactur-

* I have tried some of this plumbago cut into cubes, and it appears to answer well as a soft dark grey drawing crayon. —Ed.

* The Memo. of Dr. Thomson has been published in full in the Punjab Gazette.

† Sár, like ánwlá or aúnlá, fruit of *Phyllanthus emblica.*

ed also at Kubát. The valley of Púga, in Ladákh, from whence borax is obtained, yields also sulphur.

SIMLA.

95.—[716]. Sulphur fused in cake from Jeura, near Simla. MR. GEO. JEPHSON.

96.—[717-734]. Are specimens of fused sulphur from Jálandhar, and [746] is from Amritsar.

Both are imported for medicinal purposes.

DERA GHAZI KHAN.

97.—[928]. Fused sulphur from the Higher Hills. Dera Ghází Khán. MUNICIPAL COMMITTEE.

KANGRA.

98.—[283]. Sulphur, from Lahaul. TARA CHAND.

The Puga sulphur mine is situated a short distance from the Rulangchu, (a small stream which is full of hot springs and runs into the Indus,) at the foot of a gypsum cliff. The mineral occurs chiefly in the form of the lamina disseminated throughout the rock: but in all the fissures there are numerous detached crystals quite transparent, and of all sizes, from that of a grain of sand to one-eighth of an inch. In detaching the sulphur, the crystals are mostly reduced to powder and partially mixed with the gypsum rock: in this state it is carried to the markets of Núrpúr, Kangra, and Rámpúr. The vague statements of the shepherds, make the annual supply about 500 maunds, but I should think that it rarely amounted even to half of that quantity.*

It is probable that the sulphur has been deposited in crystals, and is still deposited in the same manner in the fissures of the mica schist by aqueous vapours loaded with sulphur. This deposit is always met conjointly with a fibrous gypsum, with the fibres generally straight, parallel, and of a silky appearance. I am led to believe that this sulphurous deposit continues to operate thus on account of the moist heat you feel when you enter a few paces into the cavern from whence the mineral is extracted. On the 26th July 1854, at half past 6 A. M., the thermometer in open air, stood at 52° Fahrenheit, while at thirteen or fourteen feet in the interior of the mine, the mercury rose to 75°, and the glass of the instrument was covered with an aqueous vapour. I was suffocated by the puffs of humid heat of an odour similar to that developed by sulphur boiling in water. I have not the slightest doubt that if galleries were made in the body of the mountain, large quantities of the mineral might be extracted. In the actual state of things the mine is worked without system, and the workmen have not the remotest idea of purifying the mineral.

* Cunningham's Ladákh.

DERA ISMAIL KHAN.

99.—[525]. Sulphur ore, associated with gypsum in small crystals. Sulaimaní hills. LOCAL EXHIBITION COMMITTEE.

RAWALPINDI.

100.—[384]. Rock containing sulphur. Murree hills. LAHORE MUSEUM.

101.—[895]. Sulphur from Gobra hill. LOCAL EXHIBITION COMMITTEE.

KASHMIR.

102.—[603]. Sulphur, from Ladákh. H. H. THE MAHARAJA OF KASHMIR.

SHAHPUR.

103.—[907]. Sulphur earth from Jabba, above petroleum springs. MR. MATTHEWS.

104.—[908]. Sulphur obtained therefrom.

Besides the numerous springs charged with sulphuretted hydrogen, and which deposit sulphur on the rock over which they pass, and on the grass and weeds by their sides, sulphur in a mineral form occurs near the surface of the nummulite limestone at Jabba, a little above the petroleum springs, in a white porous gypsum, which has evidently been formed by the decomposition of the limestone, unaltered pieces of which are still imbedded in it. The metamorphosis has doubtless been effected by the action of sulphuretted hydrogen and sulphurous acid. These gases, generated on the decomposing alum shales by passing through the fissured limestone and porous gypsum that overlies them, become mutually decomposed, and sulphur is deposited. Dumas, in 1846, proved that where sulphuretted hydrogen at a temperature of above 100° Fahr., or better still near 190°, comes into contact with certain porous bodies, a catalytic action

is set up by which water, sulphuric acid, and sulphur are produced. In this way sulphur is universally formed in nature, and even in volcanic countries no well authenticated instance is known of the sublimate of sulphur in an uncombined state.

The thickness of the sulphur formation is trifling. The mineral is bright yellow in color, and small in quantity. It was formerly worked by Maharája Guláb Singh, who ceased because it was unprofitable, and set up works at Khushálgarh on the Indus, between Attock and Kálábágh, where it is said to exist in considerable quantity. The place is called Nákband: it is in the Kuhát district, about 8 miles from the mouth of the Kuhát river, and specimens from it are exhibited.

"Misr Gean Chund, now Tehsildar of Pind Dádan Khán, told us that during the three successive years, he had from Nákband extracted 1000 Lahori maunds of sulphur for the manufacture of gunpowder for the Sikh army. He supplied it at the rate of Rs. 6 a maund. He described the pits as 30 or 40 feet deep.

The mode of extracting the sulphur from the matrix is simple. A hole is dug in the ground over which a large wide-mouthed earthen "ghara" or globe-shaped jar is placed. This is filled with crushed sulphur ore; a second ghara, with a large hole in the bottom, is put mouth downwards, on the top of the first, and a third and a fourth on the top of the second. The mouth of each jar being over the hole broken in bottom of the one beneath it, all communicate with each other, and at the joints a luting of clay is applied to fix them. The hole dug under the first or lowest ghara containing the ore, is then filled with wood and set on fire; the sulphur is thus sublimed out of the matrix, and rises into the upper jars, on the sides of which it is deposited as "flower of sulphur." The process is complete in eight or ten hours.

KUHAT.

105.—[961]. Series showing sulphur in various stages—as ore, sublimed sulphur, and cake or fused sulphur. Local Committee.

106.—[961]. Earth, containing sulphur, from Gumbat.

The mines are not now permitted to be worked. The process of extraction formerly adopted was that already described. Sulphur also occurs near Panobar, 4 miles from Shadipúr on the Indus. The crystals of native sulphur picked out of the rock are called "aunlisár."

107.—[962]. Sulphur, as it comes from the receiver before melting. "Phúl gogird," flower of sulphur.

108.—[863]. Manufactured sulphur.

This is a flat cake prepared by fusing the powdered sulphur, and allowing it to cool in flat earthen vessels.

PESHAWUR.

109.—[573]. Sulphur, Kálábágh. Value 10 Rs. a maund. Local Committee.

PETROLEUM AND BITUMEN, &c.

110.—[4304]. Petroleum, Himálayas. Lahore Museum.

111.—[4307]. Do. purified, forming a yellow colored strong smelling oil, called "pattar ka tel."

KANGRA.

112.—[ ]. Petroleum from British Lahaul. Dr. H. Cleghorn.

113.—[740-1]. Petroleum from beyond the Kánikorum range. Mulvi Umrdin of Nurpur.

RAWALPINDI.

114.—[896]. "Tel gandak," petroleum floating on water of the spring. Ratta Hotar hills. Local Exhibition Committee.

The petroleum is found at Jabba, a hamlet of Kussan, west of Chakrála, and about nine miles east of Kálábagh; at Dhádur, three miles west of Kabbákhí in the Salt range; at Narsinghpúr, in the Salt range; at Jabba, near Núrpúr; in the Algad ravine, at Kafirkot, on the Indus, and in smaller quantity at some other places.

A sample of this petroleum has been sent to England; but the report was very unfavorable.

The report states that it was impure, being combined chemically or mechanically, with extraneous adjuncts which greatly diminished its value. Details are not given; the chief impurities are merely said to be probably sulphur and phosphorus; but it appears possible that some impurity may have been due to the mode of collecting the large quantity ordered on that occasion. At all events this one adverse report should not be considered final, the report on the

previous small quantity from the same place having been favorable.

Petroleum is nearly indicated with bitumen on the one hand, and naphtha on the other, between which it occupies an intermediate place; the principal distinction being a difference of consistency and color. Bitumen in its several varieties known as mineral pitch, asphalte, pisasphaltum, &c., is solid or nearly so, and black or dark colored; naphtha is perfectly liquid and light in color; petroleum,—earth oil, or rock oil,—is vescid or oily and greenish or reddish brown in color. They are resinous minerals or mineral resins, the products as it is generally understood, of the distillation of various bituminous rocks or soils, and their distinctions, classification, and alliances, are not very clearly determined or uniformly agreed upon. Petroleum is considered to be naphtha in its natural impure condition, more or less discolored and otherwise affected by foreign accompaniments derived from the adjacent soil or rocks. It is very generally associated with sulphur.

The principal supply of petroleum in the regions adjoining the Indus now under consideration, namely, at Jabba, near Kálábágh, is in nummulitic limestone* At Kafirkot, Dr. Fleming says, it exudes from brown bituminous sandstone. The mineral oil is usually found floating on the surface of certain springs, it is thus at Jabba, near Kálábágh, at Kafirkot, and at a spring in the Kuhát district, about four miles from Hungoo Khota and six from the Indus. It is observed that in the petroleum rocks which have many fissures, the supply is generally most abundant. Besides the ordinary method of sinking shafts, it is sometimes obtained by laying bare the stratum producing it, removing the surface earth in banks where it is found to exude. In the ravine at Kafirkot, where the springs issue from the sandstone, "large holes are dug which fill with water mixed with petroleum." Till the Punjab petroleum localities have been further examined and tried, the extent and value of their produce cannot be properly known.

It appears that the present cost of the Kálábágh petroleum, before despatch down the river, may be reckoned about Rs. 3 per maund.

It is probable that by the use of wells, the quantity obtainable would be so largely increased that the cost (after paying the initial charge of sinking the well,—which may be considerable, as they are often of great depth and sometimes unsuccessful) may be greatly reduced; and at the same time being collected in this manner, it may be obtained of greater purity. At present it is collected by the natives, who plunge into a pool containing petroleum, a bundle of grass and shake it about. The petroleum or asphalte adheres, and this is scraped off with the hand into an earthen "ghara."

With regard to the uses to which it may be applied in this country, it has been tried with success in the Punjab, (as in Burmah and elsewhere,) for protecting woodwork, office record racks, &c., from the attacks of white-ants. This is an application of no small value, and it should be extended.

MAJOR ROBERTSON, when in charge of the Lahore and Peshawur road, tried it for the protection of the wood-work of timber bridges. He reported unfavorably, and found vegetable tar to be better suited; but he did not report that petroleum was unsuccessful in protecting the wood, but that it was no better than the other, and he objected that it had no drying property. It is not stated that he had it boiled with vegetable resin, which is frequently done.

For the feet of telegraph posts it would probably be valuable. It might also be worth while to apply it to railway sleepers.

It gives a good light burned in the usual way with cotton wick, but generally accompanied with a good deal of smoke. It may be purified by distillation, and then either used as an oil or by gas made from it; it might be found a not unsuitable means of lighting the Attock Tunnel, which, when it is opened on the full size, will be a matter of some importance. It is probable that it would be found at Attock, less expensive than any kind of vegetable oil.

Candles are made of paraffine, a substance obtained by Mr. Warren De La Rue's process from Burmah petroleum, and also produced by distillation of coal and other minerals of disputed relationship to coal. They could not however be made profitably except on the large scale, as now at Messrs. Price and Co.'s Patent Candle Manufactory.

Paraffine oil, obtained by the distillation of petroleum of coal, &c., is a lubricating oil of much value for machinery of all kinds, as it does not injuriously affect brass or other metals.

The petroleum itself, when pure, is sometimes used for the same purpose without distillation.

The distillation of the oil might easily be effected in this country and the experiment tried.

It has recently been used in America, as a substitute for coal and wood in generating steam. The boilers and furnaces require to be made of a peculiar construction for its use; but on the Indus, where wood is scarce, it is possible it might sometimes be found of value for this purpose.

At Bákú, on the shores of the Caspian Sea, is a petroleum locality well known for ages past, (and possessing a peculiar interest in connection with India as a place of Hindoo pilgrimage at the present day

* MR. W. THEOBALD, Jour. As. Soc., Bengal, vol. xxiii.

and maintaining a small fraternity of resident Brahmins, attendants on the sacred fire of the petroleum springs). The viscid mineral is rolled up into balls with sand, for the purpose apparently of obtaining a fuel in a convenient form.

At the same place, and at many others, petroleum is used also as covering for the flat roofs of houses; probably mixed with sand in this application also, and forming a sort of asphaltic concrete to which an approach is obtained by the composition called oropholite, often used in this country at the hill stations.

Petroleum has also been well known from ancient times, and in many countries, as a very efficacious remedy in certain cutaneous affections, both for man and beast. It has been successfully used in European practice in Burmah.* In the Trans-Indus, where it is found, Northern Deraját, &c., it is the common application for sores on the backs of camels.

It is also successfully used for rheumatism, and has other medicinal uses. COLONEL YULE was informed that it is used in Burmah as a medicine taken internally. HANWAY mentions certain complaints for which the Russians so use it, as well as its external applications.

Petroleum in one form or other has been largely used in many countries as an igneous missile in war; to which purpose the produce of these petroleum springs on the Indus appears to have been applied in former times.†

KASHMIR.

115.—[604]. —— called "momyái," is a black substance principally clay, which however burns feebly and softens slightly to the flame of a lamp, giving out a peculiar empyreumatic odour. The *momyái*, "osteocolla" of native medicine, is also, when genuine, a substance of this class; but it is of very high price, and its use is solely medicinal. The specimens purchased often consist of solified mineral tar, or still oftener of lignite. (See Division III, *ad loc.*)

EARTHS, CLAYS, AND OCHRES.

RED EARTHS.

The number of these is considerable; although varieties that receive different names are often extremely similar. Some of them are in use as medicine, others as dyes and coloring agents, and as such are imported from Hindústán, and become articles of considerable trade. The earths and clays to be met with in the bazars are known by the names of *geru* and *gerí*, *gil-i-irmani*, *gil-i-khardya*, *gil-i-abrorshi* or *farsi*, *gil-i-makhtum* and *harmuchi*.

116.—"Geru," from the lower hills of the Dera Ghází Khán, and also from the Máhrúli hills of the same district.

A specimen is also exhibited from Bunnoo [No. 565], to which place it is imported from Afghánistán, and is used for dyeing cloths red. It is a hard red laminated earth, sometimes used in dyeing, and also by school teachers who grind it up with water and teach their children to write with it on wooden slabs, like our school slates. This material has also a place in native medicine.

The next few numbers describe earth and marls of a similar nature, but differing in tint and in hardness.

Samples also are sent from Amritsar, (Nos. 4515 and 762), from Jálandhar (721), and Lahore (No. 426), though not produced in either of these districts, but as being in use there.

117.—[849]. "Gil-i-khardya," exhibited from Lahore bazar, is a variety of geru.

118.—[884]. "Gil-i-abrorshi" of Amritsar bazar, is a pink clay, hard but less brittle, and paler than "gil-i-irmani."

119.—[759]. "Gil-i-makhtum." Amritsar bazar. LOCAL EXHIBITION COMMITTEE.

A variegated earth, deep red, and pure white, soft and irregular; it contains clay, carbonate of lime, and sesqui-oxide of iron.

It is exhibited from Lahore. (No. 840). The "gil-i-abrorshi," or "gil-i-farsi," (No. 790,) is probably the same or very nearly so.

120.—[884]. "Gil-i-irmani." Lahore bazar, differs very little from geru and gerí.

It is a rough, red, brittle earth, occurring in laminated masses, used as a color, and also as a medicine by native practitioners. This is the representative of the "bolus Armeniacus," once so celebrated as a European medicine. It is now only used in Europe for coloring dentifrices, tooth powders, and also added to improve the appearance of potted meats and anchovy sauce.

* Indian Annals of Medical Science, No. iii.

† See Note H, to Sir H. Elliot's Mahomedan Historians of India.

121.—[428-4513]. "Harmuzi" or harmuchi, from the Lahore and Amritsar bazars. The earth is much used for house painting, also as an artist's color, and as a medicine; it is a fine deep chocolate red color like that yielded by our artists' "brown madder," only opaque.*

GURGAON.

122.—[144]. Red earth, brought from Gwalior.

A soft bright red earth in flat pieces.

123.—[141]. "Badóchi." A red dye, from Gurgaon. DEPUTY COMMISSIONER.

124.—[142]. "Geru surkh." A coarse red earth, of deep red chocolate color, lamellar rough texture from Gwalior. DEPUTY COMMISSIONER, GURGAON.

This is called geru, but is exactly like harmuzi.

The Dera Gházi Khán sample of "geru" is not unlike this.

SIMLA.

125.—[144, 176, 181, 186, 199, 188]. Are red ochreous earths from Dhámi, Bishahr, Kumharsen, Mahlog, Kothár, and Koti, in the Simla district.

KANGRA.

126.—[258]. Red earth, Bawarnah. LOCAL EXHIBITION COMMITTEE.

This is used to adulterate "kamela," the red dye obtained from the capsules of *Rottlera tinctoria*; it is also used as a glaze for pottery.

127.—[260]. Is a red earth, from Haripúr.

Besides these earths, ("surkh mitti" of the vernacular catalogue,) specimens are exhibited from Rawalpindi, (455,) from Bhulla in Jhilam, (496,) and from Dera Ismail Khán, (532). This last is of the color of "harmuzi."

128.—[261]. "'Udi mitti," from Haripúr, in the Kangra district. LOCAL EXHIBITION COMMITTEE.

This earth takes its names from its color ('údi, meaning chocolate purple color)—it is used for coloring pottery, and is probably allied to the harmuzi.

Among the sandstone strata at Dhurmsala and in other places in the Kangra district, there are beds of marl and clay of a deep red and chocolate color: to these formations the samples in question very probably belong.

129.—[318]. "Chamarfo," Spiti. P. EGERTON, ESQ.

A bright deep red colored earth used in dyeing.

130.—[320]. "Chasarfo," orange colored dye, Spiti, a bright orange colored earth. P. EGERTON, ESQ.

131.—[323]. "Lal mitti," red clay, from Spiti. P. EGERTON, ESQ.

SHAHPUR.

132.—[511]. Harmchi or harmuzi. Red earth, from Chitta, in the Salt range. DEPUTY COMMISSIONER.

RAWALPINDI.

133.—[455]. Pink marl, from Aktori hill. LOCAL COMMITTEE.

This marl has a soft and almost greasy feel.

PESHAWUR.

134.—[570]. "Gormuchai." Yusufai country, Peshawur. LOCAL COMMITTEE.

Value 10 Rs. a maund; is erroneously called red lead in its district list, but is harmuzi.

135.—[581]. Red ochre, "surah khaorah," from Lund Khor, Yusufai. PESHAWUR COMMITTEE.

DERA GHAZI KHAN.

136.—[548]. A dark-red smooth ochreous marl, from the Lower hills. TEHSILDAR OF DERA.

This is a fine colored marl, lamellar in structure, but with conchoidal fracture.

YELLOW EARTH AND OCHRES.

There are clays colored by the hydrated

* Besides the above named red earths, which are sold in bazars, several districts exhibit various red earths, marls, and ochres, as specimens of their own production, there are some of them made use of in manufactures, other not so, they now follow arranged in the order of their districts.

sesquioxide of iron. They are found in various parts of the province in the Salt range, at Kálábágh, and other localities.

137.—[143]. Yellow ochre, passing into red ochre, from Firozpúr of Gurgaon.

[133½] Lamellar yellow ochreous earth, from Singhána. DEPUTY COMMISSIONER OF GURGAON.

Yellow earth, "zard" or "pili mitti," as also exhibited from

Haripúr, of Kangra (259).

Kheura, Salt range (493).

Márí of Shahpúr (508).

This sample is a square block cut from the smooth yellow clay.

Jálandhar district (718).

Lahore bazar (427).

Dera Ismail Khán (527).

138.—[179]. Black earth, from Kothár, Simla. RANA OF KOTHAR.

BLACK EARTH.

A similar sample is [189] of Kotí.

These are black clays abounding in organic matter.

JHILAM.

139.—[498]. A brownish clay.

FULLER'S EARTH.

140.—[545]. From Yára of Dera Ghází Khán. This is a genuine fuller's earth, marked "mitti sabz khúrdani." It is eaten by women during pregnancy.

RAWALPINDI.

141.—[456]. "Mitti gáchni." LOCAL EXHIBITION COMMITTEE.

This is a soft and saponine drab-colored earth, something like fuller's earth, sold in small pieces; it is used for cleaning the hair, also in medicine; is to be met with in every bazar, where it is called "mitti Múltání" or "gil-i-Múltání."

Samples are also shown from the bazars of Lahore and Amritsar. Nos. 742, 839, 840.

In the report by CAPTAIN F. R. POLLOCK, on Dera Ghází Khán, it is stated that this Múltání mitti is imported to Dera Ghází Khán from the interior of the Western Range (Sulaimaní) to the extent of 10,000 maunds.

The name "Múltání" applied to the earth does not indicate its origin, except perhaps as regards the trade in it. The Assistant Commissioner of Múltán, LIEUT. CORBYN, writes as follows:—

Although it would appear Múltan is famous for its mitti or earth, yet there are no mines or pits here which produce the substance. It is imported from the sandy and rocky tracts of country lying to the south and west of Múltán. It is of the following descriptions:

1*st*.—White mitti, which is termed "khajrú" or eatable.

2*nd*.—Yellow mitti, which is termed "bhakrí," and is used by the poorer classes for dyeing cloths, &c.

3*rd*.—Light-green, or "sabz mitti," which is chiefly used by natives for washing and cleaning the hair.

The first is imported from Jaisulmair and Bikanair in quantities of 1,000 maunds, valuing Rs. 1,000.

The second is also imported from the above places to the extent of 1,000 maunds, valuing Rs. 875.

The quality, No. 3, is imported from a village named Vadúr, in the Dera Ghází Khan district, about 200 maunds annually, valuing Rs. 150.

GLASS MAKING.

The art of glass-making is yet in its extreme infancy in the Punjab, as may be seen by a glance at the collection in the Department of Manufactures. In fact the specimens of white clear glass, are one and all manufactured by melting up fragments of European white glass vessels. The only glass of native manufacture from its first elements is a coarse greenish "kach," or glass in lumps. Glass is little used by the natives for any of the domestic purposes for which in Europe, it is considered almost a necessary of life; hence there has been but little encouragement given to the manufacture; no doubt, if search were made, the province could produce fine sands and good alkalis, suited to an improved manufacture.

GURGAON.

142.—[151]. Glass-making sand, from Chatta in the Firozpúr Tehsil, Gurgaon. DEPUTY COMMISSIONER.

The glass sand occurs in the form of a whitish sand mixed with an alkali, which effloresces naturally. It is called reh, that only of a good white color makes glass. This substance is identical with the alkaline efflorescence which appears in many parts, and whose presence is destruction to cultivation wherever such an efflorescence occurs over clean sandy soil, there is naturally formed a mixture of sand and alkali which fuses into the course lumps of bottle green glass.

143.—[ ]. Crude fused glass, called "kach." Singháná.

KASHMIR.

144.—[609]. Peroxide of manganese. Jammú Territory. H. H. THE MAHARAJA OF KASHMIR.

This is used in glass-making, to destroy the green color of glass by converting the *protoxide* of iron into *peroxide*.

LAHORE.

Manganese is found in the bazar as a binoxide, called "jugní" or "missí siya."

145.—[871]. Lump of fused or raw glass. "Kach." LAHORE BAZAR.

POTTERY.

The pottery clays are better represented. Clay exists abundantly all over the province, and in some places of a fair quality. The commonest kind is the gray clay, which burns red; but there are several earthen vessels in the collection showing the clay, when burnt, of a yellowish white or cream color; such clay mostly comes from Dera Ghází Khán, Dera Ismail Khán, and Kuhát. Several of clay vessels of Hazara exhibit a black clay. As yet, however, no pale-colored clay suited for Terra Cotta, like the beautiful samples from Madras, have appeared.

The subject of the production of kaolin has received attention. Some disintegrated granite, forming kaolin has been brought down from Dalhousie, where it is to be had in plenty, but the cost of carriage is great.* This kaolin has been tried, and the vessel in baking received a colored tinge, and did not stand pure white. This is said to be caused by the presence of iron, but may have been the fault of the furnace, rather than the material.

DELHI.

146.—[14]. White clay, supposed to be kaolin. Aurangpúr, Delhi. MUNICIPAL COMMITTEE.

This is white clay with some carbonate of lime and mica, and may very likely have been formed by the disintegration of granite. It has been employed for making crucibles in the Foundry at Roorkee, N. W. P.

KANGRA.

147.—[282]. Kaolin, Lahaul. R. ELWES, ESQ.

This is not kaolin but a very fine grey sand, and does not appear to possess tenacity.

148.—[308]. Fine clay, from Spiti. P. EGERTON, ESQ.

DERA ISMAIL KHAN.

149.—[528]. Pottery clay. Dera Ismail Khán. LOCAL EXHIBITION COMMITTEE.

The box contains also sample of a whitish gray clay, a black clay, and a red earth, used for coloring pottery.

LAHORE.

150.—[432]. Common pottery clay, from Kot Khoja Sáí, near Lahore. MR. B. POWELL.

* The whole surface soil of Dalhousie consists of disintegrated primary rock, schist, and granite, more or less enriched and discolored by iron and by decayed vegetable matter, but in many places the paths cut in the hill side are as white as if made of chalk, and crumbly pieces of whitened rock; both schist and granite may be gathered with the hand, soft and friable as dry pipeclay. On the road to Chamba, and also on the hill road into the Kangra district, there are places so whitened with the disintegrated rock as to impress the spectator with the idea that he is approaching a chalk cliff in several places. I have noticed that the white material had been dug out and was employed by the hill people as a whitewash, the disintegrated mica schists of the softer varieties, form a whitish saponine powder used for a similar purpose.

27665

151.—[160A] "Kharya mitti," fire clay. Lahore bazar.

This is a pale colored clay, almost the same as "chikni mitti," and used to make crucibles of. The term "khari mitti" is also applied to chalk. But there is no indigenous chalk in India; there are many white clays and substances similar in chemical composition to chalk, but there is no secondary cretaceous formation.

152.—[ ]. "Kaolin," from Dalhousie. DR. PENNY.

[ ]. Kaolin worked up into clay.

[ ]. Small covered pots made of the kaolin, but unbaked and unglazed. LAHORE CENTRAL JAIL.

[ ]. Small baked and glazed jug of kaolin. The color has changed from white and got a yellowish tinge in baking. This is said to be owing to the presence of iron in the kaolin.

This kaolin was brought from Dalhousie. It is ground up, and the fine powder collected in running water and separated; the coarser particles are again taken up and ground, till the whole is reduced to an impalpable powder.

SHAHPUR.

153-54.—[514]. Series of pottery clays. DEPUTY COMMISSIONER.

Consisting of (1) gray clay for pottery found at Nalli; (2) similar clays from Surakhi; and (3) a sample of smooth lamellar marl, from Dhák and Khusháb. Specimens of the pottery made from this clay will be found in Class XV., Division II.

GUGAIRA.

155.—[521]. Clay, from Syadwala, Gugaira. DEPUTY COMMISSIONER.

DERA ISMAIL KHAN.

156.—[528]. Clay, "chikna mitti," very porous, from Dera Ismail Khán. LOCAL COMMITTEE, DERA ISMAIL KHAN.

DERA GHAZI KHAN.

157.—[558]. Pottery clay from Dájal. TEHSILDAR OF DAJAL.

158.—[550]. Clay for brick-baking, from Dera Ghází Khán. TEHSILDAR OF DERA GHAZI KHAN.

159.—[551]. Porous clay for vessels from Dájal, Dera Ghází Khán. TEHSILDAR OF DERA GHAZI KHAN.

SUB-CLASS (B.) FUELS.

COAL.

Of the various samples of coal that are exhibited, there is hardly one, as the Jury remarked, that can properly be so called. There is, however, a coal from near Pind Dádan Khán, and a sample from Kashmír, that are very similar to genuine coal of the carboniferous formations, but the majority of the specimens are anthracite and lignites. They occur in irregular patches of variable, but usually of inconsiderable, extent, in a number of places in the Punjab. In the Kangra district, in Dera Ismail Khán, among the Murree hills, and in Jummú, there are several places where glossy black lamellar lignite is found associated often with shales, containing sulphate of iron, and belong to strata of tertiary formation.

But the principle source to which attention has been attracted is the Salt range, for here at any rate the quantity is much greater than most of the other localities indicated.

In the Salt range there are two of the formations coal or lignite. These I shall distinguish as OOLITIC COAL and TERTIARY COAL.

I. OOLITIC COAL.—Among the shales of the oolitic series occurs, what is called Kálábágh coal, which has to a certain extent been employed as fuel for the Indus steamers. This bed is in a ravine about a mile west of Kálábágh. The coal is found in lumps of various sizes in dark bituminous shales. It does not occur in beds but in detached masses, which appear to be compressed and fossilized trunks of trees; in many cases the junction of trunks and branches can be traced. The occurrence of these masses is altogether irregular and uncertain, and nothing like a systematic working or shaft-cutting, to reach it, would be in any degree remunerative.

"The coal," says Dr. Fleming, "is very hard and light, exhibits a conchoidal fracture in which its woody structure is most apparent. It is of a jet-black color, has a brown streak, and often encloses nests of half-decomposed wood resembling peat."

It burns quickly without coking, to a light colored ash, and emits a large amount of smoky yellow flame; on being distilled, it yields a light spongy coke of a glistening metallic color, with a large quantity of inflammable gas. On analysis the following results were obtained in 100 parts:—

Carbon (coke), ...	37·5
Volatile (bituminous inflammable matter), ...	60·0
Ashes, silica, &c., ...	2·5
	100·0

The large amount of bituminous matter at once refers the coal to the lignite or coals imperfectly carbonized; the amount of ash is small, which may be accounted for by the solid nature of the wood not admitting of the infiltration of earthy matter.* This coal burns very rapidly.

* Flemming's Report. Selected Correspondence of the Punjab Government, No. xxii. page 310.

The evaporative power of coal is in direct ratio to the amount of carbon it contains. English coal yields 50 to 70 per cent. of carbon, this coal only 37·5; hence double the quantity of this coal would be required: but still it has twice the evaporative power of wood, which has only 16 to 18 per cent. of charcoal.

During 1850, Dr. Fleming tell us, 2,500 maunds of this coal were dug, and from 1851 to March 1852, 2,126 maunds, at the rate of 8 maunds per rupee, which could not remunerate the miners for any length of time. Calculating that an ordinary steamer burns 600 lbs. an hour of English coal, and that of Kálábágh coal, the consumption would be nearly double, from considerations adduced above,—the whole produce of the year 1850 would keep a steamer going 166 hours.

II. Tertiary coal.—The most important series of coal strata in the range, however are the beds occurring in the strata of the eocene series. It is principally in the lower alum shales that coal occurs; it is found at many places all along the range, and also across the Indus in Chichalli range.

The first coal occurs at *Baghanwalla*, 10 miles west of Jalálpúr, being about half way between it and Pind Dádan Khán. The seam is about 3½ feet thick, at its widest part and gradually thins out towards either end. It is enclosed in shales and yellow marl, resting on variegated sandstone. The seam dips conformably with the strata at an angle of 45° or 50°. This coal was brought to the notice of Government in 1847. It is very brittle and alternates in parts of the seam with shale, which renders it also very friable. There would be considerable difficulty in sinking shafts on account of the brittle nature and the steep incline of the strata. But Dr. Fleming notices this seam as the most hopeful one to be worked, should Government determine on mining the coal.

At *Drengan*, coal again appears, which is probably a continuation of the Baghanwalla seam.

Kheura, this coal was found in 1848, in a seam about 2 feet thick at the bottom of a roundish hill of nummulitic limestone, in a ravine about a mile to the N. E. of the Salt mines. It rests on blue clay containing septaria and crystals of gypsum. In 1849, 500 maunds were extracted, but this is not a productive seam, as the extraction appeared to have exhausted it.

On the road from Kheura to Choya Saidan Sháh, coal occurs at *Pid;* the coal is not so good, it occurs in two seams. At Dindhot, Mukrach and Núrpúr, coal occurs in a seem of about 2 feet thick, of inferior quality, and difficult of access.

At the top of Karmiwán above Kuthá, shales full of iron pyrites occur, enclosing beds of coal much more compact and mineralized than most of the other lignites; the seams were only about 6 inches thick. In 1852, Dr. Fleming remarked that the outcrop of the coal had become concealed by huge masses of limestone thrown down by an earthquake.

Between Kuthá and the Indus no coal occurs, except in occasional and unimportant films. But at Kutkí, in the Chichalli range, among the alum shales, coal was obtained; the miners stating that it occurred only in patches, and not in regular seams; access to it is easy, and it burns well, notwithstanding the quantity of earthy matter it contains.

The coal of the Salt range generally very much resembles that called *splint coal*, but is soft and brittle. It is not used as fuel by natives, but ground to powder and administered with milk as an "osteocolla" for wounds and broken bones, internally. It is often called "sang-i-salájít," and sometimes "múmiái," though múmiái properly is hardened bitumen or petroleum. The genuine múmiái is derived, it is said, from the Bakhtyárí hills in Persia.

The coal is difficult to ignite, but when lighted gives out a quantity of smoke having an empyreumatic odour, and burns without coking, with a considerable amount of flame and heat; it leaves however a large quantity of ash, in which respect it is unlike the coal of the oolitic series, previously described as found at Kálábágh. Generally speaking, the coal is free from iron pyrites, but some of that brought for trial to the Punjab railway was said to have omitted a smell of sulphur during combustion, which is a common fault of lignites generally. The coal is better adapted for combustion than for smelting ores, to which purposes it is not applicable, because it yields but a small amount of coke, and cannot produce the high and continued heat required for smelting operations. The total length through which the coal occurs is 130 miles, in the nummulitic formation, hence the total quantity in existence must be considerable. But the steep angle at which the seams lie, and the friable nature of the supervening beds, render shaft-sinking difficult; carriage is also very difficult in many places.

The coal is of the kind called brown lignite; it has a brown streak, and when freshly dry a black glossy lustre, like the jet coal above described; it contains occasional nests of a semi-mineralized substance like peat. Some of the Baghanwalla specimens, however, that have reached Lahore are of a much superior character, they are very like real coal, and have a black streak on being scratched. No indications of fossil wood have been obtained in the shales, but one or two shells.

The following are Dr. Flemming's analyses of the coals:—

BAGHANWALLA, No. 1.

Coke (carbon), ...	41·36
Volatile (bituminous inflamable matter), ...	40·64
Ashes, ...	18·00
	100·00

BAGHANWALLA, No. 2.

Coke, ...	59·705
Volatile (inflammable matter),...	38·455
Ashes, ...	1·840
	100·000

No. 1 was from the upper part of the seam, and No. 2, a remarkably fresh fine specimen, from the centre.

KUTKI, ALUM SHALE PIT-COAL.

Carbon (coke), ...	35·579
Volatile (bituminous inflammable matter), ...	36·421
Ashes, ...	30·000
	100·000*

* For the sake of comparison, the analysis of several varieties of English coal, showing the amount of carbon contained in each, may profitably be consulted.

100 PARTS OF EACH SORT CONTAINED—

	Carbon.	Bituminous.	Earth ash.
Kilkenny coal, ...	97·20	..	3·70
Swansea, ...	73·53	23·14	3·33
Newcastle, ...	58·00	40·00	..
White Haven, ...	57·00	41·30	..

Professor Ansted remarks, that no good coal occurs in England or Europe out of the regular carboniferous series, but oolitic coal is abundant in America; and there does not seem any reason on this account why coal should not be found in India, among oolitic and tertiary strata, and capable of being successfully worked. The existence of the seams being indicated, and an analysis of the coal effected, it only remains to make careful and well-judged experiments to determine the ultimate success of coal-mining on the Salt range; but we must ever bear in mind, and especially with regard to promises of coal in the Sub-Himaláyan and other tertiary formations, that lignite is apt to occur in detached irregular masses, which are no more indications of a regular workable seam of serviceable coal, than the fortuitous discovery of a copper coin is of the propinquity of a copper mine.

The subject has received renewed attention of Government in this year (1864). Professor Oldham and Dr. Jameson have visited the localities, and coal has been sent down and burned on the Punjab Railway, where it answered perfectly, but we have as yet no promise of the establishment of remunerative coal mines;—the principal difficulty appears to be the very heavy cost of carriage to the places of consumptions.

The general conclusions we come to on the subject of the coal formations in the Punjab appear to be these:—

1*st*. That we are in no measure to be deterred by the statement so often but erroneously put forth, that coal as serviceable fuel does not occur out of the carboniferous series. The discoveries of Professor Rogers in America, and the works of Ránigunj in Bengal, not yet determined to be of the real carboniferous series, sufficiently prove the fallacy of it.

2*nd*. That the existence of coal and the laws of its production in the country can only be determined by esoteric observation. The observations already made seem to lead to the conclusion that there are two formations of coal in the range; the first, is that belonging to the nummulitic eocene period; the second, like the Kálábágh coal, to the oolitic or secondary. From observations of the nummulitic limestone and the discoveries of small portions of coal in parts of the Sulaimaní range and near Dera Ghází Khán, as well as the formations recently noticed in Sindh, and thence upwards through Dera Ismail Khán, Bunnoo, Wazírí hills, Murree, &c., a probability is established of the uniform continuance of strata of the series containing thin beds of lignite of greater or less development, among shales and sandstones, across the whole of that portion of the frontier country between Sindh and the Salt range, including the Dera Ghází Khán, Dera Ismael Khán, Bunnoo, Kuhát, Shahpúr, Jhilam, and part of the Rawalpindi districts. On the other side also, the appearance of coal or lignite in the tertiary formations in the Jammú territory in the Kangra district, and again at Biláspúr, indicate an equally wide range of such strata on the other frontier to the north and north-east.

The seam of nummulitic coal appears to attain its greatest development at Baghanwalla, a place 8 miles west of Jelálpúr, close under the southern scarp of the Salt range, and at the entrance to a gorge through which a stream issues; the way is up this gorge, and at a distance of about 3½ miles from the village the seam becomes visible. Here the coal is in a bed 3½ feet thick or in all probability not so much except where it crops out, as it has the appearance of having been squeezed very much, and to have here found a more roomy space where it could somewhat expand. The coal is partly friable, but good bright coal can be obtained. The beds dip at an angle of 63°, and also in other places at 58°, which would necessitate the working by galleries one over another, and then the whole of the coal might be worked out. Care must be taken to keep the galleries clear of dust and

small coal, as spontaneous combustion might, and often does ensue from the decomposition of the iron pyrites, &c., which is abundantly contained in it. The coal is good, notwithstanding that it emits a somewhat sulphureous smoke; it succeeds on the rail-road, and for steamers on the Indus; one maund of this coal is as effective as 2½ to 4 maunds of ordinary wood fuel.* With regard to the quantity of fuel available at this place, Dr. Oldham writes as follows:—

"Taking Baghanwalla then, as unquestionably the most promising of any of the localities, we can here make a rough approximation to the quantity of 'coal,' which will be available at a moderate cost, that is without going to any great expenditure for machinery, or other such appliances. I put aside altogether any calculations of what may occur (and I suppose does occur) at depths to which it most indubitably would not pay to drive the workings for such a coal as this.

"At Baghanwalla, the seam, when cut through in the water-course, was 3 feet 6 thick, occasionally a little more. This I have already given my reasons for considering to be more than the regular or general thickness of the bed. To the west, the bed holds on steadily in direction, but gradually thinning out for more than a mile; to the east it can be seen for more than quarter of a mile. We may, therefore, take the whole length as about 2,000 yards, and we may take the average thickness as 2 feet 6 inches, the portion which lies above the water level, and which is therefore most readily accessible and could be worked by adits, without pit-sinking, may be taken on the average as 100 feet into the rock. We should then have 6,000 × 2·5 × 100 feet = 15,00,000 cubic feet of coal; take from this ten per cent., to allow for irregularity of beds, and we would have 13,50,000 cubic feet, which may roughly be taken as equivalent to maunds. This would be equal to about 45,000 tons of coal. If the workings were carried down, say 50 feet, below the water-level, and I scarcely think it would pay to go much further, we should have in addition to the quantity given before, 6,000 × 2·5 × 20 equal to 3,00,000 cubic feet, or deducting as before one-tenth, equal to 2,70,000 cubic feet, or maunds of 'coal,' making a total of 16,20,000 cubic feet or maunds of coal.

"From this, at least one-fourth must be taken for waste, small coal, dust, impurities, &c., leaving 12,15,000, or in round numbers 12 lakhs of maunds of coal. This quantity ought, I think, to be available here, 12,00,000 maunds equivalent to about 40,000 tons, is however a quantity so insignificant that the prospect of such a return would not justify even a small expenditure of mechanical appliances, and the difficult roads which would have to be made better, before the coal could be transported is also a great source of expense."†

It appears that beyond Baghanwalla the seam of coal divides into two, which gradually thin out towards the west, for at the next station, Kheura, the coal bed is observed to have in it some seams of shale; beyond that the beds are separated each 3 feet; beyond that again at Chamil, they are 8 feet apart; and at Sakesar, 100 feet, the shale and sandstone beds becoming thicker and the coal less. The lower beds of strata are more productive than the upper, so that at no place but Baghanwalla would working be remunerative, and even there remuneration would be questionable for any diggings beyond what might be locally consumed, or applied in the immediate neighbourhood.

* Memorandum on the results of a cursory examination, &c., page 21.

† It will be proper to add, however, that persons of local experience say, that more coal has already been dug out than the total quantity above indicated.

Dr. Oldham observes that all the localities which have recently been examined, and from which there is any likelihood of obtaining coal, have been known for more than ten years past, and he considers that the Salt range, whatever the value of its coal for local consumption, and the supply of steamers on the Indus, can never be a permanent scource of fuel for the province, either for the purposes of domestic use, or for the railways and factories that are now multiplying around us, with the increase of capital and the extension of knowledge.

Dr. Oldham concludes that the chief value of these coal deposits will be to *supplement* the ordinary wood fuel, and that thus it is worth while economizing it, but that it will not ever supplant wood fuel. The cost of carriage to Múltán would be nearly a rupee per maund (to say nothing of the cost of the coal itself), and since about three maunds of wood are equal to one maund of coal in effect, and the price of three maunds of wood is generally about Rs. 1, the coal would not be cheaper than wood.

With regard to the oolitic coal of Kálábágh. It is very limited in quantity, it does not form regular beds, but owes its formation to masses of wood which were drifted into the mud, which formed the shales in which the lignite now occurs. Hence this coal will only occur in limited masses, and can only be valuable as a fuel for the Indus steamers coming to Kálábágh.

The coal, says Dr. Oldham, does not form probably more than one twenty-fifth of the mass of the strata containing it; and calculating on these data, the whole bed now above water, would not on excavation yield more than 40,000 cubic feet. If the works were carried down below the water-level, say 20 feet, 10,000 cubic feet more might be obtained, deducting what would be waste, &c., about 45,000 maunds might thus be obtained. Dr. Oldham, is of opinion that the coal could not be supplied at Rs. 3 a maund for long; and that it would not be advantageous to establish any machinery, but simply to take what could be obtained for local use. In conclusion, there is not the remotest probability of coal being found above or below the beds alluded to.

In this general sketch of the prospects of coal in the Punjab, I have of necessity been unable to mention *all* the various localities where coal has been found. The reader will find all such details annexed to the names of the specimens in the immediate sequel, but few of these localities have attracted any attention, save for the production of lignite as a mineral curiosity. The small patches of coal occurring at several places among the Murree hills, were systematically examined by a committee formed by H. H. the Lieut. Governor, Sir Robert Montgomery. Samples of the lignite were sent for analysis to Calcutta, they presented the same general appearance as in other lignites, but the quantities in which they occurred were small and uncertain, and the supply in several of those places appeared to have been already worked out.*

The prospect of Kashmír coal, in the Jammú territory at one time attracted considerable attention, more especially as the Engineer who noticed the workings at Dundéla confidently reported the strata to be of the carboniferous series. Since then, however, the coal of Dundéla has proved to be like the rest of eocene origin among nummalitic limestones, but undoubtedly the coal may be of local value, a large lump now in the Lahore Museum might pass for "Wallsend," so good is its appearance.

* The detailed proceedings of the Committee have been published in a little pamphlet, called "Coal and Iron in the Punjab." Printed in 1859, at the P. W. Department Press.

The coal at Bunnoo, from the Wazírí hills, has been mentioned with some hope; and lately baskets of coal have come down as specimens from Kangra and Dharmkót, at Dharmsala, but these also are tertiary and limited in quantity; and at present, the verdict to be returned on Punjab coal, "is valuable only for local consumption and to supplement wood, not for export, or to supply the province at large."

KANGRA SERIES.

160.—[241-4]. Lignites, from Garti. Bawarnah, Jawálamukhí, and Derah on the Beyás. LOCAL EXHIBITION COMMITTEE.

The sample from Jawálamukhí is mixed with a bituminous shale, which is white from the efflorescence of an abundance of proto-sulphate of iron which it contains; the Derah sample is a hard lignite in thin uniform layers or tablets, coated with a yellowish substance on the outside.

Gopipúr, in the Kangra district, furnishes a lignite superior to either of these; a sample was sent to the Central Museum after the Exhibition closed; there is also coal at Dharmkót near Dharmsála.

161.—[381-2]. Two samples of lignite, from Biláspúr, near the Beyás river. LAHORE MUSEUM.

JHILAM.

162.—[463]. "Parrot coal." Kundal mountain. LOCAL EXHIBITION COMMITTEE.

This is a lignite, something like Cannel coal.

163.—[464]. Shale, from ditto ditto.

SHAHPUR.

164.—[499]. Samples of coal from the Salt range at Sangli, Choíwala, Súlakhí, &c. DEPUTY COMMISSIONER, SHAHPUR.

There are specimens of the best kinds of coal found in the Salt range. Samples have been forwarded to Múltán to undergo trial. On the spot, the cost of the coal is Rs. 5 per 100 maunds.

165.—[500]. Coal from Kálákos and Kálábágh. MR. MATTHEWS.

DERA ISMAIL KHAN.

166.—[524]. Coal, from Sulaimání hills. LOCAL COMMITTEE.

A poor hard lignite.

DERA GHAZI KHAN.

167.—[539]. Coal from Lagári hill. SIRDAR JAMAL KHAN.

BUNNOO.

168.—[552]. Lignite, Kálábágh. DEPUTY COMMISSIONER.

The quantity in which it exists is not yet ascertained, but is believed to be plentiful, and can be collected on the river's bank at a cost of three maunds per rupee.*

KASHMIR.

169.—[6012]. Sample of lignite, from the Jammú territory. H. H. THE MAHARAJA.

This lignite occurs at Kotlí in a bed from 15 to 18 inches thick.

Analysis of two specimens of coal from Kotlí.†

No. 1.		No. 2.	
Carbon,	90·5 p. ct.	Carbon,	90 p. ct.
Volatile matter,	4·0 „	Volatile,	6 „
Ash,	5·5 „	Ash,	4 „

170.—[613]. Salájít (lignite). Srínagar.

The place of production is not noted.

171.—[380-384]. Samples of Kashmír coal. LAHORE MUSEUM.

The principal place where coal was observed was in the Jammú territory at Dandela.

The rocks in the immediate vicinity of Dandela are thin carbonaceous shales and grits, with earthy ferruginous limestones; among them is "the bed or seam of coal or anthracite, varying in thickness from 1 inch to nearly 2 feet, undulating in chambers or bunches, more than in a continuous even seam." This is Mr. Calvert's description of the spot he selected, from which to take his samples, and it may serve

* Deputy Commissioner of Bunnoo.

† Extracted from the Official Correspondence on Coal and Iron in the Punjab.

as a favorable type of all that is actually visible. The strata he describes are thickly strewn with fossils of the nummulitic formation, which is characteristic of the lower tertiary period. From a close comparison of these rocks with the description given in Dr. Flemming's Report on the Salt range, there can be no doubt that these coal measures are the same as what is there described as "lignite or Salt range coal."*

* See a Tract, entitled "Coal and Iron in the Punjab."

The general character of the coal is that of a hard anthracite.

One of these is a large lump, much more like genuine coal than the lamellar lignites above enumerated.*

* There are many samples of a glossy lignite to be met with in the druggists' shops, called Salájit. They are not included here, but in Division V., as they are only kept in small quantities for medicinal purposes.

SUB-CLASS (C). SUBSTANCES USED IN BUILDING.

STONE, MARBLE AND BRICKS.

THE first division contains sandstones, granites and primary rock, marbles, and limestones, other than those soft kinds, which are used only for burning, and included under "cements."

SANDSTONES.

DELHI.

The collection consists of a series of sandstones from Sahi Balabgarh, in the hills to the south-west of Delhi. It is exhibited by C. J. CAMPBELL, ESQ.

172.—[2]. White sandstone.

173.—[3]. Red sandstone.

174.—[4]. Spotted sandstone (red and whitish).

GURGAON.

175.—[115]. Flexible sandstone, from Dádri. DEPUTY COMMISSIONER OF GURGAON.

HISSAR.

176.—[161]. Flexible sandstone, "sang-i-larzan," (*i. e.*, shaking stone,) from Dádri in Jhínd. LOCAL COMMITTEE OF HISSAR.

This, and the preceding (115), are obtained from the Kalyána hill in the pergunnah Dadri, of the newly acquired Jhínd territory. Nos. 165 and 166, are samples from the same locality, sent by the Rohtak Committee. The stone is mostly used for roofing and for ornamental pillars.

SIMLA.

177.—[201]. Sandstone, with yellow mica. Hills near Simla. MR. G. JEPHSON.

178.—[202]. Another specimen of sandstone, containing mica, from the same place.

KANGRA.

179.—[246]. Soft sandstone. Kangra. LOCAL EXHIBITION COMMITTEE.

This is the sandstone ordinarily used for building at the station of Dharmsala.

180.—[247]. Soft red sandstone, Kangra. LOCAL EXHIBITION COMMITTEE.

181.—[248]. Hard blueish sandstone.

This is but little worked, owing to its extreme hardness.

182.—[249]. Hard sandstone. LOCAL EXHIBITION COMMITTEE.

This is a hard stone, but has a very pleasing appearance when cut. It is worked into monumental stones, &c.

183.—[334-335]. Two specimens of sandstone. Bakloh, near Dalhousie. MAJOR REID.

This sandstone appears to be geologically the same age as the Dharmsala sandstone.

They are probably of tertiary formation, and differ much in hardness. The traveller will notice these strata highly inclined, and presenting in some places the most picturesque and grand appearance on the road to Dalhousie; they are intermediate between the most recent conglomerate formation of the lower hills, and the schists of the upper. But, perhaps, the most striking exhibition of their inclined strata anywhere to be seen is, on the road to Sindhára on the Rávi; in one place the strata incline downward at a very steep angle to the edge of the river and form high cliffs on either side; but these cliffs consist of

strata of various degrees of hardness, and all the softer portions here become much washed away from above by the action of rain or other causes, leaving only the harder beds of rock, which accordingly project like huge walls built down the cliff at a steep incline: on looking down the river, the eye follows wall after wall of these rocks, projecting like so many gigantic knife blades.

RAWALPINDI.

184.—[ ]. Calcareous sandstone, from Attock. MAJOR SANDILANDS.

JHILAM.

185.—[480]. Gray sandstone. Dumeli hill. LOCAL COMMITTEE.

186.—[481]. Red sandstone. Pabbi hill, Jalálpúr.

BUNNOO.

187.—[553]. Yellow sandstone, "zirah-rang-konha." Shaikh Budín hills.

188.—[534]. Black sandstone, "tora-rang-konha." Shaikh Budín hills.

GRANITE AND PRIMARY ROCKS.

189.—[250]. Granite. Kangra district. LOCAL EXHIBITION COMMITTEE.

190.—[304]. Greenstone. Kangra.

191.—[302]. Mica imbedded in quartz. Spiti. P. EGERTON, ESQ.

RAWALPINDI.

192.—[441]. Granite, from near Attock. MAJOR SANDILANDS.

JHILAM.

193.—[479]. Granite (?), from Choya Saidan-Shah, Jhilam. LOCAL COMMITTEE.

As no plutonic rock occurs in the Salt range this is a doubtful granite, unless it is a boulder extracted from tertiary conglomerated strata.—[B. P.]

LIMESTONES.

(Hard limestones not used for burning.)

HUSHYARPUR.

194.—[324]. Limestones, from Lower Sewalik range.

RAWALPINDI.

195.—[444]. Series of hard gray limestones containing sand. Mandra. LOCAL COMMITTEE.

The samples are as follows:—

[445]. Granular limestone, mixed with sand; from Bishender nallah.

[443]. Limestone containing sand and some mica, from Káli.

[446]. Earthy limestones, consisting of carbonate of lime with sand, like 445, only darker colored, from Rattiál.

196.—[450]. Hard argillaceous limestone. Bhai Khán river.

197.—[451]. Crystalline limestone. Khánpúr.

198.—[452]. Argillaceous limestone. Gúrah.

199.—[442]. Compact limestone, from Attock.

200.—[ ]. A variegated limestone, from the same place. MAJOR SANDILANDS.

Near Campbellpore a mottled limestone, variegated yellow and brown, is found. It is called "sang-i-abri," or "sang-i-tabak," and is made into pestles, mortars, cups, and plates, or fancy articles.

The rock at Attock is a very dense black limestone, often giving indication of iron.

SHAHPUR.

201.—[482]. Grayish-white limestones. Pabbi hill, Jalálpúr. LOCAL COMMITTEE.

DERA GHAZI KHAN.

202.—[541]. Limestone, from Chota Bála. JAMAL KHAN.

KUHAT.

203.—[538] Khajúra stone.

A concrete deposit of lime. The sample is a cut

square piece, rough and porous. It may be called travertin.*

JHILAM.

204.—[471]. Limestone, (pink magnesian,) from Karúli hill.

205.—[472]. Compact white limestone, containing a little magnesia. Kúsak and Kundar.

206.—[473]. Mottled magnesian limestone.

This is a regular dolomite.

207.—[469]. White limestone.

208.—[483]. Compact limestone.

209.—[480]. White limestone, with sand in it (contains a little magnesia). Dúmelí.

HAZARA.

210.—[592]. Compact dark gray argillaceous limestone. Abbottabad. MAJOR SANDILANDS.

There are also some building stones exhibited from Balót and from Kuhát. Nos. 535, 536, and 537.

I have found cubes of sulphuret of iron in this limestone, along the banks of the Dorh river.

MARBLES.

DELHI.

211.—[5]. White marble, Sahi Balabgarh. C. J. CAMPBELL, ESQ.

212.—[6]. Black do. do. do.

213.—[7]. Gray do. do. do.

HISSAR.

214.—[163]. Inferior marble, "kalaika-pattar." Narnaul of Hissar. LOCAL COMMITTEE.

This is a marble which takes a good polish; nevertheless, it is much used for making the first quality of chunam (lime). Narnaul is in the Pattiala territory, 50 miles from Bhawáni.

GURGAON.

215.—[107]. Gray marble. Bhunsi. DEPUTY COMMISSIONER.

Not unlike Narnaul marble.

KASHMIR.

216.—[385-3861]. Samples of black marble. LAHORE MUSEUM.

A sample of this marble finely polished was also sent by His Highness the Maharaja. (No. 615.)

217.—[390]. Hard granular gypsum. Jammú. LAHORE MUSEUM.

JHILAM.

218.—[465]. White marble. Sardi mountain.

219.—[466]. Veined marble, from the same locality.

220.—[467]. Impure marble.

221.—[477]. Translucent marble, "safaid pattar," from Shahpúr, near Kúsak and Kundar.

PESHAWUR.

222.—[576]. Yellow marble, called "shah maksadi," from Manairi. Yusufzai. PESHAWUR LOCAL COMMITTEE.

Cut into charms and ornaments.

BRICKS AND BUILDING STONES.

223.—[210]. Specimens of bricks. Jálandhar. MR. TAYLOR.

224.—[501]. Building stones, from Kathá, at foot of the Salt range, Shahpúr.

They are sold for Rs. 12-8 a 100.

225.—[540]. Building stone, Choti Búla. Dera Ghází Khán. JAMAL KHAN.

SLATES AND ROOFING MATERIALS.

The series of slates exhibited are very fine. There is one immense slab, 12 feet long, from

* In the Lahore Museum is a piece of lime travertin, very similar in appearance; it was brought from the hills near Sihunta, on the road from Dalhousie to Dharmsala through the hills. The deposit is found in concrete, with beds of a pudding-stone, or conglomerate of great hardness, formed of pebbles of volcanic and primary rock, held together by a calcareous cement: the water in the neighbourhood is impregnated with lime.

the Dalhousie quarries. The slates are some of them mixed and veined like marble; they are generally of a blueish-gray tint not inclining to purple, nor have they the fine texture of Welsh slates, being much more schistose. They are used universally in the hills both for flooring and roofing purposes. Large quarries are worked near Dalhousie, where the schists present the utmost variety of appearance. Some of them are hard, and good for slates; others are micaceous, soft, and flaky, and extremely lamellar. They occasionally contain quartz and iron in irregular lumps. Sometimes the stone is white and lamellar, at other places it is found so hard as almost to lose its schistose character: some of the rock has become quite disintegrated, and in other places, especially near Katallagh, near Dalhousie, there are whole beds of micaceous schist so brittle, that great pieces can be detached with the hand, and these are found to be so extremely soft and sectile, that they separate almost as thin as sheets of paper. Many specimens are evidently marked and discolored by oxide of iron, and sometimes the surface of the slate is beautifully marked with a brown-colored tracery, like the crystalline flower-work that every one has noticed on a glass window during a frost. The cutting of slates for roofing purposes is somewhat costly, and even at the quarries they fetch a high price.* Occasionally they are brought to the plains, when an enterprizing contractor undertakes such a task, otherwise slate is but seldom met with. This mineral is acknowledged a medicine by natives, and called sang-i-Músá, "Moses' stone."

GURGAON.

226.—[109-114]. A series of slates from Firozpúr, Páli, Chimnáwar, and Sonah. Deputy Commissioner, Gurgaon.

These slates are the products of the hilly tracts of the Sonah, Páli and Firozpúr pergunnahs of the Gurgaon district.

The samples consist of a schist called "sail." It is only used close to the places of production.

SIMLA.

227.—[196-7]. Specimens of slate, from Simla. Captain G. Pengree.

This sample (196) is described as a slate that does not last long; (197) is a more durable kind, and there are temples roofed with it that have lasted hundreds of years. The Simla list calls slate, "chápar," *i. e.*, "roofing."

228.—[198-9]. Slate from Kasauli. Mr. Geo. Jephson.

CHAMBA.

229.—[336-345]. Series of slates from Dalhousie. Major Blair Reid.

No. 335. Is thick slate for building.

No. 337. Is suited for flooring.

The other samples are roofing slates; one of them is a fine specimen, nearly 12 feet long, No. 338.

RAWALPINDI.

230.—[439-440]. Two samples of slate from Attock. Major Sandilands.

KANGRA.

231.—[245]. Slate from Kanyára, near Dharmsala. Local Committee.

These slates occur under totally different conditions from the Simla and other slates. They are in structure almost crystalline schists, hence they are too coarse for many purposes to which slates are usually applied: but in point of durability, from their hardness, they are superior to the Welsh slates.

232.—[301]. Slate from Spiti. P. Egerton, Esq.

HAZARA.

233.—[591]. Slate from Abbottabad. Local Committee.

* As high as Rs. 3 per 100.

LIME.

DELHI.

234.—[8]. Common kankar. Calcareous concrete.*

235.—[9]. "Harsarû kankar."

There is a place in the North of the Gurgaon district, close to a ridge of small hills, from which this concrete is obtained, and from which it takes its name.

There is also a lime called "harsárú" prepared from it—which is described in the subjoined extract:—

"In the pergunnah of Jhársa, and close to the salt works near the Najafgarh jheel, are extensive excavations of limestone, much esteemed in the neighbourhood of Delhi. It is found in horizontal layers, varying from a foot and a half to two feet in thickness, at about four feet from the surface of the soil, and water is immediately beneath it and touching its lower surface.

"When first exposed, the stone is soft and easily broken, containing fresh-water shells, and not to be distinguished in color from the black soil in which it is found; on drying it assumes a gray hue and becomes very hard. It is a curious fact, that this formation when once removed is not reproduced. The workmen affirm that they have searched in spots which have not been touched within the last hundred years, and never found it where it is known to have been once quarried." †

At Delhi also a material called "bájri," which is disintegrated gneiss, collected from ravines, &c., is much employed as a gravel.

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* *Memorandum of experiments on, and analysis of, specimens of kunkar, from about the 393rd mile-stone on the Grand Trunk road, near Naubutpore.* By Lieut. C. H. Dickens, *Artillery. 19th September*, 1849.

The following is the result of analysis:—

Carbonate of lime,	.. .. ..	40·05	The sand contained some alumina, probably in igneous combination with the silica.
" of magnesia,	.. ..	1·24	
Silica,	.. ..	1·80	
Alumina,	.. ..	1·75	
Iron,	.. ..	4·75	49·59
Sand,	.. ..	34·00	The last probably in part from soluble salts, for which no examination was made.
Water,	.. ..	13·36	
Loss,	.. ..	3·05	50·41
		100·00	

The first five ingredients are the active constituents of the mortar. Arranged in percentage of their sum, they stand thus:—

Carbonate of lime, ...	81·1
Carbonate of magnesia, ...	2·3
Silica, ...	3·6
Alumina, ...	3·5
Peroxide of iron, ...	9·5

† Report on Zillah Gurgaon. Appendix, page ix.

236.—[10]. Limestone, Sahi Balabgarh.

237.—[11]. Old mortar, from demolitions of ancient buildings.

GURGAON.

238.—[116-17-18]. Lime, from Narnaul and Firozpúr.

HISSAR.

239.—[162]. Kankar. Toshám. Local Committee.

Value Rs. 18 for 100 maunds at Bhawáni, for 1st, or "Chappar kankar;" Rs. 11 per 100 maunds, of 2nd, or "Rewasa."

Chappar and Rewasa are localities in the Toshám pergunnah, where kankar is found.

JALANDHAR.

240.—[209]. Kankar for making lime. Sikandarpúr. Mr. Taylor.

Kankar is also exhibited [520] from Syadwalla of Gugaira, and from Gujranwalla (434).

AMBALAH.

241.—[171]. A stone used for making lime, obtained on the hills at Manimájra, Kothár, and Kálásar.

242.—[172]. "Kankar," from Borhári. Local Committee.

In some parts of the Ambálah district, below the hills, the streams bring down such quantities of limestone, that the deposit is collected largely by the people, who burn it for lime; in former days a revenue of Rs. 2,000 a year was obtained from leases of lime kilns.

In the lower hills, at the foot of the great range, where wood and the stone is abundant, the kilns are erected; they are made of a cylindrical shape like a well, about 10 or 12 feet in diameter, and the same in height; there are two valves or openings to each furnace. The kiln is then charged with a fuel consisting of green wood, and the stone to be calcined is put on the top; and the whole is ignited during 36 hours. Stone is thrown on to the kiln little by little, in four days the whole cools, and the stone is found to be calcined and of a white color; this is slaked by throwing water on it, and the result is chunam or lime in powder. In some places the kiln consists merely of a hole dug in the ground.

The following Table shows the localities and out-turn of the lime manufacture for the last three years. From the office of the NAWAB OF MALER KOTLA.

	Place.	No. of furnaces.	Quantity of lime made.	Manufacture costs per 100 maunds.	Value of out-turn.
			MDS.	RS.	RS.
1861	Sangrel and Mathánáa, ...	18	23,800	14	3,332
	Chakigalla, ...	20	25,000	...	3,500
	Chandi, Garyálí, and Thal, ...	9	20,000	...	2,800
1862	Sangrel and Mathánáa,...	9	7,000	12	660
	Chakigalla, ...	5	1,000	14	140
	Chandi, Garyálí, and Thal, ...	10	12,000	...	1,680
		7	5,000	...	700
1863	Sangrel and Mathánáa, ...	10	13,000	14 to 15	1,280
	Chakigalla, ...	5	3,000	14	420
	Chandi, Garyálí, and Thal, ...	8	12,000	...	1,680

SIMLA.

243.—[192]. Limestone. Baghat. RANA OF BAGHAT.

KANGRA.

244.—[251]. Pink or red-colored limestone, "chúna-ka-pattar." Giroh tahsil. Kangra. LOCAL EXHIBITION COMMITTEE.

LAHORE.

245.—[387]. Slaked lime, "kalai," used for white wash.

246.—[388]. Lime, "chúnah."

247.—[389]. Quick lime, "áhak."

SHAHPUR.

248.—[505]. Lime, from the Salt range. MR. MATTHEWS.

This is exhibited as "plaster of Paris," but it proves on testing to be slaked lime. No doubt plaster of Paris is produced, seeing that gypsum exists in abundance;—probably this is only a mistake, both being white powders.

249.—[510]. White earth, from Chita, Salt range. DEPUTY COMMISSIONER.

This white earth contains common lime, a trace of sulphate and a little salt, the sample has imbedded in it some recent fresh-water shells, a *helix*, and a little spiral shell.

No. 492, from Jhilam, erroneously called gypsum, is exactly similar.

250.—[518]. Pumice stone. *(Sic)* Kathá. DOCTOR HENDERSON.

This cannot be a pumice stone, seeing that no volcanic scoriæ or tertiary volcanic rocks exist in the range; it is probably a recent calcareous tuffa or travertin deposit.

GUJRAT.

251.—[457]. Rolled limestone. Bhimbar nallah. LOCAL EXHIBITION COMMITTEE.

This limestone is called at Gujrat, "chanchal-ka-pattar" or "chúna-ka-pattar." It is found in the bed of the Bhimbar nallah, and in the rivers Chenab and Jhilam. It occurs also in small quantities in the Pabbi range of hills in the Gujrat district. There are two varieties: one of a dark blue, and the other of a light gray color. The former is somewhat harder, and well adapted for metalling roads; the other yields the best lime when burned. Limestone is the principal material used in metalling that part of the Lahore and Peshawur road lying between the rivers Chenab and Jhilam. When consolidated, it makes a hard and very durable road, and although not quite so smooth as kunkur, is much more lasting. Most of the limestone for this purpose is procured from the beds of the Chenab, Jhilam, and Bhimbar, and as it has often to be transported for long distances on camels' backs, its cost, including carriage, varies from Rs. 3 to 14 per 100 cubic feet.

The fuel, generally used for burning the limestone, is the wood of the "pullahi" (*Acacia modesta*). 200 maunds of wood are required for every 100 maunds of limestone. This yields about 50 maunds of lime. The lime sells at the rate of Rs. 25 per 100 maunds.

252.—[459]. Chunam, from Gujrat. LOCAL EXHIBITION COMMITTEE.

JHILAM.

253.—[495]. Lime from Tilla mountain. Salt range. LOCAL COMMITTEE.

DERA ISMAIL KHAN.

254.—[531 and 33]. Lime, from Paháŕpur and Kuhát.

GYPSUM.

Gypsum or alabaster—the harder varieties are often suited for ornamental carving work, as marble. There is a white granular gypsum of this nature in the Jammú territory. The other gypsums are softer, and only fit for burning to form plaster of Paris or "gach."

SIMLA.

255.—[179]. "Makol" gypsum, from Kothar. RANA OF KOTHAR.

The sample consists of white granular gypsum in pieces; several other Hill States show similar samples. No. 192 is probably the same, though called limestone. Indeed, the mistake is not to be wondered at, since the gypsum is constantly called "chún-ka-pattar" in the hills. I visited some gypsum diggings at Bátri, near Dalhousie, where the soft gypsum is so called, from which the gypsum is taken to Dalhousie, burnt, and used for a white wash in all the buildings. The gypsum occurs among slate schist strata, which, however are very hard in texture just above the veins; in some places the rock just above the gypsum was almost like a chert. The vein of gypsum was over 5 feet thick, clear and white in the centre, but the upper and lower part of the veins were much streaked with the matrix rock.

KANGRA.

256.—[291]. Gypsum, from Spiti. P. EGERTON, ESQ.

257.—[321]. "Kársi," native soft gypsum, containing also a little carbonate of lime, from Spiti.

258.—[292]. Alabaster, from Spiti.

A hard white granular gypsum. This is a good gypsum.

259.—[293]. Gypsum granulated, white but soft.

RAWALPINDI.

260.—[391-2]. A sample of fibrous gypsum. Murree hills. LAHORE MUSEUM.

These specimens are flat pieces having a striated crystalline appearance. They have evidently formed portions of thin veins of the substance occurring in the rock. It is probably a kind of foliated granular gypsum.

SHAHPUR.

261.—[484]. Gypsum. Kheura. DEPUTY COLLECTOR, KHEURA.

Gypsum occurs in the marl beds of the Devonian or primary strata of the Salt range. It is found either in irregular beds or in detached masses; whenever it occurs in beds, it is much cracked and the fissures are filled with red marl or a blueish clay. Beds of it seem to lie above and below the salt. In some localities the strata of gypsum are remarkably bent and contorted. The mineral is for the most part of a light gray color, with a shade of blue and translucent on the edges. It has a saccharine appearance, but masses in which a coarse crystalline structure prevails, are by no means uncommon. Red varieties also occur (a sample is exhibited from Jhilam) and beds of a dark gray earthy gypsum are generally associated with the saccharine kind. It is nearly a pure sulphate of lime without any carbonate. When calcined, it yields a plaster of Paris, but plaster of Paris without carbonate of lime, is less coherent as a cement than when it contains from 10 to 12 per cent. The best plaster would be obtained therefore by mixing some lime with it. Natives only use it mixed with pure lime into mortar to give the shining marbly appearance to the finer kinds of chunam work. From Pind Dádan Khán any amount might be obtained.

It is in the gypsum of Mári, Kálábágh and Sardi that the beautiful regular quartz crystals (called Kálábágh and Mári diamonds) occur. They are transparent, milky, or red. The specimen marked "Bohemian topaz" of the Jhilam collection con-

sists of small crystals of this quartz, in the form of dodecahedra, or double six-sided pyramids, but there is not the six-sided prism so characteristic of quartz. The Kálábágh diamonds are quartz in six-sided prisms, terminated by six-sided pyramids. In the Keila Wán, above village Khond, crystals of iron pyrites occur in beds from which a sulphur spring issues, depositing sulphur in the gypsum over which it flows.*

262.—[910]. Sang-i-jeráhat, a sulphate of lime. Kheura. Salt range.

JHILAM.

263.—[468-9]. Gypsum, or inferior alabaster. Sardi and Karúli mountain.

Erroneously called "marble."

264.—[470]. Red alabaster, from Kúshak and Kundar mountains. DEPUTY COMMISSIONER.

DERA GHAZI KHAN.

265.—[543]. Selenite, from Yáru. THE TEHSILDAR OF YARU.

266.—[544]. Fibrous crystalline gypsum, called "jaráh," from Sangar. TEHSILDAR OF SANGAR.

PLASTER OF PARIS.

267.—[54]. "Gach," plaster of Paris, from Lower hills.

"Gach" is ordinarily found in the bazars in round cakes; the calcined gypsum having been mixed with water, and thick substance thus obtained dropped down in circular cakes and left to dry.

KASHMIR.

268.—[608]. Makol, gypsum. H. H. THE MAHARAJA.

269.—[614]. Gach, plaster of Paris.

AMRITSAR.

270.—[4537]. Pándo. Amritsar bazar. LOCAL EXHIBITION COMMITTEE.

A good sample of plaster of Paris.

GURGAON.

271.—[146]. Makol.

This is an artificial cake, and contains a little powdered mica.

SANG-I-JERAHAT.

(Soapstone or steatite.)

This is a substance employed in carving and ornamental work; it is also ground up with lime and employed to give chunam work a fine smooth surface and polish.

GURGAON.

272.—[631]. Sílkari, steatite, from Singhána. THE DEPUTY COMMISSIONER.

PESHAWUR.

273.—[575]. Soapstone, or steatite, "sang-i-jeráhat." Shahkot, Yusufzai.

KASHMIR.

274.—"Sang-i-palauń," French chalk, a substance resembling steatite, used for making crucibles. Bánihál hills, Jammú. H. H. THE MAHARAJA.

MICA OR TALC.

This mineral, besides being used as a substitute for glass, is largely used, pounded up into powder, and mixed with lime to form a beautiful glistening plaster. This may often be observed in ornamental native buildings, when the interiors are finished with shining pearl-like plaster, which has been embossed with flower work, pannellings, &c.

GURGAON.

275.—[146]. Series of micas, from Mahanti and Bhunsi. DEPUTY COMMISSIONER.

One of these is a fine specimen in large plates; another is tinged red from the iron earth it is near; a third is a piece of hard micaceous rock, having a

*The bulk of this information is derived from Dr. Flemming's "Account of the Salt Range."

reddish, and in some parts, purplish, tinge, which is ferruginous mica-stone (No. 158.) The fourth specimen is a glistening micaceous shale having micaceous fine particles; and the last is a soft and brittle red-mica schist having a pink lustre.

276.—[12]. Talc in pieces. Sahi Ballabgarh. C. J. CAMPBELL, ESQ.

277.—[13]. Talc pounded for plaster. Ditto.

SIMLA.

278.—[1827]. Black talc, "abrak siyah." Sirmúr. RANA OF SIRMUR.

KANGRA.

279.—[264]. White mica, from Jagatsukh, Kúlú. LOCAL COMMITTEE.

280.—[265]. Black mica. Barágarh, Kúlú. LOCAL COMMITTEE.

PESHAWUR.

281.—[574]. Mica paste, "mattai shagga," from Swat. LOCAL COMMITTEE.

This is mica ground up with lime ready for application as an ornamental plaster. Value Rs. 1-8 a maund.

KASHMIR.

282.—[605]. Talc, from Hasora. H. H. THE MAHARAJA.

SHAHPUR.

283.—[903]. Talc, from Mári. MR. MATTHEWS.

SELENITE.

BUNNOO.

284.—[561]. Clear selenite in crystals, from Kálábágh and Esakhail. DEPUTY COMMISSIONER.

KANGRA.

285.—Selenite. LOCAL EXHIBITION COMMITTEE.

This is in a thin layer with beautiful pearly white lustre.

CEMENTS.

DUGSHAI.

286.—[206]. Cement stone unprepared. The Himálayas. MR. D. OLIVER.

[720]. Ditto, prepared for use.

[208]. Ditto, in balls.

These balls were plunged into water immediately on being made, showing the drying powers of the cement. If the cement is taken in a powdered state and kneaded with the hand into a mass, in about three minutes it becomes warm to the feel, and if then plunged into water it hardens immediately. These samples are deserving of special notice.

287.—[534]. "Surkhi," pounded brick for mixing with lime and mortar.

PLASTERS.

RAWALPINDI.

288.—[453]. Fine white clay. Rawalpindi. LOCAL EXHIBITION COMMITTEE.

JHILAM.

289.—[491]. Hard white marl, erroneously called French chalk.

SHAHPUR.

290.—[509]. A smooth blue clay, from Chitta, in the Salt range. DEPUTY COMMISSIONER.

HAZARA.

291.—[593]. Blue clay, from Dharmtura and Salhad, used as a plaster for houses, Abbotabad. LOCAL COMMITTEE.

KASHMIR.

292.—[606]. White clay. Jammú. H. H. THE MAHARAJA.

GURGAON.

293.—[135]. Soft white clay, from

Bhunsi. DEPUTY COMMISSIONER, GURGAON.

SIMLA.

All these Hill States exhibit a soft white earth, called in several of them "makol." The term makol is also applied to gypsum and plaster of burnt gypsum.

294.—[175]. White earth or pipe-clay, from Kumharsen. BY THE RANA.

Nos. 180, 181, 187, 191, are similar earths from Mahlog, Dhámi and Balsán.

PESHAWUR.

295.—[582]. Crude chalk, "spinah khaorah," from Land Khor, Yusufzai. LOCAL EXHIBITION COMMITTEE.

Probably a white clay. The entire absence of cretaceous formations in upper India renders *chalk* a thing almost unknown, except as imported in pieces for use on the black boards in schools. What is called chalk usually proves to be plaster of Paris; white clay or lime which, though it may occur of the same chemical composition as chalk, is not a consistent mineral such as is properly called chalk.

SUB-CLASS (D). MINERALS USED AS IMPLEMENTS IN PROCESS OF MANUFACTURE.

296.—[393]. Lithographic stone. Salt range. LAHORE MUSEUM.

This is a fine close-grained limestone, but not so hard as European lithographic stone. An indigenous stone of this description is a great desideratum, since the principal part of native printing is by lithograph. At present European stones are imported and sold by weight at high prices,—some kinds of native stone are in use, but the European are always preferred for the finer kinds of work, and where great sharpness of delineation is required in the print.

FIRE CLAY.

SHAHPUR.

297.—[513]. Fire clay, from Kafir Kot. MR. MATTHEWS.

A white clay with occasional streaks and patches of red and blue in it.

PESHAWUR.

298.—[575]. "Shaukanrai," from Shahkot, Yusufzai. LOCAL COMMITTEE.

Fire clay, used for lining and making furnaces, ovens, &c. Price 1 rupee per maund.

JHILAM.

299.—[497]. "Matti chikni," or fire clay, from the Tilla and Bhulla mountains, Salt range. LOCAL EXHIBITION COMMITTEE.

It is a white clay just like 297.

KASHMIR.

300.—[616]. Fire clay, "sang-i-dalam," from Srínagar. H. H. THE MAHARAJA.

This is a good hard yellowish fire clay.

Clay used by metal workers for making crucibles, which they do by beating up the moistened clay with a quantity of flocks of cotton wool to give it tenacity.

301.—[627]. Artificial facing sand, for foundry use. Roorkee Workshops. MAJOR ALLEN.

302.—[624-5-6]. Porous bricks, called "jháwaṅ." H. H. THE MAHARAJA OF KAPURTHALLA.

They are used as flesh rubbers or scrapers, as pumice stone is used in Europe to remove ink stains.

SHAHPUR.

303.—[617]. Flint, from Kálábágh and Namal. MR. MATTHEWS.

BUNNOO.

304.—[563A]. Flint, "patr-i-atish." Namal hills, Pergunnah Miyániwála. DEPUTY COMMISSIONER.

Occurring in beds of eocene formation of a whitish limestone, not unlike chalk; the flints have a regular chalky white coating.*

305.—[583]. Whetstone, "shurah shiggai," from Nílah. LOCAL COMMITTEE.

This stone has glistening lustre. Price Rs. 1 each.

306.—[585]. Cutler's sand, "bat shigga."

Used by cutlers and iron workers in sword grinding; value Rs. 1-4 a maund.

307.—[586]. "Kurund" corundum, from Nílah.

HISSAR.

308.—[159]. Sang-i-kara. From Dádri in Jhínd. LOCAL EXHIBITION COMMITTEE.

A hard and very heavy stone of horn-blende rock, too heavy for building.

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* See Geological Sketch of the Salt range, at the end of the 5th Division of this Class.

MILLSTONE.

PESHAWUR.

309.—[584]. Millstone, "Maichane-kanrai," from Palandra, Yusufzai. LOCAL COMMITTEE.

Price Rs. 1 a pair.

HISSAR.

310.—[960]. "Sang-i-chakki." millstone grit, from Dádri. LOCAL EXHIBITION COMMITTEE.

ASBESTOS.

BUNNOO.

311.—[4964]. Asbestos, "sang reshadar." Khost valley, beyond the border.

This remarkable mineral exists in flat beds or vein above the Khost valley, and could be procured in considerable quantities. It is said to be twisted into rope by the hill people of those parts. Its most curious property is indestructibility at a red heat—on this account it is utilized in England in gas stoves. Little tufts of asbestos being fixed in front of a series of small jets, these when ignited heat the asbestos red, which gives the appearance of a regular fire.

Asbestos has been woven into fabric but as a curiosity only.

A specimen of hard fibrous gypsum is exhibited without indication as to whence it came. It is a curious specimen like a collection of long stiff bristles in a glistening mass.

The collection did not contain any specimens of materials used as a glaze for pottery. A hard siliceous stone or quartzoze rock is used, finely pounded together with powdered "kach," or coarse glass.

MR. THORNTON mentions, in a Memo. on the Delhi district, a substance called "burbura," which he says is probably a form of felspar, and is used in the manufacture of porcelain and in polishing glass.

SUB-CLASS (E). SUBSTANCES USED FOR ORNAMENTAL PURPOSES AND FOR PERSONAL DECORATION.

DELHI.

312.—[15]. Rock crystal, from Aurangpúr.

Natives are extremely skilful in carving rock crystal. The manufactured department shows many samples of workmanship in beads, cups, &c.

The village of Aurangpúr is situated in a small valley surrounded by hills, and the roads leading to it from all sides are, for a distance of three miles at least from the village, impassable to any but foot passengers and cattle, from their rocky and precipitous character. The mines themselves are situated about two or three miles to the south-west of the village, and can only be approached by paths like those just described.

The crystal does not occur in its primitive position, but in a secondary deposit of siliceous breccia very highly impregnated with iron. Each crystal is encased in a sheath of hæmatite.

It would appear that the rocks in which the crystal was originally formed, have been disintegrated and broken up at some early geological period, and the debris have been consolidated into the porous breccia by the long continued action of heat and moisture under great pressure. Water having a large quantity of iron in solution has then permeated the mass, and by depositing the metallic oxide has bound together the siliceous particles in a ferruginous matrix.

The general character of the range in which this deposit occurs is that of thick beds of a blueish gray quartzose rock, alternating with coarse red sandstone and breccia. Throughout the whole range there is evidence of very great disturbing forces, as the beds are all inclined at high angles; but nowhere in all the extent which I have examined, are there more evidences of violent disturbance than in the neighbourhood of Aurangpúr.

The deposit of crystal occurs in a small valley or basin among these hills, about two or three miles to the south-west of the village of Aurangpúr. The valley is about 500 yards long, and from 50 to 100 yards broad, and dips towards the north. The only part of the deposit which has been worked is the south end.

The works have hitherto been carried on in two ways:—1st, by open pits gradually sloping downwards; 2nd, by wells and shafts. Of the former there are two, neither of which have been worked for many years. Neither is deeper than 20 feet from the surface. Of the latter there are three, the deepest of which was sunk by the late Rajah of Ballabgarh, and is 20 feet in depth, and about 10 feet in diameter. From the bottom several galleries extend for a short distance on all sides. The two wells are of much less depth.

The strata passed through by the deepest shafts are not uniform for more than the first half of the depth; at first they are the same as I have described, and highly ferruginous. Subsequently the rock begins to lose the iron, and a short way down is composed of small pieces of pure quartz embedded in a matrix of almost pure white clay. I have not been able to ascertain in what way the crystal occurs in these beds, but the Lumberdars of Aurangpúr inform me that it is here the largest and the purest specimens are found. In the upper ferruginous beds are layers of red clay, which I consider to have originally been kaolin, and subsequently impregnated with iron.

In the upper strata many of the crystals are tinged with yellow from an admixture of iron.

I took a man with me from Roorkee as a guide. For some time previously a considerable quantity of the white clay had been annually brought to the Roorkee Workshops as a valuable furnace material.*

GURGAON.

313.—[119]. Crystals from Bhún. Deputy Commissioner.

KANGRA.

314.—[252]. "Zahr múhra." Suket. Raja of Suket.

315.—[253]. Cup of "zahr múhra." Ladákh and Thibet. Local Committee.

"Zahr múhra" is a stone, which is supposed to crack and split if poison is put into it; hence its

* Extracted from Dr. Thompson's Report on the Mines; published in the "Punjab Gazette."

name. In Europe a similar superstition prevailed as to Venetian glasses, and in the middle ages, the opal was believed to lose its color at the sight of poison!

The kind of zahr múhra, called "khatai," is a hydrate of magnesia, and most esteemed by the natives as a medicine.

316.—[384]. "Jál mor," from Balti. TARA CHAND. In the Lahaul collection.

It is used like zahr múhra for cutting into cups, &c.; the value of a cup is from Rs. 3 to 4.

It is a dark hard serpentine-like stone, takes a fine polish.

317.—[290]. Red quartz, from Spiti. P. EGERTON, ESQ.

318.—[295]. Granular white quartz rock, from Spiti.

SHAHPUR.

319.—[503]. Quartz crystals. Kathá.

There is also a very interesting specimen, showing these crystals imbedded in a matrix of granular gypsum, which preserves their shape and smooth polish from all contact.

A similar series are exhibited from Kálábágh, in the Bunnoo and Lahore collections, Nos. 394 and 558.

320.—[506]. "Sang-i-abri," mottled stone. Kálábágh. MR. MATTHEWS.

RAWALPINDI.

321.—[ ]. Sang-i-tabak.

A stone similar to sang-i-abri; cut into plates, cups, &c.

KASHMIR.

322.—[610]. Rock crystal. Srínagar. H. H. THE MAHARAJA.

323.—[611]. "Zahr múhra," serpentine. Skardo (from Little Thibet).

JHILAM.

324.—[485]. "Bohemian topaz," from Kúshak hill.

Small dodecahedral crystals, very perfect, of reddish quartz.

SIMLA.

325.—[184]. Species of turquoise. Bishahr. RAJA OF BISHAHR.

KANGRA.

326.—[280]. "Turkis," from Lahaul. TARA CHAND.

This gem is said to be brought from Thibet proper or China. The principal ornament of the Ladákhi women is a head band, hanging like a long tail, and studded all down with large turquoises; this is called "berák," and often even with common people worth Rs. 20 or 30.*

The price, however, of these stones must have increased of late years, for MR. EGERTON says that, the berák sent to the Exhibition, which was an inferior one, cost Rs. 80. The Nono of Spiti is also described as having great difficulty in collecting stones for his daughter's head-dress. (*See* Journal of a Tour through Spiti, p. 58.)

327.—[281]. "Támbra," (lit. red or copper colored gem.) TARA CHAND.

A kind of garnet, or jacynth, used for rosary beads; said to be brought from Persia by Kábul merchants.

328.—[289]. Garnets. Spiti. P. EGERTON, ESQ.

329.—[305]. Garnets in quartz. Spiti. P. EGERTON, ESQ.

330.—[316-17]. Boxes containing cornelian, amber, and lapis-lazuli beads, from Spiti. P. EGERTON, ESQ.

Lapis-lazuli is called "rust."

The hill tribes are very partial to ornaments made of coral and amber. I once saw near Chamba a woman who wore a long necklace consisting of large smooth lumps of amber strung together in an irregular manner; her husband said the ornament was a family one, but he could not say whence it came.

A man at the same place had a necklace of fine coral, which he said he bought from a merchant who brought it from beyond Kumaon.

LAHORE.

331.—[326]. Series of gems.

The Lahore district exhibited a series, with a view to showing what gems were in use for decorative purposes in the Punjab. Not a few of them come from the Northern Frontier, beyond Kábul, and Kandahár. Hawking merchants are to be often met with, offering for sale agates, cornelians, blood-stones, turquoises and garnets, from these places. Some of the

* *See* Cunningham's Ladákh, p. 304.

gems are imported from southern parts, such as sapphires, which come from Ceylon,* and rubies and diamonds from Central India, Golconda, &c.

The series are as follows :—

Diamond. (Híra almás.)

Ruby. (Mának.)

Inferior ruby. (Lálri.)

Garnet. (Sang-i-mehtáb. Támbrá.)

Jacynth. (Gulmídak.) A gem owing its deep orange color to the presence of zircon. Gulmídak is a stone very little thought of by native jewellers. The name Támbrá (copper colored) is sometimes applied also to the jacynth.

Imitation Jacynth.

Emerald. (Zamrud. Sabza, panna.)

Sapphire. (Nílam.)

I subjoin an account of some of these gems as showing the native ideas on these subjects :—

Diamonds are esteemed by native jewellers as the first-class of jewels. They are believed by them to be white, yellow, red, green and black; that the colored ones are extremely rare, but that they are occasionally found of a white color spotted with red, which are rejected as bad.

Diamonds are brought from Golconda in the Dekkan, and from Charna-parna. They are stated to be obtained by washing the soil, a workman pouring out the sand against the sunlight and noting the diamonds by the flash of light. They are classed by jewellers into three kinds—"Hírá ba-rang-i-nausádir" (grayish, or the color of sal-ammoniac); "híra makdúni," of paler color; and "almás-i-hadídi."

Next in rank to diamonds, according to the ideas of native jewellers (and they are correct), come rubies. They must be hard and transparent, "shafáf."

The most esteemed kind is the yákút rumáni, "whose color is like the seed of a pomegranate."

There are inferior kinds of rubies, classed as "lálri," and garnets (támbra, &c.)

They enumerate among rubies the "dúdi" or tánsala, which is a kind of "smoky" cairngorm, and the "náringi," which I suppose to be the jacynth (also called gulmídak), and which English jewellers sometimes erroneously call "cinnamon ruby."

The kinds distinguished by the appellations, "zafráni," and "zard," or phokráj, are pale and dark topazes.

Included as a sort of rubies also, come sapphires, called by the epithets "kábúd," "asmáni," "surmai" (color of antimony, blue-gray.)

Formerly rubies were brought from the Bádakshán mines, which do not now yield. A native jeweller informed me that they came from "Jazíra Pígu," by which he might have meant the Burmah peninsula.

The "blue rubies" (sapphires) come from "Lanka," Ceylon.

Emeralds are less hard than either of the foregoing; and yet emeralds (all more or less with flaws) are the very commonest kind of jewels, and some of the native princes have emeralds of immense size. I have seen a flat tablet of emerald, full of flaws, but otherwise of good color, nearly 2½ inches square, worn as an amulet, and engraved all over. The Maharaja of Kapurthálla possesses a large oblong emerald of this kind, and the Maharaja of Pattiala has a round emerald of enormous size.

Probably they are imported, some *viâ* Calcutta, Bombay, and the Persian Gulf, and some overland by Yarkand and Herát; though this source is not now so important as it was before the Bombay and Calcutta trade was known, at which time the import trade must have supplied all Northern India; Central Asia *may* be a source of emeralds; the *beryl*, of which mineral many of the native stones consist, occurs in the Siberian Altai range; a number of these gems also come from Khatân, Ilchi, and the Chinese provinces.* Natives say they are found in gold mines, and take 20 years to come to perfection. They are called "zamrad," or "zabrjad," and in Panjábi "panna." The most esteemed colors are—the "zabábi," next the "saídi" said to come from the city Saida in Egypt. "Raiháni," *new* emeralds; "fastíkí," old emeralds, (that is, that have completed their 20 years); "salki," "zangári" (color of verdigris,) "kirási," and "sábúni." Sometimes emeralds have flaws of intervening talc or sand. It is believed that a fly will not settle on this gem. Most of the emeralds commonly in use, are smooth cut and bored like beads; they are always full of flaws, and this seems so much the custom that a very good mock emerald which I have is made with flaws —as if sure to be detected otherwise. The flaw is termed, "rag."

Emeralds are very restricted in their localities of production. Pliny says, the best came from Scythia in his time. Mawe on diamonds, quoted by MacCulloch, says that for the last two centuries Peru has been the only country known to yield emeralds. The beryl, no doubt, is found in Siberia, which may have given rise to Pliny's statement.† Still it is difficult to say with certainty where Indian emeralds

* Interesting information about the gems of this island will be found in Sir E. Tennent's work on Ceylon.

* Many gems are imported from Ceylon, where rubies, amethysts, topazes, sapphires, and cinnamon stones in great abundance are found, but not emeralds.

† This confirms to some extent the supposition that many emeralds come from Russia, Siberia, and Central Asia to India.

formerly came from. They are not produced in Central India; and notwithstanding the probability of the North West trade as a source, emeralds are not enumerated in any of the lists of imports; they may however come in those unknown parcels of gems that are imported by Yarkand and the adjacent regions.*

Turquoises are found at Níshápúr, Khujind, Kirmán, at Azirbeján, in the hills near Shiraz, and in the Thibet hills. The best come from Níshápúr, and these are said to be clear of color when the air is clear, and to become dim in cloudy weather; they are called níl bhúm, and lose their color at the smell of musk and tallow. The color of the Kirman turkis, is evanescent. Dealers practise deception by soaking their turkises in water, which makes them look of a darker color than they really are. The Shiraz and Kirmán turkises are of a whitish color, and called shiábúki and shirbhúm (milky.) There is also a coarse kind of turquoise stone found in Thibet, used to ornament saddlery and women's head dress of those parts of the country.

Turquoises are of eight kinds, ranged in order of their excellency:—"Fatahi," "azhari," "sulaimáni," "zánwí," "asmáni," "abd-ul-hamídi," "Indalísi," "kanjínya." The stone is believed to take seven years in coming to perfection. The best existing account of the Níshápúr mines is in "Ferrier's Caravan Journeys;" the book is sufficiently uncommon now, to warrant my extracting the account as it stands. The author writes as follows:—

"These celebrated mines are near the village of Madene, about thirty-two English miles from Nishapoor; the road to it is for the first five miles across a plain of great extent, covered with villages, gardens, well cultivated fields, marvellously productive, owing to the streams which flow from the Banaloo Koh and other mountains near. Approaching these the country changes, and we found ourselves riding through hills of sand and a reddish clay devoid of all vegetation; their sterile appearance was accounted for by the traces of efflorescent salts which were soon seen in large quantities, and would prevent any cultivation.

"Salt abounds in this locality, and we passed the principal mine, Dooletaly, about six miles from Madene. This is an enormous rock, covered on its exterior surface with a thin layer of red clay similar to that I have mentioned.

"Nothing can be imagined more simple than the mode of working out the salt—the miner's mattock is the only instrument used. These mines are the property of the Government, who lease to the highest bidder; at present the rent is only 150 tomauns yearly. A good workman can extract about 800 lbs. a day. The salt is beautifully white and of a fine grain.

"The road which led to the turquoise mines, the principal object of our excursion, ran through some high and naked rocks, which by their dark colour seemed to be porphyry; I think, however, they were of a compact calcareous nature, strongly stained, as I did not see any rocks of another system. At their highest elevation they had a metallic appearance, which made me think that iron was the coloring matter; but not being sufficiently learned in the geology, I could not positively determine this. In the middle of this rocky and broken ground we came at length in sight of two villages, one on the crest of a hill, the other in a pretty valley. Beneath, they were fortified by a loop-holed wall and inhabited by about 150 families, who emigrated here from Badakshan, under the protection of one of the last Persian Kings. These colonists speak bad Persian, and have quite forgotten their own language; they show considerable tact and intelligence in working the mines.

"The turquoises are divided into two classes according to the positions in which they are found. The first called sangai or stony, or those which are incrusted in the matrix, and which must be removed by a blow of the pick or hammer. The second are found in washing the alluvial deposits, and are called *khaki* or earthy; the former are of a deep blue, the latter though larger, from being paler and spotted with white, are of less value. If we are to believe the miners, no turquoises have been found except in this group of rocks. The Persian Government never makes any explorations on its own account, and is content to lease the mines at an annual rent of five hundred tomauns. I understood that the most valuable stones are found amongst the debris of the old working, and at the bottom of shafts long since abandoned. Excavations have been made one above the other, but for the most part near the base of the mountains.

"Here are to be seen galleries, tunnels, and shafts, the largest of which are thus designated: Abdoor ryzak, Sharperdar, Kharydji, Kemeri, Khaki and Goorsefid.

"Having given a largesse to the miners to strike a few blows with their picks in honor of the happy planet of the traveller, Be-talei-saheb, we were permitted to enter the first of these mines to witness the operations. These were simple enough; the mattock was again the only instrument, but it was very skilfully used, and when a layer of rock was

* MR. BOILEAU, who was appointed a few years ago to appraise the jewels in the Governor General's Toshakhana, mentioned the import from Yarkand as a fact.

detached, great precautions were taken to remove it without disturbing the turquoises which might be met with. These are not found in the hollow of an eagle-stone like the amethyst, but are seen as if incrusted or glued in the matrix, to the number of from twenty-five to thirty, and more or less near one another. Each of these stones is enveloped in a thin calcareous covering white on the side adhering next to the turquoise, but brown on that next to the matrix. How is it that the coloring substance has stopped precisely at the exterior, and that it has not injured the purity of the turquoise ?. But I will rather relate what I saw, and not undertake to explain. I will simply state that one finds on the side of this very mountain, Benaloo Koh, indications of the carbonates of copper, both blue and green, as are the best varieties of malachite.

"We were not very successful in our researches, but the best turquoises are found, with the exception, I have before stated in this mine, Abdoorryzak ; those of Kharyji follow.

"We next examined the washings of the Valley. These are to the south of the village. The rock is not met with here, and the soil is composed of clay, gravel, sand and rounded stones, evidently an alluvial deposit. Here I was again obliged to try the influence of my planet, after which several sieves were filled with the soil and gravel in question taken from a shaft just opened ; these were carried to a running stream close at hand and the earthy substances washed from them, and the stones being turned over, the turquoises were soon recognised by their azure tint. Of these we found a pretty good number, and of fair size, but they were unfortunately of a pale color, and therefore of little value. The workmen called them by the name of "Taze Madene," or of the new mine, to distinguish them from those of a deeper color found in the old workings.

"These worthies affirmed the turquoises are similar to cherries, inasmuch as both one and the other acquire their color as they ripen ; and they added that although the cherry comes to perfect maturity in one season by the vivifying rays of the sun, a turquoise requires a thousand to obtain the same result. The miners here do not enjoy a great reputation for honesty, and very fine turquoises are said to take their way to Nishapoor instead of into the pockets of the owners of the mines, being sometimes transferred for a consideration to parties who visit the mines. But here the uninitiated may be taken in, for the miners keep them for some time in a wet cloth which deepens their color, and the purchaser does not find how pale the stone is until he has parted with his money. I was informed that turquoises of immense size are sometimes found in the washings. Futteh Allee Shah, the predecessor of the present monarch, had one made into a drinking cup, and it is well known that there was a turquoise in the Treasury of Venice which weighed several pounds. A nobleman's harness in Khorassan is frequently ornamented with small turquoises, but these are of course of comparatively little value."

Continuing the list of gems sent by the Lahore district we come to—

"Tánsala." Smoky Cairngorm.

Topaz. "Phokráj."

Cat's-eye. "Lasniyáṅ."

Turkis. "Firozah."

Imitation do. (Very commonly used).

Bloodstone. "Sang-i-pattauni."

Lapis lazuli. "Lájward" from Kandahár. It comes also from Bukhára, Persia, and Central Asia.

Cut Agates. "Manka," brought from Kandahár and Kábul.

White and red cornelians. "Ghori," do.

Onyx. "Sang-i-Sulaimán" do.

"Yamní," a kind of "pebble," from Hindústán.

Avanturine. "Sang-i-sitára," (from its star-like glitter of particles).

Coral red. "Gullí." Bekh-i-marján.

Mother-o'-pearl. Nimrú.

Pearl. "Moti," "Lúlú," "Marwarid."

Pearls are imported either from Ceylon and Japan, or from the Persian Gulf at Bahrein.

"The pearls taken at Bahrein, though not so white as those of Ceylon and Japan, are much larger than those of the former place, and of a more regular shape than those of the latter. They are of a yellowish cast, but have this recommendation, that they preserve their golden hue ; whereas the whiter kind lose much of their lustre by keeping, particularly in hot countries. The shell of both these species which is known by the name of mother-o'-pearl, is used in Asia for various purposes.

"The annual revenue arising from the fishery in the latitude of Bahrein is computed at 3,600,000 livres (£157,500). The greatest part of the pearls that are uneven are carried to Constantinople, and other ports of Turkey, where the larger compose part of the ornaments of the headdress, and the smaller are used in works of embroidery. The perfect pearls are reserved for Surat, from whence they are distributed throughout all Hindoostan. In 1824, pearls to the value of 1,200,000 German crowns were imported into India from Bahrein."*

The foregoing are the only gems ever met with ; but pearls, emeralds, turquoises, rubies and diamonds

* This information is derived from several parts of the volume in the Bombay Selections, entitled "The Persian Gulf."

are the commonest in native jewelry. Most of these jewels have some fancied medicinal or talismanic virtue, and to this day, elixirs made of jewels reduced to powder are administered, and pearls are also supposed to act medicinally. A ruby worn on the finger is supposed to protect the wearer from nightmares in his sleep and from evil dreams.

There is a kind of ornament worn on the arm, called a "nau ratn," the "nine gems," which indicates the only jewels that are esteemed as precious, they are—Diamond, ruby, emerald, sapphire, topaz, pearls, coral, turkis, tansala. The others, and also the agates, blood-stone, &c., are mostly in use for signet rings, in the art of engraving which natives are extremly skilful.

The Report of the Jury now follows:—

REPORT ON MINERAL PRODUCTS.

SECTION A. CLASS I.

DIVISIONS I. AND II.

JURY.

DR. BROWN, *Chemical Examiner*,
MR. PURDON,
DR. GRAY,
MR. BAINES,
MR. GORDON,
MR. J. E. GORDON,
KUNHYA LALL,
MAHOMED SULTAN,
MR. STONE.
COLONEL SIM.

REPORTER—MR F. DREW.

The objects contained in this class are the products of the earth itself which are brought into use either in the state in which they are found, as colored earths, talc, slates, building stones, &c., or are rendered useful after peculiar treatment, such as metals obtained by smelting, or lime and plaster of Paris obtained by calcination. The other great class of mineral products is occupied by those substances, distinguished by the appellation "chemical substances," which are obtained from various minerals, earths, &c., after undergoing chemical processes of sublimation, distillation, solution, &c., &c. It is with the objects in the first class only that the present Report deals. It includes also a notice of the fossil collection, but without considering that subject in a palæontologic point of view, which properly belongs to a different branch altogether. A classified list of the various kinds of articles will be given below, and afterwards the specimens will be described, so as to show the value or importance of the mineral wealth of each District of the Punjab, and what use has hitherto been made of it.

The metals are Iron, Copper, Lead, Antimony, Gold and Manganese.

Then follow Building stones, Sandstones, Limestones, Marbles, Hydromagnesite, Agates, Lapis-lazuli, Precious Stones, Slates, Elastic Sandstone. Mica or Talc, Gypsum, Selenite, Fire clay, Porcelain clay and Pottery clays, Glass-sand, Sulphur, Plumbago, Millstone, Whetstone, Corundum, Petroleum.

Yellow earth, Red earth, Fuller's earth, Múltáni mitti, &c., several Clays and White Washes, Coal lignite, Fossils.

These products are now considered in detail:—

METALS AND METALLIC COMPOUNDS.

IRON.

From Gurgaon there is a specimen of a good rich iron ore, the hydrous peroxide of iron.

There are specimens of magnetic iron sand (that is, sand composed of small particles of magnetic oxide of iron) from two or three places in the Simla District, from Suket and Mandi, and from six or eight localities in the Kangra District, and from these too is a piece of schistose rock containing the magnetic iron ore in minute crystals; this being the kind of rock from which the iron sand was originally derived.

From the Kot Kandi Mines in Kangra is some very good hæmatite iron ore (No. 231). From Chamba are one or two specimens of good iron ore, and others that are poorer.

From the Kashmír territory is a piece of massive magnetic oxide of iron or lodestone, and some siliceous iron stone from a bed of it found in Kashmír proper.

From the Wazírí hills there is a brown iron ore that is pretty good; and there is a very rich red hæmatite from Bakot in the Hazara district. Besides the ores there are specimens of the iron made at Rampúr on the Sutlej, from Suket and Mandi, and from the several places in the Kangra district; from one of these, the Bhir Bangál mines, is the piece (No. 214) for which the prize for the best specimen of native iron is awarded; this, like most of the others, is smelted from a fine magnetic iron sand; and Mr. Baines, of the Punjab Railway Department, reports that the iron has been forged and proves to be of most excellent quality. Nos. 363 and 364 are also good iron; they were produced in Kangra, but are now exhibited from the Lahore Museum. From the Wazírí hills and from Bajún in the Dera Ismael Khán district, is some iron that is tolerable good, and the same from Bajaur north of Peshawur, but there is no specimen of the best iron of that place. From this it appears that almost in every hilly region around the Punjab there is iron ore and in most of them ore of good quality; the reasons that the manufacture of iron has not been carried out to a greater extent to meet the late greater demand, are that coal is not found near the iron ore as in most cases in England, and that from want of knowledge the smelting with charcoal is carried on in such a way that not nearly as much result is produced as might be.*

COPPER.

From Gurgaon, there is a piece of copper pyrites, which is a usual ore of this metal. There are specimens of good copper ore (No. 155) from the Hissar district and of the metal got from it; from Pelang in Kúlú and from Manikarn near Kúlú, in the Kangra district, is some copper pyrites, and there is blue carbonate of Copper from Spiti. From Rondu, 16 marches beyond Kashmír, is copper glance, another kind of ore.

Of artificial compounds, there is acetate of copper crystallized and sulphate of copper (blue vitriol) from Amritsar, and blue vitriol again from Hissar.

On the whole, the specimens of the ore of this metal are but poor, but their presence in several different parts is proved.

LEAD.

The common ore of lead is galena, the sulphide; it is found at Rupi of Kúlú, in the Kangra district, associated with quartz, and there are some small fragments of it (No. 904); from Khagúla in the Shahpúr district; besides these there are only a specimen from the Kashmír country and one from Kandahár.

* For want of competing specimens the prize for native steel offered by the Railway Company has not been awarded.

ANTIMONY.

There is sulphide of antimony found at Jaggatsukh Kúlú, in the Kangra district, and two specimens are sent from Spiti; from Bajaur is some of the same, the price of which is given as Rs. 12 per maund.

Besides these there are four good specimens from the Lahore Museum, but there is no record of where they were dug.* It would seem that there is enough of good antimony ore in various parts; but as it is here only used as a cosmetic, &c., and not in making alloys; it is not worked in any great quantity.

MANGANESE.

There is pyrolusite or oxide of manganese (used in glass-making) from the Kashmír territory.

GOLD.

In the great gold-mining countries there are three ways in which gold occurs,—in the solid rock, in nuggets, in gravel, clay, &c., and in the form of gold-dust mingled with the sands of the rivers; in the Punjab it is only in the last, the least productive form that is found, but in this form it is met with in the sands of almost all the five Punjab rivers.† The specimens sent are—ore from Karrar on the Markanda river in the Amballa district; one from Spiti; one (No. 235) from the Beyás near Haripúr in Kangra district, (to which a prize is awarded), this sand being of more than usually coarse grains; and one from Lahaul. Then there are some from the Jhilam river, for one of which (No. 460) from Kas Gabhir in the Jhilam district a prize is given; it is gold of a good color and is in pretty large grains. From the Indus also both from Attock and Hazara there are specimens of gold-dust.

BUILDING MATERIALS.

STONE OF VARIOUS SORTS.

From Sahi Balabgarh, in the Delhi district, there is a good collection of building materials, which includes the red, the spotted and the light-colored sandstone, so much used in the large buildings of Hindústán; and from the same place are polished blocks of white marble, and of a pretty dappled gray marble (called Narnaul marble), which last is also exhibited from the Hissar district.

From the Kangra district there are gray limestone, sandstone of two sorts, both good for building, and granite. Sent from Madhopore, is some nice workable sandstone which must come from the hills, above that place. From Kashmír there is some black marble and some polished slabs of serpentine, which is found at Tashgám in little Thibet.

From the Salt range (Jhilam and Shahpúr districts) there are good building stones, sandstone and calcareous sandstone; from Jhilam are specimens of marble which might become useful for building, among this series must be counted the gypsum or alabaster of the same hills (sometimes wrongly labelled soapstone, or marble (Nos. 468 and 469). The harder varieties of this might be used for interior decorations while the general run is fit

* These specimens are of Himálayan production.—B. P.

† I have never seen gold from the Rávi. The natives say it is never found there.—B. P.

for making plaster of Paris, of which there is one specimen (No. 515*) from Shahpúr. From Dera Ismael Khán, there is only some soft white limestone, from Kuhát a cellular limestone used in rubble masonry, while from Attock are two or three kinds of stone, calcareous sandstone, a variegated limestone, granite and sienite; lastly, there is yellow marble from Peshawur, and argillaceous limestone from Abbottabad.

ZAHR-I-MOHRA.

A stone (No. 611) called by this name, but which scientifically is hydromagnesite, a compound of magnesia, is dug near Skardo in Baltistán, and there cut and turned into cups, plates, &c., it is supposed to have a wholesome effect on any fluid put into it and to break should poison touch it, one kind of zahr-i-mohra, called Khatai, or "Chinese,"—is much valued by natives as a medicine, they grind the stone into a fine powder with water and swallow it.

SLATE.

From Gurgaon, there is moderately good slate. There is some also from the Simla district. From the Kangra and Dalhousie hills, there are many specimens of slate, some of them very fine ones, which show that there is a supply of good roofing material, the use of which may extend to wherever the expense of carriage does not hinder it. There is one slate from Dalhousie 12 feet long and 4 or 5 feet wide; there is another with a particularly nice grain, it looks like marble. From the Kangra district are two slates with Tibetan inscriptions carved on them. Again there are slates from Attock and from Abbotabad. Among stones used for roofing purposes appears the sang-i-larzan, or

ELASTIC STONE.

This is a sandstone that has the wonderful quality of flexibility to a considerable degree; it is sent from Kalyána hill in Dádri, now part of the territory of Jhínd. The districts of Hissar, Jhínd and Rohtak, all exhibit samples from this locality. The specimen from Rohtak is a fine one, 2½ feet in length.

LIME.

In all the districts that are all hilly, limestone is found, as Gurgaon, Simla, Hushyarpúr, Kangra, Jhilam, Pindi, the Deraját, &c.; in the plains its place is somewhat supplied by kankar, of which there are specimens from six districts, and it probably exists in more.

CEMENT STONE.

A rock, half lime half argillaceous, from Dugshai district, with specimens to show its application Nos. 206, 207 and 208.

MICA OR TALC.

Is used in building, being first pounded and mixed up with the lime, &c., in making chunam, which thus acquires a glittering appearance: some lump plaster of mica used for

* The sample proves on analysis to be common lime, but from the description accompanying it, it is reasonable to suppose that plaster of Paris is made in the district by burning gypsum. Just as it is at Batri in the Dalhousie hills.—B. P.

this purpose are sent from Delhi and Gurgaon, and there is also some from the Kangra district and other places.

SELENITE OR CRYSTALLIZED GYPSUM.

A mineral that is often mistaken for talc and for other substances; it is in clear white crystals that are rather flaky; there is some from Murree, from Dera Ghází Khán, and other places.

SUBSTANCES USED IN MANUFACTURES.

FIRE-CLAY.

This substance, so useful for crucibles and furnaces, is only sent from two places, Kafir Kót in the Shahpúr district, and Bánihál in Kashmír.

POTTERY AND PORCELAIN CLAY.

There is pretty fine clay for ordinary pottery sent from several districts, but the desideratum is a kaolin from which purely white porcelain can be made. Some sent under that name from Lahaul is only very fine sand, and quite untenacious; some from Dalhousie has been used in the Central Jail, but it is found that it colors slightly on baking; there is a specimen from Delhi that is pretty white, but has fragments of mica mixed with it. Therefore the prize offered for the best porcelain clay cannot be awarded.

SAND FOR GLASS-MAKING.

The only samples from Gurgaon. It is a coarse earth abounding in the alkaline efflorescence so abundant in many parts of the country: this sand is melted just in the state in which it is found, as it contains the alkali naturally. The result is the coarse green "kach," or semi-transparent glass which accompanies the sample.

SULPHUR.

Sulphur, somewhat mixed with impurities, is exhibited from the Murree hills, from the Sulaimán hills near Dera Ismail Khán, and from Kálábágh. From Ladákh there is a purer specimen.

PLUMBAGO OR BLACK LEAD.

There is a powdery plumbago from the Jammú territory, and a specimen of rather better stuff found in some other parts of the Gurgaon hills, and sent from the Lahore Museum.* Nos. 376 and 378 are a mixture of shale and plumbago, they make a pretty good mark on paper; No. 376 is a schist, probably a talcose schist, which might also be used for drawing; but no one of the specimens sent are of that fine and sectile black lead that is required to make pencils of. There are some samples from Gurgaon approaching in nature to plumbago. One of these, No. 182, contains sample of the material cut up with little cubes; it does not appear to have much of the polishy appearance of black lead, but makes

* These samples were unfortunately not marked, but it is highly probable that they come from Gurgaon near Sonah, and that they were sent up with the report on plumbago of the Mewatti hills, an abstract of which will be found under the head of Plumbago. A drawing, which was executed with points cut from the plumbago, was sent to the Exhibition to illustrate how far the plumbago was likely to be useful for the purposes of pencil making.—B. F.

a soft gray mark more like drawing crayon, for which purpose it probably would answer very well.

MILLSTONE.

There are two kinds of millstone sent: quartz rock from Dádrí, in the Hissar district; and a schist, with nobs or lumps of quartz in it, from Palandurah, in the Peshawur district.

WHETSTONE.

Is sent from Panjtar, in the Peshawur district.

CORUNDUM.

Comes from Nílah, in the Peshawur district (No. 586), where it is priced at Rs. 13 per maund, and from Dádrí, in the Hissar district (No. 159). It is used in cutting and polishing stones.

PETROLEUM, OR MINERAL PITCH.

There is a specimen (called momyai) from Ladákh, it is sold at one tolah for 9 annas; and there is some brought by Dr. Cleghorn from Lahaul, where it is found oozing out of the ground in three or four places. There is also a specimen of liquid petroleum, and of oil distilled from it, from the Rawulpindi district; and in some parts of the Salt range this mineral also occurs. It is used as an ointment.

ASBESTOS.

A fibrous silky mineral found in veins in rocks; there is a specimen of soft asbestos from Bunnoo, and another (locality unknown) that has a harder and stiffer, but still fine fibre.

SUBSTANCES USED AS DYES, &c.

YELLOW EARTH.

There are yellow clays or ochres from Gurgaon, Haripúr in Kangra district, Lahore, Kheura, in the Jhilam district, and Márí, in the Shahpúr district.

MULTANI MITTI.

That sold in the bazars is a lamellar hard yellow ochre used in dyeing, but under the same name are sent specimens approaching in nature to fuller's earth, and called *sabz mitti* or *khajrú*, sent from Dera Ismail Khán and Dera Ghází Khán districts.

FULLER'S EARTH.

From Yárú, Dera Ghází Khán district (No. 456), and from Rawalpindi.

RED EARTH.

There are orange colored and red earths used as dyes, from Spiti.

There are red clay and red ochre from the Simlah district, from Chamba, Haripúr in Kangra, Lahore, Rawalpindi, Bhalla in Jhilam, and the Deraját, Kohát and Yusafzai. Among these is the well known *harmuzi*, an earth of deep chocolate red color.

There is some fine colored powder exhibited from Lahore, as lapis lazuli. It is imported from Europe, being the artificial or prepared kind; it sells at Rs. 4 a seer.

FUEL.

Every specimen, in the Exhibition, of what is called *coal* is, with perhaps one exception, really *lignite*, a substance half way in structure between wood and coal; this is found in many parts of the hills, usually in detached pieces in the rock,—the remains of some tree that got buried in the sand and mud when the strata were being formed; but now and then the lignite is in a more or less continuous layer, in which case it has been made by the growth of plants of various kinds at that very spot.

There is lignite from Biláspúr, and from different places in the Kangra district (No. 241–244); some pretty good lignite from near Kotli in the Kashmír territory, where it occurs in a bed 15 or 18 inches thick; from Kundal mountain, Jhilam district, is some coal, approaching to Cannel coal (No. 463); one or two specimens are sent from Kálábágh, and some from the Sulaimán hills, on the frontier of the Dera Ghází Khán district. Of the coal lately brought into Lahore from near Pind Dádan Khán, there is not a specimen in the Exhibition (unless No. 463 be from the same bed), but it may be as well to mention it here, as it is more like a true coal, and more promising as a useful fuel than any other yet found in the Punjab.

ORNAMENTAL AND PRECIOUS STONES.

The best of the precious stones, being mounted, are reckoned in another Section of the Exhibition, so there is little to be said about them here. There are some beautifully complete and perfect crystals of quartz in the form of a double hexagonal pyramid and a double pyramid with prism from Kathá in the Sháhpúr, and Kúsak in the Jhilam district; they occur imbedded in the salt gypsum.

Dittú, a goldsmith of Lahore, exhibits a box of stones, among which the sapphires and the light rubies, though of no great size, deserve mention, and there is a rather large colorless topaz.

From Bombay is a case of Cambay pebbles, agates, &c., worked into various fancy articles, of which the best (and these are really good) are, a white cornelian necklace, a long paper-knife, and a watch-stand of agate, a cup, and saucer in agate, and one in jasper, and some knife-handles of the same stones.

MISCELLANEOUS.

FOSSILS.

It does not come within the scope of this Report to give a palæontological description of the Fossils sent, but it is well to record the localities they come from. The finest collection has been made and exhibited by Dr. Costello from the Shaikh Budín hills, in the Bunnoo district; it consists chiefly of remains of mammalia, but these also are shells from the older rocks. From Sirmúr are some fossil elephant's teeth, and from other places in the Siválik hills (especially Núrpúr in the Kangra district) are mammalian bones. From Spiti are several specimens of ammonites and of bivalves; and there are some fossils from Bunnoo and from Dera Ghází Khán. Several that were in the Exhibition are not mentioned here, because there was nothing to show their locality.

The Jury awarded the PRIZES allotted to them as follows:—

A prize of Rs. 60, given by Mr. Arratoon, for the best sample of gold-dust from the rivers of the Punjab, is awarded—

Half to the TAHSILDAR OF TALAGANJ, for gold dust from Khass Gabhîr, Jhilam district (No. 460);

Half to LOCAL EXHIBITION COMMITTEE, Kangra, for gold sand and gold from near Haripûr on the Biyás, Kangra district (No. 235.)

A prize of Rs. 50 given by the Punjab Railway Company, for the best specimen of iron produced in the Punjab, is awarded to—

LOCAL EXHIBITION COMMITEE, Kangra, for iron produced at the Bír Bhangál mines, Kangra district (No. 214.)

The Jury also awarded HONORABLE MENTION to the following:—

Collection of Fossils from Shaikh Budín hills, Bunnoo districts (No 17 to 100), exhibited by C. COSTELLO, Esq., Assistant Surgeon, 6th Punjab Infantry.

Collection of Building Materials used at Delhi, from Sahi Ballabghar, Delhi district, (Nos. 2 to 13) exhibited by C. J. CAMPBELL, Esq., Executive Engineer.

Slates from Dalhousie (Nos. 336 to 345), exhibited by MAJOR BLAIR REID.

Salt from Kathá, Kheura, and other mines in the Salt range, Shahpûr district (Nos. 504 to 507), exhibited by Mr. CHILL and MR. W. MATHEWS.

F. DREW,
Reporter to the Jury.

N.B.—The special prizes for porcelain clay and native steel were not awarded.—B. P.

Division III.—Chemical Substances used in Manufactures.

SUB-CLASS (A). MINERAL ACIDS.

THE method of preparing the acids is as yet an imperfect one, and the manufacture is conducted on a small scale, only in the large cities such as Lahore, Amritsar, &c.; there is a factory also in Kashmír. The price at which these acids are turned out is high compared with the prices current of Europe. It will be long before we can obtain here sulphuric acid even of an inferior quality at 3*d.* a lb., as we can at home. The acids principally made, are sulphuric, nitric of two kinds, and hydrochloric. Sulphuric is made in leaden chambers, as at home, only on a smaller scale. At Lahore, where the manufacturer is a very intelligent and progressive man, the samples produced are very fair, and likely continually to improve. The manufacturer is importing a platinum retort, to concentrate his acids.

332.—[888]. "Tezáb gandhak," sulphuric acid, made and exhibited by MUHAMMAD ISMAIL BASHI. City of Lahore. Lahore Collection.

Sulphur is burnt and the fumes of the sulphurous acid gas are passed into a leaden chamber with steam and nitric acid; the acid as it forms, is drawn off by a leaden pipe at the bottom of the chamber. It is then evaporated in leaden vessels till white fumes begin to be given off. It is subsequently concentrated in a platinum retort.

333.—[889]. "Tezáb shora," nitric acid (by the same maker.)

This is nitric acid prepared by treating sulphuric acid with nitrate of potash, as in Europe.

334.—[890]. Tezáb shora-wa-kahi, nitric acid mixed with hydrochloric (by the same maker).

This is another kind of nitric, or rather mixed acid, which is much cheaper than the last mentioned. It is obtained by distilling "kahi," the impure protosulphate of iron and alumina with nitre (shora). The nitre contains a quantity of chloride of sodium, and hence in distillation, hydrochloric acid is formed along with the nitric. The nitric acid is much used in fining gold from an alloy of silver, by what is called the process of quartation. If pure nitric acid is used, the alloy is digested for some time till the acid has dissolved the silver, leaving the gold in a spongy mass of particles. The solution of silver is then precipitated with common salt; forming chloride of silver.

From this substance the metallic silver is recovered by the hydrogen evolved on mixing it with zinc scrapings and dilute sulphuric acid. If the mixed kind of acid is employed, it is necessary first to remove the chloric acid from the nitric, which is done by adding nitrate of silver in solution, as long as any precipitate falls. The result obtained is pure nitric acid and chloride of silver. These are separated; the nitric acid is used as before described, and the chloride of silver may be reduced along with that formed in the second part of the process.

335.—[890]. "Tezáb nimak," hydrochloric acid.

This is usually made by pouring sulphuric acid on culinary salt in a still, and applying heat till the acid passes over into a receiver. Lately it has been made by heating the substance which remains after the preparation of nitric acid, with common salt. If the nitric acid be made by the first process above mentioned (No. 327), the residue is chiefly bisulphate of potash; but if the nitric acid has been prepared from nitre and "kahi" (No. 329), the residue consists partly of bisulphate of potash and partly of sesquioxide of iron, and in that case the residue requires to be purified by solution and filtration before being used to make the hydrochloric acid.

336. Acetic acid, "sirke-ká-tezáb" is not represented in the collection though it

has been prepared at Lahore by MUHAMMAD ISMAIL, the manufacturer who produced the other samples.

There are several varieties of acetic acid. It can be distilled from vinegar, but the common country vinegar of the bazar generally contains only a very small portion of acetic acid, often not more than 2 per cent. If 10 measures be taken of vinegar, it should be distilled till 9 have passed over.

A variety of pyroligneous acid is produced by the distillation of chips of wood in an iron retort, provided with a bent tube leading to a receiver. Some kinds of wood answer better than others. In Bengal the jainti *(Æschynomene)* is employed; experiment would determine which in the Punjab is the best. The product of the distillation is allowed to settle 24 hours, and the acid separated from the oily matters, and again distilled. Either of these acids may be converted into pure acetic acid by adding "sajji lota" (the better kind of carbonate of soda, not the black kind) till all effervescence ceases. The mixture is allowed to settle, after which it is poured off and evaporated till crystallization begins. Collect the crystals when the mixture is cold and again heat them very gradually, stirring all the while, when an odour of acetic acid will be perceptible. The crystals are acetate of soda. Take any quantity of this salt and pour over it double its weight of strong sulphuric acid in a glass retort, and distil on a sand bath nearly to dryness. The receiver should be cooled by saltpetre. The distilled liquor is to be shaken up with a little red oxide of lead (sandúr), and when the powder has subsided, it should be decanted and re-distilled, and pure acetic acid will be the result.

In England, instead of carbonate of soda, they use lime and then decompose the resulting acetate of lime by sulphate of soda, and so produce acetate of soda.

This process was followed at Lahore, but the carbonate of soda being ready in every bazar and very cheap, it is simpler to use it at once.

"In Germany," says O'Shaughnessy* "a strong acetic acid is obtained cheaply and rapidly by causing a mixture of one part spirit, four parts water, and about $\frac{1}{1000}$th part of honey or yeast to filter into a cask containing wood shavings and provided with holes to secure a free circulation of air. The fluid drops into the cask containing the shavings, and should be repassed over the shavings four times. The action is most effective when the temperature ranges from 75° to 100°." The cask to contain the shavings should be provided with a tray above to receive the liquor, the tray is perforated with small holes stopped with cotton wicks to moderate the flow and furnished with larger holes for ventilation, which are filled with glass tubes rising above the level of the liquor to prevent it flowing down them.

337.—[4411]. Sulphuric acid, locally, called "Feroki." TAHSILDAR OF DERA GHAZI KHAN.

Dera Ghazi Khan Sample.

* Bengal Pharmacopeia, p. 233.

SUB-CLASS (B.) MINERAL SUBSTANCES USED FOR DYES AND COLORS.

For the sake of clearness of classification the manufactured or artifical dyes and colors are separated from the natural ones which form the large class of earths, ochres, and clays, —and which are employed in manufactures in the same state as they are found. The ochres and earths are included in Division II., at page 22. The Mineral Kingdom does not, in the native system of dyeing, play nearly so important a part as the vegetable; the red dye from "gerú;" an ochre yellow dye,—and the beautiful but utterly unstable ultramarine dye, are almost the only ones in use. The Mineral Kingdom furnishes, however, iron salts and alum, which are indispensable in dyeing operations, though not themselves dyes. Notice of these is taken under the sub-class "Salts."

Artist colors, as well as those prepared for the wood turner, the enamel worker, and the house painter, are mainly supplied from the Mineral Kingdom. Most vegetable colors have too little body or permanency for native artists' colors, (though to this rule there are a few notable exceptions,) and for the purposes of the other trades, the vegetable colors are generally incapable of combination with the vitreous or resinous vehicles employed in applying them to the work.

ARTIFICIAL MINERAL COLORS AND DYES.

The following series was exhibited by Ghulam Mahbub Subhani.

338.—[4574]. "Nílsafá" or "níl wilayíti."

Lahore Collection.

This is not indigo as its name would indicate, but lumps of the ordinary prussian blue (prussiate of iron), probably imported from Europe. Value, Rs. 2-8 a seer.

339.—[5577]. Lamp black. "siyahi."

This is used also for writing ink. It consists of fine soot collected in a vessel held over a burning lamp. The soot is mixed with gum and caked, and the cakes are then sliced up into little shavings. The best black comes from Hindústán, and is valued at Rs. 2 a seer.

This ink is frequently adulterated by mixing with the lamp-black, powdered charcoal, made by burning almond shells.

340.—[4578]. "Ceruse," or white lead, "*safeda*" (carbonate of lead), used as white paint. Value Rs. 1-2 per seer.

It is largely imported from Europe, but comes also from Káshgár. In the bazar there are two qualities, one almost pure ceruse, and sells at 35 Rs. a maund; the other mixed largely with lime and whiteing, sells at Rs. 10; the latter is known by its lightness and by the dirty color it gives when employed as a paint.

341.—[4579]. "Shingarf," cinnabar (sulphide of mercury).

This is imported from Europe, but is said to be found native, in Central India, and also in some parts of the Thibetán mountains in crystalline masses. It is easily ground to a fine powder. The color is beautiful but not very permanent. It values Rs. 2-12 a seer.

342.—[4581-2]. "Hartál," or orpiment (sulphuret of arsenic).

Two varieties occur; the "hartál wilayíti" and "hartál warki," the last so called from its beautiful glittering lamellar texture, value Rs. 0-12-0 and 1-2-0 a seer. The difference is in the shades of yellow they yield; both are sulphurets of arsenic. This mineral is also found native in parts of India. Under the head of Peshawur specimens will be observed an orpiment which comes from the hills north of Swat.

343.—[4583]. "Wilayíti peori."

This is a chromate of lead, or precipitate produced by the addition of bichromate of potash to a solution of acetate of lead. It is the chrome yellow of artists' colormen. It is called "peori," from its resemblance to the "hardwárí peori," or Indian yellow.

344.—[4586]. Sandhúr.

This is a red oxide of lead and is brought from Hindústán,* and also from Europe. It sells for 7 annas a seer, is used largely in painting and decoration. Hindús often use it for religious purposes, making marks with it on their idols, &c., or putting it on their rupees at certain seasons for good luck. It is not unusual in the hills to see a boulder or other stone marked with a patch of red lead, which has been done to convert it into a "devi" or object of worship.

345.—"Lájward," artificial ultramarine. Value Rs. 4 a seer.

There is also exhibited with it a sample of *genuine* ultramarine by the illuminator, IMAM WAIRDI, which he says is now rare; but this appears to be either an ultramarine ash, or else to be much mixed with white paint, as it is a pale light blue. It is uncommon, and before the introduction of the European artificial lájward (of which a description is given subsequently, under the Peshawur sample) was sold for many rupees a tolah. In England ultramarine costs £5 or more per ounce.

346.—"Zangár," verdigris, sub-acetate of copper.

When pounded yields a green or blue green of great beauty.

Amritsar Collection.

Samples of colors were also sent from Amritsar, the Local Committee of which city exhibited the following, in addition to many of the kinds just described.

347.—[4516]. "Sang sabz."

This is the green earth of mineralogists,—a silicate of protoxide of iron.

348.—[ ]. "Kahi surkh," bichromate of potash imported from Europe.

349.—[4563]. Color sticks, for lacquer ware.

These are used by the Kharáti, or wood-turner, to color his ware when the turning process is complete. The sticks consist of shell lac melted down with a certain proportion of wax and sulphur, and colored by various simple or compound colors. They are applied by the hand. The operator holds the color stick against the turned wood object while revolving rapidly; the heat produced by the friction melts the lac and the color is deposited on the surface of the wood. The skill and fancy of the operator directs him either in laying in a uniform layer of color, or else putting it on in little spots or touches, by allowing the color stick only very lightly to touch the revolving wood, thus producing either a smooth uniform color or the pretty mottled appearance so often observed in lacquered ware. Two or three different color sticks are often applied giving the whole a marbled and variegated appearance of great beauty. The color thus applied is spread, fixed, and polished by pressing the edge of a piece of bamboo wood, cut to a flat clean edge, against the turned object while revolving. The final polish is given by a rag with a little oil. The principal colors—are lac-crimson, orpiment, red lead, green, (made of orpiment and prussian blue,) dark blue (indigo or prussian), black, white, brown (or gold color), light blue (or ultramarine).

350.—[4567—70]. Series of enamel colors. LALA RATN CHAND.

These are vitreous masses employed by the "mínákár," or enameller on silver, &c. The colors are principally green and blue,—salts of iron and copper—diffused through vitreous matter; a yellowish color also is produced by litharge. In the class "works in the precious metals" will be seen examples of the manufacture, which consists in taking a silver or metal vase, having the pattern of leaves or flowers worked on it in relief and filling the hollows with enamel in a melted state. The colors exhibited are blue, green, and red. Only two persons in Lahore possess the art of making this material; it is made also at Múltán and other places.

Peshawur Collection.

351.—[577]. Lapis lazuli, "lájward," priced at 10 Rs. a tolah; is said to be brought from Central Asia.

Lapis lazuli is also brought from China, Persia, and Bukhárá and from the province of Badákshán, where there are mines of the mineral. In order to manufacture the powdered color, the stones containing the crude mineral are heated red hot and then flung into water to make them easily pulverizable. They are next ground and mixed with a varnish of resin, wax and linseed oil; the mixture is put into a

* It can be made by very carefully and gently oxidizing pure metallic lead while melted in the crucible. A gentle stream of air is blown on to the fused surface, and the process stopped to a nicety, or else the whole is spoiled.

cloth and kneaded with hot water. The first washing is thrown away, and when fresh water is added the fine blue powder is washed out and falls to the bottom; subsequent washings give tints less valuable. In Europe the refuse, after the extraction of the blue, is calcined and yields a series of delicate gray tones known to artists as "ultramarine ash."

The following is an account of the lapis lazuli mines of Badákshán taken from Wood's "Personal Narrative, &c."

"Firgamu stands at the head of the fertile portion of the Kokchan valley, which south of this takes the name of Koran. Beyond Firgamu the mountains rise directly from the bed of the river. * * * Where the deposits of lapis lazuli occur, the valley of the Kokcha is about 200 yards wide. On both sides the mountains are high and naked. The entrance to the mines is in the face of the mountain on the right bank of the stream and about 1,500 feet above its level. The formation is of black and white limestone, unstratified, though plentifully veined with curved lines. The summits of the mountains are rugged and their sides destitute of soil and vegetation. The path by which the mines are approached is steep and dangerous, the effect of neglect rather than of natural difficulties. The mountains have been tried for lapis lazuli at various places. The shaft by which you descend to the gallery of the principal mine is about 10 feet square, and not so perpendicular as to prevent you walking down. The gallery [at the bottom] is 80 paces long with a gentle descent, but it terminates abruptly in a hole 20 feet in diameter and as many deep. The width and height of the gallery though irregular, may be estimated at 12 feet, but some places where the roof has fallen in, its section is so contracted that the visitor is forced to advance on his hands and knees. * * No precaution is taken to support, by means of pillars, the top of the mine, which, formed of detached blocks wedged together, requires only a little more lateral expansion to drop into the cavity. Any further operations can only be carried on at most imminent risk to the miners. The temperature at the further end of mine was 36° Fahr., while in the open air it was 29°.

"The method of extracting the lapis lazuli is sufficiently simple. Under the spot to be quarried a fire is kindled, and its flame fed by dry furze is made to flicker over the surface. When the rock has become sufficiently soft, it is beaten with hammers and flake after flake knocked off, till the stone of which they are in search is discovered. Deep grooves are then picked out round the lapis lazuli, into which crow bars are inserted and the stone and part of its matrix are detached.

The workmen enumerate three descriptions of lajward, these are the *neeli* or indigo colored, the *asmáni* or light blue, and the *subzi* or green. Their relative value is in the order in which I have mentioned them. The richest colors are found in the darkest rock, and the nearer the river the greater is said to be the purity of the stone. The search for lajward is only prosecuted in the winter, probably because labor in the mine being compulsory, the inhabitants are injured less by giving to it in a season of comparative idleness, than when their fields require attention. Perhaps also during the cold of winter the rock may be more susceptible to the action of heat and thus be more easily reduced than when its temperature is higher. * * * The mines, the produce of which are exported to Bukhára and China, have been known from a very early period."*

Recent returns show the produce exported to be about 2 seers; what little lapis lazuli does come to the Punjab, is imported in small pieces and used for beads, charms, the stones of rings, &c. Some of these also come from Káshgár. Some persons have formed the erroneous idea that the common lajward of the bazar, which is everywhere sold at 4 Rs. a seer, is made from the genuine mineral, and might be profitably exported to Europe, when in fact every ounce of it in India is imported thence! The author of the "Makhzan-ul-Adwíya" admits that lajward is imported from Bombay.

Real lapis lazuli as a pigment has been long known to the people of the province; it is certain that many years ago it was sold at several rupees the tolah, a price which would be equal to that of real ultramarine in Europe.

The common lajward, answers to chemical test exactly like the real lapis lazuli, that is it is dissolved by diluted sulphuric acid, its color being destroyed and giving off a smell of sulphuretted hydrogen. In fact the lajward made in Europe consists of the same substances artificially combined as exist naturally in the lapis lazuli. It is, therefore, properly an artificial but not an *imitated* ultramarine, as the ground cobalt glass would be. The coloring matter was discovered to be due to the action of sulphide of sodium on the other constituents.

In 1828, M. Guimet succeeded in making some of this color, guided by the analyses of other chemists and by the remarks of M. Tassaert, that a blue substance like ultramarine was occasionally produced on the sandstone hearths of his reverberatory soda furnaces.

* Chapter XVII. of "Wood's Personal Narrative of a Journey to the source of the Oxus, by the route of the Indus, Cabul and Badákshán."

M. Gmelin gives a receipt for the manufacture, which is to mix in a Hessian crucible, 2 parts sulphur and 1 of dry carbonate of soda; these are to be heated to redness till the mass fuses, and then a mixture of silicate and aluminate of soda, containing 72 parts of silica, and 70 of alumina is to be added, sprinkling it by degrees, and the crucible exposed to the fire for an hour*. It is said also that kaolin heated with sulphur and carbonate of soda does as well. An imitation lapis lazuli used to be made in Europe by grinding to an impalpable powder glass, previously colored blue with cobalt, but this is not common, and is certainly not the kind in use in India. The native standard book on Materia Medica, entitled "Makhzan-ul-Adwiya," gives the most absurd account of the making of ultramarine; showing, however, that the idea of an artificial color is familiar to the natives. The method related is probably founded on some faint reminiscence of the natural appearance of the lapis lazuli, confused with an account of the manufacture, which the author may have imperfectly heard or read, and still more imperfectly understood. It shows how a "little knowledge is a dangerous thing," and how much we need to strive to diffuse some genuine chemical and physical knowledge, and displace the teaching of such rubbish as the following:—"The imitation lajward," says the learned author of the "Makhzan," "consists principally of mercury and sulphur (he says the same of rubies a little further on!) The sulphur and mercury are to be mixed, the sulphur in greater proportion, and to this is added a portion of gold ore (*mádah-i-zabah*), these are to be moistened with a solution of yellow arsenic (*zarnikh*), one part of this compound is mixed with three parts of alum (*zák*) and sand, the whole is then ground together, after which a small quantity of solution of salt is poured over it, and the mass stirred several times with a bar of red hot copper, which, acted on by the ingredients, imparts a color to the mass. At first the color obtained is green, but after a time, when dry, it assumes the lapis lazuli blue." Another process is described as taking pieces of marble, and soaking them in vinegar and then in dung of animals, after which it is ground, &c. This latter is probably the glimmering idea of the process of making the real blue from lumps of lapis lazuli, which are heated and powdered as previously described. In England, real ultramarine sells as high as £5 an ounce, and a cake of it prepared as a water color costs 21*s.*; artists say that it differs from the artificial, in producing a greater degree of airiness and purity of tone in a picture.

* Ure's "Dictionary of the Arts and Sciences." Art. Ultramarine.

352.—[4660]. "Hartál" orpiment from Káshkár. Peshawur Exhibition Committee. Value Rs. 16 per maund.

353.—[857]. Another sample of hartál, from Swat.

In these places it is found native in the hills north of Swat; it is also used as a medicine in skin diseases and syphilis.*

354.—[706]. Litharge from Jagádri. Amballa Sample. Deputy Commissioner.

Jagádri is a great place, for the preparation of metallic oxides, &c., especially those used in native medicine. Borax is refined at this place, and the oxide of lead or massicot manufactured (*see* Mineral Drugs). The litharge is a dingy yellow oxide of lead, prepared by gently oxidizing metallic lead by a stream of air. Red lead or minium, can be made from massicot, by exposure to the flame of a reverbatory furnace during about 48 hours.

KAHI AND HERA KASIS.

These are earths containing in greater or less quantity and purity, salts of iron in the form of an anhydrous sulphate; in the pure samples it takes the form of a whitish or cream-colored radiated crystalline mass. This substance is largely imported from Pind Dádan Khán, at which place it is of superior quality, but it also abounds at Kálábágh and other places. Kahi is also seen as a manufactured salt, obtained by dissolving and re-crystallizing the sulphate contained in the earth and shales, and which separate being insoluble (*see* note to the Shahpúr samples.)

There are several sorts of kahi.

"Kahi safed," is a sulphate of iron and alumina.

"Kahi sabz," is an impure green vitriol, a sesqui-sulphate of iron, and made by dissolving iron in sulphuric acid. This is usually a manufactured product, the green vitriol of commerce (proto-sulphate of iron) is called "hira kasís," a term which is in-

* See Appendix to Dr. Bellew's "Report on the Yusufzai Country."

correctly extended to earths naturally impregnated with iron salts.

"Kahi zard," is only a yellowish variety of the kahi safed, it is a sesqui-sulphate produced probably by the decomposition of iron pyrites *in situ*. There is also an impure dark variety of earth like a black shale, containing sesqui-sulphate, and called kahi siyah.

"Kahi surkh or lál,"—red kahi,—has no connection with the iron salts. It is bichromate of potash, and is always imported from Europe.

Kahi can be produced by concentrating the mother liquid of alum shale. It contains sulphate of alumina, and sulphate of proto and sesqui-oxide of iron.

Kahi often resembles "sajji matti" in appearance, and is sent by mistake for that product from several districts.

355.—[710]. Kasis (kahi sabz), sulphate of iron from Sirmúr, a grayish green earth containing iron in abundance. THE RAJA OF SIRMUR. Simla.

356.—[4666]. Kahi safed. HIS HIGHNESS THE MAHARAJAH. Kashmir.

357.—[4667]. Kahi siyah.

Of these earths, both containing salts of iron, the kahi safed is the purest, both are used in dyeing leather black, and in dyeing "khaki," or gray, and also black, to produce which, the cloths to be dyed are first dipped in a solution of galls or other substance containing tannin, and the iron acting on this according to the strength of the decoction used, produces shades of gray and black. Lime juice is further added for black dyes.

358.—[563]. Kahi mitti. An earth containing iron as a sulphate, Kálábágh. DEPUTY COMMISSIONER. Bunnoo.

This is abundant, but not much used in the place of production.

The Amritsar collection exhibits all three varieties —"safed," "sabz," and "siyah."

359.—[910]. Sulphate of iron, from Namal. MR. MATHEWS. Shahpur.

360.—[512]. Kahi mitti, from Chitta, in the Salt range.

This is a shale containing sulphate of iron and alumina.

Associated with the black alum shales alluded to in the account of alum manufacture, but occurring in smaller quantity, are gray shales with silky crystals of anhydrous protosulphate of iron. The kahi is prepared by mixing the pounded shale with the mother liquid for the crystallization of the alum. The mixture is then allowed to cake up and dry in the sun; when dried, it is once more treated with the alum liqour and once more dried, after which the residue assumes a tawny yellow color. This is a mixture of alum and sulphate of iron, the latter largely predominating.

Samples of kahi are included in the Jálandhar collection, but are not produced in the district.

361.—[261]. Kasís, from Haripúr. LOCAL EXHIBITION COMMITTEE. Kangra.

362.—[358]. Kasís, or white vitriol, from Swat. Value Rs. 16 a maund. Peshawur.

It is used by cutlers.

SULPHATE OF COPPER.

363.—[156]. "Nila tútya," blue vitriol, (sulphate of copper), from Nighána, Bhagúl, Buhal and Ketari; average value, Rs. 1 per seer. LOCAL EXHIBITION COMMITTEE, HISSAR. Hissar.

This is extracted from ore similar to that producing the metallic copper (*vide* supra). The stone when pulverized is thrown into earthen vessels filled with water, and allowed to stand during the night, after which the liquid is poured into another vessel and the crystals of blue vitriol obtained by spontaneous evaporation of the liquid in the same way as alum.

364.—[629]. Sulphate of copper. Singhána. DEPUTY COMMISSIONER. Gurgaon.

365.—[4522-3]. Sulphate of copper, two kinds, viz., nîla tútya "wilayiti" and "desi." Amritsar.

Of this substance there are both the imported and native made. The former is distinguished by its large crystals of a fine blue, the latter by its efflorescent small crystals, and opaque pale color. It is made at Amritsar by boiling sheet copper or copper filings with sulphuric acid, and evaporating the residue. This substance, besides being used as a color and also as a drug, will be noticed again under the class of Chemico-pharmaceutical substances.

ACETATE OF COPPER.

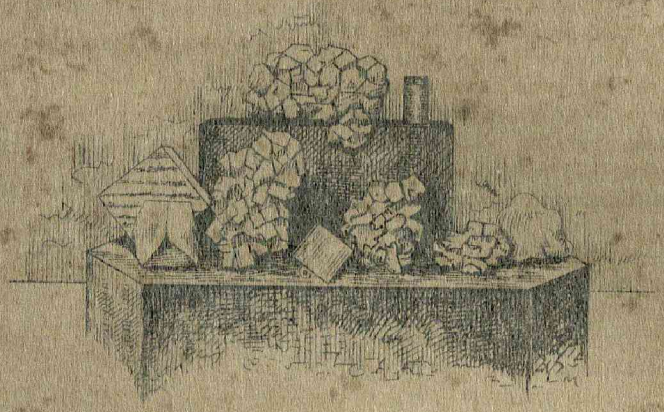
366.—[ ]. Zangár, sub-acetate of copper, prepared in this country. Lahore.

When ground up it gives a beautiful turquoise or verditer blue.

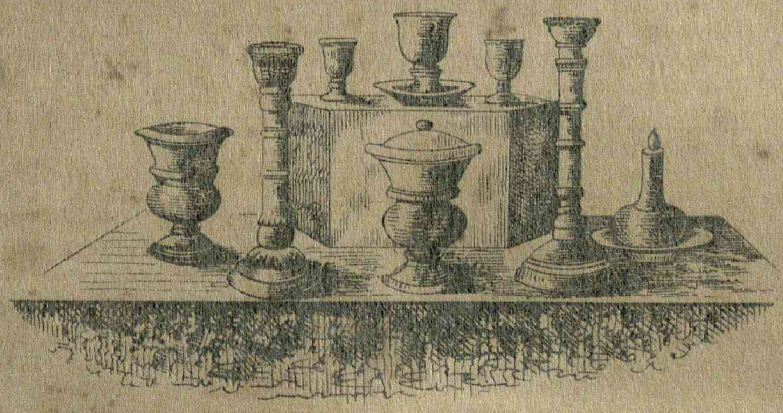
367-68. [ ]. Two samples of zangár in crystals. Local Committee. Amritsar.

IMPERIAL RECORDS DEPARTMENT

68 CSL



GROUPS OF SALT CRYSTALS



CUPS AND VASES OF ROCK SALT.

SUB-CLASS (C.) SALTS, WITH ILLUSTRATIONS OF THE METHOD OF MANUFACTURE.

The principal substances which are classed under the head of salts, are common rock salt, and preparations of evaporated salts,—saltpetre (nitrate of potash)—alum—"sajji" or barilla—"naushádar," or sal ammoniac—and borax, or "sohága." All these are important articles of trade. Another salt, called "kalar," an efflorescent sulphate of soda, is so prevalent in some parts of the country, as to destroy cultivation: the sulphate has not yet been utilized, but many efforts have been made to discover the cheapest method of neutralizing its evil effects on the soil. H. H. The Rajah of Kapurthala offered a prize of Rs. 200, for a cheap and effectual method of destroying it. The manufactories of saltpetre and the salt mines of the Punjab, are sources of permanent revenue to the State. In some places, as at Jhung and Sirsa, there is income derived as "sair," from the manufacture of barilla; and in Gurgaon or Hissar from the brine pits.*

COMMON ALIMENTARY SALT.

The principal beds of salt occur in the red marls and sandstones of the Devonian group, on the southern side of the Salt range. They are from 150 to 200 feet in thickness, but masses of salt are also found interspersed among the marls and detached from the main beds.

There are three principal varieties of salt, viz., red, white and crystal salt. The red is preferred for merchandise, as it does not break up so readily as the others. The white variety not unfrequently passes into a gray or greenish and purplish color. The crystal salt when pure is a mineral of great beauty, some of the finest crystals sent to the collection are represented in the annexed plate, together with some of the vessels which have been carved out of the rock salt. In chemical composition all the varieties resemble one another. The red color of the salts is said to be due to organic matter, and not to iron—the gray or other opaque colors are the result of an admixture of soil or other impurity. The collection in the Lahore Museum, contains the following varieties in color:—dark red, light red, pink, white tinged pink, orange color, pale yellow, transparent white, opaque white, efflorescent crystalline white, greenish white, pale gray, dark gray, (amorphous), black (granular crystalline) purplish.

The Bahadur Khail Trans-Indus mine, yields black salt, and this is shipped at Esa Khail for export, having specific uses of its own. To the Dera Ghází Khán district 500 maunds of red salt are annually imported by river, and of the Bahadur Khail salt 700 maunds.

The salt when it occurs in the main beds is remarkably pure; it contains a trace of sulphate of lime, but is free from chloride of magnesium—on which account it is very little deliquescent.

The beds of salt indicate that their formation is due to crystallization from a salt

* In 1860-61, the revenue derived from brine pits and saltpetre pans, was Rs. 79,720; and in 1861-62, Rs. 49,205.

solution or brine; in the extremities of the beds the salt is much mixed with the marl, but in the centre it is pure, and there are no cavities in the main body containing crystals, from which sublimation might be inferred.

The salt beds have evidently been upheaved, as appears from the frequent faults and dykes, sometimes filled up with debris of gypsum, breccia, sandstone, &c. It is impossible to give a better account of the working of the mines than has already been done by Dr. Fleming. I therefore extract his account verbatim.*

"When a spot has been fixed on as a promising locality, a tunnel is cut in the marl about 5 feet high and 3½ broad, and carried on till salt is reached, the proximity of which is generally indicated by the marl becoming moist and assuming more the character of a dark red clay. The mineral is then excavated as long as a supply is procurable, no attention being paid to leaving pillars at intervals, for the support of the workings, the consequence of which is that great annoyance is experienced from the falling in of the roof of the mines: and accidents to the unfortunate miners themselves are of frequent occurrence. Should the shaft have been sunk on, and reached only a mass of salt, after this is worked out, the mine is either abandoned or a gallery driven to a greater depth into the marl, until another large mass is found or the real salt bed reached. As this invariably has a strike and dip corresponding to the strata superior to the marl, the stratification of the rock guides the miners in their onward course. These mines are nothing more than huge caves entirely excavated in the salt, which is seldom or never worked through, either in the floor or roof, because as the salt approaches its matrix it becomes intimately mixed with marl, and is highly deliquescent from containing magnesia. † In almost every mine in the Salt range, the evil of having left no pillars to support the roof is experienced, and some of the largest and best mines have been in a great degree abandoned in consequence of their becoming filled up with huge masses of salt, gypsum, and marl, that have fallen in from above.

"As the marl is the lowest rock of the range and dips under all the others in a northerly direction at an angle of from 25° to 40°, as might be expected, much trouble is occasioned by the filling of the mines with water when they reach to any great depth. During the rains too, in July, August and September, the water rushes through passages in the marl into the mines, and by detaching large portions renders them quite unsafe. In these months the miners desert their work, partly on account of its dangers, and partly on account of the intense heat, and the numerous fleas and musquitoes which infest their neighbourhood.

"In consequence of the irregular way of carrying on the workings, the passages into the various mines exhibit at present a succession of ascents and descents, which sometimes become so polished and slippery as to render walking over them a matter of some difficulty.

"In extracting the salt, the chief instrument used is a hammer, pickshaped and hard tempered at one end, and with a round head at the other. A mass of salt being fixed upon as the scene of operation a portion is lined off, about 2 feet thick, and along this a groove is cut with the sharp pointed hammer to the depth of some 8 or 10 inches. Larger sharp pointed hammers as wedges are then introduced at intervals along this line, and on their broad heads a series of sharp blows are inflicted. This generally detaches a block of salt, which is then broken up into lumps of a convenient size for being carried out of the mines. The amount of waste resulting from such a method of working is immense, and as powdered salt is not saleable as long as lumps can be had, it is generally shovelled into the bottom of the workings, where there frequently is a brine pool ready to receive it.

"Instead of making a deep groove, along the limits of the mass it is desired to detach, we believe the object could be equally well attained by adopting the plan used in granite quarries in Scotland, which is as simple as it is effective; small holes 3 or 4 inches long, 2 inches broad, and 4 deep, are picked out at intervals of 8 or 10 inches in the mass which it is desired to split, into these holes truncated wedges are introduced. Each of these is in succession driven into the holes and continues to receive sharp blows till the mass splits, which is at once known by the elasticity of the stone causing the wedges to jump out of their holes, a lever is then inserted into the crack and the divided portions separated. Were this process intro-

* Selection from the Public Correspondence of the Punjab Government. No. XXII., p. 271, *et seq.*

† It must be remembered that most of the mines being already excavated when they came under British authority, their present state is an evil for which there is no help. The unsupported excavations, as remarked by Dr. Oldham, are not the result of our system, but have been so since the Sikh times when they were worked. Dr. Oldham goes on to say that the shafts and galleries that we sink *now*, are sunk as well as they are in any mines in the world.

duced, the saving would be considerable.* On account of the dangerous state of the roof of nearly all the mines, gunpowder is seldom used, and all the work is done by the pick and hammer.

* * * * *

"From the want of circulation of air in most of the mines and the dampness of the atmosphere, the heat is most oppressive; and from the filthy habits of the miners, the stench in some of the mines is quite overpowering. In the month of December, when the temperature of the external air was 71°, in the Bugee mine at Kheura, the thermometer indicated a temperature of 81°.

"Men, women and children, indiscriminately pursue the avocation of salt miners. Families generally work together, the mother and children being chiefly occupied in carrying on their backs to the mouth of the mine, the masses of salt which the father has quarried. They are a somewhat discontented set, and strikes are by no means uncommon.

"The pay of the miners varies a good deal. At Kheura, Mukrach and Varchá, salt is turned out at the mouth of the mines at the rate of Rs. 3-12 for 100 maunds (£0-7-6 for 8,000 lbs.). At Sardi they receive Rs. 2-8 (5*s.*), while at Kálábágh, where the salt occurs in enormous masses at the surface and only requires to be broken up and removed, they receive Rs. 2-14 for quarrying it, and Rs. 1-5 per 100 maunds for conveying it to the depôt at Mári: oil and tools are supplied by the miners themselves.

"The quantity of salt that can be turned out in a day by a good workman is about 10 maunds (800 lbs.), which at the present rate of Rs. 2-8 for 100 maunds, would give the miners 4 as. or 6 as. a day.

"Where, however, a family work together, the earnings amount to something considerable.

"The general appearance of the miners varies greatly. At the end of the hot season they appear very sickly and sallow, but towards the close of the cold season, they do not appear to us to have a more unhealthy aspect than the inhabitants of towns in the Punjab generally have. They, however, suffer a good deal from sickness, but this is probably owing more to the position of their villages and their filthy habits, than to their trade. Certain diseases, such as opthalmia and pulmonary complaints, are very prevalent among them, and doubtless result from the injurious effect of the finely powdered salt acting as an irritant on the mucous membranes. Fever is very prevalent among the miners at Kheura, where (perhaps from the confined position of their mine) they look more sickly than at most of the other mines.

"Goitre is a frequent complaint, but particularly so at Kálábágh, where every one seems more or less affected. This the natives ascribe to the Indus water, which is generally of a milky color, from the fine calcareous mud mechanically suspended in it, and which the addition of a little alum speedily removes."

The mines are of two kinds; one where the salt rock is approached by galleries and excavations—the other where, as at Kálábágh, or the Trans-Indus mines, the salt is at the surface of the rocks and is quarried rather than mined.

Dr. Fleming gives a very graphic account of the Kheura mine, the principal of these excavated mines—I extract it from the memoir of his visit in 1848.

"The mine," he writes, "is a little to the east of the village, and on a higher level, the path leading to it, passing over red marl containing angular masses of gypsum. The entrance to the mine is by an opening cut in the marl about 7 feet high and leading into a passage which preserves throughout a height of 6 feet, and a width sufficient to allow two individuals to pass. From the entrance to the end of the workings the distance is 640 feet, where a chamber has been excavated entirely out of the rock salt, 40 feet long by 30 feet broad, and about the same height, in which at the same time we visited it, men, women and children, were busily engaged quarrying the mineral, by light of small oil lamps formed of the salt and hung by iron hooks on its walls, the crystalline surface of which, reflected the light on a deep pool of brine situated in one corner of the chamber, and which is said to communicate with several of the neighbouring shafts.

"In the interior of the mine which was remarkably dry, the heat was most oppressive, and the thermometer hung on the rock salt stood at 85°, while in the shade at the mouth of the shaft it indicated 75°.

"The appearance of the miners as seen in the dim light which illuminated the mine was highly striking,

* The supply of salt is undoubtedly large, but as we are utterly ignorant of its actual extent, it becomes a matter of considerable importance to save it and waste none. All the powdered waste and impure salt, might be collected and dissolved in tanks, when the impurities would quickly subside and the clear brine would run off into shallow pans and crystallize into excellent salt. In the Austrian mines this process is found to be worth while, even though fuel is required to effect the evaporation; but in the Salt range the process would be quite unattended with any expense as the heat of the sun would suffice. If this were done, and if also the brine springs at the foot of the hills were utilized, the produce would be immense. The point is well worthy the attention of Government.—B. P.

their faces and bodies being covered with a saline incrustation. Their dress is of the lightest description, the men wearing nothing but a bit of cloth round their loins, and a pad of "numdah" or thick woollen cloth tied over their skins to protect them from injuries from the sharp angles of the salt or the blows of their instruments. The salt is generally removed from the mine in square lumps of such a size that two will form a good load for a camel. The miners receive from Rs. 2 to 2-8 for 100 maunds, according to the quality of the salt turned out. Around the village of Kheura there are no less than 10 shafts sunk into the red marl for the purpose of extracting the salt. From the foot of the hills a narrow path, strewed with boulders and masses of rock which have fallen from the heights above, leads through a deep ravine to the salt mine village, which is built in terraces on its east side, and is inhabited by the miners and their families during the dry season. In the rains on account of the heat and the musquitoes they desert Kheura and take refuge in the small village of Tobee, which is built on the opposite side of the ravine, but at a considerable height above the salt mines, where they enjoy a cool breeze and an immunity from their winged tormentors. The inhabitants of these villages amount to about 650, of whom 400 are employed in the salt mines." *

At the Kálábágh mines, the mineral exists close to the surface and crops out behind the terraced houses of Kálábágh, forming a wall which overhangs the town. It is worked chiefly in the bed of a nullah, called "Lún." No shafts are sunk, for the rock has fallen down in immense masses from the height above, and it is only necessary to break it up into pieces for transport.

Elphinstone thus describes the town and mines of Kálábágh:—

"As we passed beneath, we perceived windows and balconies at a great height crowded with women and children. The road beyond was cut out of the solid salt at the foot of cliffs of that mineral, in some places more than 100 feet high above the river. The salt is hard, clear and almost pure. It would be like crystal were it not in some parts streaked and tinged with red. In some places salt springs issue from the foot of the rocks and leave the ground covered with a crust of the most brilliant whiteness. All the earth, particularly near the town, is almost blood-red, and this with the strange and beautiful spectacle of the salt rocks, and the Indus flowing in a deep and clear stream through lofty mountains past this extraordinary town, presented such a scene of wonder as is rarely witnessed."

The mines or rather quarries described by Elphinstone, are now closed, and the salt is extracted instead at Mari, on the opposite side of the river. Here also the salt is got at by quarrying; at first it is necessary to remove the gravel and alluvium that lies in front, but after that the salt is pure.

During the Sikh times, salt was worked at every available place, but now, with a view to facilitate the collection of the revenue derived from it, the extraction is confined to the five mine stations—Kheura, Mukrach, Sardí, Chúa Varchá, and Kálábágh. Some of the Trans-Indus mines of Kuhat, &c., are not now worked; there are, however, specimens of the salt they yield exhibited in the Kuhat collection. In the sequel will be found an account of the Kuhat mines, contributed by the Deputy Commissioner. The salt used to be sold for Rs. 2 a maund, and now, since 1861, has been sold at Rs. 3. In 1850 and 1851, the quantity of salt produced was as follows (omitting fractions): in 1850, 7,58,603 maunds, yielding a revenue at Rs. 2 a maund, of Rs. 15,37,400. In 1851, it was 6,40,618 maunds, and the revenue, Rs. 12,81,295.

In 1861-62, when the tax had risen to Rs. 3 a maund, the revenue was about 28 lacs of rupees, or £280,000; in 1862-63 it was Rs. 30,31,568.

The Kheura mines are the most productive, next to these the Mukrach, and least of all the Chúa Varchá.*

Salt when extracted is collected at depôts in the immediate vicinity delivered to the traders on presentation of their "dákhilas." These

* Journal of the Asiatic Society, No CXCVII, November 1848.

* The out-turn of salt, and revenue derived, from the Kheura mines alone for the last four years is as follows:—

	Maunds.	Rs.		Rs.
In 1861,	9,16,105	at 2-2	value,	19,46,724
„ 1862,	7,50,490	„ 2-2	„	18,93,413
„ 1863,	7,35,136	„ 3	„	22,05,408
„ 1864,	8,92,122	„ 3	„	26,76,368

73 CSL

Kasganj, Kálpí, Atára, Farrakábád, Cawnpore, Allahábád, Lucknow, Murádábád, Shahjahánpúr, Saháranpúr, Jawálpúr, Khúrjah, Sikandarábád, Bulandshahr, Delhi, Meerut.

I now proceed to the enumeration of the specimens, which illustrate the foregoing descriptions:—

369.—[254]. Rock salt from the Kangra. Drang mine. Mandí. THE RAJA OF MANDI.

370.—[255]. Rock salt, from the Gumatti mine, Mandí. THE RAJA OF MANDI.

These are grayish salts, quite unlike the beautiful clean salts of Kálábágh; in color they resemble Graywacke rock; they have the appearance of having been deposited layer by layer, but are not lamellar in cleavage: the gray salt is varied by reddish streaks. Geologically, the formation of this salt is the same with the beds of the Salt range, only here the strata reach their extremity and have become much mixed with impurities. This dull gray salt is very largely used all over the hills. Indeed it may be said that all the Himálayan states are supplied either by Salt range salt, if they are near the plains; with "guma lún" (gray salt) if intermediate; and with Tibet salt if further north, and beyond access from the mines. All the bunyas about the lower hill districts keep both gray and Lahorí salt on sale in their shops.

371.—[256]. Alimentary salt, used at Lahaul, obtained from Changthán in Thibet. LOCAL EXHIBITION COMMITTEE.

This salt, called in Thibet, "sa," comes from Changthán.

A large quantity is imported into Ladákh, mostly though the Kardár of Ladákh for consumption in his province, and for the Maharaja of Kashmír's army throughout the Jammú and Kashmír territories. The poorest class in Kashmír consume this salt, the richer people use Punjab rock salt. In the Jammú territory only Punjab rock salt is used. The Kashmír government has the monopoly of this salt.

On the Changthán border, where the Ladákh authorities have a shop for the sale of salt, its price is 1 maund and 15 seers per rupee; at Lé, it sells for 30 seers for a rupee; and in Kashmír, 16 seers per rupee. The purchase, sale, and transport is under direction of a Kardár of the Kashmír government, the monopoly having existed for the last seven years. The Changthánis barter their sal for grain (which is not produced in Changthán) and the bartering is also carried on in the case of other articles of trade, as wool, sulphur, &c.

The imports to Kashmír value at Rs. 20,000.

372.—[486]. Black rock salt. Kheura mine, Salt range. Jhilam. LOCAL EXHIBITION COMMITTEE.

373.—[488]. Red rock salt. Kheura mine, Salt range.

374.—[489]. Crystals of salt (natural), do.

375.—[490]. Amorphous salt, do.

376.—[10180]. 15 vases carved from rock salt, by JANI of Kálábágh. MR. MATHEWS. Shahpur.

The art of carving in rock salt has been long known and was practiced in the Sikh times. The workmen will readily copy in salt any pattern vase given them of a tolerably simple form.

(See *Engraving*, p. 69.)

377.—[504]. Natural crystals of rock salt, "shísha nimak," Kheura mine. MR. CHILL.

378.—[505]. Another specimen, from the Kálábágh mines.

(See *Engraving*, p. 69.)

379.—[506]. A series of 15 samples of rock salt, from the different posts in the Kheura mines, exhibiting the various colors of which salt is found—white, red, greenish-white, gray and blackish tint. MR. MATHEWS.

380.—[507]. A series of 8 samples, showing the products of the Kálábágh mines. MR. CHILL.

381.—[519]. A mass of white salt efflorescence, from Kathá, at the foot of the range. MR. T. W. MOORE.

382.—[594-96]. Samples of green and red rock salts, Nandrúga mine. LOCAL COMMITTEE. Kuhat.

383.—[595]. Black salt, from the Jatta mine.

This is not to be confounded with the artificial "kálá nimak," or black salt: the color of the specimen is natural, and of a deep purplish gray.

384.—[597-98]. White salt, a crystal, from Narí mine.

Salt is contained generally in the chain of hills running from the river Indus towards Bahádur Khail, in a direction from east to west. These hills are drained by the streams called the Tarí Tawí and the Káshí.

The mines now worked are five in number :—

1. Malgín, about 20 miles south of Kuhat.
2. Jatta, about 22 miles south-west of Kuhat.
3. Narrí, about 15 miles further on in the same direction.
4. Kharak, about 5 miles still further on.
5. Bahádúr Khail, about 50 miles south-west of Kuhat on the Bunnoo road.

The mines at the three first places are situated in low rugged hills, chiefly sandstone, in vertical strata and covered by low jungle.

The salt lies near the surface under (not unfrequently) a strata of red marl, and in color is black or dark green, the former is found chiefly at Malgín and Jatta. It is nearer the surface and as it contains a considerable quantity of sand and other impurities, it is only taken away when from press of work at the mines, the traders would be delayed in getting their animals laden with the better sort.

The transparent colorless salt, of which a specimen was forwarded to the Exhibition, is found at Narí and Kharak : the latter mine is now closed. It is not found in large quantity, and is taken away occasionally by traders more as a curiosity than from preference.

The red salt is found at Nundrúga, near Shakkardarí, and being similar to the Cis-Indus salt, the mine is closed to prevent the smuggling which would otherwise take place.

The opaque white salt is the result of the action of water found in caves, &c.

At Malgín, Jatta and Narí, the salt is obtained by blasting in the usual manner; and the miners have two descriptions of pick, one heavy, weighing 10 or 12 seers, round and heavy at one end, and pointed at the other : the second pick is about 3 lbs. in weight, and of the size of a small axe ; it is pointed at one end like the larger one.

At Kharak and Bahádúr Khail, the smaller instrument is alone used with a thick short chisel, and a stone for a mallet; blasting is not resorted to.

The rates vary at the different mines ; at Jatta and Malgín a fee is levied by Government of 4 as. per maund ; the approaches are difficult and bullocks are chiefly employed by traders, who consist of Khattaks, Afridís, and Mohmands, from the Peshawur district.

At Narí the rate is also 4 as. per maund, and is chiefly frequented by camel owners, Khattaks, and men from Hashtnagar and parts of Yusufzai.

At Kharak a fee of 3 as. per maund is levied, and the mine is frequented by Thalls, Wazíris, Powindahs, &c.

At Bahádúr Khail* the Government fee is 2 as. per maund, and the traders are Wazíris, Ghiljis, men from Upper Meranzaí, &c.

At the two latter places the trade is carried on with both camels and bullocks.

In addition to the five mines worked, there are thirteen others in the same hills, which are kept closed and watched to prevent smuggling.

The quantity taken last year from the different mines was as under :—

From January 1863 to 31st December 1863.

Name of mines.	Quantity of salt.			Revenue to Government.		
	Maunds.	Sr.	Ch.	Rs.	As.	P.
Malgín, ...	98,429	30	0	24,607	7	0
Jattá, ...	1,11,249	22	8	27,812	6	3
Narí, ...	48,203	20	0	12,050	12	0
Kharak, ...	44,949	30	0	8,438	1	3
Bahádúr Khail, ...	82,298	30	0	10,287	6	6
Total, ...	3,85,131	0	0	83,196	1	0

EVAPORATED SALT.

(120-140). Twenty samples of evaporated salt, both Sultánpúrí, and Salambhaí; from Gurgaon. Bái, Bás, Untka, Málab, Noh, Dundaherí, Kherla, Salambha, Fázilpúr, Salaheri, Sultánpúr, Basirpúr, Sádharáná, Mahmúdpúr, Hamípúr, Gopálpúr, Mubárakpúr, Zahdpúr.

* The mine of Bahádur Khail supplies the whole of western Afghanistan with salt, and the Wazíris are the chief traffickers in the same.

In the autumn of 1849, the sale of salt at the Bahádúr Khail mine was suspended, until a rate of duty should be fixed for the whole of the mines. Two rupees per maund, the same rate as that of the Cis-Indus mines was the first scale decided on ; but it being found that so high a rate had the effect of completely stopping the trade, it was soon reduced to one rupee, without, however, producing the desired effect of re-opening the trade. Thousands of men usually engaged in extracting or conveying salt from the mines to all parts of the country were thrown out of employment, and some disturbances occurred at Kuhat and Bahádur Khail, but passed off. Tranquility was restored, but the hill men had relinquished the salt trade, which, on account of the high duty, they considered beyond their reach. Things were in this state when in May 1850 the rate of the duty was finally reduced to a scale which was calculated to throw the salt trade open to every idle man in the hills and elsewhere who chose to undertake it. (From Taylor's Memorandum on Dera Ismail Khán, pages 34 and 35.)

385.—[164]. Crystallized salt, from Hissar. Sámbhar. LOCAL EXHIBITION.

Properly speaking this is a salt which is obtained by evaporation from the lake of Sámbhar in Rajputáná, but there are many other places which produce a salt similar to it. It has a peculiarly pungent taste, and all salt of this character is called Sámbhar, whether actually derived from the lake or not; it is used both for culinary purposes and in medicine.

The Sámbhar lake itself has its western side in the State of Jodhpúr, and its eastern belonging to Jaipúr. The lake is about 22 miles long by 6 broad, but it is much diminished in dry weather, and augmented in the rainy season, when it becomes less salt.

The crystalline deposit is monopolized by the Governments of the States mentioned. The salt is exposed to the sun and hardened; at first it is of a reddish hue, but afterwards becomes clear. There is a town called Sámbhar on the south bank of the lake. There are three kinds of salt which come from Jaipúr—the Sámbhar, the Dindú, and the Réwassa, they sell at 16 seers, 24 seers, and one maund per rupee, respectively.

As before remarked the salt called Sámbhar is manufactured from some brine wells as well as the lake, but it is only in certain places that the brine occurs. Sámbhar salt is the most esteemed of all the evaporated salts; similar salt, but rather inferior in quality, is made at Díndesána in Jodhpúr. The great mart for both kinds is at Bhawání, in the Hissar district.

SALTPETRE.

Saltpetre, "shora," is a nitrate of potash, ($KONO_5$,) which is found naturally in the soil in many parts of the Punjab, efflorescing near old buildings. It is not to be confused, however, with the white efflorescence often observed on the "Reh," or barren uncultivated lands, and which is usually a sulphate of soda.

Saltpetre is obtained by evaporation from water, in which has been thrown earth containing the crude salt; it is refined by further boiling and evaporation.

The purest kind (when it is allowed to crystallize carefully in six-sided prisms,) is called "shora kalmi," the long thin crystal being likened to the pen reed, or "kalam."

Saltpetre is manufactured in two methods: 1st, by boiling; the other by evaporating in shallow basins, termed "ágar." The boiling pans pay Rs. 2 a year, as their tax; the ágars, Rs. 8. The whole number of pans in the Punjab appears to be 4,200, and 20 ágars. The annual yield of the pans is variously estimated at from 100 maunds in Hissar to 35 maunds in Múltán, but this latter is much too low. The chief expense of preparation is in fuel and wages of workpeople. In Sealkot it is calculated the profit to the maker is about 65 per cent. on his outlay. MR. ROBERTS thinks this about the average of the whole province.*

In 1858, 1,96,000 maunds were produced in the Shahpúr district from 2,279 pans.† It appears that a very large quantity of saltpetre (amounting in one year to 9,000 maunds from the Dera Ghází Khán district alone) was imported to Sindh, where it is refined; and the impression was (though it was not altogether correct) that the alimentary salt extracted in the process was sold free of duty to the detriment of the revenue.

The following Table shows the number of saltpetre pans at work in the several districts of the Province:—

Division.	Number of pans.	Remarks as to the use of "agars."
Lahore,	Lahore, 58 Gújranwalla, 40 Firozpúr, 60	None.
Delhi,	Delhi, 9 Karnál, 4 Gurgaon, 48	7 in Delhi.
Múltán,	Múltán, 140 Jhung, 94 Gugaira, 67	None.
Amritsar,	Gurdaspúr, 52 Sealkot, 8 Amritsar, 0	Ditto.
Hissar,	Jhajjar, 0 Sirsa, 0 Hissar, 201 Rohtak, 181	4 exist.

* Mr. Roberts' Letter to Government, 18th October, 1859.

† The revenue realized from these pans was in 1861 Rs. 5,544.

Division.	Number of pans.	Remarks as to the use of "agars."
Deraját,	Leia (Bunnoo), 127 D. I. Khán, 201 D. G. Khán, 166	None.
Peshawur,	Peshawur, 7 Hazára, 3 Kuhát, 0	Manufacture is very small.
Ambálah,	Ambálah, 14 Thanesar, 48 Ludhiana, 38 Simla, 0	Only in Ambálah.
Jálandhar,	Jálandhar, 61 Hushyarpúr, 41 Kangra, 0	None.
Total,	1,585	Only a few, about 20.

The following account of saltpetre appeared in the "Lahore Chronicle," on the 12th May, 1855, by Mr. Gardener.

"During the Sikh reign, saltpetre was produced in a quantity merely sufficient to supply local demand. Then Government was the chief purchaser, and it was freely sold at from nine to sixteen annas per maund of about 100 to 112 lbs. weight. It was usually of a coarse quality, either unwashed altogether, or but partially so; whenever required by the Government for the manufacture of gunpowder, it had to be purified by the European officers then in charge of such works.

"After the annexation of the Punjab, small factories were first erected in the Jálandhur Doab and Cis-Sutlej states, with a view to exportation, *viâ* the Sutlej and Indus, to the Bombay and European markets. Subsequently in 1850, a considerable number of factories were established in the Múltán and adjoining districts, and lastly, in Sindh.

"The trade is still in its infancy, and should it receive the impulse of European capital and energy, the Punjab is capable of producing from 4 to 5,000 tons yearly of this useful and necessary article, which would realize somewhat about 70,000 to £1,10,000 annually in the London market."

The mode of extracting the saltpetre in the upper part of the Punjab, is usually as follows:—

"The surface of the soil is scraped off with a small spade, (called kai or kúdar) to the depth of an inch or two, and collected into conical piles or heaps from two to four feet high, which are afterwards removed sometimes four to six miles, to attain a locality where fuel and water may be convenient; there the process of accumulation proceeds, affording employment to both the male and female members of numerous families, until a sufficient quantity of the earth is procured, to insure to them the manufacture of saltpetre, at least for a season, or say five or six months. These people are generally solely dependant on this article for their subsistence. The accumulated earth is their whole stock in trade; it is usually left exposed to the full action of the weather without, however, any perceptible detriment or change. The process of extracting the saltpetre next ensues. Large mouthed earthen vessels of the form of those used on the Persian wheel are placed on an earthen tripod, each vessel having a small aperture at its bottom; first a layer of straw and then of woodash is introduced, and on this the saltpetre earth is loosely placed to within a few inches of the mouth of the vessel. The straw acts as a filter, and no doubt, experience has taught them the chemical and neutralizing property of the potass contained in the woodash; a line of such vessels is erected, with earthen empty cups beneath the orifice of each vessel, to receive the dripping liquid, the earth in the pot being kept well saturated with water until the whole of the saline matter contained in it, is pretty well carried off. This simple, though wearisome, operation, is continued day and night, to ensure a sufficient supply or quantity of the mother liquor for daily operations. This liquid usually contains but from two to five per cent. by weight of the required article. Oval iron pans, from one to two feet diameter and six to nine inches in depth are next filled with the liquid; and heat being applied, evaporation commences; the diminishing quantity of liquid being from time to time replenished by additional supplies. This part of the process requires care and experience, and occupies from twelve to eighteen hours of continued labor. The impurities as they rise, are carefully skimmed off the surface of the boiling liquid, from which, on attaining a certain degree of concentration, the impure salt and other foreign matters are copiously precipitated.

This results from the muriate of soda, or properly speaking, the chloride of sodium, being equally soluble in cold as in hot water. The filthy sediment is scooped out of the bottom of the pan at intervals, and heaped by the side of the boiler. The small pan in the upper Punjab, after thirty to thirty-six hours' continued labor, usually yields 8 to 16 lbs. saltpetre, while the larger pans, of the lower country, in the same time will yield from 15 to 30 lbs., the average yield being the medium figures of each. The quantity and even quality depend on the nature and richness of the earth used.

The soil of the lower part of the Punjab, contains

a much stronger impregnation of common salt than the upper. A line drawn from Pind Dádan Khán or from Kálábágh eastwards to Pakpatan on the Sutlej, would pretty well define the line of difference.

The following is the average cost at present of one bag of saltpetre, weighing 164 lbs. at the Chinyot factory (taken as a central position), and exported *viâ* the Indus to Bombay, and by a comparison with other countries, may give an idea of its future expectations and commercial importance.

	RS.	A.	P.
Prime cost of 164 lbs. saltpetre at the factory, ...	3	0	0
Salaries and expenses to the factors, per bag, ...	0	12	0
Cost of empty bag at Múltán, ...	0	6	0
Carriage of ditto to Chinyot factory, ...	0	1	0
Weighing, package and twine, &c.,	0	1	0
Carriage of full bag from the factory to the river bank, ...	0	1	0
Freight of ditto by river boat to Múltán at 2 annas per maund of 82 lbs. each, ...	0	4	0
Agent's and servant's salary, Kosids and hoondee expenses, ...	1	0	0
Interest on total outlay at 9 per cent. per annum, ...	0	8	0
Government license tax, ...	0	1	6
Total cost at Múltán ghát, ...	6	2	6
Freight of steamer, from Múltán to Karáchí, ...	1	4	0
Transfer to the sea-going steamer at ditto, ...	0	2	0
Freight of ditto, to Bombay at Rs. 10 per ton, ...	1	2	0
Commission of agency and servants at Sakar Barí and Karáchí, ...	0	1	6
Landing at Bombay and conveyance to stores, ...	0	2	0
Bombay agency and servants at 2½ per cent. commission, ...	0	4	0
Insurance risk from Chinyot to Bombay, ...	0	8	0
Bombay warehouse rent, and fire insurance, ...	0	2	0
Total cost delivered at Bombay,	9	12	0
Price of good saltpetre (at a brisk demand) at Bombay, ...	10	8	0
Supposed profit per bag, ...	0	12	0

A great discussion arose at one time as to the possibility of eliminating alimentary salt during the manufacture of saltpetre, and fears were entertained lest the manufacture, duty free, of this salt should injure the revenue derived from the Government monopoly of the salt mines and salt pans; but it appears that only an inferior salt can be produced, although certainly the manufacture has been practised. The manufacture of saltpetre has been subjected to a license. Act XXXI. of 1861, in Sections 5 and 6 contains provisions subjecting salt educed, whether purified or not, to the full duty, and prohibiting its manufacture otherwise.

The coarse kind of salt, alluded to, is called "kalri lún," or "nimak shor."

Previous to annexation, it was made by a class of people called "monars," or "lúngars," and was used by the poorer classes. The salt was also used, and still is, for preserving hides, tanning leather, cleansing rice, or as a stimulant for cattle, and particularly camels. It may be purchased at any druggists. The following particulars will serve to show what proportion of alimentary salt there is in saltpetre earth.

They are derived from a statement of the results of an analysis of thirty-two samples of saltpetre, received from the Múltán division, made by Mr. Hickie in 1859.

		Per cent.
No. $\frac{1}{2\,0\,7}$.	Sample of bad saltpetre, from the Shahpúr district, containing common salt, ...	32·88
No. $\frac{2}{2\,0\,5}$.	Ditto, ditto, ditto,	33·70
No. $\frac{3}{2\,0\,3}$.	Ditto, ditto, ditto,	43·56
No. $\frac{4}{3\,0\,0}$.	Ditto, ditto; ditto,	35·34
No. $\frac{5}{3\,0\,1}$.	Ditto, ditto, ditto,	62·47
No. $\frac{6}{3\,0\,2}$.	Ditto, ditto. ditto,	46·85
No. $\frac{7}{3\,0\,3}$.	Ditto, ditto, ditto,	42·74
No. $\frac{8}{3\,0\,4}$.	Ditto, ditto, ditto,	43·56
No. $\frac{9}{3\,0\,5}$.	Ditto, ditto, ditto,	28·77
No. $\frac{10}{3\,0\,6}$.	Ditto, ditto, ditto,	30·41
No. $\frac{11}{3\,0\,7}$.	Saltpetre, 2nd quality, Shahpúr district, containing common salt, ...	19·73
No. $\frac{12}{3\,0\,8}$.	Ditto, ditto, ditto,	25·48

		per cent.
No. 13/309.	Saltpetre, 1st quality, Shahpúr district, containing common salt, ...	9·04
No. 14/310.	Ditto, ditto, ditto,	9·86
No. 15/311.	Ditto, ditto, ditto,	9·86
No. 16/312.	Ditto, ditto, ditto,	15·62
No. 17/313.	From Serai Sidhú, zillah Gugaira, saltpetre, 2nd quality, containing common salt,	9·86
No. 18/314.	From Serai Sidhú, saltpetre, 3rd quality, containing common salt, ...	18·08
No. 19/315.	From Serai Sidhú, saltpetre, 1st quality, containing common salt, ...	3·28
No. 20/316.	Múltán district, saltpetre, 3rd quality, containing common salt, ...	5·75
No. 21/317.	Gugaira district, saltpetre, 2nd quality, containing common salt,... ...	5·76
No. 22/318.	Ditto, ditto, saltpetre, 3rd quality, containing common salt, ...	11·50
No. 23/319.	From Lodran, Múltán district, saltpetre, 1st quality, containing common salt,	a trace
No. 24/320.	From Mylree, ditto, ditto, saltpetre, 3rd quality, containing common salt,	75·62
No. 25/321.	Múltán district, saltpetre, 1st quality, containing common salt, ...	36·17
No. 26/322.	Jhung district, saltpetre, 2nd quality, containing common salt, ...	17·26
No. 27/323.	Gugaira district, saltpetre, 3rd quality, containing common salt,... ...	8·22
No. 28/324.	Gugaira district, saltpetre, 1st quality, common salt, ...	a trace
No. 29/325.	Múltán district, saltpetre, 2nd quality, containing common salt, ...	11·51
No. 30/326.	Ditto, ditto, saltpetre, 3rd quality, containing common salt, ...	16·44
No. 31/327.	Jhung district, saltpetre, 1st quality, common salt, ...	a trace
No. 32/328.	From Lodran, Múltán district, saltpetre, 2nd quality, containing common salt,	2·40

In the saltpetre factory of Fattihpúr, Múltán, a boiler 44 inches in diameter and 15 inches depth in the centre, produced 18 seers of saltpetre and 22½ seers of salt, the proportion being 10 chitacks of salt to a half seer of saltpetre.

MR. WRIGHT is of opinion that three-fourths of the salt produced in the manufacture of saltpetre might be converted into alimentary salt. DR. BROWN, Chemical Examiner, states that on analysis, the saline matter contains four-fifths, *i. e.*, 8 per cent. of chloride of sodium (culinary salt) with some chloride of potassium, some sulphate of soda, a little lime, and nitrate of potash.

He is of opinion that it might be used as alimentary salt, particularly if re-crystallized, but that its continued use would be liable to produce diarrhœa.

I now proceed to detail the various methods of manufacture of saltpetre, as practised in different districts, and begin with Múltán.

The nitrous earth is first soaked through a filter, after which the liquid is taken in earthen pots from the reservoir into which it has run, and put into an iron pan, in which it boils from 20 to 24 hours: when it has attained a consistency, the liquid is put in a vat, where it is allowed to cool and settle for the night. In the morning the nitrous substance is taken out in the form of small crystals, and is washed in a woollen cloth, in which it is then tied and exposed to the heat of the sun till the water has been absorbed.

The filter is built on an incline; it is formed of mud walls on three sides, one side being left open for the passage of the liquid to the reservoir, and is covered in with reeds (kurrees) upon which the earth to be treated is spread. The reservoir for receiving the liquid from the filter is made of pucka masonry, as is also the vat in which it is cooled after boiling. The pan is made of iron, and the grate of earth. The vernacular names are as follows:—

Filter,	equivalent,	Manní,
Reservoir,	„	Toa,
Vat,	„	Kunálí,
Pan,	„	Karáhí,
Grate,	„	Chúla.

Saltpetre can be obtained from the soil in many parts of this division, but the most favorable spots for its production are old mounds "bhurs," as they are termed there, (equivalent to the T'hé or Dhí, of the Cis-Sutlej,) which are sites of former villages or forts, and in which nature has for centuries been carrying on a process similar to what manufacturers adopt where they heap up the nitrous earth, wood ashes, and animal matter.

From the Gujrát district the following account has been obtained.*

The locale of manufacture is as follows:—

	PANS
In Tahsil Phalia, adjoining the Shahpur district, ...	160
In Tahsil Kharrian, ...	29
In Tahsil Gujrát, ...	15
Total, ..	204

"I am informed that the simultaneous production of salt depends upon the nature of the soil, and that although in the Jhung, Múltán and Gugaira dis-

* By CAPT. HECTOR MACKENZIE, formerly Deputy Commissioner.

tricts, salt is thus produced, being precipitated to the bottom of the pan along with other sediment during the process of manufacture, in this district no such result ensues. A sediment more or less foul, and amounting to about one-tenth of the whole produce of the pan does certainly form, but there is so little salt in it, and that little so impure and acrid, and rock salt so cheap from proximity to the mines, that it is not worth while to extract it, nor if extracted would it be fit for the food of man.

"The manufacturers are the poorer Khatrís, and Máchís; besides the license fee to Government, they pay to the Zemindars sometimes an anna a day for water supplied from an irrigating well, and sometimes a fee of Rs. 4 for the season, more or less, for the use of the soil. Four or five men working at one pan turn out from 20 to 25 maunds per month. They carry on their work during all the dry months of the year. The out-turn of season 1857-58, in this district, *i. e.*, from the close of the rains of 1857 to their commencement in 1858, may therefore amount to 5,500 maunds, or nearly 200 tons.

"The price of the saltpetre at the manufactories is at present Rs. 3, per maund of 40 seers. It varies from Rs. 2 to 4 according to the demand.

"The produce of the pans in this district is for the most part made to the order of the Pind Dádan Khán merchants. It is by them exported to Múltán and other chief marts. It is coarse and impure as it issues from the pans, but undergoes refinement after export."

The mode of manufacture in the district is as follows:—

"The earth in which it is found is collected and placed on a flat filter made of twigs and supported on pillars 3 or 4 feet high; water is then poured over this layer of earth which dissolves the salt. The solution as it passes through is collected in a vessel placed underneath, having been made previously to filter through an intermediate sheet of cloth which retains the undissolved impurities. The solution is then evaporated to about one-fourth its bulk by boiling, after which, on cooling, the nitre crystallizes. In this impure state it is used for frigorific purposes. Its value is Rs. 3 a maund. Purified nitre, "shora kalmi," is produced by dissolving, filtering, and recrystallizing the impure article; when pure it is used for gunpowder, &c., and values Rs. 8 a maund."

From Amritsar the following account has been received. "Saltpetre is prepared in Ajnálah during the months o October and November. The following is the process of manufacturing it from a species of earth called *kallar*.

"A row of perpendicular posts, each two cubits long, stuck at the distance of a foot from each other is erected, and parallel to it, another row of posts is placed at a distance of three cubits; a cloth strainer is stretched over the posts and attached to each of them. A stick is then placed breadthwise over each of the two parallel opposite posts, which acts as beams do in a pucka house. Over these sticks are placed twigs of the *kuppás* tree (cotton plant?) The thatching thus prepared is littered with grass an inch deep which acts as a filter, and over this is deposited 25 maunds of the kallar, so thoroughly saturated as to allow the water to pass through the cloth strainer into the receiver or troughs placed underneath; these troughs are not removed before they have stood 9 hours under the strainer. If there is yet some saline matter in the earth, a little water is sprinkled over it and the troughs placed again under the strainer to catch the drippings. The water thus accumulated is boiled in a caldron for 8 or 9 hours, or till such time as there is an apparent change in the color of the water from muddy gray to deep red. The caldron is then removed and its contents allowed to cool. A little after midnight the boiled salt water is stirred up with a wooden ladle and laid out in the open air in small earthen plates. In the morning the plates are removed and the water having been quietly poured off, the deposit is saltpetre. To refine it again, the boiling process must be repeated."

The process followed in the Hushyarpúr district is somewhat different from the foregoing.

"The earth, in which saltpetre is known to exist, is collected in heaps, and small *gharras* (earthen pots) are filled with it. These are put upon a stand made of earth, of a height sufficient to allow of a "tind," another description of earthen pot, being put *under* the first named "ghurra." The upper vessel has a hole in the bottom, and water being poured into it, on the top of the earth already there, it is allowed to trickle down through the hole in the bottom; the water thus filtered through, is then boiled in a "karáha," a large iron vessel, and the scum as it comes to the top is removed. After being thoroughly boiled, it is gently poured out into large pans, in which it gradually crystallizes, and the residue that remains at the bottom of the "karáha" is thrown away, as it is a coarse species of salt which is contraband.

"The evaporation system consists in putting the earth into a small pucka tank, to the depth of about an inch, in which water is poured, perhaps two inches deep: this is allowed to stand a day or two and then a plug from the bottom being withdrawn, the liquid is allowed to run off into another small tank, where it crystallizes; the water being evaporated by the sun's rays."

The exhibited samples are as follows—

386.—[522]. Saltpetre, from Shorkót. Deputy Commissioner of Jhung.
Jhung.

387.—[571]. Saltpetre, "khorah," from the Yusufzai. Value, Rs. 6 per maund. Local Committee.
Peshawur.

388.—[572]. Saltpetre in crystals (shora kalmi), prepared by Khanan Khan, Peshawur. Local Exhibition Committee.

Value, Rs. 13 per maund; used in medicine, and for gunpowder and fire-works.

389.—[122]. Large crystals of saltpetre. Deputy Commissioner.
Gurgaon.

390.—[620]. Saltpetre, crude. Rajah of Jhind.
Jhind.

391.—[621]. Saltpetre, refined.

Saltpetre is also exhibited from Kapúrthalla (623), Gujranwalla (435), Fatihabad, the Hissar district (499), Rohtak (702), Ambálla (704), Ludhiana (709), Jálandhar (726), Amritsar (purified sample) (757), with raw and refined from Phaliyan of Gujrát, from Harapá in Gugaira (918), from Dera Ismail Khán (927), and the higher Hills in the Dera Ghází Khán district (928), also from Mithankôt, and Dera Gházi Khán itself (930-931). Saltpetre is produced at Dera Ghází Khán, as stated by Major (then Lieut.) Pollock, at the rate of 8,000 maunds per annum, and the manufacture had increased considerably in 1853. The amount of duty realized by a tax of Rs. 2 per vessel or "karáwá," gave only Rs. 404. In 1854, contracts were given out for each Tahsil, and the aggregate realized was 1,787 Rs., or an increase of 300 per cent.; in 1859, it had not risen any further.

From Shahpúr, saltpetre is exhibited. It is found throughout the "Bar," especially on the sites of ancient towns or villages: Rs. 2 a maund, is its value there.

ALUM.

Both native and European alum are met with, the latter being white in color and quite pure, on which account it is preferred in medicine. Alum is manufactured in considerable quantities at Kálábágh and Kutkí, whence it is exported to all parts of the Punjab and upper India. The white alum is principally imported; it is used for sore eyes, in some kinds of opthalmia; and the sample called "phullá fatkari," from Bunnoo, is noted as being invaluable for wounds and bruises. The chief value of alum is as a brightener and mordant in dyeing, particularly with madder.

The alum made at Kálábágh, is always of a pinkish color, which arises from chloride of iron. It is remarkable also that the alkaline base of Kálábágh alum is soda, while that of English alum is potash, and in some foreign alums, is ammonia.

Bituminous shale, yielding more or less alum, is abundant all through the Salt range, for although the manufacture is confined to the two places—Kálábágh on the river bank, and Kutkí in the Trans-Indus portion of the Salt range, there called the Chichalli hills—it is exported to all parts of the Punjab and Hindústán, being shipped from 'Isakhail to the southern districts of Dera Ismail Khán and Dera Ghází Khán.

At Kálábágh the principal place of working is at Chátah, where the shale strata, called "rol," are nearly 200 feet thick. Shafts for excavation of the shale are sunk, some of them have been measured, and one was found by Dr. Fleming in 1848, to extend 207 feet from the entrance. The shales are very soft, and often the roofs of the excavated portions give way, no precautions being taken to prop the roof when the underlying matter has been removed. The shales have been known spontaneously to take fire in the shafts; and Dr. Fleming relates that smoke was constantly issuing from one of these, which had taken fire five or six years previous to his visit in 1848. This is owing to the decomposition of iron pyrites, or sulphuret of iron, which abounds in crystalline nodules throughout the shale. The shale when dug out, is loaded on bullocks in the common blanket sacks everywhere in use. The road descends by a steep path to the bed of the Sind nullah, and thence to Kálábágh along the banks of the Indus. At the alum kilns of

Kálábágh the shale varies in value from 14 to 17 maunds per rupee. The red mound-like kilns form a striking feature at Kálábágh; the fumes from them are said to be very unwholesome, the population is sickly, and goitre very common, though it is not attributable with any certainty to this cause.

In making an alum kiln, layers of brushwood, generally "jhau" or "pilchi" (*Tamarix*), which abounds on the banks of the river, are spread on the ground; then a layer of alum shale is laid upon them, then more brushwood, and so on, till the pile reaches a very great height, from 20 to even 60 feet high; the half formed pile is lighted first, and the combustion moderated by sprinkling water if necessary; subsequently more layers of shale and brushwood are added till the whole reaches the height mentioned. A pile takes 6 or 8 months to burn, and by the time the operation is complete, the heaps have acquired a brick red color, due to peroxidated iron, and its surface is covered with an efflorescence of alum, containing a quantity of sulphate of iron—kahi or kasís.

The calcined shale is next lixiviated with water in large and somewhat shallow tanks of baked earth about 12 feet square and 18 inches deep. When the soluble matter of the shale is dissolved, the liquid is allowed to flow off by a hole (plugged up during the first process) into a similar tank at a lower level. In this the liquor deposits by subsidence its mud and impurities, and again is drawn off into a third vat, lower down still. It is then poured into iron evaporating pans, and mixed with a dirty looking salt, called "jamsan," from which it derives an alkali which converts it into the alum of commerce. "Jamsan" appears to be similar to the saline efflorescence of Reh lands, and consists of sulphate of soda with a little common salt, and a very little carbonate of soda. Jamsan is obtained at Kálábágh by evaporating a solution of the "kalr" soil, collected in the jungles east of the Indus, and specially at two villages—Gari and Tatti—up the south side of the Salt range, eight or nine miles from the river.

The quantity of the salt which is proper to be added, is judged from the appearance of the mother liquor. When the mixture has settled, the alum solution appears as a clear brown fluid, which is drawn off to evaporate in vats under a shed. In these, as evaporation proceeds, the alum is formed in crystals of a pink color, the color being derived probably from the salts of iron contained in the liquid. When the crystals have formed in considerable quantities, they are removed and washed slightly with cold water on strainers of "sírki" grass and left to dry; after which they are heated to fusion in iron pans, in which they liquefy by their own water of crystallization. This liquid is poured into earthen gharras or jars, and left to cool and crystallize; when the process is complete, any water that remains is poured out of the crystalline mass by boring a hole in its surface; the ghurra is then broken, and its contents broken into lumps, these form the alum of commerce. It appears that the inhabitants of Kálábágh have for many generations carried on this trade and manufacture, the process of which differs very little from the European.

At Kutkí, across the Indus, in the Chichalli range, there are opposition alum works. They are owned by a company of eight members, who are residents of 'Isakhail, and are of much more recent date than the Kálábágh works, which have gone on for eight or nine generations; the materials at Kutkí are obtained at a much cheaper rate.

At Kálábágh, the cost per diem of keeping one "karáh" or evaporating pan, including cost of shale and fuel, and the fees paid to the Malik of Kálábágh, is Rs. 10-4-6.

At Kutkí, the shale is cheaper and the fees are lower, there being only one for water-right payable to the Lumberdars of 'Isakhail; the cost is therefore only Rs. 8-10 per diem, a circumstance likely to affect the Kálábágh

monopoly. Some jealousy it is said exists between the new and old works.

At Kutkí, about 10,000 maunds are annually produced. At Kálábágh, about 12,000, during the 10 months of the year for which they are worked.

Kálábágh alum sells at Rs 3-4 a maund on the spot; Kutkí alum at Rs. 2-8; there is no difference in the quality, but the expense of making it at Kutkí is less.

392.—[905] Alum shale, from near Kálábágh, and found throughout the Salt range. Mr. Mathews. Shahpur.

393.—[906]. Alum extracted from it.

The shale contains alumina, silica, carbonaceous matter, and some sulphate of iron.

394.—[934]. Alum from Geandari hills. Municipal Committee. Dera Ghazi Khan.

395.—[935]. Another sample, by Imam Baksh Khan.

396.—[936]. Alum earth (shale), from the same.

397.—[955]. Black earth, "rol," used in the manufacture of alum. Bunnoo.

398.—[954-5]. Purified alum, from Kálábágh. Deputy Commissioner.

The value of this alum is about Rs. 10 a maund.

399.—[579]. Red alum, Kálábágh.

400.—[956]. White alum, Kálábágh. Peshawur.

401.—[630]. Alum, from Singháná. Probably from a shale containing sulphate of iron and alumina. Gurgaon.

402.—[298]. "Murbo" (Murabbah). This is a compound of alum with mica, used as a mordant for the yellow dye of nayálú (*see* Class IV., Sub-Class (C), *ad loc.*) Lahaul.

403.—[319]. "Pasút."

This is a compound of alum with some gray slate, in small fragments used in dying black.

SAJJI OR BARILLA.

This is an impure carbonate of soda, prepared by burning plants of the *Salsola* and other species, and collecting the ashes, which melt into a dark colored mass. "Sajji lota" is a somewhat purer kind, but still contains an immense amount of organic and other foreign matter, such as the sulphates of soda and lime, chloride of sodium and potassium, sulphide of sodium, sulpho-cyanide and ferro-cyanide of sodium, together with silica and clay.

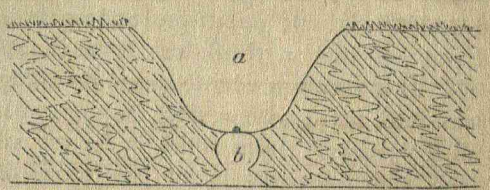
The principal places of production are—Gugaira, Sirsa and Jhung.

The following account of the manufacture of sajji has been received from Gugaira.

Sajji is produced from two different plants which grow spontaneously in brackish soil in the bar tracts of the Bari and Richnab Doabs, called "kangan khár" "láná gora," and "phisak láná," the last two yielding inferior, and first superior, sajji.

The "kangan khár" plant yields the best alkali. The pure sajji from this plant is called "lotá sajji," and the residue mixed with ashes is called "kangan khár sajji." The other two plants yield only a dirty and inferior substance known as "bhútní sajji," "devil's soda." This is black in color, and sold in pieces like lumps of ashes.

The process is as follows:—The shrubs ripen about October, and the process of making sajji is carried on throughout October, November, December and January. The first step is to cut down the plants with a wooden scythe called "*talwár*." They are then allowed to lie on the ground in heaps to dry. When perfectly inflammable, a pit in the ground is dug in



a hemispherical shape, about 6 feet in circumference and 3 deep, at the bottom of which one or more inverted "tinds," or earthen vessels, are buried, having small holes pierced in their upper portions; the holes are kept closed at the commencement of operations.

A fire is kindled and the dry plants placed in the

space (*a*) with the aid of a "sângi," or pitch fork, and the fire is kept fed with the dry plants till all is burned; during the process of burning a liquid substance is formed, which runs down into the "tind" below the fire. After all the liquid has run through with the "tind" the residue is stirred up with a stick called "mashad," which has a round flat piece of wood at the end, like a ladle, or with a "ghorla," *i. e.*, a piece of wood cut green from the tree to prevent its burning. Great care must be taken during the above process, that no water is allowed to be put on the fire, otherwise the whole mass would blow up and endanger the lives of those manufacturing it. After the residuary mass has been stirred in the manner described it is covered over with earth; it cools in 3 or 4 days but can be taken out when wanted.

The "*bhûtni*" sajji is made in the same manner as the above, but from the shrub called "phisak láná." When the earth is removed the substance is found in a solid rocky state, it is then broken out with a tool called "wadam," or wooden crow-bar. Then the "tinds" that are underneath are also removed, and being broken the contents are taken out.

The residuary mass in the pit is crude dirty potash, but that which is found inside the "tinds" is clean and free from ashes, &c., &c., it is called lota sajji, because found in the "tind" or "lota."

The proportion produced of kangan and bhútni sajji is four seers from a maund of the plant, or one tenth; and of the lota sajji, one seer in a maund, or $\frac{1}{40}$th part.

There is no rateable tax on sajji. The land producing the plants, is leased out in plots or according to Tahsil jurisdiction. The average of the last five years will be found below, the yield of each Tahsil is not shown. The quantity of sajji manufactured in the district is not large, the plants being exceedingly valued by contractors for feeding their camels.

Name of Tahsil.	Sum for which leased.
	rs.
Gugaira, ...	940
Hujra, ...	794
Pák Patan, ...	4,056
Syadwala, ...	..
Harrappa, ...	2,095
Total, 5 years, ..	7,885
Average, ..	1577·

The original price being 4 as., 5 as. is added for the Government rent and fees; a maund thus costs from 9 to 10 as., on the spot; but the market price is from Rs. 1 to 1-8 per maund. Lota sajji commands a much higher price, and sells at Rs. 8 a maund.

The expense attending the manufacture, viz., cutting, stacking, and lifting, is about 4 as., per maund.

The workmen who cut the plants get 2 as., a day, the burners take 3 as., and there is one man to superintend.

Lota sajji is principally used as a medicine, on account of its high price.

Kangan khár sajji is used in washing and dyeing with madder and kasumbha; it is used also for making soap, and also in the process of purifying sugar, and in paper making.

The castes principally employed in the manufacture of sajji are chúras, dhobis, núnáris, and a few aráras; but there is no necessary distinction or superstition on the point.

The following is an account of the manufacture in Sirsa.

Sajji, which is a preparation from a plant bearing the same name, is of three qualites.*

The first is called the "chúwa," the second "búthá," and the third "khára." All three qualities are produced at the same time, and by essentially the same process of manufacture.

The plant is cut during the months of October, November, December and January. When cut, it is allowed to dry for twenty days. The process of burning is just the same as that already described. Into the pit is thrown a small quantity of the plant, and burnt, fresh plants being gradually added to keep up a constant fire; and this is continued till the pit fills up. During this process a liquid matter exudes from the plant. As soon as this is observed the orifice of the ghurra is opened, and then the liquid matter and ashes are stirred up together. A long stick, very pointed at the end, is held in the opening of the ghurra, to prevent the sajji inside from being contaminated with ashes. The alkali found in the ghurra on cooling is called the chúwa, or first quality sajji; that which remains over the pot and under the ashes is the búthá, or second quality; and that on the surface of the pit, is the khára sajji, or third quality.

The plant comes into blossom about the month of September, and is burnt when in flower. It is *sup-*

* Memorandum by Captain E. Robinson, Superintendent of Bhutteeana, regarding the sajji plant, and the preparation of alkali therefrom.

posed that the liquid which forms the sajji of the first quality is the produce of the flowers.

The plant springs up spontaneously, and thrives best on a hard and clayey soil. The stems that have been cut away shoot out again in the rains, and by the cold season are again ready for cutting. They grow to a height of 10 inches.

The plant is peculiarly susceptible to the influence of the winter rains; and previous to manufacturing, if it is at all affected by the rains, the quality is generally deteriorated, and the yield from it is by no means remunerative.

Another precaution necessary, is to cut a sufficient quantity of plant; for, if during the burning process the supply should fail, and the fire be extinguished before the pit has filled, all the labor is lost.

The quantity of plant (when in its green state) required for one pit, is estimated at from 20 to 25 maunds.

Sajji is very extensively used in washing and dyeing cloth. It is also applied to injuries sustained by camels and horses, and I believe it is used to clarify sugar. The sajji of the first quality, or chúwa sajji, is of a light red color, and sells at the rate of Rs. 2 per maund. The second, or búthá sajji, is of a dark-grayish color, and sells at Rs. 1-8 per maund; the third quality, or khára sajji, is of a blackish color, and sells at Rs. 0-8-6 per maund.

The traffic in this article at times is very great, and large quantities are exported to Europe (?)

Mr. Edgeworth (then Commissioner of Múltán) gives the following account of the sajji plants.

"The sajji is exactly the barilla of commerce, a carbonate of soda. It is produced in Spain from a plant extremely similar to that from which it is made here. † The latter is termed in this division "khár," or in Persian "ash khar." The scientific name is, *Coronylon Griffithii*.

"A similar species is cultivated in Spain extensively: and as the price in England is from £9 to £12 per ton, I have little doubt that it could be most profitably cultivated in the bare wastes of clay, otherwise absolutely profitless, so extensive both in Bhutteana, Sirsa, and the Punjab.

"I have heard the plant producing the sajji called (by Europeans) "lahna," and I once made the same error myself; but the natives carefully distinguish between them, calling by the names of white, and red lahna and lahni, other *salsolaceous* plants, which are not used in the manufacture of sajji, though I have little doubt that with proper manipulation, they too, especially the lahni (*suæda molliflora*) would produce barilla.* There are many square miles densely covered with this last; whereas the khár is comparatively rare. Camels are ravenously fond of the latter, and the great difficulty in the "bar," or desert, is to keep the camels from destroying it. Large quantities are brought in green to the Múltán market for fodder."

404.—[581]. Crude soda, "skár," from Yusufzai. Local Committee.

Peshawur.

Used for soap making, &c. Value Rs. 3 per maund.

405.—[167]. Five specimens, showing the sajji in its various qualities. Local Exhibition Committee.

Sirsa.

Black sajji, chúwah sajji, sajji phúl, and two others, búthá and khára.

When the pit in which the sajji has been prepared is opened, on completion of the process there are no ashes or residue found, but the alkali appears like glass sparkling in masses. To every quarter seer of first-class sajji there is 1 seer of second quality, and 1½ of the third. Sajji is made at the following places:—At Tahsil Sirsa, village Shekhopúr, now called Sadowála, and Hásilpúr, 20 maunds; but now the "bangur" land is so much brought under cultivation that the spontaneous production of the sajji plant has much diminished.

		maunds.
Tahsil Sadowála, village Chutalla,	...	50
" " Motigarh,	...	75
" " Sujángarh,	...	75
" " Berangarh,	...	10
" " Marindwala,	...	100
" " Rajpura,	...	10
" " Gokháńwali,	...	20
" " Garhwáli,	...	5
Total,	...	375

In Tahsil Fazilka, it is made at Shankargarh, Abúhar, Azimgarh, Alámgarh, Dharmpúra, Pattiwalá, Kamálwálá, Túrwálá, Pajáwah, Gamjál, Kotligárh, Usmángarh, Giddránwálí, Ahmádpúr, Amrpúr,

† Barilla or Barillor. In various parts of Europe, especially in the Spanish seaports and at Teneriffe, a fine soda is manufactured by burning some varieties of plants which grow near the sea coast, especially the *salsola soda* and *salicornia herbacea*. The soda thus procured is called barilla, and still constitutes an important item in British trade. It is imported in hard porous masses of a speckled brown color.

* No doubt "láni" and "lána" are both used in making the *inferior* soda (bhútní sajji) in Gugaira and other places. —E. P.

Dotáránwálí, Senúgénú, Kúhiń, Faridkot, Bahádargárh, Hattípúr-suránwalí, Armúwálí, Mahmúdgarh, Bakshgarh, Kálábíta, Baháwalbáshí, Gúlábgarh, Pahlogarh, Haripúr, and Daulatpúr. The total produce of these villages is in the aggregate about 1,000 maunds.

Sajji of first quality sells at Rs. 3 per maund; do. of 2nd do. (bút'há chúwa), Rs. 1-8 per maund, do. of 3rd do., Rs. 0-12-0 per maund.

If there is an usually abundant produce, the rates come down to Rs. 2-8, Rs. 1-4 and 10 as., respectively. This year (1864) scarcely any has been made.

Gugaira. **406.**—[919]. Sajji, value 8 seers per rupee. (920). Kangan khár, value 23 seers per rupee. (921). Bútní, 34 seers per rupee.

Jhung. **407.**—[926]. Potash (properly soda.)

Shahpur. **408.**—[913]. Impure carbonate of soda, two samples, the sajji and sajji lota. DEPUTY COMMISSIONER.

This is manufactured in the "bar" of the tehsil Shahpúr, and also worked in the Salt range; the "sajji lota" is the purer, so called because collected pure during the burning in "lotas." Value, 1-8 per maund.

Sajji also is exhibited from Jálandhar (722); * also from Lahore as a medicinal substance; and from Dera Ghází Khán, (941).

NAUSHADAR.—SAL AMMONIAC.

This important salt (chloride of ammonium) which is met with in every bazar, is manufactured largely in the Kurnál district —Occasionally it is extracted from brick kilns in other districts, but in small quantities. It is used both medicinally and in the arts. The samples exhibited are numerous, but many are not produced in the district whence they are exhibited.

The production of naushádar in brick kilns is probably owing to the decomposition of watery vapours by the red hot bricks in presence of the nitrogen of the air and of common salt, which is purified by sublimation.

It is used as a freezing mixture with nitre and water, and in arts in tinning and soldering metals, and in the operation of forgeing the compound iron used for making gun barrels by native smiths.

It is met with in Europe in the vicinity of burning beds of coal in Scotland and England, and near the volcanos of Vesuvius, Etna, Solfaterra, &c.

Kurnal. **409.**—[154]. Large mass of naushádar, from Kaithal and Gúla. LOCAL COMMITTEE.

410.—[ ]. Glass vessel used in the manufacture.

Sal ammoniac or naushádar is, and has been, for ages, manufactured by the potters or kúmhárs of the Kaithal and Gúla tahsils of the Kurnál district:—chiefly in the Gúla tahsíl, and more than anywhere else at the village Gúmtallah.

The only village in which it is manufactured in the Kaithal tahsil is Mánus.

The amount of it manufactured annually in the district is estimated as follows:—

Place.	Quantity.	Value.
	MAUNDS.	RS.
Kaithal, ...	300	4,500
Gúla, ..	2,000	30,000

It is sold by the potters at 8 as. per maund to the mahájans, who export it to Bhawání, Delhi, Farakábád, Mirzapúr in the N. W. Provinces, and to Firozpúr and Amritsar in the Punjab, and who also sell it on an average at Rs. 15 per maund.

The salt is procured by submitting refuse matter to sublimation in closed vessels, in the manner described below, which is similar to the Egyptian method.

The process is as follows:—

From 15 to 20,000 bricks made of the dirty clay or mire to be found in certain ponds, are put all round the outside of each brick kiln, which is then heated. When the said bricks are half burnt, there exudes and adheres to them the substance from which naushádar is made; this matter is produced by

* No. 730, called sajji, from Jálandhar, is kahi, sulphate of iron.

GSL

the heat of the kiln in the hot weather in three days, in the cold weather in six, in the rains no naushádar is made. On the bricks producing this substance, which is of a grayish color and resembles the bark that grows on trees, they (the bricks) are removed from the kilns, and when cool this crust is removed with an iron scraper or other such instrument; the substance which is thus produced is of two sorts; the first kind which is most abundantly produced, and is inferior, is designated the mittí khám of naushádar, and the yield per kiln containing 15 to 20,000 bricks is about 20 or 30 maunds; it sells at 8 as. per maund; the superior kind which assumes the appearance of the bark of trees, is called "páprí," and the yield of it per kiln containing 15 to 20,000 bricks is not more than 1 or 2 maunds; it is sold at the rate of Rs. 2 or 2½ per maund. The mahájans who deal in naushádar buy both the sorts above described; but each sort requires special treatment to fit it for the market. The "khám mittí" is first passed through a sieve, and then dissolved in water and allowed to crystallize. This solution is repeated four times to clear away all impurities. When this has been accomplished, the pure substance that remains is boiled for nine hours; by this time the liquid has evaporated and the resulting salt has the appearance of raw sugar. The "páprí" is next taken and pounded finely, after which it is mixed with the first preparation, and the whole is put into a large glass vessel made expressly for the purpose. This vessel is globular or rather pear-shaped, and has a neck 2½ feet long and 9 inches round, which is closed at the mouth, or more properly speaking has no mouth.

The composition to be treated is inserted into this vessel, by breaking a hole in the body of the vessel, just at the lower end of the neck. This hole is eventually closed by placing a piece of glass over it. The whole vessel (which is thin black colored glass) is smeared over with seven successive coatings of clay.

The whole is then placed in a large earthen pan filled with naushádar refuse to keep it firm; the neck of the vessel is further enveloped in a glass cover and plastered with fourteen different coatings of clay to exclude all air, and the whole concern is then placed over a furnace kept lighted for three days and three nights, the cover being removed once every twelve hours in order to insert fresh naushádar in the form of raw sugar, to supply the place of what has been sublimed. After three days and three nights the vessel is taken off the furnace, and when cool, the neck of it is broken off, and the rest of the vessel becomes calcined. 10 or 12 seers, according to the size of the neck of the vessel containing the naushádar is then obtained therefrom, of a substance which is designated "phálí." This phálí is produced by the sublimation of the salt from the body of the vessel, and its condensation in the hollow neck. There are two kinds of "phálí;" the superior kind is that produced after the naushádar had been on the fire for only two days and two nights, in which case the neck is only partially filled with the substance, and the yield is but 5 or 6 seers, and sold at the rate of Rs. 16 per maund; the inferior kind is where the naushádar had been in the fire three days and three nights, and the neck of the vessel is completely filled with phálí, when it yields 10 or 12 seers, and the salt is sold at Rs. 13 per maund.

That portion of the sublimed naushádar which is formed in the mouth and not in the neck of the vessel, is distinctively called "phúl," and not phálí; it is used in the preparation of "surma," and is esteemed of great value, selling at Rs 40 per maund.

Each furnace is ordinarily of a size to heat at once seven of these large glass vessels containing naushádar.

The villages in which naushádar is manufactured are as follows:—

Tahsil.	Village.	Number of furnaces for manufacture of naushadar.
Kaithal,	Mánus, ...	4
Gúla,	Gúmtullah, ..	15
„	Kurrah, ...	1
„	Siyána Saíndań, ..	3
„	Barna, ...	2
„	Bindrana, ...	2

411.—[605]. Sal ammoniac, from Yarkand. H. H. The Maharaja. — Kashmir.

412.—[628]. Sal ammoniac, from Gurgaon. Firozpúr. Deputy Commissioner.

Sal ammoniac is also exhibited from Ludhiana (No. 708), Jálandhar (727 and 735), Amritsar (745), Lahore (854), where it is exhibited as a mineral medicine; also from Gujranwalla (No. 894), and Dera Ghází Khán.

BORAX.

This is a biborate of soda ($N_2O\ 2BO_3 + 10\ HO$) called sohága, or "tinkál;" it is ob-

tained in Thibet and in the Pugá valley, in Ladákh.

There it is collected in an impure state on the borders of certain lakes, as they dry up, depositing the salt. The material is smeared with fat to prevent loss by evaporation, and is thus transported across the Himálaya, on the backs of sheep and goats, to the plains, where it is refined by boiling in lime water and evaporating.

It is used in medicine; in the arts, as a glaze for pottery, as also by jewellers to clean gold, silver, &c. A sample of borax has been sent to England. It cost at Kangra, from whence it was sent, Rs. 4 per maund = Rs. 113-2-10 per ton; it was sold at Dundee for £35, say Rs. 350 per ton.

The borax is found at an uninhabited spot, named Pugá, on the Rulangchu, a small stream which is full of hot springs, and which joins the Indus on its left bank, some miles above Lé. Pugá stands in north latitude 33° 12′ and east latitude 78° 16′, at an elevation of 15,264 feet above the sea. The borax is ejected in the bed of the stream by the numerous hot springs at various temperatures, from 80° and upwards.

The borax of Monte Cerboli, in Tuscany, is found also in connection with hot springs, and with sulphur in the immediate neighbourhood. The Pugá hot springs range from 80 to 150°, and there is a sulphur mine on the banks of the stream, and numbers of coarse garnets are found there.

The commercial importance of borax may be inferred from the fact that in England in 1855, a committee of leading men in the pottery and porcelain manufacturing business, forwarded an address to Lord Dalhousie, praying for information as to the possibility of importing borax from the Himálayas and pointing out how essential was borax as a material in the processes of pottery glazing, and how limited it was in the localities of its production.

The following extract will explain the objects of the address, and the necessities that led to it.

The Committee represented as follows:

"6*th*. That boracic acid, is now only obtained from certain springs at the Lagoons in Tuscany, which are under the control of a single proprietor, who has therefore the monopoly of the article.

"7*th*. That about 1,100 tons of boracic acid are annually imported from Tuscany into England, and are there manufactured into borax, of which about two-thirds are consumed in the Staffordshire potteries.

"8*th*. That the supplies of tincal from India appear within the last few years to have varied from 300 to 600 tons, per annum.

"9*th*. That the present price of borax is about £92 per ton, to which it has been raised (under the operation of the existing monopoly), from £50 within the last five years.

"10*th*. That the excessive price materially limits the consumption, and if the article could be purchased at about £60 per ton, there is no doubt the consumption would be doubled.

"11*th*. That an increase in the consumption of borax would greatly diminish the use of lead and other substances, which are very injurious to the workmen.

"12*th*. That since the recent rise in the price of borax, the medical men in the district have observed a great increase in cases of paralysis and other diseases, usually attendant upon the use of lead (which is substituted for it).

"14*th*. That assuming the freight from Calcutta or Bombay to England, to be £4 per ton, the tincal of India might (in the present state of the market) be brought into competition with the boracic acid from Tuscany, even if the former should cost £70 per ton at the port of shipment, although at such a price there is not likely to be a great increase of demand.

"15*th*. That if, however, tincal could be obtained at Calcutta or Bombay, at about £45 per ton, a ready sale could be found, and a handsome profit realized in this country for a much larger quantity than has hitherto been imported."

The subject had been taken up with much interest by Capt. Hay and others, and it was after communication with them that this address was forwarded.

A very good idea of the locality of production will be gained from the following account, compiled from the correspondence of Messrs. Barnes, Edgeworth, and Hay. In 1854, Capt. Hay wrote as follows:*—

* Letter of Capt. W. C. Hay, Assistant Commissioner of Kangra, to D. F. McLeod, Esq., Commissioner, Trans-Sutlej States. Kangra, 13th March, 1854.

MINISTRY OF CULTURE · GOVERNMENT OF INDIA

"4. I have visited Pugá, in the territory of H. H. Maharaja Goolab Sing. It is a small valley, which may roughly be calculated at two miles in length, and three-quarter mile in breadth; (*i. e.*, the portion from whence the sohaga or tincal is collected;) it extends east and west, and has a fine stream running through it into the river Indus, but the portion producing the borate of soda, is, if not watered by, still under the influence of thermal springs, varying in four places, where I took the temperature, from 130, 140, 150, to 167 degrees, the temperature of the streams into which these empty, being in July, 56 degrees.

"6. The valley, producing this sohaga, is now farmed, but I cannot ascertain precisely at how much, it being probably an object with the Gatpo, or headman of the Rupchoo population, consisting of about 400 people, to hide from the Tehseeldar of Lé, who collects the revenue, what it really is worth. In 1850, the price paid for the tincal in barter was usually sixteen "háths" of course "lungi" cloth, said there to be valued at one rupee, for which they procured three kucha maunds of the sohága, equal to about one pucka maund of forty seers. I then ascertained, however, that for a company's silver rupee, 10 kucha maunds (equal to 4 pucka or standard maunds of 80 lbs.,) would be given.

"7. Within the last two years it has increased in price, in consequence of the greater demand, and its present price, I am informed by some of the principal carriers and traders, is three sheep loads for one rupee, which is equal to eighteen buttees, or about two maunds and two buttees of kucha weight (about 72 lbs).

"9. Immediately after Kúlú became a British possession, an Armenian merchant (Mr. Arratoon), I remember, informed Mr. Erskine, the then Superintendent of Hill States, that he had sent all the sohaga he could procure to Bombay, where he reaped on sale, a clear profit of 200 per cent.; he remarked, however, that it was in such small quantity, that unless he could obtain several thousand maunds, it would not be worth his while to engage in the trade.

"Remembering this when I reached the spot, I ascertained, as nearly as I could, that the entire produce of the valley might be roughly calculated at 20,000 kucha maunds, (a kucha maund is equal to about 32 lbs.) the greater portion of which found its way to Rampúr in Bishahr; some to Kúlú *viâ* Mandi to the lower hills, and a small quantitiy *viâ* Chamba to Núrpúr. Nearly all that going *viâ* Rampúr is taken into the lower hills in the neighbourhood of Sabáthu, Bhají, &c., where wood is procurable, and where, during winter, it is refined by the carriers who go there to graze their flocks. It thus becomes borax, in which state it nearly all finds its way to Jagádri* in the plains, and thence I presume, goes down the river Jumna or Ganges. It is probable that little, if any, finds its way to England.

"Pugá is not, however, the only place where the sohaga is produced; there is another locality near Rodok, yielding it, from which the route to the plains is *viâ* the Nite pass; this borax is said to be of a very superior quality, nearly pure, and requiring little or no cleaning, but it is produced from a portion of Thibet in Changthán, subject to China; doubtless, other localities exist if the jealousy of the factors could be overcome, and enable us to explore. Nearly all the Trans-Himálaya lakes seem to contain salts of various description, well worthy of chemical analysis; to this I shall advert in a future paragraph.

"The transport of this tincal is almost entirely effected on goats and sheep, being the animals at present best adapted to the mountainous path-ways. The trade being to a certain extent precarious, the profits the merchants demand to protect themselves from loss, would at a first view, appear large; when, however, the severity of the climate which they have to encounter, and the losses from snow falling over precipices, &c., are taken into consideration, it is not so exorbitant.

"The price of three sheep loads at Pugá, I have stated to be one rupee; the average journey of a laden sheep being about a kos per diem, it takes nearly one month to reach Kúlú from Pugá, where the same sells for eight rupees, and if cleaned as borax, it sells at Sultánpúr (Kúlú) at five rupees the kucha maund; and if taken to the lower hills at Kudli, Sisova, and Teki, at six rupees the kucha maund. After it is purchased by the Jagádri merchants, I cannot say what expenses attend it, but the difficulties are over, and the prices here quoted clearly show the immense risk that is run on the first month's journey, compared to the second from Sultanpúr to the lower hills, which occupies upwards of a fortnight and sometimes a month, as the sheep get out of condition, and are soon tired after the long journey.

"At present the people depend entirely upon falls of snow, as rain never falls in those regions, and they suppose that snow is necessary to produce the sohaga, which probably might be equally well produced by flooding. The time, I am informed, required for its reproduction is only ten or twelve days; but the sun in July and August is so very powerful, that probably a succession of evaporations might be caused; this would form ground for a chemical report."

* At Jagadri the process of refining is extensively carried on.

The borax does not effloresce on the upper surface of the soil as has been sometimes stated. The upper efflorescence consists principally of a sesqui-carbonate and sulphate of soda, with more or less chloride of sodium. Under this is the borax, which appears as a greasy substance of a greenish yellow color; CAPTAIN HAY remarks that, as there is a deposit of sulphur also found in the same locality, boracic acid might be obtained pure on the spot. The borax occurs in a confused crystalline form, and varies in color, from the greenish yellow above mentioned to dirty white or gray. The natives are remarked by MR. MARCADIEU, to be extremely skilful in digging out the borax, which they divide into three qualities. The third is worthless, and is always left till it turns into the good sort, which it does in a few days. The persons who work the borax, use a piece of wood like a spoon or spatula, with this they scratch away the superficial efflorescence, and dig out the more valuable material below. The qualities of borax, are distinguished by the degree of hardness and weight they possess: one man can collect 80 pounds (one maund) in a day. MR. MARCADIEU* gives the percentage of pure borax in the crude material as from 76 to 85 per cent. in one set of samples, and from 68 to 80 per cent. in another set; both of the first quality: the chloride of sodium varied from 4 to 5 per cent., and sulphate of soda from a mere trace to 3 and 6 per cent. In the second quality of borax the pure material was from 50 to 72 per cent. Chloride of sodium from 5 to 6, and sulphate of soda and lime, from 10 to 20 per cent. The second quality of borax is in a powdery form. MR. MARCADIEU says, that the first two qualities are usually mixed together, giving the general per centage of borax at 70 to 72 per cent. The third quality is so impure that it is not worth taking away till it has lost its impurities and soluble salts. This purification appears to be effected naturally when a shower of rain falls (which is rather a rare occurrence). The rain water takes up the more readily soluble salts, and sinks into the earth, as soon as the sun comes out the soil dries up, the sulphate and chloride effloresce as a dry white powder, and the borax which is not efflorescent is collected below. There can be no doubt that the elements of these salts exist in the soil, and when rain falls, a catalytic action is set up by aid of the water, resulting in the formation of the sulphates, &c., which effloresce, and the borax which does not. The traders can collect borax from places previously exhausted, or where it was inferior, in about ten or twelve days after the rain (or snow) ceases. The deposit of borax never exceeds two or three inches in thickness, and is succeeded by a lower deposit of inferior material. All traders who come, have a right to collect borax on payment of a fee. The borax is carried away in woollen bags, containing each from twenty-five to thirty pounds; three sacks are supposed equal to a maund, and the Gatpo takes one rupee in coin or in goods for every such triad; scales and weights are not in use.

LORD HAY, Deputy Commissioner of Simla, states, that two kinds of borax are traded in—one, the *tchalleh* of the Thibetans (the sohaga of the plain dialects), which is white and comparatively pure; the other kind, which is in hard earthly lumps, is called *tshoochal* by the Thibetans, and "teliya" in the plains. LORD HAY gives the duty charged at Púgá as eight annas per twenty seers, which is different from MR. MARCADIEU'S statement. The following paragraphs are quoted from LORD HAY'S letter to MR. BARNES, Commissioner of the Cis-Sutlej, in March, 1854.

"The people who engage in the sohaga trade are chiefly Kanáwaris and Khampos (a class of wandering traders) of Lahaul, Thibet and Spiti. In the summer months they resort to the Pugá mines and other places, to which the sohaga found in Tartary is brought, and return in the autumn before the passes are closed to the lower hills, where they remain during the winter pasturing their flocks, refining their sohaga, effecting sales of it to the Simla merchants, and making purchases of miscellaneous goods to take back with them in the ensuing summer.

"The refining process is exceedingly simple and consists of dissolving the crude borax in two parts of hot, or ten parts of cold, water, and then allowing it to crystallize. The tschoochal sohaga is similarly refined, the stones which contain it being first broken up. Formerly it was the custom to cover over the crude borax with ghee to prevent efflorescence;* this practice has been, I believe, discontinued of late years.

"The tschalleh sohaga loses one-fifth, and the tschoochal one-half in weight, in the course of purification. Sohaga is also refined, and generally with much more care, at Jagádri, a large mercantile town between Ambálla and Saharunpúr; the price in Chang Tang is one rupee for sixty-four seers; in Ladákh, it is one rupee for thirty two seers; in the bazars of the lower hills it is usually sold in its impure state at sixteen seers per rupee."†

* The statements of this writer should be received with caution: his paper on Borax, in the Punjab Selections, No XII. is full of absurdities.

* More properly speaking, evaporation or deliquescence in damp weather.

† In the plains the price is often from £55 to £60 per ton. MR. BARNES to MELVILLE, Secretary to the Chief Commissioner, March, 1854.

"To Rampúr and Sultanpúr, about 2,500 maunds, or ninety tons are annually brought. Last year it sold at Simla for nine rupees a maund, or £25 a ton, and at Jagádri it is now selling for twelve rupees, or £37 a ton.

"The trade of borax with Kúlú is almost entirely confined to the merchants of Jagádri. I am informed that they had only a few day's ago, a stock on hand of 2,000 maunds at Jagádri, which they could not find a ready sale for, the sales effected there this season being at Rs. 9-4-0 the pucka maund.*

"The borax is purified in Kúlú before it is forwarded to Jagádri, but there it undergoes another refinement before is is sent on to Furruckabad or Mirzapúr, and eventually to Calcutta, though I have reason to believe, that very little gets so far.

"In consequence of the imports into Kúlú from above being greater than the imports from the plains, carriage to the latter is very scarce, and although a mule brings four maunds of goods to Sultanpúr from Jagádri for Rs. 6-4-0, a mule carrying the same weight from Sultanpúr to Jagádri, receives from ten to twelve, or at the rate of from Rs. 2-8-0 to 3 the pucka maund.

"From Jagádri to Furruckabad it is taken on hackeries, twenty-five maunds on each: for the hire of which, Rs. 50 are paid, and from thence by water; the price of boat hire varying considerably. These statistics, however, would be a guide to any European merchant wishing to engage in the trade."

"To give an idea of the increase in the borax trade with India, during the last few years, it is only necessary to mention, that while in the years 1846-47, when the price was Rs. 9 a maund only, 1,731 maunds were exported from Calcutta; during the last six months of 1854, the large amount of 10,896 maunds, at Rs. 22 per maund, have been shipped for Europe."†

The following account of the process of purifying sohaga has been received from Jagádri:—

The borax comes from Ladákh, *viâ* Kúlú, Rampúr of Bishahr, and Simla, on the backs of sheep and goats, thence it is brought by ponies and mules to Jagádri and other places, where it is refined. In its crude state it sells at the place of production from Rs. 1-2 to 1-4 per maund, but by the time it reaches the cities of the plains, the cost is Rs. 4 to 4-8 per maund. It is purified by the following process:—

One maund of borax is mixed with double its weight of water, and placed in an iron caldron over a fire, and is there boiled for two or two and a half hours; when the whole is boiled down to a fourth of its bulk, it is removed from the fire, and poured into earthen jars (sabúcha); after three days the impurities settle to the bottom, and the borax crystallizes above; the water is then poured off, and the borax separated from the impurities and dried. About 1,200 maunds are in this way annually purified, and value at about Rs. 10 per pucka maund. One manufactory or shop will purify four maunds per diem. If the crude sohaga be of good quality, four-fifths of the salt is obtained pure; and if of only moderate quality, half is pure borax and half earth and impurities; while if the raw material be inferior, three-fifths of the whole consists of impurities. The principal market is Fírozpúr, and by thence it is taken to Bombay, and in small quantities to other cities, for local consumption. The principal borax factors are —Tulsi Rám, Hardwarimull, Kánakewal and Kashmírí. It is sold in packets of 10 or 12 seers each.

413.—[285]. Borax. From Ruthog, Pugá and Chángthán. TARA CHAND.

There are two kinds of borax in this sample—one called "chú tsalé," or "water borax," which is the best: it is found at the lakes of Ruthog.

The second requires preparation; it comes from Pugá and Chángthán, and is called "tsalé mentog." Borax flowers, of the first quality, 1 kucha maund, value Rs. 3; of the second Rs. 2½.

414.—[619]. Borax, from Srínagar.

This salt is also exhibited from Jagádri in Ambálah district [705], from Bishahr in Simla district [703]. While samples are sent from the bazars of Jálandhar, Lahore, Amritsar, and Pattiala, Nos. 733, 742, 852.

The refinement of the crude sohaga is also carried on at Amritsar.

BORATE OF LIME.

415.—[433]. Borate of lime. DR. T. E. B. BROWN, Chemical Examiner.

This salt was first made in India by Dr. O'Shaugnessy, who recommended it as a useful glaze for earthenware.

Having occasion to make a quantity of ammonia for distribution to the districts, there remained a considerable amount of solution of chloride of calcium, as this was not required in itself, it was determined to make borate of lime from it, which was easily done by adding common borax or sohaga.

Borate of lime can also be made by adding borax

* Extract from the letter of CAPTAIN W. E. HAY, Assistant Commissioner in Kúlú, to R. TEMPLE ESQ., Secy. to the Chief Commissioner, Punjab, dated Nugur in Kúlú, 29th November. 1854.

† Letter from MR. EDGEWORTH, to P. S. MELVILLE, ESQ., Secy. Chief Commissioner, Punjab, 3rd February, 1854.

to the nitrate, or any other very soluble salt of lime.

NITRATE OF LIME.

416.—[875]. Nitrate of lime. Dr. T. E. B. Brown, Chemical Examiner.

This is prepared by distilling shora or saltpetre with kahi safed, and neutralizing the acid liquor that passes over with chunam. It is recommended as a manure for lands abounding in salts, mostly sulphates, which need some agent to convert the sulphates which are injurious to crops into nitrates, which are beneficial, or at least harmless.*

This salt has been suggested as a probable remedy for the reh or saline efflorescence, which is so frequent in the Punjab.

The natives, in some parts, have long been accustomed to employ "chikna kullur," or earth which looks damp; this earth is found where animal remains are deposited, and usually contains nitrate of lime.

The reh is composed principally of sulphate of soda and chloride of sodium, with, in some places, carbonate of soda: the sulphate and carbonate of soda are very efflorescent salts, and melt partly in their water of crystallization at a temperature of about 98°, while they are rather sparingly soluble when the temperature falls below 60°. Hence, during the hot weather the reh melts and percolates the ground to some considerable depth; but as the weather becomes cooler, crystals form in this soil and form a capillary network, up which the solution travels till it arrives at the surface, where the salt gives off its water of crystallization, and falls into a dry powder by efflorescence. If to a solution of these salts, nitrate of lime is added, no change is produced by it on the chloride of sodium, but the sulphate and carbonate of soda are converted into nitrate of soda, a deliquescing salt, while the lime is changed either into the insoluble carbonate of lime or the sparingly soluble sulphate of lime, neither of which are efflorescent, or in any way injurious to vegetation.

* For an account of "reh" lands, see further on, Division V. Sub-class (C). Soils.

Division IV.—Chemico-Pharmaceutical Substances.

SUB-CLASS (A). MEDICINAL SUBSTANCES, INCLUDING MINERAL WATERS.

MANY of the earths, salts, and metallic substances used in both Native and European medicine, are also used in various arts and manufactures, such are the salts, barilla, borax. "kasís," sulphate of copper, and other substances enumerated in the preceding division. It is, however, impossible to exclude them from notice in this class; to eliminate them altogether would be to render the present division a very imperfect representation of a native mineral drug series, while, in point of fact, the actual collection exhibited was almost exhaustive, and left out no drug in use; except perhaps, some compounded mineral medicines, held sacred in the arcana of the hakeems. All such substances will, therefore, receive a passing notice in this division with special reference to their therapeutic qualities, real or supposed; information concerning their manufacture, nature, and peculiarities being found in the class to which they primarily belong. The collection of mineral drugs exhibits what the native practitioners designate as such,—although many of them are now well known to be inert or useless. In not a few instances several substances having different names and forms are considered as distinct medicines, and separately prescribed by native practitioners, although there is no chemical difference in their composition (for instance, the various forms of carbonate of lime); and, consequently, no difference in their therapeutic operation, when the substances happen to have any at all. The report of the jury contains a list of those mineral drugs exhibited, which find places in the British Pharmacopœia, but it does not embrace a fifth part of the actual collection, showing what an immense number are either inert, or else the same substances under changed forms. The tendency of modern therapeutic science is ever to reduce the number of substances in the pharmacopœia, and that notwithstanding the frequent discovery of new agents. The time when many of the native medicines here exhibited found a place in European practice, is within the memory of many persons living; and such experience it is hoped will not be without its effect in enlightening native practitioners as to the real nature of the substances they deal with—teaching them to discontinue the useless ones, which are often not merely useless, but also sources of fruitless expenditure; since we must recollect that they are in many cases imported from distant places, procured with infinite trouble, and sold at high prices, while all the time there is really no healing virtue in them.

SULPHUR.

417.—Gandak or kibrit, "áñwlásár."

Nos. 716, 717, 734, 746, 867, 878, 895, 907, 908, 928, 961-3; have previously received notice in Division II. Sub-class (A.)

Its action is as an alterative and diaphoretic, and a laxative in large doses. It is principally used externally in various forms of skin disease. In native medicine it is often exhibited in the form of "áñwlásár," which is simply *vitrous* sulphur, so called from its resemblance to the translucent fruit of the áñwlá (*emblica officinales*).

Silica.

Silica occurs in native medicines in several forms. In European medicine, it is not used except mechanically to induce the combination of essential oils with water.

418.—[819]. Rock crystal, "bilaur," Lahore bazar. RAM SINGH, Pansári.

419.—[820]. Carnelian, "sang-i-ákík." Do.

420.—[823]. Agate, "sang-i-sulaimán." Do.

This name is given to the onyx also. The stone is not administered in medicine in any form, but is supposed to have the effect when worn, of keeping people at a distance from the wearer, so as to induce solitude (!)

421.—[825]. Flint, "chakmak." Do.

422.—[827]. "Sang-i-asshar."

Supposed to be a form of silica.

423.—[828]. "Sangi assyum," millstone grit. RAM SINGH.

424.—[879]. Sand, "ret."

River sand, not used internally, but applied as a heating agent in cholic, &c., &c.

425.—[821]. "Yashb," plasma or green silica.

The constituents of this mineral are silica, alumina and iron.

Acids.

426.—Sulphuric, nitric, impure nitric, and hydrochloric, "tezáb gandak," "tezáb shora," "tezáb shora wa kahi," "tezáb nimak" (*see* page 61).

These acids are employed in medicine—the sulphuric in small quantities as a tonic; the nitric acid as a caustic, as is also the hydrochloric occasionally.

Sal ammoniac.

427.—Naushádar. Exhibited as a medicine from Lahore, Ludhiana, Jálandhar, and Amritsar (*see* page 89).

This salt is a chloride of ammonium, is valuable in the formation of freezing mixtures, and is used in the manufacture of liquid ammonia. It is rarely employed internally, but is said to be useful in chronic inflammation of the liver and spleen, and in facial neuralgia, especially when of a rheumatic nature.

Carbonate of Potash.

428.—[122]. "Jau khár." Rewárí, Gurgaon. DEPUTY COMMISSIONER.

To make jau khár, growing green barley is cut and burnt, its ashes are mixed with water; if time is an object, the solution is evaporated over a fire, otherwise the mixture is allowed to stand for some days, the sediment settles, and the clean liquid is poured off; the residuum of evaporation is jau khár.

Nitrate of Potash—Saltpetre—Shora.

429.—Nos. 699, 702, 704, 709, 725, 729' 757, 853, 899, 900, 912, 918, 927, 928, 930, 931, &c.

Is exhibited under the forms of a nitrous earth, crude nitre, and crystallized nitre, "shora kalmi." In medicine it is a refrigerant saline, diuretic and antiphlogistic (*see* page 79, *et seq.*)

Carbonate of Soda—Barilla—"Sajji."

430.—Nos. 722, 755, 736, 836, 858, 866, 913, 919, 920, 926, 941.

Exhibited as the black sajji, impure; and the "sajji lota," a superior quality (*see* page 86, *et seq.*). Beside carbonate of soda, sajji contains sulphate of soda and lime, chloride of sodium and potassium, sulpho-cyanide and ferro-cyanide of sodium, silica, organic matter and clay.

431.—[605]. "Phúlí," a salt of soda. Ladákh. H. H. THE MAHARAJA OF KASHMIR.

This is used to bring out the strength and flavor of tea in infusing it. It contains a little sulphate of soda, much carbonate, and some common salt; its solution acts with ammonia, and precipitates. Value, Rs. 12 per seer.

Alum.

432.—Nos. 636, 934, 935, 954, 955, and 906, exhibited native alums, manufactured in the localities from which they are sent.

The others, Nos. 719, 728, 753, 855, 857, and 956, were bazar alum, exhibited as drugs (*see* page 84).

In medicine alum is an astringent.

Borax—Biborate of Soda—Sohaga.

433.—Nos. 705, 713, 733, 742, 852, and from Pattiála and Simla, without any number (*see* page 90).

It is employed by natives as a tonic for loss of appetite, also as a deobstruent and diuretic in ascitis, also in cases of cholic and ulcerations of the mouth. It is given to young children to promote articulation, and is considered a very valuable medicine. It is employed in European medicine as an alterative in aphtha, as an emmenagogue. Its value as purified borax, is As. 8 a seer. It is used by jewellers to clean gold, also as a flux in soldering, and in making imitation gems.

Sulphate of Soda.

434.—[ ]. Efflorescence of sulphate of soda. Muzaffargarh. Dr. Cookson.

It consists principally of sulphate of soda, and a little chloride of sodium; most of the white efflorescence observed on the beds or paths of gardens and fields, and in "Reh" lands is sulphate of soda.

Chloride of Sodium.—Common Salt.

435.—[851]. Nimak safaid. Ram Singh, Pansári.

436.—[859]. Nimak "gumán" (*see* page 77, No. 369).

437.—[861]. Nimak shísha.

White crystal salt, of which splendid specimens occur in the Shahpúr collection (*see* page 69).

438.—[862]. "Nimak nali."

Salt fused into long pipes, whence its name, "nali."

439.—[863]. Nimak sámbar, from Hissar.

This is an evaporated salt of an extremely pungent taste (*see* page 79).

440.—[877]. Nimak kalri. Lahore, (*see* page 81).

441.—[864]. "Sindá" salt.

A white salt from Sindh (?)

442.—[876]. "Nimak manyárí," is the same as the next, being obtained in the process of glass-making; also exhibited (No. 121) from Bhúnsi of Gurgaon. Deputy Commissioner, Gurgaon.

443.—[877]. "Kachlún," (*i. e.*, the salt of kach or glass).

These last two are the dross or scum of the glass furnace, but they contain a large proportion of common salt mixed with some silica and lime.

Salt acts as a saline refrigerant in small doses; as an emetic and purgative in moderate doses; and as an irritant poison in larger doses.

"Kála nimak," "nimak siya," "kálalún," a dark colored salt, said to be made by dissolving common salt in a solution of "sajji matti" (crude soda), and evaporating it; this salt contains chloride of sodium, sulphate of soda, caustic soda and a little sulphate of sodium, but no carbonate of soda.

444.—[120]. Kálá nimak. Firozpúr. Gurgaon. Deputy Commissioner.

445.—[700]. Black salt, from Bhawání, Hissar. Local Committee.

The black salt is made as follows:—Ingredients, one maund of sámbar or Díndwa salt, ¼ seer; "baherah" (the fruit of *Terminalia belerica*), ¼ seer; "har," (the fruit of *Terminalia chebula*), ¼ seer; aoúla (*Emblica officinalis*), ¼ seer; black sajji (impure carbonate of soda): all these are put into an earthen pot over a fire and kept there till scorched; when about 35 out of 41 seers remain, the pot is taken off and the black salt is made. About two maunds of wood are used. The price is now in Bhawání, Rs. 3 per maund. It is used only as medicine, and is exported to the N. W. Provinces and the Punjab. No tax is levied at Bhawání, but it pays duty as salt when taken across the custom's line.

446.—[707]. Black salt, from Jagádri. Ambálla. Local Committee.

447.—[731]. Sample from Jálandhar. Local Exhibition Committee.

Similar sample from Lahore [850].

448.—[760]. Nimak soñchal. Lahore. Ram Singh.

A salt of the same kind as kala nimak.

449.—[893]. Black salt. Gujranwalla.

Which is erroneously described in the original Catalogue as a sulphate of ammonia; and in the vernacular list as "shora ka kism;" the sample is nimak soñchal, or black salt.

450.—[755]. Black salt. Amritsar.

Called in the Catalogue sajji mámúlí, black soda.

Lime—Chuna.

451.— Nos. 723, 902, 1381, and many

others. (*See* page 39, Division II., Sub-class (C). Building Materials, &c.)

Sulphate of Lime.

452.—Represented in the collection under a variety of names—"sang-i-jarahat," "godanti;" "sang-i-makol" of Lahore druggists, "surma safaid" (897) of Rawalpindi and Jhilam.

The substance has been noticed in Division II., Sub-class (C), as used in Arts and in Building, for Plasters, Gypsums, &c.

Carbonate of Lime.

This is one of those substances which exist under a variety of forms, and illustrate the the statement that a large number of the native mineral drugs do not differ from one another in chemical properties, and therefore not in therapeutic properties.

Carbonate of lime is used in European medicine in a form of chalk, as a desiccant and astringent in opthalmia, gonorrhœa, and other fluxes.

453.—[833]. Sang-i-marmar, white marble. Lahore bazar. RAM SINGH, Pansári.

454.—[836]. Bekh-i-marján, fragments of red coral. RAM SINGH, Pansári.

Supposed by natives to be a tonic, and taken ground into powder; oftener in a compound form.

455.—[843]. "Surma safaid," calcareous or Iceland spar.

This has been given by natives the name of "white antimony," probably from its rhombohedral fracture, something resembling that of the galena, which is usually mistaken for surma or antimony. Natives use it also for the eyes just as they do sulphide of antimony; it is needless to add, that beyond the name the substances have no affinity whatever. It is found in the rocks at Kabul, and in several parts of the Himálaya. Dose about 7 grains in powder.

The surma safaid, Nos. 929, 902, 897, from the Dera Ghází Khán, Rawalpindi and Jhilam districts, are *sulphate of lime*.

456.—[844]. Karya mitti, chalk. Lahore bazar.

Consists of either of white earth, or whiteing, or imported chalk.

457.—[846]. Sang-yahúdi, "Jew's stone," a fossil encrinite.

458.—[837]. Sang-i-khurús, a fossil encrinite.

459.—[845]. Sang-i-irmali, a fossil.

460.—[959]. Hajr-ul-yahúdi, encrinite. Peshawur. Price Rs. 10 per maund. LOCAL COMMITTEE.

461.—[885]. Sang-i-sarmahi, small fossil shells.

Small hard whitish-gray oval shaped shells.

462.—[847]. "Sang-i-shádnaj, fossil nummulite.

463.—[933]. "Sangcha," nummulites, from Mazárí hills. Dera Ghází Khán. IMAM BAKSH KHAN.

They are priced at 32 seers per rupee, and are said to be picked up in these hills by the druggists; it is not improbable that sangcha, meaning "small stone," is not a local name, but only a description given by some native who did not know the name shádnaj.

These fossils have no other virtue than what they derive from being carbonate of lime; but natives on the strength of their doctrine of similitudes, administer them on account of their resemblance to the products of disease.

464.—[881]. Tabákhir. Lahore.

This must not be comfounded with *tabáshir*, the silex from bamboos, from which it is quite distinct.

Carbonate of magnesia.

465.—[822]. Pábúd (?)

Is said to be an impure carbonate of magnesia.

(The sample was not found by the jury in the collection, nor is the name known to the ordinary druggists.)

Hydrated Oxide of Magnesium.

466.—[826]. Zahr mohra. Lahore bazar. RAM SINGH.

467.—[887]. Zahr mohra khatai. (*i. e.*, Chinese zahr mohra).

This last is considered of great efficacy by natives, who patiently grind it down with water and drink the fluid.

These substances consist of hydrated oxide of magnesium, with a little lime and protoxide of iron.

Silicate of Magnesia.

468.—[631]. Soapstone, sílkhari, from Singhána, Gurgaon. DEPUTY COMMISSIONER.

469.—[960]. Sang-i-jaráhat. Peshawur.

470.—[881]. Sílkhari. Lahore bazar. RAM SINGH.

Glass.

471.—[871]. Fused glass, "kach." Lahore bazar. RAM SINGH.

472.—[882]. Fused glass, "phutak." Lahore bazar. RAM SINGH.

Lapis Lazuli.

473.—[824]. Lajward, lapis lazuli.

It is used in native medicine for mixing with jalap powders and in other compounds; it is not taken alone (*see* page 64, *et. seq.*) Dr. Honigberger says he applied it externally to ulcers.

Gil Irmani.

474.—[884]. Gil irmani. Lahore bazar. RAM SINGH.

Armenian earth, "bolus armeniacus," harmzi or harmuchi, has been entered under head of dyes and colors; it is supposed to be the representation of the Armenian bole, once in great repute (*see* page 22).

Earths and Ochres.

475.—Múltáni mitti. This has received notice in Division II. It is used to wash hair, and one kind is taken medicinally by women at child-birth.

476.—Gil-i-geru (No. 762, 721, 849).

477.—Gil-i-makhtum (No. 759 and 840).

478.—Gil-i-zard (No. 718 and 849).

479.—Gil-i-abrúrsí (No. 760).

These earths have received notice in the preceding Division, they are only used in native medicine.

White Clay.

480.—[844]. Kharya mitti. Lahore.

Used only in native medicine and as a plaster. There are several other specimens of white clays and earths exhibited in Division IV. (*see* page 23.)

481.—[848]. "Hassan dhúp." Lahore bazar. RAM SINGH.

This is properly speaking a deposit from a mineral spring containing sulphur; the sediment is collected and made into little cakes, but ordinarily the hassan dhúp met in the bazar is a mere imitation, consisting of some earthy clay mixed with ground sulphur, and formed into cakes.

White Mica.

482.—[898]. Abrak safaid. Rawalpindi. DEPUTY COMMISSIONER.

831 and 898, are samples from Lahore and Jálandhar bazars.

Black Mica.

483.—[832]. Abrak siyah. Lahore bazar. RAM SINGH.

Granite.

484.—[838]. "Sang-i-karand." Lahore bazar.

The sample sent is fine grained granite not corundum.

Slate.

485.—[ ]. Sang-i-Musá, "Moses' stone." Lahore bazar.

Called probably Moses' stone, for its lamellar structure, as if the tables of the Law, given on Sinai, had been on slate tablets.

486.—[829]. Sang-i-sabz, green earth. Lahore bazar.

487.—[ ]. Another sample, from Amritsar bazar.

I have no information as to whence this mineral is imported.

Binoxide of Manganese.

488.—[817]. Nijní or injaní (or inganí). Lahore bazar. LAHORE MUSEUM.

A sample of pyrolusite or oxide of manganese is sent from Kashmír, from the Jammú territory. In the bazar, manganese is obtainable as a black powder, or in lumps of the pyrolusite.

Zinc.

489.—[799]. "Jast," zinc. Lahore bazar.

Oxide of Zinc.

490.—[800]. Oxide of zinc, "missi safaid." Lahore bazar.

This is very impure, contains much carbonate of lime and a little peroxide of iron.

491.—[915]. "Jasd" (Kushta). Gugaira. DEPUTY COMMISSIONER.

Iron.

492.—[724]. Iron filings, "loha chúr." Jálandhar. LOCAL COMMITTEE.

493.—[792]. Ahan (metallic iron). RAM SINGH.

494.—[795]. "Manúhr" (manohar) or loha-ki-mail.

This is dross or slag from the iron furnace.

495.—[797]. "Zafrán-i-hadíd." Lahore.

This is mentioned by Dr. Honigberger ("Thirty-five years in the East.") It is a sesqui-chloride of iron, made by burying for 10 days in the ground a composition of iron filings and naushadar, (sal ammoniac,) the damp of the earth causes the sal ammoniac to act on the iron; the process is complete after 10 days, and the substance may be taken up. (Not commonly used by natives).

Sesqui-oxide of Iron.

496.—[796]. Sahanshabed, hematite. Lahore bazar.

497.—[803]. Surma Ispahání. Lahore bazar.

This is a shining crystalline oxide, called surma, from its resemblance to antimony ore.

498.—[917]. "Kushta lohe ka." Syadwala, Gugaira. DEPUTY COMMISSIONER.

Magnetic Oxide of Iron.

499.—[798]. "Chamak pattar." Lahore bazar.

The hydrated oxide alone is used in European medicine.

Sulphate of Iron.

500.—[726-730]. Kahi safaid, kahi sabz, kahi siyah, hira kasis, noticed in Division III., at page 66. Sent as drug samples from Jálandhar, Lahore, and Peshawur. Sometimes it is called "sajji," erroneously. 790 of Lahore, is kahi sabz.

Bisulphide of Iron.

501.—[794]. Sona makki. Lahore bazar.

Theoretically sona makki should be copper pyrites, and rupa makki iron pyrites; but the two are constantly confused. Iron pyrites is found in crystals at Kálábágh, and wherever coal shales occur throughout the Salt range.

Copper.

502.—[781]. Burád-i-támba, copper filings. Lahore bazar.

503.—[787]. Sang-i-rásak. Lahore bazar.

A mixture of metallic copper with organic matter; it is obtained during the native process of melting copper and brass. A similar sample is No. 752, from Amritsar.

504.—[782]. Sang-i-basri. Lahore bazar.

The dross of copper in tubular pieces; the genuine article is said to come from the city Bassorah (Basrah), where it is collected at the mouths of the chimneys of the copper furnaces.

In native medicine it is administered in some cases of diarrhœa.

Brass.

505.—[788]. "Burád-i-brinji," brass filings. Lahore bazar.

506.—[789]. "Mail missi," dross, obtained in melting brass.

507.—[791]. "Káyá," a compound metal. Lahore bazar.

It consists of zinc, tin and copper, in certain proportions.

Sulphate of Copper.

508.—Níla tutyá.

Both native and European are exhibited in this department, Nos. 747, 4523, 4522, 783, 784, 639 (*see* page 67).

Subacetate of Copper.

509.—[785]. Zangár, "verditer." Lahore bazar.

Is poisonous and acrid.

Arsenite of Copper.

510.—[811]. "Haryáwal," arsenite of copper. Lahore bazar.

This is known as Scheele green, or the artists' emerald green, and is imported from Europe.

Oxide of Copper.

511.—[916]. Oxide of copper (kushta tambe ka). Gugaira. DEPUTY COMMISSIONER.

A sample is also exhibited from Sirmúr. No. 712, which is a black oxide of copper.

Chromate of Lead.

512.—[878]. "Peori wilayiti." Lahore.

Imported from Europe. It is made by treating a solution of acetate of lead with bichromate and chromate of potash. Yellows of all shades are produced by varying the strength of the solution, or by employing chromate instead of bichromate, from the palest "primrose yellow" to deep "orange chrome."

Bichromate of Potash.

513.—[4355]. Kahi surkh (kahi lál). Amritsar bazar. LOCAL COMMITTEE.

Is imported from England.

Sulphide of Antimony.

514.—Surma, Nos. 761, 802, 880, 901, 902, 904, &c., &c. (*see* page 10).

Used by natives for the eyes, it is supposed to strengthen the nerves of the eye. Found in various parts of the hills; and often confounded with galena.

Surma Kandahárí, is commonly galena.

Surma Ispahání is a glistering oxide of iron ore,

Tartrate of Antimony.

515.—[804]. Nimak-i-istifráj, tartar emetic.

Not met with in the bazar: is mentioned by Dr. Honigberger as existing, and with the name quoted above; but no specimen could be procured.

Arsenious Acid.

516.—[805]. Sankhyá safaid (sammul-fár, *Arabic*), white arsenic. Lahore bazar. RAM SINGH, Pansári.

517.—[807]. Another kind, of a more crystalline texture.

518.—[806]. "Sankhyá bilauri."

Vitreous arsenic, soon becomes opaque by contact of air.

Arsenious acid is a powerful alterative and febrifuge, ranking next to quinine; is said to be best in cases of tertian fever; it may be given in doses of ¼th of a grain twice a day, during intermissions of fever, and gradually increased up to 1½ grains; it must be stopped if any pain or diarrhœa occur.

Orpiment—Sulphuret of Arsenic.

Used as an alterative in syphilis and certain skin diseases. There are several varieties. Tanki hartál, or hartál warki, hartál píli (or sankhyá píli), &c.

This mineral is found native on the hills in several parts of India.

519.—[808]. Sankhyá píli, yellow arsenic. Lahore bazar.

520.—[813]. Hartál píli.

521.—[815]. Tanki hartál, or "hartál warki," shining or leafy orpiment. LAHORE MUSEUM.

This is a very beautiful specimen of the mineral in shining lamellar mass.

522.—Hartal is exhibited also from Swat, by the PESHAWUR COMMITTEE; and from Amritsar (751). *See* page 66.

Realgar—Bisulphide of Arsenic.

523.—[750]. "Mansil." Amritsar. LOCAL COMMITTEE; also (814) from Lahore.

524.—[809]. Sankhyá surkh. Lahore. RAM SINGH, Pansári.

525.—[810]. Sankhyá siyah, black arsenic. Lahore. MR. B. POWELL.

Very impure, hence its dark color.

526.—[816]. "Naushádar káni."

An artificial bisulphuret of arsenic, occurs in glossy brown lustrous fragments, like pieces of shellac.