

SELECTIONS  
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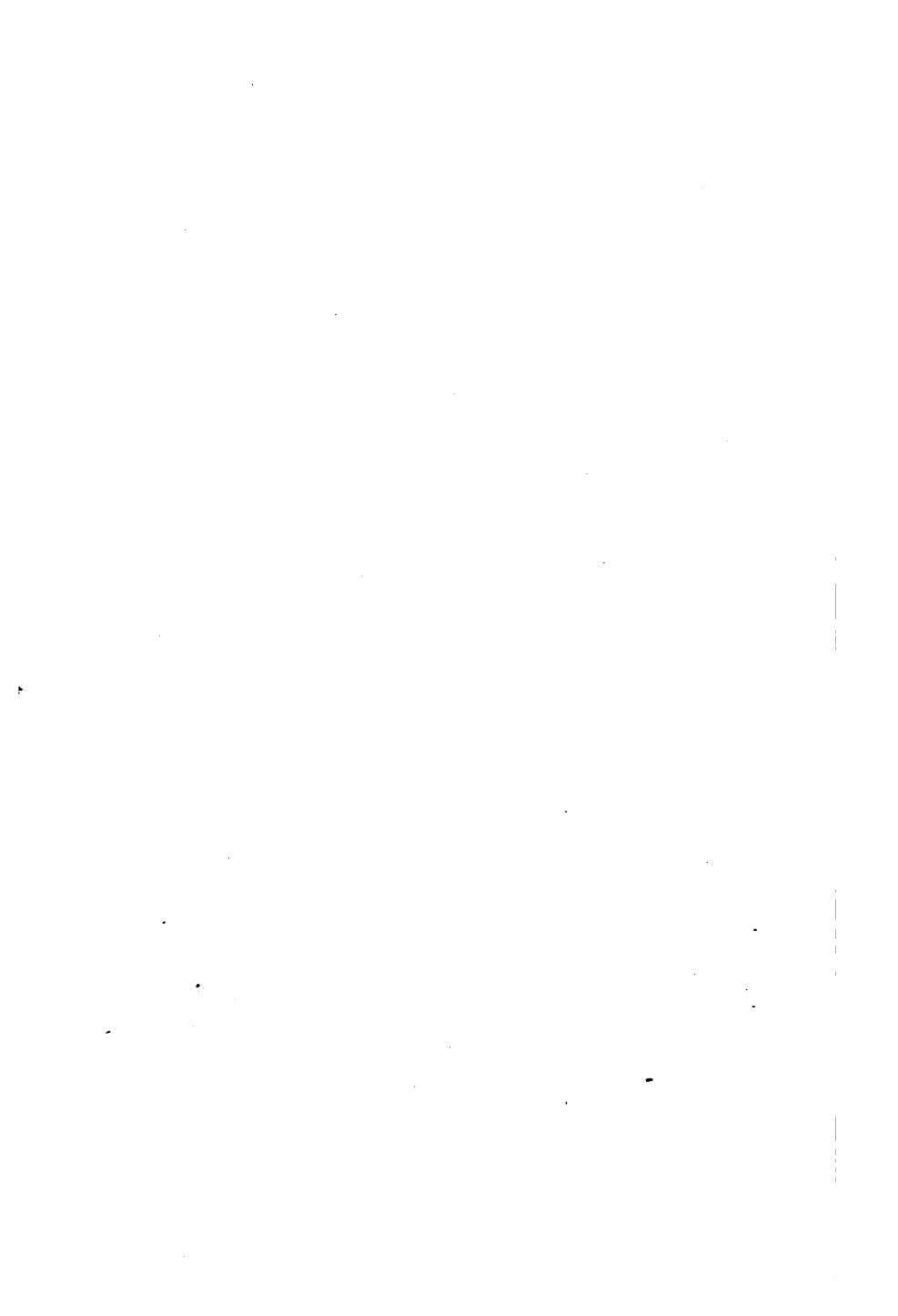
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**L A H O R E :**

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# REPORT

ON THE

OPERATIONS ON THE IODIFEROUS SPRINGS NEAR JOWALA  
MOOKHEE, BY MONSIEUR M. MARCADIEU, GEOLOGICAL  
SURVEYOR, PUNJAB.

No. 1883.

No. 84.

*From*

M. P. EDGEWORTH, ESQUIRE,

*Comr. and Supdt., Trans-Sutlej States,*

*To*

R. TEMPLE, ESQUIRE,

*Secy. to the Chief Commissioner.*

*Dated Jullundur, the 24th April 1855.*

SIR,—I have the honor to annex copy of M. Marcadieu's report on his operations on the Iodiferous springs near Jowala Mookhee, which have led to some interesting conclusions. The transmission has been delayed in consequence of a doubt on my mind about the manner of calculating the results of the produce per English pints and weights. His supplementary letter No. 125, dated 12th April 1855, also annexed, explains the manner in which his calculations were made, and partially corrects the former deductions.

2nd.—I doubt whether the manufacture of Iodine here could ever be remunerative, as a commercial speculation, looking to the inexhaustible supply derivable from sea weed ; but,

in a medical point of view, as a curative for that scourge of the hill regions, the Goitre, it merits, I think, great attention.

I have, &c.,

(Signed) M. P. EDGEWORTH,

*Commr. and Supdt. T.-S. States.*

*Commr. and Supdt.'s Office, }*

*Jullundur, the 24th April 1855. }*

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*Report on the determination of Iodine contained in the four saline springs, situated in the Jowala Mookhee valley, and of a spring of same nature at Kangra—Basa, near Hurreepore.*

In my report last year on Jowala Mookhee, I merely pointed out the presence of Iodine in the saline waters, from the four springs which were the object of my examination. I could not then determine the proportions of that body, because I had not foreseen its existence in the Himalayas, so had not with me the necessary re-agents for such researches.

That blank, so justly felt by the superior authority, I now feel in adding to it a fifth spring of same nature, which I discovered during my last stay in the valley.

In proceeding by order of their respective positions, and taking for starting point the limits of the Jowala Mookhee valley, naturally formed by an elbow of the Beas, near Nadoun, the salt Iodurated springs are placed in the following order :—1st, Kooperah ; 2nd, Jowala, (2 springs) ; 3rd, Jowala Mookhee ; 4th, Nageah ; and 5th, Cunga Basa.

The three first are situated at equal distances of about four miles, one from the other, the fourth at about three miles from the third, and the 5th at about 20 miles from the fourth.

These five springs are all situated in the same chain which borders the Jowala Mookhee valley, on its north east side, on the right bank of the Beas.

The first is situated at about a mile from the bend of the river, but as its course cuts the Jowala Mookhee valley perpendicularly in this place, and that it only takes a parallel direction to the valley, but near the opposite chain, in which are situated the saline springs, it results that all the others are distant from the Beas, nearly the whole width of the valley, distance varying from 2 to 3 miles.

The Cunga Basa spring, which figures here as the fifth, though belonging to the same formation, is separated from the others by the Kangra Nullah.

It comes to light at about 100 feet above the torrent, at a place where a small intermediate spur, which begins in the centre, and at about half the distance of the length of the valley, and joins the principal chain by the help of a curve more to the west, described by this last at this spot.

Considered in their uniformity of position, the five saline springs are seen over a distance of about 30 miles, on a parallel line to the same chain, three at the extreme limits of its basis, and the other two a little more elevated.

We may state that, in general, the greatest uniformity exists in this saliferous range.

The argillaceous marls, alternating towards the superior part with a rough micaceous sand-stone called friable, and at the inferior part with a sand-stone also micaceous, harder and smaller grained, and of a bluish color, stuck together by a calcareous cement, prevail in this formation.

After this comes the same sand stone, in which are embedded a few stones of variegated grit, then micaceous sand and a scanty calcareous formation in the state of travertin ; and at last, in nearing Kangra and departing from the springs, some conglomerates composed of granite, of mica schists, of quartz and of variegated sand-stone, also bound together by a calcareous cement, alternating at first with the grit, and finish in forming by themselves whole mountains, but only in the vicinity of the Kangra Nullah ; character which indicates that, when this formation took place, periodical increase of water interrupted this deposit of sand-stone, and of argillaceous marl, in this locality only,—for as you remove from these indications of passed perturbations, the order of formation assumes its ordinary course.

The saliferous mountains belong to the superior tertiary formation of fresh water, called by some geologists—subassensin stratum ; and by Sir C. Lyell, old pliocine.

This formation is characterized in the most irrevocable manner by the fauna it contains, which show themselves so pure in form, and so positive in the vicinity of Noorpore.

In that locality are found the remains of Mammifus, and especially those of the Equus species, (horse), which remain there as an imposing epitaph of the relative and positive age of the formation.

The stratification of the saliferous range, though it cannot be pronounced as discordant, presents nevertheless undulations, which would testify a sort of depression that the matter had undergone when the up-heaval took place.

The dipping which is observed in this part of the hills, directing itself sometimes towards the south east, sometimes

towards the north west, never exceeds an angle of from  $20^{\circ}$  to  $25^{\circ}$ . I do not think one could pronounce these irregularities a real discordance.

The saliferous springs present, in a general point of view, the same regularity of composition as that which is observed in the formation which produces them.

The saline substance varies little in each in their respective quantities.

It is true that I have never observed these springs but during the months of December, January, and February, the driest in the year, so that I cannot affirm if the volume of water, or its saltiness, increases during the rainy season, and was not able to gather exact information on the subject, except at the Cunga Basa source.

The natives of the place affirmed that it became more abundant during the rains, and that it yielded them a large quantity of salt.

If this fact is true, which requires confirmation, it proves, after observations made in Europe, that the salt is formed in this locality, and that the water which flows over it, only owes its saltiness to the more or less lengthened sojourn that it makes on the salt, or on the saline soil. Be this version as it may, of which I do not warrant the veracity, the other springs might be placed in the same category.

Near the principal spring at Jewala, on the eastern slope of the same hill, is remarked, as stated in my former report on Jewala Mookhee, another spring, yielding very little water. It is, I may say, but an oozing, derived according to all probability from the principal one.

Though it does not figure in this report as a distinct spring, I make mention of it because it presents the same interest as the others, on account of the Iodine it contains.

I think it necessary to describe as briefly as possible, the process I put in practice to determine the quantity of Iodine contained in these saline waters.

The use of nitrate of silver did not appear to me in this circumstance to be a method either easy or exact, on account of the great quantity of ammoniac required to separate the Argentic Chlorum from the Iodine of same metal.

This process is liable to cause serious errors, which are avoided without difficulty in employing a solution of Sulphate of Copper saturated with acid sulphureous gas.

This complex re-agent precipitates the totality of the Iodine, to the state of Iodine Cupreous, whilst a simple solution of Sulphate of Copper only operates a partial separation.

The sulphureous gas acting only in this circumstance as a dis-oxydating body, determines phenomena that men versed in the knowledge of practical science will easily understand, and which I do not think necessary to detail in this report.

The saline springs contain, in 100 parts, the following quantities of fixed matter :—

Koopirah, ... ..	2.20
Jowalla, ... ..	2.63
2nd Spring, Jowalla, ... ..	2.40
Jowalla Mookhee, ... ..	2.28
Nageah, ... ..	2.22
Cunga Basa, ... ..	2.32



## KOOPIRAH.

This spring shows itself, as before stated, at a short distance from the Beas. It forms a basin of about four feet in diameter, and is three feet in depth, on a level soil slightly concave round the basin.

A large stream of fresh water flows close to the spring.

I made vain attempts to empty the basin, but the boulders at the bottom, and the infiltrations of fresh water from its sides, hindered me from doing so. I noticed a noise from the disengagement of gas, heard through the fissures of the rocks, but to account for this phenomenon, which may only proceed from air located in the interior cavities of the rocks, it would have been necessary that the position of the soil was so disposed as to enable me to collect the gas; this disposition was quite reverse to the complement of such operations. The soil in which is placed this spring is well situated for sounding operations, or for the sinking of a well; it is only when either the one or the other of these works have been executed, that the real volume of the water, and the disengagement of gas can be appreciated.

The determination of the Iodine has been performed on all the springs on 1000 parts of liquid; consequently for this spring, it is the equivalent of 22 parts of salt. Now, 1000 parts of water contain Iodine, 0·0799, representing Ioduret of Pottassium, 0·1052, or for 1000 parts of salt from the evaporation of 45·454 of water, furnishes Iodine, 3·6318, representing Ioduret of Pottassium, 4·7818.

## JOWALLA SPRING.

When I returned from Thibet, the Punjab Administration transmitted me an order emanating from the Most Noble the Governor General, tending to execute some preliminary works,

to ascertain if the volume of this interesting stream could not be increased.

These works, which I had performed for the sum of Company's Rupees 249 only, have proved in the most evident manner that the water increased in volume as the rocks that obstructed its passage were cleared away. This water comes from the westerly slope of an Ellipsoid shaped hill, situated at the foot of the principal chain of which it forms part, at its basis. Its summit is 2790 feet above sea level; from the spot from which issues the spring, 1403; and the foot of it, where begins the valley, 1109.

The temperature of the spring, taken on the 10th December 1854, at 7 o'clock A. M., was  $67^{\circ}$  Farht., the air  $51\cdot30$ , difference  $15\cdot70$ .

The same day, before beginning the works, the spring only yielded 25 pints of water in 20 minutes, or 75 pints per hour, or 1800 per 24 hours.

When I made it over to the public, it yielded 25 pints per 5 minutes, or 300 per hour, or 7,200 per 24 hours.

After these facts, I only say that that which I had foreseen took place, for in presence of the figures no argument is required. 1000 parts of water represent  $26\cdot30$  of fixed saline matter, containing Iodine  $0\cdot09324$ , representing Ioduret of Pottassium,  $0\cdot12273$ .

From 1000 parts of salt, from 38,000 parts of liquid, yield Iodine,  $3\cdot5452$ , representing Ioduret of Pottassium,  $4\cdot6665$ .

2nd spring of Jowalla, which oozes, and of which it has been impossible to determine the volume. 1000 parts of water from this spring represent  $24$  of Salt, containing Iodine,  $0\cdot0799$ , or Ioduret of Pottassium,  $0\cdot1052$ .

Or per 1000 parts of salt from 41,666 parts of liquid, Iodine, 3·4958, representing Ioduret of Pottassium, 4·3833.

#### JOWALA MOOKHEE SPRING NEAR THE TEMPLE.

This spring issues from a hole made by the natives in the hard grit, it does not appear very abundant because its issue is evidently impeded by the surrounding rocks, which prevent one from ascertaining the real volume of its water in a given time. 1000 parts of this water yield 22·80 of salt, containing Iodine, 0·0799, representing Ioduret of Pottassium, 0·1052.

And 1000 parts of salt from 43,860 of water, contain Iodine, 3·5040, representing Ioduret of Pottassium, 4·6140.

#### NAGEAH SPRING.

This spring belongs to the same category as that of Jowala Mookhee, the heaps of rocks surrounding it prevent one from ascertaining its volume. 1000 parts of water yield 22·20 of saline matter, containing Iodine, 0·09324, representing Ioduret of Pottassium, 0·12273.

And 1000 parts of salt from 45,045 of water, Iodine, 4·2000, representing Ioduret of Pottassium, 5·5282.

#### CUNGA BASSA SPRING.

This spring, which ends the series, issues from the centre of a hill which borders the Kangra torrent. Its elevation is 660 feet; and its temperature is 76 ° Faht., that of the air being 52° Faht

It yields, as the Jowala Spring, 25 pints of water per 5 minutes, that is to say, that the Jowala spring only yielded this quantity after the works I was engaged in were performed.

1000 parts of this water yield 23 of salt; containing Iodine 0·09324, representing Ioduret of Pottassium, 0·12273.

1000 parts of salt from evaporation to sixty of 43,478 parts of water contain Iodine 4·0539, representing Ioduret of Pottassium, 5·3360.

I ascertained, and saw myself, that all the waters from the five springs, after having undergone a slight concentration by being exposed only for a few hours to the open air, were purchased by the Bunniahs at one anna per seer, or exchanged for the same value in Ottah &c.

The livelihood of the natives living in the vicinity of these springs is chiefly earned by this trade.

They are convinced, and tell all who question them, that the water contains an efficacious principle which promotes the cure of the Goitre.

In this circumstance they judge as soundly as the South American mountaineers, who dwell in the vicinity of the saline iodurated springs, from which the mother waters are collected with care, the salt extracted and sold to people afflicted with Goitre who live far from that locality.

I cannot affirm if, or not, there exist in different parts of India any saline iodurated springs presenting the same interest as these; but what is positive is that the Mundeé salt, and the salt from the saliferous chain examined by Dr. Fleming, do not contain the slightest trace of Iodine—at least the specimens I have taken promiscuously from the bazaar. As for the Mundeé salt, it is of an impurity truly lamentable, and it is time that the administration exacted from the Wuzeer of Mundeé, a preliminary purification of this produce, before it is given over to the Public.

Recapitulation of the produce yielded by the saline iodurated springs :—

Name of spring.	Parts of water.	Salt.	Iodine.	Equivalent in Ioduret of Potassium.
Kooperah, ... ..	1,000	22	0·0799	0·1052
	45,454	1000	3·6318	4·7818
Jowala, ... ..	1,000	26·30	0·09324	0·12273
	38,000	1000	3·5452	4·6665
Jowala 2nd Spring, ... }	1,000	24	0·0799	0·1052
	41,666	1000	3·4958	4·3833
Jowala Mookhee,	1,000	22·80	0·0799	0·1052
	43,860	1000	3·5040	4·6140
Nageah, ... ..	1,000	22·20	0·09324	0·12273
	45,045	1000	4·200	5·5282
Cunga Bassa, ...	1,000	23·0	0,09324	0·12273
	43,478	1000	4·0539	5·3360

Considering attentively these tables, and taking the question in a general point of view, we are struck with the similitude existing in the proportions of the iodurated produce of these springs.

This constancy would lead one to presume that they all have the same origin ; and that excavations, or boring performed on one of them, would furnish the same results, or nearly so, as if performed on the others. These works, if considered advisable by the Most Noble the Governor General, should be executed under the guidance of an Engineer, acknowledged a practical miner. If we only arrive at increasing the volume of water

from these springs, so as to propagate its use among the wretched hill population afflicted with Goitre, the results would be of the highest interest.

In Europe, a Medical Committee, solicited by different Governments, proposed to mix  $\frac{1}{1000}$  of Ioduret of Pottassium with the salt destined for the daily use of the mountaineers afflicted with the disease, or living in places where the infirmity exists.

Here nature offers this remedy ready formed, and in larger proportions, without the excess being injurious; besides there is a chance of finding a sufficient quantity of salt to render it profitable in a commercial point of view. I explain myself clearly. I say chance, and not certitude, because it might occur that the saltiness of the water was caused by salt clays, not very fertile in this produce; it is to the skill of a good miner that belongs the solving of this important and dubious question. In England, the boring of 600 feet cost about Company's Rupees 2,200. I do not give this estimation as rigorously exact, but as approximative, so as to give a general idea of the cost of works, the result of which might be negative in a commercial sense.

We have seen that I have only been able to determine the volume of water from the Jowala and Cunga Bassa springs.

We have also seen that these two springs yielded the same quantity of liquid, amounting for each of them to 7200 pints of water per 24 hours; this volume reduced into uniformity of weight amounts nearly to 4,000,000 parts for each spring.

Thus, Jowalla yields in 24 hours on 4,000,000 parts of water: Salt, 1,05,263, Iodine, 373, representing Ioduret of Pottassium, 491.

#### CUNGA BASSA.

From 4,000,000 parts of water: Salt, 92,000, Iodine, 373, representing Ioduret of Pottassium, 491.

Now converting for final results this produce into Troy weight, we have for Jowala, daily,

	lb.	oz.	gr.
Salt,	288		
Iodine,	1		
representing Ioduret of Pottassium,	1	3	3·85

There is then a daily loss from these two springs only, leaving the others aside :

	lb.	oz.	grs.
Salt,	529		
containing Iodine,	2		
representing Ioduret of Pottassium,	2	7	2·92

We must not expect in practical manufacture to obtain the same quantity of Iodine, but when we reflect that nearly all the fabrics of Europe extract this produce from the salt of sea weed, which only yields about  $\frac{1}{1000}$  per 1000 parts, it is evident that the salt from the Himalaya springs has a marked superiority over that of Europe ; we have only to examine the tables to see that the produce is three and half times larger, in taking the mean.

It is seldom that the treatment of the Goitre requires more than from 20 to 30 grains given under different forms ; it is even well known that the Chyroid gland is often sensibly reduced before the whole of this dose is taken ; let us then appreciate the number of cures after these data that the produce of these two springs can operate.

The Iodine daily lost from these two springs, estimated at the price at which it is obtainable from the fabrics in Europe, may be valued at 24 rupees. In this country the price is probably three or four times higher. As for the salt, it also has its value, a double interest, which should be taken into consideration, for we must not forget that saline springs have in

different parts of Europe been the precursors to Salt mines, which at a later period have been discovered by boring, and that the celebrated mines of Gem salt of Wohiska in Poland are situated in the same tertiary formation as the springs of Jowala and Cunga Basa.

(Sd.) MARCADIEU.

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No. 125.

*From*

MONSIEUR MARCADIEU,

*Geological Surveyor,*

*To*

M. P. EDGEWORTH, ESQUIRE,

*Commr. and Supdt. T.-Sutlej States.*

*Dated Camp Kutullug, 12th April 1855.*

SIR,—I have the honor to acknowledge the receipt of your letter No. 825, dated Jullundhur, 3rd April 1855, and in reply to state that 1000 parts represent 1000 grammes, or 1 kilogramme equal to 1 litre. The English pint is equal to 0·5479 parts of the litre; then in multiplying 0·5479 by 7,200 pints, the result is 4089 litres. I suppressed the odd 89 litres, to have a round number, so the 4000 litres, = 4,000,000 of grammes; then if 1000 grammes of water from Jowala yield 26,30 grs. of salt, the 4,000,000 will yield 1,05,263 grammes, equal in Troy weight, (1 kilogramme being = 1b2·68037. Troy) to lb. 281·96.

It should then be 1b2 instead of lbs. 283 written in my report, it is an error of 1lb. The produce from the Hurreepore spring has been determined in the same way.

I have, &c.,

(Signed) MARCADIEU.

*Geological Surveyor.*

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