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I. *Description and plan of the Natron Lake of Loonar, with an analysis of the Salt. By* George Smith, M. D., *Residency Surgeon, Hyderabad.*

[The following interesting description of the Loonar Lake of Berar was communicated by Dr. Smith to the Committee for the Madras Exhibition for 1857, and placed by them at the disposal of the Madras Literary Society, for insertion in their Journal.]

Description of the Lake of Loonar.

In the Circar of Meinker Soubah of Berar, about 45 miles N. W. of Hingolie in Lat. 20° N., lies the curious Natron Lake of Loonar. It is situated at the bottom of a crateriform depression, which forms a singular and unexpected interruption to the general gentle undulatory character of the district. The Lake is 510 feet below the level of the surrounding ground*—has a rounded outline and is about 3 miles in circumference. The sharp edge of the great excavation is about 5 miles round and the inner surface of the bowl rises abruptly at an angle of from 75° to 80°. The surface of this sharp slope is covered with luxuriant vegetation, in the shape of trees† and thick, vigorous underwood, tenanted by the tiger, hog, panther, deer and peacock. Between the sloping bottom of the

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* As calculated in January last by the aneroid, which during the descent from the brim of the crater to the level of the lake rose 6-10ths of an inch, nearly 510 feet.

† For list—vide Appendix No. 4 extracted from Surgeon Bradley's Memoir.

abrupt dip and edge of the still green lake, the ground especially to the N. and N. E., is under cultivation, and the luxuriance of the crops shews the excellence of the soil and the abundance of the irrigation. Water is supplied freely from springs of sweet, soft water, close to the edge of the lake, and near the surface of the ground as well as from the streams, which in the rainy reason, come from the surrounding water shed, and which have left their vertical trace upon the walls of the crateriform hollow. Here and there, in the thick recesses of the wood, are observed small deserted and ruined Hindoo temples, built of the common compact Trap of the district. Many years ago, an officer, upon entering one of them, was seized and seriously injured by a tiger. The lake, a still sheet of water, emitting an intolerable stench of sulphuretted hydrogen (especially during the heat of the day, when the gas rises in millions of bubbles to the surface of the water), has a bright green color owing to the abundance of confervæ on portions of its surface, especially near the edges. The mud close to the margin of the lake, is thick, black, salt and tenacious, from the mixture of regur, salt and alum—when dry, fan shaped, black, glassy crystals of carbonate of soda are seen. The lake has evidently lately extended its bounds a good deal, as proved by this, that numerous dead trees are standing within its margin (for every tree touched by the lake dies) and also by the fact, that a bowrie of sweet water, protected by a low wall is now completely surrounded by the water of the lake. Reptiles, fish, and insects are never found in the lake, but flocks of teal and duck dot its surface. The water has a salt and nauseous taste, and its emanations are said to give rise to fevers of intermittent and remittent types.

At two points, near the centre of the lake, distant from each other about ½ a mile (judging by sight) are two saline springs which have never been known even in seasons of extreme drought to become dry. It is supposed that the muriate of soda from this source, coming in contact with the carbonate of lime found abundantly in the other springs of the lake, and in the surrounding rocks whence it is washed down by the feeders of the lake, causes the deposition of the carbonate of soda or natron salt, in a state of greater or less purity. The purest varieties, containing upwards

of 50 per cent of the neutral carbonate, being found close to the saline springs themselves—whence it is raised by diving. The depth of the lake near the springs, varies from 5 or 6 feet in the hot months, to 12 or 14 during the rains.

Description of Salt.

There are six principal varieties of salt to which the natives give the following names:—1 dulla, 2 nimuck dulla, 3 khuppul, 4 puppree, 5 bhooskee and 6 madkhar. Dulla and nimuck dulla are used for dyeing silks, fixing colors, and as medicine, and in the manufacture of bangles.* Of khuppul, there are two kinds, one of greater value than the other; this salt is used in fixing the red dyes of cloths. Puppree is used in the manufacture of bangles, in the baking of a cake called papur—and by the native hukeems as an anti-acid in dyspepsia. There is also an inferior description of puppree. Bhooskee is a white saline salt, left as a deposit on the margin of the lake, and is principally used in the manufacture of soap. Madkhar is an inferior kind of bhooskee, used by Dhobies in bleaching clothes. The purest salt is found close to the saline springs, and the other salts in their order, as entered above, are found on receding from that point towards the margin of the lake.

Salt how raised, transported and sold.

The salt is raised by divers who proceed towards the centre of the lake, in canoes (recently introduced by Major Johnston†) formed of single pieces of light wood, from 14 to 16 feet long and 2½ broad. The divers remain under water several seconds, and come up with their hands full of salt. When the lake was very shallow in 1836, the salt was scooped up by the iron pans or towas, on which natives bake their bread—no dredging instruments are used. The process of raising the salt is rude, tedious and insufficient. The salt thus raised is much prized, and finds a ready sale in both Berars, in Nagpore, Candeish and Poonah. It is purchased at the

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* There are two manufactories near the lake. When these are in full operation, bangles are manufactured in large quantities, each man being able to manufacture from 6 to 700 daily. The eye-sight of these men fails soon, owing to the entire want of protection from the glare of the glass furnaces. Crystallized Quartz is abundant.

† For much of my information, I am indebted to the kindness of Major Johnston, Deputy Commissioner of Southern Berar.

lake by dealers, who carry it to considerable distances in bamboo baskets, and retail it.

History of the Loonar Salt Trade.

The lake has not been worked regularly since 1836, twenty years ago. A detailed statement* of the results then obtained, is appended for the information of the General Committee. From this carefully prepared table, it will be seen, that 2,136 candies of the several kinds of salt were raised, each candy being equal to 240 seers. The aggregate value of the whole being Rups. 60,081, of which sum, the Government (Native) share amounted nominally to 45,000. Since then, Major Johnston informs me, the lake has not been worked, and the salts are consequently in great demand, so much so, that inferior substitutes for the salts, supposed to be obtained from vegetable products† are procured from Bombay and sold in both Berars. Last year (1855) Major Johnston, as an experiment,‡ raised from the lake 35 candies of the several descriptions of salt, the value of which amounted to Hyderabad Rupees 1,461-4, the expense of raising, &c. to Rupees 522-9-9 leaving a profit to Government of Rupees 938-10-3 equal to about Rupees 26 per candy.

Suggestions under consideration for enhancing the revenue of the Lake.

The suggestions which have been proposed for increasing the productiveness and revenue of the lake, and which are at present under consideration may be stated briefly to consist of—

1.—Contrivances for preventing the flushing of the lake with water, supplied by the main-feeder, and by the several streams from the surrounding water shed—such as bunds and channels.

2.—Means for raising the salt with facility, and in due quantity—such as dredging machines.

3.—Means for procuring the salts in greater purity—such as evaporating pans.

4.—Means for protecting and preserving the salt raised—such as sheds, store-rooms, &c., with careful supervision by trustworthy Government officials.

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* Vide Appendix No 1.
† Impure carbonates of potass from burnt wood probably.
‡ Vide Appendix No. 2.

Remarks on the Geology of the Loonar Lake.

In an able statistical memoir of the Circar of Meikher, drawn up by Surgeon Bradley of the Contingent, then on special duty, the opinion is re-advanced and supported by Geological facts, that this singular and wild looking excavation, is the crater of an extinct volcano. On this point, however, there exists amongst Geologists, I believe, some difference of opinion, so that the question may be regarded as still "sub judice." A jagged and picturesque rent exists in the N. E. wall of the supposed crater, down which runs the little stream which passes through a stone channel called the cow's mouth, forming part of a Hindoo temple, which is perched romantically upon a spot near the top of the ravine. Since the destruction of a weir too, during the rains, a large and deep nullah is filled with water which rushes down the ravine. The water as it passes over the almost vertical face of a Trap wall deposits travertin in considerable quantity. Through this great rent, the lava current is supposed by Surgeon Bradley to have found an exit, whence he supposed it to have spread over the surrounding country. Whilst descending the ravine, the rough natural section thus exposed, shows Trap rocks of various kinds, vesicular, compact and amygdaloidal. Masses also of ferruginous trap, weathering red, are seen with seams of chalk, reddish ochre, clay and disintegrated trap having all more or less of a stratiform aspect. During the Resident's recent tour to Hingolee, Loonar, Mominadad, Oodygheer and Beder back to Hyderabad, the whole route with the exception of the syenite and green stone near Hyderabad, and the laterite plateau of Beder lay over an uninteresting country of Trap to the entire exclusion of rock of greater Geological and Paleontological character. In many places, the Trap bears features precisely similar to those observed in the walls and rent of the Natron Lake; at times, the Trap was in solid blocks with vertical seams and irregular horizontal rents—often seen in bowries—again, it was amygdaloidal the nodules being imbedded in concentric laminæ of disintegrated trap and argillaceous shale, the beds being laid over chalk, argillaceous schists, marls, red ochre and green earth—again, it appeared in rude, but distinct strata, almost as regular as the layers of stones in a wall—again, it appeared disorganized with seams, thick or thin, of chlorite, calcspar, quartz and calcedony, in contact with marl—again, it was seen in vertical shells containing triangular fragments easily separable—again, as vesicular, trap cavities being some times distant and empty, at others close and filled with adventitious minerals—again, it was solid, compact, and of a leaden black hue—again, it was reddish and ferruginous, —again, where it underlies the laterite, it was co-mingled with that deposit, and where it slopes over the syenite, boulders of that rock were imbedded in its mass—these the Committee should be informed, are merely the personal remarks of an inexperienced Geologist. The same appearances with a few exceptions were observed at Loonar and in its neighbourhood. It appears to me, as if the rocks constituting the supposed crater were too compact, to have issued from a sub-aërial volcano, though it is more than probable that this was one of the vents of the great eruption of the Trap of the Deccan, which was at first effused, it is supposed, under the pressure of water.

The points, to which the attention of the General Committee is respectfully solicited in this reference, are the following :—

a.—What is the exact chemical composition of the several salts?

b.—What is their commercial value, as now sent?

c.—Are the suggestions alluded to as under consideration, correct in their general principles? and

d.—Can the salts at Loonar be profitably separated from each other, and if so, by what process or processes?

.—The following specimens are forwarded for examination.

1.—Dulla.
2.—Nimuck Dulla.
3.—Khuppul.
4.—Puppree.
5.—Madkhar.
6.—Bhooskee.
7.—Travertin.
8.—Quartz used in glass-making.
9.—Glass prepared for the manufacture of bangles.
10.—3 Bottles of water.

[Further communication from Dr. SMITH, accompanied by a plan and section of the Lake.]

In the plan now submitted, the crateriform shape of the hollow is well seen, and if the opinion of some Geologists be correct, namely, that this hollow is the crater of an extinct volcano, the interest felt in it must be deepened by the fact, that, in all probability it is the only one in southern India.

The action, however, even of a large crater like this must have been comparatively limited, other vents and fissures, which have left no permanent mark of their existence must have given exit to those vast sheeted masses of porous and solid rocks constituting the trappean plateau of the Deccan. This plateau over lying primary and secondary rocks to depths varying from a few feet to 300 probably, covered with a rich mantle of inexhaustible black soil, and capped here and there along its eastern indented edge with laterite patches, extends from 17° to 27° N. L. and from 72° 30' to 79° E. L.

It may be interesting to remark, that at the South East angle of the plateau, the existence of numerous hot springs seems to indicate the persistence of igneous action. Taking Loonar as a centre, and with a radius of 150 or 200 miles, the quarter circle extending from the North East to the South East, will be found to include (a) the tepid spring of Beder, rising from the base of a laterite cliff; (b) the hot springs at Kair on the Pain Gunga (87° Bradley) and (c) the hot springs near Labbundee (102° Bradley) lying in a North Easterly direction.

APPENDIX No. 1.

Statement *of Salt Extracted from Loonar Lake from Fuslee* 1252 *or A. D.* 1836-1837, *under the Nizam's Government.*

		Dulla per Candy 57 Rupees.						Nimuck Dulla at 45 Rs. 4 As. per Candy.					
		Quantity.			Value.			Quantity.			Value.		
		Cds.	M.	S.	Rs.	A.	P.	Cds.	M.	S.	Rs.	A.	P.
Under Raie Bul Mookadum Talookdar.	1252 Fuslee.	3	1	30	175	15	3	2	7	10	106	14	6
	1253 Fuslee.	7	10	35	429	15	6	5	3	26¼	234	8	9
	1254 Fuslee.	3	7	0	190	15	3	18	16	0	850	11	3
	1255 Fuslee.	2	15	30	158	14	6	9	14	0	438	14	9
	1256 Fuslee.	15	18	38¼	909	1	6	20	14	26¼	938	12	0
	Total.	32	14	13¼	1,864	14	0	56	15	22½	2,569	13	3
Under Meer Mohib Ale Khan Talookdar.	1256 Fuslee...	0	0	0	0	0	0	20	13	10	934	15	6
	1257 Fuslee...	30	5	10	1,724	15	6	9	15	0	441	3	0
	1258 Fuslee...	8	8	0	478	13	0	2	13	6¼	120	4	9
	1259 Fuslee...	0	0	0	0	0	0	0	0	0	0	0	0
	1260 Fuslee...	0	0	0	0	0	0	0	0	0	0	0	0
	Total	38	13	10	2,203	12	6	33	1	16¼	1,496	7	3
	Grand Total.	71	7	23¼	4,068	10	6	89	16	38¾	4,066	4	6

		Choorah at 39 Rupees 8 Annas per Candy.						Khuppul at 35 Rupees per Candy.						Puppree at 22 Rupees 4 Annas per Candy.					
		Quantity.			Value.			Quantity.			Value.			Quantity.			Value.		
		Cds.	M.	S.	Rs.	A.	P.	Cds.	M.	S.	Rs.	A.	P.	Cds.	M.	S.	Rs.	A.	P.
Under Raie Bul Mookadum Talookdar.	1252 Fuslee.	81	8	0	3,215	4	0	177	11	16	6,214	11	0	62	19	20	1,401	3	0
	1253 Fuslee.	41	2	6¼	1,623	11	9	67	3	0	2,350	4	0	60	8	12½	1,344	4	0
	1254 Fuslee.	67	15	0	2,676	2	0	105	16	26¼	3,704	2	6	131	4	32½	2,920	1	9
	1255 Fuslee.	54	16	0	2,164	10	6	46	13	0	1,632	12	0	145	7	0	3,234	0	9
	1256 Fuslee.	26	3	12½	1,033	8	0	37	2	0	1,298	8	0	105	2	0	2,338	7	6
	Total.	271	4	18¾	10,713	4	3	434	5	36¼	15,200	5	6	505	1	25	11,238	1	0
Under Meer Mohib Ale Khan Talookdar.	1256 Fuslee...	8	2	0	319	15	0	3	15	30	132	9	0	71	14	10	1,595	9	9
	1257 Fuslee...	29	5	0	1,155	6	0	16	4	0	567	0	0	227	16	0	5,068	9	0
	1258 Fuslee...	9	5	34¼	367	1	0	3	7	12½	117	12	9	127	0	26¼	2,828	4	0
	1259 Fuslee...	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1260 Fuslee...	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	46	12	34¼	1,842	6	0	23	7	2½	817	5	9	426	10	36¼	9,492	6	9
	Grand Total.	317	17	13	12,555	10	3	457	12	38¾	16,017	11	3	931	12	21¼	20,730	7	9

Mixed Ammuis Puppree at Rs. 17-4-0 per Candy.						Bhooskee.											
Quantity.			Value.			Quantity.			Value at Rs. 7-10-0 per Candy.			Value at Rs 10-14-9 per Candy.			Value at Rs 11-14-0 per Candy.		
Cds.	M.	S.	Rs.	A.	P.	Cds.	M.	S.	Rs.	A.	P.	Rs.	A.	P.	Rs.	A.	P.
0	0	0	0	0	0	60	1	10	457	15	9	0	0	0	0	0	0
0	8	6¼	7	0	0	29	14	6¼	226	8	6	0	0	0	0	0	0
9	13	35	167	4	3	43	6	0	330	3	0	0	0	0	0	0	0
2	18	10	50	3	6	26	19	10	148	12	9	81	5	9	0	0	0
4	12	0	79	6	3	21	4	0	0	0	0	0	0	0	251	12	0
17	12	11¼	303	14	0	181	4	26¼	1,163	8	0	81	5	9	251	12	0
1	2	0	18	15	6	6	7	0	0	0	0	0	0	0	75	6	6
8	2	25	140	4	0	15	1	30	0	0	0	0	0	0	179	2	6
0	16	12½	14	1	3	25	12	0	0	0	0	0	0	0	304	0	0
0	0	0	0	0	0	0	18	20	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	6	5	30	0	0	0	68	10	9	0	0	0
10	0	37½	173	4	9	54	5	0	0	0	0	68	10	9	558	9	0
27	13	8¾	477	2	9	235	9	26¼	1,163	8	0	150	0	6	810	5	0

						Madkhar.											
Value at Rs 20-14-0 per Candy.			Total Value.			Quantity.			Value at Rs. 3-15-0 per Candy			Value at Rs. 8-5-0 per Candy			Total Value.		
Rs.	A.	P.	Rs.	A.	P.	Cds.	M.	S.	Rs.	A.	P.	Rs.	A.	P.	Rs.	A.	P.
0	0	0	457	15	9	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	226	8	6	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	330	3	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	230	2	6	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	251	12	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	1,496	9	9	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	75	6	6	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	179	2	6	4	2	25	16	4	3	0	0	0	16	4	3
0	0	0	304	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	5	3	19	5	3	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	68	10	9	0	13	30	0	0	0	5	11	3	5	11	3
19	5	3	646	9	0	4	16	15	16	4	3	5	11	3	21	15	6
19	5	3	2,143	2	9	4	16	15	16	4	3	5	11	3	21	15	6

Grand Total.						Deduct Charrum or ¼ share to parties employed in extracting the Salt.			Government Share.			Remarks.
Quantity of Salt.			Value.									
Cds.	M.	S.	Rs.	A.	P.	Rs.	A.	P.	Rs.	A.	P.	
387	9	0	11,571	15	6	2,892	15	9	8,678	15	9	
211	10	12½	6,216	4	6	1,554	1	3	4,662	3	9	240 Seers to the Candy or 12 Seers to the Maund.
379	19	13¾	10,839	8	0	2,709	14	0	8,129	10	0	
289	3	10	7,909	10	6	1,977	6	6	5,932	4	0	
230	16	37½	6,849	7	3	1,712	5	9	5,137	1	6	
1,498	18	33¾	43,386	13	9	10,846	11	3	32,540	2	6	
101	14	10	3,077	7	3	769	5	9	2,308	1	6	
340	12	10	9,292	12	3	2,323	3	0	6,969	9	3	
177	3	11¼	4,230	4	9	1,057	9	3	3,172	11	6	
0	18	20	19	5	3	4	13	3	14	8	0	
6	19	20	74	6	0	18	9	6	55	12	6	
637	7	31¾	16,694	3	6	4,173	8	9	12,520	10	9	
2,136	6	25½	60,081	1	3	15,020	4	0	45,060	13	3	

APPENDIX No. 2.

Statement of *Receipts and Disbursements on account of Salt extracted from the Lake of Loonar in the months of April, May, June, and 20 days in July* 1855, *as an experiment.*

Receipts.				Disbursements.	Amount in Hyderabad Rupees.			Total.		
35 Candies of Salt extracted from the Loonar Lake of the description named, Dulla, Khuppul, and Puppree, at Rups. 41, 12 Annas per Candy of 340 Seers	1,461	4	0	Paid to Drivers being one-fourth (Charum) for extracting the salt from the Lake agreeably to former usage	365	5	0			
				Russooms to Zemindars on the net produce at 5 per cent. agreeably to former usage . .	47	8	0			
				Russooms to Putwarrie on the net produce at 2½ per cent. agreeably to former usage . .	23	12	0			
				Pay to Khamdar for Superintendence for the months of April, May, June and 20 days in July 1855, at 10 Rupees per month	36	7	3			
				Purchase of 3 Candies	33	10	3			
				For ceremonies previous to diving agreeably to usage	10	5	3			
				Making up 2 cots to float on the Lake . .	4	0	0			
				40 Baskets	0	6	0			
				Scales for weighing	0	8	0			
				Hire to weighers	0	12	0	522	9	9
				Balance carried to credit of Government .	......	..	..	938	10	3
Grand Total Hyderabad Rupees	1,461	4	0	Grand Total Hyderabad Rupees .	......	..	..	1,461	4	0

APPENDIX No. 3.

ANALYSIS OF DULLA SALT BY MR. REYNOLDS, AN ANALYTICAL CHEMIST OF CLAPHAM.

Extracted from Surgeon BRADLEY's *Memoir—page* 62

Dulla.

Soda............	32.8	67.
Carbonic Acid	34.2	
Water...........	31.	
Chloride of Sodium	2.	
Alumia, a trace.		
	100.	

67 of the Sesqui-Carbonate—equivalent to 56 per cent. of the Neutral Carbonate of Soda.

Khuppul.

Less soluble than Dulla—the equivalent of 52 per cent. of Neutral Carbonate being present.

Lake water.

Specific gravity 1,059 (Bradley) Analysis of the Lake water (Malcolmson.)

In 1,000 grains.

Chloride of Sodium........	29. grains
Sesqui Carb: of Soda......	4.2
Sulphate of Soda..........	0.1
Potass, a trace.	

Specific gravity.

1. of water from the Cow's mouth..........	1,000	at 85° F.
2. from Loonar Lake.....................	1,060	
3. from Bowrie of Sweet water in the Lake....	1,000	

APPENDIX No. 4.

Trees found in the crater of Loonar (authority Surgeon BRADLEY.)

1. Sterculia urens.
2. Boswellia serrata.
3. Grislea tomentosa.
4. Cochlospermum gossypium.
5. Borassus flabelliformis.
6. Tamarindus Indica.
7. Mangifera Indica.
8. Anona reticulata.
9. Anona squamosa.
10. Michelia Rheedii.

1. Conocarpus latifolia.
12. Lagerstrœmia parviflora.
13. Melia Azadirachta.
14. Butea frondosa.
15. Dalbergia.
16. Cathartocarpus Fistula.
17. Bauhinia tomentosa.
18. Prosopis spicigera.
19. Acacia Smithiana.
20. Mimosa.
21. Poinciana pulcherrima.
22. Buchanania latifolia.
23. Feronia Elephantum.
24. Grewia ulmifolia.
25. Helicteres Isora.
26. Capparis horrida.
27. Combretum acuminatum.
28. Clematis Gouriana.
29. Flacourtia sepiaria.
30. Celastrus montana.
31. Zizyphus (3 var.)
32. Abrus precatorius.
33. Ficus Indica.
34. —— religiosa.
35. —— glomerata.
36. Clerodendron phlomoides.
37. Dodonœa Burmanniana.
38. Tectona grandis.

Report on the Chemical Examination of several specimens of Salt from the Loonar Lake in the Deccan, by J. E. MAYER, *Professor of Chemistry, Madras.*

Qualitative Examination of Salt No. 1 "Dulla."

A portion, not weighed, treated by dilute sulphuric acid gave off a very large quantity of carbonic acid, leaving a notable portion of impurities undissolved, consisting of dirt, earth and some organic matters; these were separated by filtration. A portion of the filtrate ascertained to be acid, was then treated by solution of nitrate of silver, a copious white precipitate was deposited, showing the presence of chlorine. A second portion of the filtered solution was neutralized by solution of ammonia, iron and alumina were thrown down in small quantity: the precipitate was separated by filtration; to the filtrate, solution of oxalate of ammonia was added, white precipitate took place; this was separated by filtration, and to the filtered solution, phosphate of soda was added, a small crystalline precipitate occurred.

A fresh portion of salt taken and tested by the blow pipe for the presence of soda, gave the characteristic flame; the only base that could be left being potash, it was passed over (as if present it could only be in small quantity) till the quantitative examination was carried out.

A fresh portion of salt was dissolved, and treated by a little nitric acid; after effervescence and filtration, solution of nitrate of baryta was added—no reaction—absent sulphuric acid. Phosphoric acid being evidently in small quantity, if present at all, was not looked for. The preliminary examination of each sample of salt was conducted in a similar manner.

Guided by the qualitative examination above shown, the quantitative determinations were carried out. The usual methods adopted by chemists were employed throughout in these determinations. To ascertain the constitution of the salt, some special experiments were required. Frezenius and Will's method for the determination of the carbonic acid was made use of, to ascertain whether it was really a sesquicarbonate with the formula 2 NaO, 3 CO_2 like the natural compounds of soda and carbonic acid in Africa, or whether it had the more ordinary formula of the neutral or bicarbonate. These experiments showed in the case of the "Dulla" salt, that there is a mixture of carbonate and sesquicarbonate, in the proportion of 54 per cent. of the neutral carbonate and 30 per cent. of the sesquicarbonate; but in the others, a neutral constitution was found to exist, as exhibited by the formula NaO, CO_2. The point of interest connected with the constitution of the Dulla salt is purely a scientific one, since natural sesquicarbonates are very rare, having hitherto been found only in Fezzan in Africa, in the soda lakes of Hungary, and in Venezuela, South America; to this list we may now however add the Loonar lake in the Nizam's country. An artificial sesquicarbonate can only be obtained with difficulty, and under certain conditions involving a very careful employment of temperature.

The following is a statement of the composition of the several specimens of salts from the Loonar lake, calculated on 100 parts.

No. 1. "Dulla."

Carbonic acid..........	38·00	83·82; equal to 77·30 of neutral carbonate consisting of— 31·48 of carbonic acid 45·82 of soda. 77·30 neutral carbonate anhydrous.
Soda..................	45·82	
Chlorides of sodium and calceum............	0·61	
Insoluble matter, trace of iron, alumina, and organic matter........	2·00	
Water.................	13·57	
	100·00	

No. 2. "Nimuck Dulla."

Nearly pure common salt, containing 92·88 per cent. of chloride of sodium.

No. 3. "Khuppul."

Carbonic acid..........	32·0	72·58; equal to 68·47 of neutral carbonate consisting of— 27·89 of carbonic acid 40·58 of soda. 68·47 of carbonate of soda.
Soda..................	40·58	
Chloride of sodium.....	0·53	
Water.................	25·09	
Insoluble matter........	1·80	
	100·90	

No. 4. "Puppree."

Carbonic acid..........	29·00	72·46; equal to 71·1 of neutral carbonate consisting of— 29· of CO_2 42·1 of soda. 71·1 of neutral carbonate.
Soda..................	43·46	
Chloride of sodium.....	0·40	
Insoluble matter........	0·80	
Water.................	26·34	
	100·00	

No. 5. "Madkhar."

Neutral carbonate of soda	27·0	Carbonic acid	11
		Soda	16
			27
Insoluble matter, consisting of clay, sand, &c.	30·4		
Water	16·4		
* Common salt	25·4	Mean of 2 experiments.	
	99·2		

No. 6. "Bhooskee."

Neutral carbonate of soda	26·0	Carbonic acid	10·6
		Soda	15·4
			26·0
Insoluble matter, consisting of sand, clay, &c.	58·0		
Water	15·4		
Soluble impurities, chloride of sodium chiefly	2·6		
	100·		

No. 7. "Travertin."

Carbonate of lime	78·00
Do. of magnesia	4·58
Insoluble matter, oxide of iron, &c.	9·00
Chloride of sodium	2·60
Water	3·80
	97·98

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* The common salt in the sample is not uniform in quantity.

No. 8. Quartz.

No. 9. Greenish brown glass, very fusible.

No. 1. This salt appears to be formed in crystalline masses, and is but slightly contaminated by chloride of sodium, or by any other insoluble impurities; these, exclusive of the water present, will amount to about 4 per cent.

No. 2. Fine cubical crystals, forming masses, in which the peculiar structure may easily be traced; this salt contains something more than 92 per cent. of common salt, or chloride of sodium.

No. 3. Has less crystalline structure than No. 1; is efflorescent and white in appearance. Chemical constitution shows a larger amount of water, while the soda and carbonic acid are nearly in the proportions required to form neutral carbonate.

No. 4 is formed by the aggregation of numerous small crystals, is whiter than No. 1, but has almost the same chemical constitution as No. 3.

No. 5 appears in larger dirty looking masses, is not homogeneous in its composition; in parts, it possesses a beautiful structure, seen in crystals radiating from a centre ; contains 16 per cent. of water, 25 per cent. of common salt, and 30 per cent. of insoluble impurities.

No. 6. A greyish looking earth, containing 58 per cent. of insoluble impurities, 15 per cent. of water, 2½ of common salt, leaving 26 per cent. of carbonate of soda.

No. 7. A salt varying from all the other specimens, being composed of earthy (not alkaline) carbonates chiefly, some insoluble impurities, a little common salt.

No. 8 not examined, it evidently consists of crystallized silicic acid, known as quartz.

No. 9. A readily fusible glass, most probably chiefly a silicate of soda, not examined chemically, scratches window glass.

I have made no remarks respecting commercial value, as this must necessarily depend on various circumstances, concerning which I am but partially informed; these will chiefly embrace, 1st, the present quantity available for the market: 2nd, constancy of the supply: 3rd, local demands for the salts, which can only be known to those residing near the lake: 4th, means of transit, should a demand exist or arise elsewhere: 5th, the small probability of bringing any natural carbonate from a distance to compete in Europe, with the carbonate of soda made from common salt by Leblanc's process: 6th, the want of any extensive Indian manufactories of glass or soap, for which in Europe alkaline carbonates are principally employed.

The foregoing observations apply more or less strongly to all the samples containing carbonate of soda. The sample No. 2, which is essentially a pure rock salt, deserves more consideration, as it might, supposing it to exist in quantity, be turned to account as a source of revenue; there being always, from the large consumption and high price of the article, a ready market for good common salt in India. Sample No. 7 is worth a trial for building purposes, provided that the common salt present could be eliminated by washing.

The purification of the salts Nos. 1, 3 and 4 is easily effected by simple solution in hot soft drinking water, decanting or syphoning off the supernatant clear fluid to separate insoluble impurities, and evaporating in cast iron or sheet iron pans by means of furnace heat. As to whether the purification would prove profitable or not will depend on the expense incurred for fuel and cooly hire, and the price of the evaporating pans, together with that of the purified article; the latter is a main point to be considered, and cannot be seen before hand.

No. 2 requires little or no purification.

No. 5 might be purified in the same manner as Nos. 1, 3 and 4. There will exist in solution, a mixture of common salt and carbonate of soda, the former averaging about 25 per cent.; by concentration of the solution, (which should also be effected in iron pans), the common salt, from its less solubility compared with the carbonate of soda, and its equal solubility in both hot and cold water, will subside to the bottom of the evaporating vessel; it can be removed by means of a colander, drained, subsequently washed and dried; the solution will then contain carbonate of soda chiefly; by further concentration it will crystallize. A second solution of the carbonate in a limited quantity of water, and evaporation, will give crystals in a pretty pure state.

If it be considered worth while to purify salt No. 5, it must be chiefly for the purpose of extracting the common salt it contains, for which a ready market exists in this country; in doing so, however, the price of the article so obtained should be weighed against the selling value of this article obtained by solar evaporation from sea water or brine springs.

II. *Notes on Indian Currencies.* *By* J. W. BREEKS, *of the Madras Civil Service.*

Of all countries, Egypt perhaps excepted, the history of none retrogrades so far into the mist of fable and tradition as the Mythological Stories of Hindostan. The four great ages or Yugs of the Satya, the Treta, the Dwapa and the Cali descriptively distinguished as the Golden, the Silver, the Copper and the Earthen, introduce us to a most extravagant antiquity and represent every occurrence in a drapery of marvel and allegory under a regime of Solar and Lunar Kings.

Out of such fabulous materials to hazard an opinion as to whether the use of a *currency** was understood in those times, would be folly. Even in Menu's Code written in all probability 10 or 11 centuries B. C., the existence of a recognised Currency is alluded to in as familiar a manner, as a modern author might tell of a pound weight, or a yard measure at the present day.

In one part of the venerable volume, we find the interest of money judiciously regulated at x for the Twice-Born, and 2 x for

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* When the term "money" or "currency" occurs, it is not restricted to Coin Stamped by Public Authority, but includes also metal and other substances used as a medium of trade.

other people, while another part is devoted to a description of the provisions to be observed in suits for recovery of debts and such actionable matters, all of which are enumerated with the most punctilious nicety.

In a chapter* on Judicature and on Law, Private and Criminal, it is ordered, that "a false witness speaking falsely through covetousness shall be fined a 100 *panas*, through distraction of mind 250."

Such examples may be multiplied *ad libitum* through the 12 books of the Institutes: when we have these illustrations so to speak, depicting the highly civilized and social position of the Hindoos certainly 3,000 years ago, to hope for any trustworthy accounts of what may have taken place anterior to that period respecting even so obvious and familiar a topic as money would be vain.

One thing is certain, a very advanced state of civilization obtained among Hindoos in very ancient times, certainly before Troy was besieged, probably when Theseus reigned in Athens, or when Abraham visited Egypt, and the further into antiquity the thread of their history extends, we are less likely to find any trusty information of their adoption of a circulating medium and the surrounding causes that led to it.

All that can now confidently be asserted is, that the precious metals were anciently found in India in great abundance, and that when in the course of nature the want of a currency made itself felt, a wide choice of qualified substances was available.

Without drawing at present upon the earlier accounts which pretty generally hold India to be the fountain of everything precious, there are to be found in more modern times numerous allusions in the manifold histories of India to the existence of its riches, and to mines of precious ores and stones.

Abul Fazl (Akbar's Prime Minister) in the Ayeen II, p. 47 speaks of the iron mines of Gwalior, of the profitable and rich copper works of Beerat and of a silver mine not worth mentioning.

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* Ch. viii. para 120.

In a supplement to a voyage to the East Indies, written by Monsieur Dillon in 1698, an account is given of the wealth of the Great Mogul, and that "he wore upon his arm a diamond of inestimable value being as big as a pullet's egg. This diamond was "stolen out of the diamond mines belonging to the king of Bisnagar, betwixt Tonquin and Pegu, where every day are 20,000 men "at work. The king reserves all the best diamonds for his own "use, which are not to be sold. The best of those we have in "Europe being only looked upon as inconsiderable, are sold to the "European merchants."

Heyne also in his "Tracts on India" has described his visit in 1795 to the diamond mines in Ellore, and various parts of the Ceded Districts—and we all know Pope's account of Governor Pitt and the Golconda diamond he bought from the Brahmin—

> "Asleep and naked as the Indian lay,
> "An honest factor stole the gem away."

It is a widely known fact, however, that Indian gold and silver and minerals generally have not hitherto received much attention from scientific men, notwithstanding that their value has been appreciated from time immemorial by the Hindoos, and the metals have been in very common use amongst them for ornament and exchange for ages back, as is evident by their own and Grecian writings and consequently indisputable.

Take for example the Chetri Ganitam written originally in Sanscrit "the language of the gods," and quoted by Heyne, one part of which, the Suvarnah Ganitam teaches the art of assaying gold and silver by the touch, and of taking their specific gravities. Herodotus also (who wrote about 5 centuries B. C.) tells a pretty story about the way in which the Indians procured their gold in his time—

Heeren vol. i. p 280.
Herodotus iii. 102: 106.

"There are other Indians living near the city of Caspatyras and "the country of Pactyica (the city and territory of Cabul) situated "to the North of the rest of the Indian nation, and resembling the "Bactrians their neighbours in their manner of life. These are "the most warlike of all the Indians, and the people who go to "procure the Gold. For in the neighbourhood of this nation is a "sandy desert in which are ants less in size than dogs, but larger "than foxes, specimens of which are to be seen at the residence "of the King of Persia, having been brought from that country. "These creatures make themselves habitations under ground "throwing up the sand like the ants in Greece, which they "nearly resemble in appearance. The sand however consists of "gold dust. To procure this, the Indians make incursions into "the desert taking with them three camels, a male one on each side "and a female in the centre on which the rider sits, taking care "to choose one which has recently foaled. When in this manner "they come to the place where the ants are, the Indians fill their "sacks with the sand and ride back as fast as they can, the ants "pursuing them as the Persians say by the scent, the female camel "eager to join her young one surpassing the others in speed and "perseverance. It is thus according to the Persians that the Indians obtain the greater part of their gold, at the same time "that the metal is also found though in less quantities in mines."

As something akin to this I may insert here Monsieur Dillon's account of Calicut, and the wonderful gold-yielding properties of the Sands there.

"Among the sands of the shore, there is good store of gold-dust "which is very fine, and everybody has the freedom to gather it "at pleasure: the biggest piece that ere I saw was not worth above "15 pence, and commonly they are not worth above 4 or 5 pence "a piece; abundance of people get a livelihood by it; and with "the consent of the Governor (which is to be purchased by a certain set price, for the maintenance of a hundred poor people) you "may have as much sand as you please carried to your dwelling "places in order to separate it with the most convenience.

Also Pennant in his "Hindostan" written about 1798 A. D., at page 41 relates, that "Abul Fazl (II. 223) speaking of the rivers "of this country (Lahore) says, that the natives by washing the "sands obtain gold, silver, copper, rowny, tin, brass and lead. "Rowny is unknown to me, brass is fictitious."

Heeren whom I have quoted before, mentions in his 1st volume that the Hindoos were the only people subject to the Persian Em-

[redacted]ho paid their tribute in gold, and not in silver. In his 3d volume, page 357, speaking directly of the ancient Indian currency, he says, "There is no doubt that the precious metals gold and "silver, particularly gold, were in very ancient times the established "medium of exchange in India; but this however will not prove it "to have been coined. If we can repose any confidence in the "published translations of native works, the use of coined money "would appear to have prevailed in very remote times, for it is "expressly mentioned in the fable of Krishna; but it is uncertain "whether the passage is taken from the Mahabarat* or the Bhagavat,† or from one of the other Puranas.‡ In the laws of Menu "the respective weights of *paras* and *racticas* of copper, silver "and gold, are very exactly determined, without however any allusion to their being stamped. But whatever may have been the "value and character of the ancient Hindoo coinage, it is quite "certain that its use is of very remote antiquity."

It is but candid however to own, that it is difficult to reconcile this with the foot note, wherein the author seems to confess, he can find no very reliable information for such remote antiquity, for he asks—

"Is there even any Hindoo coinage older than our æra? we "certainly know of none. There are indeed plenty of coins impressed with some emblematical device, but none of them have "either date or inscription of any kind."

In the Greek accounts of India as gathered from Maurice's and Elphinstone's histories—in Strabo's account of Alexander's invasion B. C. 327, a description is given of the habits and manners of the natives of India, presenting a picture very similar to what we find in the Southern parts of the Peninsula in our own time, and that "they wore gold and jewels, and were very expensive in their dresses, though frugal in most other things."

From the kingdom of Bactria founded by a detachment of Alex[illegible]'s army, and which according to Clinton's Fasti Hellenici

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* Familiar to the Hindoos 2 or 3 centuries B. C.

† The Bhagavat is an episode of the same poem.

‡ Of more modern date, written probably between the 8th and 16th centuries A. D.

lasted about 120 or 130 years, and terminated about B. C. 120 or 130, many coins have found their way into India, and have been dug out from time to time about Cabul and Peshawur, and "one as far East as Muttra on the Jumna."—See Elphinstone's History of India, Appendix iv. p. 247. 3d edition.

A better and more complete account however of Alexander's invasion, and of the Grœco-Parthian kingdom after his time, of which Bactria was only an independent Satrapy, is given in Prinsep's Historical accounts from Bactrian coins and in Professor Wilson's book on Bactrian numismatics. Previous to the researches of these two gentlemen, our acquaintance with the Grœco-Asiatic currency was confined to a stray coin or two which had turned up par hazard here and there; but now by their study and inquiry upon fresh discoveries, that acquaintance has grown into a considerable chronological knowledge, not only of the order of the kings, but of the general history of that part of the country from Alexander's invasion to A. D. 215, the end of the Grœco-Parthian dominion.

Pennant in his Hindostan, page 70, speaking of a place on the gulf of Cambay, North of Surat, called Barochia probably the ancient Barygaza, the greatest emporium of all India in ancient times, says—

"Numbers of ancient drachmæ have been found here, inscribed "with Greek letters and the names of Apollodotus* and Menander,† "king of Bactria, who also reigned in this part of India."

Also, in page 78, talking of Ougein, a city north of the Nerbudda and supposed to be Ozene in Arrians Periplus‡, having just described a vasa myrrhina or drinking cup of T. Petronius made of a stone called myrrhine from Ougein, and described by Pliny—he (Pennant) says—"Even in those early times the merchants had "their course of exchange, and made great profit by the change "of the gold and silver denarii§ for the money of the country."

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* B. C. 135

† B. C. 155, according to Prinsep's Historical Results from Bactrian coins.

‡ Written about A. D. 30.

§ Prinsep in vol. i. p. 396 of the Journal of the Asiatic Society, for September 1832, says the Denarius was the principal silver coin of the republic—and weighed 90 grains—but was reduced by Augustus to 60 and by Constantine to 40 who also hanged its name to Centionalis, because 100 pieces equalled 1 lb. of silver.

Also, in page 51 vol. II. writing of Sadras, he says, "That this was a place of commerce I little doubt, and probably frequented "by the Romans. The grounds of my conjecture are that a pot of "gold and silver coins* has been found here by a Ryot, with characters which neither Hindoos nor Mahomedans could explain. "They probably must be Roman. We know that their trade extended even farther than the Coromandel Coast, and I have also "been informed that Roman coins have been seen in the possession "of Brahmins, the only people of curiosity in all these extensive "regions and such coins must have been found within their "neighbourhood."

In spite, then, of those who would have us believe that Akbar was the first to coin gold and silver money, it is evident that the precious metals have been known to the Hindoos from a very remote æra, certainly since the Grœcian invasion, and being eminently qualified for a circulating medium, became centuries ago, as Turgot has observed, "universal money not in consequence of "any arbitrary agreement among men, or of the intervention of "any law, but by the nature and force of things," throughout the peninsula of India as well as every where else, but at what precise period remains unknown. That the choice fell upon gold and silver arose probably from their being obtainable in the country, from their possessing the requisite qualifications of durability and divisibility, from their great intrinsic value, and from their having been extensively used for personal ornaments, the former metal in particular, because more portable and in the absence of banks and such like places of deposit more suitable for hoarding. The practice of hoarding jewels and gold is very common now in the interior, probably as much so as it ever was, and a good modern instance of it is given by Schomberg in his account of Runjeet Sing and his search after his chief Moonshee's treasures. The extract is [illegible]ned. "A tomb was erected in the interior of the Moonshee's [illegible]se, ostensibly to honor his father's memory, but in reality to [illegible]ceal his treasures, which when it was opened was found to "contain not a smouldering skeleton but solid gold. There are

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* Asiatic Researches I. 158.

" to be seen in India bars of pure gold melted into a solid mass,
" and to which the Indians give a name that might very well be
" translated gold bricks. Under the floor of the Moonshee's
" private room was found a flooring of these gold bricks, the walls
" were filled with them, the beams of the rooms were hollowed out
" and stuffed with the same precious metal."

Everywhere in the early and uncultivated ages of a nation, before Fable has run into History, and Money driven out its cumbersome antecedent Barter; when as yet Capital and Commerce are too feeble to call into action that army of competing interests and trades, so fruitful in the invention of measures to facilitate the interchange of commodities; when as yet that chimerical gentleman was daily to be met with,

——— Whose wish and care
A few paternal acres bound,
Content to breathe his native air
in his own ground.
Whose herds with milk whose fields with bread,
Whose flocks supply him with attire,
Whose trees in summer yield him shade,
in winter fire.

When it was an ordinary incident, to see men, glad to satisfy their few wants by an exchange of the productions themselves with the services and commodities of their surrounding neighbours, no necessity for a circulating medium existed: and there must first arise a variety of transferable commodities, and a succession of different wants before such necessity can have existence.

But as time hurries on, and the nation gathers strength, and war obliges intercourse with other nations, the people's wants insensibly increase and certain necessities stealthily creep in, *aurâ leni*, as it were, amongst which that of a more frequent interchange of commodities is always in the van, and the convenience not to say necessity of adopting some substance to facilitate the general transfer of services and commodities, and to be a measure of value and an evidence of debt, as obviously arises in the advancing tide of that nation's knowledge, as motion is created by force, and

certain uniform effects follow certain causes in any of the physical sciences.

With a nation emerging from barbarism, as soon as a variety of productions and a multiplicity of wants have reached a certain pitch, the fact that Money will supplant the intricate and circuitous method of Barter, is as much an intrinsic axiom in Pecunio-Economy, as that 2 and 2 make 4 in Arithmetic.

Acquaintance with the early history of nations assures us that such a result will always follow; for have not all nations adopted an intermediary currency at one period or another of their rise into national importance?

The metal employed may vary, as frequently, as there are or have been nations and as best adapted to their varying resources and circumstances, nevertheless every one of them have at some period of their course adopted some, silver—some, copper—some, iron* and some, gold—some, leather and some, shells—some, tobacco and some, salt—some, beads and some, slaves; but all have employed a currency as a measure of value to represent capital, the accumulation of labor, and to promote the transfer of commodities and mutual exchanges; and the institution of money may be considered as natural a result of a certain posture of circumstances in a nation's existence, as activity and buoyancy are the natural result of youth in an individual.

For a good account of the different substances used as currency in different countries, from the time Abraham bought his field for 400 shekels of silver down to the new Florin of Victoria, see the III. chapter of a book lately published called McCleod's Theory and Practice of Banking.

With nearly all nations metal will be found to have been the [illegible]e employed, from its possession, as I have said before, of [illegible] intrinsic value and of properties such that any fixed weight [illegible]l (A) being held to represent a certain fixed value (B)

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* Lycurgus established an iron currency, to lay up 10 minæ of which (£85-5-10) a whole room was required and to remove it at least a yoke of oxen to the end that by continuing poor, the Spartans were best guarded against the invasion of an enemy.

certain parts of (A) can be made to represent the like parts of (B) proportionally.

Not that it is absolutely necessary that the currency should be of metal—it may consist of what apparently has no value, as shells, or beans; and it may consist of precious stones, or even of paper as far as the home circulation is concerned.

Mr. Ricardo in 1819 suggested some such paper plan to the famous Bullion Committee, and maintained that the circulation of England should consist of nothing but paper and small silver tokens, the Bank issuing the paper and being compelled to pay its notes above a certain amount (£100 I think) in bullion instead of coin, and that there should be no gold coin at all. But such currency schemes based upon credit for the purpose of economizing bullion can only be carried out in countries very far advanced in civilization, where men have considerable confidence in one another, and entire faith in the stability of Government; while, in a country's infancy, on the other hand, where no such feeling is at all universal, it is very essential that the circulating medium should itself possess a certain intrinsic value, and for convenience and utility's sake be divisible, durable and of uniform texture—whence it comes that value has been always estimated by weight and not by tale, and gold and silver have been the favorite metals.

In so vast an agricultural country as India, where from time out of mind, the people have been caste ridden, where labor has been abundant and wages wretchedly low under governments despotic and changeable, and where there has been considerable internal trade, and where if we make exception in the matter of dyes, precious stones, and gold dust, which the ancients tell us came from countries near the source of the Indus, there was anciently no foreign commerce of importance the great majority of payments must always have been made in small coin, and though gold may at the same time have been abundant, for one instance of a tender of a gold piece, innumerable calls must have existed in such a country for a small silver or copper currency.

Mills in his history of British India supports this inference, (though he entirely disbelieves that the people of Hindostan were in remote times profusely supplied with gold and silver, as proved he argues, by the traffic of India being chiefly one of barter and its taxes being paid in kind,) where he says "It was not till "the time of Akbar that gold or silver was coined for circulation "in the principal parts of India, antecedently to that period *small* "*pieces of copper* being the only coin," to which in a note is added "—See the analysis of Tooril Mull's system of Finance in British "India analysed—1. p. 191. These copper pieces were called *pul-* "*siah* or *feloos*, 16 of which were reckoned equal to a Tankah "of bare silver, a sort of coin or rather medal sometimes struck "at the pleasure of the King, not for use but to make presents to "foreign ambassadors and others. In the Deccan, a gold and "silver coin was known earlier; which the same author thinks "must have been introduced by the intercourse of the Persians "and Arabians, to whom the use of the coin had been known "nearly a 1,000 years before."

But I agree with Mr. Elphinstone that the coinage of gold and silver must have been very general throughout India long anterior to Akbar's time, and was probably derived from the Greek colonies in Bactria, two or three centuries B. C., though it is not unlikely that with the precious metals as their standards of value the *general* circulation consisted of a cheaper money. One can understand that much more use would be found for tokens of copper and such media, as better suited to the wants of the people and to answer the purpose of a subsidiary coinage.

Stavorinus in his voyage to the East Indies (vol. I. p. 401) from 1768 to 1771 mentions that, "copper coin is not seen in Bengal. [illegible] change they make use of the small sea shells called cowries, [illegible] of which make a *poni* and 60 or 65 *ponis*, according as there [illegible]re few or many cowries in the country, make a rupee. They "come from the Maldive islands. The money changers sit upon "all the bazaars with quantities of them to furnish the lower orders with change, for the purpose of necessaries." Again, (vol. III. p. 9) talking of the Surat currency the same Author says, "in the same way as cowries are made use of in Bengal, "almonds called badams are made use of here," to which the Translator in a foot-note adds, "when Ovington was at Surat about "60 bitter almonds was the current rate of a pice. Thevenot says "68, and adds, that the almonds that pass for money at Surat come "from Persia and are the fruit of a shrub that grows on the rocks."

Vide "Hindostan," p.151. Pennant has described the way in which the cowries are obtained.

"These shells are collected twice in the month at full and new "moon. It is the business of the women who wade up to their "middle to gather them. They are packed up in parcels of "12,000 each, and are the current money among the poor in Bengal. Hamilton mistakes the manner of gathering them when "he says—The natives fling into the sea branches of coco trees, "to which the shells adhere and are collected every 4 or 5 months. "The exchange for them from Bengal is rice, butter and cloth."

With regard to Akbar being the first to coin silver and gold, Elphinstone (p. 428) says, "it has been said that Akbar first coined silver and gold money. The assertion is inconsistent with all "history. If the Hindus had not a coinage in those metals earlier, they at least adopted it from the Bactrian Greeks about the "beginning of the Christian æra."

Mr. Charles Masson in the Journal* of the Asiatic Society of Bengal for September 1836, treating of certain coins found at Beghram, in Cabul, classifies them into five grand divisions.

1. Grœco-Bactrian.
2. Indo Scythic or Mithraic.
3. Ancient Persian, whether Parthian or Sassanian.
4. Hindu or Brahminical.
5. Kufic or Mahommedan.

Thus commencing with the third Century B. C. we have a succession of coins varying in their form and superscription according to the dynasty that issued them, from that time to close upon the Mahommedan æra.

In the same Journal* for October 1836, Mr. Prinsep has given several new varieties of the Indo-Scythic coins and more fully developed the link between that coinage and the Hindu series, through the Gupta coins of Canouj. And in the April number of the Journal for 1837, the same gentleman has engraved specimens of the Indo-Sassanian coins which he says have frequently been discovered in the Punjab topes. He fixes their probable date between the 3rd and 6th Centuries A. D., and concludes that the Sassanian dynasty prevailed in Upper India, and that Hinduism became mixed with the religion of Bactria.

After this, there can be little doubt of the remote antiquity of Hindoo coinage, so I shall speculate no further on the question, but come at once to more modern times wherein we know, that whatever new district we have annexed or acquired, and into whatever new country our people have pushed their way, scores of different kinds of currencies have been found in circulation, evidence of the fact that every petty native state ostentatiously maintained its own mint and peculiar coinage. Hence it is that such a vast variety of gold and silver coins have been current at one time or another in our territories in India, and indeed are still to some extent current.

From the time of Alexander's invasion to the Mahommedan supremacy, excepting that India represented a chess-board of independent Hindoo states, little is known of its political history. Many of the princes laid claim, we are told, to be Lord Paramount of the whole country, but without any solid title to the honor, and it is now nearly certain that as in Alexander's time, so for many centuries subsequent to him, these states, dotted over the length and breadth of India, led a feudatory and independent kind of existence.

After the breaking up of the empire of the Caliphs in the 9th century, and when several Arab conquests had taken place in the northern part of India, various dynasties we are assured sprang up,

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* Vol. v. p. 537.

* Vol. 5. p. 639.

till Sultan Mahommed declared his independence about A. D. 1,000 and established the first Mahommedan government at Ghasni, some 60 miles south of Cabul. A story is told of this prince that he promised a dirhem (Mr. Dow in his history of Hindostan, [illegible] was a mher) to the poet Ferdousi for every verse of a cert[illegible] torical poem on Persia, and that although he meant a golden [illegible] hem from covetousness he changed the payment into silver dirhems.

Dirhems and Dinars were the money of the Caliphs, and are thus described by D'Herbelot in his Bibliotheque Orientale.

" Les Mussulmans n'eurent point de dinars d'or marqués a " leur coin jusqu'en l'an 76 de l'Hegire (de J. C. 695.) Ce fut " Hegiage, lequel etablit la premiere monnoye sous le Khalifat " d'Abdalmalek. Auparavant toute la monnoye d'or etoit au coin " des Empereurs Grecs, et celle d'argent avoit son inscription " en charactêres Persiens. Les Khalifes Abbasides Haroun " Raschid, Almamom et Vathek firent battre de la monnoye a plus " haut titre que n'avoient fait les Ommiades."

The house of Ommiades ended in A. D. 750 and the Abbasides Caliphs succeeded.

" Dirhem et direm, le premier mot est Arabe et le second est " Persien. Un dirhem et demi pese un methcal ou une drachme, " de sorte qu'il y'en a douze a l'once qui n'est que de huit drachmes, ou de huit gros. Le Direm pese aussi douze carats, et " se prend souvent pour un fort petite monnoye de cuivre. Ce " fut Hegiage Gouverneur de l' Iraque Arabique qui fit battre le " premier des Derahim d'argent avec l' inscription " Allah Samad" " Dieu est inmuable. Sous le Khalifat d'Abdalmalek, ils etoient, de " bas alloy : mais les Khalifs Abbasides les mittoient a plus haut " titre."

" Abul Fazl in his ' Ayeen Akberry,' a kind of supplement to his " Akbernameh, has given the following account of Dirhems and " Dinars. Dirhem was a silver coin originally of the shape of a date " stone, Caliph Omar changed it into a round form and some say " was the first to stamp an impression on it, others that Hejaj " in the time of Abdalmalek Meerwan, others that Mahan Ebn " Zobier was the first."

" Some say that Direms were of 10, 9, 6 or 5 miskals, others " of 20, 12, or 10 Keerats weight and that Omar formed a coin of " 14 Keerats being ⅓ of the aggregate sum. In Omar's time " were current several kinds of Dirhems of 8 dangees."

" Fazel Khojendy says in former times there were two kinds of " Dirhems; 8 dangees and 6 dangees,

" 2 Hebbehs = 1 Tessuj,
" 2 Tessuj = 1 Keerat,
" 2 Keerats = 1 Dang.

" Dinar is a gold coin weighing one miscal and is equal to $1\frac{3}{7}$ of a " Dirhem.

" Miscal is a weight used in weighing gold and is also the name " of a coin.

" 12 Zerrahs = 1 Kitmeer,
" 6 Kitmeers = 1 Nekeer,
" 6 Nekeers = 1 Feteel,
" 6 Feteels = 1 Ful,
" 12 Fuls = 1 Mustard seed,
" 6 Mustard seeds = 1 Barley corn,
" 2 Barley corns = 1 Hebbeh,
" 2 Hebbehs = 1 Tessuj,
" 4 Tessuj = 1 Dang,
" 6 Dangs = 1 Miscal,
by which a Miscal = 96 Barley corns
a Dang = 16 Do.
a Keerat = 8 Do.

Upon the termination of the Ghazni dynasty in the 12th century, the house of Ghor, the slave Kings and the princes of Kilji, of Toglak, of the Seiads, and of Lodi followed in succession, and bring the history of India down to the house of Teimour and the conquests of Baber in 1526 who founded the empire of the Moguls.

In Elphinstone's account of Alla u Din's reign of the house of Khilji, at the beginning of the 14th century, mention
1295—1316 A. D. is made, that Cafur one of the king's generals returning from an expedition, brought with him vast treasures to

Delhi, to which in a foot note is added, "Ferishta* states that at "this time there was no silver coinage in the Carnatic: and Colo- "nel Briggs observes that the same was true to a certain extent "till very lately: the common coin was the pagoda and there was "a small coin called a gold fanam, as low in value as a sixpence."

Dow in his history, describing the distracted state of the country under Mahommed Toglak's rule, ascribes it to a number of reasons, and amongst others to "the king following the Chinese "custom of issuing paper upon the Emperor's credit for ready

1325—1351 A. D. "money, and to his striking a copper coin which he "issued and made current by a decree at an imagi- "nary value." He also adds, "that the merchants made their pay- "ments in copper to the poor manufacturers, at the same time that "they themselves received silver and gold for their export. There "was also much villainy practised at the mint: for a premium to those "who had the management of it, the merchants had their coin struck "considerably below the legal value. But the great source of the "misfortunes consequent upon the debasement of the coin, was the "known instability of Government. Afterwards the Emperor to "ease the minds of the people was obliged to call in the copper "currency."

In Ferishta's history of the Deccan, mention is made in many places of money, as for instance, in his account of the Bhamenee dynasty founded by Zuffir Khan in 1347, he says—"Coins were "struck, impressed with his titles of Sultan Alla ad Dien Houssun "Raujah Bhamenee." Also at page 17, he adds, "the gold and "silver coins of the Bhamenee Sultans were of square form, and "different value, having on one side the creed of testimony,† and "the names of the four holy friends.‡ On the other was the sove- "reign title, and year of his reign. The Hindu bankers at the in- "stigation of the roies of Beejanuggur and Telingana melting all "which fell into their hands that the coins of the infidels might alone

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* Who wrote a history of the Mogul Emperors and some other works at the latter end of the 16th Century.

† There is no God but God and Mahommed is his Prophet.

‡ Mahommed, Ali, Aboubekker and Omar.

"be current in the Deccan, the Sultan was enraged; and when they "persisted in the offence in spite of his remonstrances, he put all "the guilty to death, and restrained the business of exchange to "some Kutteries, descendants of Dhellians, who had migrated to "Deccan. After this, the Bhamenee coins alone were current in "the Mahommedan dominions, but since the cessation of that dy- "nasty, the coins of the Hindoo princes have been allowed also to "pass universally.

Again at page 23, describing the throne Firozeh of Sultan Mah-

1357 A. D. mood Bhamenee who reigned in 1357, he says, the jewellers valued it at a crore of *oons* which the Translator at p. 169 explains as being "those coins called pagodas by Euro- "peans, a lac of which make somewhat above £40,000," in which case the pagoda is estimated at more than 3½ rupees, the common value assigned to it. Also at page 87, describing Firoze Shaw with his bride going to the camp of his father-in-law, he says, "The two princes rode on horseback together, between ranks of

1407 A. D. "beautiful boys and girls, who waved plates of gold "and silver flowers over their heads as they advanc- "ed, and then threw them to be gathered by the populace. Silver "flowers being small coins stamped with the figure of a flower "and still used in India to distribute in charity, and on occasions "thrown by the servants of the great among the populace."

At page 175, Cowries are mentioned as well as another money called Laares, "Mohammed Shaw having heard frequent reports of

1481 A. D. "the vast wealth of Rajah Jehaun, sent for his trea- "surer. The treasurer said, oh! Sultan, my Lord had "two treasuries one of which he called the Sultan's—in this there "are now 10,000 *laares* and 3,000 *oons*—the other he named the "treasury of the poor, in this there is a sealed bag containing "3,000 laares. Whenever money come from his Jaghire, having "taken from the king's treasury the pay of his troops and stables, "he gave the remainder to the poor, not reserving a *cowrie* for his "own use.

In Baber's Memoirs written by himself, and translated by Mr.

1494. Leyden, frequent mention is also made of money. The memoirs commence with Baber becoming king of Fergâna, near Bokhâra and Samercand in Tartary.

At page 28, speaking of his uncle Sultan Mahomed Mirza, he says, "He was well versed in calculation, and not a single dir[illegible] " or dinar of his revenues was expended without his knowle[illegible] The Translator adds, "the former is now of the value of 5[illegible] " the latter of about 9 shillings."

At page 61, mention is made of a "1,000 *tumans* of silver," to which Mr. Leyden has appended this note, "It is extremely difficult [illegible] fix the value of money in remote periods. The Tumân in [illegible]a Valle's time (1617) was 10 Zecchins (Voyages vol. IV. p [illegible]7). Mendelshoe soon after values the Zecchin at 8½ or 9 [illegible]pees; which would make the Tumân of that day worth 9 or [illegible]£10 sterling. In Chardin's time, the tumân was equal to 45 livres, and Tavernier makes it equal to 46 livres, 1 denier and ⅓, or ac- " cording to his English Translator at the then par of exchange of " 4*s.* 6*d.* for the French crown, £3 9*s.* and a fraction. The livre it " will be remembered like the tumân has been sinking in value. " Fryer (Travels p. 222) makes the Tumân £3 and a noble. " It was lately worth an English guinea and from incessant tam- " pering with the coin is now worth little more than 15 shillings. " As the decline has been constant, it was probably in Baber's time " worth more than the highest of these sums."

"The Shahrukki was a silver coin of the value of 10*d.* or 11*d.* " English, 2½ shahrukkis being equal to a rupee in Akbar's time."

"The Tang or Tenki was a small silver coin of which in Men- " delshoe's time 14, 15 or 16 went to a pagoda. It was of the value " of about 5*d.* and was formerly more. It has now declined to " about a 1*d.* It seems to have been ⅛ of a dirhem. The D[illegible] " was an Indian copper coin, 1/40 of a rupee."

At page 80, in his memoirs of the transactions of the year 1499,

1499 A. D. it is written "he did not give any one a single *dang*," probably the same as Tang. Also "not a *fils* from any other quarter reached him." Fils is explained to be a small copper coin.

At page 188, among the men who adorned the Court of Sultan Hussain Mirza, is included Bèhbud Beg "who did good service in " the Mirza's expeditions, and in reward of it, his name was in- " scribed on the Tangha and Sikka" that is, on the royal seal or stamp, and on the coin.

1519 A. D. At page 282, among the occurrences of 1519, it is mentioned that "the tribute of the inhabitants was fixed at 60 *mish-* " *kals* of gold," apparently the same as miscal which Abul Fazl makes equal to 96 barley corns. And further on, a diamond valued at ½ the expense of the world is said to have weighed 4 mishkals or 220 *ratis*.[*]

At page 290, of the events recorded of the year 1525, it is related

1525 A. D. that "the brothers of Nur and Beg arrived bringing " to the amount of 20,000 *shahrukkis*, in *ashreffis* " and Tanks" which the Translator estimates to be "about £1,000[†] " sterling." He also remarks that "nothing can afford a stronger " proof of the scarcity of specie in Kâbul than this appropriation " of so small a sum. The name of ashrefi is applied to the gold " mohur which is worth about a guinea and a half. It is applied " however to gold coins of various magnitude and value."

Throughout the latter part of the memoirs, in the mention of large sums, and in estimating the revenues of a district, Baber makes frequent use of the words *lacs* and *crores*, unaccompanied by any denomination of coin; Mr. Erskine[‡] remarks upon this "that the " Emperors of Hindostan from a love of pomp and show, have al- " ways used large numbers in reckoning their revenues and in be- " stowing presents. Their revenue accounts were kept in *dams* of " which 40 go to a rupee. Hence their lacs and crores sink into " very small compass when reduced to English money."

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[*] Mr. Dow in his history of Hindostan makes the miskal equal to 39 rutteys (which I suppose is the same as *ratis*) and a ruttey equal to ⅘ of a carat, a carat being the same as keerat mentioned by Abul Fazl, makes the rutty equal to 7 barley corns.

[†] This makes the value of a Shahrukki, a shilling instead of 10*d.* or 11*d.* as he said before.

[‡] Who with Mr. Leyden translated Baber's memoirs.

In the Ayeen Akbeery by Abul Fazl, translated by Mr. Gladwin, very detailed accounts are to be found of the [illegible] of the mints and the coinage in Akbar's reign.

1556–1605 A. D.

That the officers of the Mint were

“ 1. A Derogah (or superintendent.)

“ 2. Shroff (assay master.)

“ In Persia are 10 degrees of fineness called Dehees, in Hindostan 12 degrees
“ called Barah Bannees. Formerly the old ‘hun’ a gold coin current in the
“ Deccan was 10 bannees, Akbar made it 8½.

“ 3. Aumeen—a disinterested party to see that nobody acts
“ dishonestly.

“ 4. Mushreff—to write the waste book.

“ 5. Merchant—to buy gold and silver.

“ 6. Treasurer—to watch over the stock of profit.

“ 7. Weighman.

“ 8. Melter of metal before it is refined.

“ 9. Plate-maker.

“ 10. Melter of refined metal.

“ 11. Zerrab—who cuts metal into size of coin.

“ 12. Seal engraver.

“ 13. Sickchy—places the round piece of metal between two
“ dies, and by strength of hammer both sides are stamped.

“ 14. Subbak—makes refined silver into ingots.

“ 15. Koorskoob—having heated refined silver, hammers till
“ it has lost all smell of lead.

“ 16. Chashneegeer—assays the refined silver.

“ 17 and 18. Employed in recovering precious metals from drosses.

“ 19. Pykar—brings drosses and litharge from city goldsmiths
“ to be melted.

“ 20. Neecheweewala—brings old silver coins to be melted.

“ 21. Khakshu—rents the sweepings of the mint from Go-
“ vernment at 12½ rupees per mensem.

About the 36th year of his reign, Akbar turned his attention to the coinage, restored the standard, and directed that all species of coins though they might be received by the Collectors of his revenue, were only to be taken for as much as was their value by the new standard.

[illegible] names, values, forms, and impressions of the different coins [illegible]en by Abul Fazl, I have subjoined in a Tabular form.

GOLD COINS.

Names of Coins.	Weight.			Value.	Form.
	Tolahs.	Mashahs.	Ratees.		
Sehenseh	101	9	7	12,000 Rupees.	Circular.
Do.	91	8	0	900 do.	do.

Rehess....half of both of the above and made square.

Atemah....a quarter of the Sehenseh.

Binset.....a fifth of the Sehenseh, there are also Binsets of ⅛, 1/10, 1/20, and 1/25 parts of a Sehenseh.

Jugul......a fiftieth of the Sehenseh.

Chargoshey .. Aftaby........	1	2	4¾	12 Rupees.	Round.
Ilahee..	0	12	13¼	12 do.	do.
Laal Jilaly.....	0	12	13¼	12 do.	Square.
Adel Gootkeh..	0	11	0	9 do.	Round.
Mohur ...... Mehraby.....	0	11	0	9 do.	do.

Geerd..........	½ of Ilahee.
Dehn...........	½ of Laal Jilaly.
Seleemy........	½ of Adel Gootkeh.
Reby...........	¼ of Aftaby.
Mun...........	¼ of Jilaly.
Nisfy Seleemy..	⅕ of Adel Gootkeh.
Punj..........	⅕ of Ilahee.
Pandow.......	⅕ of Laal Jilaly.
Sumny........	⅛ of Ilahee.
Kala..........	⅙ of Ilahee.
Zerrah........	1/32 of Ilahee.

SILVER COINS.

Rupeeah weighs 11¼ mashahs---first introduced by Sheer Khan, and by Akbar made more pure. Market price is 40 dams.

Jilaleh---same impression and weight as rupeeah.

1¼ Sooky = 1 Kala.
1⅗ Kala = 1 De-fa.
1¼ De-fa = 1 Ashet.
1⅘ Ashet = 1 Pandow.
1¼ Pandow = 1 Chern.
2 Cherns = 1 Durb.
2 Durbs = 1 Jilaleh.

There are also similar subdivisions of a rupee of a round form.

COPPER COINS.

Dam is a copper coin, in weight 5 tanks or 1 tolah 8 mashahs 7 ruttees, in value $\frac{1}{40}$ of a rupee, formerly called pysah and also Behlooly; accomptants suppose the dam to be divided into 25 parts, each of which they call a cheetel, and use them in calculations.

2 Dumrees = 1 Powlah.
2 Powlahs = 1 Adheleh.
2 Adhelehs = 1 Dam.

From this time, Akbar's coinage may be said to have formed the bulk and basis of the currency of the country, although numerous independent states exercised the privilege of coining and fabricating pieces of a very different stamp, weight and fineness. Rupees, mohurs and pagodas form the prevailing denomination to be met with.

In the "Memoirs of the Mogul empire" by Eradut Khan Wazeh translated by the same Mr. Scott, from whose transla-
1700 A. D.
tion of Ferishta's History of the Deccan I have before quoted, the author describing his interview with the emperer Aurungzebe about A. D. 1700, says, (p. 3,) "when I returned to his "presence, his majesty gave me his blessing, 200 mohurs and one "coin weighing 100 mohurs," to which this note is appended, "Golden coins of this and greater weight were often given as

"marks of favor—silver coin, of several hundred rupees value "were also in use; and there is one of them now in the British "Museum, of which the ingenious Mr. Richardson has given a "very full description in his very learned work, the 'Persian and "Arabic Dictionary.'"

Elphinstone* in his history, alludes very cursorily to the ancient coinage of India and merely tells us, "that the first princes used "dinars and dirhems like the Caliphs, these were succeeded by "tankhas divided into dams and jitals—Shir Shah† changed the "name of tankha to that of rupeia, or rupee, which was adopted "by Akbar, and the latter prince fixed the weight and relative va-
1761 A. D.
lue of money on a scale which remained unaltered "till the dissolution of the Mogul empire, (1761 A. "D.) and is the basis of that now in use." In a note he adds, "the "Dinar under the Caliphs was about equal to 10*s.* 8*d.* In Ibn "Batuta's‡ time a western dinar was to an eastern dinar as 4 to 1 "and an eastern dinar $\frac{1}{10}$ of a tankha, which even supposing a "tankha of that day to be equal to a rupee of Akbar, would be "only 2¼*d.* The tankha is said by Ferishta to have been in Ala u "Dins time (1295 A. D.) equal to 50 jitals, and in Mohammed "Toglak's time (1325 A. D.) it was so debased as to be worth no "more than 16 peisas."

"The rupee§ of Akbar contained 174.5 grains of pure silver "and was divided into 40 dams or peisas (of 191⅓ grs. of copper "each). The dam was divided into 25 jitals (probably a nominal "coin). Queen Elizabeth's shilling contained 88.8 grs. of pure "silver---Akbar's rupee therefore was worth 1*s.* 11⅓*d.* of English "money of his time."

Having thus traced the various denominations of coins from very early times down to a more modern date with such explanations of their values and kinds annexed as are afforded by cotem-

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* Page 429.

† Lived 1540 A. D.—947 A. H.

‡ Who wrote nearly 2 centuries before Baber, that is, about A. D. 1300.

§ Weighed 187.5.

porary authors, I will conclude with some account of our present coinage, and compare it with others that have been current within the last century in British India.

From a revised Assay Table, lately published by the Bombay Government, of coins current in the territories under that Presidency, or imported there as bullion, it is shown what a marvellous variety of sorts each district exhibits. It should be remembered, these are all coins of quite a modern stamp, with one or two exceptions, probably none of them being much more than a 100 years old.

The Table contains 27 varieties of gold coins current in, or imported from the Madras Presidency. Of these, the average is 80 per cent touch, that is 20 alloy to 80 gold, while the English sovereign is 91·666 touch.

Among them the Gharava Tharokee Pagoda formerly current in the Southern Mahratta country, gives the finest touch being 85.25. While the Sultana and Canteroy Fanams show most alloy, being only 58 and 59 touch respectively.

The same Assay Table gives 22 varieties of Rupees from Guzerat with an average touch of 87.

The highest being the Ahmedabad Hallee Rupee, 98.05.

The lowest the Chittoree Rupee, 74.52.

The fineness of the new Company's Rupee current through British India is 91.666. And the English shilling, 92.5.

Twenty varieties are given of the Deccan coinage, with an average touch of 88.

The highest being the Berhanpoor Rupee, 94.75; coined by Scindia in Khandeish.

The lowest, the Komptee Old Rupee, 63; struck at Pannallee by the Rajah of Kolapore.

Eighteen varieties of the S. Mahratta coinage with an average touch of 86.

The highest being the Phoolsheree Rupee, 95.60; a species of Ankoosee: coined at Phoolsher.

The lowest the Nilkunkee Rupee 54

Twenty-nine varieties of the Hyderabad Assigned* Districts with an average touch of 80.

The highest being the Chandore Rupee, 92.

The lowest the New Narrinpett Rupee, 74.86.

Twenty-six varieties from Scinde with an average touch of 86.

The highest being the Tuttaee Old Rupee, 98 23, current at Shabunder, Dhurraza, Succara and Kekrola.

The lowest the Hydrabadee Rupee, 69.60.

Fourteen from the Punjaub, with an average touch of 88.

The highest being the Sha Jehan Rupee, 97.76.

The lowest the Goondashye Rupee, 75.52.

These examples will serve to exhibit the state of the currency before the establishment of Mints by the E. I. Company. That these were all the varieties of coins, and that there were not legions of others up and down India, I must not for a moment be supposed to put forward. Only the other day Mr. Seton Carr in his speech to the Court of Proprietors upon the policy of granting Lord Dalhousie a pension, mentioned that the Company's Rupee had supplanted some 60 different kinds of currency in the Punjaub alone, and I imagine the varieties there are not more numerous than in other parts of India.

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* In 1852, the Nizam's Government sent down a number of Uncurrent Coins weighing 9,51,166 Tolas 8 A. 0 P. to be assayed and valued at Madras, in order that their net outturn in Company's Rupees might be taken in payment of the Nizam's debt to the British Government. Subjoined is the result of the operation given by Major J. T. Smith, the Mint Master at that time, showing the net Outturn to be 8,14,203 Rs. 14 A. 7 P., exclusive of Seignorage and Refinage.

Gross weight.		As per Assay Master's outturn Reports, dated 3rd September and 30th October 1853.		
Before Melting.	After Melting.	Standard Weight.	Outturn Value.	Net Outturn Value.
Tolas A. P. [illegible] 0	Tolas A. P. 9,49,899 8 0	Rs. A. P. 8,39,563 10 [illegible]	Rs. A. P. 8,39,563 9 0	8,14,203 14 7

In Col. Smith's Report also, upon the various points of enquiry regarding the Madras Mint, suggested by the Government of India, the Hydrabad Currency is alluded to in these words, (para. 42) "An extensive Coinage will probably be "required to rectify *the indescribable confusion* of the Hydrabad Currency. Its "value is, I believe, estimated at from 2 to 3 Crores, which with a due proportion "of small Silver and Copper coins, would require a coinage of 17 or 18 crores of "pieces."

With regard to the coins which have just been enumerated, it is right to draw attention to the high standard of value the majority of them reach. It almost leads one to suppose that native Princes never debased their coinage, as the Romans did in the 1st Punic war, when they reduced the As from 12 oz. to 2, and as Henry VIII. and some of our Kings have done, and as James did in Ireland in 1698 after the siege of Londonderry, to serve their own or some political convenience, were it not that such a conclusion is opposed to all we know of the origin and lives of many of them—who being often mere adventurers, and succeeding to the musnud by some happy stroke of luck or desperate villainy, were not likely to neglect the mint, so powerful an engine to wipe off a debt or replenish (for the moment) an empty treasury. Indeed, we may feel certain that tampering with the fineness of the metal was a very common practice with them, for we know it was customary with native Financiers in Bengal to demand "a Sherusteh " Butta or per centage on the difference between the coin in which " the lands were universally assessed and the coins in which the " cultivators paid their taxes," and no doubt they made it a fruitful source of income.

Akbar's coinage however is admitted by all hands to have been the true and ancient standard. Jervis speaking of it in his Indian Metrology, (p. 63) says, "the coins of Bengal were originally the same as those of Surat, as restored and established by " the wise and virtuous Akbar. The true tola weight and the weight " of the rupee was then fixed at 12 massas or 187.5 grains."

A curious account of Akbar's treasures in coined money and jewels is given in the "New History of the East Indies," translated from Abbe de Guzon, (page 263. vol. i.) "Achobar for so that " prince was called caused a certain species of money to be coined " of the value of 25, 50 and 100 toles which were worth 2,012½, " 4,025, 8,050 crowns, each piece, amounting to the sum of " 6,970,000 massas which make 97,580,000 roupees or 48,790,000 " crowns, money of France. He had also besides a 100,000,000 " of roupees or 50,000,000 of crowns, in a certain species of money " called after his name, roupees of Achobar. And 250,000,000 of

" another species of money called peisas or pechas, 30 of which " make a roupee.

" The peisas or pechas are a small piece of copper not quite 2 " lairds French money in value.

" The mamoudy is their smallest piece of silver, it is valued at " [illegible] sols; 26 pechas = 1 mamoudy; a roupee of silver is valu- " ed at 30 French sols.

" The roupee of gold is only known among the great lords, and " is worth 14 silver roupees or 21 livres. The thiel of silver makes " 11, 12 or 13 roupees current money. The massas is another " piece, of which 11½ make a thiel of silver; and 10 of these make " a thiel gold.

" 100,000 roupees = a lek.
" 100,000 leks = a couron.
" 100,000 courons = padan.
" 100,000 padans = nil.

I do not engage to understand Mon. Guzon's computation, in one place he says, 30 *peisas* make a *roupee* and afterwards that 30 sols make a *roupee* and that a *peisa* equals 2 lairds (or ½ a sol), but I give the extract as a curiosity. The sol, the livre, the laird, the denier and the pistole formed the ancient money of France which ceased to be current in 1834.

To go back to Jervis again, who says Akbar's rupee was divided into 12 massas, each massa being 15.625 grs. troy, we find, "In " the reign of Shah Jehan the coinage was reduced to 11½ massas, " and this multiplied by 15.625 shows the origin of the deteriorat- " ed coins of later years, and equals 179.6875 grs. troy, which " standard with very trifling modifications has continued at a stay " ever since, though it is remarkable through the profound ignor- " ance of our own governments and countrymen on the subject or " probably their apathetic indifference to such calculations and to " the great financial questions in connection with the character, " dignity and stability of the state, this standard has been suppos- " ed to be the full weight of 12 massas or 1 tola, and now ulti- " mately fixed as the unit of the monetary system throughout " British India."

When we first came to India, attracted by the inviting reports of Drake and Cavendish, and were permitted to establish here and there a factory, originally subordinate to Surat, but afterwards to Madras, Bombay and Bengal---constantly at war to-day with the Mahrattas, to-morrow with the Moguls, and the next with the Dutch, Portuguese or other European rivals---our hold upon India, even up to the close of the 17th century, was of far too precarious and insecure a nature to admit of our finding, at the present day, many traces significant of our early occupation of the country ; nevertheless our factories and stations rapidly continued to extend with a growing charge in their accounts to "Civil and Military expenses," and eventually resulted in the foundation of a British empire in the East, the envy of the present age. In this preliminary state, things continued with variable fortune till 1746, when our political horizon looked gloomy in India, and Madras was taken by the French, but restored by the peace of Aix la Chapelle in 1748. Subsequent to this, occurred those memorable struggles between our countrymen under Clive and the French under Dupleix, ending after a long conflict in their overthrow, and in the extinction of the Mogul empire and the eventual succession of Company Durbar. In 1771, the East India Company, we are told, "stood forth publicly in the character of Dewan."

It is not always an easy matter to get information of many things connected with our first government of India—and the coinage of money is among the number.

Cæsar Mureau's "E. I. Company's Records" exhibit in chronological order the Commercial and Political history of the Company from 1600 to 1823, and is a very comprehensive account in a succinct and readable form ; but he alludes to mint matters only once, and that merely to say that in 1677 permission was granted the Company to coin money.

The earliest notice of a mint, I can anywhere trace, is in Kayes' History, (p. 68,) where speaking of various administrative schemes 1669 A. D. proposed by the Court in 1669-70, he says, "They recommended also the establishment of a Mint."

Accordingly in the charter granted by Charles II. to the E. I. 1677 A. D. Company in 1677, besides having their old privileges confirmed to them, authority was granted them to coin money (not resembling British money) at Bombay and other places in India, with respect to which Mr. Kayes says, (p. 71)—"The establishment of a mint had long before been re- " commended to the Company by their servants abroad ; and it " had been much considered and discussed but had never before " taken practical shape. It was now however actually to pass in- " to a fact by the express permission of the crown. The Company " regarded it simply as an instrument of trade but their servants " five and twenty years before had been looking at the matter of a " Tankshall* in the Deccan in connexion with the question of war.

" The Factors at Rajapore, recommending the Company to coin " money, wrote in 1659 "For your worships may please to know " that all these artificial mines of money which were made in time " of peace are now exhausted through a civil war—will it not be " necessary to have a Tankshall in the Deccan and a coin that will " be current to carry on a trade here, as large as you please during " your war with India and which will continue no longer than you " please ?—Then judge if you would not make the Tankshall " cry as mournful to the king of India's ears as the liver, the " fountain of the blood, should complain in a natural body, and " then what conditions you may bring him to is easy to foretell."

Many years would naturally elapse before the Company's coinage took an important part in the general circulating power of the country. Each district wedded to its own currency would reasonably be jealous of a foreign coin, and resist its introduction at any rate at first. It was probably far into the 18th century before the Company's coinage took its place among the other currencies of the country and performed a material part of the duty of circulation.

Mr. Dillon in his "East Indies" speaking of the natives in 1698 A. D. Malabar alludes to the currency of that part of the world in 1698, " To every one of these natives you

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* From two Sanscrit words signifying *a coin* and *a hall.*

" pay 8 tares per diem which amounts to ½ a fanam. The fanam is " a small piece of gold worth 16 tares, and the tare is a small silver coin worth about a ½*d*. Each native has not above 4 tar[illegible] day when he keeps guard in a house, but when he travels he [illegible] double pay."

In an old Fort St. George Journal for 1716 is an entry for the
month of May, " Rupees Madrass Dr. to Edward
1716 A. D. " Harrison, Esq., Mint Master, Pagodas 238-32, for
" 836½ Rupees received of him account coinage at 350 Rups. per " 100 Pag." And in the June Journal, " Rupees Madrass Dr. to " Edward Harrison, Esq., Mint Master, Pag. 105-9-0, for 268 5-0 " dd. out of the Mint into the Warehouse account coinage for the " month of May at 350 Rups. per 100 Pag.," and so on for other months.

Pagodas and Fanams were the old money of account at Madras, and were reckoned in this wise.

10 Cash made a Dudy.
8 Dudies made a Fanam.
45 Fanams made a Pagoda.

Lullier has given an account of Pondicherry in 1722, and alluded
to the currency in these words. " The Company
1722 A. D. " (French) as Sovereign of Pondicherry and its de-
" pendencies causes money to be coined there in the name of the " king. Cowries are not taken in payment, which however are " current in the country, although no more than little shells 20 of " which are worth a liard. They also use caches (cash) a small " piece of copper worth a denier: the largest pieces of silver are " valued at 4 sols; and their coins called Pagodas ½ a pistole."

Stavorinus in his account of his voyage to the East mentions
1768—1771 A. D. gold and silver Rupees as current in Bengal and
throughout the whole extent of Hindostan, stamped with Persian letters instead of any portrait or arms. " When the " Rupees first come from the mint they are called Sicca Rupees " of the first year, and they decrease every year in value, and at " the end of nine years are taken at the same rate as Arcot Rupees. " Those coined at Moorshebad are the current coin in which the " trade of the Company is carried on. It is the money of account " according to which the value of the other Rupees is calculated. " The Arcot Rupees are coined by the English at Arcot and by the " French at Pondicherry. The gold Rupee called Mohur is worth " 15 silver Sicca Rupees."

At page 475 of vol. ii. of his voyages he describes the Mint at Surat. " The mint where the silver is imported and coined into " Rupees, by having the impression of the Emperor's name and " the year of his reign stamped upon them, is a large pile sur-" rounded by a high wall—along the wall are sheds under which " the workmen sit: on the right hand is an elevated apartment for " the overseers and inspectors when any work is doing; opposite " to it a square place is walled off where the silver and copper are " melted and cast in moulds into bars or ingots. The metal is " weighed to the workmen who cut it into pieces of the exact " weight which the coin to be struck requires, every one having a " pair of scales at hand for that purpose in which every piece is se-" parately weighed. These workmen beat it round and flat, though " one piece sometimes falls thicker than another to which exact " attention is not paid. It then goes to the coiners who were then " about 30 in number, each of whom has an assistant, who puts " the prepared piece of copper or silver upon the lower die, while " the other places the upper one which he holds in his left hand " upon them, and stamps the impression upon them with a forcible " blow of a hammer."

Schomberg describes the Mint of the king of Oude much in the same terms; his account is somewhat more modern, and it appears the Oude Mint paid more attention to the beauty of the coin and the accuracy of workmanship, the description does not otherwise differ much from that given of the Surat Mint.

Mr. Holt Mackenzie in his evidence before the Select Committee in 1832 says, " the Sicca Rupee has been a legal tender in Calcutta " ever since we acquired the country—the present Sicca Rupee bears " the date of the 19th year of the last King—There were 3 Rupees, " the current Rupee, the Sonat Rupee, and the Sicca Rupee— " But previously to A. D. 1773, the Rupees were distinguished by

" the years in which they were coined; that is to say the im
" sion bore that they were struck in such a year of the reig
1773 A. D. " King of Delhi; and after circulating 4 or 5 years " they suffered a depreciation whether they had lost " weight or not, being reckoned Sonat Rupees, that is, Rupees " of " years." These with several other coins continued to circulate at " different rates of discount, and accounts were kept in a nominal " coin called the current Rupee, which was probably taken at the " rate of 116 to the 100 Sicca Rupees to represent the average of " the currency actually in circulation. The first step to reform, " was a resolution that all Rupees coined in future should bear " the impression of the 19th year* of the reign of Shah Allum, " and so put an end to the arbitrary distinction previously made to
1792—3 A. D. " the coinage of different years; and in 1792—3 A. D. " the Sicca Rupee was by the rules contained in Reg. " 35 of the Bengal code rendered the only legal silver currency " for the provinces of Bengal, Bahar and Orissa—The Sonat Rupee " is still used in the military accounts and is considered equivalent " to the Ferruckabad, Madras and Bombay Rupees. Since " 1793 all other Rupees but the Sicca Rupees have been receiv- " ed as bullion. The Sicca Rupees used to be receivable as of " full weight, if the deficiency did not exceed 6 Annas ($\frac{6}{16}$) in " 100 Rupees. Since 1818 the limit has been extended, a defici- " ency of 2 pice ($\frac{1}{32}$) or about 2 grains being allowed in each " coin. In the remoter districts and in the dealings of the poorer " classes, different rupees appear still to be in circulation, but the " mass of the currency is the Calcutta Sicca Rupee. In general " the state of the currency out of the Company's territory is very " irregular, each Sovereignty has its own Rupees and they vary " very considerably."

Further evidence was also given before the same Committee,
1809 A. D. that prior to 1809 there were *four* Mints in the Bengal territories, one at Calcutta, one at Benares, one at Ferruckabad, and one at Delhi; and there were *three* currencies, the Calcutta Sicca, the Benares, and the Ferruckabad Rupee, the last

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* About 1773 A. D.

called also Quenow Rupee, because intended to be equivalent to that of the Oude Government, and struck both at Ferruckabad and Delhi, but the Delhi Mint was never employed to any great extent. For a long time back, the Calcutta Sicca Rupee had circulated in Bengal, Behar, and Orissa—the Benares Rupee was confined to the province of Benares, and the Ferruckabad Rupee to all ceded and conquered districts, except Cuttack and the acquisitions east of Bengal, into which the Calcutta Rupee had been introduced. It was also stated that the standard of the Calcutta Sicca Rupee and Ferruckabad Rupees was the same, being $\frac{1}{12}$ alloy —the former weighing 192 grains with 176 grains pure silver, the latter weighing 180 grains with 165 grains pure silver, omitting fractions—and that at Madras and Bombay the rupee was similar to the Ferruckabad—and that there was a mint at Saugor established for the temporary purpose of converting local currencies into Ferruckabad Rupees. It was likewise stated that a copper coin passes through the Bengal territories at the rate of 64 to a Rupee, but is legal tender only for the fractional parts of that coin—and that because the market value of gold relatively to silver was greater than the mint value, therefore gold had ceased to circulate. Also that the Bengal gold mohur weighs 204·710 grains of which 187.651 is fine gold—and that the Madras gold Rupee is of the same weight and standard as the silver, viz. 180 grains—and that at both Presidencies the relative value of gold to silver is 15 to 1—and that there were *three* mints at Bombay, one at the Presidency, one at Trivat and one at Broach, and that Madras had one mint.

1818 A. D. In 1818, the Bengal Government added to the weight of the Rupee, leaving the quantity of silver the same and increasing the weight by alloy, the reason given was that the Rupee being much purer than other coins, and more especially than the Spanish Dollar of which the import into Calcutta was large, a considerable expense was incurred in refining, and some delay occasioned.

In 1819, the currency was changed in Madras from Pagodas to Rupees, in which former coin all accounts had previously been kept, and the Rupee was rated in the accounts rendered to Parliament at 2*s.* 3 $\frac{408}{1000}$*d.*, though at the mint price of silver in England it should only have been 1*s.* 11 $\frac{40}{1000}$*d.*

In 1835, the East India Company's coinage underwent its final adjustment to the state that it remains in at the present day. It was ordained that the undermentioned coins only should be coined at the Mints within the territories of the East India Company.

1835 A. D.

The Co.'s Rupee weighing 180 grains. The ½ do. & the ¼ do.	$\frac{11}{12}$ standard, or 165 grains pure silver and 15 grains alloy.

Impression on one side, the head and name of the Sovereign of Great Britain, on the reverse, the name of the coin in English and Persian, and of the East India Company.

The Company's Rupee, ½ Rupee and double Rupee to be legal tender, if not deficient more than 2 per cent. in weight, and if not clipped or filed or defaced otherwise than by use.

The Company's Rupee to be equivalent to the Bombay, Madras, Ferruckabad, and Sonat Rupees, and to $\frac{15}{16}$ of Calcutta Sicca Rupee; Company's ¼ Rupee to be legal tender only in payment of the fraction of a Rupee.

The undermentioned gold coins only to be coined at the mints:
A gold mohur or 15 Rupee piece, 180 grains weight and $\frac{11}{12}$ fine.
A ⅓ do. or 5 do. do.
A ⅔ do. or 10 do. do.
A double do. or 30 do. do.
Gold coin not to be legal tender.

By a proclamation issued in 1841 gold was allowed to be received at the public treasuries in payment of taxes, and was so received very frequently till 1852, when in consequence of the discovery of gold in Australia the proclamation was cancelled, and gold is now only received into treasuries as deposits for security.

To compare the Company's Rupee with an English Shilling.

The Co.'s Rupee is 180 grs. in weight of which 165 are pure silver.

that is, 440 grs. out of 480 grs. (the oz.) are pure silver.
or 220 dwts. out of 240 dwts. (the lb.) are do.
that is, the Co.'s Rupee is $\frac{11}{12}$ fine or ·916 touch.

The English Shilling is 87 $\frac{3}{11}$ grs. in weight of which 80 $\frac{8}{11}$ are pure silver.

that is, 444 grs. out of 480 grs. (the oz.) are do.
or 222 dwts. out of 240 dwts. (the lb.) are do.
that is, it is $\frac{37}{40}$ fine or ·925 touch.

English silver which is $\frac{37}{40}$ fine is called standard silver.

The Company's Rupee, it will be observed, is Worse .009, that is, a pound of English standard silver contains 2 dwts. more pure silver than a pound of Company's Rupees.

In England, from 1600 A. D. down to 1816, a pound of standard silver was coined into 62 shillings—in 1816 it was ordered to be coined into 66 shillings, 4 shillings being retained by Government as a seignorage amounting to 6 $\frac{1}{37}$ per cent. By this means, a fictitious value is given to the silver coinage, and the pieces pass current for more than their real value, and thereby having no value in other countries equal to their value at home are neither melted nor exported. Though in England an oz. of standard silver is coined into 5 Shillings and $\frac{6}{12}$ of a Shilling over, ($\frac{4}{12}$ of which are retained as seignorage) yet silver coins are always rated at the assumed price of 60*d.* per oz. per British standard.

An oz. of silver B. standard = 60*d.*
therefore 1 grain = ·125 of a penny.

A Company's Rupee contains 178·37 grains B. standard
therefore Co.'s Rupee = 1*s.* 10·29625*d.* (Par of exchange.)

Sicca Rupee weighs 191·916 grains of which
175·921 are pure silver,
or 176 B. standard silver.

That is 439·995 out of 480 grs. (the oz.) are pure silver,
or 219·997 out of 240 dwts. (the lb.) are do.

That is, it is $\frac{219977}{240000}$ fine, or ·9165 touch,
and 1*s.* 11·78*d.* is its Par of Exchange.

For easier comparison I annex a tablular Statement of some of the principal Silver Coins at present current in different parts of the world.

Names of Coins.	Gross weight.	Quantity of pure silver.	Quantity of British Standard silver.	Number of grains out of 480 (the oz.) that are pure.	Number of Dwts. out of 240 (the lb.) that are pure.	Touch.	Par value in English money.		Par value in Company Rupees.
	Grains.				Dwts.		s.	d.	Co. Rups.
French 5 Franc piece..	385⅘	347·17	375·32	431·9	215·95	·8997	3	10·915	2·104
Dutch Florin.........	166	148·01	160·01	427·98	213·99	·89162	1	8	·897
United States Dollar....	416	370·93	401·01	427·996	213·998	·89165	4	2·12	2·247
Russian Silver Rouble..	320	277·33	299·82	416	208	·866	3	1·47	1·680
Company's Rupee......	180	165	178·37	440	220	·916	1	10·29625	
Sicca Rupee.........	191·916	175·921	176	439·995	219·997	·9165	1	11·78	1·625
English Shilling.......	87$\frac{3}{11}$	80$\frac{8}{11}$	—	444	222	·925	—	—	·538

III. *Entomological Papers, being descriptions of new Ceylon Coleoptera with such observations on their habits, etc., as appear in any way interesting. By* John Nietner, *Colombo, Ceylon.*

No. I.

[Introductory Note on the publication of new species under disadvantages such as describing entomologists necessarily labor under in countries remote from the European centres of science.]

I little doubt that the following descriptions of new Coleoptera will meet with anything but approbation from the entomological world at home. As, however, in spite of this anticipation of an ungracious reception, I shall not be deterred from my purpose of publishing such descriptions hereafter, I may as well try to vindicate this measure, by setting forth the reasons which induce me to consider the difficulties which beset the path of the entomological author in this country, as not insurmountable.

The objections raised against me will be these: that considering the state in which entomological literature still is, that is to say, considering that it has not, generally speaking, been condensed into a certain limited and obtainable number of volumes, as is the case in the higher branches of Zoology and Botany, that on the contrary the bulk of it consists of fragments which float without order in the misty and unfathomable ocean of scientific journals—it is next to impossible that an individual entomologist abroad should surround himself with this shapeless mass of learning, and keep himself by this or other means so well informed of the details of the actual progress of the science, as not to be exposed to mistakes of one kind or another but more especially to the multiplication of synonyms, in attempting to work independently. It will further be urged against me, that not having the facilities and the wholesome check which arise from the diligent use of extensive and well named collections, not even having the gratification of a brother entomologist's views and opinions on doubtful cases, it will be impossible even to determine whether an insect be new or not; and from these reasons it will be inferred, that entomologists abroad should confine themselves to collecting and observing the habits of the objects of their attention, but that they should never go to print with matters, on which it is impossible for the ablest among them to be quite competent to deal with. These arguments are unfortunately too true, but still I think they admit of being mitigated sufficiently to come to final conclusions less disheartening than the above.

First of all, every entomologist gives preference to a certain order of insects—say *Coleoptera*—and in this, even in almost all cases, to one or two particular families. In studying for the publication of new species under the disadvantages just mentioned, he will confine himself to this order or perhaps family. Now, although as objected above, the information existing on this particular branch is for the most part fragmentary, still there are certain families on which it has received a tangible shape, through condensation by able hands: Burmeister's *Lamellicornes*, Dejean's *Carabidæ*, Erichson's *Staphylinidæ*, Schoenherr's *Curculionidæ*, Boheman's *Cassidæ*, Westwood's *Paussidæ*, etc., as well as the latter author's general work on the families, and Lacordaire's on the *Genera Coleopterorum*, diligently consulted, go as guides a long way, and should, although some of them have by the rapid progress of the science become rather antiquated, guard against a number of mistakes of a systematic nature. As to whether a beetle be new or not, I admit that in forming an opinion on this question the entomologist situated as above, will have quite as much to be guided by a certain tact (not clearly definable but understood by scientific men) as by anything else, and I am forced to concede that under almost any circumstances, it is totally impossible to arrive at an *indisputable certainty* either the one way or the other. This, however, by no means excludes the possibility of his forming an opinion with so much precision, as to enable him to pronounce in the matter with a very *high degree of confidence and all probability* in his favor. In attempting to come to a decision on this difficult point, he will receive a first superficial idea from careful reflection on certain accidental circumstances, such as size, scarcity, or other peculiarities of the insect in question. This idea, which ever way it may incline, will then either gain or lose strength by diligent reference to his library, until at length with a certain amount of

[illegible] and judgment he will arrive at a result, which under such cir[illegible]stances must carry much weight with it. I shall illustrate this [illegible] by an example: If for instance after collecting for five years in Ceylon generally, and in the Colombo District more especially, I find at the latter place an insect—say the *Chlænius 5-maculatus* described below for the first time, am I not entitled to consider it as very scarce? If on consulting my library I discover nothing which can possibly refer to it (finding that not a single *Chlænius* is marked as occurring in Ceylon), are not the chances greatly in favor of its being an undescribed species? If again, I collect beetles as small and inconspicuous as the *Trichopteryx* described below, and consider at the same time that, although they are in certain localities of common occurrence, no professional Coleopterologist has ever collected before me in this Island; if, moreover, my library offers nothing that could possibly refer to them individually (there being hardly an Asiatic species mentioned), am I under these circumstances not justified in considering them as undescribed? Decidedly I am. Circumstances like these would indeed be altogether conclusive, if there was not a chance of the beetle occurring in some neighbouring country, and it having thence found its way into the normal collections of Europe. The possibility of such being the case, of course enhances the difficulties of the case very materially, but I do not see why they should not, to a certain degree, be overcome by the same or similar means as those cited for overcoming them in one particular country.

I think I have said enough to show, that the disadvantages encountered by the entomologist here, or in other places similarly situated, in *conscientiously* attempting to publish new species may (his principal assistance being perseverance, a good library and tact—entomological instinct I am almost tempted to call it)—be overcome, I [illegible] far from saying *entirely*—but so far as to expose him from *want* of resources in the execution of his plan, *to no more mistakes* than are incident to entomologists under more favourable circumstances, from *neglecting them.* But I am not satisfied with obtaining the simple grant of permission to describe on the spot a part of what he collects—I claim more for the entomologist abroad. I wish to show that he should naturally be expected—nay desired—

to do so, for although he labors under distressing disadvantages in some respects, he happily enjoys a proportionate share of advantages in others. It is unsatisfactory in the extreme for an enthusiastic entomologist to be obliged to let his collections go out of his own hands, see others reap the honors from them which are to be reaped on such occasions, or perhaps see as it were a gulf close over them, hear no more of them, and find himself forgotten. For what is a mere collector? Let him display as much industry as possible, he is hardly looked upon as an entomologist, certainly as long as he is prevented from publishing anything, not as a scientific one. Now, if such a man merely desists from publishing the fruits of his researches, from want of resources to assist him to go creditably through such a task; if he suffers his collections to go out of his hands because he is too true a lover of science not to see the credit in a great measure due to himself reaped by another rather than to hoard up his entomological treasures—a useless heap eventually to be destroyed by moths and time—I say, that a man who acts upon principles like these, finds himself not seldom disheartened in the prosecution of his studies, under difficulties such as I have set forth. If however, as I have endeavoured to point out, these difficulties can be overcome to a very considerable extent, is anything more natural than that he should be the herald of his own discoveries? Could anything be more unkind and ungenerous on the part of his scientific brethren at home than to oppose and discourage him by their disapprobation? I might enlarge on this subject, which has been a sore one with me for a long time, but I think this is sufficient to direct the reader into the train of my ideas and to enable him to follow it up..

I hasten therefore to conclude. As mentioned above, the tropical entomologist has a proportionate share of advantages to balance what falls to his lot of the contrary. One of the advantages which he enjoys over his brethren at home is, that he has an opportunity of seeing and studying alive what can at home only be examined in a state differing more or less from that of life. Therefore, if he is *enabled* and *expected* to describe new species, it is moreover *highly desirable* for the sake of the promulgation of *sound* information that he should do so, that he should avail himself of this, his principal advantage and describe fresh from nature, as many of his favourites and their habits as possible; and to discourage him in such an undertaking on any of the above grounds would be to discourage the progress of science in general.

FAM. CARABIDÆ, TRIB. CHLÆNIDÆ.

1. *Chlænius Ceylanicus.* N.

C. subellipticus, subconvexus, glaberrimus, nitidus; supra brunneo-æneus, capite, thoracis elytrorumque margine aureo-viridibus; subtus piceus, margine, pedibus oreque dilute castaneis. Long. corp. 5¾ lin.

Caput ante oculos 2-impressum. Antennæ art. 3° quarto paulo longiore. Mentum dente magno excavato. Thorax subquadratus, latitudine parum longior, obsolete punctulatus, antice subconvexus, lateribus deflexus, postice depressus, planus, 2-impressus. Elytra subtiliter striato-punctata, obsoletissime punctulata.

In stagnorum ripis inter arundines habitat, in prov. occid. et merid. infrequenter legi. Per occasionem nocte ad lumen advolat.

A handsome and interesting species, distinguished as well by its general shape, which is more elliptic and convex than usual, as by its polished surface. The head is oblong and, with the exception of the mouth the parts of which are of a deep brown, of a bright metallic green divided longitudinally by a streak of copper color. The thorax is rather longer than broad, rounded in front and flat behind and finely punctured all over; it is of a brownish metallic color bordered laterally with bright green. The elytra are of the some color as the thorax, the same bright green stripe running along the sides. The margin, properly speaking, is deep brown. They are impressed with rows of fine indistinct punctures and with the usual series of larger setigerous ones within the margin. They are rather narrowed near the apex.

The female, in addition to having the anterior tarsi not dilated, has the basal impression of the thorax of a somewhat semi-circular shape, and is broader in the body than the male.

2. *Chlænius 5-maculatus.* N.

C. præcedente major, minus convexus, latior, rugosus, pubescens; supra obscure nigro-viridis, capite viridi-æneo, nitente, glabro, elytris maculis 5 flavis; subtus piceus; pedibus, elytrorum margine antennisque flavis, ore thoracisque margine magis minusve brunneis. Long. corp. 6¼ lin.

Caput ante oculos leviter 2-impressum, punctulatum. Antennæ art. 3° quarto plus sesqui longiore. Thorax subquadrato-rotundatus, latitudine haud brevior, dorso planus, ad basin 2-impressus, rugosus, pilosus. Elytra subdepressa, subtiliter striata, rugosa, pilosa, maculis 2 humeralibus, 2 intermediis, 1 apicali flavis ornata.

Specimen singulum m. in lacus Colombensis ripis sub graminibus putrescentibus legi.

Not less distinguished than the former, especially by the rounded shape of the thorax and the 5 yellowish spots with which the elytra are adorned. These are arranged in the following manner: 2 small ones at the shoulders, 2 large transverse ones at the middle stretching from the external margin towards the suture reaching, however, but little more than half across, 1 at the apex; this is of the shape of a hammer, and half in one and half in the other elytron. The palpi appear to me longer and more markedly elbowed at the joints than is usual with insects of this genus, the last joint is deeply excavated at the tip. The thorax is of suborbicular form, the back and hind part are flat, the sides slightly depressed, the margin sharp, the basal impressions very near the angles; it is, as are also the elytra, rough and finely pubescent, the striæ of the latter being thereby rendered obsolete. Legs of m. stout, anterior tarsi strongly dilated.

3. *Chlænius pulcher.* N.

C. elongatus, subconvexus, subglabratus, æneo-viridis, elytris obscurioribus, limbo pedibusque flavis, subtus piceus. Long. corp. 6¾ lin.

Caput oblongum nitidissimum, ante oculos 2-impressum. Mentum dente fortiter excavato. Antennæ art. 3° quarto sesqui longiore. Thorax oblongus basin versus angustatus, parce punctulatus, antice lateribus deflexus, postice dorsoque planus, basi 2-impressus. Elytra striata, ad strias, præcipue apicem versus, subtilissime pilosa, flavo-marginata. Pedes flavi, spinulis castaneis. Abdomen flavo-marginatum.

Specimen singulum m. in ripis Maha-Oyæ fluminis prope Negombo cepi.

Distinguished by its elongate shape. The head is of a bright green color with the labrum and the mandables of deep, and the antennæ and palpi of a light brown, the latter being darkened towards the end. The thorax is of the same color as the head reflecting a copper hue from the back, its anterior angles are obtuse, the basal ones being right. The elytra are of the same greenish copper color but darker, they are impressed with longitudinal lines, which are bordered on each side by a row of minute hairs. They as well as the abdomen have a yellowish margin.

4. *Chlænius cupricollis.* N.

C. subconvexus, subglabratus, capite thoraceque cupreis, elytris nigro-æneis, limbo pedibusque flavis, subtus piceus. Long. corp. m. 5¾—f. 6¼ lin.

Præcedenti affinis. Caput ante oculos indistincte 2-impressium. Thorax ut in præcedente sed minor, antice lateribus magis deflexus, linea media impressionibusque basalibus longitudinalibus, præcipue in f., profundioribus. Pedes flavi, trochanteribus spinulisque castaneis. Elytra præcedentis.

In prov. occid. fluminum lacuumque ripis infrequenter legi.

Allied to the former but easily distinguished by size, color and sculpture of the thorax. The male is shorter and the female plumper than the former. The thorax is smaller and, as is also the head, of a bright copper color with greenish sides, its impressions, especially in the female, are deeper and its anterior part laterally more deflexed. Moreover the yellowish margin of the abdomen is wanting and the tooth of the mentum is not excavated. The elytra, antennæ and palpi are, making allowances for size etc., those of the former.

5. ***Chlænius rugulosus.*** N.

C. subconvexus, subglabratus, thorace occipiteque rugulosis cupreis, elytris nigro-viridibus, pedibus, elytrorum limbo lunulisque apicalibus flavis, subtus piceus, abdomine apice margineque flavis. Long. corp. 6½ lin.

Caput fronte 2-impressum, subtillissime longitudinaliter rugulosum. Menti dens laciniis extus rotundatis. Thorax lateribus rotundatus, deflexus, basi sat fortiter angustatus, obsolete 2-impressus, parce punctatus, subtiliter transversim rugulosus. Elytra ut in præcedente sed apice utrinque lunula flava signata, ad strias distinctius pilosa, his apicem versus per paria coëuntibus. Pectus abdomenque picea, hoc segmentis 2 ultimis, præcedente dimidio margineque flavis.

Specimen unicum f. in *Ch. pulchri* N. societate cepi.

Of the general appearance of the preceding two species. The head finely longitudinally, the thorax transversely rugose ; the latter with rounded and deflexed sides. The mandibles are of deep brown, the palpi and antennæ of yellowish color darkened towards the tip. The lobes of the mentum tooth are externally rounded. The elytra are marked by two sub-apical spots of yellowish color and semi-lunar shape (the back of the lunulæ being turned towards the suture). The striae verge near the apex by twos into each other. The abdomen is distinguished by having a yellow margin and apex.

Trib. SCARITIDÆ.

6. *Scarites minor.* N.

S. elongatus, niger, nitidus, subtus nigro piceus, pedibus piceis, tarsis, antennis palpisque castaneis. Long. corp. 5 lin. lat. 1½ lin.

Caput subquadratum, ante oculos 2-impressum, postice irregulariter sulcatulum. Mentum rugosum, medio costatum, lateribus utrinque profunde uni-sulcatum, lobis obtusis, dente forti, lobis paulo breviore. Maxillæ validæ, breves, apice extus leviter arcuatæ et excavatæ, subacuminatæ. Mandibulæ validæ, inter medium et basin fortiter dilatatæ, obtuse dentatæ, dextera dente obtuso subapicali, supra subtusque longitudinaliter sulcatæ. Antennæ art. 1^{o} sequentium trium—2° tertii prope longitudine. Thorax oblongo-quadratus, angulis anterioribus obtusis, posterioribus oblique truncatis, anguste marginatus. Elytra thoracis capitisque prope longitudine, striata, ante medium ad striam 2^{m} uni—apicem versus ad striam 3^{m} 2-punctata, punctis piliferis, basi granulata, angulis oblique-truncatis, anguste marginata. Pedes anteriores tibiis apice extus 5-dentatis, dentibus 2 ultimis parvis, omnes tarsis subtus leviter excavatis.

In prov. occid. arenis humidis sub vegitabilibus putrescentibus specimina nonnulla legi.

Scarce and but little distinguished excepting by its size, for which reason, a lengthened description makes itself necessary. The head is subquadrate, in front with 2 deep longitudinal impressions, behind the eyes finely sulcated. The labrum is of the usual shape, the eyes are not very prominent; the antennæ are of about the same length as the head, the first joint is about as long as the 3 following together, the 2nd, which is generally longer than the 3rd, is in this case of the same length, joints 1—4 are naked, 5—11 pilose, increasing towards the tip gradually in size and thickness, taking at the same time a subquadratic and depressed shape. The mandibles are strong, much dilated and dentated from before the middle to the base, the right one having an additional subapical tooth. The maxillae also are strong, but slightly bent at the apex, where they are also slightly excavated. The labial palpi have the last joint longer than the 3rd, elongated and elliptic. The thorax is oblong with the basal angles obliquely truncated. The elytra are oval, striated, granulated at the base, and have, as has also the thorax, a narrow margin. The anterior tarsi are furnished externally with 5 teeth, the 2 last of which, however, are very small, the posterior legs are similarly provided, but the teeth are indistinct. The joints of the tarsi are slightly excavated below. The sides of the body below are rugose.

7. *Clivina rugosifrons.* N.

C. ferruginea, capite, thorace abdomineque piceis. Long. corp. 4⅓ lin. lat. 1⅓ lin.

Caput rugosum, inter oculos elavatum, elevatione plana ant[illegible] profunde 1-impressa. Mentum lobis subtiliter sulcatis. Anten[illegible] robustæ, thoracis medium vix attingentes, art. ultimo elong[illegible] penultimo—, art. 2° tertio sesqui longiore. Thorax subquadratus, antice parum angustatus, elytrorum latitudine, subtus parce punctatus, prosterno sulcato. Elytra striata, in striis punctata. Pedes tibiis anterioribus apice extus 4-dentatis, subtus excavatis, tibiis reliquis fortiter spinosis, tarsi articulis margine apicali setoso.

In prov. occid. sub vegetabilibus putrescentibus infrequentissime legi.

A large and distinguished species. The head is very rugose, the clypeus is contracted behind the apical angles and then produced again into another pair of angles. The labrum is transverse, slightly sinuate in front, with the angles rounded and setose. The mentum is quadrate, the lobes rounded at the apex and slightly sulcated, the tooth is strong, of equal length with the lobes and of the typical spearheaded form. The ligula has the apical angle much elongated, terminating in a membranaceous bristle which is bifurcate at the tip. The maxillary palpi have the last joint elongate, cylindrico-conic; that of the labial ones is still more elongate, elliptic. The antennæ have the basal joints elongate, those towards the tip rounded. They and the legs are hairy, otherwise the insect is of a bright polished surface.

8. *Clivina elongatula.* N.

C. elongata, subdepressa, supra nigro-picea, subtus picea, p[illegible]bus elytrorumque margine castaneis, antennis oreque dilatio[illegible] Long. corp. vix. 3 lin. lat. $\frac{3}{4}$ lin.

Caput triangulare, subtiliter punctato-rugosum. Palpi articulo ultimo apice leviter truncato. Thorax oblonge quadratus, ante apicem leviter sinuosus, parce obsoleteque transversim strigosus. Elytra striata, in striis punctata, ad striam 3^m utrinque 4-punctata. Subtus parce punctata.

Ubi præcedentem specimen singulum legi.

I have not dissected the labium of this species, which, however, is at once recognised by its depressed and, in proportion to its width, very long shape. The labrum, antennæ and legs are so much like those of the former that they need no further description. The bristle of the ligula appears simple.

9. *Clivina maculata.* N.

C. picea, elytris ferrugineis infra medium macula nigra indistincte ornatis, pedibus intermed. et post. oreque brunneo-testaceis, pedibus ant. antennisque obscurioribus. Long. corp. 2 lin.

Caput oblonge quadratum, rugosum, costis 5 magis minusve interruptis ad marginem anteriorem dentibus 4 productis munitum. Palpi art. ultimo basi intus incrassato. Antennæ art. 2-3 subæqualibus. Thorax subquadratus leviter rotundatus. Elytra striata in striis profunde punctata.

Ubi præcedentes specimen singulum legi.

As distinguished as the preceding two species. The palpi and the mentum appear to me of a somewhat extraordinary form. The last joint of the former is considerably more inflated at the base than in any other Ceylon species that has hitherto come under my notice, whilst the others are of a very curved appearance in both the maxillary and labial palpi. The emargination of the mentum would at first sight appear to be of a semi-lunar shape. However, it is only the lower margin which has this form, the oblique truncature which forms the emargination being such as to give it that shape. The tooth is of the typical shape, but being on a level with the lower margin, it stands at a small angle with respect to the inclined plain formed by the rest of the truncature. The apical angles of the lobes are somewhat pyramidal being formed by 3 sides. I have not dissected the labium, therefore do not know whether the remaining parts exhibit any peculiarities. The insect is however, easily distinguished by its general facies, which is rather like that of a *Dyschirius*, from which genus, however, the mentum alone is sufficient to separate it. I may as well remark here that, although the Island is well supplied with *Scarites* and *Clivanæ*, I have hitherto not discovered a single *Dyschirius*, a genus so well represented in Europe. Of the three *Clivinas* just described, [illegible] specimens only have been in my possession for a considerabl[illegible] There are three or four more species met with about Colom[illegible] these being of common occurrence I abstain from describing then here as they may possibly be amongst those described by Putzey or others from the Indian continent.

Fam. RHIPIPHORIDES.

10. *Rhipiphorus tropicus.* N.

R. niger, nitidus, elytris albidis, nigro-maculatis, labro palpis antennis (pectine nigrescente excepto) unguibusque brunneis, impresso-punctatus, punctis magnis sed non profundis, subtus sub orbicularibus piliferis, supra oblongis lævibus. Long. corp. 2⅓ lin lat. ad humeros ¾ lin.

Caput oblongum, latitudine paulo longius, parte frontis inferiore dense profundequê punctata, vertice obtuse obconico glabro, nitidissimo, occipite piloso. Thorax elevatus, ad basin 2-impressus, medio angulo obtuso, apice excavato, glabro, inter elytra producto. Elytra ad suturam utrinque stria lata brunnea punctata impressa, acuminata, apice dehiscentia, albida vel subhyalina, apicibus, medio utrinque et ad basin nigro-maculata. Alæ apice fuscæ. Pedes tarsis anticis art. 2-4 unguibusque bifidis omnibus brunneis, tarsis subtus setosis, anticis art. 2—3 primo que apice, subtiliter sericeo-penicillatis.

Specimen singulum m. prope Colombo, in floribus legi. De metamorphosi adhuc nihil constat.

The head is rather long in proportion to its width, the occiput [illegible] narrowed, short obconic. The hind part of the thorax is elevated above the elytra. The central part of its base is prolonged between the elytra in an obtuse angle, the apex of which is abruptly truncated, excavated and polished. The labrum is hairy and the ungues of the tarsi bifid as usual.

The tibiæ of the anterior legs are furnished at the apex with one, those of the 4 posterior legs with two spurs. The anterior tarsi

have joints 2-4 brown. The tarsi are setose below joints 2-3 and the apex of the first of the anterior ones wearing fine yellowish silky brushes instead.

All over the Island the *Rhipiphorides* and *Mordellinæ* appear to be very scarce, with the exception of 1 or 2 species of *Anaspis* which are not occasionally taken in flowers. Still I recollect having met with about seven species including two large *Mordellæ* which however I have not been fortunate enough to catch as yet.

Fam. STAPHYLINIDÆ. Trib. PINOPHILINI.

11. *Œdichirus alatus.* N.

Œ. alatus, setosus, nitidus, rufo-testaceus, thorace dilatiore, capite, elytris abdominisque segmentis 3 ultimis nigris; elytris apice 2-maculatis, maculis rufo-testaceis; pedibus flavis, femoribus apice tibiis que basi nigrescentibus; autennis palpisque maxill. basi obscuris, apice testaceis, reliquis oris partibus rufo-piceis. Long. corp. 3⅛ lin.

Œ. pæderino Er. simillimus, præter colorum distributionem differt tamen *alis*, elytorum antennarumque articuli ultimi sculptura. Antennæ art. ultimo penultimo æquali nisi paulo minore, apice fortiter *truncato* leviterque excavato. Thorax *Œ. pæderini*, dorso punctis biseriatim impressus, serie interna vel centrali elliptica punctis minoribus magis inter se approximatis, externa vel submarginali punctis magnis distantibus. Elytra oblonge subquadrata, infra medium rotundata, thorace *longiora* et fere duplo ampliora (utrumque elytron thoracis fere magnitudine), basi parte thoracis adjacente *duplo*—infra medium illius latitudine antica plus tertia parte latiora. Os, pedes et abdomen *Œ. pæderini.*

Pæderorum more victitare videtur; in eorum societate in lacus Colombensis ripis infrequentissime legi; illis minus gracilis atque minus agilis.

I have not had an opportunity of examining specimens of either of the three *Œdichiri* hitherto described. However, I have before me Erichson's figure and description of the Sicilian *Œ. pæderinus* with which I find my species strongly to agree.

It differs, however from the former materially in the following three points, viz., the wings, the sculpture of the wing-covers and the last antennal joint. The fact that this species has wings would render an alteration in Erichson's diagnosis of the genus necessary, it being characterized therein as apterous. The elytra are not so much contracted and rounded at the base, and, being longer than the thorax, have therefore a more oblong, subquadrated appearance. As in the above typical species they are however, rounded at the sides and broadest a little below the middle. They are about twice as broad at the base as the adjoining part of the thorax and in their largest part, rather more than a third broader than the greatest breadth of the thorax. The third point in which the two species differ is the last joint of the antennæ, which in this case is strongly truncated at the tip and slightly excavated. They are further distinguished by the distribution of the colors; my species being of a dark yellowish red, thorax lighter, head, elytra and three last abdominal segments black, elytra with 2 reddish spots at the apex, legs yellowish, at the apex of the femora and base of the tibiæ blackish, the mouth is brown, the maxill. palpi yellowish with the three first joints dark at the base, the antennæ have the 6 basal joints dark excepting at the apex where they as well as the 5 remaining ones are yellowish. In all other points I find the insect entirely agrees with the typical *Œ. pæderinus:* the palpi, legs and anal segment of the abdomen are of the same structure, the hairy vestiture is exactly the same in the different parts of the body of my species as it is in the corresponding ones of Erichson's.

It is perhaps wrong in me to describe an isolated species of this extensive and difficult family. However, the gen. *Œdichirus* is one so extraordinary that I am sure it will be noticed wherever the description of a new species of it may be found, be it by itself [illegible] amongst those of other *Staphylinidæ.* The case would be different if the object of the description were a *Homalota* or the like.

IV. *Description of a Plain or Waxed paper Process in Photography. By* JESSE MITCHELL, *Adjutant 1st Native Veteran Battalion.*

So much has been written on the paper processes that the subject would appear to be exhausted. Nevertheless a good paper process, easy to manipulate and applicable to all situations appears to be still a desideratum, I have therefore, at the request of our Honorary Secretary, undertaken to describe my mode of operating, and I believe that any one who faithfully follows these directions will, after a little practice, find no difficulty in producing, at least, tolerable negatives. Skill in Photography as in any other Art, or Science, is only acquired by practice, and no reasonable man should feel annoyed if in his first attempts, he fails to produce as good pictures as those who have practised assiduously for many years.

This process is a modification of the original waxed-paper process of Le Gray, but it is equally suited to unwaxed papers. As the manipulation of unwaxed paper is much the easiest and the results so much alike that the operator himself cannot, after a time, say which was taken on waxed, which on plain paper. I shall confine myself to a description of the latter process, giving afterwards such additional directions as may be necessary to adapt it to waxed paper.

In Photographic operations, absolute cleanliness is an essential element of success. It is not sufficient that the Photographer's hands, for instance, be mechanically clean, they must be chemically so, therefore when he is about to select his papers, he should not be satisfied with the usual washing with soap and water, but should rinse them afterwards in a good quantity of clean water, lest the soap do that mischief it was intended to prevent. This applies still more strongly to the trays used in the various stages of the process. The Tray used for Iodizing the paper should be used for that purpose alone, or if from the paucity of apparatus which in this country is not always procurable, he is compelled to use it for the exciting solution also, that is the greatest liberty he may take. The exciting dish must never be used for developing, and the dishes for developing solutions should not be used for any other purpose, except washing the paper after it is excited, in which case if clean they are not likely to do any harm. After being used with Gallo-nitrate they should be washed as soon as possible in abundance of clean water, and if the Gallo-nitrate solution decomposes rapidly when placed in them, they must be washed with a weak solution of Cyanide of Potassium (5 grs. to one ounce of water), and with plenty of clean water afterwards. The trays for Hypo-sulphite cannot be used for any other purpose except for washing the finished negative. The Photographer will also find it advantageous to have separate measure and funnels for his Aceto-nitrate and Gallic-acid solution.

PAPER.

The paper used in this process is Canson's thin Negative. It is not without imperfections, such as unevenness of texture and minute holes which allow the exciting, and developing solutions to pass through and stain the back of the negative. To the beginner these things are not of much importance, as he must expect to spoil a few papers, but when a little more advanced, he should examine his papers carefully by a strong light, rejecting any that have the imperfections above noted which need not however be thrown away, as the best will do for waxing which fills up any very small holes, and the remainder will do for Positives. The papers should be cut of the same width and half an inch or so longer than the Camera slide; one side of the paper is smoother than the other which is best ascertained by holding it so that the light falls upon it obliquely; this should be marked in two opposite corners with a capital letter, which better defines the side on which the mark is made than a circle or cross.

IODIZING.

The solvent may be either whey or distilled water, I believe the former produces the most dense skies and a greater opacity generally in the dark parts of the picture, it is however somewhat troublesome to prepare:—the following method of obtaining it, is perhaps as good as any.

Let pure milk from the cow stand until it is sour, for each quart of milk beat up the whites of three eggs; add these to the milk in any convenient vessel, porcelain is best—if brass or copper utensils be used they should be well tinned. Boil gently over a slow fire for a few minutes and the caseine will be taken up by the coagulated albumen. When cold, filter through a double fold of cambric, and then through bibulous paper, the latter is a tedious process unless the operator has a large funnel which he can fill and leave whilst he is attending to other matters. If properly made it should be clear and transparent and of a straw colored tint.

To each ounce of whey or distilled water add the following ingredients—

Iodide of Potassium........................	grs.	7½
Bromide of Potassium........................	„	2½
Cyanide of Potassium........................	„	0⅛
Chloride of Sodium, dry, (table salt)...........	„	0½
Sugar of Milk........................	„	12
Crystallised Honey (from the bottom of a jar)...	„	5

Dissolve, and add to the mixture as much re-sublimed Iodine as will produce a brown sherry color: try *10 or 12* grs. to the quart of 40 ozs.—and if that is found insufficient, add more, as the exact quantity is of no importance. The Iodine being rapidly extracted from the solution by the starch in the paper will require to be renewed occasionally, the necessity being indicated by the paleness of the solution. It is some hours before the whole of the Iodine is dissolved.

Filter the above solution into a dish to the depth of one inch, or more if the dish is deep enough. Take a paper by two adjacent corners and place the other end upon the solution so as just to touch it, without pause lower the hands gradually and carefully to exclude air bubbles, for the better seeing of which the iodizing tray should be placed between the operator and a window. Let the paper lie for a moment until it is wetted, then take it up by the corners nearest to you and place the other side of the paper upon the solution in the same way. Then by the help of a bent glass rod, or by tilting the tray, cause the solution to flow over the paper.

Should air bubbles be present, they will be indicated by that portion of the paper remaining uncolored. Put in as many papers as the tray will hold without crowding. When all are in, remove in succession the bottom paper to the top, turning it as you do so; this will enable you to see if the whole have been properly immersed. The dish should be shaken occasionally to prevent the papers adhering to each other, which they have a tendency to do, and which is shown by light patches where the free access of the solution has been prevented. The papers may be immersed from 2 to 3 hours, and then hung up to dry.

The best mode of suspending iodized papers is to hang up each sheet with two of the American spring clips, made of Beech and sold in London at 1 shilling a dozen, they are to be strung upon a piece of bobbin or thin cord, and stretched across a room that is free from dust, which would soil the papers,—and from strong draughts of air, which would tear the paper out of the clip.

An additional precaution which I found necessary to prevent staining is to prepare some strips of new blotting paper, as wide as the clips and about ¾ of an inch long, fold these in two, and having taken up a paper by two corners, let an assistant drop one of these papers on each corner close to your fingers, he then opens a clip and you put in one corner of the paper, where the blotting paper is, you will find it most convenient to open the second clip yourself. A small strip of blotting paper should be placed at each of the lower corners to facilitate draining, and prevent an excess of the iodising materials from lodging there, which will be the case if this is not attended to.

When the papers are dry, trim off the half inch in excess of the length of the slide from whichever end appears most to need it, and put them by in an envolope made of course drawing paper, which should be kept in a portfolio, or a tin case made for the purpose.

Thus far the operations may be conducted in any convenient room, but those which I am about to describe must be carried on in a room fitted up for the purpose, and into which no ray of white (or common daylight) must be allowed to enter whilst either exciting, or developing papers is in progress. This we will call the operating room.

Where circumstances permit, the best light is obtained through ruby coloured glass, made for this purpose, one or two moderate sized panes of this should be fitted into a window or door, if possible at the level of the table, that being the most convenient direction of the light in many Photographic operations. The light thus procured will not affect Collodion (unless the sun shines upon the glass) and is so abundant as to permit everything to be seen with the greatest comfort. Where this mode of fitting up a room cannot be adopted, a double fold of long cloth, or close woven country cloth, dipped in an aqueous solution of Turmeric, and made to sit close to the wall, makes a curtain that obstructs the actinic rays, and admits a considerable amount of light, but not so much as the glass.

TO EXCITE FOR THE CAMERA.

The exciting solution consists of,

Distilled water....................................	oz. 1
Crystallized Nitrate of Silver..................	grs. 25
Glacial Acetic Acid (half a fluid dram)........	mins. 30

This solution should either be kept in a yellow glass bottle, or in a bottle with a wooden or dark pasteboard cover, as although Aceto-nitrate of Silver is not liable to be decomposed by daylight when the chemicals are pure, it becomes so after contact with the organic matters contained in the iodised paper.

Filter as much of this solution as will cover the dish to the depth of a quarter of an inch. Float the marked side of the paper on it for four minutes—taking care that there are no air-bubbles. These, if any exist, will be indicated (in from 30 to 60 seconds,) by that part of the paper remaining of a dark colour—whilst the remainder is becoming white (apparently, but in reality of a primrose yellow colour.) Have ready a dish with distilled water and float the excited paper on it for a minute or two, this removes the excess of Nitrate (perhaps some Nitrate of Potash, &c.), and makes the paper keep longer without becoming discoloured. On a clean table, or a board kept for the purpose, put 3 or 4 folds of blotting paper with a fresh piece on the top, on this lay the wet side of your paper, and cover it with another piece of fresh blotting paper —blot off the excess of fluid by passing the hand lightly and equally over it. Then put in between fresh blotting paper and place it in a drawing paper envelope, which may be deposited in a portfolio or a flat tin case made for the purpose, until required to be put in the slide. This should not be done for about half an hour, unless it be intended to expose it immediately, as the evaporation from the paper is condensed upon the glass, and forms a number of small plano-convex lenses which doubtless refract the rays that have passed through the glass of the slide and injure the picture.

I have not had occasion to keep this paper longer than 18 hours after exciting, it kept well for that time.

EXPOSURE IN THE CAMERA.

With a given paper and light, the time of exposure will depend upon the focal length of the lens, and the aperture of the diaphragm in front of it. My pictures were taken with a Ross' 4 inch Landscape lens of 20 inches focus, with an aperture of $\frac{1}{2}$ an inch in the diaphragm. And the time of exposure I found necessary will be the best guide I can give to others.

I took a good negative of the Catholic Cathedral in 9 minutes, between 3 and 4 P. M., the paper having been excited about half an hour previous to exposure in the Camera. This is a white building much darkened by time. There were some deep shadows, the detail in which is fairly rendered: the Cassarina trees also would have been tolerably well represented, had it not blown very hard at the time. During half the time of exposure, the sun was obscured by a small, but dense, black cloud. The Museum was taken between 7 and 8 A. M. on paper excited on the previous evening, it was exposed 9 minutes in bright sunshine. This was perhaps exposed rather too long to be called a good negative, although not altogether to be despised. It need not have been made quite so intense, but there was a palankeen carriage and horse in very deep shadow under a large tree, which I wished to bring out, or else the development could have been stayed earlier. These

pictures were developed in 23 and 24 minutes, $\frac{1}{16}$ of the volume of Gallic-acid, being added from the exciting solution.

The amount of exposure for any focal length and aperture being known—the time necessary for any other lens is found by the following rules, viz.:—

With lenses of the same focal length, the time of exposure is inversely as the square of the diameter of the aperture in the diaphragm.

With the same aperture and different foci—the time of exposure is, directly as the square of the focal length.

With different apertures and foci, the times of exposure are, inversely as the square of the diameter of the apertures, and directly as the squares of the focal lengths.

The correct time of exposure however is one of the Photographer's difficulties, and requires some considerable experience to adjust accurately under every kind of light.

DEVELOPING SOLUTION.

Some hours before it is required to be used, fill a large stoppered bottle with distilled water, put in a piece of camphor, the size of a nutmeg, and some Gallic-acid, the exact quantity is of no consequence, so that it be in excess. Upon an emergency the solution of the Gallic-acid may be accelerated by putting the bottle (without stopper) in a jug of hotwater. The Photographer however should be careful to have a saturated solution, always, or there will be no certainty in his practice.

Filter as much of the above solution into the developing tray as will cover it to the depth of at least one-eighth of an inch, and then examine the state of your negative.

If by the light of a taper, the outline of the upper part of the buildings or trees,* is just plainly visible, the paper is in the best state for developing and you should add to the Gallic-acid about [illegible] of its volume of the exciting solution. If the sky line is very strongly marked, add $\frac{1}{20}$ to $\frac{1}{24}$, and if the paper has been so long exposed as to bring out the brighter parts of the view, you may perhaps save it by omitting the Aceto-nitrate altogether or even, in extreme cases, diluting the Gallic-acid,—adding a small quantity

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* "Technically known as the sky line."

of the Silver solution, when the detail is nearly all visible; on the contrary, if the sky line be entirely invisible add 1/3 of the Aceto-nitrate solution.

Tilt the tray to and fro half a dozen times to ensure the perfect mixture of the solution, or you will have patches of unequal development.

Float the marked side of the paper on this as before described, and be careful that no portion of the solution is allowed to touch the back of the paper—should this unfortunately happen, as it sometimes will notwithstanding every precaution, instantly reverse the paper and wet the whole of the back as the only way to avoid a stain—turning it again as soon as the back is wetted thoroughly and developing by immersion. Should there be an insufficiency of Gallo-nitrate to cover the paper well, get an assistant to pour in more whilst you hold the paper, replacing it face downwards as soon as the solutions are mixed.

The sky and most strongly illuminated parts of the picture first appear, then the portion more in shade. When the darker parts become visible through the back, lift one end between yourself and the light, if the detail in the least brightly illumined parts is at all visible, take it up and examine it carefully. If satisfied that you have obtained as much detail in the shadows as can be done without too much intensifying the high lights, remove the paper at once to a pan of clean water and plant it face downwards to allow any decomposed Gallo-nitrate to fall to the bottom of the pan, then pour off the water or, what is better, remove the negative to another vessel of clean water. If from the length of time occupied in the development or any other cause, decomposition of the Gallo-nitrate has taken place to any extent, the face of the negative may be very cautiously brushed with a small camel's hair brush. After washing in 4 or 5 changes of water for half an hour remove it to the fixing solution.

FIXING SOLUTION.

This consists of 3 or 4 ounces of Hypo-sulphite of Soda to 1 pint of clean (not distilled) water—in which the negative is to be left until all the yellow Iodide of Silver is dissolved, this can only be ascertained by daylight which will not hurt the picture after

it has been some time in the solution—still it is not prudent to expose it to too strong a light (such as sunshine) until the Hyposulphite has been washed out.

When all the Iodide of Silver is removed, wash in three or four waters in succession, and then leave it in a large quantity of water for 3 or 4 hours, changing the water every half hour, after which pin it up to dry,—(pins do no harm now). When thoroughly dry, it must be waxed in one of the following ways.

TO WAX PAPER.

A dish of double block tin, without joints in the bottom and one inch deep, is made to fit into another and larger vessel, also of tin, containing boiling water which must be kept at the boiling point by any convenient heater. A cake or two of white wax is put into the waxing dish, and when it is melted the sheet of paper is floated thereon, when the paper is saturated with wax take it up and drain off as much as possible of the superfluous wax. Do the same with any number of papers. Then with a clean box-iron—iron them one at a time between from 4 to 6 thicknesses of blotting paper until the blotting paper is saturated with wax; then iron between fresh blotting paper, which may require to be repeated. The 2nd and 3rd papers of the 1st batch will do the 1st and 2nd ironing of the 2nd batch. Proceed thus until all are ironed and appear (when held between the eye and the light) free from any opaque, or shining spots—and perfectly clear and transparent.

Another method of waxing papers is to place the paper on two or three folds of blotting paper; then as you pass the iron over the back of the paper with one hand follow it closely with a piece of wax held in the other, the excess of wax being ironed out as before, I do not recommend this mode of waxing papers previous to iodizing, but it answers very well when one or two negatives have to be waxed, and must do when the Photographer is unprovided with a tray.

After the negative is waxed the edges should be trimmed, it is then ready to print from. In taking out the superfluous wax from the finished negative, as hot an iron as possible should be used to remove the wax, for notwithstanding all his efforts to extract the excess, he will, not unfrequently, find by the spots in his print, that the Sun has done what he was unable to effect. For the glass plate of the printing frame becomes so hot as to transfer the wax from the negative to the positive, through the coagulated albumen.

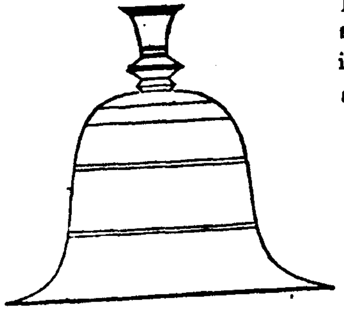
Having said all that appears to be necessary on the subject of unwaxed paper, I will add what may be necessary to enable the novice to use waxed paper. He will find at the outset that it is much more difficult to immerse waxed papers in the iodizing solution, the difficulty is lessened when there is a good depth of solution, I have also found that the papers are more easily immersed in a solution made with whey than in one prepared with water. In exciting waxed papers, float twice the time directed for unwaxed papers. They will require about five thirds the exposure, and generally, the development, fixing, and washing of waxed papers will require a longer time. With these exceptions the manipulation is the same as with plain papers.

In conclusion I have only to add, that the method of manipulating is that followed by Captain Tripe and Dr. Neill, which will recommend it more to your notice than anything I can say in its favour. They do not soak their papers so long in the iodizing solution as I recommend. It was an experiment with me, and the result having proved satisfactory, I of course direct you to do that which has succeeded in my hands. But I am not certain that such lengthened immersions are necessary, though I am quite satisfied they are not injurious. The iodizing compound contains nothing new to Photography, but the proportions are different from any published formula, I believe. How much of its greater rapidity of action is due to that (or perhaps the longer immersion in the iodizing bath,) I am not prepared to offer an opinion, because neither my leisure nor circumstances permit me to enter into numerous experiments. But I know it is considerably quicker than any modification of the waxed-paper process that I have tried, it is as quick as the Calotype, and I think is deserving of a more extended trial by Indian Photographers than an Individual has the power to give it. It is doubtless capable of improvement, and the probability of this will increase with the number of hands that can be induced to give it a trial.

V. *Description of the Manufacture of Biddery Ware.* By GEORGE SMITH, M. D., *Residency Surgeon, Hyderabad.*

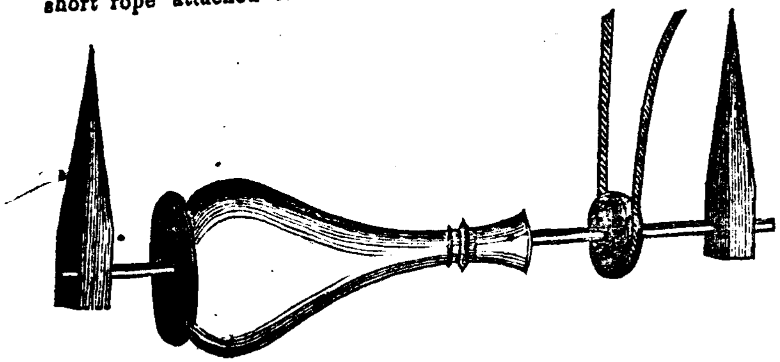
[Communicated by the Committee of the Madras Exhibition for 1857.]

On passing through Beder about two months ago, I thought it would be well, to make a few enquiries into the mode of manufacturing the unique and elegant ware commonly called Biddery; accordingly I procured two workmen, who, partly shewed and partly explained to me the several stages of the manufacture; the information thus obtained may assist those desirous of imitating his beautiful ware.



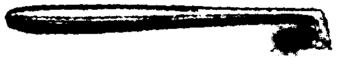
No. 1.

Suppose the vessel to be made, resembles in form the common small hookah bottom (vide Fig. No. 1). The steps of the manufacture are as follows—A mass of finely pounded and sifted old laterite dust mixed with cow-dung, is put upon a rude lathe, and when dry is carefully turned into the correct shape. The lathe is rude and simple, and is turned either by the hand alone, or by a short rope attached to a small piece of wood (vide Fig. No. 2);



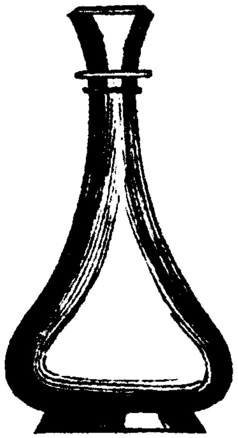
No. 2.

with the other hand the workmen holds a sort of chisel (vide Fi No. 3), with which he cuts and smooths the model. The mod

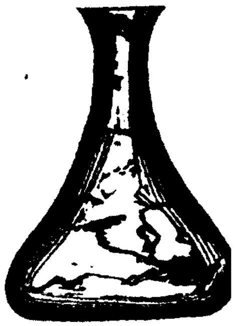


No. 3.

thus carefully prepared, is next covered with a mixture of wax an oil boiled together (vide Fig. No. 4), when dry, the whole ma is again turned, carefully thinned and smoothed. Over this coating is plastered a second layer of laterite dust moistened with water but without cow-dung—this coat is rough, and is not subsequently smoothed down, (vide Fig. No. 5). The next stage consists in boring two openings in the composite mould, and in placing it in the fire, the effect of thi being to melt the intermediate layer of wax, and thus to leave a vacant space for the reception of the alloy. Into this space is poured the alloy (consisting of copper 1 part and pewter 4). The vessel has now a dull leaden look; it is hard, but easily cut. Thi model or shell is carefully turned and smoothed. Upon the smoot surface of this shell, the pattern is etched by hand, a small pointe graver (like the pattern of the chisel, but only sharper at th point) being used. This etching is done rapidly. The workma next takes a small chisel and hammer, and following the lines of th pattern, cuts it deeply and expeditiously, scooping out the tracing of the little leaves, &c., and leaving an indented but rough surface. This rough surface is next smoothed down by hammering gentl

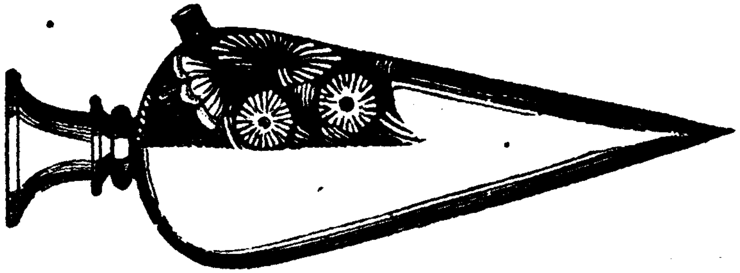


No. 4.



No. 5.

with another blunt pointed chisel, and the space is then ready for the process of inlaying (vide Fig. No. 6).



No. 6.

Thin plates of very pure silver are taken, and the little leaves (vide Fig. No. 7) are cut out with a small hammer and chisel,

No. 7.

each little leaf is then raised separately by the chisel and finger tip, and hammered gently but carefully into the depression intended for it. This part of the process is tedious. In the more durable kinds of Biddery ware silver wire is substituted for the silver leaf. The vase in this state is rough and requires smoothing. This is done with a common file and with a curved scraper, of a rude and clumsy form. The hole in the bottom of the vessel is filled up with lead and is smoothed down. Finally the vase is gently heated, and whilst warm, is blackened by the application of a powder, supposed to consist of chalky earth and muriate of ammonia, this imparts a brilliant black polish to the shell, and careful hand rubbing brings out the lustre of the silver.

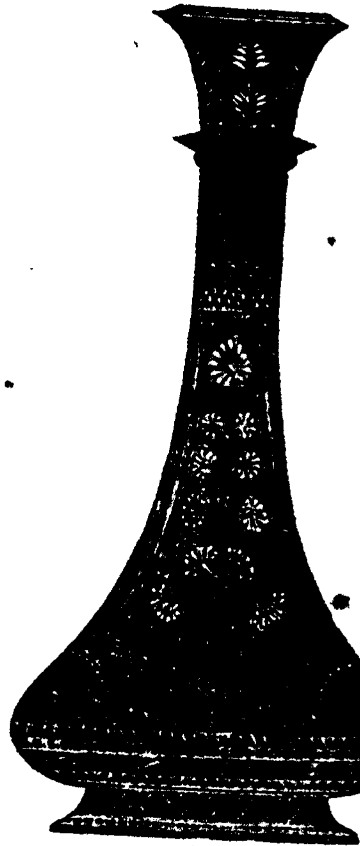
The value of the ware depends upon the thickness of the silver inlaying—the common ware of the bazaars rarely lasts long. Inlaying is also executed in the same way with copper leaf, but the artistic effect I think, is inferior to the silver. The price of a small hookah bottom like that described varies, in Beder, from 7 to 10 Rs.

It might be worth while to ascertain, if any intelligent work at Madras would undertake to imitate this elegant and dura manufacture.

The following patterns are forwarded: they will illustrate the several stages of the manufacture.

1. The first dust and cow-dung model. 2. The wax coating. 3. The rough compound model. 4. The shell, showing also the graving, the scooping out, and the inlaying processes. 5. Half finished shell. 6. The cutting chisel. 7. The silver leaf—with an oval leaf cut out. 8. The polishing powder.

No. 8.



No. 9.

[No. 8, is a fac simile of a cake of laterite dust and cow-dung sent for inspection. No. 9 shows the appearance of a vessel after the inlaying process has been accomplished.]

VI. *Notulæ Botanicæ No. I. On the Sand-binding Plants of the Madras Beach.* *By* HUGH CLEGHORN, M. D.

Having lately been requested by the Military Board to examine the condition of the South Beach, between the Saluting Battery and Saint Thomé, with a view to consolidate the drifting sand thrown up near Colonel Cotton's groynes, I endeavoured to estimate the comparative value of the different species of maritime plants in preventing the encroachments of the sea on the land, and in fixing the loose soil along the shore. All that seems worthy of mention has been condensed in the following short notice of these useful plants, which originally appeared in the *Journal of the Agricultural and Horticultural Society of India,* vol. IX. part II.

The wide-spreading roots and under-ground stems of the sand-binding plants extend themselves in quest of food, and thus become interwoven together, so as to sustain the soil in a sort of basket-work, and consolidate the sands thrown up by the waves of the ocean. If it were not for the subterranean stems of these sea-side plants, which can vegetate amidst dry and drifting sand, the banks which man heaps up as a barrier against the sea would be blown away by the first hurricane. In Holland, the great sea-dyke preventing inundation, owes its stability to these plants, creeping Gramineæ are employed, which are carefully protected under the instruction of Government. Along the shore of Great Britain, as in Lincoln, Suffolk, &c., the quantity of dry land has been much increased by the propagation of the Bent star or Sand Carex (*Carex arenaria*) and Lyme grass (*Elymus arenarius*).

Let us cast a glance at the localities under consideration. On this low coast, the wind which blows alternately over the sea and from the land, but more continuously from the sea, propels landwards the sand, which collects in a succession of parallel ridges—these gradually advance, and year by year fill up any hollow declivities, or gain on the vegetable soil which is buried. The accompanying figure will illustrate the way in which hillocks are formed by the constant encroachment of sand.

This figure is intended to represent sand-hills placed perpendicularly to the direction of the prevailing winds. The wind pushes the sand from the bottom *a* to the top *b*, it then falls in the direction *b c*. A hillock therefore will always increase if fresh sand is supplied in front, or be removed, if the sand be kept continually in motion.

Sandy and irregularly irrigated soil can only produce shrubby and herbaceous plants; it's vegetation, suspended during the dry-season, revivifies during the rains, and covers with a transitory carpet of verdure, the earth which appears naked and sterile during the rest of the year.

The drifting in of great masses of sand is, I understand, one of the greatest obstacles to the perfect success of the Eastern Coast Canal, now in progress near Madras. The drift occurs from both sides, but chiefly from the sea.

Along Canals, in which the level of the water is nearly constant, the banks at different heights are in different conditions of moisture and frequently also of soil: so we see certain species of Grasses, Bulrushes, &c. placed above each other in regular nar[illegible] parallel bands forming a kind of girdle, beyond which the soil [illegible] comes too dry on one side, and too wet on the other, for th[illegible] prosper.

1. *Spinifex squarrosus*, Linn. the species known to Europeans by the designation of "Ground Rattan"* comes nearest to the *Sand Carex* of England in its habit of growth, creeping along horizontally sometimes above, sometimes below the surface of the earth, emitting roots and shoots at short intervals of a few inches. It likewise possesses the advantage of being extremely tenacious of life; the shoot at every node is capable of renewing the existence of the individual as fast as destroyed, and the whole plant offers a resistance to the storm which is rarely overcome. I think this species would be nearly as indestructible from natural causes as Couch grass, and it appears to me (after watching patches of it on the road to Ennore, where it is little disturbed) that it would speedily colonize the sand tracts spontaneously, if it were only left unmolested for a year or two. In the experiment lately made in front of the Fort, and near the Saluting Battery, this binder has answered well, notwithstanding the frequent disturbance of the young plants. The fishermen do not appreciate the conservative design of this "ground rattan" or mat grass, but collect it for fuel, and thus destroy their greatest protection: the reason seems to be that the spiny leaves injure their naked feet, and the turf does not answer for spreading their nets upon. On this account, it would be well to propagate the other plants mentioned, immediately in front of fishing villages. This grass is *Polygamo-diœcious*, (Spinifex dioicus of Ham. MS.S.), and reproduction is effected in a very remarkable manner; the male spikes congested into an umbel are carried by the wind to the female flowers, which are fascicled on a distinct plant, and being light and spherical, the Dutch call them wind-ball (Wind-boll).

Rumphius in the "Herb. Amboinense" alludes to this plant, as being connected with a superstition among the natives, who, seeing the capitula carried along the shore by the sea-breeze, think they are propelled by the devil. (Vide Plate No. 2).

2. *Ipomœa pes-capræ*, Sweet. Goat's foot leaved *Ipomœa*, (also known as "Rabbit weed"). Perennial, creeping to a very great extent. Stems rooting at distant intervals. Leaves smooth, long petioled, two lobed, like those of *Bauhinia*, tipped with a *mucro*. Flowers large, reddish purple, very handsome. Common on the sandy beach north and south of Madras, where it is of great use in binding the loose sand, and in time rendering it sufficiently stable to bear grass. This fine creeper is equally abundant in both peninsulas, and is also a native of Mauritius, Macao, &c., occupying the place of *C. Soldanella* of the British coast, and we have rarely seen a more striking and beautiful species of the Tropical Bind weeds. Rabbits, goats, and horses eat it, so do cows, but

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* Also called "Sea Pink," these names are both popular misnomers, the correct designation is "Spinifex" of Botanists. The Tamil name, *Ravanen mise*, i. e. Whiskers of Ravanah, is a descriptive epithet

their milk is tainted. Great difficulty occurs in raising this p in the vicinity of houses—as the inhabitants tread it down, cattle nibble the tender shoots. It naturally takes a higher position on the sand-bank than the Spinifex, and suffers less injury during a storm, but they often grow together and conjointly effect much benefit. The Spinifex arrests the drifting sand, and the Ipomœa secures what the former collects. Mr. Cadell has planted it most extensively along the Canal banks near Tranquebar. (Plate No. 3).

3. *Canavalia obtusifolia* D. C. common on the sea-shore, frequently entwined with the last named binder, this is also a very useful plant, and is very abundant at the Adyar, Ennore, the mouth of the Godavery, and between Quilon and Anjengo. (Plate No. 4).

4. *Hydrophylax maritima*, Linn. Seaside *Hydrophylax*. A straggling herbaceous plant, native of the shore of Coromandel, where it shows its pale lilac blossoms great part of the year. The branches run over the sand, sometimes under the surface, and strike root at the joints. It answers well when the sand is moist. Figured in Roxb. Cor. pl. t. 233.

5. *Microrhynchus sarmentosus*, Wight. A widely diffused humble plant, common along the sea beach, with long flagelliform runners; but according to my observation, no species of the Compositæ possesses sufficient strength to effect the object in view. It i well figured in Wight's illustrations, Vol. II., t. 133. (Plate No.

6. *Pupalia orbiculata*, Wight. *Achyranthes orbiculata*, He Wallich, *Cyathula orbiculata*, Moquin, "stem prostrate: leaves short petioled densely villous when young, becoming orbicular, retuse, acute at the base, smoother by age: fascicles densely tomentose, many-flowered, globular, remote, with long brown bristles." Wallich in Roxb. Fl. Ind. Carey Edit. 2. 507. Wight Icon. Vol. v. t. 1783.

On sandy soils near the sea beach, abundant at St. Thomé, and near the mouth of the Adyar River.

An extensively spreading procumbent plant, the branches being often several feet long, round, pubescent of a light brownish-green colour: leaves when full-grown coriaceous and nearly glabrous, spikes terminal, long, at first compact, but becoming interrupted the plant increases in length: fascicles of flowers capitate, dense- tomentose: bristles when full-grown not simple, but compound, as it were pinnate, pale brown, attaching themselves to the clothes of passengers, cling to them with tenacity.

7. *Pandanus odoratissimus*, Linn. (Kaldera bush.) A large spreading ramous shrub, which fringes the coast in many places, and is often planted in belts, but takes up much room, forms dense thickets, and harbours venomous reptiles. The lands in which Chay Root is cultivated are often protected from drift sand by means of his shrub. It is a *very strong binder*, but is objectionable from its aising sand-hills, which near the Marine Villa interrupted the currents of sea breeze to the island.

8. *Ehretia arenaria*, Griffith, which is found between 12° and 28° N. L. (*vide* "Notulæ ad plantas Asiaticas," Part IV, page 212) appears to be widely distributed, and binds together the loose sand, although in a minor degree. Is this the same as Ehretia (X) cuneata? Wight Icon. Vol. IV. t. 1385 which grows on sand banks in the beds of all our rivers.

The above are the sand-binding plants most frequently noticed along the Coromandel beach. There are others as *Pedalium murex*, *Ipomœa pes tigridis* and *Sesamum prostratum*, &c., which co-operate in the work of conservation to a minor extent, but are less widely diffused along the coast. In this notice, I have only included those which seem obviously preferable for the purpose specified, by peculiarity of structure or rapidity of growth.

List of Sand-binding Plants.

1. *Spinifex squarrosus*........	Spinifex...............	Ravanan míse.
2. *Ipomœa pes capræ*........	Goat's foot *Ipomœa*...	Mosul taylie.
3. *Canavalia obtusifolia*.....	Round leaved *Canavalia*.	Kòyli avaree.
4. *Hydrophylax maritima*....	Seaside *Hydrophylax*.	
5. *Microrhynchus sarmentosus*	Creeping *Microrhyncus*.	
6. *Pupalia orbiculata*........	Round leaved *Pupalia*.	Adai yotti.
7. *Pandanus odoratissimus*...	Kaldera bush..........	Taylie marum.
8. *Ehretia arenaria*.........	Sand *Ehretia*........	

Trees such as the Cashew (*Anacardium occidentale*) the Alexandrian Laurel (*Calophyllum Inophyllum*) and the wild Date (*Phœnix sylvestris*) grow well, and render a double service by preventing a further encroachment of sand, and rendering the land useful.

NOTE.—In support of my favourable opinion of the *Spinifex*, I may quote the following authorities from the Records of the Military Board.

In 1849, Major Worster, Superintendent of Roads, first recommended the transplantation of this grass as well adapted for securing the sand from drifting; and in 1851, he represented "that of the two experiments made with the *Rabbit Weed* and the *Ground Rattan* to protect the side of the Sea Beach Road, the preference is given to the Rattan, the trial of this plant to the extent of 872 ft. x 10 ft. being considered to have proved perfectly successful" Under these circumstances, Government sanctioned an outlay of 240 Rs. for planting the Ground Rattan between the Coom Bar and the Ice House, on a length of 4,100 feet by 12 in breadth.

Again, Captain Cannon, Acting Superintendent of Roads, under date 21st July 1853, in reporting on the effects of this plant in protecting the South Beach, states the experiment succeeded "as a preservative to the edges of the road next to the beach, preventing them from being breached to the same extent as formerly. The good effects are best seen (between the Marine Villa and fishermen's huts) by comparing the portions where it flourishes in full luxuriance, with those where from the constant passage of the fishermen over it, the plant has been destroyed; in the former there is a high bank of sand covered with vegetation, and little subject to drift, whereas in the latter, the sand is constantly shifting, and moreover the foot paths form channels for the drainage of the road, and where such is the case breaches most frequently occur. I consider the Ground Rattan far superior to the Rabbit Weed as a protection to the Beach."

Mr. Cadell, Sub Collector of Tanjore, likewise informs me that he finds this the hardiest and most useful of all the plants tried on the sides of the Eastern Coast Canal.

VII. *The Geological features of Madura, Trichinopoly, Tanjore, and Poothacotta.* By the REV. D. MUZZY.

The region of country embraced in this paper is that included in the four Districts of Madura, Trichinopoly, Tanjore and Poothacotta. It is bounded on the north by South Arcot and Salem, on the east by Paulk's Straits, on the south by the Gulf of Manar and the Collectorate of Tinnevelly, and on the west by the Province of Coimbatore and the Malabar country.

Its mountains are the Patchemalies or Green Mountains in the north-western part of Trichinopoly; the Pulneys and Serumalies in the Madura District, with various ranges of smaller mountains and detached spurs and cliffs, and some vast rocks. The rivers are the Vellâr, or White-river in the extreme north, the Cauvery and Vigay with their branches; these and a few other small streams comprise all the rivers that are found in this region.

The face of the country is that of a level, and in some places an undulating plain; lower in most cases at the foot of the mountains and vast rocks, which rise abruptly from the surface, than in other places. As most of the vallies are occupied with tanks and ponds for irrigating the country, ravines and deep water-courses are very few.

The soils are the regur, or black cotton in the north, west and south, and in small patches in some other places; the red sandy and red irony in parts of the Talooks of Sevagunga, Maloor, Ramgherry and Tadicomboo, and the light sandy and gravelly on the sea-shore and in vicinity of the rivers, and a few other places; and the dark-brown vegetable soil confined mostly to the hills and vallies of the mountains. These various soils, with the exception of the last mentioned, contain a portion of clay, but this is so free from it that water penetrates through it nearly as freely as through sand, or ashes, and when burned it falls to pieces like so much earth.

The alluvium beneath the soil partakes much of the nature of the underlaying rock except in the vicinity of the sea and the rivers. There it is either the fine-washed sand mingled with land, fresh water, or marine shells, or the fluviatile and lacustrine deposits. A deposit resembling the loess of the Rhone, and the silt and crag of some pools of England are met with in various places.

In noticing more particularly the features of this region we find, that in the northern part of the Trichinopoly District, in the black soil through which that remarkable bed of fossil shells and crustacea passes, and in the vicinity of the Vellâr are beds of a pure basalt, both in nodular masses and in large blocks, and as it breaks with a smooth and even fracture, it is used, to a considerable extent, for building purposes. Adjoining this in the north-east are beds of laterite resting upon syenitic granite. And in the north-west the plains are much variegated by the out-croppings of this underlying granite, which in some places passes into syenite and greenstone, and rises in other places into hills and mountains that extend westward beyond the boundary of the District, and southward to within a few miles of the Cauvery. Among these hills is a small mountain situated a few miles north-west of Moosery, composed partly of beautifully pure magnesite and brucite and some of the other magnesian compounds. Where it is associated with iron, it possesses considerable hardness and solidity, but the brucite is soft and friable and has a large proportion of magnesia in it.

Near this mountain, in the direction of Cannanore, is an extensive bed of pure chlorite potstone. This is wrought to a considerable extent, and the vessels made of it, find a ready sale in Trichinopoly, Madura and other large towns.

It is in this region also that portions of the iron ore used by the Porto Novo Iron Company are found. This appears to be an oxide of the metal occurring in small gravelly pieces in the soil and is mingled with much impurity.

In this vicinity, three miles from Moosery on the road to Salem, is situated a hill, or small mountain, composed, as far as appearances indicate, almost entirely of crystalline pyroxene associated with beds of albite. Here were masses of beautiful dark green crystals of jeffersonite, black cocolite, forsterite, and hypersthene. The disintegration of the pyroxene imparted to some places a peculiarly rusty and irony appearance.

At Totiem about eight miles from Moosery, the soil though composed of a large portion of sand, imbeds large quantities of felspathic gravel, which is used for improving the roads.

Near this place, is a ridge of rocks composed of a quartzose granite associated with striated siliceous limestone and pure albite, as also massive garnet and chlorite rock, and at a little distance were augite and felspar.

In the vicinity of the upper annicut on the Coleroon river are rocks of granular limestone, some of which have in their composition silica and pyroxene and some a portion of serpentine and the rock is a variety of verdantique marble.

To return again to the north, we find at Valcondapuram and vicinity considerable quantities of magnesian rocks. In some cases they are associated with lime and a chertty rock resembling a compound of jasper and lime. Beautifully pure specimens of magnesite as also round shot like grains or crystals of ferruginous oxide

of titanium in nodular concretions of recent limestone are found here.

The same kind of granite as mentioned above is found to underlie all this region to within about 10 miles of the Coleroon; in some places it is associated with the common granite as its frequent outcrop and disintegrating fragments in the soil plainly show. Nearly all the mountains and hills, however, and most of the vast blocks that nearly cover the surface in some places are syenitic. The granite near the river Coleroon is of the common kind and highly porphyritic.

At the junction of these two kinds of granite and crossing the road from Madras to Trichinopoly, near the 182nd mile stone from the former place, is a bed of finely and evenly stratified grey sandstone. The strata are from 2 or 3 inches to $\frac{1}{10}$th of an inch in thickness, and they separate with a fracture so smooth and even that the pieces resemble smooth plates of slate. A specimen obtained there is about 2 feet long, one foot wide and 1 inch thick and nearly as even and smooth as a board. The small crystals of felspar contained in it are of the orthaclase species, and of a dull flesh colour.

The extent of this bed has not been ascertained; it has been traced, however, more than a mile in length, but the width of the outcrop is not more than 10 or 15 yards; and it runs in a direction nearly east and west. The strata on the south side of the bed are crossed by joints which pass through it nearly parallel to each other and about two feet apart and at an angle of about 50° with the line of direction; the dip of the strata appeared to be about 60° on the south side and nearly 20° in the centre, while that of the north side was not satisfactorily determined. A singular characteristic of this bed is, that the strata on the south side of it are composed of nearly pure silicious sandstone; in the middle they were porphyritic, containing felspar, while those on the north side were composed almost entirely of a greenish black hornblende, these thin strata forming a beautiful hornblende slate. This appeared to be the junction of the two minerals hornblende and mica; to the north of this, hornblende, either in a free state, or combined is syenitic granite, or greenstone, is prevalent, while to the south of it mica, combined with quartz and felspar forming the common or porphyritic granite, is equally prevalent.

We have now arrived in our notices of the country at the eastern part of the Trichinopoly District, which is traversed by that remarkable bed of fossil-shells already referred to, sometimes called the Ootatoor marble. In the tour mentioned above, this region was visited, and I proceed now to state a few particulars in regard to it.

In the vicinity of Ootatoor, the syenitic granite containing garnets is very abundant, it crops out and lies on the surface in flat masses and huge blocks; and rises into hills and mountains imbedding in some places the blue or oolitic quartz, fine specimens of jade, crocidolite, and a black curiously crystalline carbonate of lime and small pieces of iron.

About half a mile east of the Travellers' bungalow, the granite disappears from the surface, or remains only in small quantities and scattered in disintegrating fragments. The prospect from this place to the north, east and south is that of a great plain extending in vast wave like undulations as far as the eye can reach.

The soil is a dark loam containing magnesia and lime evidently formed from the disintegration of the rock on or beneath its surface. Small pieces of red irony crystalline limestone as also pieces of the marble full of small white shells of the multilocular class called the turrilite are found here.

In the rolling surface of this plain, there is a fair opportunity, considering the loose and earthy nature of the soil, for the denuding effects of the water, hence we see many of those ridges worn into banks and mound-like and deep ravines by the torrents. One of these, about a mile east of the bungalow is well marked. The ravine is about 58 feet deep and lays bare the surrounding strata to a considerable extent. The upper stratum on the western side is a marl or earthy limestone and occupies a large portion of the surface; the next stratum below appeared to be an iron sandstone, slightly resembling laterite yet regularly stratified, and of a reddish brown color, evidently containing a considerable quantity of

[illegible]e oxide of iron. Farther to the north where other smaller ra-[illegible]es come into the large one a still lower stratum is laid bare, it [illegible]onsists of a well-defined gneissoid sandstone. It is plainly and evenly stratified with layers of mica, silicious sand and felspar, or lime. The stone is soft and friable and appears to be considerably extensive, underlying much of the western part of this plain, its thickness is unknown. In a bank in the lower part of the ravine were strata of a pure white clay, or chalk alternating with layers of a dark dun-colored substance of the same apparent composition; both containing carbonic acid and effervescing freely with acids. This dun-colored clay is very extensive throughout this region and becomes indurated and passes into limestone. Much of the recent limestone in which the shells are imbedded is evidently formed from this clay; as it exists in different parts of this plain underlying the cotton soil in almost every degree of hardness from that of marl and soft clay to that of compact and solid limestone.

On the east side of this ravine, this clay and the cotton soil which commences here is overlaid with an earth containing salts of different kinds; those containing nitrate and muriate of soda are conspicuous. The sulphate of lime in the form of bladed, amorphous, and fibrous gypsum was so prevalent as nearly to cover the ground in some places although some bandy loads had been collected and sent to Madras. In and on the banks of this ravine were found a large number of the shells called belemnites and spe-cimens of globular, cylindrical and over-shaped substances, of va-ious sizes from that of an ounce bullet to that of some six or ight inches in diameter and length. These substances were com-osed invariably of a dark blood-red or brown-jointed oxide of ron and laterite or fine radiating zeolite. Sometimes these [illegible] ubstances were inclosed as nuclei in nodules of pure white chalk; ut more frequently they were covered with a thin smooth cretace-us substance, which gave them an uniform appearance as far as he texture of this external coat was concerned.

In our farther examination of this interesting locality, it was und, that this black soil and these globular specimens of fossil rustacea, (as there is evidence to believe they are), extended to nearly a mile east of the village of Giridimungalum, which is situated at the quarry of the Oottatoor shell marble, a distance of some five miles north easterly from Oottatoor.

As we passed from this place to Giridimungalum we saw, to the north of our path and some two or three miles from it, what had the appearance of vast banks and mounds of earth recently thrown up. On visiting them, however, we found them to be high ridges of land, washed into the forms mentioned, by torrents of water similar to the location just referred to. Here were found nearly all the different kinds of fossils and minerals that had been found there besides others, such as ammonites of some eight or ten different species, some of which though not entire, were more than nine inches in diameter and some entire were about six and seven inches, while others were only three or four inches, and nautili were well preserved and had the syphuncle well developed. While the fossil crustacea before referred to were here larger and more in the shape of the living animal, some resemble the body of a large lobster, or crab so exactly, that there seems but little risk in calling them fossils of that animal; and some resembled the different kinds of echinus, especially the spatangus. There were also other masses with two lobes somewhat resembling a small saddle having distinct marks of shell or skin. These are only a few of the great variety of forms and shapes that were met with. These were all composed of the oxide of iron, selenite, or zeolite and lime, as before described. Many of those bodies were broken and the oxide of iron, which had formed them, with portions of the fossil animal distinct, lay in different places where they had been entombed. They were of various sizes, from that of the shrimp to that of an animal of some 25 or 30 feet in length.

We next examined the limestone in the village of Giridimungalum; this appeared to be of different ages; while some of it, being highly crystalline, must have been of a high antiquity, other parts of it were more recent, imbedding a different kind of shell; and some appeared to be of the clay above mentioned, and to be, even now, in a state of formation. The shells in the oldest rock, were in the best state of preservation, being much fresher and freer from fracture, than those in the more recent formation, some of them still retaining in part their color and all the small ridges natural to them. This rock is of a bluish color highly crystalline and so hard as to receive a good polish. A noticeable feature of these shells was, that although they were so numerous as to compose a large proportion of the rock, they were, with few exceptions, of the bivalve class.

Not possessing the means, nor the time to name these shells, I do not attempt it. Most of them will be found figured in Sowerby's Geological Conchology, in Lyell's Manual of Elementary Geology, and a few of them in this Journal for June 1840.

We obtained parts of what appeared to be two fossil tortoises and a few large bivalve shells entirely converted into limestone, a number of pieces of fossil wood in limestone; some with the holes made by the teredo nearly filled with calc spar; these also contain knots or the beginning of branches. There was also found at this place, an ammonite in good state of preservation measuring some 15 inches in diameter and about 4 inches in thickness; the outward whorl of which is partly free from the limestone which envelopes the central part and shows the shell but little altered. This bed of limestone was found to be narrow, not being more than half a mile wide in the widest place; we traced its length for about two miles south of the village and could see its outcrop for about a mile further. Persons were sent to follow this bed to its southern extremity, who returned with fossils and minerals; plainly indicating that although its continuous outcrop is not more than about four miles in length it does extend beneath the surface to the village of Pullumpardee near the Coleroon, where it again crops out and is wrought.

From the south of a small rivulet, which runs across it, the rock and fossils appeared to be more silicious, and frequent masses of granite and small pieces of sandstone were found among them. Now considering its extent from Pullumpardee, and that from the rise of ground near Giridimungalum those high denuded ridges, like those where the fossils are so numerous, can be seen extending in a north-easterly direction as far as the eye can reach, and also that this kind of limestone appears on and under the surface in the same direction at Virdachellum, Seedraput, and other places between these places, may we not safely conclude that this same formation accompanied by its fossils and minerals continues, either beneath, or upon the surface the whole distance from Seedraput to Pullumpardee? If so, we have a space of more than 100 miles in length and from two to five miles in breadth, which, when this country was submerged beneath the ocean, as was most probably the case in, what is called the cretaceous or latter part of the secondary epoch, was the peculiar home and feeding ground of innumerable animals, similar to what the Newfoundland and Bahama banks are now. Here, they lived and flourished and here they died and were buried, and here in the abundance of their fossil remains we read the history of creative wisdom and preserving goodness of which we have such abundant evidence in our day.

In our return to Trichinopoly we found the country near Oottatoor covered, in places with the same dark granite before mentioned, and across the road passed a vein of pure augite slate, so hard and fine grained as to admit of a high polish. At the distance of about three miles south-west from Oottatoor occurred the same undulating denuded surface as at Giridimungalum in which were found nodular concretions of iron ochre imbedding selenite which was very pure; here was also found chlorite, porphyry and an abundance of crystalline gypsum and a kind of limestone which had the appearance of being simply a mass of fossil hamites, and another kind made up of different species of the shell called terebratula, the turbinidæ, and many others; the whole differing entirely from any thing discovered in the other places mentioned. This is an interesting locality and deserves further investigation.

As the formation on the sea-shore and in the vicinity of the rivers is composed of light sand, and up from the shore, of diluvium brought down by the waters, it will require no further remark.

We have now come to the northern part of the Madura District. We find that granite underlies nearly the whole of this District; there is reason to believe that the laterite rests upon granite, as it does in other places. So also some of the syenite on the tops of the mountains is found to rest upon granite. Indeed syenite is not known to be an underlying rock to any extent in any part of this district, but appears in blocks or rounded masses both on the mountains and some parts of the plains.

In the direction of Vellum and Poothacotta from Trichinopoly the granite pierces the laterite, which covers most of the surface, in a number of places where it appears either in ridges of some height or in broken masses scattered over the plains, but the laterite does not appear here often in the form of a rock, but of gravel mingled with the soil, or immediately beneath it. In the vicinity of Vellum and from that place south through the Poothacotta and Sivagunga districts, the laterite takes more the form of a glomerate rock and is used for building purposes. Its appearance in some places when it is forming is that of a liquid percolating the soil and forming for itself small pipes, or veins which branch in different directions not unlike the veins in the human system; these multiply and harden till the whole mass becomes thoroughly impregnated with iron, and by degrees formed into a hard and rich iron ore. Considerable hills are formed of this substance in the Poothacotta district; still containing the pipe, or vein-like formation.

From Trichinopoly in a south and south-westerly direction the granite is porphyritic and contains at Verallimalli a vein of nodular greenstone imbedding granular chlorite and beautifully white albite. On the road from Trichinopoly to Dindigul at Amaparthi is a bed of granular limestone imbedding grains of pyroxene, of considerable extent and hardness; this is found in some cases united to the granite, connected with the felspar of which, are crystals of vermicutorite. At Manaparie 25 miles south-west from Trichinopoly, the granite is diversified by large masses of viscid quartz and quartz rock and granite; the minerals found at this place are rock crystals, axinite, calcspar, chlorite, ripidolite, octahedral and specular iron, prehnite, chlorite porphyry, polyolite, schorl, albite, pyrope, garnet, aquamarine, nigrin, rutile, zeuxite, arseniate of copper, nicoline, and crystalline hornblende.

Near Corttamperthe is an extensive bed of silicate of iron; it forms a part of four small mountains and continues in one direction, either upon, or beneath the surface, a distance of about eight miles and contains the different varieties of this ore and their different crystals.

In the vicinity of Tovarankurchy are considerable hills of quartz rock having a quantity of green diallage in its composition. In the Maloane mountains, gonulite is the prevalent rock and it imbeds black and common garnets which with the massive variety is found in considerable quantities in the granite soil of this region. Alagiri Malei is a mountain situated 12 miles north of Madura and is about 1,000 feet in height and some ten or fifteen miles in length, and is composed almost entirely of aventurine quartz or micaceous sandstone. Some portions of it appear to have been formed upon a shore and are stratified and have inequalities resembling ripple-marks.

Five miles north-east from Madura is that remarkable rock called Elephant mountain, from its resemblance to that animal in a reclining posture. It is a block of gneiss two miles in length, ½ of a mile wide and some 250 feet high. Strata of felspar, mica, and quartz run horizontally through this mass from one end to the other and are seen on both sides of it, and are crossed at different angles by veins or faults of a felspathic rock which pass through the entire vein. A porch and a temple have been hewn out of one side of it. As there can be but little doubt of the sedimentary origin of this rock, we must suppose it to have been formed in some vast pit and elevated to its present position by that force which has produced so many of the changes which have from time to time variegated the surface of the earth.

The vast fields of granite at the south-eastern base of the Sirumalei and Alagiri mountains would seem to indicate the direction and denuding force of ancient oceanic currents.

At Vadapadi 16 miles north-west from Madura is a small mountain composed almost entirely of porphyritic greenstone. The hornblende in its composition is of the dark basaltic variety and the felspar is of the andesine or the white variety and in the composition of the mass the columns appear in spots like the skin of a Leopard.

The limestones of the district are numerous and of various kinds. The lime gravel, or kunker, is widely diffused in the soil, and in some places is nearly a pure carbonate of lime ; in other places it is mingled with other substances and takes the form and consistence of concreted limestone or pisolite. These are the kinds used for making roads and burning into lime. Travertine or tufa is found in stalagmitic concretions in caves and bordering around the stems and branches of plants. The crystalline limestones are also numerous, they are found in nodular masses and large blocks and show the crystals of calcspar and the fine granular and compact varieties. Some of these kinds receive a tolerably good polish and might, it is thought, be wrought for marble. The minerals found imbedded in these stones are the chondrodite, graphite, pyroxene, and molybdenum ; and the different locations where they are found are Poovandy, Puntelacoodee, Carnapadi, Vitherapadi, in the Tirumungalum Talook and in a number of other places. In the location at Puntelacoodee the outcrop is some 20 yards in width, six or five miles long and of a depth not explored. These masses of rocks are nodular in most places, nor does there appear to be any regularity of dip in the case of any of them. They lie in wild confusion in every part of these limits resembling the ruin of a vast wall. The stone of the south side of this bed is highly crystalline calcspar of a dull whitish colour, while that on the north side is finely granular or compact, and of a bright flesh colour.

Another feature of the district is its iron. This is widely diffused : it is found in almost every part of the district, either in the form of native iron or united with oxide in the form of hæmatite, of ochre or of octahedral crystals of specular iron and iron sand, &c. ; there is the silicate of iron, the carbonate and sulphuret and a vast quantity of laterite, but so small quantities are found in any one place, except of the silicate and laterite that it has been but little wrought.

The region where gold is sometimes found was visited and the sand and rocks of the same, to some extent, examined. The name of the place is Pulkanáth, 14 miles north of Dindigul just under the east end of the Pulney mountains. The gold is found in small particles in the alluvium and sand of a plain at the foot of a smal mountain about two miles from the Travellers' bungalow. The [illegible] and alluvium of this plain are composed of the disintegrated [illegible] decomposed rocks of the mountain, as the frequent fragments [illegible] sand and gravel abundantly testify. So that there is no doubt, but that the gold was originally in this rock which is in some places a granulitic, in some a micaceous, and in others a syenitic granite containing alamandine garnets and specular iron in abundance. The yield of gold as yet obtained is rather small, not averaging more in value than could be earned by day labor. This is probably owing, partly to the inefficient way the labor is performed, and partly to a want of water: it is the opinion of those who have taken gold here that the proportion of gold is much larger at the depth of some feet below the soil than on the surface. Could a shaft be sunk some 25 or 30 feet, there is a *fair* prospect that the yield would well repay the labor, especially as it would afford water to wash the earth and sand, which is now found only at a considerable distance from the place where it could be used.

VIII. *A Vocabulary of the Dialect spoken by the* TODAS *of the* NILAGIRI *mountains. By the Rev.* F. METZ *of the German Evangelical Mission.*

[Previous notices have appeared in this Journal, descriptive of the manners and customs of this peculiar race, the Todas. Vide an article entitled, "The antiquities of the Neilgherry Hills, including an inquiry into the de-"scent of the Thautawars or Todars. By Captain *H. Congreve.*" Vol. XIV. No. 32, 1847. See also "An Essay on the Relationship of Languages and "Nations. By the Rev. *Bernhard Schmid.*" Vol. V. No. 14, 1837. But nothing like an useful Vocabulary of the Toda language has yet been published. ED. M. JOUR.]

The pectoral pronunciation of the Todas in speaking their language is the reason why so many Europeans, who heard them speak, believed that it had no relationship at all with any of the S. Indian languages. If these Europeans had lived longer among the Todas and if they had understood the Badaga dialect, they could not have given such an opinion. In my opinion the Toda language is a rude dialect of old Canarese and I can find nearly all its words in the Badaga language, only I must keep in mind, that according to the rules of Toda pronunciation a common Canarese word is so much changed that it is difficult to recognize it again as such and it requires a long time to get the ear accustomed to their jungle language. I find it nearly impossible to get their language reduced to writing with such perfection, that any one who reads my Toda words can be understood by the Todas. On this account I may say, that the Toda language cannot be properly learned except by living amongst the Todas and by hearing their conversations.

As the whole life of a Toda is concentrated in his Buffaloes and as no great variety of words is required for the purposes of their common life and occupation, I find it very difficult to discover words for abstract terms, without which I cannot have a religious conversation with them, so I help myself with Badaga words, which most of them understand. The Todas do not trouble themselves much about religion. Theirs is a very convenient one. Heaven is nothing else but a place where they will have plenty of Buffaloes and as no Toda has any doubt about his going to heaven, he thinks that the occupation in the other world viz. feeding Buffaloes does not require any preparation.

On this account I find their language very poor and insufficient to convey the truth of the Gospel to them.

Most of their verbs have only one tense, and they help themselves by adverbs of time to express the future and past tenses.

I also find that there is a slight difference in the dialects of the different tribes of the Todas. For instance one tribe has an *Sh* where another has an *S* or a *Th* (like the English,) which another again changes into *S* or *T*. I write their language in Canarese characters. In printing the Gospel of Luke in the Badaga language, we were obliged to take up some of the old Canarese characters, which are not in use now in the present Canarese. In the Toda language I helped myself by adding marks in some characters to shew the peculiar Toda sound. For instance, the *Th* I have given with ಥ಼ to distinguish it from ಥ, and as their *Kh* is pronounced like the German or rather Swiss *Ch* I mark this sound by ಖ಼ to make it different from ಖ. In many cases the *Ph* is like the English *F*, which no Badaga can pronounce on account of the pectoral pronunciation, I have therefore chosen ಫ಼ to represent (*F.*) They have no pure *A* as it occurs in other Indian languages but their *ā* is pronounced as *ā* in tall and as *u* in much.

There are 2 sounds of the vowel *i* (ee) the one is like the English *ee* (*í*) in meet, the other one like the German *ü* in *über*, for instance, ಬಿರ್ಷ್ *birsh* with *ü* means a tiger and ಬೀರ್ಷ್ *bírsh* with *ee* means the sun, ಮಿರ್ಷ್ *mịrsh* with *ü* means a hare and ಮೀರ್ಷ್ *mírsh* with *í* means a peacock.

VOCABULARY.

Abaisance (I make) ಕಾಲ್ಮೇಲೆಬುಥ಼್ಬಿನಿ *kál-méle-butth-bini.* I fall at (your) foot.

Abandon ಬುಟ್ಟು ಬುಥ಼್ಬಿನಿ *buṭṭ'hu-buṭth-bini.* Badaga ಬುಟ್ಟು ಬುಟ್ಟಿನಿ. *buṭṭ'hu buṭṭ'hini.*

Abide ಎಷ್ ಕೆನ್ *eshken* lit. I sit ಎಷ್ ಕೆನಾ shall I sit down.

Abject ತಲಿವೆರ್ಷ್ಬಿನಿ *tali vershbini; ersbini, ershbini* or *vershbini* means I am, which is generally put to the root of a verb. The Badagas use *uṇṇane* (ಉಂಣನೆ.) for it.

Abominate	ನಾಂಥ಼್ಬಿನಿ.	*nánth bini.*
Abomination	ನಾನಂ.	*nánam.*
Abortion	ಮೊಖ್ ಯಿಡಿಲಾದಿ.	*mokh yiḍiládi.*
Absorb	ನುಗ್ಗಿವಿಟ್ಟಿನಿ	*nuggiviṭṭ'hini,** Badaga ನುಂಗಿಬುಟ್ಟಿನೆ.
Absurd	ಪೆರಾಟ್.	*perát.*
Abundant	ಉಪಾಂ.	*upám.*
Accede	ಆಡ್ಬಿನಿ.	*ádbini.*

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* The Todas always assimilate the *n* to the following consonant.

Accept	పర్త్బిని.	*parth bini.*
Accommodate	సరిమాడ్బిని, సరిగిత్బిని.	*sari mádthbini sarigitthbini.* B. *sari máḍine, sari giṭṭine.*
Account v.	యెనివెర్ష్బిని.	*yenivershbini.* B. *yeniuṇṇane.*
Account n.	యెక్కం.	*yekkam.* B. *yekka.*
Accompany	కూత్వెర్ష్బిని.	*kúṭth vershbini.* B. *kúṭiuṇṇane.*
Accurate	సరి.	*sari.* B. *sarri.*
Accurse	బర్తిబడ్బిని.	*bartibadthbini.*
Accuse	పిర్యాది ఎష్ట్స్బిని.	*piryádi yeshts bini.*
Aches, it	బాడ్తి, పస్తి or పరస్తి.	*Bádthati, pasti* or *parasti.*
Acquire	కత్బిని,	*katthbini.* B. *kattiuṇṇane.*
Adolescence	మొఖర్ష్.	*mokharsh.*
Adore	కుబ్బుట్టిఖెన్, అడబుడ్థిఖెన్.	*kubbuṭṭ'hikhen, aḍabudthikhen.* B. *kombiṭṭine,** *aḍabuḍḍini* I bow down the horn, I fall.
Adorn	నార్షిమాడ్బిని, నార్ష్గెర్ష్బిని.	*nárshi máḍth bini, nársh gersh bini.*
Adultery	ఉర్ద్వెర్ష్బిని, సూళెబచ్ వెర్ష్బిని.	*urdthvershbini, súḷe bach versh bini.* I commit a.
Adulterer	సూళెమొఖ్.	*súḷe mokh.* B. *súḷemága.*
Advantage	ఉలివల్.	*ulival.*
Adversary	అఖెవెర్ష్బెన్.	*Akhevershbén.*
Advice	బిడ్డి.	*biddi.*† B. *buddi.* (wisdom.)

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* This appears rather to be a corruption of the Tamil கும்பிடேன் *kumbiṭṭén* I salute.—W. E.

† The *i* in బిడ్డి is pronounced like the German *ü* in *über.*

Afar	బథఖ్.	*bathakh.*
Affection	గావ.	[illegible] B. *gáva.*
Afraid	అఞ్జిబిని.	[illegible] B. *anjine.*
Afternoon	ఏకార వొత్ఖ్.	*ẹkára vótkh.*
Again	తెరిగి.	*terigi* B. *tirigi.*
Age	ప్రేయ.	*préya.* B. *perea.*
Ago	ముచ్చ్.	*muchch.* B. *munche.*
Agree	వొబ్బిస్బిని	*vobbisbini* B. *vobbiuṇṇane.*
Air, wind	కాత్.	*kát.* B. *kātu.*
Alas	అయాఖ్.	*ayákh.*
Alms	దర్మ.	*Darma* B. *darma.*
Alike	ఉద్థేర్ష్బిని.	*udthérshbini.*
All	యెల్లుమాది.	*yellumadi.* B. *yella.*
Anecdote	కధ్.	*kadh* B. *kade.*
Alone	వుద్ది ఆళాది.	*uddiaḷádi.* B. *vondāḷági.*
Amputate	క్వర్థ్దెర్ష్బిని.	*kwarthdershbini.*
Anger	బిజ.	*bija.*
Angry I am	బిజబడ్చి	*bija badthachi* (anger is come)
Ana	వెలి.	*veli.*
Ancestor	దొడ్డావన్.	*doḍḍavan.*
Another	యింనొడ్డ్.	*yinnodd.*
Ant	ఎర్బ్	*yerb.* white ant గెజలు. *gejalu.*

Ant hill	ಗೆಜಲುತ್ತ. *gejalutta.*
Ape	ತೂರು ನ್. *túrun.*
Appear	ತೂವರ್ಸ್ಬಿನಿ. *tuvarsbini.*
Arbiter	ನಾಯಗಾರ ನ್. *náyagaran.*
Arm	ಪಾರ. *par.*
Apprehend	ಬತ್ತ್ರಿವೆಷ್ಕಬಿನಿ. *battivershbini.*
Army	ದಡ್ಡು. *daddu.*
Arrive	ಬ ಷ್ಕೆನ್. *bashken.* ಬಡ್ಸ್ಬಿನಿ. *baddsbini.*
Arise	ಮಗೆದ ದು ವೆಷ್ಕಬಿನಿ. *magedadu vershbini, imperative* ಮಠ್ಯೋ. *irregular.*
Arrow	ಆಬು. *abu.*
Around	ತುಚಿ. *tuchi.*
Arse	ತುದ ಷ್ಕ. *tudarsh.*
Ascend	ಹ ಟ್ಸ್ಬಿನಿ. *hatsbini.*
Ashamed	ನಾಂಥ್ಬಿನಿ. *nanthbini.*
Assembly	ಕೂಟ. *kuṭa.*
Assemble	ಕೂಟಗೆಷ್ಕಬಿನಿ. *kuṭagershbini.*
Ass	ಕ್ರಟ್ಟೆ. *kratte.*
Attend	ಕ್ರೆದ್ಸ್ಬಿನಿ. *kredshini.*
Attest	ಸಾಕಿಶಿ ಏಷ್ಕಬಿನಿ. *sákisiershbini.*
Avarice	ಕರಿ. *kari.*
Avidity	ಆಶೆ. *ase.*
Authority	ಅಧಿಕಾರಂ. *adikaram.*

IX. Scientific Intelligence.

[The following letters regarding Earthquakes, lately observed at Travancore, are extracted from the Madras *Athenæum*.]

SIR,—Perhaps the following account of the Earthquake observed in Travancore on the morning of Monday the 11th instant may interest some of your readers.

The assistant in the Trevandrum observatory having the watch on the morning referred to, was entering an observation when he heard a low rambling sound which he thought at first was distant thunder towards the north-east; in about three seconds the rafters of the building began to creak, the windows to rattle and a mirror resting on the table to shake: he immediately looked at the clock and found the time 5 h. 53 m. 30 s. which, allowing for the known clock error, would give the mean Trevandrum time of the commencement of the sound 5 h. 51 m. 25 s. He then went out to look towards the north-east and immediately thereafter the sound ceased with a louder "bom"; on looking again at the clock the time by it was 5 h. 54 m. and he estimated the duration of noise and shock at nearly twenty seconds. He now examined the magnetical instruments, but could perceive neither vibration nor change of mean position. It is not impossible however that the magnets might have had swinging or dancing motions without being remarked by the observer, as vibrations round a vertical axis only are noted. An examination by myself since, of the observations made before and after the shock, confirms the fact of the steadiness of all the magnets; neither did I find any thing remarkable in the state of the atmosphere. The velocity of the wind from the north-west was nearly as usual at the same hour; the sky was nine-tenths clouded, the clouds moving from north-west; the temperature of the air was nearly 73°, the maximum temperature of the day being nearly 78°.

A lady living near the observatory was awoke by a low rumbling, puffing noise, which terminated by a stifled explosion, as if under ground, she saw the foot of the bed moving slightly from side to side (north and south) and heard the windows rattle. The sound seemed to her to precede the shaking by a few seconds, but she did not conceive that the whole lasted more than from five to ten seconds. The air appeared hazy to her and to several other persons. The atmosphere felt close and disagreeable during the day.

Lieutenant Colonel Faunce, living about three-quarters of a mile west of the observatory, has informed me, that the noise and shock appeared to him to come from the south-east and to proceed in a north-westerly direction: the noise seemed in or on the surface of the ground and the noise and shock lasted at least six or seven seconds. The shock was rather strong, his right leg was swayed from right to left (i. e. east to west) while he was sitting facing the north and his whole body felt the movement: Colonel Faunce also thinks that the sound preceded the shock. The windows rattled considerably. He likened the noise to that of a steam carriage; a rumbling sound terminating louder than it commenced.

Dr. Sperschneider, three-quarters of a mile north-west of the observatory, also felt the shock. The noise he says began a few seconds before the earthquake and lasted a few seconds after it. It appeared to Dr. Sperschneider to go off in a westerly or north-westerly direction; the windows and roof of his house trembled.

Dr. Waring, about a mile and half north of the observatory, heard and felt the earthquake though apparently not so markedly as by the others. I am told that about the same distance south south-east of the observatory the shock was very distant; while within the fort about two miles south of the observatory the earthquake was not perceived at all. It should be noted that about the Fort decomposed granitic rocks are covered by a thick stratum of sand, while all the other stations are immediately on laterite rock.

The shock it seems was felt at Quilon "about six o'clock," and Mr. Liddell at Charlio's Hope near the road between Quilon and Courtallum says "we had a smart shock of an earthquake about ten minutes before six on Monday morning."

I was on the summit of our highest mountains, the Agusteer Mally (about 30 miles W. N. W. of Trevandrum) on Monday the 11th but did not perceive any shock. I noted that the Tinnevelly country and the mountains to the north appeared much clearer that morning than usual.

The testimony on the whole seems to indicate a southerly and easterly point as the direction of the origin, all agree that the sound was heard before the shock was perceived.

It is quite possible that the shock may have been propagated from Tinnevelly below the ghats and not have been very sensible at their summits. It would be of importance for the purpose of determining the origin, the velocities and the direction of transmission of the shock to have the accurate time it was perceived at some localities considerably distant from Trevandrum.

I have the honor to be,
Sir,
Your's obediently,
John Allan Brown.

Trevandrum Observatory,
16th August, 1856.

P. S.—Where the earthquake has been observed it will be desirable to mention by what means the error of the timepiece has been obtained.

Sir,—I took the liberty a few days ago of forwarding to you a notice of an earthquake felt in Travancore on the 11th instant, allow me to add to that communication that I have found since that the shock was neither perceived at Nagercoil (40 miles S. E. by E. of Trevandrum) nor at Cochin (120 miles N. W. by N.) but I understand it was felt at Cottyam (90 miles N. N. W.) It was also felt at Courtallum (40 miles N. E.) by several persons; and Dr. Barker estimates the time of the shock there at 5h. 50m. a. m. (verified to some degree by the sunrise) this time agrees really with that of the shock at Trevandrum. At Quilon Mr. D'Albedhyll informs me that two ladies give 20 minutes before 6 as the time of the shock. On the best consideration of all the facts as yet received by me I am inclined to consider a west north-westerly direction from Trevandrum as that of the origin of the shock and perhaps towards the Laccadive islands.

On the 22nd August about 4 hour 25 minutes P. M. while lying on a cot reading in an upper room I felt the cot shaking rather violently, I immediately looked at the bed posts, these, and the tester frame seemed to vibrate irregularly and sharply from east to west. On going to the magnetic observatory I found the time of the shock to have been almost exactly 4 hours 25 minutes, 10 seconds. I observed the magnets dancing up and down in short jerks, and a brass weight hanging in a closed box was observed by means of a telescope, to dance perceptibly 15 *minutes* after the shock. I could not observe any swag or side motion, but I concluded from the vibration of a hanging cord, seen in a room below me by another person, from the motion of the bed posts, and from the wetted sides of a glass vessel containing water, that the shock had been propagated in the direction between W. N. W. and E. S. E. the shock was accompanied by a low trembling sound. This second shock was observed also at Quilon by Mr. D'Albedhyll and others about 4h. 16 minutes. If the clocks there can be trusted this, as in the case of the first shock, is about 10 minutes before the time at Trevandrum.

General Cullen informs me that a shock was felt in Travancore in February 1823, 19th September 1841 and 20th November 1845.

I shall feel obliged, if any person has observed the time or direction of either of the shocks of the present month, by the communication of the facts to me.

I have the honor to be,
Sir,
Yours faithfully,
JOHN ALLAN BROWN.

Trevandrum, 25th August, 1856.

P. S.—The second shock is said to have been stronger than the first. The first shock was observed at Quilon by few persons; the second was observed by many Europeans and Natives. No native at Trevandrum appears to have observed either shock excepting those on the watch at the observatory.

SIR,—The shocks of earthquake are reaching us so frequently that they will cease to be interesting as news, and the proper place to notice them in detail will be in the pages of some scientific periodical.

Another shock was felt here at 15 m. 0 s. afternoon of to-day (1st September). The effects of the shock on the magnetical instruments were even more remarkable than on the last occasion; and the ball of a pendulum 17 feet long moved through a space of about 4 inches in the direction N. W. by N. and S. E. by S.; I believe from the former to the latter.

In my attempts to obtain information on the last two shocks I have heard (from Dr. Colebrook of Madura) of a remarkable shock experienced on the 17th of March last, near midnight, about 30 to 40 miles east of Madura, the noise seeming to travel from west to east. An examination of the observations of the magnetical instruments in observatories on Agustier Mullay and here, shows that the shock was felt markedly by both places.

Any communication on earthquake shocks felt in Southern India addressed to me would much oblige.

Sir,
Your's very obediently,
JOHN ALLAN BROWN.

Trevandrum, 1st September, 1856.

[The following letter, describing the shock experienced on the 17th of March last in Madura, is taken from the "*Thinavarthamani*" of the 27th March 1856, a Tamul Newspaper edited by the Rev. P. PERCIVAL.]

(Literally translated.)

"I am sure you will not object to publish the following account of a wonderful Phenomenon, in your valuable journal, for the information of the people of other countries.

At 1 o'clock on the night of the 17th March 1856, a sound was suddenly heard in Paramagoody a village of this Zillah of Madura, which continued 10 minutes like a peal of thunder, and appeared to move from west to east. During its continuance houses and other things were agitated, and many persons who were sleeping were aroused and sprung from their beds.

Fissures in the earth were also caused in some places.

The people of this village, ignorant of the nature of this phenomenon, feared that it might be a judgment inflicted by the Gods.

Since that, the Moonsiff of this Division, Mr. William Boalth, has told them that it was an earthquake, and has explained its cause and mentioned other incidents of a similar kind; which has proved a relief to their minds. I think your readers will not be otherwise than wonderstruck at this occurrence."

I am,
Your servant,
THEROO CANACASABY MODILIAR.

Paramagoody,
20th March, 1856.

[Extract of a letter from R. D. PARKER, Collector of Madura, dated 31th of August 1856, reporting the discovery of a pot of gold coins in his district].

"In a piece of waste land, belonging to the village of Caliempootoor, in the Iyempully Talook, a pot of very beautiful gold coins, bearing the heads of Augustus and other early Roman Emperors, has been discovered.

The persons Pona Boyen and Dasa Boyen by whom they were found, and who are tank diggers, were employed in excavating brick earth. The coins were packed in an earthen pot about the size of a large mango, which unfortunately is broken. The original No. was 63, of which 4 are not forthcoming and two are reduced to ingots, leaving 57 in excellent preservation, with the heads and inscriptions exceedingly distinct. The pot was found about ½ foot below the surface of the ground adjacent to the bank of the Shunmoogum Nuddy River, which is near the boundary of the Madura and Coimbatore Districts, and rather more than 30 miles South-West of Dindigul."

[The following notice of the late Storm of the 20th Nov. 1856, was kindly furnished by Major JACOB, The Hon'ble Company's Astronomer.]

The Barometer began to show a downward tendency as early as the night of the 17th but so slight as to cause no alarm; for the next two days this tendency continued, but there was no sudden depression; the daily rise being only a little *less*, and the daily fall rather *more* prolonged than usual. No decided fall took place until the afternoon of the 20th when instead of the usual rise after 4. P. M., the mercury, after fluctuating slightly for about an hour, continued descending until 3 h. 30 m. A. M. on 21st, when it stood at 29·540.

The wind, which had been for some days a little westerly, blue rather fresh from N. N. W. about midnight of the 19th, but the pressure scarcely exceeded 5lb. on the square foot.

On the morning of the 20th, after a short lull it veered to the eastward of N., about 10 h. 30 A. M. returning to nearly due N., in the afternoon between 2 and 3 P. M. the pressure reached 12lb. but only in a single gust. From 5 to 8 the gale moderated and again became easterly; but freshened again during the night, and about midnight began to veer westerly, from 4 to 5 A. M. on the 21st it attained a force of 18½ lb., when it began gradually to moderate and by the evening had become nearly calm, still coming round till it finally blew S. W. The Barometer continued to rise steadily from 3½ A. M., and by the evening had nearly attained its usual height.

From the course followed by the wind it was inferred that the centre of the storm was passing a little southward of Madras, and this agrees with the reports of the shipping which stood out to sea in a S. E. direction, and met with worse weather than what occurred on shore.

The rain continued heavily on the evening of the 19th, and continued with little intermission until the morning of the 21st, the fall in those 36 hours amounting to 11·65 in. of which 6·22 in. fell in the night of the 20th.

X. *Proceedings of the Madras Literary Society and Auxiliary of the Royal Asiatic Society.*

Thursday Evening, *October* 9, 1856.

The Hon'ble WALTER ELLIOT, President, in the chair. Read Extract of a letter from H. CLEGHORN Esq., M. D., dated 11th September 1856.

I take this opportunity of submitting for the consideration of the Committee, some passing thoughts as to the urgent want of a good Library of reference in Madras, a want equally felt, I believe, in the other Presidency Towns of India. The advance of education and the increased attention bestowed upon Statistical and Scientific enquiries, renders the possession of standard works for reference an imperative necessity. The arrival of many able men in India, who have devoted much time and attention to particular branches of science has greatly increased the demand for books, and the supply has to a certain extent kept place with the demand; but still there is no place in Madras where a student can find the information required in many enquiries of every day occurrence. Standard works on many branches of science are with difficulty obtained for reference. The Medical College and Medical Society having formed their books into one collection, the aggregate exhibits a fair professional Library. The Corps of Engineers and Artillery have each a good well selected Library relating to their respective Departments. The Clerical Society has I believe a Theological Depôt. At the Club House there is a considerable collection of works upon Miscellaneous Literature. The Literary Society alone has a large General Library containing (crowded together in a small area and scarcely in a consultable state) almost all the more interesting works of Travels, History, Science, and Antiquity, but the Society like the sister in Calcutta has almost ceased to purchase the more expensive publications of the day, and by necessity devotes the greater portion of its fluctuating income to works of an ephemeral nature, because they are in special demand by the bulk of Subscribers, while the Chemist, the Naturalist, the Archæologist, and the Statist have no means of keeping up to the level of the day, and have no means of knowing the discoveries which have been and are being recorded, unless they are able and willing to purchase largely from their own resources, and there are few who are in a position to do this.

Resolved, with reference to Dr. Cleghorn's letter, that 10 per cent. of the Society's funds be set apart for the purchase of standard works on scientific subjects.

The Secretary communicated to the Meeting, the result of a Circular issued in May last, and forwarded to all the Stations in the

Interior, inviting Contributions and Subscriptions in support of the "Madras Journal of Literature and Science," the Society having determined to commence the republication of that Journal. The appeal for literary support having been responded to with much readiness and upwards of 200 Subscribers having been registered, it was *resolved*, on the motion of the President, seconded by Mr. G. Ellis, that the Journal be published Quarterly, and that the number for October, November, December 1856, be entitled No.* I. of a "New Series," and be issued in December.

The foregoing resolution having been discussed and agreed to; it was resolved to refer the same to a Committee of Papers to carry the resolution into effect.

Read an interesting paper by George Smith, M. D., Residency Surgeon, Hyderabad, descriptive of the Natron Lake of Loonar, in the Deccan, accompanied by a plan and section of the Lake, with two statements exhibiting the result of two experiments to extract Salt from the Lake.

Read also an excellent account, by the same gentleman, of the Manufacture of Bidderyware, at Beder.

Read also a paper on Indian Currencies by J. W. Breeks, M. C. Service; and a paper descriptive of the Plain or Waxed Paper Process in Photography, by Jesse Mitchell, Adjt. 1st Nat. Vet. Battalion.

Resolved, that the thanks of the Society be presented to the Donors and that the Papers be set aside for publication in the Journal.

The thanks of the Society were voted to Major Jacob, Director of the Madras Observatory, for the Meteorological Observations for July, August and September last, which will appear in the Journal.

Thursday Evening, *November* 13, 1856.

The Hon'ble WALTER ELLIOT, President, in the Chair.

The Secretary informed the Meeting that specimens of Salt, extracted from the Loonar Lake, had been forwarded to Dr. Mayer, Professor of Chemistry, Madras, for examination.

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* No. II. of "New Series" for January, February and March 1857, will be published in March.

Dr. Mayer's Report was laid upon the Table:

Read the following letter from Dr. Mayer,

> **I have much pleasure in forwarding the accompanying paper on the Chemical composition, properties, and probable uses of the various Salts forwarded to me, and stated to be obtained from the Loonar Lake. I cannot close this note without favorable mention of Mr. G. Norton my assistant in the Laboratory, by whose great assiduity and intelligence I have been enabled to finish my examination in a very short space of time.**

Resolved, to tender the thanks of the Society to Dr. Mayer for his able and interesting Report, which was delivered to the Committee of Papers for publication in the Journal, as an appendix to Dr. Smith's account of the Loonar Lake.

The Receipt of the following Papers, was communicated to the Meeting.

A Vocabulary of the Toda Language, by the Rev. T. Metz, of the German Evangelical Mission, (commenced in the present number.)

An Entomological Paper descriptive of some new Coleoptera found at Ceylon, by J. Nietner Esq., (published in the present number.)

This is the first number of a Series of Entomological papers, which the author has resolved upon publishing. He has kindly promised to furnish the Society with a fresh number every month.

The thanks of the Society were voted to Mr. Metz and Mr. Nietner for their able communications, and the Committee of Papers were desired to address a letter to the latter gentleman to inform him of the pleasure it will afford the Society to receive a fresh Entomological paper from him every month.

The following papers were presented to the Meeting.

The Secretary to the Photographic Society communicated a paper by Captain Tripe on a Paper Process which he has found well suited to Indian Photography. This paper, which had already been read before the Photographic Society, will appear in the Journal, together with a table of Formulæ for preparing Albumenized paper, drawn up by Captain Scott of the Artillery, also transmitted by the Secretary.

Mr. Elliot read a paper, communicated through him by Dr. Traill, on a collection of deep sea Molluscs made with the aid of a towing net, on his voyage from England round the Cape in the American Clipper *Blue Jacket*. Mr. Traill is known as an accomplished Malacologist. During the former period of his service he successfully investigated the Conchology of the Straits, and since his return to India he has classified and named the shells in the Government Central Museum. The paper was accompanied by drawings of the different species obtained during the voyage and by a chart exhibiting the localities at which they were captured.

After some general observations on the classification of Pelagian Shells and on the means employed for catching them, Mr. Traill proceeds to notice the different specimens, in the order in which they were found, giving incidentally such notices of their peculiar habits and forms as occurred to him, and referring to the figures. It is to be regretted that he has not added a synoptical descriptive list of all the species, naming such as have not been hitherto described. This desideratum, it is hoped, may still be supplied.

The specimens more particularly noticed in the paper belong to the division of ENCEPHALOUS MOLLUSCS, and include examples of all the great families, the PTEROPODS, GASTEROPODS and CEPHALOPODS, by far the largest number appertaining to the first, which are essentially oceanic in their habits.

Of the CEPHALOPODS a single species only was obtained of a diminutive *Argonaut* apparently new to Science, of which two specimens were captured alive. Mr. Traill gives an interesting description of its locomotive habits and shows that it differs from the common Paper Nautilus.

Individuals were captured belonging to two genera of GASTEROPODS, viz. three species of *Ianthina* and two of *Atalanta.* The Author remarks on the singular fact of finding Molluscs belonging to a group which is characterized by the possession of a crawling foot among the inhabitants of the deep sea, where such an organ is useless. But the *Ianthinas* are fitted for this peculiarity of habit by the possession of their vascular float, while the foot of the *Atalanta* is divided into two lobes which it uses for purposes of progression after the manner of fins. Mr. Traill was enabled to make some minute observations on the organs of sight possessed by these curious little animals. The second species of which a single individual only was obtained has the shell covered by a strong epidermis the lower edge of which is prolonged into a broad keel serving to sustain the shell in an erect position during the process of swimming. This species is probably new to Science.

Several specimens of a species of *Glaucus*, an aberrant group intermediate between GASTROPODS and PTEROPODS (although generally included among the former), were taken in Lat. 34 S. These are without shells but are furnished with lateral symmetrical appendages which are supposed to be bronchiæ and also serve for purposes of locomotion.

Dr. Traill's specimen differs from the common kind and appears to have been considerably mutilated. It may prove to be new.

But the richest harvest was obtained in the class of PTEROPODS. Of the 8 or 9 genera constituting the family of *Hyaleidæ* in this group, numerous specimens were obtained belonging to *Hyalea*, *Cleodora*, *Cuviera* and *Creseis* or *Theca* and one species of *Limacina*. The genus *Hyalea* was particularly prolific of species. Some it is probable have now been met with for the first time. Their specific characters are carefully pointed out and all are faithfully represented in the drawings.

Mr. Traill has some excellent remarks on the analogy between the organization of the young of some kinds of GASTROPOD MOLLUSCS and that of the adult PTEROPOD, and has observed that the young of the *Cypræa* or Cowry shell when first released from the egg or capsule and before they are able to crawl, exhibit a mode of progression very similar to that of the PTEROPODS.

The greater part of the specimens described were captured in the night, the habits of most of the genera being more or less crepuscular or nocturnal, except the genus *Creseis* which was often met with during the day.

Dr. Traill's memoir was referred to the Committee of Papers, and will appear in the Journal.

Thursday, 11th December 1856.

The Hon'ble WALTER ELLIOT, President in the Chair.

The Secretary laid before the Meeting the state of the Society's Funds, up to the termination of the present year, 1856.

LIABILITIES.	RS.	A.	P.
Due to Messrs. Allen & Co. for Books, Periodicals, &c.	1439	3	4
Due to Deposits of 5 Third Class Subscribers........	50	0	0
Excess of Assets over Liabilities	830	2	6
	2319	5	10

ASSETS.	RS.	A.	P.
Balance in hand of Treasurers.....................	2003	5	11
Arrears of Subscriptions....	316	0	0
	2319	5	11

Resolved, that the Statement is satisfactory, and be published in the Journal for the information of Members of the Society.

Dr. Cleghorn read a paper on the Sand-binding Plants of the Coromandel Coast, in which he mentioned eight species of these useful plants, more or less serviceable in strengthening the beach between the Saluting Battery and St. Thome. Representations of these binders lithographed in Dumphy's best style were laid before the Meeting, showing the distinctive character of the respective plants. Dr. Cleghorn points out the soil and situation in which these plants are best calculated to succeed, and hopes to find leisure to contribute similar notices from time to time under the head of Notulæ Botanicæ. The thanks of the Meeting were voted to Dr. Cleghorn for his able and interesting communication.

The following Books and Papers were presented to the Society.

1. Geschichte Wassaf's—Persisch Herausgegeben und Deutsch übersetzt von Hammer-Purgstall, *from the Author*.

Correspondence respecting Rain Gauges, *from the Chief Se-*

notice of the late Storm, of the 20th Nov. 1856, *from the Astronomer*.

ams of Barometrical and Thermometrical Curves for 854 and 1855, *from the H. Co.'s Astronomer*.

5. Meteorological Register for October and November, *from the H. Co.'s Astronomer.*

Resolved, that the thanks of the Meeting be presented to the Donors, and that the Committee of Papers be requested to address a letter to Baron Hammer von Purgstall to convey to him the thanks of the Society for his donation to the Library.