

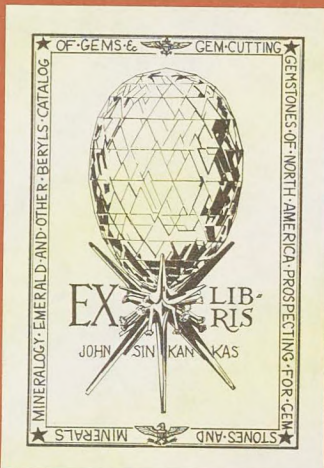
AMBER CAT

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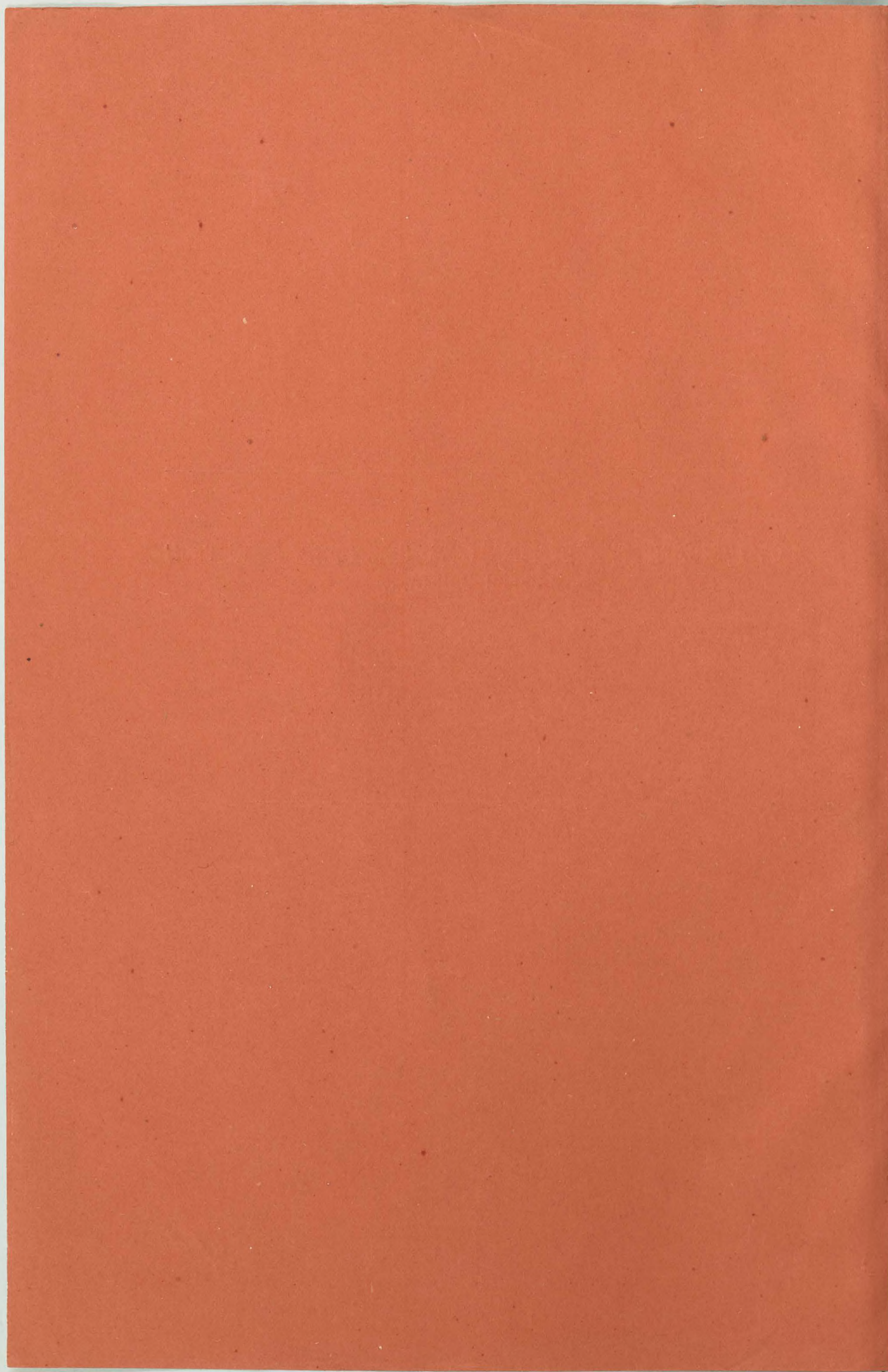
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ON THE OCCURRENCE OF BURMITE, A NEW FOSSIL RESIN FROM  
UPPER BURMA.

BY  
Dr. FRITZ NOETLING,  
PALÆONTOLOGIST, GEOLOGICAL SURVEY OF INDIA.

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*On the Occurrence of Burmite, a new Fossil Resin from Upper Burma :  
by Dr. Fritz Noetling, Palæontologist, Geological Survey of India.*

I have to begin this note with the explanatory remark why, instead of the time-honoured name of "Amber," under which the fossil resin of Burma has been known for centuries, I introduce a new name. The reason is, that the preliminary chemical examination has shown that the Burmese amber is totally different from any other known fossil resin, especially from that generally known as amber (Succinite), however similar their outward appearance may be, and I am greatly indebted for this information to Dr. Otto Helm in Danzig who, being a specialist in fossil resins, has kindly consented to undertake the chemical examination of this variety from Burma. His preliminary note on this *new resin* was published in the last part of the Records XXV, page 180. There is, however, no reason why for all practical purposes the name "amber" should not be used, although this term would be inadmissible in a scientific paper, once the fact has been established that the fossil resin in question is different from Succinite. In concordance with Dr. Helm's suggestion, the name of Burmite is adopted for the new fossil resin.

I. HISTORICAL SUMMARY.

The fact that Burmite is found in a country difficult of access, jealously guarded by those who have every interest that the exact place may be kept dark, lest they should lose the substantial profit they have hitherto enjoyed; accounts for the scanty data about its occurrence. In fact it seems that previous to the expedition of 1891-92, only two Europeans have visited the locality where it is found, and curious to say these two, Captain Hannay and Dr. Griffith, followed each other within one year's time. As no later record can be found proving that anyone else had visited the amber-mines afterwards, we must suppose that all the information on this mineral, contained in numerous descriptions of Burma, may ultimately be traced back to the references just mentioned. It will therefore be useful to give them *in extenso*.

Captain Hannay visited Maingkhwan, and from there the amber-mines in March 1836. An abstract of his journal of a route from Ava to the amber-mines of the Hukong valley was published in the Journal of the Asiatic Society of Bengal, Vol. VI. p. 274, 1837. The following is his description:—

"We set out at 8 o'clock in the morning and returned at 2. P.M. To the foot of the hills the direction is about south 25 west, and the distance three miles, the last mile being through a thick grass jungle, after which there is an ascent of one hundred feet, where there is a sort of a temple, at which the natives, on visiting the



mines, make offerings to the ngats or spirits. About a hundred yards from this place, the marks of pits where amber has been formerly dug, are visible, but this side of the hill is now deserted, and we proceeded three miles further on to the place where the people are now employed in digging, and where the amber is most plentiful. The last three miles of our road led through a dense small tree jungle, and the pits and holes were so numerous that it was with difficulty we got on. The whole tract is a succession of small hillocks, the highest of which rise abruptly to the height of 50 feet, and amongst various shrubs which cover these hillocks, the tea-plant is very plentiful. The soil throughout is a reddish and yellow-coloured clay, and the earth in those pits, which had been for some time exposed to the air, had a smell of coal tar; whilst in those which had been recently opened, the soil had a fine aromatic smell. The pits vary from six to fifteen feet in depth, being, generally speaking, three feet square, and the soil is so stiff that it does not require propping up.

"I have no doubt that my being accompanied by several Burmese officers, caused the people to secrete all the good amber they had found. For although they were at work in ten pits, I did not see a piece of amber worth having. \* \* \* On making inquiry regarding the cause of the alleged scarcity of amber, I was told that, want of people to dig for it was the principal cause; but I should think the inefficiency of the tools they use was the most plausible reason:--their only implements being a bamboo sharpened at one end, and a small wooden shovel.

"The most favourable spots for digging are on such spaces on the sides of the small hillocks as are free from jungle, and I am told that the deeper the pits are dug, the finer the amber; and that that kind which is of a bright pale yellow, is only got at the depth of 40 feet under ground."

A little previous to the above (p. 270), it is stated, that "besides the amber which is found in the Payen toung, or amber mine hills, there is another place on the east side of the valley called *Kotah-bhum*, where it exists in great quantities, but I am informed that the spot is considered sacred by the Singphos, who will not allow the amber to be taken away, although it is of inferior description."

The following is Dr. Griffith's description of the amber-mines published in "Journals of Travels in Assam, Burma, etc., by William Griffith, Calcutta, Bishop's College, 1847, page 77:—

"March 26th.—Visited the amber mines, which are situated on a range of low hills, perhaps 150 feet above the plain of Meinkhoon, from which they bear S. W. The distance of the pits now worked is about six miles, of which three are passed in traversing the plain, and three in the low hills which it is requisite to cross. These are thickly covered with tree jungle. The first pits, which are old, occur about one mile within the hills. Those now worked occupy the brow of a low hill, and on this spot they are very numerous; the pits are square, about four feet in diameter, and of very variable depth; steps, or rather holes, are cut in two of the faces of the square, by which the workmen ascend and descend. The instruments used are wooden tipped (?) with iron crowbars, by which the soil is displaced; this answers but very imperfectly for a pickaxe: small wooden shovels, baskets for carrying up the soil, etc., buckets of bark to draw up the water, bamboos, the base of the rhizoma, forming a hook for drawing up the baskets, and the Madras lever for drawing up heavy loads.



"The soil throughout the upper portion, and indeed for a depth of 15 to 20 feet, is red and clayish, and appears to inclose but small pieces of lignite; the remainder consists of greyish slate clay increasing in density as the pits do in depth: in this occur strata of lignite very imperfectly formed, which gives the grey mineral a slaty fracture, and among this the amber is found. The deepest pit was about 40 feet, and the workmen had then come to water. All the amber I saw, except a few pieces, occurred as very small irregular deposits, and in no great abundance. The searching occupies but little time as they look only among the lignite, which is at once obvious. No precautions are taken to prevent accidents from the falling in of the sides of the pits, which are in many places very close to each other (within two feet): but the soil is very tenacious.

"We could not obtain any fine specimens, indeed at first the workmen denied having any at all, and told Mr. B. that they had been working for six years without success. They appear to have no index to favourable spots, but having once found a good pit they of course dig as many as possible as near and close together as they can. The most numerous occur at the highest part of the hills now worked. The article is much prized for ornaments by the Chinese and Singhpos, but is never of much value; five rupees being a good price for a first-rate pair of earrings. Mein-khoon is visited by parties of Chinese for the purpose of procuring this article."

These two accounts agree so well that it is unquestionable that Dr. Griffith and Captain Hannay visited the same locality, *viz.*, a low hill to the south-west of Maingkhwan, as the name of the village is spelt now. The most remarkable fact, however, is that both were exceedingly surprised at the scarcity of amber, for which both try to find an explanation. I want particularly to draw attention to this fact, as I noticed a similar small output: I shall however deal with this subject later on.

## 2. THE HUKONG BASIN AND THE SITUATION OF THE BURMITE-MINES.

The Hukong valley forms an extensive flat basin, which is surrounded on three sides by nearly impracticable hill-ranges rising to something like 7,000 feet in the Patkoi-range; it is only from the south that this secluded valley is accessible, where the low hills forming the watershed between the Chindwin and the Irrawaddi are easily surmounted. This broad basin is intersected by innumerable streams and rivulets, running down towards the centre from all sides. Here they join, to form the Tanaika-choung, the chief branch of the Chindwin. The Hukong valley represents in fact the headwaters of the Chindwin. It need hardly be mentioned that a country which has such an abundant supply of water nearly all the year round, besides a well-regulated drainage, is extremely fertile and therefore dotted with villages.

The centre of the Hukong valley is flat, but towards the outskirts low isolated hills and short hill-ranges suddenly rise from the surrounding plains. It is on one of these ranges, in the south-west corner of the Hukong basin, where the mines famous for centuries for the golden resin are situated. According to the recent survey their position has been fixed at Lat.  $26^{\circ} 15'$ ; Long.  $90^{\circ} 30'$ . According to Colonel Yule's map, which is undoubtedly based on either Captain Hannay or Dr. Griffith's authority, the geographical position of the mines is Lat.  $26^{\circ} 10'$ ; Long.  $96^{\circ}$ . This agrees so well with the position as recently fixed, that there can be no further doubt as to the identity of the mines.



It seems important to me, for reasons which will appear later on, to have proved that Captain Hannay, Dr. Griffith and myself have visited one and the same locality.

The mines which I examined are situated on a low hill-range of approximately five miles in length, bearing nearly north-south, which has apparently no particular name, although there are nine localities distinguished by different names where burmite has been found or is said to have been found. All these localities are, however, situated on the same range and so close to each other that it is quite apparent that they are merely local names. The particular place where I was led to, and where I stayed for nearly a fortnight, is called Nango-tai-maw, on the northern end of the range, and nearest to Maingkhwan; the distance is about three miles in a straight line, but, with the twisting and turning of the road, it is as good as six miles.

Nangotaimaw, as we may call the hill-range for the sake of brevity, rises rather abruptly from the plains, although the height is not considerable, 150 feet at the outside. The top being nearly in one level throughout, it seems probable that it once formed part of a terrace skirting the higher ranges. It is covered with dense nearly impenetrable jungle, which renders a geological examination almost impossible, unless extensive clearings are carried out; as it is, I only could get glimpses of the strata now and then in the steep narrow gullies.

There is, however, a rumour current, particularly among the Chinese traders, that the chief mines are at the southern end of the range, near Laloung village. I was unable to verify this statement, because the column, although visiting Laloung, did not stay to examine the hill to the rear of Laloung, where the mines are supposed to be. I must, however, confess that I fully believe in the truth of this rumour, as it seems impossible that the large quantities of burmite, which have unquestionably been obtained from the mines in the Hukong valley, could only have been extracted from the place which Captain Hannay, Dr. Griffith and myself visited.

### 3. GEOLOGY OF THE HUKONG BASIN.

As far as I could ascertain, the strata which compose the hills to the west, south and east belong to the Tertiary formation; whether all throughout or only partly is impossible to say for the present, but those hills directly bordering the plains are certainly of Tertiary age. It is highly probable that the hills on the north are also of Tertiary age, although an ammonite found in a pebble, which cannot possibly have come from anywhere else but the hills to the north, tends to prove that there also exist strata of Mesozoic age, probably belonging to the cretaceous formation.

The Tertiary strata consist chiefly of sandstones of yellowish colour with a layer of brown clay now and then imbedded. Blue clay resembling very much in appearance certain beds in the Chindwin group has so far only been found west of Maingkhwan. No fossils have been found, but to judge from the petrographical appearance, I should think that the yellow sandstones which I found on the southern and western side of the valley are contemporaneous with those which I distinguished as Irrawaddi-sandstone in the Irrawaddi basin; these belong undoubtedly to the upper miocene. I am less certain, as regards the age of the blue clay because it has not been found in direct connection with the yellow sandstone, but I rather think it to be of lower miocene age.



Nangotaimaw consists throughout of a blue, more or less hard clay, dipping at a high angle ( $88^\circ$ ) towards west. The strike is south-south-east to north-north-west, a direction which nearly agrees with the axis of the hill. Although I carefully looked for, I could not discover any fossils in the blue clay; there is, however, no doubt as to the Tertiary age; the only question would be whether it belongs to the group of the Irrawaddi-sandstone or to the Chindwin-sandstone. As already said, its whole appearance is so very much like that of the blue clays of the Chindwin group that I think the clay of Nangotaimaw is equivalent to them.

By fixing the position of the pits as well as I could in the dense jungle, I found that they are mostly situated in the central part of the range; that is to say, there are none on the eastern, and very few on the western slope. Now, considering the strike of the strata, we must suppose that the bed which contains the burmite, traverses Nangotaimaw from north to south in its centre. This renders the probability of burmite mines near Laloung very likely.

It is unfortunate that no characteristics can be given for the present which might lead to the discovery of burmite-producing localities somewhere else. There is, however, no doubt that the burmite-bearing strata once possessed a larger extension; a very careful examination of the Hukong basin, particularly along its outskirts, might lead to the discovery of some other burmite-bearing localities. Concerning this, I especially want to direct the attention of would-be-explorers to the northern side of the Hukong basin, along the foot of the Patkoi range, particularly those spurs which fall into the line of Nangotaimaw, if continued towards north.

The blue clay is superficially discoloured, and changed into a dull-brown clay, lying in the shape of a cover of varying thickness on the top of the first. This change is apparently due to the oxydising influence of organic acids, produced by a luxuriant vegetation. Burmite found in these parts, is strongly affected by the same causes; it loses its colour, becomes dull and brittle, while a crust of decomposed burmite is formed, which often enough envelopes only a small kernel of sound mineral.

Although my operations could only be carried out on a limited scale, I could establish the fact that burmite occurs in pockets irregularly distributed in the stratum above mentioned. This was not only proved by actual observation, but the arrangement of the old pits in clusters must necessarily lead to this supposition. The pockets vary in size of course, and the bigger the pocket the larger the output. Burmite is usually found in flat pieces resembling very much in appearance the pebbles found along the sea beach, proving that they must have undergone a certain amount of wear and tear before they were deposited at their present resting-place.

#### 4. PHYSICAL AND CHEMICAL QUALITIES.

It is not advisable to anticipate Dr. Helm's chemical examinations to be carried out on a large scale on receipt of more material which has recently been forwarded to him. His views will be found in his preliminary note; the chief interest rests with the fact that burmite does not contain succinic acid, like amber, from which it is therefore chemically totally different, although the physical appearance of the two fossil resins is very much the same.

As regards the physical qualities of burmite, it may be said that it is a little harder than amber, its hardness being  $2\frac{1}{2}$  to 3; it is easily cut and takes an



excellent polish, qualities for which it has been highly appreciated by the natives as well as by the Chinese.

The specific gravity is 1.033 to 1.042; the heavier varieties containing generally all sorts of inclusions, amongst which thin films of calcspar are not at all uncommon; specimens of perfectly clear color and without any inclusions have a specific gravity of 1.033 to 1.034.

So far as can be judged for the present, burmite shows less variety in colour than amber; in fact there are only three shades of one color. The original color is a bright pale yellow, which might be best compared with the color of light sherry; darker shades eventually lead to a reddish color which turns into a dirty brown in the majority of pieces; the last might be best compared with colophony or better solidified petroleum. I never saw any specimens exhibiting the fine cloudy milk-white color for which amber proper is so highly appreciated, but there are several specimens of the quality known to the German amber dealers as "bone" with which as regards appearance it can in fact be best compared. One specimen of this kind is particularly interesting, inasmuch as it shows a core of perfectly clear resin enveloped in a thick crust of bone: whether this peculiarity is due to the absorption of water, will be shown by the analysis; the bone shows again two varieties, the inner one being of yellowish white exhibits a splintery fracture, while the outer one has a light brown, streaky color and a smooth fracture.

Burmite is particularly remarkable for its strong fluorescence, that is to say a bluish tinge, which appears when light enters it at a certain angle; according to Dr. Helm the darker varieties contain a lot of organic matter, probably minute fibres of wood; others contain films of calcspar, of sometimes considerable thickness; in one case it had 6 mm. thickness near the surface, but thinned quickly out towards the centre. It is very probable that these layers were originally cracks forming in the drying resin which were eventually filled in with the calcspar when the pieces were deposited in the clay in which they are now found. As this peculiarity is very common, it is clear that it must seriously influence the value of the burmite as an article of commerce; because no large pieces for working purposes can be cut off from a mineral thus cracked in every direction.

A few insects have been found enclosed in burmite.

##### 5. MODE OF EXTRACTION.

Burmite is obtained in a very primitive way: after the harvest, those who feel inclined to dig for the valuable resin, set out for the place where it is known to be found. In selecting the place the digger is not guided by any principles or by any experience, besides the general knowledge that he might get the mineral at the place where he digs. All he does is to keep clear from places where numerous old pits indicate that somebody else has already made a big haul. Frequently enough the digger finds himself disappointed although his pit has reached a considerable depth, as no burmite is found. He then tries another place, perhaps with better luck this time. Of course the result of this wild digging is that the whole hill is covered with pits in all states of dilapidation.

The digger does not require any other tools but his *da* (sword), without which no Kachin can be imagined. With his *da* he shapes his tools; a small, pointed



wooden hoe, a wooden shovel, and a basket made of split bamboo; a long bamboo cane, with its curved root still affixed, serves for drawing up the earth; sometimes if the digger can afford it, the hoe is supplied with an iron shoe.

The work of digging is very simple; the clay is loosened with the hoe and the refuse removed by means of the basket and bamboo-cane and thus the shaft is deepened, till a pocket of burmite is reached. The shaft is square and generally just wide enough to allow one man to do the digging; the digger descends and ascends by means of small niches cut into opposite sides. No timber lining is required, because the stiff clay stands without caving in. The pits are very shallow: I never found one exceeding 45 feet in depth; in fact if at that depth nothing is found the pit is abandoned. Three men generally form a party; and while two of them sit smoking at the mouth of the pit, now and then hauling up the baskets filled with earth, the third man works in the pit for about three hours, when places are changed. Progress is of course very slow; the presence of pockets is generally indicated by strings of coaly matter appearing in the clay. If the pocket is too large to be exploited from one pit, a second or third, or as many as are required, are sunk closely to the first pit, and by joining hands underneath, the whole pocket is cleared out. A cluster of old pits indicates therefore the place of a successful digging.

No information could be obtained regarding the annual output, but to judge from the considerable quantity that has certainly been exported, it must have been important in former years. I have seen large bags full of burmite at the houses of the Burmese cutters in Mandalay, which have unquestionably come from Mogoung.

Now the question arises, has this large quantity been obtained from the locality that has been visited by Captain Hannay, Dr. Griffith and myself, or has it been obtained from elsewhere? As I have already pointed out, there is not the slightest doubt that we three have visited one and the same locality, *viz.*, Nangotaimaw-hill. Captain Hannay as well as Dr. Griffith complain of the scarcity of the fossil resin, for which they try to find an explanation. Now I dare say that I did not only stay longer at the mines, but that I worked under more favourable circumstances: I encamped for about a fortnight at Nangotaimaw, I employed about twelve coolies at the time, and I had some twelve pits dug at various places, but the quantity obtained was next to *nil*. Small fragments of absolutely no commercial value were all I discovered; they were sufficient, of course, to prove that burmite can be found at this locality, but they were too insignificant to pay even for the labour. Now it seems convincing that when three different observers record the same fact, burmite must really be very rare at Nangotaimaw; but on the other hand, it is an established fact that large quantities of burmite have been exported from mines situated in the Hukong valley. How can these two facts be brought in concordance? I must confess that this problem has puzzled me for a long time without finding a satisfactory solution of it. All I can say is that the only way to get out of the difficulty is to accept the theory of the existence of richer mines somewhere in the Hukong valley, unless one supposes that the large quantities of the mineral, which have been exported to China and Mandalay, represent the accumulated production of scores of years. I personally feel inclined to think that there are richer mines in existence in the Hukong valley, and the information I received from Chinese traders at the jadeite-mines seem to confirm this view.



## 6. FUTURE PROSPECTS OF THE BURMITE-MINES.

After the foregoing it seems hazardous to venture an opinion on the probable prospects of the burmite-mines, but although nothing definite is known about the probable quantity of the output, yet certain facts may now be considered as established, which are sufficient to form a general idea as to the value of the mines. Supposing that there are really mines, which are capable of turning out a large production, so that there would be no doubt as to the quantity, if mining operations were carried out in a systematic way : is the material obtained of such quality that it will pay the investment of capital? This question may be safely answered with no, for the following reasons. Burmite possesses the following good and bad qualities :—

- (a) Good qualities :—1. Hardness:  
2. Easy to cut, and polish.  
3. Indifference towards solvents.
- (b) Bad qualities :—1. Color inferior to that of amber.  
2. Presence of fissures filled with calcspar, which render even large pieces unfit for cutting.

Of the above five qualities we have of course only to take those under (b) into consideration. Now as regards (b) 1, it is of less importance, because the fashion may change, and clear colors may come to the front again, although it is not very likely that the disagreeable bluish tinge of burmite will be fancied. But supposing there were a large demand for the mineral, the peculiarity mentioned under (b) 2 would prevent its general use ; in fact I consider this quality as the most important disadvantage.

It may therefore confidently be said that the bad qualities of burmite so greatly surpass its good ones that it will always be inferior to amber. It is therefore not likely that burmite will ever be a serious competitor of amber in the markets of the world : it is even improbable that it will cut out the inferior kinds of amber, because a process was invented some years ago, by means of which small pieces of amber can be cemented into one big lump. This artificially manufactured amber greatly resembles burmite in its appearance even up to the bluish tinge ; large quantities of this artificial product could be turned out and sold for a mere trifle, if burmite should ever appear on the market and endanger the monopoly of amber.

The beginning of this struggle is already noticeable ; up to about two years ago burmite was largely used by the Mandalay cutters. When inquiring for burmite in Mandalay in April last, I hardly could get a single piece ; “ Indian ” amber being in competition with the indigenous material ! The Indian amber proved to be Prussian amber (succinite) ; and this amber imported from Europe, after having travelled so many thousands of miles, was sold at a cheaper rate in Mandalay than the product of the country. The cutters further stated that the Indian amber is ever so much more satisfactory for cutting purposes than the Burmese amber.

Matters look therefore serious : if burmite is already being cut out from the limited market which it hitherto commanded, *viz.*, Burma and China ; and once being replaced by the cheaper and better amber, it will hardly retake the ground once lost.



It may therefore be safely stated that although burmite will never answer the high expectations which have been entertained about it, it is still good enough to form a profitable article of commerce, provided necessary steps are taken to ascertain whether it really occurs in large quantity. This can of course only be tested by prospecting operations carried out on a large scale. Such operations cannot be strongly enough recommended, even if the result should be contrary to the expectations; in this case we know, however, for a certainty that the quantity available is insignificant, and taking the inferior quality into consideration, it would be conclusively proved that the exploitation of the burmite-mines would not pay.

#### 7. THE NATIVE BURMITE INDUSTRY.

Burmite has been largely used for centuries by the Burmans, and quite an industry for cutting and polishing the raw stone existed in Mandalay, and probably also in the former capital of Burma. The cutters chiefly manufactured beads for rosaries, as used by the religious Burman, nadoungs (cylindrical pieces worn in the hole perforating the lobe of the ear), besides various small trinkets, such as elephants, monkeys, fish, etc. etc. More elaborately and costly, were figures of Gautama, but these have become very scarce now, as there are only two men living at present who understand the art of cutting such figures.

Burmite was rather cheap about three years ago; one viss (3'65lbs.) sold for R25, but the price has considerably risen since, as there were hardly any fresh supplies coming in, owing to the political disturbance in the northern part of Burma.

The manufacture of beads, which chiefly occupies the cutters, is very simple. With a sharp knife the labourer cuts a piece of burmite in small cubes of about 10mm. side-length; these are roughly shaped by cutting off the corners, thus a bead in the shape of two cones united with their basis is produced. The drill which is used for boring the hole, consists of a thin bamboo into which a flat-edged needle is fitted. When drilling the hole the labourer catches the bead with his right hand, presses it against the needle which he sets moving with his left. After being perforated, the bead is smoothened with a file, which is a little curved at the upper end; the polish is produced by rubbing it with a dried leaf, which contains a considerable quantity of silica, and lastly petrified wood is applied to finish the polishing process.

#### 8. THE OCCURRENCE OF FOSSIL RESIN IN OTHER PARTS OF BURMA.

Besides Nangotaimaw, fossil resins similar to burmite have been found at two other localities. At neither place, however, is there a sufficient quantity to be of commercial value.

The first place where I discovered a fossil, amber-like resin, is Mantha on the Irrawaddi; about Lat. 23° Long. 96° in the Shwebo district. Here the resin is found imbedded in a hard coaly clay, which underlies a coal seam. If I am not greatly mistaken this locality falls now within the property of the Burma Coal Mining Company. The strata in which the coal and fossil resin are found belong undoubtedly to the miocene formation. The resin is very common, but the pieces are small and difficult to extract, not only because they are very brittle, but also because the clay is rather hard. In appearance the Mantha-resin looks like burmite, perhaps it is a little darker; the specific gravity, 1'037, being nearly the same.



The second locality, where I found a single small piece of fossil resin of the amber type, is Yenangyat in the Pakoko district; about Lat.  $21^{\circ}$  Long.  $95^{\circ}$ . Here I found it among the refuse dug from an old petroleum pit, together with numerous miocene fossils of marine type: although I looked for more I never found another piece, and so far it has remained solitary.

From the foregoing we may conclude that fossil resin of the burmite type is widely distributed through the Tertiary strata of probably lower miocene in Upper Burma. It is therefore not improbable that it will be discovered at other localities in the same geological horizon, but whether in workable quantities seems more than doubtful.















