

KAURI GUM.

By J. L. HARRISON-SMITH.

General and Descriptive.

Kauri Gum is the popular and commercial name of the resin produced by the kauri tree (*Agathis australis*). It has been an important article of commerce in New Zealand's exports since about 1847 and up to the end of 1939, 442,501 tons, valued at £23,730,163, had been exported. The peak year was 1899, when 11,116 tons left these shores. In 1900 the quantity was slightly less—10,159 tons—but the value was the highest recorded, being £662,293. Since then there has been a steady decline both in quantity and value, until in 1939 the amount was 2,316 tons and the value £112,650. The record low level since 1865 was reached in 1932 with 2,068 tons for £62,137.

The average price per ton has varied a good deal and was £10 in 1860, £36 in 1888, £51 in 1900, reached £84 in 1920 and fell again to £48 in 1939.

Kauri gum is used mainly in the manufacture of varnishes and linoleums and has other smaller uses in various trades.

By far the greatest amount in recent years has gone to the United Kingdom. The 1939 figures give some idea of the position:—England, 1,405 tons; U.S.A., 405; Canada, 208; Netherlands, 77; Australia, 73; France, 70; Japan, 31; Germany, 26; Sweden, 21.

In appearance the gum varies from the purest amber to a dirty looking substance like burnt sugar. Good gum is glassy in appearance, transparent or translucent and quite brittle. There are two kinds known to commerce, the "fossil" gum which is dug from the ground and the "green" gum which is collected from the trees. The latter is more usually of a white colour and often of the consistency of pitch; it will change its shape in warm weather.

As might be expected, the green gum has formed a very small percentage of the total collected. The reason is that it comes from the living kauri forests which even in the old days were limited in area, while the fossil gum is dug from extensive regions where there is no historic record of living trees and the gum dug up is probably the product of many generations of trees.

Legal.

The first legislative notice of any consequence seems to have been taken of kauri gum in 1898 with the passing of the Kauri Gum Industry Act, "an Act to regulate the kauri gum industry." There had been various clauses dealing with kauri gum in previous Land Acts, but they were mainly fiscal in purpose. Amendment acts have been passed on several subsequent occasions.

The general idea is that people dealing in kauri gum are required to have licenses of which there are four varieties. They are:—

- a. Special license necessary for digging on kauri gum reserves.
- b. Ordinary licenses for digging elsewhere.

Provision is made, however, to prohibit digging on Crown Land and land subject to the State Forest Act, 1908, on which there are live or dead kauri trees, (a license under the Forests Act is now required in any case) and on Native or private lands without the consent of the owners.

The Special license can be made to apply to a specified Kauri Gum Reserve and is issuable only to British subjects by birth or naturalization in New Zealand. An applicant for an Ordinary license must have resided for at least twelve months in the country.

Both the above are issued by the Commissioner of Crown Lands, through the local constable, the former costing 5/- and the latter £5.

c. Gum Buyer's license for those engaged in buying. The licensee must inspect the seller's license when buying (unless the gum is dug on Native or private land). He must also keep a gum purchase book to record transactions and particulars of the sellers' licenses and the book must be open to inspection by any constable or ranger under the act: The fee for the license is £1.

d. Gum Broker's license for those acting as agents only. No person may hold both buyer's and broker's license at one time: the fee is £5.

The latter two are issued by the Lands Department.

The Act and Amendments set up areas of Crown Land as Kauri Gum Reserves and these were available exclusively for digging.

Minor details under the various Amendment Acts were the appointment of Rangers and making the lighting of fires on Kauri Gum Reserves unlawful.

In 1914 an Amendment Act gave the Minister of Lands power, among other things, to buy or sell kauri gum, appoint buyers, agents, etc. In addition the Minister of Finance was empowered to raise money up to £50,000 and credit it to the "Kauri Gum Industry Account." The amount was raised to £75,000 by the Appropriation Act, 1918. The fund was abolished in 1931.

In 1925 the Kauri Gum Control Act made provision for controlling the trade in and export of kauri gum. It established the Kauri Gum Control Board and gave it power to assume limited or absolute control of all kauri gum produced in New Zealand. The Board was, however, abolished in 1934, when control reverted to the Lands Department.

Collection of "Green Gum."

Kauri gum collected fresh from the trees is usually called "green gum" to distinguish it from that dug from the ground, the fossil gum.

In collecting it is, of course, necessary to climb the trees and there are two methods of doing this. In the older way a rope was used but this means was later rendered obsolete by the invention of climbing irons.

When the rope was used the climber carried a fishing line to the end of which was attached a weight of green wood. Having decided

on the tree to be climbed the climber carefully coiled the line in his left hand and with his back to the tree heaved the line over a branch. The rope was then attached to the line and was drawn up over the branch and down the other side.

The method of climbing was peculiar. The double rope was gripped in the hands and the body pulled up, arms and knees bent, so that the feet were raised as high as possible and the rope was caught with the feet. A firm foothold on the rope was obtained by hooking it under the sole of the left foot and bringing it round on to the top of the instep of that foot with the right one. Thus the right foot "stood" on the left one, trapping the rope in between, the rope taking the form of an S. It is rather hard to explain but easy enough to do.

With the weight of the body taken off the hands it was easy to reach up the rope and get a fresh grip with the hands. Considerable physical fitness was obviously necessary to climb any distance but it is said that a climb of 70 feet without a stop was quite possible. Once in the branches the climber pulled up one end of the rope to which was attached a bo'sun's chair, and sitting therein, let himself down, chipping the gum off the trunk as he went.

Climbing irons, which were invented about 1920, were a later development and formed a much easier means of ascending the trees. The writer has no difficulty in climbing a 40 foot tree at any time with the irons but that distance with the rope would demand a week's training if the climb was to be done without pausing.

The climbing irons consist of "hooks" and "climbing boots." The former are like miniature miner's picks but are entirely of metal, usually mild steel. They have handles 12 to 14 inches long and the ends are bent in the form of a J so as to give a better grip. The points are curved downwards slightly so that the weight tends to force them deeper into the tree.

The climbing boots are usually specially made wooden clogs. A spike projects about an inch from the toe and round the edge of the sole is screwed a bit of old band-saw. The teeth of the saw project below the sole and so give a very firm grip when the climber is walking about in the branches of the tree.

In going up the climber gives the impression of ascending an invisible ladder, with the slight difference that both his feet stand on the same rung at each step. Care is taken that the weight is always supported on three points while the fourth is being moved. The points of the irons need only penetrate the bark about an inch or even less but the beginner is apt to drive them in much further and so tire himself pulling them out.

In this method of climbing one end of the rope is taken up by the climber, the bo'sun's chair being slung over the shoulder and the rope dangling between the feet. On arrival at the head of the tree the climber loops the rope over a branch and lets himself down, just as in the older way.

The gum is chipped off with a small axe into a canvas bag that the climber wears round his waist.

Besides the gum on the trunk there are often large lumps on the branches and in the clefts between them. Pieces up to 50 lbs. are not unknown but the usual size is in the region of 2 to 4 lbs.

Though most of the gum collected nowadays comes from natural exudation a great deal in the past was obtained by "bleeding." Kauri forests were even leased for that express purpose and many men were employed by the lessee. A good deal of poaching also went on. As long as the cuts made for bleeding were not too numerous and did not penetrate into the wood—it was not necessary for them to do so—no great harm was done. The kauri's habit of shedding its bark in time obliterated all trace of the work.

The collected gum was taken to camp and the bark and rubbish scraped off, usually a wet day job, and the cleaned gum graded. It was then ready for the buyer.

The large pieces of this gum grades as "bold" and at present is worth from £70 to £90 per ton. The scrapings from this type are worth £30 if free from dirt.

The smaller gum down to about half inch, when free from dirt, is worth £50. This is the greater part of the bled gum produced and is called "first bled gum." The second grade of this contains some dust and is of smaller pieces: its price is £40.

A small amount of green gum is still collected from the kauri forests: gum collected from State Forests is subject to a royalty of 10/- per cwt.

Statistics make no distinction between green gum and fossil gum so it is impossible to give the relative amounts that have been exported.

Fossil Gum.

The collection of the fossil gum can be divided into many phases. The earliest, when the gum was plentiful, consisted of merely digging over the surface of the ground where the kauri forests had stood. The gum was easy to get so that it was not necessary to go deeper. The method was called "paddocking" and at first the diggers only dug one spit deep, turning over the ground as in digging a garden. The exhaustion of the surface gum led to deeper paddocking and often the same ground was turned over two or three times. All this digging was carried out in dry country and the gum obtained was called "range gum."

About this time was invented the forerunner of the gum spear. It was just a bit of fencing wire, about a foot long, attached to a handle of wood like the flounder spear and was called "nappi-nap." It was used to locate gum just under the surface, saving a good deal of aimless digging. It developed into the gum spear proper and by the end of last century spears were 5 feet long and had bred great skill in their using. The spear was made of square section steel, tapered

like a foil and a blacksmith who could produce a good one was much in demand. Spears at that time cost about 1/6 per foot. The handle was usually that of an old spade sawn off about three inches from the top of the shaft.

By this time gum digging had become an art and the writer has been told how a skilled digger could locate a patch of gum by the size and shape of a mound of earth raised by the roots of a falling tree, a tree that had probably disappeared hundreds of years before. The position of the depression from which the earth was lifted by the roots would give the direction in which the tree had fallen and by noting the size of the mound the digger would be able to judge the probable height of the tree and thus the position where the branches had hit the ground. The spear would do the rest. It should be noted here that on a great many of the gum-fields there is no record whatever, either in European or Maori history, of the occurrence of living kauri trees.

An improvement in the spear that revolutionised digging occurred about 1910. This was the invention of the "joker" as an addition to the spear. It was merely a few turns of wire of about 18 gauge, bound round the end of the spear about an inch from the point. Its action was to make a hole somewhat larger than the spear and so almost eliminate the friction of the spear on the sides of the hole. The origin of the "joker" was supposed to have been the brass eyelet of an old boot, accidentally speared as a digger was walking home to camp.

Whatever it was, its effect was to lengthen the useable spear by about 400%. Whereas the previous maximum had been about five feet, now a 20 foot spear became a possibility and 15 foot ones were common.

The invention was timely for by now the shallow gum was becoming scarce and speculative deep digging was not a payable proposition. With the gum definitely located, both in position and quantity, the matter was entirely different. Thus a new class of digger arose, the swamp digger. The old hands mainly stuck to their range digging for it was not easy to change the habits of a lifetime.

The invention of the "joker" marked the end of the square section spear and from then on round mild steel rod of about $\frac{1}{4}$ in. diameter took its place. The cost was also reduced to about 6d. per foot.

The younger men took to the swamp digging, the holes getting deeper and deeper. It soon became necessary to deal with the water that came in and this was usually bailed out with a ten inch or eleven inch bucket. Bailing was an art and a good man would bail from the bottom of a ten foot hole and hardly spill a drop on himself. The holes put down were always bell shaped, about $3\frac{1}{2}$ feet wide at the top and anything up to 10 ft. or so at the bottom.

An offshoot of the swamp digging was the working of the very wet swamps with a "hook." This was called hooking and was a

specialist's job demanding considerable skill. A man who was good "hooker" was seldom a good digger. The hook itself was usually a spear with the last three or four inches bent in the form of a J. Hooks were commonly 15 feet long while ones up to 25 feet, made of $\frac{1}{2}$ in. water pipe were not unknown.

In hooking, the size and number of pieces of gum was found by poking about with the spear or hook. Then the smallest piece was pulled up first using a jerking motion, not a straight pull. Had the biggest bit been brought up first it would not have been possible to lift the others for had they fallen off the hook there would not have been the friction on the sides of the hole to prevent them from falling back.

The gradually deepening holes and the wetter swamps being worked led to the invention of the gum pump. This simple device, made from ordinary plumber's "down-pipe" of three or four inches diameter or even six by one timber enabled one man to continually deal with the water in the hole while another did the digging. Naturally there was not room for both bailing and digging at one time.

The pump was a section of pipe, up to 13 feet long, at the bottom of which was fixed a wooden cage with a foot valve in it. The valve itself was a piece of leather or the heel of a rubber boot. The piston rod was of wood, about 1 in. by $1\frac{1}{2}$ in. with a T handle. The piston was of leather made in the shape of an inverted cone about 6 inches high. When the pump was in good order it would lift bits of gum, sticks, sand and all sorts of rubbish; in fact anything that could get through the foot valve.

Whereas the old digger was strictly an individualist, the necessity of pumping led to partnerships or "digging company" as it was called.

This brings us to the boom period of 1921 and thereabouts and a few words on the grades of gum at that time will not be out of place.

Range gum—that dug on hill country—was generally referred to as White gum and was divided into three classes:—(a) **Clear** was quite clean and free from dirt, (b) **R.S.W.** (rescraped white) was twice cleaned gum, (c) **O.W.** (ordinary white). The scrapings and chips were sold as dust and nuts respectively.

It will be appreciated that in gum that has been dug there is a certain amount of dirt that cannot be washed off because it is actually ingrained in the surface. This is scraped off with a sharp knife and though the gum is raised in grade it loses weight according to the amount of scraping. About 1920 the premium paid on scraped and rescraped gum fell to such an extent that scraping was no longer a payable proposition and was dispensed with.

Swamp gum was generally black and was referred to as Black gum. The classes were:—(a) Pale select; (b) R.S.B. (rescraped black); (c) S.B. (Steel black, with no "sugar"); (d) B.1. (Half sugar and half solid gum); (e) B.2. (black sugar and weak half-

and-half). There was also dust and chips as in the white gum. The sugar was a sugar-like type of gum that often formed a large part of the diggings.

Another type of gum was "glass heart" and what corresponded to the sugar just mentioned was called "chalk." The cleanings of this type were also divided into dust and chips.

Prices of swamp gum obtaining in the Far North in 1921 and thereabouts were somewhat as follows:—

Pale select (or steel)	...	up to	£115 per ton
R.S.B. and S.B. (black)			£112 per ton
B.1 and B.2 (chalk)	...		£36 per ton
Chips	...		£30 per ton

Dust from the gum was not sold by weight but bargained for, the buyer usually making an offer for a heap.

However, prices fluctuated rapidly and these prices are near the maximum obtained. By 1922 the prices of the two former had fallen to about half the figure given above.

The exhaustion of the higher grades of gum and the increasing market value of the lower grades led to the gradual abandonment of "selective" digging (if we may borrow a forestry term) in favour of what might be called "clear" digging, in which everything that looked like gum was collected. This was accomplished by turning over all the ground on a face and putting the gum-bearing earth through a separator.

This phase started about 1910 and for about two years was carried out with sieves. The gum-bearing earth was simply washed through a sieve by bailing in water with a bucket and stirring up the dirt with the hand or a bit of wood.

Then came a contrivance known as a "hurdy-gurdy." This consisted of a wooden or metal tub with a bottom of perforated sheet iron. There was a vertical axle in the middle with a wooden blade at the bottom and a crank handle at the top. The earth was put into the tub together with sufficient water and the handle was revolved by hand until all the earth had been washed through. Material which would not go through, consisting of gum, bits of wood, fern roots, and charcoal was removed by hand and carried to the drying ground for later separation.

The hand-powered machine has now developed into an engine-driven outfit of considerable complexity. At the present time a new machine, complete with diesel engine "every modern convenience" costs about £250, while a good second-hand one with petrol engine is obtained for about £80 to £100. Powerful engines are necessary and units up to 12 H.P. are used, while ones of 6 H.P. are common.

Basically, the power machine is still of the "hurdy-gurdy" principle with a revolving paddle in close proximity to a gauze bottom. But additions are a centrifugal pump to supply a constant stream of water for washing, a bottom with much finer holes, and a power-driven winch with which the outfit hauls itself along.

The usual method of working an area of gum-bearing soil takes two years. The land is divided into strips 10 or 12 feet wide and each alternate strip is trenched to a depth depending on the depth of the gum. The spoil is piled on the strips between the trenches, the work being done in the summer. When winter comes the trenches are allowed to fill with water. Then the washing machine hauls itself on to one of the solid strips and the spoil piled thereon is shovelled into the tub, the machine running all the time. The soil that is washed through is conducted to one of the trenches and at intervals the small door in the side of the tub is opened and the gum, etc., carried ashore on a sack stretcher or a wheelbarrow. As the spoil is put through, the outfit hauls itself forward and the process continues throughout the winter.

All the while the soil that passes through the machine is consolidating in the trench and by the time summer comes it is hard. Then the second strip of ground is trenched, the spoil being piled on top of the now hard silt. This spoil is washed in the second winter.

There are various processes of separating the gum from the rubbish and these fall into two broad classes, the wet and the dry processes. Probably the most obvious wet process is by differential flotation with brine and this has been practised for some time. There is the objection that it is expensive, requiring the constant addition of salt, while all traces of salt must be removed from the gum afterwards.

A similar process, using a suitable specific gravity of clay suspended in water was therefore developed. Apart from the fact that some care and experience was required in selecting the clay it had many advantages over brine. It was cheap, costing only the cartage of the clay; it left the gum sufficiently clean without further washing to suit the buyer; a small amount of judicious stirring and the addition of clay or water kept it at the required specific gravity. It was tested by dropping in a lump of gum. Hydrometers have been used but the digger will not be bothered with a hydrometer when a piece of gum will do as well.

Another wet separation process recently developed is based on the gold washing table. It is merely a ditch with a good flow of water. The ditch may be anything up to 10 chains long and may be any convenient one or it may be dug specially for the purpose. If the latter is the case it is usually made zig-zag.

In the dry separation process sieves are first employed, many different grades being used for the different impurities. The sieved gum is then wind separated as in the old method of winnowing grain. Of late a machine for wind separation has been developed. It is basically a power-driven fan to produce sufficient draught to blow away the dust, and mechanically shaken sieves to separate the various sizes of gum from the impurities.

Operating this machine must be a nerve wracking job, for besides the incessant clatter of the shakers there is the noise of the engine and a haze of dust that envelops everything.

Marketing.

Gum is usually sold on the ground, the buyer making periodical visits. The buying is now almost exclusively in the hands of Dalmatians and has been for some years. The great majority of the digging is also done by them nowadays and they seem particularly adapted to the work. Many have made gum a stepping stone to better things and in the North there are many now comfortably settled on farms, men who came to the country with practically nothing.

The local prices ruling at the present time are somewhat as follows :— (Prices are now quoted in shillings per cwt.)

Black, 55/- ; B.2. 56/- to 60/- ; B.3. 40/- to 50/- ; Chalk, 36/- to 40/- ; Nubs (nuts or small pieces) 40/- to 50/-. These prices are for salt or clay-cleaned gum. Gum produced by the washing machine is called chips and is graded according to the actual gum content. It is not economic to remove all the impurities in the field. The present prices are :—60% gum, 22/- ; 65%, 26/- ; 70%, 31/-.

It will be noticed that the grades have changed somewhat since the 1920 period.

The digger greatly prefers to sell his gum on the ground rather than send it to Auckland or some other centre. On the ground he can haggle over the price, tell the buyer what he thinks of him and generally get the satisfaction of getting a few more shillings per hundredweight. Sent to Auckland, he loses control of it altogether, for if he does not accept the price offered he has the alternative of paying the freight back.

At the present time the greater part of the gum on the market is swamp gum, obtained with machines. Individual diggers still work some of the swamps but owing to the low price they make but a small wage.

As in most other industries the machine age has entered the gum digging business and come to stay—that is, as long as there is gum to dig and money to pay for it.

In conclusion I would like to record my thanks to those from whom I have collected information for the preparation of this paper.

It is fully realised that a great deal has been left unsaid. The work of the various Kauri Gum Commissions has not been touched on, nor has mention been made of the investigations of the Department of Scientific and Industrial Research. The main object of this paper, however, is to describe the field work in the industry and I trust that this in some measure has been accomplished.