SZECHWAN

ITS PRODUCTS INDUSTRIES ∴ ∴ AND ∴ ∴ RESOURCES

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With Two Maps

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PREFACE

In 1874 Augustus Raymond Margary, a young British Consular Officer, was instructed to cross China to meet and conduct a Mission from India having for its object the exploration of a trade route from India through Burma into Western China. He left Shanghai on the 22nd of August, travelling by steamer up the Yangtsze to Hankow and then by native boat into Hunan and up the Yüan River to the city of Chen-yüan Fu in Kweichow, whence he proceeded overland through the west of Kweichow and the province of Yünnan. He reached Bhamo on the 17th of January 1875 and there joined the Mission under the leadership of Colonel Browne.

On the 18th of February the Mission arrived at the Burmo-Chinese frontier where rumours of dangers ahead reached it. Margary volunteered to re-cross the frontier alone and ascertain the state of the country. This he did next morning and reported from Seray that all was quiet and that he was going on to Manwyne, the first important town within the Yünnan border. He was followed up by the Mission as far as Seray; but no further message was received from him. On the 22nd letters reached the Mission from Burmese agents in Manwyne that on the previous day Margary had been brutally murdered in the neighbourhood of the town and the Mission was simultaneously attacked and had to retire into Burmese territory. A Mission of Inquiry composed of the Hon. T. G. Grosvenor and two Consular Officers—Arthur Davenport and Edward Colborne Baber—was later sent across China to Yünnan, but no satisfactory explanation of the murder was obtained, nor were the real instigators or perpetrators of the crime brought to book, and a settlement of the case, known at the time as "The Yünnan Case," was reached only after protracted negotiation, by the Agreement of Chefoo of the 13th September, 1876, in which were incorporated other stipulations dealing with Official Intercourse and Trade.

This Agreement marked the beginning of official connection with the great province of Szechwan, for Section III provided that the British Government would be free to send officers to reside at Chungking to watch the conditions of British trade in Szechwan. Baber was the first officer to take up his residence there, and in 1881 I was subsequently appointed to the same post. During the three following years I made three journeys through the provinces of Szechwan, Kweichow and Yünnan with the object of studying the conditions of trade in Western China. Reports of these journeys and the information collected during my wanderings were issued as

Parliamentary Papers at the time. In 1902 I was appointed Consul-General for the province of Szechwan, arrived at Ch'êngtu, its capital, early in 1903 and resided there for a couple of years. The first of these two years I devoted to a more exhaustive study of the province, its products, manufactures and potentialities and the results of my investigations were issued as a Parliamentary Paper in October, 1904. In the second year I paid a visit to the Eastern Frontier of Tibet and a Report of this journey appeared as another Parliamentary Paper in August, 1905. In 1911 I again visited Szechwan as Special Opium Commissioner and during these later journeys I was able to collect information additional to that contained in my 1904 Report.

I lately returned from a brief visit to China where I was informed that there is a continuous demand for this latter Report and I was urged to re-print it in book form and assured that it would be welcomed and meet a demand which it is now impossible to supply as the Report is out of print. As it stands, this Report requires few alterations; but my fuller knowledge of Szechwan, gained from travelling in that province since it was written, enables me to add to the information which it contains.

This, then, is not a story of travel or adventure nor does it profess to be entertaining reading. It is simply a book of reference for one of China's largest and richest provinces from a commercial and industrial point of view. It takes no account of the political turmoil and inter-provincial warfare with which Szechwan has been harassed since China became a Republic. These internal troubles, combined with lawlessness and brigandage, have naturally had a disturbing effect on the province; but, in spite thereof, its productive and industrial life as described herein remains practically unchanged.

At the time when I completed my 1904 Report, an Association of which I was elected President was formed at Ch'êngtu and I selected for my inaugural address a brief synopsis of that Report. This synopsis, which may interest the general reader more than the solid material of the Report, is inserted as a Prefix to the present volume.

The two maps which appeared in the 1904 Report are here reproduced with the addition, within brackets, of the new names given to many of the cities by the Republican Government. The province is variously known as Ssuchuan, Szechuen, Szechuan and Szechwan, and I have adopted the last spelling as it is the one now most generally used and has, moreover, the imprimatur of the Chinese Postal Administration.

ALEX. HOSIE.

Sandown,
Isle of Wight,
November, 1921.

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*Inaugural Address to the Chengtu Association.

TABLE OF WEIGHTS, MEASURES, ETC.

Weights, measures, etc. are frequently given in English only; but the following Table will be useful where the Chinese denominations are not accompanied by the English equivalents :—

$1 Szechwan = T. 0.71 Ch'êngtu.
T. 1 Ch'êngtu = T. 1.05263 Shanghai.
T. 1 Haikwan = T. 1.114 Shanghai = T. 1.061 Ch'êngtu.
1 inch Ch'êngtu = $1\frac{3}{8}$ inches English.
10 inches Ch'êngtu = 1 foot Chinese = $13\frac{3}{4}$ inches English.
1 oz. Chinese = $1\frac{1}{3}$ oz. English.
16 oz. Chinese = 1 catty = $1\frac{1}{3}$ lb. English.
100 catties = 1 picul = $133\frac{1}{3}$ lb. English.
1 Mou = 0.15 acre English.

The average sterling value of the Haikwan Tael was 2*s*. $10\frac{3}{8}d$. in 1904 and 6*s*. $9\frac{1}{2}d$. in 1920. In 1904 the Szechwan dollar was worth about 850 small copper cash.

SZECHWAN

PART I.

Short Survey of Szechwan.

The Need for Observation.—Some animals, such, for instance, as the Dog and the Cat, are born blind and do not see their surroundings for periods varying from 9 to 12 days. The reason for this deprivation of sight at birth is perfectly obvious. These animals when they come into the world are endowed with the power of locomotion and, had they sight in addition, they would doubtless proceed on tours of exploration for which, without the necessary education, they would be altogether unfitted and unequipped. In this state of unpreparedness they would be liable to those accidents and mishaps which frequently overtake even expeditions on which the greatest care and forethought have been bestowed.

Once a dog gets his eyes opened, however, he loses no time in taking advantage of them and he is very soon prowling about in every available corner. In the puppy stage he is somewhat silly; but, as he has to reach full development in about two years and is a fairly old dog at ten, he has to make the best of his comparatively short life. True, some dogs remain puppies all their lives; but, as a rule, dogs can be educated and trained to work wonders where their eyesight, which is better and keener than man's, is concerned.

Man, and by man I mean the human race, is born with his eyes open but without the power of locomotion in the infantile stage. He is a helpless creature for a year or two and is entirely dependent for his existence on the attention and care bestowed upon him by his parents or nurse. His average life is much longer than that of the dog and he has plenty of time to mature; but it is a well-known fact that the mental does not always keep pace with the physical development. Like the puppy some are born mentally as he is, physically, blind; but, unlike him, they prefer to keep their eyes shut throughout life.

Man, however, is capable of a high degree of education and in these days of compulsory school attendance an excellent foundation may be laid by those whose minds hanker after something higher and better than the lessons of the schoolroom. Schools and colleges are, after all, merely a foundation for higher knowledge; but,

unfortunately, many stop at the threshold of the higher knowledge and refuse to go farther. It is true that they cannot always be blamed for this: they may not have the means or the advantages required for the pursuit of advanced culture. Nor do all minds run in the same groove. I once knew a well-educated man who could tell me every detail of the dress worn by a lady at a ball—he certainly had that power of observation and description—but if I took him into a garden or into the country, he was utterly lost. He could not recognize potato tops or a head of celery although well acquainted with both vegetables when served at the dinner table. Nor did he take any interest whatever in them.

Appeal to Residents in China to Observe.—But this want of knowledge—shall I call it ignorance?—is not confined to home-lands. There are many thousands of foreigners in China, most of them well-educated men and women, who ought to be able to use their eyes to great advantage and tell us what they see; but it is a truism to say that the vast majority of them spend their lives in China with their eyes metaphorically shut. This may be more or less pardonable at a port which is not really China; but for those resident in a purely Chinese city and in the heart of a remote province exceedingly interesting from many points of view, there is certainly not the same excuse. You may say: "We have no time; we did not come here to study these subjects; we came to impart knowledge to the Chinese." Are you then content with your present knowledge of China? Surely not. Do you wish to limit your knowledge? I can assure you that the more information you try to acquire the greater will become your capacity for acquiring. Do not tell me that your minds are already satisfied, that your memories are overburdened. No. They are capable of great expansion by a careful observation of what lies around you.

I do not mean for a moment that each foreign man and women, say in Szechwan, which is claiming our immediate attention, should attempt to deal with the whole province individually: that would be unsatisfactory and in all probability a failure at its close. Moreover, it would be unavailable for present day uses. All the best and lasting work is these days is done by specialists. One man does not build a locomotive: many artisans are engaged at the same time on its different parts and when these are completed they are fitted together to form a homegeneous whole. That is the easiest and quickest way to turn out a perfect machine. So it is with accurate knowledge. No man is master of all the sciences and for one man to try and elucidate the whole of his surroundings would be a struggle with the impossible. I am perfectly sure that in the great city of Chengtu, for example, and in the large and, after all, little-known province of Szechwan there are many foreign residents, men and women, who could contribute much to our knowledge of

this part of China. They hide their lights under bushels: they think that other people know what they know and that it would be useless for them to bring it before the public. They make a great mistake. No two minds are built on parallel lines and one mind does not know everything. Everyone has something new or can at least throw a new light on a subject which may seem to be well-known and hackneyed.

Configuration of Szechwan.—What, then, is it desirable for us to observe and how are we to go about it? If an individual were suddenly planted in any part of the province of Szechwan he would naturally wish to know exactly where he was. He might find out by enquiring that he was in a certain place, in a certain district, in a certain prefecture; but if he wished to map his position he would require to use certain scientific instruments, to handle which he must have had special training. It is worse than useless to attempt scientific work without training. It is done, however, and the result is confusion, if not to the observer himself, assuredly to those who come after. But this is only one branch of what I may call the Science of Geography which in its widest sense embraces a great variety of subjects more or less closely allied.

If the foreign resident has not been trained in the use of scientific instruments he can at least employ his eyes and his mind in many other directions. In Szechwan he cannot fail to be struck by the variety of mountain, valley, and river. There is also the plain of Chengtu which affords a striking contrast to the general configuration of the province. He will notice, too, that the land is not waste; that plain, valley, and hill side if not under crop are being prepared for some product or other, or intentionally being allowed to lie fallow. He will also observe that the whole country is well and variously wooded.

Inhabitants.—The different types of the inhabitants of the province will afford him food for thought and, if he cares to travel, he will find races altogether removed from the Chinese type, new people, new languages, and new forms of writing.

The primary aim of every country is to supply its own needs in the matter of food, clothing, and luxuries; and if it can itself produce all these it may be considered lucky. If not, it has to produce what other countries need or lack to be able to exchange and satisfy its own requirements. If, then, we can discover what constitutes the food of the people of Szechwan, whence they derive their clothing, and what are their habits, in other words what the province produces to maintain the life, health, comfort of its population, we shall have advanced a long way towards a knowledge of that part of China for Szechwan, unlike many other provinces of the country, is almost but not quite self-contained.

Climate.—The extremes of temperature in Northern China, where the soil is ice-bound from four to five months of the year, regulate the crops that can and cannot be cultivated with advantage. In the North, however, there is always abundant sunshine and the crops ripen much more rapidly than in Szechwan, enabling the farmer in many cases to gather in two crops during the seven or eight months of the open season. Frost begins at the end of October or beginning of November and does not relax its grasp until early in March. In the plains and valleys of Szechwan, however, where the temperature rarely falls to freezing-point and there is sufficient heat in spring, summer and autumn, the land is always under cultivation and the farmer by paying particular attention to irrigation and manuring is able to reap rich harvests of all the crops of Northern China and many more.

Food Plants.—Rice, glutinous rice, wheat, barley, maize, three kinds of millet, buckwheat, oats and Job's Tears (erroneously called "Pearl Barley") are the cereals and grain plants of Szechwan. Closely associated with these are leguminous plants embracing many varieties of beans, the ground-nut, and the common pea. Then we have starch-yielding plants, such as the sweet and foreign potato, three kinds of yams, the constricted rhizomes of the lotus, the taro, and other tuberous plants. Add to all these, a very large number of vegetables and seasoning plants, besides some forty different kinds of fruit, and I think it will be admitted the Szechwanese are indeed rich in food-stuffs. From many of these, too, they produce dainties of which the foreign resident has very little knowledge. Who has not looked with wistful eyes on the itinerant street-stall, laden with its many-coloured jellies surrounded by dozens of bowls containing sauces of every pungency and hue? Who amongst us has tasted these who can describe how they are compounded? Truly our ignorance is colossal. From some of these, too, are manufactured red and white soy, vinegar, wines, and spirits which do not specially appeal to the foreign palate.

Sugar.—In the field of what may be considered luxuries rather than necessities we have sugar, tea, tobacco and opium. Everyone in Chengtu is familiar, at any rate in the streets, with the two kinds of sugar-cane grown in the province—the white and the red or purple, the former mostly used in the manufacture of brown, white and barley sugar, and the latter grown for chewing purposes. Many people have, no doubt visited a sugar-mill in the country and witnessed the manufacture of that imperfectly crystallized stuff called brown sugar. On exposure in the shops it later gives forth a syrup which by the adoption of certain improvements in the manufacture could easily be converted into genuine crystals and prove a source of profit to the farmer and the manufacturer. On the whole, the quality of Szechwan sugar is of the poorest description.

Tea.—Tea of excellent aroma and flavour is grown on the hills and mountains in the west and north-west of the province, but we with our debased and artificial taste prefer to sip a beverage from the roasted leaf produced in other provinces. Why is the tea-leaf treated in this unnatural way? Is it because the sun-dried leaf suffers from a sea-voyage? This is in all probability the reason, for it is a well-known fact that tea carried overland, say to Russia, loses very little of its original aroma. Delicacy of aroma is not, however, appreciated in foreign countries to any great extent and it may surprise some to learn that, in England, for example, teas are differently prepared for different parts of the country. For the coal mining districts the leaf has to be sufficiently flavoured to penetrate the dust-begrimed palate of the miner. In the case of more aristocratic drinkers the perspiration from the hands and feet of the tea-coolies, engaged in rolling the leaves, is considered sufficiently pungent!

Tibetan Tea.—When Szechwan has prepared enough tea for the consumption of its own population, it proceeds to make up the balance and all the coarse leaves and twigs into brick tea for the Tibetan market. The palate of the Tibetan can hardly be called refined, for he turns his tea into a soup churned with rancid butter and, I can vouch for it, produces a new and highly original flavour. One more word with regard to this brick tea. Yachou and Kuan Hsien are the great centres of its manufacture for transport to Ta-chien-lu and Sung-p'an respectively; but, although several descriptions of its manufacture exist, not one of them to my mind is sufficiently detailed to enable a would-be manufacturer to put up plant and start a business elsewhere. In describing any industry every detail, however trivial, should be mentioned. There are those living where this brick tea is manufactured who could give a clear and accurate description of the process which is able to lay down annually in the Tibetan market nearly 40,000,000 pounds of tea.*

Tobacco.—Tobacco, its cultivation and preparation, would also form an excellent subject for study by a resident in China, even by a non-smoker if he approached it simply from an economic point of view. The great centres of production in Szechwan are the three districts of Chin-t'ang, P'i Hsien and Shih-fang Hsien—all lying at no great distance in the Chengtu plain. The traveller in this plain in May will not fail to be struck by the intensity of the cultivation of this plant—Nicotiana tabacum as distinguished from the smaller leaved variety Nicotiana rustica grown on the hilly land further west. He will note the raised beds the care taken to ensure adequate irrigation, and the absence of a single weed. He will

*See my "Report of a Journey to the Eastern Frontier of Tibet" China No. 5 (1905).

see how the leaves are developed at the expense of the flower, or, rather, attempt at a flower (for every flowering-plant makes bold and repeated attempts to reproduce itself by seed). In the case of tobacco all these attempts are carefully frustrated by the farmer who diligently examines each plant and snips off by hand the coming central spike.

Different methods of preparation of the leaf are pursued dependent on the kind of tobacco required. In the case of tobacco for the water-pipe the leaves are sun-dried between bamboo-screens while in the preparation of the ordinary shrivelled up leaf which one sees in shops, the bunches of leaves are hung up under cover by the bent-over ends of the stalks.

**Opium.*—Szechwan was at one time a great wheat producer and exporter; but with the rapid and extensive growth of poppy cultivation in the province, that export ceased and was replaced by opium. It is too readily taken for granted that the cultivation of the poppy trenches on the food crops of the people; but it must be remembered that it is a winter crop, and that it shares the ground with wheat, rape, beans, peas and barley. Szechwan has always produced sufficient flour for home consumption, but the export of wheat of former years gave way to opium which the farmer found a more profitable crop. Besides the actual opium extracted, the dried capsules and stalks pay the farmer better than the straw remaining from the wheat, while he can also dispose of the poppy seed to an oil mill. It is true that much extra labour is involved in cultivating poppy as compared with wheat; but the very ample margin of profit more than recompenses the farmer for his additional toil. Moreover, while wheat prefers a rich clay, the poppy flourishes best in a medium sandy soil, its favourite ground being the sloping terraces on the sandstone hills of the province. For this reason, the poppy has never been extensively grown on the rich plain of Chengtu which is a great wheat producer.

Oil Plants.—The great edible oil plant of Szechwan is Brassica juncea, generally called Rape by foreigners. It is very much in evidence during the winter months, sharing the ground with wheat, barley, peas, and beans, and its yellow flowers in Spring light up the greenery of the other crops. Most of the other edible oils produced in the province are, owing to their cheapness, used to adulterate it. The one great exception is sesamum which is much more expensive. Ground-nut, poppy (whose oil has no narcotic properties), soy bean, walnut, cotton seed, cabbage, sunflower, flax and one or two others all serve for adulterants, while tea-oil from the fruit of Camellia sasanqua is used as a hair-oil, and castor-oil for mixing seal-colouring. Wood-oil has a great variety of uses,

*For further details, see Part II of this volume.

such as paint oil and for waterproofing and the like. It is a peculiarity of the wood-oil tree (Aleurites Fordii) that it flourishes best on rocky soil and many people must have noticed it clinging to the rocky banks of the Yangtsze on their way up, between Ichang and Chungking. It yields a rich harvest where there is insufficient soil to support any other crop. I have mentioned Flax, and it is somewhat peculiar that the utilitarian Chinese has not discovered the value of its fibre. It is largely grown in the hilly country between Kuan Hsien and Sung-p'an, but only for the oil expressed from the seed. Linen is, of course, the product of flax and I have heard ladies speaking of linen made in Szechwan. This, however, is a misnomer for grasscloth (Hsia Pu) which is derived from quite a different plant which I shall mention later.

Chinese Candles.—These oils, although largely utilized for cooking, have other uses such as the manufacture of candles, and I can assure you that such an insignificant thing as a Chinese candle would be an excellent subject for investigation. Of what is it made? Bamboo, cotton, tallow (usually vegetable), or oil with a small quantity of insect white wax to give it greater consistency, with a coating of the latter also to prevent guttering. Then there are the different dyes used in colouring the candles. I am sure that a detailed description of all these ingredients would be of great interest and value.

Vegetable Tallow Tree.—I have mentioned the vegetable tallow tree known variously as Stillingia sebifera and Sapium sebiferum. It is easily recognisable in autumn by the beautiful ruddy tint of its foliage. It bears bunches of fruit whose capsules, on opening, release seeds about the size of a coffee bean with a soft covering—the tallow—encasing a small black kernel from which in some parts of China, but not in Szechwan, a yellow oil is extracted.

Soap-trees.—Everyone in Szechwan is familiar with the fruits of the soap-trees—the short fat brown pod of the Gymnocladus chinensis, the long thin pod of the Gleditschia sinensis—a fine tree of immense proportions, and the round marble-sized brown fruit of the Sapindus Mukorossi. The brown fleshy skin of the latter contains the soapy matter covering the round black seeds which are strung into rosaries and necklaces. All these are used in place of soap for washing purposes and the brown pods of the Gymnocladus are manufactured with pig's fat into salves and toilet soaps.

Varnish.—The varnish of Szechwan is obtained by tapping the stems of the Rhus vernicifera which grows abundantly on the hills in the north of the province. The sap of the tree becomes black on long exposure to the atmosphere. In its natural state it is of a brown creamy tint and, when different colours are required, it is kept covered to prevent contact with the air and in its creamy state mixed with the desired colouring matter. Paper umbrellas

are varnished with the juice of the steeped fruit of the wild persimmon which grows abundantly on the hills of Szechwan.

Textile Plants. Lack of Cotton.—I come now to the clothing of the Szechwanese and that brings me to the subject of Textile Plants in some of which the province is rich, while in the most important one it is poor. It is really its inability to grow the latter in any quantity that prevents Szechwan from being self-contained. I refer, of course, to cotton which is the everyday wear of the mass of the population. The most prosperous part of Szechwan is a basin surrounded by high mountain-ranges. The bottom of this basin is a thick layer of reddish and yellow sandstones overlying deposits of coal, lime salt and petroleum. Cotton will not thrive on a sandstone soil and it is only in the valleys, such as between the western branch of the Chia-ling River, which enters the Yangtsze at Chungking, and the T'o River, which joins the same river at Lu Chow, in which the sandstones have become covered by a layer of heavier soil that the cotton plant will flourish. The district of Sui-ning Hsien, which is the chief centre of cotton cultivation in the province, is an instance of this formation. Of course, cotton grows in other suitable valleys; but the total production is small and altogether inadequate to meet the wants of a population which, after long and careful study, I place at 45,000,000.

Importation of Cotton Yarn.—When I first entered the province in 1881, I found that the great bulk of the imports consisted of bales of raw cotton from the Central Provinces of China and native manufactured cottons from Hupeh, notably from what is now the port of Shashih. All this is now changed: raw cotton has given place to cotton yarn, principally of foreign manufacture. It is a branch of trade in which the British Empire especially India, is very much interested. Some of the yarn finds its way to Kweichow and Yünnan; but the great bulk of it is manufactured into cotton goods on native looms and sold in the province.

Hemp.—The Chinese language is frequently exceedingly indefinite and the traveller in Szechwan will meet several distinct plants which are all grouped together by the Chinese and indiscriminately called "Ma," which is usually translated Hemp. Only one of these, however, is the true Hemp plant—Cannabis sativa, which is extensively cultivated in the Chengtu plain especially in the districts of Wen-chiang Hsien. It is easily distinguished on the field by its straight green stems, frequently over six feet in height, and with large digitate leaves. The fibre is woven into sacking and sackcloth for mourning purposes, and for the working clothes of some of the aboriginal tribes in the west of the province.

Ramie or Chinagrass.—But the finest, strongest and most expensive fibre produced in the province is yielded by Boehmeria nivea, otherwise known as Rhea or Ramie. This plant is a member

of the Nettle family and grows in much the same way except that it reaches a height of 6 to 8 feet. The leaves are covered with a grey silvery down underneath and the same ground yields three crops during the year. The stems are cut down close to the ground, carried to the farm-house and peeled by hand. The peel, which contains the fibre lying between the woody interior and the green epidermis, is then scutched between a piece of iron shaped like a shoe-lift and a thumb-ring fitted with a crosspiece of bamboo. In this way the green skin is removed, leaving the fibre which is hung up to bleach in the sun. The scutching is done when the peel is wet. When bleached and dry, the fibre is steeped for a short time in water and then shredded by hand into thread, the ends of the threads being joined by a twist of the thumb and forefinger, aided by a little batter. The thread is thereafter mounted on the loom and woven into grasscloth.

This fibre has attracted great attention at home and processes, chemical and mechanical, have been invented for reducing the fibre to what I may call the ultimate fibres some seven inches long, as white and fine as silk. It is now spun into fine thread and has been woven into beautiful damasks, velvets and other high-class materials. The strength, durability, and lustre of this fibre, which shines like silk, promise a great future for this important plant, which, while pretty generally distributed throughout the province, is particularly abundant in the districts of Lung ch'ang and Jung ch'ang and in the prefecture of Sui Fu. I have given rather minute particulars of this plant because it has been a particular hobby of mine for many years. I have an idea that several varieties are cultivated in the province and the subject is another of those which deserve further investigation and research.

Abutilon and Jute.—Two other plants—annuals—are cultivated in Szechwan for their fibres, namely Abutilon Hemp (an unfortunate name because it does not belong to the Hemp family) and true Jute. The fibres of these are, however, mostly used for cordage and ropes.

Coir-palm.—Then we have the coir-palm (Trachycarpus excelsus), whose brown fibrous bracts, which encircle the stems at the ends of the leaf stalks, are a natural cloth utilized for rain-clothes, hats, covering boxes, tea-pot baskets, mats, floor-carpets, uppers of rain shoes, hassock covers, ropes, and the like.

Bamboo Fibre.—The stems of the bamboo are also reduced to fibre and serve such diverse purposes as material for sandals to the transparent network covers of the high class official summer hats. So fine is the latter work, which is carried on by a limited number of families, that one is at first inclined to doubt that it is the work of human hands. Such, however, it is and exceedingly artistic.

Rushes.—Amongst textile plants I must also include the rushes known as Juncus effusus and Scirpus lacustris L. both of which

are woven on upright looms into the mats which are so familiar to those who live in Szechwan. Sui Fu is a great centre of this industry.

Wheat straw, etc.—Wheat straw, again, is used for the braid of which the large wide-brimmed hats are manufactured for summer wear; and we all know the rice-straw mattresses which we carefully remove from the beds of Chinese inns when we seek repose. To complete the list of textiles, I must add the fibres of the young shoots of the tree Sterculia platanifolia which are extracted by retting and used for making slow matches for matchlocks, twine and, sometimes, sandals.

Paper.—The manufacture of Paper in Szechwan is an interesting study. Rice straw and a reed, called Imperata arundinacea, after retting by lime, are the ingredients of the coarse kinds, while young bamboos similarly treated go to make up the finer and whiter varieties. The mucilage of the Hibiscus is the adhesive used in both cases. A limited quantity of the well-known tough paper called P'i chih is made in the province; but the paper-mulberry from which it is manufactured is more at home in the province of Kweichow. The inner fibrous bark is used in the manufacture.

Rice-paper.—The pith-yielding plant known as Fatsia papyrifera grows in several places in Szechwan. It is the source of the material misnamed Rice-paper which is used as a ground for painting but mostly in the manufacture of artificial flowers. One must not run away with the idea that the pith is reduced to a pulp and then pressed into sheets. No such thing happens. A piece of pith like, say, an ordinary tallow or wax candle, is placed on its side on a flat stone. The workman places his left hand on the top of the pith and, pressing with his right a long heavy sharp knife fitted with a short wooden handle against the bottom of the pith, pares it into a thin sheet as he rolls it away from him with his left hand.

Dyes.—Not so many years ago Szechwan was not only entirely dependent on its own production of dye-stuffs but was also able to supply other provinces of China with large quantities of safflower grown principally in Chien Chou and the prefecture of Shun-ch'ing Fu. Although the introduction of aniline dyes has done much to destroy the fast vegetable colours of the province, yet, with the exception of green which is now wholly artificial, red, blue and yellow, which are the primary colours, are still produced and are derived from safflower, Strobilanthes flaccidifolius and Sophora japonica respectively. Polygonum tinctorium, which is the true indigo plant, is little cultivated in the province. The green of Szechwan used to be derived from another variety of Polygonum; but its extraction was a somewhat difficult and tedious process and it has been supplanted by the inferior aniline. In dyeing black, nutgalls, acorn capsules, and in the case of cottons soot from burnt

pine, are all used. I have heard complaint everywhere in China of the poor quality of the black colour of silks and satins and in Chengtu the black dyes are said to be much inferior to those produced in Eastern China and one reason given for this inferiority is the mixture of rape oil with the dye. This is said to cause a less fast colour and to give the material an objectionable smell. This also applies to the Plum colour (Tsang ching) produced in the province, which is made up of a mixture of Strobilanthes indigo and safflower.

Chinese Medicines.—Out of 189 kinds of vegetable drugs I have been able to identify the sources of 163. Many of them are no doubt valueless in the light of medical science; but, on the other hand, there must be others of considerable value, and I would venture to suggest to the faculty the desirability of making a thorough investigation into the subject of Chinese medicines. I need only mention Rhubarb for the supply of which the world is dependent in a great measure on Tibet and the Western provinces. If Rhubarb, why not drugs equally valuable?

Woods.—I have rarely visited a Mission compound in Chengtu without finding the manufacture of furniture in full swing and it cannot be that the owners have not selected their wood for that purpose. I have gone into the question of woods used in carpentry and totalled up a list of 30 different kinds, including the bamboo. There are certainly some beautiful woods in Szechwan and several of these I am sure, to judge from the beauty of their grain, would find a ready market in foreign countries, did manufacturers know of their existence. I need only mention the Hung Tou Shu* a tree, so far as I am aware, not yet identified, and the thin slabs of Ying Mu, the root of the Camphor tree.

Animal Products. Silk.—I have dealt in a general way with the vegetable products and I propose now to deal with the products of animal origin. Of these the most important is undoubtedly silk whose annual value to the province amounts to about Tls. 15,000,000 with a volume of about Piculs 40,000. Szechwan yields two kinds of silk. There is the wild silk of Antheraea Pernyi in the districts of Nan-ch'uan and Ch'i-chiang on the borders of Kweichow. The quantity of this wild silk, which is oak fed, is, however, insignificant when compared with that yielded by Bombyx Mori, or the mulberry worm. This is of two colours—yellow and white.

In the chief centre of sericulture in Szechwan, namely the prefecture of Chia-ting Fu, the silkworm is fed on two different kinds of leaves; in the infantile stage, on the leaves of Cudrania triloba, a tree resembling in size and appearance the mulberry but

*This tree has since been identified by Mr. E. H. Wilson and named Ormosia Hosiei.

with the addition of thorns; and from youth to old age—the life of a silkworm is seven weeks—on the leaves of the mulberry itself. In the case of wild silk the worms feed on the trees; but the Bombyx is fed and nursed in the house. To produce good silk and prevent disease it is essential that the surroundings of the worm should be kept scrupulously clean and I can assure you that the nurses of the silkworm bestow far more care upon their charges than they do upon their own persons. Nature, as we all know, makes few mistakes: it is the clumsiness of man that spoils Nature's handiwork. The cocoons of Szechwan are as perfect as elsewhere; but the silk yarn is uneven, inferior, and consequently less valuable than that produced in the Eastern and Southern provinces.

Why is this so? You have only to examine a reeling machine —that is, the machine employed in reeling the silk filaments from the cocoons into yarn—to find the reason. The filaments on their way to the winder pass up from the cocoons and over a slip of bamboo bound with straw. The straw is intended to give a smooth passage; but, as a matter of fact, the pressure is frequently too great for the weak filaments which snap and have to be replaced by others. It is this adding of new filaments that causes the unevenness and inferiority of the yarn and the poorer quality of Szechwan silks and satins. In modern reeling machines the filaments, instead of pressing against a straw-covered rigid piece of bamboo pass over a small revolving metal wheel with the result that they rarely sever and the yarn is in consequence much superior owing to its evenness. When I was investigating the subject of silk, I drew the attention of the Viceroy to the cause of the inferiority and, although I do not claim that my remarks were of any avail, I was very pleased to notice in the Arsenal some time afterwards a reeling machine of the newest pattern which had just been imported from Japan and which had just been put together to be imitated. A machine like this would add some Tls. 100 per picul to the value of Szechwan raw silk besides improving the quality of silk fabrics manufacture in the province.*

I spent over two months in following this raw silk to its manufactured state in the shape of satins, silks, crapes, velvet, plush, gauze, ribbons, braid, cord, and thread, and in examining the uses to which pierced cocoons (that is, cocoons from which the moths have emerged and which have thereby been rendered useless for reeling purposes) are put. I have found it impossible to condense the result of my investigations, which are very technical, into a few lines. Those who are interested in the subject must study it in a more detailed account.†

*The number of these reeling machines has now greatly increased.

†See Part II of this volume.

Insect White Wax.—There is one very interesting animal product of Szechwan which is worth to the province over Tls. 2,000,000 a year. I refer to the Insect white wax which is produced, for the most part in the prefectures of Chia-ting, by a tiny insect to which the name Coccus pela has been given. It has an extraordinary life history. In the valley of Chien ch'ang, nodules are found on the stems of the Ligustrum lucidum or large-leaved privet in Spring. These nodules are the dried-up scales of the mother insect containing her offspring, a moving mass of tiny grey creatures like flour. The scales are removed and carried into baskets to the Chia-ting prefecture where they are enclosed, 20 or so together, in the large leaves of the wood-oil tree, which are suspended by straws in the branches of the Ash known as Fraxinus chinensis. One or two holes are drilled in the leafy envelope as each packet is suspended. This occurs early in May and as the weather gets hotter, the insects develop and leave the scales by the orifices caused by their removal from the stems of the privet. They spend a few days wandering about the branches of the ash and then take up their positions on the bark whereon they deposit a white waxy substance which gradually attains a thickness of about a quarter of an inch. The deposit is completed in August when the insects, covered by the wax, change into cocoons from which later they emerge full-fledged flies which work their way, tail first, from the bark through the white wax to the outer air and escape to commence their life in the outside world. You will understand from what I have said that this white waxy substance is simply deposited as a protection to ensure the continuation of the race of insects. Protection against what? Well, every living being, especially in youth, has its enemies and the pet foe of the white wax insect is a fine species of ladybird. Those who take an interest in flowers must have noticed the avidity with which the ladybird devours the aphides which cause so much destruction to rose-bushes. This pretty ladybird of Szechwan is so enamoured of the youthful white wax insect that she (I say *she*, advisedly) devours and digests them. Both in the pupa and imago stages this destruction goes on and the white wax farmer may be seen going the round of his ash trees and belabouring the stems with a club to bring to the ground the beautiful but deadly foe of his tiny wax producers.

The white wax, when melted up in boiling water after removal from the trees, is poured into moulds of various sizes and shapes and is exported over the whole of China and put to many different uses, such as glossing for paper, furniture polish, candle-making, a coating for pills, and the like.

Honey.—Honey with its accompanying beeswax is also a product of the province; but instead of being used as a delicacy as in foreign lands, the Chinese chemist utilizes it for compounding

those nauseous drugs with which our medical advisers occasionally make us familiar. Like the white wax insect, the honey bee has a formidable enemy in the powerful Hawk moth, whose ravages on the hives are all too familiar to the bee-keeper.

Animal Products, Hides, etc.—There are many other animal products, raw and manufactured, such as hides, leather, and glue; horn, hoof and bone-ware; hair, bristles and feathers; wool and its products; skins and furs; soap and musk. Most of them are very interesting, especially in their methods of manufacture and preparation, and would well repay study.

Minerals.—Gold, silver, copper, lead and zinc, especially gold and copper, are found in the west of the province, and by west I mean the country to the west of the Min River. Gold and copper are also found and worked in places to the east of the Min; and the south-west of the province, where it dips into Yünnan, is particularly rich in metals. Indeed there is one place so rich in gold that the tribesmen who live there compel the Chinese who visit the banks of their streams to remove their sandals, for each pair of sandals is reputed to carry off gold dust to the value of one tael of silver. Antimony is worked in the district of Hsiu-shan on the Hunan border. Coal, iron and lime are widely distributed. Saltpetre, sulphur, sulphate of soda, gypsum, potash, and sulphate of iron are all worked or manufactured in different places. There is a jade mine to the north of kuan Hsien. Asbestos is also met with in the Chien-ch'ang valley. The methods of working all these minerals are somewhat primitive and scientific mining has a great future before it, although some of these primitive methods are exceedingly interesting, especially perhaps, to mention one instance, the refining and casting of shoes of silver, or sycee.

Salt and Fire-wells.—To Szechwan, however, the most valuable mineral at the present is salt. It is found in 40 districts of the province at depths ranging from 30 to nearly 3,000 feet, and wells have been sunk to that great depth to secure the brine. All residents in Szechwan are familiar with the names of Tzu-liu-ching and Wu-tung-ch'iao, the greatest salt producing centres, situated near the banks of the T'o and the Min Rivers respectively. The former has the deepest wells and has the great advantage of possessing what are called "fire-wells," that is, wells whence rises hydrogen or petroleum gas, supplying a natural fuel for evaporating the salt. I have my own theory on this subject and it is that heated petroleum at a still greater depth than the brine and separated from it by a layer of rock—probably limestone—gives forth its gas or vapour which percolates through the rock layer into the well, and thus constitutes a "fire-well." The oil itself is kept back by the superincumbent rock, and to reach it the rock will have to be pierced, when untold wealth may result to Szechwan. I have gone very

carefully into the amount of salt produced in the province and have arrived at the conclusion that it reaches the total of about 500,000,000 catties, or some 300,000 tons, of the value at the centres of production of nearly Tls. 9,000,000. Szechwan supplies not only its own population but parts of Yünnan and Shensi, nearly the whole of Kweichow and the east of Hupeh.

Inhabitants of Szechwan.—You will observe that I have endeavoured to give you a summary of the economic products and industries of Szechwan, and I now propose to touch briefly on the people. The Eastern half of the province is inhabited by Chinese little distinguishable from the Chinese of other provinces; but a closer observation shows that they differ from each other in manners, dress and even in language and we know that, several hundred years ago, this part of Szechwan was peopled by immigrants from other provinces, and it is rare indeed to find anyone who will tell you that he is a native of Szechwan. As a rule, he claims to belong to the province of his immigrant ancestor. Previous to this influx of immigrants, who were the inhabitants of Szechwan? Or was the country uninhabited?

Cave-dwellers.—In the rocky cliffs of the Yangtsze and its tributaries, we have evidences of the existence of a former race in the shape of cave-dwellings which are called Man-tzŭ caves by the Chinese. The term Man-tzŭ, however, does not give us a very accurate clue as to the dwellers in these caves, for the Chinese apply it to all the non-Chinese races in the west of the province, and even to Tibetans. Some people, who pose as authorities on the subject, hold that the aborigines were a race of low stature with long arms, and they claim to be able to pick out the descendants of this race from the inhabitants of the present day. They fail to convince me; nor would this agree with the Chinese designation of the caves which, however, can hardly be looked upon as conclusive. So far as we know, there are no cave-dwellers among the tribes in the west of the province at the present day; but caves are found along the Min River and its tributaries reaching to the neighbourhood of Li-fan Ting, where we find many tribes extending westwards to the Tibetan border. All these tribes, such as the Hei-shui, Somo, Tsa-ku, Sung-kang, etc., dwell in stone houses built of two storeys and frequently with towers, after the Tibetan pattern; but it is a curious fact that representatives of these tribes, especially the Hei-shui, descend every year into the plain of Chengtu in search of employment as masons and diggers of wells. Is it not possible that they have inherited their skill from ancestors who carved their dwellings from the solid rocks, of which they were ultimately dispossessed by the Chinese?

Tribes.—But let us look more closely at these tribes. They occupy a wedge between the Lolos, Tibetans and Sifans on the

south, and Sifans on the north to the west of Sung-p'an T'ing. Although they inhabit the province of Szechwan, they are not Chinese : they are aliens for they pay tribute to Peking ; but their chiefs are allowed a more or less free hand in the transaction of local affairs. Are they Tibetans like the Sifans, or a distinct race like the Lolos, with a language and writing of their own? I may state parenthetically that my predecessor as Consular Resident at Chungking, Mr. E. Colborne Baber, a distinguished explorer in Western China, who left behind him a model book of travel entitled "Travels and Researches in Western China," was the discoverer of Lolo writing which he came upon by sheer accident in the house of a Lolo chief where he took up his quarters one night when travelling on the border of Lolodom. These tribes living in this wedge abutting on the Eastern frontier of Tibet are certainly not Chinese, and I do not think that they are Tibetan, for, although their dress is akin to the latter, and they send their sons to Séra, one of the three great monasteries near Lhassa, to be initated into the mysteries of Lamaism, their customs and manners are very different. They speak, too, a different language or languages which, however, as I have quite recently discovered (if it may be called a discovery) they use the Tibetan alphabet to express in writing. There is nothing wonderful in this, however, for the Tibetans borrowed their alphabet from the Sanscrit, just as the Manchus borrowed theirs from the Mongols and not from the Chinese. Moreover, the Chinese language, so far as my experience goes, is ill-adapted to represent the speech of these tribesmen and, as the latter have until recent years been at warfare with the Chinese who have been pushing them farther back into the wedge, it is only natural that their intercourse has been more with the west than with the east. But I have come across books in the language of some of the tribes written and printed in Tibetan letters, but altogether unintelligible to the Tibetans. This, however, is a very large subject and, pending further research, I shall leave it where it is. It will serve to show that there is an immense field open to the enquirer after knowledge.

Further research urged.—At the outset of this paper, I stated that everyone can throw a new light on any subject, however, well-known and hackneyed it may appear. I have not hesitated to say many things that may have been already well-known to many ; but if, in my treatment of them, I have succeeded in suggesting any fresh lines of investigation I shall consider myself amply rewarded. I have kept well to the physical side of Szechwan leaving to others the mental, moral and social, sides of the province, which should yield rich harvests to the reaper and add greatly to our knowledge of Western China.

PART II.

Chapter I.

Boundaries, Physical Features, People, Population, Climate, Soil, etc.

SZECHWAN, which derives its name of "Four Streams" from the four rivers, Chialing, T'o, Min, and Yalung, flowing through it from north to south into its great trade highway the Yangtsze, is the largest and probably the richest province of China. Its western frontier touches Tibet and the Kokonor region; on the north it is bounded by Kansu and Shensi; on the east by Hupeh and Hunan; and on the south by the provinces of Kweichow and Yünnan. Its area is estimated to be 218,533 square miles; but size alone does not account for its wealth, for Western Szechwan, including nearly one-half of the total area of the province, is a very mountainous region sparsely peopled by aboriginal tribes and little cultivated or developed, except its valleys, into which the Chinese have penetrated, and in which they carry on their agricultural and industrial pursuits. That Western Szechwan is indeed rich in valuable minerals, which have as yet been only partly exploited, is undoubted; but for the present prosperous condition of the province we must look more especially to the eastern half.

Eastern Szechwan has been called the "Red Basin," that is to say, a basin with a thick surface layer of red and grey or yellow sandstones. Underneath this layer are deposits of coal and lime, and the basin is surrounded by high mountain ranges through which the Yangtsze has forced an eastern outlet, and in its course carved magnificent gorges which, beginning in the east of the province, continue for about 100 miles into Hupeh. With the exception of the plain of Ch'êngtu, measuring some 90 by 40 miles, there is very little level ground in this basin, whose valleys rise in many places to an altitude of over 1,000 feet above sea level; while the basin itself has been broken up by foldings of the earth's crust, forming ranges of hills and exposing numerous coal-seams of various thicknesses and qualities; but the friability of the sandstones has enabled the inhabitants to till not only the river valleys, with their alluvial deposits, but also to bring the hills themselves under cultivation, and, even where this has been found impracticable, they have discovered the means of extracting produce from the rockiest of soils. But

under its soil Szechwan possesses a most valuable asset in that great necessity of life—salt. At depths varying from about 30 feet to over 2,000 feet brine is found, raised and evaporated : and, although the richest deposits are found in the Red Basin, especially near the left banks of the T'o and Min, salt is found and worked elsewhere ; even in the far south-west of the province bordering on Yünnan. So great is the supply, and so vast the industry, aided as it is at the chief centre of manufacture by petroleum gas, which was struck when brine was sought, that Szechwan, in addition to satisfying home requirements, is able to send an immense surplus to Kweichow, parts of Yünnan, as well as to the eastern provinces. The presence of salt in Szechwan has given rise to many industries, such as coal and iron mining, and ironworks for the manufacture of evaporating-pans, and it has added greatly to the hardy and skilful race of sailors who day by day navigate those dangerous waterways on which the profitable employment of steam has proved impossible until recently.

Before beginning, however, to deal with the products and industries of Szechwan it is necessary, in order to the proper understanding of the present condition of the province, to glance briefly at its history.

There are evidences all over the Red Basin of the existence in prehistoric times of a race of cave-dwellers. The Yangtsze, Chialing, T'o, and Min have, in the course of ages, worn for themselves deep beds in the sandstone, and in the steep cliffs are rock-cut dwellings with small doorways and occasional windows, and here and there a certain amount of rude mural sculpture inside and outside—vestiges of a bygone race. These empty dwellings are called by the Chinese Man-tzŭ Tung—that is, Mantzŭ Caves, Mantzŭ being the generic name applied by them to the tribes inhabiting the west of the province. Who were these cave-dwellers, and do their descendants survive in these western tribes? The name would appear to point to such connection and it is a curious fact that the Man-tzŭ of to-day are greatly in demand by the Chinese for their skill in building and well-sinking, an art which they may have inherited from these stone-hewers of another age.

Coming to historical times, however, we find that the Szechwan of to-day was, during the former and latter Han Dynasties (B.C. 260 to A.D. 230) divided into five principalities, one of which, called Yi Chou Shu, and afterwards simply Shu, was usurped and ruled over by the Minor Han Dynasty (A.D. 221 to 263), with its capital where the city of Ch'êngtu is now built, the whole kingdom being represented by the present prefecture of Ch'êngtu Fu. There is no trace of the palace of this dynasty, which was situated in the north-west of the city, and the so-called Imperial City of to-day, which lies

near the centre of Ch'êngtu, and is generally pointed out as the Imperial residence of the Sovereigns of the Minor Han, was merely the residence of a Prince, one of the sons of Hung Wu, the first Emperor of the Ming Dynasty, who was sent to govern Szechwan. It is known in the provincial and district annals as the Shu Wang Fu, or residence of the Szechwan Prince, and in 1665 became the Examination Hall for candidates for the provincial degree.*

Liu Pei, who founded the Minor Han Dynasty which ended with his son, was a poor kinsman of the Imperial House of Han, and it is recorded that in his younger days he was a dealer in straw sandals; and it is curious to note that his namesake Liu Yu, the founder of the Sung Dynasty (420 to 478), followed the same profession.

It is a far cry from the fifth to the thirteenth century, but the records of Chinese dynasties are exceedingly uninteresting, and would be out of place in what is intended to be a practical commercial treatise. The second half of the thirteenth century saw the rise of the Yüan (a Mongol) Dynasty, when Kublai Khan carried his victorious arms over nearly the whole of China. This dynasty came to an end in 1367, and was followed by the Ming (1368 to 1643), the most illustrious of all the dynasties that have ruled over China. In the declining years of the latter, a rebellion broke out in Szechwan. It was headed by Li Tzŭ-Ch'êng, Chang Hsien-Chung, and Wang San-huai, who, especially Chang and Wang, bore destruction to life and property throughout the whole of the province. The Manchu Dynasty, which commenced in 1664, had thereafter to spread peace over the land, and it is not surprising that the census of Szechwan, taken about the year 1710, gave a return of only 144,154 souls, or less than one-third of the present estimated population of Ch'êngtu. The most reliable census of China in recent times was taken in 1812, when Szechwan figured for 21,436,678, and since that date various returns have been hazarded by travellers and others, who have not hesitated to put forward figures ranging from 30,000,000 to 60,000,000, and the certainty that exists may be gauged from the conjectures made as to the population of Ch'êngtu, some foreigners who have resided in the capital for years giving 1,000,000, while others unhesitatingly state that 500,000 would account for the whole population inside and outside the wall and leave an ample margin.

On my arrival in Ch'êngtu I endeavoured to ascertain from the Viceroy the actual population of the city, and his Excellency, who had recently numbered all the houses inside and outside the wall, and has ordered a census to be taken, was then able to supply me

*The Prefect's Yamên is said to be built on the site of the old Palace.

with the number of families only. This he officially gave me as 55,058.*

It has been the custom in trying to arrive at an estimate of the population of parts of China to assume five members to be the average number of a family, but in a city like Ch'êngtu, which is the centre of the official life of the province, and where there are thousands of retired and expectant officials occupying residences, each with its servants and hangers-on practically forming a village in itself, it seems to me that this average might be reckoned more reasonably at eight than at five. On this basis the inhabitants of Ch'êngtu would number 440,464, and when one considers that there are large open spaces inside the wall, whose circumference is 9 $\frac{1}{10}$ miles, used as vegetable gardens, into which the suburbs could be fitted with ease, I am of opinion that 500,000 should be accepted as the outside estimate of the population of Ch'êngtu and its suburbs.

As regards the population of the whole province, the estimates, as stated above, range from 30,000,000 to 60,000,000; but I think that one-half of the total of these two, or 45,000,000, would be a much nearer approximation, and this is the extreme estimate arrived at, in a roundabout way, by the "Mission Lyonnaise d'Exploration Commerciale en Chine" whose members travelled extensively in Szechwan a few years ago. This large population is due not merely to natural growth but also in a great measure to immigration, and it is difficult, if not impossible, at the present day to get an inhabitant of the province to admit that he is a native of Szechwan. He will say that he belongs to Hupeh, Hunan, Shensi, Kiangsi, Chekiang, or even Kwangtung, claiming as his province the home of his immigrant ancestor, and in some districts colonies of the descendants of early settlers are found retaining the costumes, manners, customs, and even the dialects of the provinces of their forefathers. In other parts, again, they have so far amalgamated as to have formed a "patois" unknown in any other province of China. I do not mean that their speech is unintelligible, but they have introduced words and expressions requiring explanation to be understood.

It is, I think, an established fact that people who emigrate to a new country with ample scope for employment succeed much better

*The following corrected Return was later supplied to me by the Viceroy :—

	Families.	Population.
Manchu city (1)	730	2,777
Chinese city...	44,468	235,696
Suburbs	13,670	59,450
Bannermen (2)	...	8,500
Total	...	306,423

(1) Chinese only. (2) Obtained from other sources.

than if they had remained at home ; they have had the energy to try new fields, and when there is sufficient work to utilize that energy their material prosperity is increased and the country of their adoption is enriched. So it is with Szechwan. This province has gathered her workers (some probably unwilling immigrants) from all parts of China ; they brought with them the knowledge and skill acquired in their respective provinces ; and they found scope for their varied attainments in the natural richness as well as in the potentialities of their new home. The result is that Szechwan is one of the fairest and richest corners of the country, and I propose to pass in review the varied products and industries which have raised the province to its present eminent position, and point out the great obstacle that retards its natural development.

The distribution of the population throughout Szechwan naturally follows the line of soil-fertility, for, as elsewhere in China, the production of foodstuffs is the greatest industry of the province. Indeed, it may be said that Szechwan, owing to its remoteness and to the difficulties and dangers which have to be encountered to reach it, must produce its own food supply, and when, as sometimes happens, climatic conditions are unfavourable, with a resulting shortage, dearth is keenly felt, for, although the people generally are well-to-do, there is, as I shall explain later, no immediate means or possibility of making good the deficiency. The most populous part of the province is undoubtedly the plain of Ch'êngtu, which, owing to its system of artificial irrigation, is *par excellence* the garden of Szechwan. In this garden and on its borders there are seventeen cities, including the capital, but, speaking generally, the population is essentially rural. The eastern half of Szechwan is dotted with farmhouses, hamlets, villages, and market-towns, many of them larger and more important than cities, and as markets are held in rotation at these towns every few days all over the province, there is no lack of facilities for the interchange of agricultural produce and local manufactures. Under the Manchus there were 112 territorial districts (Hsien), 11 departments (Chou), 8 independent departments (Chih-li Chou), 10 sub-prefectures (T'ing), 2 independent sub-prefectures (Chih-li T'ing), and 12 prefectures (Fu) in Szechwan ; but there were only 99 district cities, for each prefectural city was also a district city, and Ch'êngtu, the capital, was the seat of two district magistrates. As each department, independent department, sub-prefecture, and indepedent sub-prefecture was represented by a city with its seat of government, the total number of governmental cities in Szechwan was 142, 109 lying to the east of the Min, and the balance of 33 being scattered over the west of the province.*

*Under the Republican Government, all cities except prefectures (Fu) have been made Hsien cities. The names Ting and Chou have been abolished.

There are no extremes of climate in Szechwan. The temperature in summer rarely exceeds 100° Fahrenheit in the shade, and 95° may be taken as a fair average maximum. In winter the mercury seldom falls below 35°; frost is exceedingly rare, and half an inch of ice which appeared for a day or two on stagnant pools in Ch'êngtu some years ago was looked upon as a great curiosity. This, of course, refers to the valleys and plains of the Red Basin, for on the hill-tops in the Basin and on the surrounding mountains snow lies for a time every winter and huge icicles are to be met with in crossing mountain passes. Sunshine is rare in winter, for a bank of mist hangs over the land preventing surface evaporation and consequent fall in temperature. This humidity in the atmosphere, while preventing a low temperature and enabling the farmer to have his land always under cultivation, does not, however, suffice to mature the winter crops, and light rains, usually falling in January, February, and occasionally in March and April, have to be supplemented by irrigation, in the manipulation of which the people of Szechwan undoubtedly excel. The winter crops are all harvested in April and May, and heavier rains, commencing in the latter month continue through June and July, bring on the paddy crop on the plains and bottom lands, and cease to enable it to mature under sunshine and be harvested in August and September. There are intermediate crops between the two main harvests; but I shall refer to them in their proper place.

The fact that the swallow does not find it necessary to seek a warmer clime is sufficient guarantee of the mildness of the winter climate of Szechwan. While the summits of the mountain ranges overhanging the gorges were clad with snow on their northern slopes when I passed up in December 1902, the swallow was skimming over the surface of the Yangtsze in search of his insect prey; in the valley of the Min he was equally busy in January; and in February he was circling round the bamboo groves and along the streams and canals of the Ch'êngtu Plain.

The nature of the country has dictated various methods of irrigation, some of which are exceedingly simple, while others show a considerable amount of ingenuity. Where there is an absence of river, stream, or running water of any description the farmer digs a reservoir alongside one of his fields, which are surrounded and separated by low narrow dykes of earth. These dykes are constructed to retain a supply of water when irrigation is necessary, and small openings in the dividing dykes, which can be closed at pleasure, lead from one field or plot of land to another. Water accumulates in the reservoir during rain, but it has to be raised into the nearest field. Carrying by bucket would be a slow and laborious process, and, where the reservoir is shallow, the method which I shall call the basket scoop is usually employed. Two men

standing face to face a few feet apart on the bank of the reservoir hold between them a closely woven wicker basket which they dip into the water and they scoop the latter by a forward swinging motion into the field requiring it. The mouth of the basket faces the field and the ropes are attached to both sides of the basket, back and front. If the reservoir is full, only short ropes are required; but, as the water sinks, they are lengthened. This method is, no doubt, primitive, but the dexterity with which the farm-labourers are able to keep up a continuous swing and flow of water is remarkable. It will be readily understood, however, that this method is impracticable when the water has to be raised 5, 6, or more feet. Then it is that the commonest water-lift in China comes into use. I shall call it the wooden chain lift. It may be seen at work on the banks of every stream in the land during the summer months. It consists of a long narrow wooden trough, from 2½ to 3 feet high, closed, except the top, along its whole length to about one-half its height. It is open at both ends, and, when in use, one end is placed on the bank, or at such height as it is necessary to raise the water, the other end being immersed in the stream.

At the immersed end there is an open vertical wheel with six notched spokes fixed equidistant in an axle supported by two posts attached to the sides of the trough. A similar, but larger, wheel, with seven similarly notched spokes, is fixed to an axle between two poles or planks driven into the bank of the stream at a short distance beyond the upper end of the trough. A horizontal wooden bar, the use of which will be described below, connects the two poles higher up. An endless chain of wooden floats, about 1 foot square, 1 inch thick, 12 inches apart, and joined together by wooden spindles 1 foot long and 1 inch in diameter passing through their centres, each spindle fitting into the other at a point equidistant from each float and forming a flexible joint where wooden pegs unite them, is passed over the two wheels, the chain resting on the notches at the ends of the spokes. When everything is in position the bottom of the trough is filled with part of the chain of floats, the internal measurement of the trough slightly exceeding the size of the floats. Half-way up the height of the interior of the trough two boards facing the bottom are nailed along its length leaving the centre exposed. The upper part of the trough is really a rail designed to guide and control the chain of floats as it descends to the water. In the axle on each side of the wheel on the bank four treadles are fixed at equal distances, forming what may be called a couple of treadmills.

To set the machine in motion two men jump on the axle at either side of the wheel with their backs to the trough, and seizing with their hands the horizontal bar mentioned above, work the pedals round and round with their feet. Both wheels revolve, and

the chain of floats descending along the upper rises in the lower part of the trough, bringing with it the water which falls into an inclosure banked with mud on each side of the upper end of the trough. The flow of water is fairly continuous, and is carried along shallow channels to the plots of land requiring to be irrigated. I have seen this chain-lift driven by hand, a crank being inserted at one end of the axle on shore; but the above is the ordinary lift employed in Szechwan. There are many modifications of this method, such as a horizontal wheel turned by ox, donkey, mule, or water-buffalo, and working into a vertical wheel by the use of cogs, and in Northern China sails are employed, but I have not seen them in use in Szechwan.

The rivers of the province have eroded deep channels in the soft sandstone, and in winter their water-level is frequently 30 or 40 feet below the surrounding land. At that season the wooden chain lift is useless for irrigation purposes, and the rivers are either tapped by canals in their upper waters, as in the Ch'êngtu Plain, or a special lift is employed. A very ingenious machine has been devised for the purpose. A number of green bamboos are tied together into the shape of a skeleton wheel, with crossed spokes from the double rim fitting into the wooden axle, supported by staging erected partly in the river and partly on the bank. Short bamboo tubes projecting landwards are tied at an angle of about 45° on or underneath the rim, into which a number of light floats of matting are inserted. If the current is not strong enough to drive the wheel, a narrow passage is banked to form a small waterfall, and, as the wheel revolves, the bamboo tubes collect the water on their downward course, and on reaching their highest elevation pour their contents into a trough raised, like the top of a wheel, above the level of the bank of the river. From the trough, bamboos lead the water to the land to be irrigated. The wheels, which are of various sizes, dependent on the height the water has to be raised, are exceedingly light, and can be driven by a gentle current. The wheel is very graceful, with the exception of the wooden axle, which is heavy and clumsy beside the light bamboo. It is, however, exceedingly effective, requiring no attention once it has been placed in position.

Water is found at a depth of about 20 feet below the Ch'êngtu Plain, and well-irrigation is everywhere to be seen inside and outside the city where there are market gardens for the supply of the population. If there is a tree near the well, a cross piece of wood is attached to the lower branches, and to this a long pole is loosely fixed, the butt end shorter and with a stone weight bound to it furthest from the mouth of the well. A length of bamboo is tied by its tip to the thin end of the pole, while the lower part of the bamboo is pegged or tied to the handle of a wooden bucket. The latter is lowered by pulling down the bamboo which dips the tip of

the pole, and when full is easily raised with the stone-weighted butt. If there is no tree near the well, a wooden stage takes its place, and ropes are frequently attached to the pole for raising and lowering the bucket when greater speed is required. I have seen three men engaged at one well, one attending to the bucket and two employed on the ropes.

Owing to the light sandstone soil of the Red Basin, irrigation alone is insufficient to produce good crops, and manuring is practised at all times and in all seasons.

Nothing is wasted which would tend to enrich the land—night-soil, stable manure, potash from burned stubble, roots, weeds, and rice husks, horse, ox, water-buffalo, and pig's hair, in fact, everything that is otherwise valueless is returned to the land. Manure is applied in both a liquid and a dry form, especially the former, and every farmer has one or more concrete tanks alongside his fields, where the manure—night-soil in particular—is specially treated by dilution and maceration before being applied to the soil. With the exception of paddy (rice), which is necessarily fertilized by liquid additions to the water continuously required to insure the growth of the cereal, manure, whether liquid or solid, is applied to individual plants, or groups of plants, for the Chinese farmer does not scatter his seed broadcast on his fields: he sows it either in drills or in hollows made by hoe or dibble, and on these and these only does he bestow his malodorous fertilizer. Ch'êngtu being a large city, supplies large quantities of valuable manure to its immediate surroundings, and, although the buckets are covered, the stench on the streets, especially in the neighbourhood of the gates, is absolutely disgusting. Nor is this manure a gift for the removal—it is daily the subject of chaffering between the carriers and the door-keepers of different residences, the price being the perquisite of the latter. But waste products are not the only fertilizers in Szechwan, for the province grows a number of oil-yielding plants and trees, such as rape, ground-nut, beans, sesamum, cotton, poppy, castor, wood-oil, vegetable tallow, etc., whose seeds and fruits, after the extraction of oil, furnish refuse cakes of great value as manures. And when the farmer finds manures too expensive, he digs a pit in the middle of a field and extracts the sub-soil, with which he top-dresses his land.

These observations on irrigation and manures naturally lead to the subject of agriculture, and it is my intention to give some details regarding the agricultural products of Szechwan, pass in review the various industries to which they give rise, and then deal with the animal and mineral products of the province. So varied are these products, and so numerous the resulting industries, that my remarks thereon must be brief; but when I come to new or little known ground, it will be necessary to furnish fuller information.

CHAPTER II.

Agricultural and Horticultural Products.

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1. *Cereals and Grain Plants.*

(*a.*) *Rice* (*Oryza sativa, L.*).—Rice is the most important food-crop of Szechwan; the granary of the province is the plain of Ch'êngtu, whose water supply never fails, owing to the sub-division of the Min River at the District City of Kuan Hsien, where it leaves the mountains, into a network of streams and cross-channels; but rice is cultivated wherever water is naturally or artificially available. Only one crop is harvested during the year. The seed bed is laid out in April, and in May the young plants are transferred to the paddy land. The crop is ripe and harvested in the end of August or early in September. The yield of grain depends upon the soil. While one "mou" of hill land will produce 13 bushels of paddy or unhusked rice—each bushel weighing 32 catties, or a total of 416 catties, which, in turn, will give 164 catties of rice—the same area of plain land with a good water supply will yield 25 bushels of paddy, or 330 catties of rice. The price of a bushel of rice weighing 30 catties, or 40 lbs., in Ch'êngtu was about 1,000 copper cash, which at the exchange of 850 cash per dollar of the value of 1*s.* 8*d.*, makes the cost of 1 cwt. to be 6*s.*

A variety of this rice, called "Hung Mi," or red rice, from the reddish colour of the pellicle which tenaciously adheres to parts of the grain after hulling, is cultivated in many of the hilly and mountainous districts of Szechwan. It is used for food only, and should not be confounded with the dull-red tinted rice of Ch'êngtu, which is dyed and boiled with inferior meat to impart to it a fine red healthy colour. Having frequently been struck with the abnormally healthy appearance of old pieces of meat on street stalls and in the baskets of pedlars, I felt impelled to inquire how it was done, and the above explanation was given to me in the strictest confidence.

(*b.*) *Glutinous Rice* (*Oryza glutinosa, Rumph*). Glutinous rice, which is easily distinguished from *Oryza sativa* by its whiteness and opaqueness, as well as its more globular shape, does not take the latter's place as an article of diet, nor is it cultivated for that purpose. It amounts to only 20 to 30 per cent. of the total rice cultivation, the farmer devoting most of his attention in summer to the production of the staple food of the people. It is occasionally cooked and eaten as a change from the ordinary daily food; but the common method of preparation is to roast the grains after they have

been steamed, when they become exceedingly light and brittle. Whole or ground into flour they are baked into cakes, or simply steeped in hot water they serve as a light refreshment between meals. The process of roasting or baking is peculiar. The ordinary iron Chinese cooking pot is filled with sand, to which a quantity of wood-oil is added and the whole heated till it becomes perfectly black. The steamed glutinous rice is then mixed with the sand. The grains swell up to three or four times their original size, and when sufficiently baked the mixture is placed in a sieve through which the sand passes, leaving the swollen rice clean, dry, crisp, and, for the most part, hollow.

But sugar is extracted from glutinous rice. The hulled grain is steeped in cold water in a large shallow wooden tub for about eight hours, usually from daylight till noon. During this period it has absorbed a large quantity of water, and in its swollen state is removed from the tub and steamed in the usual Chinese fashion. After steaming it is packed into an earthenware jar, and ground-up barley which has been in course of preparation seven days, and developed shoots about an inch long is spread on the top. The jar is then covered up tightly to exclude the air for three days, when the contents are removed and boiled. The whole is then passed through a sieve, and the juice boiled till it assumes the consistency of syrup. In this state it is used by itinerant hawkers, who, provided with a portable stall with a stove on one side and a smooth flat stone on the other, pour the hot syrup on the cold stone, forming in the process characters and figures which, hardening into toffee, delight the eye and palate of China's rising generation. If greater consistency is required the syrup is boiled a second time. In its harder form it is still brown in colour, but it is bleached by pulling and otherwise manipulating by hand. In this whitey-yellowish form it is made into cakes, which are usually provided with an outer covering of seeds, such as sesamum, or mixed with groundnuts. The proportion of barley to glutinous rice is 1 to 36. The mixture is necessary to set up fermentation and the development of this starchy sugar.

In addition to the above uses, glutinous rice, which is over 11 per cent. dearer than *Oryza sativa*, is manufactured into a weak spirit known as "Lao Chiu" (old wine); but this will be dealt with in its proper place.

The harvest of glutinous rice is about a fortnight later than in the case of ordinary rice.

(*c.*) *Wheat* (*Triticum vulgare, L.*).—Wheat is a very important cereal in Szechwan. During my journey up the valleys of the Yangtsze and Min Rivers in December 1902 and January 1903, I noticed that it took a prominent place among the other winter crops of the province, such as rape, poppy, barley, beans and peas. Rape

seemed to hold the first place, with wheat a good second. The yield per "mou" averages 240 catties or 320 lbs., giving 192 lbs. of flour. The market price of wheat in Ch'êngtu ranged at that time from 4*s*. 6*d*. per cwt., and the retail price of flour, which is by no means white, was 36 to 40 cash, or less than one penny a lb. The latter is made into bread, biscuits, and cakes containing meat and vegetables. The best flour in the province is manufactured at Mien-chu Hsien, to the north of the Ch'êngtu Plain. K'uei-chou Fu, Chung-chiang Hsien in T'ung-ch'uan Fu, and Chungking are noted for their macaroni or vermicelli, which is made up in paper packets 9 inches long by $1\frac{1}{2}$ inches in diameter, open at both ends. Each packet weighs half a catty, and the price per catty was 56 cash in Ch'êngtu. The dough, having been worked up to the proper consistency, is pressed through small holes in the bottom of a wooden vessel and the vermicelli drops into a pot of boiling water, which causes it to solidify and enables it to be made up into packets. It is, however, very brittle, and falls to pieces as soon as the latter are opened. In Ch'êngtu no attempt is made at this form of manufacture. Flour, mixed with water containing soda, is baked into thin cakes resembling chamois leather, and these are cut up by knife into thin strips, which are sold under the name of "ch'ieh mien" (sliced flour) at 44 cash a catty. The colour is poor, and is more yellow than white.

Wheat, which blossoms in April, occupies the ground from November to about the beginning of May. Both awned and awnless varieties are grown, principally the former.

(*d*.) *Barley* (*Hordeum vulgare; L. var H. hexastichum*).—Except in the hilly and mountainous regions of Szechwan barley is little cultivated. During a days's walk in the country round Ch'êngtu in April I came across only one small patch amid miles of waving wheat, seeded rape, beans (*Vicia faba, L.*), and peas. It was a six-lined variety with long awns. The reason, of course, is that flour is more highly appreciated than barley meal, and that where wheat grows well barley is little cultivated, and when it is cultivated it is not so much for food as for the manufacture of spirits, ferment, and for feeding cattle, especially pigs. As in the case of wheat, it occupies the ground from November to May. A bushel of barley weighing 40 lbs. costs T. 0·5·5 against T. 0·6·5 to T. 0·7·0 for wheat. The yield per mou is about 320 lbs.

I have come across another variety of barley, which is called the "lan mai," or blue barley, by the Chinese deriving its name from its blue-green colour on the field. It is a long-awned variety in which the grains follow no regular lines, but while overlapping, are disposed irregularly round the rachis, the ear swelling towards the centre and tip owing to the increase in the number of grains. As the seed readily separates from the *paleae*, it is a naked barley,

and is probably akin to Nepaul or Himalaya barley. It is not cultivated to any great extent, and I had some difficulty in procuring a specimen tallying with the description previously furnished to me. Another variety, also six-lined, in which the *paleae* are dark-brown —almost black—is grown in Szechwan. It is, however, of somewhat rare occurrence; but it is cultivated within the department of Mei-chou, to the south of Ch'êngtu. In the west of the province and on the Tibetan border, Huskless Barley is the principal crop and barley-meal is the staple food of the tribes who inhabit that region.

(*e.*) *Millet* (*Holcus sorghum, L.*).—This is the Kao-liang or tall millet, which is grown so extensively in Northern China and Manchuria. In Szechwan there are two varieties, with purple and brown-cased grains respectively. Although grown in the plains and valleys of Szechwan, it is in the highlands of the province, where rice is not procurable, that it is raised for food. It is also manufactured into spirits; but, as I have fully described elsewhere* the whole process of manufacture, it is unnecessary to go into details in this place. Millet is much dearer here than at Newchwang, where a bushel of 40 lbs. ranges from 480 to 640 cash, whereas the price in Ch'êngtu is quoted as 780 cash. It is, of course, a summer crop, and is harvested at the end of July or the beginning of August in the plains; but, like other crops, the harvest is later in the northern and western hill country.

(*f.*) *Italian Millet* (*Setaria italica, Kunth*) is not cultivated to any great extent in Szechwan for food. It is mostly a summer hill crop, and is sold in the cities for feeding birds, of which the Szechwanese have a great variety, and are inordinately fond. The price at Ch'êngtu was about 660 cash a bushel of 28 lbs. 5 oz., when a dollar of the value of 1*s.* 8*d.* was equal to 850 cash.

(*g.*) *Maize or Indian Corn* (*Zea Mays, L.*).—Maize is cultivated generally throughout Szechwan, and with oats, buckwheat, and barley, takes the place of rice in the mountainous parts of the province. The juicy shoots are the favourite food of the wild pig, which abounds in the hills to the north-west of the Ch'êngtu Plain, and during the season the enemy is hunted down with packs of dogs, the hunter not always coming off victorious. Maize occupies the ground from April to June, and a bushel of 40 lbs. costs in Ch'êngtu T. 0·6·0, about 718 cash, or nearly 1*s.* 5*d.* Besides its use as food, it is manufactured into spirits, to which I shall refer later.

(*h.*) *Buckwheat* (*Polygonum fagopyrum et tataricum, L.*).—The cultivation of buckwheat, which does not require a heavy soil, although carried on in the plains, is mostly confined to the uplands of

* "Manchuria: its People, Resources, and Recent History," London 1901, pp. 226-235.

Szechwan. Two crops are gathered during the year: the first, sown in March, is ripe in June; the second, sown in September, is harvested in December. In Ch'êngtu unhusked buckwheat sells for about 1 dollar a bushel of 30 lbs. It is ground up with water, the husk is removed by sieve, and the flour baked into dough with salt and a pinch of lime. The dough is then made into vermicelli. The process of manufacture may be seen any day on the streets of Ch'êngtu. The stall of the itinerant vendor is provided with a stout beam having a round hole cut in it, and a perforated iron plate at the bottom, all forming part of the stall. A piece of wood fixed in a lever fits the hole, and when the dough is placed in the hole and the lever pressed home, the strings of macaroni or vermicelli fall through the perforated plate into a pot of boiling water, and are cooked and ready for eating with a choice of sauces in a few minutes. This vermicelli, like that manufactured from rice, is not sold in a dry form, and, so far as I can gather, the only dry rice, macaroni, or vermicelli made in China is an export from Fukien Province. I shall speak of bean, pea, and sweet potato vermicelli in another place.

(*i.*) *Oats* (*Avena sativa, L.*).—Oats are extensively cultivated and consumed in the highlands of Szechwan where, and in the cities bordering on the producing districts, the shellings or groats are cooked and eaten whole, or roast and ground into oatmeal. I saw a few patches under cultivation when crossing the Ch'êngtu Plain in May, and the green plants frequently formed an edging round other crops. In the hill to the north of the plain, and as far as Sung-pan T'ing in this province, oats are a prominent summer crop, which is harvested in September, and comes later according to the altitude.

(*j.*) *Job's Tears or "Pearl Barley"* (*Coix lachryma-Jobi, L.*). —This grain plant is very widely cultivated in China. The seeds, under the name of "pearl barley," are exported from Manchuria in the north to the West River in the south. Owing to their shape and the furrow down one side they resemble barley, but have no connection whatever with that cereal. The principal places of production in Szechwan are the district of Kuan Hsien 40 miles to the west of Ch'êngtu, and the districts of Nanchuan and Ch'i-chiang bordering on the Province of Kweichow. The seeds are inclosed in hard globular or tear-shaped lustrous capsules, whence the plant derives the name of Job's Tears. The seeds are said to possess diuretic and cathartic properties, and are more extensively used in medicines than as food. They are, however, boiled and made into gruel, and also added in small quantities to flour cakes to attract buyers. In Ch'êngtu the retail price was 112 cash a catty; but in the south of the province it is very much lower.

(*k.*) There is another grain plant cultivated in Szechwan, especially in the Prefecture of Hsü-chou Fu and in the district of

Fu-shun Hsien, in which lie the chief salt wells of the province. It is locally called "Mao Pai," and is also known as "Chan tzŭ." It is described as a grass about 3 feet high, with long leaves about three-tenths of a Chinese inch broad. It has a feathery brown grain head when ripe, and the plumes resemble a Prince of Wales' feather. The grains, which are white, covered with a brown follicle, are used in making cakes. They are slightly ovate, and bear a strong resemblance to the grains of *Setaria italica, Kunth.* It is *Panicum Crus-Galli, L.* It is planted after the rice crop has been harvested, and is ripe in the late autumn.

The above are the grain-food plants of Szechwan; but there are other grain-yielding plants, such as sesamum and rape, which are cultivated especially for their oil. These will be discussed later, for the prominence given to pulse among the winter crops of the province, and the important place which legumes occupy in the diet of the population, entitle them to rank immediately after cereals.

2. Pulse.

1. *Soy Bean (Glycine hispida, Max.).*—The soy bean does not play the same part in Szechwan as it does in Northern China, and especially Manchuria, where it is cultivated almost entirely for its oil and for the refuse cakes, which find a ready market not only in China and adjacent countries, but are winning their way as fertilisers into remoter regions. The great oil yielding plant of Szechwan is rape, and although oil is extracted from the soy bean, it is as an article of food, whether cooked whole or in the form of resultant products, that the latter is appreciated in Western China. Three well-marked varieties, each with two or more sub-species, are cultivated.

(I.) *Yellow Soy Bean:*

(*a.*) *"Pai Huang Tou," or White Yellow Bean.*—This, although not the largest is the lightest in colour of the three sub-species of the yellow bean. A bushel of 40 lbs. cost T. 0·8·8., or about 2*s.* 1*d.* The beans, which are ovoid in shape, are not much larger than the common pea, and weigh 150 to the ounce. As a rule they are cooked whole and served as a vegetable condiment.

(*b.*) *"Ta Huang Tou," or Large Yellow Bean.*—There is a slight tinge of green in the yellow colouring of this bean, which is larger and heavier than the preceding, 122 going to the ounce. It is cooked and eaten in the same way as the white-yellow bean, and a bushel of 40 lb. costs T. 0·9·0.

(*c.*) *"Hsiao Huang Tou"—Small Yellow Bean.*—These three sub-species of the soy bean have all the same ovoid shape; but this bean is much smaller than the other two sub-species, and 266 are required to make up an ounce. It is less expensive than (*a*) and (*b*),

costing T. 0·8·5 for 40 lbs., and for this reason it is in demand for the manufacture of beancurd in its various forms. It is also used as a vegetable.

Oil is extracted from (*a*) and (*b*), and to a much less extent from (*c*); but this subject will be dealt with under the head of oil-yielding plants.

(II.) "*Ching Tou*"—*Green Soy Bean.*—There are two sub-species of this bean (*a*) where epidermis and inside are both green, and (*b*) where epidermis is green and inside yellow. The former is more commonly cultivated in Szechwan, and both are eaten and cooked as a vegetable. They are also salted and put away in jars for winter use. This bean is of the same size, shape, and weight as the white-yellow bean, and valued at T. 0·8·0 a bushel of 40 lbs.

The above yellow and green varieties of the soy bean occupy the ground from April to August, whereas the next variety (black) takes a month longer to mature.

(III.) "*Hei Tou*"—*Black Soy Bean.*—There are two sub-species of this bean:

(*a.*) The first is much larger, rounder, and heavier than the yellow and green variety. Only eighty-eight are required to make up an ounce, and the cost is T. 0·6·5 per bushel of 40 lbs. Like the green bean, it is used cooked in its fresh state as well as pickled.

(*b.*) The second is a small, flattish bean, about 450 going to the ounce. It is used in medicine and for food, principally the former. The cost was T. 0·8·0 for 40 lbs. Both these sub-species are black outside and yellow inside, the epidermis of the former being readily detachable when crushed.

2. "*Lü Tou*"—*Green bean* (*Phaseolus Mungo, L.*).—This is the small green bean which is widely cultivated in Northern China for the manufacture of vermicelli as well as for its sprouts, which are highly esteemed as a vegetable. It is extensively grown in Szechwan for both purposes. Its size may be gathered from the fact that 600 are required to make up an ounce. It cost T. 0·8·5 per bushel of 40 lbs. It is very easily grown, and requires only sixty days from sowing to reaping occupying the ground from May to July.

3. *Ray-fruited dwarf bean* (*Phaseolus radiatus, L.*).—There are two species of this bean distinguished by their red and white colours. They are small, hard, glossy, ellipsoidal, with blunted ends and white inside. The white species is called "Pai Hung Tou," white red bean, to show that it belongs to the same family as the red bean. The red species is ground up and used for stuffing cakes and sweetmeats, being preferred to the white for this purpose owing to its red colour. The white is boiled and eaten as a vegetable with rice. They occupy the ground from May to November and the price was T. 0·5·5 and T. 0·6·0 for red and white respectively.

4. *"Pa Shan Tou"—Long Red Bean.*—This resembles the red ray-fruited dwarf bean in colour and weight, but it is thinner and more elongated. It measures $^{4}/_{16}$ths to $^{5}/_{16}$ths of an inch in length, and has a long white scar on the saddle. Although it is used for the same purpose and costs exactly the same price as the ray-fruited dwarf bean, there can be no doubt that they are distinct species.

5. *Common Kidney Bean (Dolichos Lablab, L.).*—This bean is usually cut up and eaten with the pod. It is called the "Ssŭ Chi Tou" (four seasons bean), because it can be and is cultivated through the whole year.

6. *Long-podded Kidney Bean (Vigna sinensis, Hassk).*—The round pods of this bean attain a length of a foot or more, and are cooked and eaten in the same way as 5.

7. *Large White Bean (Lablab cultratus, D.C.).*—This is a white rounded bean measuring half an inch long. There are two varieties with white and purple flowers respectively. The pod is short, broad, and less fleshy than 6, and is borne in a cluster of five or six. It is called the "Pai Pien Tou tzŭ." It occupies the ground from April to October. Fifty-eight go to an ounce, and they cost in Ch'êngtu T. 0·1·0 a catty.

8. *Broad Bean (Vicia Faba, L.).*—This bean, which is very widely cultivated in Szechwan as a winter crop, has a variety of uses. It is boiled and eaten fresh as a vegetable; it is manufactured into bean sauce, it is pickled, and it is ground up into flour and made into vermicelli. Early in April fresh beans are put upon the market at about 40 cash a catty, and in May when they are ripe they are valued at T. 0·7·0 per bushel of 40 lbs.

9. *Common Pea (Pisum sativum, L.).*—These peas are in the market all through the winter in Ch'êngtu; but it is the May crop which is of the greatest importance to the inhabitants of Szechwan. The matured dry peas are ground up with water, the shells removed, and the fine white flour collected and dried. The latter is then made into vermicelli, which, after being dried, is made up into hanks like the product of *Phaseolus Mungo L.*, and sold throughout the whole of the province. I shall describe the process of manufacture later. The flour is also used for thickening soups and other foodstuffs, and frequently takes the place of starch. The dry peas cost T. 0·6·5 per bushel of 40 lbs.

10. *Ground Nut (Arachis hypogoea, L.).*—The ground nut, which prefers a light soil, is generally cultivated throughout the province, and Ch'êngtu is supplied from the districts of Tê-yang, Chung-chiang, and Chin-t'ang and the department of Han Chou to the north-east. The nut is grown as much for food as for the oil which it yields. It is eaten roasted or as a favourite ingredient in confectionery of various kinds. It is sown in the end of March or

beginning of April, and harvested in July and August. The price in Ch'êngtu averages about 42 cash a catty.

3. *Starch-yielding Plants.*

1. *Sweet potato* (*Ipomoea fastigiata, Sweet*).—The sweet potato is universally cultivated throughout Szechwan, especially on the hill-terraces of the province. The young shoots of the previous year's potatoes are planted out in drills in May, and the new crop is gathered in August. During the season they are cooked fresh with a little water in the ordinary iron pot or baked in ashes; but as they deteriorate by keeping they are preserved by being cut up into slices or strips, which are first scalded in boiling water and afterwards dried in the sun. In this form they may be seen heaped in shops for sale during the winter months. But the treatment of the sweet potato does not end here. It is macerated with cold water and its starch is collected, dried, and manufactured into vermicelli. Sweet potatoes cost about 10 cash a catty in Ch'êngtu.

2. *Yams* (*Dioscoreae*).—Two kinds of yams are cultivated in Szechwan :—

(*a.*) "Pai Shao" (*Dioscorea japonica, Thunb*).

(*b.*) "Chieh Pan Shao" (foot-flat yam) (*Dioscorea sp.*).

This is so named from the shape of the tubers, which are flat, and branching with a resemblance to fingers or toes. Both kinds are boiled and eaten like the sweet potato, but they lack the sweetness of the latter.

(*c.*) There is another yam called "Ti Kua," which is shaped somewhat like a turnip. It is sweet to the taste, and is eaten either raw or cooked.

3. *Lotus* (*Nelumbium speciosum, Wild*).—The lotus is grown in Szechwan not only for its beauty, but also for its seeds, and more especially for its rhizomes, which are highly valued for food as well as in medicine. The kernels of the seeds or nuts, after the removal of the encircling membranes, are steeped and cooked in boiling water or tea. The rhizomes, however, are treated in several ways. They are (1) peeled and cut into thin slices and eaten raw as a fruit; (2) stuffed with glutinous rice, boiled, sliced, and eaten cold; and (3) pounded into flour or starch, which is highly appreciated as an article of food. This flour, which ranges from buff to white in colour, according to quality, is very expensive, costing as much as 420 cash a catty. The long white rhizomes of the lotus resemble a string of sausages, each about a foot long, and separated one from the other by a constricting fibre. It is these constricting fibres which are used in medicine, and are credited with the property of restoring to health persons suffering from nervous exhaustion.

4. *Taro* (*Colocasia antiquorum, Schott*).—The taro is cultivated in Szechwan in summer wherever a good water supply is available. Each plant produces seven to fifteen egg-shaped tubers, which are valued at some 30 cash a catty. They are cooked whole, or sliced and fried in sauces of various kinds.

5. *Alocasia cucullata, Schott.*—This plant, which requires less moisture than the preceding, is cultivated usually on the edges of fields in which other crops are being grown. Not only are the tubes cooked and eaten fresh, but the brown, ruddy petioles are also sliced fine, pickled, and stored in earthenware jars.

6. *Amorphophallus Konjac, K. Koch.*—This tuberous plant is not cultivated in Szechwan to any great extent. The tubers are ground up with water, and the starch collected and made into a compound resembling beancurd.

7. *Pueraria Thunbergiana, Benth.*—The dry roots of this plant, from which a starch is extracted, are exposed for sale in the streets of Ch'êngtu, but the meal enters very little into the diet of the people, nor are the fibres of the plant woven into cloth, as in some parts of China, especially in the neighbourhood of Kiukiang.

8. *Scirpus tuberosus, Roxb.* (*Ch. "P'ei-chi"*).—A starch meal is produced from the small onion-shaped bulbs of this plant, which, like *Trapa bispinosa, Roxb*, is usually described as a water chestnut. The latter will be referred to under the head of Nuts.

9. *Sagittaria sagittaefolia, L.* (*Ch. "T'zu-ku"*).—The spherical rhizomes of this plant, known as arrowhead, measure about 1½ inches in circumference. They are cooked in the same way as the taro.

10. *Bracken* (*Pteris aquilina, L.*).—In some parts of Szechwan the rhizomes of the common bracken are dug up, dried, and manufactured into a white, starchy substance, which is baked into cakes for food. Twenty years ago, when travelling in the south-west of the province, I bought these small cakes for 3 cash apiece. The young fronds of the bracken are also gathered and cooked as a vegetable.

11. *Potato* (*Solanum tuberosum, L.*).—Although despised by the rice-eating people of the plains, the common potato is cultivated and consumed among the mountains in the north, west, and east of the Province of Szechwan. K'uei chou Fu, in the east produces an excellent-looking mealy variety, but it is tasteless, and nowhere in Szechwan have I seen anything approaching in quality and flavour the home product.

4. Vegetables and Seasoning Plants.

Probably no province in China has a greater variety of vegetables than Szechwan, whose inhabitants indulge fearlessly in almost everything green, from clover to the young spring shoots of trees. I have

endeavoured to make the following list as complete as possible, and I do not think that much has escaped me.

1. *Lucerne* (*Medicago lupulina*, *L.*).—This clover, which bears a small yellow flower in winter, is widely cultivated for its stems and leaves. In April it is ploughed into the paddy fields as a fertiliser for the rice crop.

2. *Tare* (*Vicia Cracca*, *L.*).—This vetch is cultivated sometimes alone, but more frequently mixed with beans (*Vicia Faba*, *L.*). There is no prettier sight in Szechwan in April than a field of tares with their beautiful blue, almost purple, blossoms. The stems and leaves are plucked for food, and the seeds, when allowed to ripen, are used, so Chinese books say, for the manufacture of a dye for converting grey into black hairs.

3. *Shallot* (*Allium ascalonicum*, *L.*).

4. *Onion* (*Allium cepa*. *L.*).

5. *Garlic* (*Allium sativum*, *L.*).

These three are widely cultivated in the vegetable gardens of Szechwan for market and home consumption.

6. *Leek* (*Allium porrum*, *L.*).—As elsewhere in China, the leaves of the leek are flattened and covered with earth to insure blanching; and the white leaves, which are considered a delicacy, are sold under the name of "Chiu Huang" or "Chiu Ya" (leek yellows or leek buds).

7. *Turnip* (*Brassica rapa*, *L.*).—Flat, round, long, red, and white turnips are extensively cultivated; but I have never tasted a turnip in Szechwan that can compare in flavour with the home product. They are all watery and insipid. There is one variety of long white, of somewhat better flavour, cultivated near Ch'êngtu, which deserves special mention. The seeds are brought annually from the Province of Shensi, and the turnip is never grown from seed that has ripened in the province. It is called "Jeh Lo Po," or hot turnip.

8. *Carrot* (*Daucus carota*, *L.*).—Some of the finest carrots I have ever seen are grown in Szechwan. I refer more particularly to their size, for the flavour is inferior. The alluvial shingle banks of the Min River, which I ascended in January, were covered with them, and tons of them over a foot in length were heaped at the water's edge, ready for shipment to the cities, market towns, and villages in the neighbourhood, and they were even finding their way down the Yangtsze. There is a much smaller carrot grown near Ch'êngtu, but the difference in size is probably due to a less congenial soil.

9. *Radish* (*Raphanus sativus*, *L.*).—The radish is cultivated in market gardens and used as a relish.

10. I have examined numerous varieties of the cabbage family cultivated in Szechwan. Some I recognize, but the majority are unknown to me, and as regards the latter I must content myself with giving the Chinese names :—

(*a.*) *Shantung Cabbage* (*Brassica campestris, L. var.*).—This cabbage is well known throughout the whole of China, but comes to greatest perfection in the cold climate of Shantung and Manchuria.

(*b.*) *Pickling Cabbage* (*Brassica oleracea, L. capitata*).—This cabbage seems to grow throughout the whole year in Szechwan. While some plants are hearting in May, others are only a few inches above ground.

(*c.*) "*Wu Chin Pai Ts'ai*" (*Black Golden Cabbage*).—This has short glossy leaves, and bears a white flower in spring.

(*d.*) "*Ch'ing Ts'ai,*" *also called* "*Ch'un Pu Lao.*"—The leaves of this cabbage are somewhat coarse, and both leaves and stems are eaten. It bears yellow flowers in April.

(*e.*) "*Ta T'ou Ch'ing Ts'ai.*"—This is also a coarse cabbage whose hearts and stalks are cooked and eaten.

(*f.*) "*Niu P'i Ts'ai,*" "*Hou P'i Ts'ai,*" *or* "*T'ien Ts'ai.*"—This resembles the Shantung cabbage in its appearance and manner of growth, but it is much coarser, the petioles being broad, white, and leafless in the lower half of their length above the stem. Although cooked and eaten by man, it is frequently used for feeding pigs.

(*g.*) "*Chien-nan Ts'ai.*"—This has a finer leaf, and has some resemblance to (*b*). It bears yellow blossoms in March.

In addition to the above the common European cabbage has been introduced, and is widely cultivated in market gardens.

11. *Rape* (*Brassica juncea, Hook. f. et T.*).—Two varieties of rape are cultivated in Szechwan—the white and the red. The young leaves and shoots of the former are eaten as a vegetable, but it is the great oil-producing plant of the province, and it is for this purpose that it is so widely cultivated. It keeps wheat company during the winter and is harvested in the end of April and early in May. Red rape is eaten as a vegetable, and is usually sown in borders—not in fields. Little bundles of the stems and leaves, even when in flower, are hawked about the streets of Ch'êngtu in winter and early spring.

12. "*Ta T'ou Ts'ai*" (*Brassica juncea, Hook. f. et T. var.*).—A variety of *B. juncea* under the above Chinese name is widely distributed throughout China. It has a tuberous root like a turnip. It is never eaten fresh, but root, stalk, and leaves are all pickled together and form a condiment—one of the numerous relishes required to season the saltless diet of cooked rice.

13. *"Kohl-rabi"* (*Brassica oleracea, caulo-rapa*).—This, like the common European cabbage, is an import, and is cultivated in market gardens only.

14. *Lettuce* (*Lactuca sativa, L.*).—The coss lettuce is extensively cultivated throughout the province—not so much for its leaves as for the stalks, which grow to over a foot long and several inches in circumference. The latter are peeled, sliced, boiled, and eaten as a vegetable. In winter and early spring it is the most prominent crop in the market gardens in and around Ch'êngtu.

15. *Brinjal* (*Solanum melongena, L.*).—Five varieties of the brinjal are cultivated in Szechwan. They are—

(*a.*) *"Chin pa tzŭ."*—Long, purple (4 to 5 inches), with a girth of 8 to 9 inches.

(*b.*) *"Tung kuan."*—Round, purple; up to a catty in weight.

(*c.*) *"Tzŭ hua."*—Long (4 to 5 inches), purple and green striped.

(*d*). *"Niu nai."*—Long (foot or more), purple; about a catty in weight.

(*e*). *"Pai."*—Long (4 to 5 inches), light green.

These different varieties are in the market from June to the beginning of October.

16. *Celery* (*Apium graveolens, L.*).

17. *Spinach* (*Spinacia oloracea, L.*).

18. *Goosefoot* (*Malva verticillata, L.*).

These three are winter vegetables, but celery blanching is not practised. The leaves of the goosefoot are plucked, cooked, and usually eaten with capsicum sauce.

19. *Coriander* (*Coriandrum sativum, L.*).—The leaves of the coriander are cut fine and fried with other relishes. It is said to be an excellent specific in cases of cold or chills.

20. *Ipomoea aquatica, Forsk.: Ch., "Wêng Ts'ai"* (*"Ung Ts'ai" in Szechwan*).

21. *Amarantus caudatus et gangeticus, L.*

22. *Chrysanthemum segetum, L.*

Like 19, the leaves, of these three plants are fried to make relishes, and in the case of 22 the root is similarly treated.

23. *Basella rubra, L.*—This is a creeper cultivated in market gardens for its leaves only, which are fried to make a condiment. It bears white blossoms in autumn, succeeded by black seeds, which are discarded except for sowing in the following spring. It is called "Juan Chiang-tzŭ."

24. *Cayenne Pepper* (*Capsicum annuum, L.*).—Two subspecies are widely cultivated—*C. longum, D.C.* with long peppers and *C. cordifolium, Mill*, with heart-shaped fruit. This is undoubtedly the most important relish in China. In their unripe or green state the peppers are fried for use as a relish. When ripe and red they are ground up with water in a mortar to form a sauce,

roasted and ground into meal ("mien") which is used for seasoning vegetables, and the whole peppers are also boiled in oil to impart to the latter their pungent flavour. The oil thus treated is known as "La Yu," and will keep good for years.

25. *Mustard* (*Brassica nigra? Koch*).—The leaves of this plant are fried to make a relish and the seeds are ground and used for the same purpose.

26. *Chinese Pepper* (*Zanthoxylum Bungei, D.C.*).—This is a shrub which grows in the mountainous country in the north and west of the province. The fruit is a small dark-brown oval seed, very brittle when crushed, and contained in a ruddy capsule. The latter, not the seed, possesses the aromatic principle, and in private houses the seeds, if any remain (for the capsule opens and drops its seed when ripe), are discarded before the capsules are roasted and pounded in a mortar. The pounded pepper is used for seasoning food. The capsules, too, are softened in water and threaded by needle and thread into chains which are converted into rings and other charms supposed to emit the original fragrance when they come in contact with the moist skin in summer; but in my own experience there is more beauty than fragrance in these charms. In their manufacture care is taken to accentuate the original colouring by the addition of a little aniline dye.

27.—*Ginger* (*Zingiber officinale, L.*).—Ginger is grown everywhere throughout the province and the rhizome shoots used as a relish, to produce which they are treated in different ways according to their age.

28. Bamboo Shoots are used as a vegetable throughout the province. They vary in size and weight according to the kind of bamboo from which they spring. There are several kinds grown in Szechwan and I shall refer to them latter.

29. A sedge produces here, as elsewhere in China, a flower bud which is gathered before opening and eaten as a vegetable. It is locally called the "Kao Sun," and is the "Chiao (Kao) Pai" of Shanghai. This is *Zizania latifolia*.

30. *Cedrela sinensis, A. Juss.*

31. *Pistacia chinensis, Bunge.*

The young spring fronds of these two trees are highly appreciated as vegetables.

32. The following are the Cucurbitaceae cultivated in Szechwan:—

(*a*). *Pumpkin or Ground Melon* (*Benincasa cerifera, Sovi. Ch., "Tung Kua"*).

(*b*.) *Bitter Gourd* (*Momordica charantia, L. Ch., "Ku Kua"*).

This gourd, which is of a greenish white colour with an extraordinary warty exterior broken by longitudinal ridges, is never eaten in its perfectly raw state. It is usually pickled in soy or preserved in

sugar. It attains a length of 15 inches with a girth of $6\frac{1}{2}$ inches, and is shaped like a cucumber. As its rind is particularly thick and tough, nature provides a curious method of releasing the seeds when ripe. The lower end of the gourd bursts, the gourd splits up into three parts, which, curling up towards the stalk end, expose each on its sticky, fleshy surface a double row of blood-red seeds readily detachable by mere contact with the figures. The open gourd, which quickly turns yellow, bears a striking resemblance to a starfish.

(*c.*) *Water Melon* (*Cucurbita citrullus*, *L.* *Ch.*, "*Hsi Kua*").—This melon is always eaten raw. There are three varieties with red (black seeds), yellow (white and yellow seeds), and white (white seeds) flesh.

(*d*). *Squash* (*Cucumis melo*, *L.* *Ch.*, "*Nan Kua.*")

(*e.*) *Luffa cylindrica*, *Roem* (*Ch.*, "*Ssŭ Kua*").

The flesh of the luffa is eaten when young, but when the fruit is ripe the interior becomes a fibrous mas now so well known and so widely used as a flesh brush. There is one use for this fibre which I have not hitherto seen mentioned: the Coreans sew it into their socks to keep their feet cool in summer. The fibre is used in China as a medicine.

(*f.*) *Gourd* (*Langenaria vulgaris*, *Ser.* *Ch.*, "*Hu Lu*").—This gourd, of which there are two varieties, is grown not for food but for its hard shell, which takes the place of a bottle or jar with us. It is either pear-shaped or made up of two spheres separated by a narrow neck, the lower sphere being much the larger of the two Cut in two these shell are used as water balers.

(*g.*) *Gourd.*—A long cylindrical gourd is cultivated for food under the name of "Hu-tzŭ Kua." This is *Langenaria vulgaris*, var. *clavata*.

(*h.*) *Gourd.*—A small roundish yellow gourd ("Chin Kua"—Golden Gourd) is cultivated for decorative purposes only.

(*i.*) *Cucumber* (*Cucumis sativus*, *L.*).

(*j.*) *Vegetable Marrow* (*Cucurbita ovifera*. *Ch.*, "*Sun Kua*").—This marrow does not grow to any great size. It is yellow in colour, from 9 to 12 inches long, with a girth of 6 to 8 inches.

(*k.*) "*Ts'ai Kua*" is the name of a plant which produces a fruit resembling a cucumber, and, like the latter, it is eaten raw. It is *Langenaria leucantha*, var. *longis*.

(*l.*) White very flat melon seeds are on sale in the streets of Ch'êngtu. They are called "Chin Ch'uan Kua-tzŭ," *i.e.*, Golden Stream melon seeds, "Chin Ch'uan" being a synonym for the "Ts'ao Ti" or grass country to the west of Sung-p'an T'ing, and forming part of north-eastern Tibet south of the Kokonor region. They constitute an article of export from Tibet to Szechwan.

Several of the above vegetables are pickled by being steeped in brine for from fifteen days to a month. Twenty pounds of salt are allowed to every 133⅓ lbs. of vegetables.

5. *Fruits.*

The fruits of Szechwan are numerous and varied, and the following table gives their names and chief centres of production :—

1	Apple	Han Chou, Chin-t'ang Hsien.
2	Apple, crab	Chien Chou.
3	Loquoat	Hsin-ching Hsien.
4	Pear	Mao Chou, Han Chou, Tzŭ-yang Hsien.
5	Quince (*Pyrus cathayensis*, Hemsl.)	Chien Chou.
6	Apricot	Chien Chou.
7	Cherry	Chia-ting Fu, Hsü-chou Fu, Ch'êngtu Fu.
8	Hovenia dulcis, Thunb.	Te-yang Hsien, Han Chou.
9	Jujube (*Zizyphus vulgaris*, Lam.)	Chiang-yu Hsien.
10	Lichee (*Nephelium Litchi*, Camb.)	Chia-ting Fu, Lu Chou, Nan-ch'i Hsien, Na-ch'i Hsien, Ho-chiang Hsien.
11	Lungan (*Nephelium longana*, Camb.)	Lu-chou, Nan-ch'i Hsien, Na-ch'i Hsien.
12	Olive (*Canarium album*. Raeusch.)	Ho-chiang Hsien, Chiang-ching Hsien, Na-ch'i Hsien, Kuan Hsien.
13	Peach (*Prunus persica*, S. and Z.)	Chien Chou.
14	Plum (*Prunus communis*, Huds.)	Chien Chou.
15	Buddha's Hand (*Citrus medica, Risso. var. digitata*, Lour.)	Ho-chiang Hsien, Hsü-chou Fu.
16	Cumquot (*Citrus Japonica*, Thunb.)	Chin-t'ang Hsien.
17	Grape (*Vitis vinifera*, L.) ...	Kuan Hsien.
18	Lemon (*Citrus medica*, L.) ...	Chin-t'ang Hsien.
19	Mulberry (*Morus alba*, L.) ...	Chia-ting Fu.
20	Orange (*Citrus aurantium*, L. *Citrus nobilis*, Lour.)	Ch'ung-ch'ing Fu, especially Chiang-ching Hsien.
21	Persimmon (*Diospyros Kaki*, L.)	P'i Hsien.
22	Pomegranate (*Punica granatum*, L.)	Tê-yang Hsien.
23	Pumelo (*Citrus decumana*, L.) ...	Chien Chou.
24	Strawberry, drooping (*Fragraria filipendula*, Hemsl.)	Wa Shan, Ta chien lu.
25	Strawberry, hautboy (*Fragraria elatior*, Ehrh.)	Wa Shan.
26	Strawberry (*Fragraria indinca*, Andr.)	This bright berry dots the banks of streams and canals in May. It is sweet, but flavourless, and is considered inedible by the Chinese.
27	Strawberry tree (*Cornus capitata*, Wall.)	Ch'ung-ning Hsien. This is generally known as *Arbutus*.
28	Bramble (*Rubus pileata*, Focke.)	Western Szechwan.
29	Bramble (*Rubus moluccanus*, L.)	Western Szechwan.
30	Bramble (*Rubus phoenicolasius*, Max.)	Western Szechwan. This is the Japanese wine berry.
31	Raspberry (*Rubus parvifolius*, L.)	These berries grow wild, but the Chinese consider the fruit to be inedible. They are found on the way up Mount Omei (11,100 feet).

32	Currants red and black (*Ribes*).	These berries grow wild in the west of the province.
33	*Actinidia chinensis*	A delicious fruit known as the "Ichang Gooseberry" but more a medlar than a gooseberry, found at high altitudes.
34	Acorn	Several kinds of oaks grow in Szechwan, and in years of scarcity the the acorns are ground into flour, made into a substance resembling beancurd, and in this form eaten by the poor.
35	Chestnut (*Castanea mollissima*) ...	Ch'ung-ning Hsien.
36	Ginkgo (*Ginkgo biloba*, L.) ...	This is the white nut which is so common throughout Western and Southern China. The tree, otherwise known as *Salisburia adiantifolia*, Smith, is common in Szechwan, especially in the hills bounding the valley of the upper waters of the Min River.
37	Hazelnut (*Corylus Colurna*, L., *var. chinensis*)	Chia-ting Fu, especially on Mount Omei.
38	Lotus (*Nelumbium speciosum*, Wild)	The lotus is grown wherever water is available, and the nuts, as well as the rhizomes, are used for food.
39	Pine seeds (*Pinus koraiensis*, S. and Z.)	Sun-p'an T'ing.
40	Torreya nut (*Torreya nucifera*, S. and Z.)	Wu-shan Hsien.
41	Walnut (*Juglans regia*)	Chiang-yu Hsien. Not only is the fruit of the walnut eaten, but, where the tree is largely grown in the north of Szechwan oil is expressed from it.
42	Water chestnut (*Trapa natans*, L.)	This, like the lotus, is grown in Szechwan wherever there is an available water supply.

The banana tree grows in Szechwan, but the fruit never comes to maturity.

Many of these fruits are preserved with sugar at Sui Fu, which is a great centre of the sugar industry.

6. Products of Cereals, Pulse, and Starch-yielding Plants.

1. *Beancurd and Jellies.*—In my book on Manchuria I have fully described the manufacture of beancurd from the yellow soy bean, and it is therefore unnecessary to go into details in this place; but in Ch'êngtu it is preserved and exported in jars like wine. The beancurd is cut into small pieces, drained of its water, and packed in jars with layers of salt. There they remain for forty days, when they are taken out drained of the brine, packed in other jars with ground up bread, red rice (dyed), star-aniseed, and red wine. The jars are then closely stoppered and the preserved beancurd is ready for export. It is also preserved without the wine, which is replaced

by the cold water which had previously drained from it, but with a seasoning of ground-up chillies, star-aniseed, etc. In addition to beancurd, various gelatinous substances somewhat similar in appearance are manufactured in Szechwan from other plants, and they deserve a passing notice. They are :—

(*a.*) *Pea Jelly.*—This jelly is prepared in the following way : A catty of pea flour is thoroughly mixed in a baler of cold water and poured into a Chinese cooking pot containing boiling water amounting to twice the quantity used in mixing the flour. To the boiling water one-tenth of a Chinese ounce of alum has previously been added. The whole is then brought to the boil for a few minutes and afterwards poured into a basin the inside of which has been carefully rubbed with a cloth that has been dipped in rape oil. After nine hours the jelly can be turned out of the basin quite white, hard, and ready to be sliced and sold by the street hawkers, who will realise about 200 cash to pay for the flour (88 cash), alum, fuel, labour, and the necessary profit.

(*b.*) *Sweet Potato Jelly.*—This jelly is prepared in exactly the same way as the above, but two Chinese ounces of Indian corn flour are first added to each catty of sweet potato flour. It is of a reddish black colour, and realises the same price as pea jelly.

(*c.*) *Rice Jelly.*—Ordinary cooking rice is steeped for a night in cold water. It is then removed and ground up with warm water and a small quantity of slaked lime sufficient to fill a small wine cup. Three catties of rice thus ground up and the warm water will weigh about 8 catties. The whole is added to six of boiling water and boiled for half an hour, the contents being constantly stirred during this period to prevent burning. It is then poured into a basin prepared with oil as above. Three catties of rice, costing 124 cash, yield 14 catties of yellow jelly, which will be disposed of for 400 cash.

(*d.*) *Buckwheat Jelly.*—The buckwheat is ground dry and passed through a sieve to remove the husks. The flour is then mixed with cold water and worked by hand for half an hour till it becomes sticky between finger and thumb ; it is then placed in a jar and mixed gradually and throughly with cold water. It is at once baled from the jar into a wooden vessel with a fine silk strainer at the bottom, placed over an empty cooking pot. When it has all strained into the pot, the fire is lighted, and the filtrate boiled for an hour, when it is ready to be emptied into the oiled basin. Seven catties of buckwheat, costing 240 cash, will yield 18 to 19 catties of black jelly of the value of about 600 cash. No alum or lime is used in the manufacture.

2. *Macaroni and Vermicelli.*—Under cereals, pulse, and starch-yielding plants I have frequently referred to vermicelli, and it may be well to summarize here the plants from which it is made, and the methods of manufacture. Vermicelli is made from both rice

and buckwheat flour; but, as already stated, the product remains wet, and is intended for local consumption only. It does not constitute an article of trade in the province. The products of wheat, peas, and beans, on the other hand, circulate in a dry form throughout Szechwan, and are of considerable importance as foodstuffs. Under the head of wheat I have already dealt with flour vermicelli, and a full description of the manufacture of bean (Lü Tou) vermicelli will be found at pp. 184-6 of my book "Manchuria" above referred to. There remains only the product of pea flour for consideration; but even this vermicelli is a compound of pea and sweet potato, the proportions of the mixture being 12 ounces of pea to 6 ounces of sweet potato flour. The two dry flours are well mixed together, and a small quantity of the dry compound is put in a bowl, mixed with cold water, and well stirred. This is poured into a larger vessel, which is then filled with boiling water, and the whole is rapidly stirred till it assumes the consistency of starch. During the process of stirring, four-fifteenths of an ounce of dry alum is added and melted up, and the liquid compound is gradually added to the dry flour (in this case 4 lbs.), and the whole kneaded into dough, which is then placed in a wooden baler having thirteen round holes drilled in the bottom, each hole measuring five-sixteenths of an inch in diameter. By a little gentle pressure the dough flows through the holes in round strings, diminishing in diameter as they descend into a pot of boiling water, whence they are quickly transferred to a bucket of cold water. When cool they are hung up on a bamboo framework to dry and bleach in the sun. At the end of three days this beautifully white vermicelli is made up into hanks and bundles for sale. Four pounds of flour, costing 258 cash, yield six pounds of vermicelli, which is sold at 72 cash a pound or a total of 432 cash.

3. *Soy or Bean Sauce.*—Two kinds of soy are manufactured in Szechwan—white and red—or, as the latter is frequently called, black:—

(*a.*) *Red Soy.*—In describing the manufacture of soy, I propose to give the exact quantities employed, so that a better idea of the amount of soy yielded by them may be obtained.

Twenty-eight catties of yellow soy beans are steeped overnight in cold water. In the morning they are removed in their swollen state and steamed for five hours. They are then taken from the steamer, spread out on mats, and allowed to cool, after which they are thoroughly mixed with 20 catties of wheat flour and placed in a basket made of split bamboo. In six or seven days, as soon as yellow mould begins to appear, they are placed in an earthenware jar with 30 catties of cold water (well-water preferred) and 30 catties of granular salt and the whole is thoroughly mixed and the jar covered. In three or four days the jar, which has been placed in

the sun, is uncovered and the contents stirred by hand, and the same takes place daily for three months. At the end of this time the liquid has all evaporated. During the following months the cover is removed during the day and replaced at night. The contents are now a black pickle, and may be eaten as such; but to obtain the soy they are divided up into equal parts and placed in two earthenware jars, to each of which is added 40 catties of boiling well-water. The contents of each jar are now thoroughly mixed and stired up and a fine bamboo sieve in the shape of a basket is placed in the jar. The liquid escapes into the basket while the dregs are kept back by the sieve. In two or three days the liquid has all drained into the basket, when it is baled out and boiled with two catties of white sugar or glucose manufactured from glutinous rice, already described, with the addition of two or three ounces of mixed whole chillies and star-aniseed. Each jar will yield 35 catties of red soy, valued at 96 cash a catty, so that the 28 catties of yellow beans, with the other ingredients, yield 70 catties of soy. A whole year is required from the steeping of the beans to the production of this soy.

(*b.*) *White Soy.*—In the case of white soy the beans are first roasted in sand which has been previously heated in an iron pan with a mixture of rape oil. This roasting is complete when the beans open or spilt, and the sand is removed by sieve. They are then placed in an earthenware jar and steeped in cold water for twelve hours. They are afterwards steamed as in the manufacture of red soy, and mixed with flour and salt; but, instead of 30, some 60 catties of water are added to prevent the blackening of the beans and the discoloration of the soy. The daily uncovering, stirring, and recovering take place as in red soy, but at the end of 120 days the solid matter is removed and the liquid alone is exposed in the jar to the sun. This soy is ready for use at the end of the 120 days, but improves by keeping and exposure to the sun. No sugar or glucose is used, and the seasoning is placed in the jar with the 60 catties of water. Nor is there any boiling before use. The cost of white soy, which is more yellow than white, is from 80 to 96 cash a catty, according to quality.

4. *Vinegar.*—The following is a description of the process by which vinegar is manufactured in Szechwan :—

Rice (40 lb.) is boiled to a pulp and rice and water are poured warm into an earthenware jar or kang. Twenty catties of ferment (see below) is then added. Fermentation takes place in twenty-four hours, but the mixture remains untouched for three days. After the lapse of that period it is poured into a wooden tub containing 160 catties of dry wheat husks, and the whole is carefully mixed up by hand and then covered to exclude the air. In two days the cover is removed and the mixture again stirred and covered, and for the next fifteen days the uncovering and stirring take place once a

day. The tub is then carefully covered for three days, when the contents are transferred to a large round wooden vat and levelled therein by hand. Lotus leaves which have previously been softened in water are then spread on the top, and above these a layer of clay some 4 inches thick. The mixture remains in the vat from fifteen to thirty days. The clay and lotus leaves are removed and the contents divided into three equal parts, which are placed in three large earthenware jars on the top of a strainer resting above an opening drilled at the bottom and side of each jar. A wooden plug fits the opening. Each jar is then filled with cold water and the whole allowed to stand for 24 hours, when the liquid is drawn off and again poured into the jar, where it remains for another 24 hours, when it is finally drawn off. With the above proportions of rice, wheat husks and ferment, each jar yields 40 catties of vinegar, which is then brought to the boil with 3 ozs. of orange peel, whole chillies, and star-aniseed in equal proportions to add to the flavour. The vinegar is then strained into jars and is ready for use; but it is considered better to place the jars in the sun for some time to ensure the retention of the flavouring. The vinegar can be produced for 64, but the factory sells at 80, cash a catty.

The ferment is made by mixing ground-up unhusked barley and wheat in the proportion of one to four with cold water sufficient to form a paste, which is moulded into bricks. The latter are piled, with interstices for the passage of air, in a room which is carefully sealed up to exclude draughts until fermentation takes place. When the bricks are thoroughly permeated by the ferment, they are repiled without interstices, and may be kept and used for a period of three years.

5. *Wines and Spirits*:—

(*a*) *Wine*.—The basis of all Szechwan wines, which pass under a variety of names according to their flavour and colour, is glutinous rice. Such names as "Fo Shou Chiu," "Kuei-hua Chiu," and "Tung sang Chiu" owe their origin to the fruit of *Citrus sacrodactylus*,* the flowers of *Osomanthus fragrans*, and the leaves of *Morus alba*, with which they are respectively flavoured, while "Hang Shao Chiu," "Pai lao Chiu," and "Hung lao Chiu" owe their names principally to their colour. This again is dependent on the ferment used in their manufacture, whether it is raw or baked, and, if the latter, on the amount of colour which is imparted to it. In "Hang Shao Chiu," for example, the ferment (wheat) is not baked; in "Pai lao Chiu" (white old wine) the ferment is slightly baked, but not sufficient to colour the wine; and in "Hung lao Chiu" (red old wine) the ferment is baked brown, and gives to the liquor its ruddy tint. Although these names convey to the Chinese

*Citrus medica, var. digitata.

mind different kinds of wine, the principle of manufacture is practically the same. It is as follows :—

A bushel (32 lbs.) of glutinous rice is steeped in an earthenware jar for a night in cold well-water. Next morning the swollen rice is removed and steamed for two hours. At the end of this time the steamer is placed on a wooden stand and buckets of cold water are poured into it to cool the rice, which, after the water has all drained off, is placed in a shallow round wooden tub and thoroughly mixed with $10\frac{2}{3}$ ozs. of ground rice (the ordinary food rice) ferment. The mixture is at once placed in an earthenware jar and a circular hollow, 8 inches in diameter at the top and narrowing to 4 inches at the bottom, is made in the contents of the jar, which is tightly closed with a large stopper made of straw. At the end of twenty-four hours the stopper is removed, and examination shows that the lower half of the circular hollow is full of liquid. The jar is again stoppered for forty-eight hours, when a second examination reveals the hollow to be quite full ; $1\frac{1}{2}$ "shêng," or $4\frac{1}{2}$ lbs. of wheat, ferment are now added, the whole is thoroughly mixed up by hand, 32 to 40 lbs. of cold water are poured in, and the jar again stoppered. This mixing and stoppering is repeated daily for eight days when the contents of the jar are emptied into a wooden vat and forthwith packed in pongee silk bags, 3 feet long by 9 inches wide. The bags, which are securely tied at the month, are then placed in a sloping wooden press and covered with a tight-fitting wooden lid, which is pressed home by a lever and kept in this position for five hours, when it will be found that the liquor has all escaped from the bags and drained down the slope into a jar. The liquor is then poured into a large kettle of tin, about 3 feet in diameter and 2 feet high, and provided with a spout. The lid is put on and the kettle and its contents placed in a deep iron pot of boiling water. A large wooden lid, with four small perforated round holes placed at equal intervals in the circle, and provided with movable pieces of wood whereby the holes can be exposed or closed at pleasure, is placed on the top, and nothing but this lid is visible. What is now required is to bring the wine to the boil in the kettle, and while the boiling is proceeding the jars in which the wine is to be ultimately stowed are placed bottom upwards, their necks covering the perforated holes in the lid. The steam escaping from the boiling water ascends through the holes into the jars and heats them, and, as soon as the wine in the kettle has been brought to the boil, jars and wooden lid are removed, the kettle taken out, and the wine poured from the latter into the jars. The particular flavouring desired is added when the jars are being filled, and consists of a small cup of spirit in which the fruit or leaves have been steeped. As soon as a jar has been filled a round dry lotus leaf is spread on the mouth and neck, a cross band of bamboo bract is placed on the top of the leaf,

and a narrow strip of bamboo is tied tightly round the lip or neck of the jar keeping leaf and bract in position. Clay is then added round neck and top to exclude the air, and the wine is ready for market. I have been unable to discover the exact composition of the rice ferment, which is a trade secret; but in the case of the wheat ferment, the grain is ground up, mixed with water to form a paste, moulded into bricks, and covered with straw for three days, when the bricks are sufficiently fermented to be ready for use. A jar containing 30 catties, or 40 lbs. of wine, is sold at the factory at from 500 to 800 cash, according to its strength—that is, according to the amount of water added in the process of manufacture. A bushel, or 32 lbs., of glutinous rice will yield 60 catties, or 80 lbs. of wine.

(*b.*) *Spirits.*—There is one kind of spirit, called "Ta Ch'ü Chiu," or great ferment spirit, the manufacture of which is, so far as I know, confined to Szechwan. Although it is distilled generally throughout the province, the district of Mien-chu, some 50 miles north of Ch'êngtu, holds the reputation of producing the best spirit, and it is widely advertised on the signboards of the wine shops of Ch'êngtu. I shall describe the process of manufacture as carried on in a distillery with which I am acquainted and in doing so my figures will represent the actual quantities of material and output used and obtained at one distillation.

Unhusked barley, millet (*Holcus Sorghum, L.*), and Indian corn, each weighing 880 lbs., are separately ground fine and afterwards well mixed. To this are added 133⅓ lbs. of rice husks, and distributed evenly throughout the ground grain. The mass is then divided into three equal parts and placed in three wooden steamers over iron pots each containing about 60 lbs. of boiling well-water. After an hour's steaming the grain is removed, the contents of each steamer being piled up separately on a clean concrete floor. A hollow is made in the top of each pile, and the whole of the boiling water from each pot is poured into its respective pile. The grain must neither be too dry nor too wet before future manipulations, and the test is made by a workman taking up a handful and rubbing it together close to his ear. If the sound is satisfactory, each pile is levelled on the floor with flat wooden spades, and allowed to remain till cool. It is then shovelled into drills and in the hollows between three and a half bricks, each weighing 12 lbs., or 42 lbs. of pulverized ferment, are spread and thoroughly mixed with the grain, which formed one pile. That is to say, 126 lbs. of ferment are required for the whole quantity under treatment. The grain is then packed in three separate concrete pits, each of which is covered with an inch-thick layer of clay mixed with paddy husks for binding purposes. It remains there for a month untouched, when it is removed and the contents of each pit spread on the floor and mixed with 176 lbs. of ground raw barley, millet, and Indian corn in equal proportions, and

26 to 27 lbs. of paddy husks. The stuff is now ready for distillation and is placed in the steamer fitted with a sloping wooden lid having a round opening at the top whereon rests the leaden condenser with its overflow pipe and draining tube. The steam rising from the grain in the steamer is condensed by the cold from the water in the condenser, and flows as spirit down the draining tube into an earthenware receiver. In two hours the whole of the spirit has passed over, and the contents of the steamer are removed and again packed in an empty pit for another month in the method described above. At the end of this month raw grain and husks are added as before, and it is again distilled. This is done a third time, but for the fourth and final distillation neither grain nor husks are added. At each of the four distillations 35 catties, or 46⅔ lbs. of spirit are obtained, so that each pit yields 140 catties, making the total yield of the three pits in which the grain was originally packed 420 catties, or 560 lbs. That is to say, 4,224 lbs. of grain, 240 lbs. of rice husks, and 126 lbs. of ferment, of the value of under T. 60, yield 420 catties of spirit worth about T. 84, leaving a balance of over T. 24 for fuel, labour, and profit.

This, however, represents the yield during the cooler months only, for in hot weather condensation is difficult, and a certain quantity of spirit is lost.

7. *Sugar.*

Two kinds of sugar cane are cultivated in Szechwan. They are—

1. The purple—or, as it is called by the Chinese, the red cane, which is cut up into short lengths and exposed in every street and on every roadside stall, and used for chewing purposes only; and

2. The yellow or white cane, which, although chewed occasionally during the season, is the source of the very extensive sugar output of the province.

The traveller in Szechwan will look in vain for a field of purple canes, for when growing, and even when ripe, they are covered with a creamy white substance, and it is only after they have been harvested by uprooting in November, and pitted for a time, that they develop their purple colour. They are unearthed as required for consumption, and are available all the year round. A whole cane measures 4 to 5 feet in length, with a girth above the root of 4 to 4½ inches, tapering very gradually to some 3 inches near the tip. When I say the tip I mean the tip of the cane exclusive of the leaves which surmounted it when growing. A good cane of this length will have twelve to fourteen joints separated near root and tip by short intervals which increase in length to some 6 inches at the centre. It is from these joints that the new canes of the following year spring, the

planting out in the end of March and beginning of April consisting in laying down cuttings of old canes in shallow trenches, and covering them with soil. The price of a whole purple cane is in Ch'êngtu about 20 cash, while the short lengths are retailed at from 2 to 3 cash apiece according to size. It is not improbable that this purple cane is the *Saccharum officinarum*, var. *rubricaule*.

The white (*Saccharum officinarum*, var. *sinense*), which attains often a height of 9 feet exclusive of its crest leaves, is much slenderer and longer-jointed than the purple cane, and is much more widely cultivated. Although hills and mountains alone bar its growth in Szechwan, there are certain well-defined areas of cane cultivation and sugar production in the province. They are the valley of the T'o River, especially Nei-chiang Hsien and the valley of the Yangtsze from Hsü-chou Fu to Chungking. Nei-chiang sugar has a special reputation, and it is advertised on shop signboards all over the province; but I am inclined to think that much of the product so advertised was manufactured many miles outside that district. Although the cane is ripe in the end of November, I saw numerous brakes uncut (the white canes are not uprooted), in January between Chung-king and Hsü-chou Fu. They were waiting their turn to be harvested and crushed at the small sugar factories scattered at intervals along the banks of the river. I visited several of these factories, and the following description of one of them will give an idea of the process of sugar manufacture in Szechwan :—

In the centre of a circular-roofed shed two stone cylinders, 4 feet high by 2 feet in diameter, are fixed side by side in a stone bed by wooden axles, and are kept in position by a wooden bar into which the wooden axles at the top of the cylinders fit. This bar is held by stone pillars sunk in the ground at each end. The stout top axle of one of the cylinders projects high above it, and into the projecting part a long curved wooden lever sloping downwards to the edge of the shed is firmly fixed. At the end of the lever two water buffaloes are harnessed, and the lever is curved sufficiently to clear, when it is dragged round, the wooden bar which keeps the cylinder in position. A short distance under the upper parts both cylinders are grooved, and wooden cogs inserted, so that when the lever is dragged round by the water buffaloes the cogs of one cylinder fit into the grooves of the other, and both cylinders revolve inwards, but in opposite directions. The lower halves of the cylinders are smooth, and the canes are fed between them, passing out at the other side, while the juice descends into a tank below, which drains off into another tank near the boilers. This cane press is a somewhat rude form of the "Chica Ballapura." In a room alongside the circular shed a platform 20 feet long by 8 feet wide was built of brick and lime 2 feet above the floor. On the opposite side of the platform, and below the level of the floor, was a long furnace in which coal

costing 3 cash a catty was being burned. Into the platform six iron pans were built 2 feet below the top—three arranged in the form of a triangle evidently to economise space, and the other three in a line stretching from the base of the triangle, and at right angles to it. The diameter of each opening on the top of the platform was about 3 feet. When I entered this room each pan contained juice in different stages of boiling, and there was a tub alongside into which scum from the various pans was being emptied. One workman was busy ladling juice in small quantities from one pan into the other from the apex of the triangle inwards, while another was violently stirring the end pan (furthest from the triangle) in which the juice was concentrating, with a wooden plumper. Soon after my arrival the contests of this pan were ladled into a cold iron pan, where they were again vigorously stirred for ten minutes with a miniature iron spade, and then poured into wicker baskets of various sizes loosely lined with paper. These baskets were sized to contain from 2 to 30 catties, and their contents, when cool and adhering to the paper, resembled toffy rather than sugar; but it goes under the name of brown sugar ("Huang T'ang"), and is a very important article of internal trade, entering largely into the manufacture of confectionery of every description. This brown sugar, which is very imperfectly crystallized, being sticky and full of syrup, was worth at the factory 30 cash a catty, or T. 2½ per picul of 133⅓ lbs. In Ch'êngtu the retail price is 40 cash a catty. It is refined into what is called white sugar ("Pai T'ang"), a granular sugar of a brownish-white colour. Wooden vats with drainage holes in the bottom are carpeted with grass, filled with brown sugar, and covered with vegetable ashes or earth. The vats are then exposed in the open night and day for about thirty days, and moisture percolating through ashes or earth and sugar washes away the syrup, which escapes through the drainage openings. After the lapse of thirty days the ashes or earth are removed, and the contents of the vats further bleached by spreading on mats in the sun until the necessary quality of whiteness is obtained. This sugar, which is unadulterated, costs 80 cash a catty; but a much whiter article can be procured if the purchaser is content to pay for an admixture of pea flour.

Barley sugar, or sugar candy, is manufactured from the so-called white sugar by fusion, and the necessary high temperature to effect the fusion is attained by mixing lard with the sugar. In Ch'êngtu, barley sugar, which consists of large dingy-brown crystals, is retailed at 140 cash a catty—about 2⅓*d.* a pound. It is generally used as a sweetmeat. The visitor to the sugar-producing centres of Sze-chwan will not fail to notice, during the season, strings of porters each carrying a couple of buckets full of a black liquid towards the cities and market towns, and, on inquiry, he will be told that it is "Lou-tzŭ T'ang," or drained sugar, that is, the liquor containing

the syrup which has drained from the vats during the conversion of brown into white sugar. It is, of course, sweet, and is used for mixing with water as a beverage as well as in baking whole rice cakes. For long distances drained sugar is put up in tubs of a capacity of over 200 catties each. Chungking, for example, is supplied in this way from Chiangching Hsien higher up the river, the cost per catty being 20 odd cash. The rice cakes with which it is backed cost at the port 2 cash apiece.

It appears to me that there is much waste in the production of sugar. Apart from the fact that the juice is not exhausted by the primitive crushing of the canes, the appearance of the brown sugar shows that it is very imperfectly crystalized in the boiling process, probably due to the development of acidity, and were a little quicklime added prior to boiling, there can, I think, be little doubt that much better results would be obtained. Sugar is a great industry of Szechwan, and is largely exported eastwards, so that a little more care would greatly add to the resources of the province.

8. *Tea.*

The Province of Szechwan not only supplies itself with tea (*Camellia Thea, Link.*), but exports the whole of its surplus—no small quantity—for consumption in Tibet. It must not be suppósed for a moment that the many millions of this province all drink tea. It is a beverage in which all who can afford it indulge ; but in remote parts—that is, remote from the producing centres—tea is a luxury available only to the well-to-do classes, and it should always be borne in mind that, whereas in Great Britain tea is an essential part or accompaniment of at least two daily meals—if I may call afternoon tea a meal—in China generally, and even in tea-growing provinces like Szechwan, the cup that cheers is in no sense the constituent of a meal. A cup of tea in China, while primarily taken to assuage thirst, is a thing to play with, set before a guest, and talk over. A tea-house in a large city like Ch'êngtu resembles a club. It is the meeting place where gossip is carried on and the latest scandal regarding one's neighbours and acquaintances is tossed about and gathers strength in its gyrations. In the busy centres of China tea drinking is a comparatively cheap luxury. One takes a place at a table *al fresco* or under cover and calls for a cup. The waiter responds, puts a pinch of dry tea in a cup, fills the latter up with boiling water from a kettle, covers it with a shallower inverted cup to prevent the escape of the heat and the aroma, and leaves the customer to sip the infusion and manufacture and pass on scandal to his companions from morning to night for the sum of 3 cash, renewing gratis the boiling water as often as the consumer requires it, but charging 3 cash for each renewal of the leaves.

Although tea is grown in the east of the province, the great tea-producing districts of Szechwan are the hills and mountains to the west of the Min River, forming parts of the Prefectures of of Ya-chou and Chia-ting, the independent Sub-prefectures of Moukung and Li-fan, and the district of Kuan Hsien, in the Ch'êngtu Prefecture. Of these, the city of Ya-chou is the great centre of tea manufacture, not only for Szechwan, but also for Tibet, the processes being perfectly distinct for the two markets. Whereas Szeshwan prefers the leaves fired in their green state without previous fermentation, but well scented, usually with jasmine, the Tibetans like not merely the infusion but something substantial in the shape of leaves and twigs dried, fermented, fired, or steamed, and hammered into loose bricks, which they pulverize and make into soup with butter after straining. This latter is the brick-tea of Tibet which many foreigners have heard of but few have tasted, and these few, I am safe to say, have expressed no anxiety to be helped a second time. This I can testify from personal experience.

Tibet and its trade have not unnaturally exercised considerable fascination over many of the British Consular officers who have been stationed in Western China since 1877, and several of them have, in the course of their wanderings, collected valuable information regarding both. Tea is a necessity of life to the inhabitants of Tibet, it is the chief import into that country from Szechwan, and as such has received the closest Consular attention. In the early days of our acquaintance with this province we thought that the best way to arrive at an estimate of China's trade with Tibet was to follow the great trade highway through Ya-chou and Ta-chien-lu and note what passed over it. This Mr. Baber did in 1877, visiting both Ya-chou and Ta-chien-lu, and in his Memorandum on the Chinese Tea Trade with Tibet of January 1879 he estimates the export of brick tea (the manufacture of which he fully describes) at about 10,000,000 lbs., of the value of some 160,000*l*. In 1883, I followed in Mr. Baber's footsteps, and estimated the total value of the Chinese tea trade with Tibet at between 150,000*l*. and 200,000*l*. At that time, however, the northern trade route to Tibet through Sung-p'an T'ing had not attained its present dimensions, and Mr. Litton, who visited Tochien-lu February 1898 and Sung-p'an in 1897, gives the latest figures on the subject of the Tibetan tea trade. They are : through Ta-chien-lu, T. 1,100,000, through Sung-p'an, T. 760,000—a total of T. 1,860,000, or at the exchange then ruling, some 200,000*l*. When I again found myself in Szechwan in 1903, I determined to approach the subject of Tibetan trade a second time, and, as Ch'engtu is the residence of a Taotai (Yen Ch'a Tao), who exercises superintendence over the salt and tea production of the whole province, I asked him in a friendly way if he would kindly supply me with a list of the places of production and the annual output of these two

articles. He willingly agreed, and as he was a gentleman who had held office in Shanghai and was acquainted with foreigners and their ways, I began to think that I had made a friend who would assist me in satisfying my thirst for knowledge. He called upon me some days later, and blandly produced from the leg of one of his boots what he described as the information I had requested. A glance at the list showed me how incomplete it was, and I pointed out to him that I did not see the names of several important salt wells in the province which I had myself visited twenty years ago, and one especially which I had carefully examined on the way up the Yang-tsze a month or two before, while Ya-chou, the great centre of tea production, was omitted altogether. He seemed somewhat uneasy, and said that my mind was too exacting as to details; but after I had told him that information was of no value unless exact, he promised to send me a revised list. I have not seen my friend since, and although I reminded him twice by letter of his promise, he did not even favour me with a reply. My thirst for knowledge was evidently considered dangerous. He has since been promoted, and is no longer in charge of salt and tea; but I have kept the lists he handed me as an official curiosity. Information derived from merchants on the spot may not be altogether reliable, and must be looked upon as only approximate, but it is infinitely more trustworthy than anything that emanates from official sources. And it is only by questioning and cross-questioning—not one but several—merchants that even the approximation can be arrived at. Had I put any faith in the official list, I should have been under the impression that the total export of tea from Szechwan to Tibet amounted to only 1,000,000 lbs., and that the only places exporting are Mou-kung T'ing and Li-fan T'ing, whereas the total export approaches 40,000,000 lbs., of which the Kuan Hsien district alone sends at least 4,000,000 lbs. through Sung-p'an T'ing. In May I paid a flying visit to Kuan Hsien, traversed a few miles of the Sung-p'an road to the north of the city, and saw with my own eyes tea-porters with their 120-catty (160 lbs.) loads bound northwards to Sung-p'an. There the tea changes hands, and is transported north-west into the grass country of Tibet. Each package of tea really weighs 122 catties, the extra two catties being the weight of the bamboo matting.* By a slip, or what is more likely a printer's mistake, Mr. Litton, at p. 19 of his "Report of a Journey to Northern Szechwan" (China, No. 457, Miscellaneous

*In the autumn of 1904 I visited Ta-chien-lu and the results of my investigations, details of which will be found in my "Report of a Journey to the Eastern Frontier of Tibet" [China No. 5 (1905)], was that 581,500 packages of brick tea of four qualities with a total weight of 8,533,000 catties or 11,377,333 lbs. and a value T. 948,591 annually pass through that town for consumption in the west of the province and Tibet.

Series) makes the price of tea at Kuan Hsien "6 or 7 catties for the tael," while in the Table on p. 22 he values each package of 120 catties at Sung-p'an at T. 8. The latter is, of course, the correct valuation, for each package at Kuan Hsien costs T. $2\frac{1}{2}$ without the duty, *li-kin*, and other charges, which amount to T. 1. That is to say, a 120-catty package of tea on leaving Kuan Hsien is worth T. $3\frac{1}{2}$, and the carriage by porter (I questioned several) amounted to 3,000 cash (*i.e.*, Mr. Litton's 25 cash a catty) or T. $2\frac{1}{2}$, the original value of the tea. The difference of T. 2 is accounted for by additional taxation and the merchant's profit at Sung-p'an.

In the mountainous country to the north of the Ch'êngtu Plain the tea is made up in half packages of 60 catties each for the Tibetan market at Sung-p'an.

What may be the extent of the production of finer teas for the Szechwan market it is impossible to say, and it would be rash to hazard even a guess. Many fine teas are, however, prepared, and I have seen fifteen samples of tea purchased in Ch'êngtu, ranging in price from 2,400 to 48 cash (T. 2 to T. $^1/_{25}$) per catty. That is to say, the price of 1 catty of the best tea prepared will purchase 50 catties of "Lao Ch'a" (old tea), the most inferior article in the market. Ten of these samples (the finer teas) are scented with jasmine, the remaining five are plain. I have also seen a sample of what is called "K'u Ting Ch'a" (bitter tea). It is, however, not a tea but the leaves of the mulberry steamed, mixed with rape oil, and pressed into cakes of the consistency of Cavendish tobacco, which it very much resembles. It is of a dark brown colour, and the infusion is used as a cooling beverage in hot weather. There is another tea prepared in the prefecture of Chia-ting which I met with in my travels twenty years ago, but I was unable to procure a sample in Ch'êngtu. The leaves are curled up into the shape of pellets, and I was informed that this peculiar formation was effected by sprinkling limewater on the tea leaves during the process of firing. Like the bitter tea mentioned above, the tea with the natural flavour of milk and sugar which Mr. Baber discovered in a temple on Mount Omei, and with which the priests regaled him, was afterwards discovered to be a preparation of the leaves not of a camellia but of a viburnum.

9. *Tobacco.*

The cultivation and manufacture of tobacco is one of the great industries of Szechwan. The plant (*Nicotiana tabacum, L.*) is grown extensively throughout the province for local consumption; but the chief centre of production and export is the Plain of Ch'êngtu, notably the districts of Chin-t'ang Hsien, P'i Hsien, and Shih-fang Hsien. In spite, however, of the large output of Sze-

chwan, considerable quantities of tobacco, prepared for smoking in the Chinese water pipe, are annually introduced overland from Lanchou Fu, in the Province of Kansu, which is famed for the excellent flavour of its leaf. I have visited P'i Hsien, and the following is a description of the methods of cultivation and preparation practised in that district.

The seed is sown in a seed-bed in October and the bed is then watered with liquid manure and covered with rice straw. When the seedlings have attained the height of half an inch the straw is removed and screens made of rape stalks are set up to protect them from frost, snow, and cold, to which they are exceedingly sensitive. If the weather is dry during the winter months the seedlings are watered several times. In March they are sufficiently advanced to be transplanted into rows 18 inches apart, and a like distance between the plants. A considerable interval is left between each set of two rows, and in the end of April the plants are banked up, each two rows forming a bed of fine black loam about $2\frac{1}{2}$ feet wide, with the plants near the edges, while the intervals between the beds are converted into trenches 2 feet deep by $2\frac{1}{2}$ feet wide at the top, and narrowing to about 1 foot at the bottom. These trenches are the irrigation channels, and the Plain of Ch'êngtu being one network of streams and canals diverted from the Min River, it is a very simple matter to allow the water access to any particular field, as required. After banking up has taken place the trenches are filled with water every morning to within an inch or two of the surfaces of the beds, and as the plants are close to the edges their roots are easily irrigated. Every four or five days, however, liquid manure is applied to the plants instead of water. By the middle of May the plants have grown to the height of a foot or more, and the tops are then snipped off by hand to prevent flowering and to divert the sap to the leaves which have already attained large dimensions. Irrigation now practically ceases unless the weather is exceptionally dry and the crop is harvested from the middle to the end of June.

Each leaf, with its stalk, is carefully removed by hand and spread between two openwork bamboo screens capable of holding twelve or thirteen leaves without over-lapping. The screens are placed in the sun for four or five days, when they are opened and the leaves, which are now of a brown colour, removed. The contents of about a hundred of these screens are then placed together between two larger but similar screens, and firmly bound with rope for four or five days, when the bundle is opened and each leaf removed separately by hand and assorted into bundles of about $3\frac{1}{2}$ catties in weight, each of which is tightly bound with a band of rice-straw encircling the flat bundle across the width. Each bundle contains about 130 leaves, of the value of T. 0·1·2 to T. 0·1·3 per catty. In this form, called "Ta Yen," or large tobacco, the bundles are packed,

circulate throughout the province, and find their way down the Yangtsze beyond the borders of Szechwan.

The smaller leaves, called "Erh Yen," or second tobacco, having undergone the same processes as the preceding, are manufactured into "Shui Yen," or water tobacco for smoking in the Chinese water pipe. The stalks and larger veins having been removed by hand from the leaves, the latter are spread in layers in a wooden box 2 Chinese feet square and 6 inches deep, and rape oil is sprinkled between each layer. A box of this size will contain 50 catties of leaf. When full a lid is placed on the top and weighted with stones to press out the superfluous oil. After two days stones and lid are removed and the contents of the box cut up into slices about 2 inches wide. These slices are placed in a press for from four to six days till they are sufficiently hard to be planed into thin tobacco called "Tiao Ssu" and costing 320 cash a catty. An inferior quality of water tobacco is made by adding with the rape oil two to three catties of "T'u-hung," a red-coloured earth, to every 50 catties of leaf when placed in the box. This quality is called "Shuang Lan," and costs 220 cash a catty. The stalks and veins of the leaves are dried, ground up, and added to the water tobacco.

The tobacco most generally manufactured and consumed in Szechwan as well as exported is called "So Yen" or cord tobacco. The leaves are harvested by knife, and each stalk is cut close to the stem of the plant. Two inches of the end of each stalk are bent over to form a hook, and by this means the leaves are hung on cord or rope stretched under cover in sheds or under the eaves of houses. In the centres of tobacco cultivation special sheds are erected for the purpose. The leaves are in this way exposed to the air for twenty days. At the end of that period they have changed from green to brown and have shrivelled up laterally. On the twenty-first day they are hung outside the sheds for one night and exposed to the dews of heaven. Next morning they are taken in and rolled up tightly with the cord in bundles of about 20 catties in weight. After two days the bundles are opened, suspended under cover for two days, and again exposed for one night in the open. This takes place a third time when the leaves are removed from the cord and assorted according to size. They are now ready for market, the larger leaves being worth 130 cash a catty and the shorter 60 cash. For transport purposes they are made up into bales of 200 catties bound with bamboo screens but open at both ends. The district of P'i Hsien is credited with only 2,000 piculs of cord tobacco, its principal energy being devoted to the production of "Ta Yen," "Erh Yen," and water tobacco, which is placed at 120,000 piculs. Chin-t'ang and Shih-fang districts, on the other hand, devote themselves for the most part to the manufacture of "So Yen." In P'i Hsien the best land is said to produce 400 catties of dry leaf per "mou" and inferior land

about 250, or about a ton and a half and a ton respectively per English acre. The consensus of native opinion is that the best flavoured leaf in the province is grown in the district of Chin-t'ang, and is closely followed by P'i Hsien and Shih-fang Hsien. The best "T'u-hung," or earth-red, used for mixing with the inferior water tobacco, comes from Chiang-an Hsien on the Yangtsze, between Lu-Chou and Hsü-chou Fu. It costs 40 cash a catty. A lighter coloured earth-red, costing 12 cash a catty, comes from Hsin-ching, Tan-ling, and Chia-ting. So far as I can gather, it has no properties beyond that of colouring. Many years ago the excellence of the Szechwan leaf was discovered, and trial shipments were made to Europe, and, were better methods of preparation introduced into the growing districts it is probable that this industry would have a great future, especially in foreign markets.*

In the hilly and mountainous country to the north and west of Ch'êngtu, *Nicotiana rustica L.* is cultivated for local consumption only. The product does not constitute an article of provincial trade.

10. Opium.

In the year 1881 a special volume on the subject of opium was issued as a Customs publication by order of the Inspector-General of Customs. In this volume the results of an attempt to arrive at the quantity of native opium produced in China at that time are given; but the Estimates received from the Commissioners at the various Treaty ports to which the inquiry was addressed differed so widely, ranging as they did from 12,000 to at least 265,000 piculs, that the Inspector-General in his introductory note to the volume simply assumed that the native production did not exceed the foreign import, which was there placed at 100,000 piculs. Assuming, in the same way, but on more reliable data, that the average daily consumption of an opium smoker amounts to three-tenths of a Chinese ounce, he arrived at the conclusion that the number of opium smokers in the Chinese Empire was 2,000,000 out of the population, which he took to be at least 300,000,000, or two-thirds of 1 per cent. The great difference in the estimates arrived at by the Commissioners proves the difficulty, not to say impossibility, of obtaining accurate information regarding the interior of China at the coast ports, and, even in the interior, with the poppy growing all round one, the difficulty, if less acute, still exists, for while it is easy enough to ascertain the average quantity of opium which an acre of land will yield, only an approximate estimate of the area annually under

*The export from Szechwan of leaf and prepared tobacco through Chungking amounted to 103 piculs in 1904, when my Report was written, and has increased to 37,624 piculs in 1919.

poppy can be discovered. Szechwan at one time was a great wheat producer and exporter, but with the rapid extension of poppy cultivation in the province, that export ceased, and was replaced by opium. It is too readily taken for granted that the cultivation of the poppy trenches on the food crops of the people, but it must be remembered that it is a winter crop, and shares the ground with wheat, rape beans, peas, and barley. Szechwan still produces sufficient flour for home consumption, and the export of wheat of former years gave way to opium, which the farmer found a much more profitable crop. I am not defending the cultivation of the poppy, I am merely looking at its economic value to the province. An English acre of wheat will on an average yield grain of the value of 4*l.* 5*s.* 6*d.*, whereas a similar area will produce raw dry opium of the value of 5*l.* 16*s.* 8*d.* In the one case we have 19 cwt. of wheat, worth 4*s.* 6*d.* a hundredweight, in the other 297 Chinese ounces of raw opium, worth on an average 200 cash an ounce. It may be said that the farmer has his straw to dispose of, and that much less labour is required in the cultivation of grain, but in the case of the poppy he can sell the juice-drained capsules and stalks for fuel and dispose of the seed to an oil mill. As a matter of fact the poppy seed and stalks are of considerable value. I am informed that an acre of poppy will yield 26·4 bushels of seed, each bushel weighing 32 lbs., and that it is worth T. 0·6 per bushel, a total of T. 15·8·4, or about 37*s.*, while the same area is credited with 52·80 piculs of stalks, worth 150 cash a picul, making a total of 7,920 cash, equivalent to about 18*s.* An acre of wheat straw, on the other hand, weighs about 2,508 catties valued at 3 cash a catty, a total of 7,524 cash, or about 16*s.* 8*d.* It is true that much extra labour is involved in cultivating poppy as compared with wheat, but the above figures show that there is a very ample margin, sufficient to insure a handsome profit and recoup the farmer for his additional toil. Moreover, while wheat prefers a rich clay, the poppy flourishes best in a medium sandy soil, its favourite ground being the sloping terraces on the sandstone hills of the province. On this hill-land, too, the yield of raw opium amounts to 80 Chinese ounces per "mou," against 40 to 50 ounces on the plains. For this reason the poppy is not extensively grown on the rich plain of Ch'êngtu, which is a great wheat producer.

I have said above that the population of the province may be put at 45,000,000, but in order that I may not be accused of exaggeration, I shall drop the odd 5,000,000, which will simply cover the non-Chinese races, who are non-smokers as well as many of the richer classes, who prefer Yünnan opium. Of the balance of 40,000,000 it may be taken that 16,000,000 are adults. After careful inquiries I have come to the conclusion that of the population of Szechwan three-tenths are urban and seven-tenths rural, so that of the 16,000,000, equally divided between males and females, 2,400,000

males and 2,400,000 females inhabit cities, and 5,600,000 males and 5,600,000 females live in the country. Now, I am well within the mark when I say that in 1904 in cities 50 per cent. of the males and 20 per cent. of the females smoke opium, that in the country the percentage was not less than 15 and 5 per cent. respectively, and that the average daily consumption of a smoker is two-tenths of a Chinese ounce. It will be observed that I make the consumption less by one-tenth than the Customs publication, but 10 Chinese ounces have repeatedly been given to me as the average daily consumption of fifty smokers.

On this basis, then, I arrived at the following result :—

URBAN.

	Adult Population.	Smokers.	Amount Consumed Annually.
			Piculs.
Men	2,400,000	1,200,000	54,750
Women	2,400,000	480,000	21,900

RURAL.

Men	5,600,000	840,000	38,325
Women	5,600,000	280,000	12,775
Total	16,000,000	2,800,000	127,750

This makes a little over 17 per cent. of adults, and 7 per cent. of the whole population, of the province opium smokers, and the annual consumption 127,750 piculs. The latter is, however, prepared opium, to produce 70 piculs of which 100 piculs of raw opium are required, so that the annual consumption of raw opium would be 182,500 piculs. To this has to be added the annual export from Szechwan, which was itself considerable, for, although exact figures are not available, we know that about 20,000 piculs passed through Chungking, that a large quantity was shipped from centres east of Chungking, and that much was carried overland through the Province of Hunan. It may, I think, be fairly assumed that the Province of Szechwan annually produced more than fourfold the quantity of Indian opium introduced into China.

To show extent of opium smoking in Ch'êngtu, I may mention that when the late Acting Viceroy arrived there in 1902 he laid the opium saloons under contribution in the sum of 1,000 cash each per month, and it was found that they numbered over 7,500, or one saloon to every 67 of a population of 50,000. These saloons were open to men only, and women had to smoke in their own homes.

I have said above that the poppy (*Papaver somniferum, L.*) is a winter crop. The seed is sown in drills late in October or early in November, the plant is in full bloom in March, and the capsules are ready for lancing in the end of April and beginning of May. The crop is usually harvested on the plains by the middle of the latter month to make room for the rice crop; but the time of harvest depends in a great measure on altitude, soil, and climate. In collecting the juice from the capsules no oil is mixed with it. The crude opium is placed in bowls and the moisture got rid of by sun evaporation.

On the 20th September 1906 an Imperial Edict was issued denouncing the cultivation and consumption of opium in China and fixing a limit of ten years for their eradication. This Decree was followed at the end of November by a series of Regulations having for their object the enforcement of its terms. As the latter included foreign as well as native opium, it was necessary for China to enter into an arrangement with Great Britain whose subjects had the right, under Treaty, to import opium from India into China, and in 1907 such an arrangement was arrived at, whereby Great Britain undertook to diminish annually the export from India *pari passu* with the reduction of opium cultivation and comsumption in China. This arrangement was to hold good for three years and it stipulated that, in the event of China carrying out her part of the arrangement, it would remain in force until the expiration of the ten years in 1917. As conflicting reports reached the British Government as to the progress made by China in her task, it was decided to send a Consular Officer to the chief opium producing provinces, and I was appointed personally to examine what progress was being made. In the course of my investigation I visited Szechwan among other provinces in 1911 and travelled through what had been the chief opium districts of the province where I failed to discover a single opium-poppy plant. The British Government being satisfied with these results, agreed to a continuance of the 1907 arrangement and a fresh agreement containing certain modifications and additions for the remaining seven years was signed at Peking on the 8th May, 1911. But in the following October the Revolution broke out causing chaos throughout China and ending in the establishment of the Republic which has, up to the present, been unable to exercise its authority over all the provinces. Szechwan, especially, has been the scene of military conflict with the southern provinces and Tibet, and the

Central Government has not been in a position to enforce its will in this and other provinces. A recrudescence of opium cultivation in Szechwan and elsewhere has resulted and still continues. In spite of this, however, the British Government has faithfully fulfilled its part of the arrangement and the export of opium from India direct to China ceased in 1917.

11. Varnish, Tallow, Soap, and Oil Plants.

1. *Varnish.*

(*a.*) *Rhus vernicifera, D.C.*—Much of the varnish used in Szechwan comes from the Province of Kweichow, especially from the Prefecture of Tating, whence it finds its way overland to the Yung-ning River, which enters the Yangtsze at the district city of Na-ch'i, south by west of Lu Chou. But the varnish-tree also grows in the hills of Szechwan, especially to the north and west of the Ch'êngtu Plain, from Kuan Hsien to Sung-p'an T'ing, and the varish is carried in round wooden tubs, weighing about 50 catties, to centres of consumption like Ch'êngtu. Crude varnish is the pure sap of *Rhus vernicifera*, and is obtained from horizontal incisions made in the bark of the tree and its branches about 18 inches apart. Incisions are first made when the tree is seven years old, and two years are allowed to elapse before the same tree is again tapped. The sap on issuing from the wound is of a greyish white colour and is collected in vessels of various kinds; but care must be taken to prevent exposure to the atmosphere, which hastens its inherent tendency to become black, for varnish applied in its crude state assumes a deep black colour when dry. As an article of commerce it is, as I have said, of a greyish-white colour, of the consistency of syrup, and bowls of varnish brought to me for inspection have always been covered with a layer of paper to prevent contact with the air. Varnish of this quality costs T. 0·6 to T. 0·8 a catty in Ch'êngtu. Mr. Litton, at p. 16 of his "Report of a Journey to North Szechwan," says that the varnish "is sold in Lung-an for 200 to 300 cash a catty, then taken to Chungpa, where it is adulterated with wood-oil, and sold in Chungking for about 700 cash."

An expert in varnish informs me that there are three tests for adulteration. They are—

(1.) Smell.

(2.) If the varnish is held up and allowed to drop, the strings will remain unbroken if it is pure, but will break if adulterated with oil; and

(3.) If varnish, when placed on a sheet of soft Chinese paper, *runs*, it is adulterated, the paper absorbing the oil.

As crude varnish furnishes only one colour, namely, black, the following plan is adopted for the production of the common colours

in use, such as brown, red and yellow: 100 catties of wood-oil are boiled for over an hour to about 98 catties of the consistency of thin syrup. In this state it is called "P'ei Yu," whose natural colour is greyish-white, but a chocolate "P'ei Yu" is obtained by maturing it in old varnish tubs. To produce brown 4 to 8 ounces of "P'ei Yu" are added to 16 ounces of crude varish, according to the shade of brown required. The more "P'ei Yu" added, the quicker the varnish will dry. "P'ei Yu" costs only T. 0·1·2 a catty, and the price of this brown varnish is from T. 0·5 to T. 0·6 per catty. Red varnish is obtained by mixing together 10 ounces of crude varnish, 6 ounces of "P'ei Yu," and 18 ounces of cinnabar. The cinnabar costs T.0·1·2 an ounce, and red varnish is valued at T. 1·2·8 a catty. Yellow is obtained by mixing 10 ounces of varnish, 6 ounces of "P'ei Yu," and 14 ounces of powdered orpiment, which is steamed and dried before being added to the varnish and "P'ei Yu." Orpiment costs T. 0·1·5 a catty, and yellow varnish is valued at T. 0·6·7 a catty.

(*b.*) *Diospyros Kaki, L. f.*—This is a wild variety of the edible persimmon, and is known in Szechwan as the "Yu-Shih-tzŭ," or oil persimmon. It grows extensively in the hills of the province, and the capital draws its supplies of the fruit from the east of the Ch'êngtu Plain, 15 miles distant. The fruit is plucked green in July when it is about the size of a crab-apple; 100 catties of this fruit, which is purchased by the varnish shops at 3 cash a catty, are reduced to a pulp by means of a wooden hammer (metal would discolour the fruit), placed in an earthenware jar, and covered with about 70 catties of cold river water. A lid is placed on the top of the jar. At the end of two or three days froth gathers on the top, and the contents of the jar are vigorously stirred with a wooden pole and again covered. This is repeated three times every two or three days, when the jar is left untouched for twenty days. The pulp is then removed, and the liquid is poured into another jar into which the remaining moisture from the pulp is also squeezed.

The liquid is now a varnish, but, being more or less colourless, it is necessary to give it a ruddy tinge to accord with its future use, and for this purpose 10 catties of the leaves of the "Tung-ching" tree (*Ligustrum sp.*) are steeped in the liquid. At the end of ten days varnish and leaves are both red, the leaves are removed, and the varnish is ready for use. If a darker colour is required the steeping may be continued for five days longer. This varnish is used principally in the manufacture of paper umbrellas, and is not merely a varnish but a gum, for it is applied between the several layers of bark paper forming the screen of the umbrella to make them adhere, while the top of the umbrella is brushed with wood-oil, over which is painted a layer of "Kuang-Yu," or lustrous oil—itself a product of wood-oil as I shall show later. The umbrella shops, as a rule,

manufacture their own varnish; but it can also be purchased from oilmen for from 17 to 18 cash a catty. This varnish is also applied to rain hats, and is used for waterproofing purposes generally.

2. *Vegetable Tallow and Soap Trees.*—Many difficulties beset the path of the investigator of the products of China. Not only has the same product or article different names in different provinces, but even in the same province it frequently has a variety of names, and, as I shall show later, earlier and later crops of the same product may have each a distinctive name attached to it, thus landing the investigator in almost hopeless confusion.

(*a.*) *Stillingia sebifera, Michz., or Sapium sebiferum, Roxb.*—This tree, so well known in Central and Southern China for the beautiful ruddy tint which the leaves assume in autumn, and where it is called the "Chiu-tzŭ Shu," is named the "Ch'üan-tzŭ Shu" in Szechwan. It is the source of the vegetable tallow which is extensively used in the manufacture of candles. In Central China it yields both tallow and oil. The seed pods, usually containing four seeds about the size of a well formed coffee bean and of a greyish-white colour, are collected in the autumn and sun-dried, when they quickly open and release the seeds. The latter are steamed, and the fleshy exterior of the seeds, which is the tallow, is rubbed through a bamboo sieve, with meshes sufficiently small to retain the hard black kernels, which in turn are passed between millstones so set as to crush the shell without injuring the white interiors. The latter are then roasted, steamed, made up into cakes, placed in a press, and the oil extracted by the driving in of wedges. The tallow which has been rubbed through the sieve is collected, melted, and moulded into cakes for market.

In Szechwan, however, oil is not expressed from the kernels: the whole seeds are simply ground up, steamed, placed in the press in the usual way, and the result is vegetable tallow, the refuse cakes being used for manure. The yield of tallow varies according to the quality of the seed, and ranges from 27 to 30 catties per 100 catties of seed, or an average of a little over 28 per cent. In Ch'êngtu it is valued at 6,000 cash or T. 5 per picul of 133⅓ lbs. As I have said, it is largely used in the manufacture of candles, and, being of greater consistency than the oils also used for that purpose, it requires very little white wax mixed with it—only one-tenth of a Chinese ounce to the catty. The refuse cakes, which weigh some 10 catties each, are worth from 150 to 160 cash a piece, and are used to fertilize the soil.

(*b.*) *Gymnocladus chinensis; Baillon.*—This tree, which belongs to the *genus Caesalpinae* (*Leguminosae*), bears in autumn fat brown pods some 2½ to 5 inches long by 2 inches broad. They contain black ovate compressed seeds about double the thickness of a broad bean (*Vicia Faba, L.*). Both sides of the pod contain, between the outer skin and the inner membrane, a thick layer of brown tallow,

which gives to the pod its value as a material for washing clothes, producing a good lather when rubbed in hot or cold water. The pods are also cut up very fine and ground to a paste with such perfumes as sandalwood, cloves, garoo, putchuck, rue, musk, camphor, etc., and then thoroughly mixed with honey. The result is a dark substance of the consistency of soft soap, and is packed with a layer of thin paper in small pasteboard boxes covered with cloth, and measuring $1\frac{1}{2}$ inches long, $1\frac{1}{4}$ inches wide, and $\frac{5}{8}$ths of an inch deep. Each box, which with its contents weighs three-quarters of an ounce and costs 12 cash, bears a red label on the lid with the name of the maker and the four characters "P'ing Shê Fei Tsao" (camphor-musk soap); but this soap is used by the fair sex not so much as a cleansing material as a cosmetic for face and hands. Barbers also use it as a salve on the heads of their victims after having denuded them of their superfluous hair.

The seeds have likewise their use. They are steeped in boiling water, the hard black shells removed by hand, and the pulpy white flesh is used by embroiderers in silk, who draw needle and floss-silk thread through it to give evenness to the latter and facilitate its passage through the silk or satin groundwork.

(*c.*) *Gleditschia sinensis, Lamb.*—This is a fine tall branching tree with small light-green leaves, which forcibly remind one of the maidenhair fern. The fruit consists of long black flat pods, sometimes a foot or more in length by an inch and a half in breadth. Sometimes straight, sometimes curved, they bear a striking resemblance to the locust bean of the *Ceratonia siliqua*. Nor is this surprising, for both trees belong to the same family. They contain a yellowish, tough, spongy pulp, which contains the tallow, and in which are embedded ovate brown seeds, not unlike beans in size and shape. The whole pods, which cost 48 cash a catty, are broken up and rubbed between the hands in cold or hot water, when a lather quickly forms, exactly as if soap had been used. A close examination of a number of dry pods landed me in a somewhat curious discovery. I noticed that each pod had several small round perforations, and in following them, that each led to a seed cavity, that the seed contained a round hole, sometimes two, and was more than half hollow. There was no sign of life nor of any insect which had been at work. I then dissected the pods where there were no perforations, and was successful in finding not only hollow seeds, but small beetles in the cavities, and, in one instance, I found a beetle inside the seed. In each case the beetle was dead, and had evidently been unable to pierce its way out and escape from the pod. There can, I think, be no doubt that the eggs from which these beetles, by metamorphosis, derived their being had been deposited in the seed cavities of the infantile pods, if not in the seeds themselves;

and the case is on a par with the beetles found in the mother scales of the white wax insect, except that they would appear to serve no useful purpose. In the case of the white wax, the beetle is a deliverer, not a destroyer.

The much smaller black pods of the *Gleditschia officinalis, Hemsl.*, which also grows in Szechwan, are used for medical purposes only.

(*d.*) *Sapindus Mukorossi, Gaertn.*—The fruit of this tree is about the size of a marble, and consists of a round, hard, black seed inclosed in a tough light-brown fleshly integument, the inner lining of which is a clear glistening membrane containing tallow or fat. The fruit is widely used in Szechwan for washing clothes, especially white clothes, being cleaner than the pods of Gymnocladus or Gleditschia. For washing purposes, only the fleshy integument is used, the seeds being discarded; but the latter have another use. They are strung into rosaries and necklaces, which are much worn during the hot weather. The fruit, which costs 24 cash a catty in Ch'êngtu, produces an excellent lather in either hot or cold water.

3. *Oil Plants.*—Szechwan is exceedingly rich in oil plants, but the products yielded by two of them, employed for widely different purposes, stand out prominently as the great vegetable oils of the province. They are rape (*Brassica, sp.*) and wood-oil (*Aleurites Fordü*). I say *rape* advisedly, for Dr. Augustine Henry states that this oil is yielded by *Brassica juncea, Hook, f. et T.* As however it is generally known as rape oil I shall continue to call it by that name. Except at an oil mill it is very difficult to procure pure rape oil, for, being of universal consumption as a food oil, and therefore in constant demand, it is adulterated with all the cheaper vegetable oils, many of which are produced. The soil conditions required by these two oil plants are very dissimilar: rape grows side by side with wheat as a winter and spring crop, and prefers a rich clay soil, whereas the wood-oil tree finds a congenial home on the rockiest of soils, where the marvel is that vegetation of any kind can exist.

(*a.*) *Rape Oil* (*Brassica juncea, Hook. f. et T.*).—The Chinese distinguish three kinds of rape seeds according to colour—black, yellow, and coloured. The black is really a dark brown, and the coloured is a mixture of black and yellow; the latter is reputed to yield the greatest quantity of oil. On visiting an oil mill a few miles outside the west gate of Ch'êngtu, I found in one room two millstones, the lower revolving rapidly and driven by a horizontal water-wheel on which part of a stream of water was falling from a height of several feet, the wheel being underneath the floor, the upper stationary and surmounted by a wooden filler from which, through an aperture near the bottom, a stream of rape seed was trickling into a round hole driven through the upper millstone. The crushed rape

seed was falling into a circular well or gutter surrounding the mill-stones underneath. In another room there was an enormous wooden tub, with open-work bottom, covered inside with hemp-cloth—in other words the steamer—built over a huge iron pot, underneath which was the furnace. At one place between steamer and pot there was a small opening or drain by which the latter is supplied with water; this opening can be plugged when necessary. The steamer has a capacity of 950 catties, or slightly over half a ton. When this quantity had been ground in the adjacent room, the steamer was filled and the contents steamed for an hour. In the same room were a couple of long wooden semicircular troughs fixed horizontally on the floor with a tank under each. One-half the contents of the steamer was removed and made up by means of a circular mould into fifteen round cakes, each of which was cased with rice straw. They were placed side by side in the trough against a high plank which closed the end of the trough or oil-press and a similar but movable board was inserted against the cakes at the other end. Stout logs were then placed crosswise and horizontally between this latter board and the end of the press, and iron-bound wedges were driven in between them to cause the necessary pressure. The other press was filled in the same way. Each press, therefore, contained 475 catties of ground and steamed rape seed. At the end of twenty-four hours the wedges were removed and the cakes taken out, broken up, and resteamed. The stuff is again made up into cakes and placed in the press as before, with the result that at the end of forty-eight hours each tank contains 152 catties of oil. In other words, 950 catties of seed yield 304 catties of oil, or 32 per cent. The seed is bought at the mill for T. 7·3 per 250 catties, the oil is disposed of for 8,000 cash per 100 catties, and the refuse cakes, weighing 20 catties apiece, are each worth 400 cash. Reducing all these to a common denomination, we find that 100 catties of seed, of the value of 3,504 cash, yield 32 catties of oil worth 2,560, and 63 catties of cake worth 1,260 cash—a total of 3,820 cash, or a balance of 316 cash in favour of the mill; that is to say, the mill gains 3,002 cash in reducing 950 catties of seed to oil and refuse cake, a process which occupies two days. Six men were engaged on the work, and as the daily wage of a workman may be put at 150 cash, including food, their wages for the two days would amount to 1,800 cash, leaving to the millowner 1,202 cash, or 601 cash a day. On being taken out of the press each cake measured 2 inches thick by 16 inches in diameter.

In the Ch'êngtu Plain, where a large quantity of rape is grown, the harvest takes place in the beginning of May. The stalks are cut down by sickle and occasionally torn up by the root. They are laid down gently in the field for a day or two to dry, over-ripe stalks being spread on large mats to preserve the seed, and then removed

to the farm-house where the seed is threshed out on a concrete floor with flat flails made of strips of bamboo. The seed is then cleaned either by being passed through a winnower, or failing that, is thrown up in the air where the dust is caught by the wind and blown from the seed.

Rape oil, which goes under the two names of "Ts'ai Yu" and "Ch'ing Yu," is the great cooking oil of Szechwan. In it nearly all the vegetables used as condiments to the rice diet are fried. The cakes are in great demand as a fertilizer, and the stalks, as stated in another place, are used as screens for the protection of tobacco seedlings. They are also made up into bundles to form a spinning ground for silkworms and ultimately serve as fuel. But cooking is not the only use to which rape oil is put. It is the great lighting oil of the province. Kerosene, when it reaches Ch'êngtu, costs 10 dollars a case, and is a luxury in which few can indulge. The small lamp with its tiny flame which vainly tries in the public interest to pierce the darkness of night in the streets of Ch'êngtu, the round copper lamp with its three flaming spouts on the street stall or in the shop, and the foreign-looking glass tumbler of Chinese manufacture suspended in the guest hall of a Chinese inn, and shedding from its rush or cotton wick floating on a layer of oil resting in water a miserable light which serves only to accentuate the gloom, all burn rape oil. It has always been a puzzle to me how it is that the Oriental can find his way about in the darkest of nights. True, he usually carries a paper lantern which is more for show than for use, and the solution would appear to be that he has never had his eyes dazzled by electricity, gas or kerosene, and that, being accustomed to light little removed from actual darkness, he has learned to penetrate even darkness itself.

Rape oil is also largely used in the manufacture of candles. To 16 ozs. of oil is added four-tenths of an ounce of white wax, according to the degree of hardness required. The mixture is simmered in an iron pot over a fire till the oil and wax have combined, when it is poured into an earthenware vessel. Into this strips of bamboo bound several inches at one end with cotton yarn, dependent on the length of candle to be manufactured, and with a projecting wooden barb at the other, are dipped, and then hung up by the barb to cool and harden. Four dips with the necessary intervals will produce a candle somewhat thinner than the ordinary European candle; but repeated dips will produce any thickness that may be desired. Yellow is the natural colour of these candles, but the best red is produced by mixing 8 catties of oil and white wax with two Chinese ounces of cinnabar, and giving the candles a final dip therein. An inferior red is produced by using adulterated cinnabar, while still another red is obtained by mixing five catties of animal tallow with

one-tenth of a Chinese ounce of aniline red. The top of each candle is squared by knife, leaving a bamboo tip bound with yarn.

I may state here that the manufacture of the wicks is a separate industry. They are purchased by the candle shops at the following prices—smallest size 720 cash per 10,000, medium 120 cash per 1,000, and largest 240 cash per 1,000.

(*b.*) *Sesamum indicum, L.*—Both the white and black seeded varieties of sesamum are cultivated in Szechwan, the former for the oil extracted from it and the latter in small quantities for medicinal purposes. This is the most expensive edible oil in the province, costing 240 cash a catty to produce, and retailed at 320 cash. It is called "Hsiang Yu," or fragrant oil, and is eaten raw mixed with cooked vegetables. The method of manufacture is peculiar. I propose to describe it as I witnessed it. Twenty-five catties of white seed, valued at 2,000 cash, were carefully washed in cold water and spread out to dry. They were afterwards placed in an iron pot and baked till of a light-brown colour when they were taken out and ground between two millstones. The ground seed was then collected and placed in another iron pot, and boiling water sufficient to cover the contents poured in. The whole was then carefully stirred with a rolling-pin till the moisture was all absorbed. Boiling water was poured in, stirred, and absorbed a second and third time, and finally a fourth time, when, the absorptive power of the seed being satisfied, the stuff was in a more or less liquid condition. The workman then took up a whole gourd fitted with a wooden handle, and containing one catty of broad beans to weight it, and gently tapped the contents of the pot till the oil rose to the surface and the solid matter sank to the bottom. The oil was then poured off, and weighed between 10 and 11 catties—that is to say, the yield of oil amounted to between 40 and 50 per cent. of the weight of the seed. The refuse is sold for feeding pigs. As a rule, this oil, being very expensive, is highly adulterated with rape oil, which costs only one-fourth the price. Contrary to European ideas, the higher and more expensive grades of oil can be purchased cheaper in the retail shops than at the oil mills, for the simple reason that they are adulterated with inferior and cheaper oils, and there is no law or regulation to prevent it. I should have mentioned that sesamum is a summer crop, the seed being harvested in August.

(*c.*) *Arachis hypogoea, L.*—The ground nut is also a summer crop and is cultivated on light sandy soils and on the banks of rivers. There are two methods of extracting the sweet oil from the nuts. In neither case are the shells removed. They are roasted, ground, steamed, and pressed in the usual way. The shells have the reputation of greatly aiding in the fattening of pigs, and the refuse cakes, worth about 20 cash a catty, are used for this as well as for fertilizing purposes. The oil is employed for cooking, lighting, adulterating

rape oil, and in the manufacture of candles. It is cheaper by about T. 1 per picul, and has a less specific gravity than rape oil, so that in candle making it requires $\frac{1}{2}$ to $1^1/_5$ Chinese ounces of white wax per catty. The yield of oil is about 16 per cent. of the weight of nuts, which are much smaller than those produced in Northern and Eastern China.

(*d.*) *Papaver somniferum*, *L.*—The widespread cultivation of the poppy in Szechwan leads to a large production of poppy seed, which having no narcotic properties, yields an excellent cooking oil. The seed is roasted, ground, steamed, and pressed in the usual way, and 100 catties of seed will give about 40 catties of oil. It is cheaper than rape oil, and is, therefore, an adulterant. In many country districts it is the farmer's only cooking oil. The refuse cakes are used for feeding pigs.

(*e.*) *Glycine hispida*, *Max.*—In Szechwan the soy bean of Northern China and Manchuria is replaced by rape seed, and it is cultivated more as a vegetable than for its oil. The production of the latter is insignificant from a commercial point of view.

(*f.*) *Juglans regia.*—In the mountainous north of the province the walnut tree abounds, and the peasantry have hit upon the idea of extracting from the fruit an oil which, like other cheap oils, is used to adulterate rape oil.

(*g.*) *Gossypium herbaceum*, *L.*—Very little cotton is grown in Szechwan ; but in the producing districts north by west of Chunking a cooking, lighting, and adulterant oil is extracted from the seed, the refuse going to the pigs and to fertilize the land.

(*h.*) *Brassica nigra* (?), *Koch.*

(*i.*) *Brassica campestris*, *L.*

(*j.*) *Helianthus annuus*, *L.*

From the seeds of these three plants—mustard, cabbage, and sunflower—oils are extracted in very small quantities, and of no value as articles of trade.

(*k.*) *Cannabis sativa*, *L.*—It is somewhat surprising that, in spite of the large quantity of hemp grown in the districts of P'i Hsien and Wên-chiang Hsien, little attention is paid to the extraction of oil from the seed, which, like the next, is mostly used for feeding cage birds. It is also to be found in the Chinese Pharmacopæia.

(*l.*) *Perilla ocymoides*, *L.*—I have noticed this plant cultivated on the edges of fields in the Ch'êngtu Plain, but the oil is rarely heard of as an article of sale in the oil shops.

(*m.*) *Vicia Cracca*, *L.*—In years when this tare is more than usually abundant a lighting oil is expressed from its small black seeds, but it is of no particular value. As a rule the tare is simply grown and ploughed into the land as a fertilizer for the rice field.

(*n.*) *Camellia oleifera, Abel. Sasanqua, Thunb.*—In those parts of Szechwan where this camellia grows wild, but more especially within the district of Tan-lêng Hsien and the Department of Chiung Chou, south-west of Ch'êngtu, the seeds are collected, ground, steamed, and pressed for the oil which they contain. It is used to adulterate rape oil, and by Chinese ladies as a dressing for the hair. The refuse cake is a fertilizer, but it is also used to wash clothes for the purpose of removing oil-stains, and it has also the reputation of destroying the "earth worms" which attack rice plants.

(*o.*) *Ricinus communis, L.*—The seeds of the castor-oil plant, which grows into a small tree in Szechwan, are collected, removed from their capsules, roasted, ground, steamed, and pressed. They yield about 38 per cent. weight of oil, which is used for mixing the colours for Chinese seals. It is an expensive oil, costing as much as 400 cash a catty. The refuse cake is a fertilizer.

(*p.*) *Linum usitatissimum, L.*—In the mountainous regions of Northern Szechwan flax, with its beautiful blue flower, is grown, not for its fibre, but for its seeds, which in addition to medicinal uses, yield an oil utilized locally for cooking and lighting. The plant is not sufficiently cultivated to make the oil of any commercial value. It is cultivated up to 11,000 feet.

(*q.*) *Aleurites Fordü.*—I have left to the last what is, from a commercial standpoint, the most important oil produced in the province, namely, wood-oil. This name, by which it is known to foreigners, comes from Southern China. There is a considerable export of the oil from the West River, where it is called by the Chinese "Mu Yu" : literally, "wood-oil," and is derived from *Aleurites montana*. On the Yangtsze and in Western China it is called "T'ung Yu," that is oil of the T'ung or T'ung-tzŭ tree, the *Aleurites Fordü*, which flourishes on thin-soiled rocky ground and grows in great abundance to the north and south of the Yangtsze east of Chungking. It attains a height of about 15 feet, with large, shady, dark-green leaves. In March and April it bears bunches of small pink-white flowers which give way to clusters of green fruit not unlike small-sized apples. The fruit is ripe in August to September, and, if well-developed, contains four seeds resembling shelled Brazil nuts. The green fruit is collected, make into heaps, and covered with straw or grass. The heat thus generated quickly rots the fleshy part of the fruit and the seeds are easily removed. They are then roasted (roasting is not essential), ground, steamed, and pressed like other oil-producing seeds. The product, which amounts to about 40 per cent. of the weight of seed, is a brown somewhat watery oil whose uses are numerous and varied. It is packed in wooden tubs and wickerwork baskets, and sent down river in large quantities for distribution throughout China and for export abroad. No junk is complete without a coating of wood-oil; it is a varnish,

the chief paint oil of the country, a water-proofing material, and an ingredient in the manufacture of concrete. Within the last few years the oil has found a market in the United States of America. The price at the producing centres in the east of the province ranges from 4,000 to 5,000 cash a picul; but in Ch'êngtu it is quoted at 140 cash a catty, or as much as 14,000 cash a picul. It must not be supposed that for water-proofing or varnishing purposes the oil is laid on in its crude state. I have already stated that, after over an hour's boiling, wood-oil becomes a syrupy oil called "P'ei Yu," used for mixing with varnishes and paints. To produce water-proofing material, called "Kuang Yu," 100 catties of wood-oil are boiled for two hours with 8 ounces of T'u-tzŭ, or earth pellets, grey outside and chocolate-brown inside, to which are later added during the boiling 8 lbs. of powdered quartz impregnated with a yellow metal resembling iron-pyrites. The quartz, known as "T'o Shên," costs 360 cash, and the pellets are worth 60 cash a lb. Both come from the district of Kuan Hsien, 40 miles west by north of Ch'êngtu. Kuang Yu is a yellowish grey sticky substance, and is applied by brush to silk gauze and pongees to make them waterproof. It, like P'ei Yu, costs 160 cash a catty, or 120 cash a lb. It is kept carefully covered with paper to prevent drying before application. For lighting purposes wood-oil is exceedingly dirty, and in the great producing centres in the east of the province it is specially consumed for its soot, which forms an important ingredient in the manufacture of China ink.

12. Textile Plants.

Although much has been written regarding the textile plants of China, there is still considerable confusion, not only as to the plants themselves, but also as to the districts in which they are cultivated. This confusion is very much accentuated by the classification—or rather erroneous classification—of fibres in the Returns of the Chinese Maritime Customs. At some ports attempts have been made to identify and name them, while at others they are indiscriminately called hemp; but even at ports where classification has been attempted the results are not always satisfactory. One port, for example, is credited with an export of jute which certainly does not grow within the area from which it draws its exports; at another, where jute is actually cultivated, the resulting fibre is classed as hemp; and, generally speaking, rhea, hemp, Abutilon hemp, and jute are inextricably mixed up. But there is one very good reason for all this confusion. Each province, as a rule, has its own distinctive names for its fibre plants. Rhea, for example, which is known in Eastern China as "Ch'u Ma," is called in Szechwan "Yuan Ma" and "Hsien Ma"; in North China hemp and Abutilon hemp are respectively called "Hsiao Ma" and "Ch'ing

Ma"; in Szechwan "Huo Ma" and "T'ung Ma"; and jute known in Eastern China as "Lü Ma," becomes "Huang Ma" and "Pai Ma" in Szechwan.

Of course, there is no difficulty in distinguishing these plants in the field; but it is not, I suppose, the business of the Custom-house authorities to trace the fibres to the plants which yield them. To the dealer in fibres, however, the Customs Returns are very misleading.

1. *Boehmeria nivea, Gaudich.*—This is the Rhea, Ramie, or China-grass plant which has within recent years created no little excitement among European manufacturers. For a long time the decortication and degumming of the fine silky fibre presented serious difficulties; but in 1897 a Manchester house kindly forwarded to me samples of beautiful dress fabrics of silk and rhea, and wool and rhea mixtures, and of rhea plushes, tapestries, damasks, canvas, and sail-cloths, and I have noticed ramie underwear advertised in the English press. Although it would thus appear that the difficulties have been practically overcome, there is a factory at Wuchang for the extraction and preparation of the fibre, with German machinery installed. There can, I think, be little doubt that the home manufacturer is placed at a great disadvantage in having to treat dry ribbons, for the gum which they contain hardens rapidly. In Europe this fibre, after due preparation, is used in knitting the webbing which forms the basis of incandescent gas-mantles.

In experiments which I saw conducted some years ago in Formosa, the gum on the drum of the machine in which green stalks had been treated was so hard the following morning that it had to be chipped off with a hammer. The raw fibre, as placed on the market in China, has lost much of this gum in the process of removing the outside skin or bark. I have dealt elsewhere* with the cultivation and preparation of rhea in China, and it is unnecessary for me to go into details in this place. Suffice it to say that there are three crops a year in Szechwan as elsewhere, harvested in June, August, and October respectively, and that the August crop, being the longest, is considered the best, because the fibre is shredded by hand and fewer lengths are, therefore, required to make up the thread for weaving grass-cloth. At the producing centres the prices of the fibre of the three crops range about 96, 112, and 50–60 cash a catty—that is to say, 5,000 to 11,200 cash a picul. In discussing the subject of rhea, I have frequently pointed out that, as the ultimate fibres are only a few inches in length, the foreign manufacturer need not purchase the longest, and therefore the most expensive, ribbons, and that if, weight for weight, short contain

* "Three Years in Western China," London, 1897, pp. 73-74. "Journal of the Agricultural and Horticultural Society of India," vol. ix, Part I, new series, Calcutta, 1891. "Trade of Wuchow for the Years 1897 and 1898." China Nos. 2168 and 2248. 1898-1899.

as many ultimate fibres as long ribbons, there is no reason why he should not be content with the cheaper raw material.

The rhea plant is a perennial, and, as the stalks are cut before the seed matures, it is propagated by cutting of its fleshy rhizomes. It is cultivated generally throughout Szechwan, but the chief centres of production and of grass-cloth manufacture are the district of Chiang-ching, on the Yangtsze, south-west of Chungking and the districts of Jung-ch'ang, Lung-ch'ang, and Nei-chiang, between the Chia-ling and T'o rivers. A certain quantity of the fibre made up in round bundles, as well as of the cloth, goes down river to the central provinces, and the latter finds its way even as far north as Peking, while the Province of Kweichow also draws its requirements from Szechwan. It will not bear comparison with Canton grass-cloth, which is the finest and most expensive in China.

The best Szechwan cloth costs in Ch'êngtu T. $2\frac{1}{2}$ per piece, measuring 51 feet by $19\frac{1}{2}$ inches English. A coarser cloth costs half that price. The bleaching of grass-cloth is a tedious business. To produce the best white colour one to two months are required, and the cloth has to be constantly immersed in clean running water and then dried in the sun. The length of the bleaching process depends, of course, on the available sunshine. Only the coarser grass cloths are dyed, usually different shades of blue.

2. *Cannabis sativa, L.*—This is the true hemp plant which is grown very extensively within the districts of Wên-chiang and P'i Hsien, in the Ch'êngtu Plain. The seed, mixed with powdered rape cake and wood ashes, is sown in February. In May the plants have formed a dense forest of stems from 6 to 8 feet high, and in June they are cut down, made up into bundles, and steeped for three or four days in shallow pits containing some 2 feet of water. They are then removed and sun-dried for two or three days. By this time the small leafy branches near the tips have rotted sufficiently to be brushed off by hand, leaving the straight stems, which are of a brown colour. The latter are then stacked in the shape of hollow cones, which are encircled with matting, and in each hollow are placed and fired 8 to 10 ounces of sulphur for every 100 catties' weight of stems. By this means they are bleached white. To extract the fibre, which usually falls to the lot of women and children, the stems are sprinkled with cold water, and each stem is taken and pierced an inch or two above the butt end with a bamboo knife, which is drawn up to the tip, dividing the stem into two parts. By bending over the pierced inch or two at the butt the fibre is readily detached by hand and made into bundles for market. A "mou" of land produces from 100 to 120 catties of cleaned fibre, which, at harvest time, realises about 60 to 70 cash a catty, against 120 cash later in the retail shops. The sulphur which comes from the Lu Shan hill in the Mien-chu district costs 120 cash a catty.

The rejected cores are then bundled and steeped for two months or more in cold water, when they are taken out and dried. In this form they make an excellent tinder. They are also burned to an ash, which is mixed with gunpowder in the manufacture of fire-crackers.

This hemp is in great demand for ropes and cordage and for caulking purposes generally, and each junk on the Upper Yangtsze carries its supply. It is likewise shredded and manufactured into coarse cloth, the best of which, about a foot in width, sells for 16 cash a Chinese foot, and is used for making grain sacks; while inferior cloths, worth 12 to 14 cash a foot, are made up into mourning raiment for the poor. I do not think that much of this hemp, whose cultivation is confined to a comparatively small area, leaves the province. A later crop of hemp is grown for a special purpose. The fibre of this, which is said to be tougher than the summer crop, is cut up into short lengths and made into the bodies of paint brushes, and even into the hearts of Chinese pens, which are then provided with an outer covering of hair.

3. *Abutilon Avicennae, Gaertn.*—It seems a pity that the authorities of the Royal Gardens, Kew, determined some years ago to call the fibre of this plant Abutilon hemp, for the plant itself has no connection whatever with the hemp family, and the name, although containing the qualifying word Abutilon, is very apt to mislead.

This plant, an annual, cultivated mostly in Eastern Szechwan as a summer crop, grows to a height of from 9 to 10 feet, and has a straight, branchless stem with alternate large, smooth, serrated, ovate, acuminate, green leaves with long leaf stalks. When ripe in August, the stems are cut down near the root by knife, and crowns and leaves are lopped off. They are then made into bundles, steeped in ponds of stagnant water, covered with earth, and allowed to rot for several days. The peel and fibre is now loose enough to be removed by hand, and the ribbons are carefully washed in clean water and spread out in the sun to bleach for a few days, when the green colour disappears, leaving a greyish white fibre tinged with a silvery, lustrous colour. This is the so-called Abutilon hemp which is made up into bundles for export. Most of the "hemp" which goes down river from Szechwan is the fibre of this plant. It lacks the tensile strength of rhea and hemp, is unsuitable for weaving purposes, and is mostly employed for making ropes and cordage. This plant is widely cultivated in Manchuria, Mongolia, and Northern China, and its fibre is called jute in the Tientsin Customs Returns.

4. *Corchorus capsularis, L.*—This is the true jute plant. It is cultivated in Eastern Szechwan, but to a limited extent. The fibre, which is used in rope-making, is consumed locally, and has

little commercial value in face of the more important textile plants grown in the province.

5. *Gossypium herbaceum*, *L.*—The red sandstone of Szechwan is unsuited to the cultivation of cotton, but there is a small area of the province with a superincumbent layer of alluvial soil where the cotton plant flourishes. This area lies to the north of the great rhea-producing districts between the Fou, the western branch of the Chia-ling, and the T'o River. The city of Sui-ning and the market-town of T'ai-ho-chên are the great centres of the native cotton trade, as well as of the import trade in Indian yarn, which is largely used, mixed with native yarn, in the weaving of cottons, a very important industry in this cotton-producing area. There can be no doubt, however, that cotton growing in Szechwan is on the decline in face of cheap Indian yarn, and it seems a pity that even the limited cultivation of the only textile plant which is lacking to make the province self-contained should have to go. It is like the once large production of safflower, which is fast disappearing before the influx of aniline dyes.

6. *Trachycarpus excelsus*, *H. Wendl.*—This tree, known as the coir-palm, grows all over Szechwan, but its chief habitats are the district of Kuan Hsien and the Department of Chung-ching Chou, in the west of the Ch'êngtu Plain. It grows to a height of 10 or more feet, and is untouched for a period of ten years. After a time, however, the brown fibrous bracts which encircle the stems at the ends of the leaf stalks are gradually removed once a month. These bracts are, in reality, natural pieces of fibre cloth, and are sewn together to form rain clothes and hats. They are also used to cover trunks and teapot baskets, to make sleeping mats and floor carpets, and the fibre is woven and made into the uppers of rain shoes for men and women. The bracts are also teased into fibre and manufactured into ropes of all thicknesses. These ropes, which withstand wet much better than those made of hemp, are sold, no matter what the thickness, at the rate of about 140 cash the catty. Brushes, brooms, and fly brushes are likewise manufactured from this fibre. The bracts, which are exported down river in large quantities, cost 2,700 to 2,800 cash a picul of 133⅓ lbs. I may state here that the stems of this palm are much used in the country districts of Szechwan as pillars for doorways.

7. *Bambuseae.**—I am dealing with the bamboo here as a textile plant only, and do not propose in this place to enumerate or try to enumerate the many other uses to which it is put.

Bundles of bamboo fibre made up of flat strips, measuring 18 by 1½ by ⅛ inches, loose at one end, but united at the other by part of a joint not included in the above measurement, are for

* The commonest bamboo in the province is Phyllostachys mitis.

sale in the streets of Ch'êngtu; but I could find no one in the city who could explain to me the process of extracting the fibre from what is well known to be one of the hardest of woods. This fibre comes from Ya-chou Fu, a four-days' journey to the south-west, and I had to send into the country for an expert to explain the method of treatment. He was supplied with a bamboo from my garden and an iron chopper from the kitchen. He promptly chopped the bamboo into lengths just under each joint, so that the lengths were open at one end and closed at the other. Taking up a thin string of bamboo fibre which was lying about, he twisted it into a round collar large enough to fit tightly the mouth of the length of bamboo, and, having adjusted it just under the lip, he set the piece of bamboo upright, mouth upwards, and the jointed end on a stone. Holding it in his left he began to hammer gently the mouth with the blunt back of the chopper in his right hand. At first the crushed edge dropped inwards; but, inserting a finger, he pulled it out and over the edge all round, and continued hammering on the top of the overhanging bruised mass of bamboo, now reduced to a fibre. Gradually the length of bamboo presented the appearance of a miniature open umbrella, and was soon reduced to fibre, the inner hard sheathing of the tube being broken and removed by hand from time to time during the hammering. The collar, which is to prevent the bamboo from splitting lengthwise, slips down as the hammering proceeds. The fibre is then divided up into the usual widths, which are pressed before being made up into bundles. So far as I know, it is used for two purposes only: The best sandals in Szechwan, with the exception of the trappings and the thin strip of leather over the projecting toe-piece, are entirely woven from this fibre. They cost from 20 to 40 cash a pair, according to size, against 17 to 18 cash for sandals made of rice straw. The best straw sandals are, however, made at Han Chou, in the Ch'êngtu Plain. They are said to be very strong, cost 40 to 50 cash a pair, and will last in daily use for about twenty days. The other use to which bamboo fibre is put is the making of matches for matchlocks. I should state that young bamboos are required for fibre treatment—and by young I do not mean short bamboos, for I have seen bamboos attain their full height in a fortnight, growing as they do at the rate of about 2 feet in twenty-four hours. In Ch'êngtu bamboos are split lengthwise into strips half an inch wide, and each strip is subdivided by knife into thin layers which are woven by hand into matting. This matting, usually with a white and black pattern, is in great demand for the ceilings of rooms in Chinese houses. Hats, basket-ware of every degree of fineness, and sun-screens are also woven of split bamboo, and before the advent of summer I noticed short lengths of fine bamboo stems being strung into undershirts to prevent the

clothes sticking to the skin in the hot weather. The ordinary Chinese umbrella which, in the moist Province of Szechwan, may almost be looked upon as an article of attire, also owes its handle and ribs to the bamboo. Necessity, it is said, is the mother of invention, and the bamboo has been turned to a use in Ch'êngtu which I have not seen nor even heard of elsewhere in China. The City is famed for its fleas, and certainly they are the most numerous and the most voracious I have ever met in this land of insect pests. It has been found necessary to invent a flea-trap, and the bamboo has come to the rescue. A piece of open-work woven split bamboo about 2 inches in diameter and over a foot in length is closed at one end. A length of bamboo about half the diameter of the open-work is inserted at the open and rests against the closed end, and is kept in position in the centre by a bamboo pin which passes through the inner bamboo and the rim of the open end. The woven open-work bamboo is merely the cover to the inner bamboo, which, after being coated with a sweet, sticky substance, is placed in position. This trap is as commonly worn on the person as stowed away among the bedclothes, and is said to be very effective. This is the fancy trap; a cheaper and inferior article is made by cutting horizontal openings in a length of bamboo between the joints, opening one joint for the inner bamboo, and drilling holes below the joint for the pin. In both cases the covering bamboo is to prevent the sticky substance coming in contact with the clothes.

It is a pleasure, however, to turn from a lively but uninteresting subject to a real work of art. Some foreigners are probably aware that the bowl-shaped summer hats worn by Chinese in official employ are made in the Province of Shantung, which supplies practically the whole of the Empire. These hats are of different qualities. A messenger, for example, wears a superior hat to a chair-bearer, who, in his turn, despises the head-gear of a yamên-runner. These Shantung hats are beautifully woven of straw; but the high Chinese official wears quite a different article. The latter is a very elaborate affair. First a framework of fine split bamboo is made. This is gummed on the top to preserve the shape, and it is then lined inside and outside with silk gauze, the colour of which depends on the taste of the wearer. A cover exactly the shape of the hat is placed on the top and bound round the edge to the gauze-lined framework. It is this cover which is the work of art. It is a transparent netting woven of bamboo fibre reduced to the fineness of hair. It is so fine that the marvel is that it is the work of human fingers. Yet so it is. The industry, which is hereditary, is carried on by certain families in the villages round Ch'êngtu, and the hat shops in the city have their respective makers. The hatter who brought me the different parts of a hat for inspection informed me that the family with

which his shop deals supplies the covers at from T. 0·4 to T. 1·2 each, according to fineness, and that it takes a man two days to weave one of secondary quality. The bamboo used is the "T'zŭ Chu,"* which grows plentifully round Ch'êngtu, and the fibre is taken from the inside of the wood, the inside and outside layers being too hard for weaving purposes. The cover, which is light brown, is never coloured, and the shade of gauze is distinctly visible through the fine bamboo net work. Frequently, however, the wearer wishes to show off the colour and fineness of the cover, in which case white gauze is used for the top lining of the framework underneath. Contrast with this very fine work the split bamboo hawsers required by native shipping on the waterways of Szechwan, in the manufactures of which enormous quantities of trees must be annually consumed.

8. *Juncus effusus*, *L.*—Doubts have been expressed as to whether the rush from which the excellent mats of Szechwan are made yield the lamp-wicks largely exported from the province; but I may state here once for all that the same plant is the source of both. These doubts may have arisen from the fact that mats are made from rushes with and without pith; but the latter are simply the stems from which the wicks have been extracted.

The great centre of cultivation of this round rush (*Juncus effusus*) and of mat-weaving is the Prefecture of Hsü-chou Fu, or Sui Fu; but an examination of these mats shows that they are nearly all made of rushes containing the pith, which makes them thicker and harder if not so fine as those woven from the hollow rushes. As a matter of fact, there is comparatively little of the lamp-wick industry at Sui Fu. It is chiefly centred higher up the valley of the Min River, at places like Mei Chou and Chia-ting. This rush, which is carefully cultivated, is a source of considerable profit to the farmer. In the beginning of July the rushes, which have attained a height of 5 or 6 feet, are cut down by reaping-hook and, if the farmer wishes to extend the cultivation, the roots are, after a month, taken up, well washed, roughly subdivided, and planted out in land prepared as if for the reception of paddy shoots, for a continuous water supply is essential to the production of a good crop. At the time of transplanting all the green tops are carefully cut off. They remain in the ground till November, when they are again taken up, treated as before, subdivided, and replanted. In March and May of the following year they are heavily manured, and in July they are ripe for the sickle. When cut, the rushes are spread out on an open space of ground—usually the threshing floor—sprinkled with water and then dusted with charcoal ashes for bleaching purposes. In two days they are ready

* Phyllostachy mitis.

to have the pith extracted or be woven into mats. If the former, they are steeped in cold water for half an hour, and each rush is then placed separately between two pieces of bamboo tied together and having a knife point projecting from the fork ½ an inch below their flexible points. Each rush is impaled on the knife point a couple of inches from the butt end, the back of the knife facing the tip of the rush so as not to cut the pith, and the workman pressing lightly the two projecting bamboo points with the thumb and forefinger of his left, pulls the rush by the butt end with his right hand until within an inch or two of the tip of the rush. The tip is readily dislodged, and the rush is cut in two except the 2 inches at either end. These cut rushes are afterwards placed in the sun, where they quickly curl up and are ready for mat-making.

A workman will treat 10 catties of rushes in a day and extract 1½ catties of wick, worth 320 cash a catty. One "mou" of land, if a first-class crop, will yield 30 piculs of rushes, valued at 2,500 to 2,600 cash a picul; but the average harvest may be placed at half that quantity.

The weaving of the mats is a very ingenious process. A wooden frame consisting of two upright beams, joined at top and bottom by stout round poles, are firmly embedded in the ground several feet apart. Under the lower and over the top of the upper pole a large number of hemp strings about half an inch apart are arranged and tightly tied to form a web; but before the circuit is completed each string is passed through an oak bar several feet long, 3 inches wide, and 3 inches deep, with two handles 6 inches long protruding in front, and 2 feet apart. On the top of the bar are alternate small holes and 1½-inch horizontal slits, and through these the strings are threaded, coming out on the opposite side underneath in similar slits and holes; but each hole on the top of the bar is represented by a slit on the under side, and *vice versâ*. By raising the bar with the two handles and pushing it over the web is opened—each string being pulled in the opposite direction to its neighbour in the space below the bar, and by raising the bar and depressing the handles another space is formed; but in the latter case the strings are reversed. These movements take place alternately, and into the spaces below the bar the rushes are fed one at a time. The man feeding the loom sits at the side, and, taking a rush, bends the end of it over a notch near the tip of a long flat piece of bamboo, not unlike an arrow, pushes bamboo and rush into the space between the cross strings, and quickly withdraws the bamboo, leaving the rush, which the man at the upright loom pushes down with the bar. While the bar is down, the latter twists the projecting end of the rush round and between two stouter pieces of string forming the outside of the web on either side, making a noose, and, at the same time, part of the

edge of the mat. The noose is made first on one side and then on the other side of the mat, each rush being thus tied on one edge only. The man at the bar does this with the hand nearest the edge requiring to be fixed. The noose completed, the bar is again raised, pushed over or depressed as the case may be, opening another space below, but with the strings reversed. Another rush is fed, and so the weaving goes on with great rapidity. The bamboo represents the shuttle in cloth weaving. When the mat is of the necessary length, the edges are trimmed with a knife. The mats, which are used for sleeping on in summer, run from 5 to 6 feet long by 3 to 4 feet wide, and are worth from 100 to 400 cash, according to size. The bars are of various lengths, according to the width of mat required.

9. *Scirpus lacustris*, *L.*—This three-sided rush is cultivated in Szechwan, but not to the same extent as the preceding. It is also woven into mats in exactly the same way; but large quantities of the rushes are used by shopkeepers as string. The mats are slightly dearer than those made from *Juncus effusus*, and are said to last longer. There are two crops a year in July and October respectively.

10. *Triticum vulgare*, *L.*—Wheat straw is largely used for making braid, from which large wide-brimmed hats are manufactured for summer wear. This work is done by women, and the hats vary in price from 600 to 1,500 cash, according to quality. The straw is also used for making cheap fans, costing some 20 cash apiece.

11. *Oryza sativa*, *L.*—Rice straw is woven into straw mattresses and a couple of inches of this straw laid on the hard boards of a bedstead seem to satisfy the wants of the native of Szechwan, who is just as able to sleep anywhere, anyhow, and at any time as his brethren of the other provinces.

12. *Sterculia platanifolia*, *L.*—This tree, with its fine, massive, shady leaves, is scattered about the province. In winter in Ch'êngtu I noticed it reduced to a mere stump, for the branches had been lopped off to yield their fibres, which are extracted by retting and used for making matches for matchlocks, twine, and sometimes sandals. In spring it presented a very remarkable appearance, the huge leaves having the appearance of being attached directly to the trunk.

13. *Paper-making Materials.*

1. *Oryza sativa*, *L.*—Rice straw is the commonest paper-making material in the province. From it and the following, whether alone or in combination, the coarsest and cheapest paper is made. This straw-paper, of which there are several qualities, is used

for wrapping goods, in the manufacture of fire-crackers, for making paper-money, so much in demand at all funeral ceremonies, for pipe spills, and for a variety of other purposes.

The straw is made up into bundles and steeped with water in a deep, concrete pit for a month, when it is taken out and well washed. The water in which it has been steeped is removed and the straw is spread in layers in the pit, each layer being thoroughly sprinkled with slaked lime and water containing 1 catty of soda to each 100 catties of lime. There it remains for twenty days. At the end of this period the straw has been reduced to a pulp, which has sunk to the bottom of the pit. The surface water and as much as possible of the lime are removed, and the pulp is taken out, placed in a steamer, and steamed with 1 per cent. weight of soda, when it is ready to be made into paper. A quantity of the cold pulp is placed in a trough of cold clean water, to which is added some mucilage extracted from the *Hibiscus Abelmoschus*, *L.*, a wild plant, and cultivated in Szechwan, and a fine oblong bamboo frame, the size of the desired sheet of paper, held at the two ends by a workman, is drawn down end-ways and diagonally into the liquid contents of the trough. The contents are well stirred before the frame is used. It is then gently raised to the surface, and the film which has gathered on the top drops off as a sheet of moist paper when the frame is turned over. This paper is kiln-dried and made up into bundles for market.

It may not be out of place to mention here how the paper-money or paper cash referred to above is made. The trunk of a tree 6 or more feet in circumference, and about 6 feet high, set up in the verandah of a shop in Ch'êngtu is the usual signboard of a paper cash factory. Standing on a scaffolding which brings his elbows well above the top of the trunk a man takes a bundle of this coarse paper several inches thick, and about 6 inches square, and with a wooden mallet exactly the same as that used in finer stone work at home, hammers an iron chisel consisting of a central pointed iron spike with two sharpened concave scoops on either side through the paper till the spike and scoops reach the trunk. This he repeats in parallel lines all over the bundle till each sheet is covered with cash-shaped perforations consisting of a round centre and two half-moon shape slits held together by the paper between the scooped openings. The sheets are always used whole, and no attempt is ever made to subdivide them into the cash which they represent; but the paper is so cheap that even a Chinese does not think it worth his while to study economy in this matter. Sheets of paper cash are scattered on the roadway in front of the coffin when being borne to the grave and burned at the grave itself after the burial has taken place. This paper is also watered with tin and moulded into the shape of sycee, and it also goes largely

to make up the flimsy sedan chairs which, with the imitation sycee, are likewise burned at the graves as offerings to the departed.

2. *Imperata arundinacea, Cyr., Ch.* "*Mao Ts'ao.*"—This reed is manufactured into paper in exactly the same way as rice straw, and the two are frequently mixed for the purpose. It grows in abundance to the north of the Ch'êngtu Plain, especially within the district of Mien-chu Hsien, which is the great centre of paper manufacture in Northern Szechwan. Mien-chu paper is famed throughout the province, more especially its bamboo paper, of which I am now about to speak.

3. *Bambusa.*—Two kinds of bamboo are used in Szechwan for the manufacture of paper, the "Tz'ŭ Chu" and the "Chin Chu." They must be tender stems usually of the same year's growth, and in no case must they be more than two years old. They are cut into lengths of eight Chinese feet to suit the size of the concrete pit, where they are steeped in bundles with cold water and heavily weighted with stones. After three months they are removed, opened up and well washed. They are then stacked in layers, each layer being well sprinkled with lime and water containing 2 catties of soda to every 100 catties of lime. After two months they are well retted. The lime is then washed out, and they are steamed for fifteen days with 3 catties of soda to each 100 catties of the fibrous mass, which, on removal from the steamer, is thoroughly rinsed with cold water. It is then placed in a concrete pit and reduced to fine pulp with wooden rakes. After this it is ready for conversion into paper. A quantity of the pulp is put into the trough with cold water and mucilage from the *Hibiscus*, as in the case of the coarse straw paper. The whole is thoroughly stirred and the frame passed into the trough and raised with the film of paper in the usual way. This paper is much finer, whiter, thinner, and more expensive than straw paper. There are, of course, various qualities used for different purposes—from papering windows to fine writing and note paper. Much of this paper is coloured on one side as well as dyed, and very often note and care paper is glossed with white wax to give it a smooth polished surface; but I shall speak of this later when I come to the subject of animal products.

Paper is manufactured all over the province; but the great centres for bamboo paper are Mien-chu Hsien, Chiung Chou, and Chia-chiang Hsien, while Lu Chou, on the Yangtsze west of Chungking, produces very large quantities of straw paper.

4. *Broussonetia papyrifera, Vent.*—This, the paper mulberry, attains to the dimensions of only a bushy shrub in Szechwan; but, so far as I can gather, no attempt is made in the province to manufacture paper from its inner fibrous bark. That there may be no question as to its existence in Szechwan, however, I may

state that several plants grew wild in my garden. The tough "bark paper," or "P'i Chih," made from this plant, and so extensively used in China, comes from the Province of Kweichow.

There is one prominent use to which this light, pliable, tough paper is put in Szechwan. I had not hitherto noticed it, nor have I seen it referred to in any book on China. It is this: In all fur-lined and wadded garments the chief desiderata are lightness, warmth, and the protection of the material lined from being frayed by the skin or wadding. As everyone knows, a fur is usually made up of a number of skins sewed together, and these seams present an uneven surface which would in time wear the silk or satin material lined. This wearing is prevented by inserting a layer of this paper, which presents an even surface to and preserves the material. Cotton and silk wadded garments are treated in the same way when there is risk of unevenness proving injurious. Lightness, warmth, and durability are the result.

5. *Fatsia papyrifera, Benth. et Hook. f.*—This plant is the source of the fine thin pith paper so well but erroneously known to foreigners in China as "rice paper." The paper, which has no connection whatever with rice, is cleverly shaved from the round pith of the plant by means of a sharp heavy knife. The pith is largely exported down river from Szechwan, but the greater part of the export is brought into the province from Kweichow where the plant is extensively grown. In Canton this paper is largely used for painting, but in Szechwan it is mostly converted into artificial flowers. It grows wild throughout the province.

14. Dyestuff, Dyeing, and Paint Colours.

In spite of the great influx of aniline dyes into Szechwan of recent years, the province still produces and uses its own dyes where fast and superior colours are desired. There is, however, one exception, namely green. The Polygonum (*cripolitanum*, Hance) which yielded this latter colour, grows wild in Szechwan, but, so far as I can gather, the extraction of the dye from its leaves ("Yeh-tzŭ Lü") has been abandoned in favour of the imported article. Not many years ago Szechwan safflower was famed throughout China, and considerable areas, notably the Department of Chien Chou to the southeast of Ch'êngtu and the Prefecture of Shun-ch'ing to the north of Chungking, were devoted to the cultivation of the plant. Aniline dyes have greatly restricted the demand from other provinces, and the area of cultivation has been cut down to little more than what is required for home consumption. I propose to enumerate here the various Szechwan dye-stuffs, and describe their methods of preparation and employment, beginning with the primary colours red, blue, and yellow, where no other

dyes are required to produce the necessary tints, and then passing to black and green, which require the introduction of blue and yellow respectively. I shall afterwards refer to the colours used in paints as distinct from dyes :—

1. *Red.*—Several red dye-stuffs are produced in Szechwan, such as the bark of *Lithospermum officinale, L.*, known as "Tzŭ-p'i," the roots and stems of *Rubia cordifolia, L.*, called "Ch'ien-ts'ao," and the petals of *Impatiens Balsamina, L.*, or "Chih-chia Hua"—the Finger-nail Flower—which derives this name from the fact that a decoction of its petals is used by ladies for tinting their finger-nails red; but the red dye of the dye-houses is par excellence Safflower—*Carthamus tinctorius, L.*,—and it is with this that I shall deal especially with reference to the dyeing of silk, for which it is principally used. It is necessary, however, to digress for a moment to explain in what form silk may be and is dyed, for it must not be supposed that silk in any shape or form can be immersed in the dye-vat. Nearly all silk which is to be manufactured into coloured piece goods is dyed in its raw state—that is to say, after it has been reeled from the cocoons and made into suitable yarn. The exception is crapes (Hu Chou or Fu Tsung in Szechwan). They are first woven the natural colours of the silk—white and yellow—and afterwards prepared and dyed. Raw silk intended for the woofs of silk known as Ning Chou and satin are not prepared; but all other raw silk and crapes undergo the following treatment before they are sent to the dye-house: they are steeped for three or four minutes in a pot of boiling water containing a solution of crude soda, removed, and rinsed in a tub of cold water, with which has been thoroughly mixed a greasy substance manufactured by hammering up a pig's caul with waste silk. This substance, known as "Chu-i-tzŭ," or pig soap, is, after the hammering process, hung up to dry for fifteen days, when it is ready for use; and the proportion of this soap to water is 2 ozs. to 50 lbs. There are many smells and stinks in China, but this soap emits the most loathsome odour I have ever experienced. After the silk has been rinsed in this greasy water, it is thoroughly washed in clean running water to remove as far as possible the soda and the soap-oil and then hung up to dry. It is now ready for the dye-house. As only the warp of the harder silks and satins is treated in this way, the dyeing of the silk, unlike crapes, must take place before the fabric is manufactured.

In Ch'êngtu red dyeing is a distinct branch of the dyeing industry, and is conducted in separate establishments, where no other colours are produced. When I visited one of these houses the following red dye was prepared for my benefit: 10 catties of dried safflower petals, worth T. $3\frac{1}{2}$, were ground dry and placed in a jar with sufficient water to make up a paste. This was removed

and placed on a double layer of coir-palm bracts resting on a circular piece of open bamboo strips fitting the middle of another jar having an orifice fitted with a wooden plug at the foot. A bucket of cold water was poured into the jar on to the safflower paste and allowed to stand for half an hour. The plug was then withdrawn, when a yellowish liquid escaped; it was thrown away as of no value. The safflower paste was then collected and packed in a coarse hempen bag which was squeezed until all the moisture had drained out. The bag was then emptied and the contents dropped into a jar into which water containing 5 catties of crude soda in solution was poured. A paste was again formed of this mixture and spread on the coir-palm bracts in the jar above referred to. A bucket of cold water containing 1 catty of dissolved soda was poured on the top and the contents allowed to stand for another half-hour; the plug was then removed, and the black liquid escaping was now carefully collected in a jar, into which a decoction obtained by steeping 10 catties of dried plums ("Suan Mei-tzŭ") in boiling water for three days was poured, the mixture resulting in a beautiful red liquid sufficient to dye 6 catties of raw or manufactured silk ("Hu Chou").

Although *Rubia cordifolia* is grown in the Department of Mao Chou, between Ch'êngtu and Sung-p'an T'ing, it is used more for medicinal than dyeing purposes. It yields an excellent red dye, and is largely employed in the Province of Kansu for dyeing the tassels of official hats which are made from the hair—not the tail—of the yak. The colour of these tassels, which is a deep red, is impervious to rain and weather, and well it might be, for the price of a good tassel ranges as high as T. 6. For *Rubia cordifolia* and *Lithospermum officinale* I had to have recourse to the drug shops of Ch'êngtu, the dye-houses being unable to supply me with specimens.

In the case of cotton cloth the following method is adopted: 4 ounces of aniline red are mixed with 2 ounces of alum in a bowl of boiling water. The contents of the bowl are poured into a jar and about 10 lbs. of cold water are added. The white cloth, having been thoroughly damped with clean water, is then placed in the jar, removed after an hour's immersion, and hung up to dry in the shade. The above quantity of dye is sufficient for 100 feet of cloth of a width of about $6\frac{1}{2}$ inches.

2. *Blue.*—The blue dye of Szechwan is derived from *Strobilanthes flaccidifolius*, *Nees*. The cultivation of this plant is not confined to any particular area or district of the province, but parts of the Ch'êngtu Plain, such as P'êng Hsien and Kuan Hsien, as well as the Prefecture of Ya-chou Fu to the west, produce the dye in very considerable quantities. The plant is propagated by cuttings, not from seed, and three crops of leaves are

gathered during the year—in July and the two following months. The cuttings, some 5 inches in length, are planted out vertically in rows in March, leaving 1 inch of each cutting showing above ground. They are at once watered after planting. In a month they have put forth leaves; in June they are manured at the roots with rape cake previously macerated with water, and in July, when they have attained a height of about 2 feet, the first crop of leaves is gathered. After the first harvest the plants are again manured with rape cake, and in August the second crop of leaves is collected, followed by the third in September. In October the stems are cut down level with the ground, pitted in dry earth and rice straw, and kept for planting out in the following spring. For this purpose the stems must not exceed two years' successive growth; if older, they are discarded and utilized for fuel. It is estimated that 600 catties of rape cake are necessary for the proper manuring of a "mou" of indigo-bearing land, which, if in good heart, should yield 720 catties of the manufactured dye, of the value of T. 36, or T. 5 a picul.

When harvested the stems with leaves are placed in a concrete pit with cold river water, and allowed to steep for from three to five days. They are then removed, leaving the water of a green colour. To this water, now containing the indican slaked lime, the proportion of 1 to 20 catties weight of leaves is added, and the mixture is then thoroughly worked for two hours with a wooden rake or plumper. At the end of twenty-four hours the indigo is found precipitated at the bottom of the pit with a surface layer of clear water. The latter is run off, leaving the indigo, which is removed and packed for transit in water-proofed wicker baskets and wooden tubs. 300 catties of leaves are estimated to yield 240 catties of wet or moist indigo. It is in this moist or soft clay form that the indigo reaches the dye-houses. Suppose, now, that the dyer wishes to dye 100 ozs. of raw or manufactured silk (Hu Chou). He takes 100 lbs. of indigo, mixes it with ten times its weight of water, and adds 10 lbs. of crude soda previously dissolved in water. The dye vat is now ready. The mordant in this case, however, is not a decoction of dried plums, but a solution of alum. In this the silk is dipped, thoroughly saturated, and then transferred to the dye-vat. The quantity of the dye absorbed by the silk is made good by adding 10 lbs. of indigo and 1 to 2 lbs. of dissolved soda, when the vat is again ready for a fresh supply of silk. It would appear from this, therefore, that 10 lbs. of indigo are required to dye 100 ozs. of silk, or that 10 ozs. of silk absorb 1 lb. of the dye.

To dye twelve pieces, or about 360 feet, of cotton cloth the following ingredients are required: 25 catties of indigo, 15 catties of crude soda, 3 catties of slaked lime, and 48 buckets of water.

They are thoroughly mixed in a vat, and stirred morning and evening for from two to four days. The cloth is then damped in cold clean water and immersed in the vat. It is removed after an hour, washed in clean water, and dried in the sun. If the colour is too bright the cloth is again placed in the vat for an hour, removed, washed, and sun-dried. By the addition of 10 catties of indigo, 1 catty of soda, and 4 ounces of lime to the vat another piece of cloth may be dyed.

3. *Yellow*.—As already stated, the natural colours of Szechwan silk are white and yellow, but when it is necessary to dye white silk yellow the dye used is a decoction of the flower buds of *Sophora japonica, L.*, a tree which is widely scattered over the province. To dye 40 ozs. of raw or manufactured silk the following quantities of dye-stuff and mordant are required: 3 lbs. of Sophora buds and 8 ozs. of alum. The buds are first baked of a light brown colour, placed in a pot of cold water, and brought to the boil. The yellow liquid or dye is poured into a jar or dye-vat, and the silk, which has been previously saturated in boiling water in which the alum has been dissolved, is immersed in it. The immersion lasts about an hour, when the dyed silk is removed and hung up to dry. The powdered roots of *Curcuma longa, L.*, are also used as a yellow dye, which, however, is employed less in the case of silk than of cotton cloth.

But Sophora buds are also employed to dye the latter, and the following is the procedure as regards one piece of 30 Chinese feet: 12 Chinese ozs. of buds having been baked a light brown are placed in some 10 catties of hot water, brought to the boil, and boiled for half an hour. The liquid is then drained into a jar. Half a catty of alum is dissolved in boiling water and mixed with 10 catties of cold water. In this latter the cloth is damped and then immersed in the jar containing the decoction from the Sophora buds. After half an hour's immersion it is removed and hung up in the shade to dry. If the powdered roots of *Curcuma longa* or turmeric are used, 1 catty of the powder is boiled in a pot of water and the cloth, having been damped with cold water, is placed in the pot and boiled for an hour, removed, washed in clean water, and dried in the sun.

4. *Green*.—I have stated above that aniline is the only green dye for silk now used in Szechwan. It is used for both silk and cotton cloth; but the former must first be dyed yellow in the manner already described. Forty Chinese ozs. of yellow silk are first dipped in a decoction obtained by boiling 2 catties of dried plums in water and then immersed in the dye-vat containing 4 Chinese ozs. of aniline green thoroughly dissolved in two buckets of cold water. After immersion the silk is removed and hung up to dry.

To dye one piece of cotton cloth, 1 Chinese oz. of aniline green and 1 oz. of alum are dissolved in a bowl of boiling water. The contents of the bowl are then mixed in a jar with about 10 catties of cold water and the cloth, after being moistened with clean water, is immersed in the jar, removed, and hung up in the shade to dry.

Cotton cloth is also dyed green with the bark of *Rhamnus parvifolius, Bunge*, which grows within the district of Kuan Hsien. It costs T. 0·0·3–4 a catty. It is boiled in water, the proportions being 10 lbs. of water to 2 lbs. of bark. The liquor is strained into a jar and $\frac{3}{10}$ oz. of alum and $\frac{1}{3}$ oz. of soda are added. The cloth, after having been dipped in cold water and rinsed, is steeped in the jar for an hour, removed, and at daylight spread on grassy ground, where it remains until about 8 or 9 o'clock in the morning, when it is taken up, washed in running water, and then hung up to dry. This is repeated three times, after which the dyeing is completed. At first the cloth is of a yellowish colour, which becomes green by the time the process is finished.

5. *Black.*—All silk to be dyed black must first be dyed blue in the manner above described. The dyer wishing to dye 40 Chinese ozs. of blue silk takes 1 catty of gallnuts, or nutgalls as they are variously called, grinds them to powder, and bakes them till they are of a deep black colour. He then takes half a catty of ordinary rice and bakes it black. He places the baked nutgall powder and rice in a pot of cold water and brings the whole to the boil. He then pours the resulting black liquid into a jar, discarding the dregs. Half a catty of the best rape oil is then brought to the boil, allowed to cool, and poured into the jar containing the black liquid or dye. Meantime, $1\frac{1}{2}$ catties of copperas or sulphate of iron have been dissolved by boiling in water, and in this the silk is dipped and damped, after which it is immersed in the black dye. To obtain a deep black colour, the silk is immersed three times in a vat, being dried after each immersion. These gallnuts, costing T. 0·2 a catty in Ch'êngtu, are derived from the *Rhus semialata, Murr.*, a tree which grows abundantly to the west of the Min River, especially in the Sub-prefecture of Ma Pien T'ing and in the District of P'êng Hsien, and must be carefully distinguished from the gallnuts derived from another species of *Rhus* (*hypoleuca, Champ?*) and used for medicial purposes. The latter are smaller, and run to about the size of a pigeon's egg. It will be observed that the former are ground to powder for dyeing purposes, and, as they are hollow, the powder occupies a much smaller space than the whole gallnuts. There is a great demand for these galls in foreign countries, and it appears to me that much freight would be saved by having them ground before export.*

*This method has since been adopted in Hankow, and is coming into favour.

I have stated above that all silk must first be dyed blue before it is dyed black, and this is strictly accurate when nutgalls are used; but when the cupules of acorns are employed, such previous dyeing is unnecessary. In the case of the latter the following is the procedure :—

Ten catties of cupules are placed in a pot with 100 catties of cold water and boiled for four hours. The liquid, which is then black, is passed through a bamboo sieve and the dregs rejected. It is now divided into four equal parts in four earthenware jars, each part being sufficient for dyeing 45 Chinese ozs. of prepared silk or silk embroidering thread. Each part is poured into a pot, and when it has come to the boil the above quantity of dry white silk is placed in each pot and boiled for five minutes. The silk is then removed and wrung. At this stage it is of a brown-black colour and is hung up in the sun to dry. Meantime the dyer takes a bowl of the unused black liquid and places it in a pot with 4 Chinese ozs. of copperas. This, having been heated till the copperas is melted, is poured into the jar containing the liquid in which the silk has been dyed a first time, and the silk is taken down before it is perfectly dry and once more placed in the jar for half an hour, when it is removed, wrung, and hung up in the sun to dry. It is now exposed till it is perfectly dry. The same quantity of copperas is required for each of the four jars. One hundred and eighty Chinese ounces of silk have thus been dyed twice, but the process is still incomplete : 1½ catties, or 2 lbs., of white rice are baked black in an iron pot, mixed with 50 catties of cold water, and boiled for an hour. The resulting black liquid is passed into a jar through a bamboo sieve and the dregs rejected. A catty of rape oil which has been boiled for a quarter of an hour is, when cool, added to the contents of the jar and thoroughly mixed therewith by vigorous stirring. The whole of the silk is then placed in this jar, whose contents are cold, and rinsed in the liquid by hand for an hour, when it is removed, wrung, and hung up in the sun to dry. It has now attained the necessary black colour and the process is complete. So far as I can gather, this final rinsing is intended to impart a lustre to the dyed silk.

The nutgalls are also used for dying cotton cloth, and, as in the case of silk, the cloth must first be dyed blue. The dyer, wishing to dye 100 Chinese feet of cloth, takes 25 catties of powdered galls baked black, adds about 6 catties of hot water and boils for an hour. The black liquid is drained off and the dregs boiled a second time with the same quantity of water. This is repeated a third time, so that the total resulting liquid amounts to about 18 catties. The latter is then divided into two parts and placed in separate jars. The blue cloth, having been damped with clean cold water, is immersed for an hour in one of the

jars, when it is removed and dried in the sun. It is then dipped in a jar of hot water in which 5 Chinese ozs. of copperas have been dissolved, removed, and dried in the sun. When dry it is immersed in the second jar of dye for an hour, removed, and after having been dried in the sun, dipped in another jar of hot water containing 5 Chinese ozs. of dissolved copperas. It is then washed with cold water and dried. The cloth has now been dyed twice, but a third process still remains. It is immersed in a strained black liquid, obtained by boiling for about an hour 3 catties of rice baked black. After an hour's immersion the cloth is removed, washed, and dried in the sun, when the dyeing is complete.

In the pine-growing districts of Szechwan, especially in the Department of Fu Chou, in the east of the province, the soot from pine wood (*Pinus Massoniana, Lamb.*) is collected and used for dyeing native cotton cloth. The following is the method pursued :—

One and a half ounces of soot are mixed with an ounce of millet spirit ("Shao Chiu"), and the resulting paste is placed in a jar containing some 12 lbs. of cold water and thoroughly mixed with it. In this black dye the cloth, having been first damped with water, is immersed for an hour. When dry the cloth is wound tightly round a wooden roller, which is placed on a stone bed under a heavy stone with a flat bottom and two ends projecting upwards. On these two ends the workman places his feet, and grasping a cross-bar in front of him with his hands, pushes with his legs the stone first to one side and then to the other, causing the cloth-covered wooden roller underneath to revolve. By this means the cloth is calendered, a glaze is imparted, and the dye is firmly pressed into it. The soot costs 84 cash a catty.

In the country districts the peasantry use the leaves of the walnut (*Juglans*), alder (*Alnus cremastogyne, Burkhill*), tallow-tree (*Sapium sebiferum, Roxb.*), and of *Pterocarya stenoptera, C.DC.*, for dyeing their cotton black. They are employed by individual families only, and find no place in the public dye-houses.

The following are the Szechwan colours used in paint work :—

1. *Red.*

(*a.*) "Yen-hung," a dark-red mixture of copperas and clay moulded into blocks from 2 to 3 catties in weight and baked. It comes from Chiang-an Hsien on the Yangtsze, and from Chia-ting Fu on the Min River.

(*b.*) "T'u hung," light-red briquettes from the east of the province.

2. *Blue.*—A blue paint colour called "Yang Lan," which is manufactured at Chungking in the following manner :—

The refuse cuttings of ox hides and horns are pared fine, placed in a Chinese pan, and baked to cinders, which are then

deposited in an earthenware jar and slowly baked for six hours in a kiln. They are afterwards packed in a bag and steeped in water. When the colouring matter has all come over into the liquid, alum is added to the latter, which is poured into jars and placed in the sun to evaporate. The solid residuum is the "Yang Lan," or blue paint colour.

3. *Yellow.*

(*a.*) The colour extracted from the leaf-buds of *Sophora japonica*, *L.*, referred to under "Dyes."

(*b.*) Orpiment from the Prefecture of Chia-ting Fu. It costs some 200 cash a catty.

(*c.*) The seeds with capsules of *Gardenia florida*, *L.*

4. *Black.*—Pine soot from Fu Chou, in the east of the province, already referred to as used for dyeing cotton cloth.

5. *White.*

(*a.*) A white clay, called "Pai Ni," from the Department of Mao Chou and the District of Kuan Hsien. It is made into bars weighing 4 ozs., and costs 7 to 8 cash a bar.

(*b.*) *White Lead.*—The manufacture of white lead is somewhat peculiar. The lead, which comes from the district of Jung-ching Hsien, in the Ya-chou Prefecture, southwest of Ch'êngtu, is beaten into sheets, which are rolled up loosely like paper and piled in a wooden steamer over an iron pot built into a brick furnace. Vinegar is poured into the pot, and a small opening or door is left at one side, between the pot and the steamer, for facilitating the addition of vinegar every five days. When not being used for this purpose, it is, like all other interstices, sealed up with clay and lime, and a stone slab resting on a mat of rice straw is placed on the top of the steamer. A slow fire of powdered charcoal, baked with water into 4-lb. blocks, is kept burning night and day for four months, and at the end of that time the metallic has been converted into white lead. The steamer is removed, exposing a yellow mass; but this yellow colour is merely superficial, and is pared off by knife. The white lead is then placed in an earthenware jar with cold water and steeped for fifteen days, when it crumbles down into powder. During these fifteen days the contents of the jar are frequently agitated with a round wooden plunger. The powdered lead is collected and packed in a cotton bag, and, when the water has drained off, it is removed from the bag and spread in a shallow wooden trough to dry for a period of five days; but before the drying process is completed it is cut into small squares by knife, each square representing as nearly as possible 12 Chinese ounces, or 1 pound. The squares are then carefully weighed, added to or reduced, and packed in paper for sale. Each packet costs T. 0·1·8. There is some waste in the shape of dregs, which are disposed of for 100 cash a catty.

Although white lead is extensively employed as a paint colour, its principal uses are for rounding the soles of Chinese boots and shoes and for a ladies' cosmetic.

15. *Medicines.*

It is with great hesitation and not without considerable apprehension that I approach the subject of Szechwan medicines, but the province produces so large and so varied an assortment of vegetable drugs that their omission from this Report would be unpardonable—especially as, with the exception of a few well-known articles like rhubarb and liquorice, they are practically—and, it may be, happily—unknown to Western medical science.

A list of Chinese medicines was compiled from the Returns of each port, and published by order of the Inspector-General of Customs in 1889, and an attempt is there made to identify the plants yielding the drugs and give their province of origin; but many of the identifications have naturally proved to be erroneous as our botanical knowledge of Western China has increased, and many of the drugs recorded from one or more provinces are produced in others not named—due, no doubt, to the fact that they did not appear as imports or exports in the port Returns. Such is the case as regards this province, which produces, but is not credited with, many of the medicines classified in the list as exports from other parts of the country. In compiling the accompanying Table of Szechwan medicines I adopted the following plan: I had copies made of the Customs list so far as this province is concerned, and had them distributed in several drug shops in Ch'êngtu, with a request that they would add to the list, if necessary, name the places of origin in the province, and note the price of each drug. The attached Table is the result of a comparison of the copies returned to me. I have followed the identifications given in the Customs list, correcting only such as are now well known to be erroneous; but I fully recognize that there must still be numerous inaccuracies and omissions, and that many years must elapse before our botanical knowledge is sufficiently extended to make the identifications scientifically exact. The medicines of animal and mineral origin are given at the end of the Table.

SZECHWAN MEDICINES.

(A.) Vegetable.

No.	Chinese Name.	Botanical Name.	Place of Production.	Retail Price in Ch'êngtu. Per Catty. T.	m.	c.
1	Ch'ai-hu	Bupleurum falcatum, L.	Kuan Hsien, Tzŭ-t'ung, Ma-pien T'ing.	0	0	8
2	Ch'ang-shan	Dichron febrifuga, Lour.	Kuan Hsien	0	0	7
3	Ch'e-ch'ien ts'ao	Plantago major, L.	Generally	0	0	6
4	Ch'ên-ai	[?]	Ditto	0	0	5
5	Ch'ên-p'i	Citrus sp.	Hsü-chou Fu, Ch'ung-ch'ing Fu.	0	0	5
6	Chi-li	Tribulus terrestris, L.	T'ung-ch'uan Fu	0	0	8
7	Chia-mu-tou	[?] a black wood	Chin-t'ang Hsien	0	1	2
8	Chiang-huang	Curcuma longa, L.	Chien-wei Hsien	0	0	6
9	Ch'iang-huo	Peucedanum decursivum, Max.	Kuan Hsien	0	2	0
10	Chieh k'eng	Platycodon grandiflorum	Chin-t'ang Hsien	0	1	5
11	Chien yün p'i	Citrus peel	Ch'ung-ch'ing Fu	0	0	8
12	Chien-hu	Angelica decursiva, Miq.	Kuan Hsien	0	1	0
13	Ch'ien jên	[?]	Hsin-fan Hsien	0	2	0
14	Ch'ien-ts'ao	Rubia cordifolia, L.	Kuan Hsien, Mao Chou, Ta-chien-lu.	0	1	4
15	Chih chü tzu	Hovenia dulcis, Thumb.	Generally	0	3	2
16	Chih-ho	Nelumbium speciosum	Pa Hsien	0	1	2
17	Chih-k'o	Ægle sepiaria, DC.	Chiang-pei T'ing, Pa Hsien	0	1	4
18	Chih-po	[?]	P'êng Hsien	0	2	4
19	Chih-shao	Pæomia albiflora, Pall.	Ch'iung Chou, Kuan Hsien	0	1	4
20	Chih-shih	Ægle sepiaria, DC.	Chiang-pei T'ing, Pa Hsien	0	1	8
21	Chih-tzŭ	Gardenia florida, L.	Hsü-chou Fu	0	1	0
22	Ch'ih shih chih	Ægle sepiaria, DC. [?]	Hua-yang Hsien, and generally.	0	0	4
23	Chin hu tou	Dendrobium nobile, Lindl...	Ya-chou Fu	0	2	5
24	Chin yin hua	Lonicera japonica, Thumb.	Hsü-chou Fu, Kuang-yüan Hsien.	0	4	0
25	Ch'in chiao	Acanthaceæ Sp. [?]	Ya-chou Fu, Kuan H. Chiang-yu H.	0	7	0
26	Ching chieh	Salvia sp.	Ch'ung-ch'ing Chou	0	0	5
27	Ch'ing mu hsiang	Aristolochia recurvilabra Hance.	Sung-p'an T'ing and Grass country.	0	1	0
28	Ch'ing têng hsiang	[?]	Kuan Hsien	0	8	0
29	Ch'ing yüan p'i	[?]	Chin-t'ang Hsien, Ch'ung-ch'ing Fu.	0	1	0
30	Chou niu	Ipomœa hederacea, Jacq.	Kuan Hsien	0	0	9
31	Chiu ts'ai tzŭ	Allium odorum, L.	Generally	0	2	5
32	Chu-ling	Fungus	Kuan Hsien, Chang-ming Hsien.	0	2	4
33	Chu-shêń	[?]	Hsü-yung T'ing	0	7	5
34	Chü-hua	Chrysanthemum sinense, Sab.; C. indicum, L.	Shih-fang Hsien, Chung-chiang Hsien.	0	2	0
35	Chü-lo	Citrus sp. (Chalaza)	Ch'ung-ch'ing Fu	0	0	7
36	Ch'uan hou p'o	Magnolia hypoleuca, S. and Z.	Kuan Hsien	0	6	4
37	Ch'uan hsiung	Pleurospermum austriacum, Hoffm.	Ditto	0	0	7
38	Ch'uan lien tzŭ	Melia Toosendan, S. and Z.	Generally	0	0	6
39	Ch'uan wu t'ou	Aconitum Wilsonii, Stapf.	Mien-chu Hsien	0	0	8
40	Ch'ung ts'ao	Cordyceps sinensis.	Sung-p'an T'ing, Ta-chien-lu.	4	0	0
41	Fên-tan p'i	[?]	Kuan Hsien, Wên-ch'uan Hsien.	0	1	6
42	Fo shou p'ien	Citrus medica, Risso. var. digitata, Lour.	Lu Chao, Ch'i-chiang Hsien, and generally.	0	4	0
43	Fu hua	Enula Britannica, L.	Hsü-chou Fu	0	1	2
44	Fu-ling	Pachyma cocos, Fries	Ch'iung Chou, Kuan Hsien	0	3	6
45	Fu-tzŭ	Aconitum Fischeri, Reich	Kuan Hsien	0	1	6
46	Hai chin sha	Fern and Lycopodium spores	Ditto	0	0	4
47	Ho hsiang	Lophantus rugosus, Fisch	Generally	0	0	7
48	Hsi hsin	Asarum himalaicum, Hook, f. et F.	Kuan Hsien	0	1	6
49	Hsi ku kuei	[?]	Sung-p'an T'ing	0	4	0
50	Hsia k'u hua	[?]	Generally	0	0	6
51	Hsiang fu	Cyperus rotundus, L.	Hsü-chou Fu	0	0	7

No.	Chinese Name.	Botanical Name.	Place of Production.	Retail Price in Ch'êngtu. — Per Catty. T. m. c.
52	Hsiang ju	Elsholtzia cristata, Willd.	Kuan Hsien	0 1 0
53	Hsiao hui	Foeniculum vulgare, Gaertn.	P'êng Hsien	0 1 2
54	Hsien hu tou	Dendrobium nobile, Lindl.	Ya-chou Fu	0 2 5
55	Hsien mao	Hypoxis minor, Don	Hsü-chou Fu	0 2 6
56	Hsin i	Magnolia conspicua, Salisb.	Kuan Hsien	0 3 0
57	Hsing jên	Prunus Armeniaca, L.	Hsü-chou Fu, Ch'engtu Chang-ming H., Kuan H.	0 1 6
58	Hsü tuan	Dipsacus asper, Wall.	Kuan Hsien	0 0 8
59	Hu huang lien	Pieris repens, Lour.	Sung-p'an T'ing	1 2 0
60	Hu lu pa	Trigonella foenumgraecum, L.	Chiang-yu Hsien	0 1 6
61	Hu ma	Linum usitatissimum, L.	Kuan Hsien	0 0 6
62	Hua chiao	Zanthoxylum Bungei, Planch.	Ya-chou Fu	0 2 5
63	Hua fên	Trichosanthes multiloba, Miq.	Kuan-yüan Hsien, Kuan Hsien.	0 4 0
64	Ditto	Trich. Kirilowii, Max.	Ditto	0 4 0
65	Hua t'ung	Clematis sp.	Kuan Hsien	0 1 0
66	Huai shu tzŭ	Sophora japonica, L.	P'êng Hsien, Kuan Hsien, and generally.	0 1 8
67	Huang ch'i	Astragalus hoantchy, Franch.	Sung-p'an T'ing, Tachien-lu	0 1 2
68	Huang ch'in tzŭ	Scutellaria sp.	Chin-t'ang Hsien	0 1 0
69	Huang lien	Coptis chinensis, Hemsl.	Ya-chou Fu	4 5 0
70	Huang po	Phellodendron amurense, Rupr.	Chiung Chou, Kuan Hsien	0 0 8
71	Huang yao	Dioscorea, sp.	Kuan Hsien	0 3 5
72	Hung hua	Carthamus tinctorius, L.	Chien Chou, Shun-ch'ing Fu	0 4 8
73	Huo ma	Cannabis sativa, L.	Wên-chiang Hsien	0 0 9
74	Kan chiang	Zingiber officinale, L.	Ch'ang-ning Hsien, Hua-yang Hsien.	0 0 8
75	Kan sui	Wickstroemia micrantha, Hemsl.	Chiang-yu Hsien	0 6 0
76	Kan sung	Nardostachys Jatamansi, DC.	Kuan Hsien	0 1 2
77	Kan sung hsiang	Ditto	P'u-chiang Hsien, Hsü-chou Fu.	0 0 5
78	Kan ts'ao	Glycyrrhiza uralensis, Fisch.	Sung-p'an T'ing, Wên-ch'uan Hsien.	0 1 6
79	Kao pên	Ligusticum simense, Oliv.	Kuan Hsien	0 0 9
80	Ko pei	Nutgall	Ma-pien T'ing, Lu C., Chiung C., Kuan H., Chiang-yu H.	0 1 6
81	Kou ch'i	Lycium chimense, Mill	Generally	0 4 0
82	Kou t'êng	Uncaria rhynchophylla, Miq.	Hsü-chou Fu, Kuan H.	0 2 4
83	Kou wen	Ditto	Ditto	0 3 0
84	K'u lien tzŭ	Picrasma quassioides, Benn.	Generally	0 0 4
85	Kuan chung	Woodwardia radicans, Sm.	Kuan Hsien	0 0 8
86	Kuan kuei	Cinnamomum Cassia, Blume.	O-mei Hsien, Huan Hsien	1 0 0
87	K'uan tung hua	Petasites japonicus, Miq.	Chiang-yu Hsien	0 3 0
88	Kuang ts'ao	[?]	Kuan Hsien	0 0 8
89	Lei wan	Mylitta lapidescens, Horan	Ch'ang-ning Hsien	0 2 8
90	Li hua	[?]	Generally	0 0 8
91	Ma huang	Ephedra Gerardiana, Wall.	Kuan Hsien	0 1 2
92	Mai tung	Ophiopagon japonicus, Gawl.	Mien Chou	0 2 2
93	Mao ku	Coelogyne bulbocodioides, Franch.	Kuan Hsien	0 5 0
94	Mêng hua	Buddleia officinalis, Max.	Ditto	0 1 6
95	Ming tang shên	Adenophora polymorpha, Ledeb.	Chiang-yu Hsien	0 3 0
96	Mu hu	Dendrobium nobile, Lind.	Shuang-liu Hsien	0 4 0
97	Mu kua kan	Pyrus cathayensis, Hems.	Hsü-chou Fu, Kuan H.	0 0 8
98	Mu pi	Magnolia yulan, Desf.	Kuan Hsien	0 2 0
99	Mu tsei	Equisetum hiemale, L.	P'êng Hsien, Kuan H.	0 1 0
100	Mu t'ung	Clematis grata, Wall.	Ditto	0 7 8
101	Nan chu tzŭ	Nandima domestica, Thumb.	Chiung Chou, Kuan H.	0 0 8
102	Nan têng	[?]	Ma-pien T'ing, Kuan H.	0 1 0
103	Niu hsi	Achyranthes bidentata, Blume.	T'ien-ch'üan Chou	0 1 2
104	Niu pang tzŭ	Arctium Lappa, L.	Kuan Hsien, P'êng H.	0 0 9
105	Nü chên tzŭ	Ligustrum lucidum, Ait.	Generally	0 0 8
106	Pa tou	Croton tiglium, L.	Chiang-an Hsien	0 1 0
107	Pai chi	Bletia hyacinthina, R. Br.	Kuan Hsien	0 1 0
108	Pai chih	Angelica anomala, Lallem.	Ch'ung-ch'ing Chou	0 0 8
109	Pai ho	Lilium Brownii, F.E. Brown	Generally	0 2 5
110	Pai jên	Thuya orientalis, L.	Chiang-yu Hsien	0 2 5
111	Pai mu êrh	Hirneola polytricha, Franch	Chiang-yu Hsien	9 0 0

No.	Chinese Name.	Botanical Name.	Place of Production.	Retail Price in Ch'êngtu. Per Catty. T.	m.	c.
112	Pai pu	Stemona tuberosa, Lour.	Kuan Hsien	0	0	8
113	Pai shao	Paeonia albiflora, Pall.	Chung-chiang Hsien	0	1	4
114	Pan hsia	Pinellia tuberifera, Tenore	Sui-ning Hsien	0	1	8
115	Pei hsieh	[?] Smilax. [?] Dioscorea	Kuan Hsien	0	0	8
116	Pei mu	Fritillaria Roylei, Hook	Sung-p'an T'ing, Kuan H., Ta-chien-lu.	2	4	0
117	Pi ch'êng chieh	Litsea pungens, Hemsl.	Kuan Hsien	0	0	4
118	P'i p'a yeh	Eryobotrya japonica, Lindl.	Generally	0	0	4
119	Pien tou	Dolichos Lablab, L.	Ditto	0	0	8
120	P'ien tzŭ ts'ao	Lithospermum officinale, L.	Hsü-chcu Fu	0	2	5
121	Po ho yeh	Mentha arvensis, L.	Chung-chiang Hsien, Ho Chou.	0	0	8
122	P'u huang	Typha orientalis, Presl.	Generally	0	1	6
123	Sang chi shêng	Loranthus Yadoriki, S. & Z.	Ditto	0	5	0
124	Sang pai	Morus alba, L.	Ditto	0	0	5
125	Sha shên	Adenophora polymorpha, Led.	Chin-t'ang Hsien, Kuan H.	0	3	0
126	Sha yüan	Tribulus terrestris, L.	T'ung-ch'uan Fu	0	0	8
127	Shê ch'uang tzŭ	Selinum Monnieri, L.	Ch'êng-tu Fu	0	0	8
128	Shê kan	Belamcanda chinensis, Lam.	O-pien T., Ma-pien T., Ch'ung-ch'ing C., Kuan H.	0	3	0
129	Shên yeh	Aralia spinosa, L.	Chin-t'ang Hsien	0	1	6
130	Shêng chin ts'ao	Lycopodium clavatum et cernuum, L.	Kuan Hsien	0	0	4
131	Shêng ma	Astilibe chinensis, Franch. et Savi. Astibile Thunbergi, Miq.	Kuan Hsien and generally	0	0	8
132	Shih chün tzŭ	Quisqualis indica, L.	Liang-shan Hsien	0	1	4
133	Shou wu	Polygonum multiflorum, Thunb.	Kuan Hsien	0	1	0
134	Shuang p'i	[?]	Ch'ung-ch'ing Chou, Kuan H.	0	0	7
135	So yang	Balanophora sp.	Chiang-yu Hsien	0	6	0
136	Su tzŭ	Perilla ocymoides, L.	P'êng Hsien, Kuan H., Chung-chiang H., Ho C.	0	2	8
137	Su yeh	Ditto	Ditto	0	1	0
138	Sui jên	[?]	Kuan Hsien	0	0	8
139	Ta chi	Euphorbia humifusa, Willd.	Hsü-chou Fu	0	5	0
140	Ta huang	Rheum officinale, Baill.	Sung-p'an T., Wên-ch'uan H., Ta-chien-lu.	0	3	5
141	T'ai wu	[?]	Kuan Hsien	0	1	0
142	Tan shên	Salvia multiorrhiza, Bunge	Chang-ming Hsien	0	1	2
143	Tang kuei	Angelica polymorpha, Max. var. sinensis, Oliv.	Chiung Chou, Kuan H.	0	2	4
144	Tang shên	Codonopsis tangshên, Hemsl.	Chang-ming Hsien	0	2	4
145	T'ao jên	Prunus persica, S. and Z...	Generally	0	1	0
146	Ti fu tzŭ	Kochia Scoparia, Schrad.	Cheng-tu Fu	0	0	8
147	Ti huang	Rehmannia glutinosa, Libosch.	Ch'ung-ch'ing Fu	0	2	0
148	Ti ku p'i	Lycium chinense, Mill.	Kuan Hsien	0	0	8
149	Tiao lan hua	Oeceoclades falcata, Lindl.	Generally	0	3	0
150	T'iao shên	[?]	Kuan Hsien	0	4	0
151	T'ien ma	Gastrodia elata, Blume.	T'ien-ch'üan Chou	0	0	8
152	T'ien nan hsing	Arisaema japonicum, Blume. [?]	Ma-pien T'ing, Kuan H.	0	1	2
153	T'ien tung	Asparagus filicinus, Ham.	Hsü-chou Fu	0	2	4
154	Tou ling	Aristolochia debilis, S.andZ.	Chang-ming H., Kuan Hsien	0	6	0
155	Ts'ang shu	Atractylis ovata, Thunb.	Wu-shan Hsien	0	1	7
156	Tsao jên	Zizyphus vulgaris, Lamb.	Chiang-yu Hsien	0	3	5
157	Ts'ao chüeh ming	Cassia Sophera et Tora, L.	Chin-t'ang Hsien	0	0	7
158	Ts'ao wang	[?]	Sung-p'an T'ing	0	2	0
159	Ts'ao wu	Aconitum Hemsleyanum, Stapf.	Kuan Hsien	0	0	8
160	Tsê hsieh	Alisma plantago, L.	Ditto	0	0	7
161	Tsui yü ts'ao	Buddleia curriflora, Hook and Arn.	Generally	0	2	2
162	Tsun tung	[?]	Mien Chou	0	2	0
163	Ts'ung jung	Æginetia indica, Roxb.	Chiang-yu Hsien	0	8	0
164	Tu chung	Eucommia ulmoides, Oliv.	P'ing-wu Hsien	0	1	6
165	Tu huo	Peucedanum, sp.	T'ien ch'üan Chou, Kuan Hsien.	0	0	7
166	Tu pei	Galls of Rhus sp.	Lu C., Chiung C., Ma-pien T'., Kuan H., Chiang-yu H.	0	2	6
167	T'u ssŭ tzŭ	Cuscuta sp.	Ho Chou	0	1	6
198	Tung jên	Benincasa cerifera, Savi	Generally	0	0	3

No.	Chinese Name.	Botanical Name.	Place of Production.	Retail Price in Ch'êngtu. — Per Catty. T. m. c.
169	T'ung ts'ao	Fatsia papyrifera, Benth. et Hook. f.	Kuan Hsien	0 2 6
170	Tzŭ pi	Lagerstroemia indica, L.	Generally	0 1 0
171	Tzŭ ts'ao	Lithospermum officinale, L.	Hsü-chou Fu	0 2 5
172	Tzŭ su	Perilla arguta, Bent.	Generally	0 0 7
173	Wei ling hsien	Clematis chinensis, Retz.	Chin-t'ang H., and generally	0 1 2
174	Wu chia p'i	Eleutherococcus Henryi, and leucorrhizus, Oliv.	Kuan Hsien	0 1 4
175	Wu chu yü	Evodia rutaecarpa, Benth. et Hook. f.	Hsü-chou Fu	0 3 0
176	Wu pei tzŭ	Rhus hypoleuca, Champ.	Ma-pien T'ing, Lu Chou, Chiung Chou, Kuan H.	0 2 6
177	Wu wei tzŭ	Schizandra chinensis, Baill	Kuan Hsien	0 2 0
178	Wu yao	Lyndera strychnifolia, Vill.	Mien-chu Hsien	0 0 8
179	Ya tou	Dendrobium nobile, Lindl.	Ya-chou Fu	0 5 0
180	Ya tsao	Gleditschia officinalis, Hemsl.	Chiung Chou, Ning-yüan Fu.	0 2 0
181	Yang tu ts'ai	Fungus [?]	Sung-p'an T., Wên-ch'uan H., Kuan H., Shih-ch'üan H.	0 5 0
182	Yi mu ts'ao	Leonurus sibericus, L.	Ch'êngtu Fu	0 0 6
183	Yin-chên	Artemisia capillaris, Thunb.	Ditto	0 0 8
184	Ying su k'o	Papaver somniferum, L.	Generally	0 0 6
185	Yü chin	Curcuma longa, L.	Ch'ung-ch'ing Chou	0 2 5
186	Yü li	Prunus japonica, Thunb.	Generally	0 2 0
187	Yüan chih	Polygala tenuifolia, Willd.	Chiang-yu Hsien	0 2 0
188	Yüan hua	Daphne Genkwa, S. and Z.	Kuan Hsien	0 1 0
189	Yüan shen	Scrophularia Oldhami, Oliv.	Shih-fang Hsien	0 0 4

(B.) Animal.

No.	Chinese Name.	English Name.	Place of Production.	Retail Price in Ch'êngtu. — Per Catty. T. m. c.
190	Ch'an i	Exuviae of Cicadae	Chiung Chou	0 5 0
191	Chiang ch'ung	Dried silkworms	Generally	0 4 0
192	Chiu hsiang ch'ung	Beetle	Yi-pin Hsien	0 5 0
193	Ch'üan ch'ung	Scorpions	Chiang-yu Hsien	1 0 0
194	Ch'ung sha	Cockroach dung	Generally	0 0 6
195	Hsiung tan	Bear's gall	Sung-p'an T'ing (Ts'aoti)	0 5 0 (per oz.)
196	Hu Ku	Tiger's bones	Sung-p'an T'ing, Mien-chu Hsien.	2 5 0
197	Ling yang ko	Chamois horns	Sung-p'an T'ing	4 0 0
198	Lu chaio	Deer horns, old	Sung-p'an T., Ta-chien-lu	0 4 5
199	Lu jung	Ditto, young	Ditto	2 0 0 (per oz.)
200	Mi t'ang	Honey	Hsü-chou Fu, Kuan H., and generally.	0 2 0
201	Pai la	White wax, insect	Chia-ting-Fu	0 5 0
202	Pan mao	Cantharides	Hsü-chou Fu	0 2 4
203	Pieh ch'ung	Beetle	Generally	0 7 0
204	Shê hsiang	Musk	Sung-p'an T., Ta-chien-lu	(In pod), 18 0 0 (without pod), 24 0 0 (per oz.)
205	Shê hsiang p'i	Musk pod	Sung-p'an T'ing, Ta-chien-lu	1 5 0 (per oz.)
206	T'zŭ wei p'i	Hedgehog skin	Chiang-yu Hsien	1 4 0 (per oz.)
207	Yeh ming sha	Bat's dung	Chiung Chou	0 0 8

(C.) Mineral.

No.	Chinese Name.	English Name.	Place of Production.	Retail Price in Ch'êngtu. Per Catty.		
				T.	m.	c.
208	Ch'ing yen	Black salt	Kuan Hsien	0	0	6
209	Hsiung huang	Realgar	Chungking Fu	0	2	8
210	Hua shih	Powdered stone	Kuang-yüan Hsien	0	1	0
211	Kan shih	Zinc bloom	Lu Chou	0	1	2
212	Liu sha*	Sand (exuviæ of silkworms)	Chia-ting Fu, Pao-ning Fu, Shun-ch'ing Fu.	0	0	5
213	Lung chih	Fossil teeth and bones	Ta-ning Hsien, Chiang-yu Hsien.	0	4	5
214	Lung ku	Ditto	Ditto	0	2	0
215	Mêng shih	Brown mica	Kuan Hsien	0	1	6
216	Mi t'o sêng	Litharge	Kuan Hsien, Hsü-chou Fu	0	1	6
217	Tao sha	Cinnabar ore clay	Hsiu-shan Hsien	4	0	0
218	T'u sha	Ditto	Kuan Hsien	0	0	8
219	Wang yüeh sha	Ditto	Han-Chou	0	1	2
220	Yü liang	Clay ironstone	P'êng Hsien	0	0	6

My investigations into the products of Szechwan have revealed to me the incredible ignorance that exists among those engaged in the various industries as to the origin of the materials with which they deal and in which they trade. They know not, and do not care to know, whence the raw materials are derived or whence they come. They are content, as their forefathers were, to buy in the cheapest and sell in the dearest market. It will be noticed in the above Table that Kuan Hsien very frequently appears as a place of production; but Kuan Hsien is really a distributing centre for the products of North-Western Szechwan, and many of the medicines credited to that district are in reality produced in the mountainous west and north of the province, whence they find their way overland to the city of Kuan Hsien for export.

I have stated above that rhubarb and liquorice are the chief Szechwan drugs with which we have at present any concern, and it may be well to emphasize here that the plant producing the former on the Szechwan-Tibetan border is *Rheum officinale Baill.*, and not *Rheum palmatum, L.*, which is alleged to be the source of the rhubarb exported from Kansu and the Kokonor region.

16. Woods used in Carpentry.

1. *Bamboo.*—I have already described the part which the bamboo plays as a vegetable, in the manufacture of paper, and its uses as a textile plant, but in Szechwan it occupies in addition the first place among woods used in carpentry. Not only can it be utilized in almost every department of the carpenter's art, but it can also be employed for purposes in which other woods would be altogether unserviceable.

*Should more properly be classed under animal medicines.

Many varieties of the bamboo grow in the province. The larger kinds are cut into lengths for buckets, liquid measures, flower and ornamental vases, and cash boxes, made into tubes for raising brine at the chief centres of salt production, manufactured into chairs, tables, and furniture of every description, carved, painted, and lacquered for decorative purposes, and even boiled, pressed, and trimmed into thin slabs for fans. The medium sizes are also used for making furniture, for scaffolding, irrigation wheels, water and gas pipes, broom handles, battens for sails, sedan chairs, carrying poles, opium pipes, flutes, umbrella frames, fan handles and ribs, lanterns, bird cages, combs, foot-rules and chop-sticks, while, shod at the butt end with iron, they serve as sounding-rods on all the provincial waterways. The small-sized bamboos, again, are in great demand for Chinese penholders, and after the perforation of their joint compartments, find a ready sale as the stems of tobacco pipes. These represent a few of its uses, but any one acquainted with the every-day life of the Chinese will easily be able to give numerous other instances of its employment. In the Plain of Ch'êngtu, which is thickly dotted with farm-houses nestling amid trees, impenetrable fences made by bending over and intertwining the stems of bamboos are much commoner than mud or brick walls. And a visit to a vegetable garden in summer shows that the frames, over which creep and twine the various cucurbitaceous plants, are all of bamboo.

The largest bamboo in Szechwan is the "Nan Chu," which grows in the district of Chiang-an Hsien, between Lu Chou and Hsü-chou Fu on the Yangtsze, and in the Prefecture of Ya-chou Fu to the west of the Min River. In addition to the uses attributed above to the larger kinds of tree, the wood of this bamboo is specially prized for its chop-sticks, which are varnished at the city of Ch'ung-ch'ing Chou, in the Ch'êngtu Plain, and have a reputation throughout the country. They are eagerly sought for by every visitor to the province. A set of these chop-sticks, consisting of sixteen pieces, or eight pairs, costs in Ch'êngtu 12 cash unvarnished. If made of other bamboos they are much cheaper. The next in size are the "Tz'ŭ Chu," grown principally in the Department of Lu Chou and in the districts of Mien-chu Hsien and Chia-chiang Hsien, and the "Pan Chu," which while scattered throughout the province, is produced in large quantities in the district of Kuan Hsien. Then come the "Shui Chu," without any special habitat, the "Hsiang-fei Chu," whose home is in the Chungking Prefecture, the "Kuan-yin Chu," in the Ch'êngtu Prefecture, and the "Lo-han Chu" and "Chin Chu," which are grown in gardens for ornamental purposes only. Bamboos are sold by the piece or by weight, and in the latter case bring from 6 to 20 cash a catty according to variety and quality. The "Hsiang-fei Chu," which

is in demand for penholders and pipe stems, is the dearest, and the "Tz'ŭ Chu," which is made into paper screens, matting, and the like is the cheapest. The "Kuan-yin Chu" is mostly used in the manufacture of opium pipes, flutes, and flageolets.

2. *Cunninghamia sinensis, R. Br.*
3. *Cupressus funebris, Endl.*
4. *Pinus Massoniana, Lamb.*

These three conifers are largely used in Szechwan for a variety of purposes. The *Cunninghamia*, which grows extensively in the Department of Chiung Chou, the districts of Kuan Hsien and Hung-ya Hsien, and on the hills bounding the valley of Chien-ch'ang or Ning-yüan Fu in the southwest of the province, is employed for building, for the manufacture of common furniture, and as coffin wood. A tree with a diameter of $6\frac{1}{2}$ inches at the base and a length of about 33 feet is worth from T. 1 to T. 2. Much of the lumber used in Ch'êngtu is felled in the mountainous country to the north and west of the city of Kuan Hsien, carried to the bank of the Min River, made up into rafts, and floated down that branch of the river which passes the North Gate of the provincial capital. The *Cunninghamia* is called "Shan Shu" (pronounced sha shu in Szechwan), and two varieties known as "Hsiang" (fragrant), "Sha" and "Yu (oil) Sha," are brought here from Kuan Hsien. The latter is used principally for coffin wood, and costs eight to nine-tenths of a tael per Chinese cubic foot of $13\frac{3}{4}$ English inches. But the coffin wood of the rich in Szechwan comes from the Chien-ch'ang valley.

On the surrounding mountains the *Cunninghamia* grows to a very large size. There it is felled, shaped into coffin wood called "Ho-pan," and carried on the backs of coolies to the nearest waterway for distribution throughout the province, and even for export. The traveller going westward from Ch'êngtu to the Chien-ch'ang valley will meet day after day large numbers of coolies perspiring under heavy loads of this rough-hewn coffin wood, which, when made up, may cost anything from T. 100 to T. 400. The most valuable coffin wood, however, is called "Yîn-chên mu" (long-buried wood), which is also found in the Chien-ch'ang valley, where huge *Cunninghamia* are discovered buried at a considerable depth under the surface. They are detected by probing with iron rods, or, as others say, by young sprouts ascending from the old trunks. A coffin of this latter wood may reach a price as high as T. 1,000, and inquiries as to why such sums are paid have elicited the reply that it preserves the dead body, and, as a proof, I am told that if food is cooked and placed in one of these coffins it will be found, after the lapse of ten days, as fresh and good as when it was placed there. The history of these buried trees is lost; but earthquakes occur in the Chien-ch'ang valley,

and the old city of Ning-yüan or Chien-ch'ang is reported to have been engulfed in the early years of the Ming Dynasty, and the present city suffered severely from a similar catastrophe in 1850, so that an earthquake or an avalanche would account for these buried forests. The signboards of the best coffin shops in Ch'êngtu declare that the proprietors are dealers in Chien-ch'ang coffin wood.

The cypress, known as *Cupressus funebris, Endl.*, is one of the commonest trees in Szechwan. It grows to a considerable height, and yields an excellent white wood, which is made into chairs, tables, and furniture generally. It is also manufactured into tubs, but rarely into water buckets, which are usually made of the preceding. The wood is valued at from seven-tenths to eight-tenths of a tael per Chinese cubic foot.

The pine (*Pinus Massoniana, Lamb.*), is less common in the west than in the east of the province; but Ch'êngtu is supplied from the districts of P'u-chiang Hsien to the south-west. The wood, which is used in house building and in the manufacture of inferior furniture, costs about T. 0·4 per Chinese cubic foot.

5. *Machilus Nanmu, Hemsl.*

6. *Cinnamomum Camphora Nees et Eberm.*

These two laurels, the "Nan Mu" and the camphor tree, supply wood for the best furniture made in Ch'êngtu. The former grows luxuriantly in the line of the Min River, in the Prefectures of Hsü-chou, Chia-ting, and Ch'êngtu, and it is a prominent tree in the temple grounds in and around the provincial capital, and is met as far west as Kuan Hsien, on the border of the Ch'êngtu Plain. The wood is expensive, costing T. 1 per Chinese cubic foot. There are several varieties of *Machilus* in the west of the province, but *Machilus Nanmu* seems to be the most common.

The camphor tree is found throughout the Ch'êngtu Prefecture, especially within the Department of Chiung Chou. The wood is less expensive than the "Nan mu," and is valued at seven-tenths to eight-tenths of a tael per Chinese cubic foot. No camphor is distilled from the wood, but the wood is sawn into thin, flat slabs beautifully marked, which, under the name of "Ying Mu," is made into small boxes and dressing cases, and used for facing inferior woods in the manufacture of wardrobes and similar articles of furniture. It costs T. 1·1·0 per Chinese cubic foot.

7. *Sophora japonica, L.*—The wood of this tree, which is particularly abundant in the districts of Hsin-ching Hsien, P'u-chiang Hsien, P'êng Hsien, and Kuan Hsien, and in the Department of Chiung Chou is utilized for furniture and costs T. 0·0·1 a catty. Many Chinese woods are sold by weight. Once in March I paid a visit to a fair which is held annually in and around a large temple outside the southwest corner of the wall of Ch'êngtu.

At this fair woodwork was predominant. Taking a fancy to a large massive table of "Hung-tou mu," of which I shall speak later, I asked the price, and was informed by the proprietor that he did not know as he was unacquainted with the exact weight. As he had no means of weighing it and refused a sporting offer, we were unable to come to terms.

8. *Cedrela sinensis*, *A. Juss.*

9. *Melia Azedarach*, *L.*

Of these two trees, which belong to the *Meliaceae*, the former is known as the Chinese mahogany, but the wood, which is beautifully marked with rich red bands on a yellowish-brown ground, is not plentiful in the piece. It is made into furniture, and costs T. 0·0·1 a catty.

The wood of the latter, which comes to Ch'êngtu from the districts of O-mei Hsien and Kuan Hsien, is worth 5 to 6 cash a catty, but is little used.

10. *Sterculia platanifolia*, *L.f.*

11. *Pterocarya stenoptera*, *C.DC.*

12. *Sapium sebiferum*, *Roxb.*

13. *Ligustrum lucidum*, *Ait.*

14. *Morus alba*, *L.*

The wood of the above five trees is also made into furniture. Ch'êngtu is supplied with the *Sterculia* by the districts of Hung-ya Hsien and P'u-chiang Hsien, and the Department of Chiung Chou. The timber is comparatively expensive, costing T. 1 per Chinese cubic foot. The *Pterocarya* is common throughout the Ch'êngtu Plain wherever water is available, and is valued at 8 cash a catty. The *Sapium*, or vegetable tallow tree, is common throughout the province, and costs T. 0·9·0 per Chinese cubic foot. The *Ligustrum*, a large-leaved privet, has a similar value, and comes from the Prefecture of Chia-ting Fu and the Department of Chiung Chou. The mulberry, which is cultivated very extensively in the Prefectures of Chia-ting Fu and Chengtu Fu for purposes of sericulture, is likewise of the same value.

15. *Cudrania triloba*, *Hance.*

16. *Salix babylonica*, *L.*

I shall have occasion to refer later to the *Cudronia* under the head of silk, and need merely state here that it is widely cultivated in the Prefectures of Chia-ting Fu and Ya-chou Fu, and in the Department of Chiung Chou. From these places the timber is brought to the provincial capital and sells for T. 0·0·2 a catty. The willow, which costs half that amount, grows along most of the waterways in the province. The wood of both is used for making the smaller articles of furniture.

17. *Buxus sempervirens L.*—The box is grown as an ornamental shrub throughout the province, but in the Department of

T'ien-ch'üan Chou, to the north-west of the city of Ya-chou, it is specially cultivated for its wood, which is the source of all the best combs manufactured in Szechwan. It costs T. 0·0·4 a catty.

18. *Ailanthus glandulosa, Desf.*

19. *Alnus cremastogyne, Burkill.*

The wood of this *Ailanthus*, called in Chinese the "stinking cedrela," is little used except for firewood. It costs from 4 to 5 cash a catty. The alder, which costs 3 to 4 cash a catty, grows in profusion on the banks of every rivulet, stream, and canal in the Ch'êngtu Plain, and, while mostly felled, owing to its quick growth, for firewood, it serves another useful purpose. Owing to its light weight, it is made into boxes for the carriage of treasure from one part of the province to another. Twenty years ago, in the absence of foliage, I expressed the opinion that this tree was probably a beech, but I now find that I was wrong in jumping to such a hasty conclusion.

20. *Pyrus sinensis, Lindl.*—The blocks used for printing books, for seals, and for visiting cards are made from the wood of the pear-tree. That used in Ch'êngtu comes from Mao Chou, to the north, and a block measuring 1 Chinese foot square by 1 inch thick costs about 100 cash. Combs are cut and made from this wood. They are dyed yellow with the fruit of *Gardenia florida*, so as to resemble yellow boxwood.

21. *Quercus sp.*—About a dozen different kinds of oaks are grown in Szechwan, and the wood, besides being converted into chairs, tables, and the like, is in great demand for the carrying poles of the better class of sedan-chairs. In the piece it costs seven-tenths of a tael per Chinese cubic foot, and in fragments is procurable at about 5 cash a catty. A pair of curved chair poles from the trunk of a tree cost from T. 10 to T. 15.

22. *Betula utilis, D. Don.*—In the northwest of the province, in the country of the so-called Man-tzŭ, there are forests of birch described to me as hundreds of *li* in length and breadth. However this may be, there can be no doubt that the birch grows there, for the yellow inner bark, with its numerous well-marked lenticils, is brought here and used in making the inner lining bands of the large straw hats worn in summer. A lining consisting of two lengths $2\frac{1}{4}$ inches broad, pasted together by two pieces of cloth, costs 10 cash on the streets of Ch'êngtu.

23. *Castanea sativa, Mill.*—The chestnut is a common tree in Szechwan, and its wood, costing 15 to 16 cash a catty, is used for making furniture.

24. *"Hung tou Shu."**—This tree, whose wood is of a rich red colour, beautifully marked, and costing T. 2·4·0 per 100 catties,

*This tree has since been named Ormosia Hosiei, Wilson.

is in great demand for the better class of furniture and for carving purposes. The Chinese name of "red bean tree" is derived from the fact that the seeds, which are red, are contained in bunches of bean-like flat pods, following on what are described to me as whitish-mauve flowers in spring. The leaves, which grow in pairs on the branches, are glabrous, ovate, and acuminate, the largest measuring from 4 to 5 by 2 to 2½ inches. Five miles to the northwest of Ch'êngtu there is a famous "red bean tree" which is honoured with a small local shrine. When I visited it on the 30th August, 1903 I found among the dense foliage, only after the most careful scrutiny, bunches of yellowish-green pointed pods, measuring 1½ inches long by ⅜ inch broad. Each pod contained five red embryonic seeds of the size of a pin point. This was in spite of the repeated assurances of the rustics living in the neighbourhood of the tree that the seeds had fallen long ago. As a matter of fact, they were only in their infancy. The tree itself, at a height of 2 feet from the ground, had a circumference of 16 odd feet, and at a height of 12 feet branched off into several enormous limbs with thick dense foliage shading a circle some 20 yards in diameter. One of the branches had come to grief in a storm, and part of the trunk was exposed where it had been attached. Incredible as it may seem, a pair of sedan poles of this wood are sometimes valued as high as T. 100.

It was while visiting this tree that I obtained confirmation of a statement made above that the perforations in the pods of *Gleditschia sinensis, Lam.*, are made from within. Loads of green pods were being carried to Ch'êngtu, and on examining them I found numerous scars or punctures which had healed over. Following them up, I found small caterpillars making their way to the seed cavities, whence they have later to emerge as full-fledged beetles.

25. *Dalbergia hupeana, Hance.*—The wood of this tree, which is white in colour, exceedingly heavy, and costs 15 to 16 cash a catty, is almost exclusively employed in building the passenger and goods wheelbarrows so much in use in the Ch'êngtu Plain, and in making the handles of carpenters' tools, blocks and pulleys for native craft, and the rammers for oil-presses. The timber, called "T'an Mu," and reputed to be of great strength and hardness, comes principally from the districts of Hsin-ching and P'u-chiang, and the Department of Chiung Chou in the southwest of the Ch'êngtu Plain.

26. *Corylus Colurna, L., Ch. Ssŭ-li.*—The Ch'êngtu supply of this timber comes from the districts of Hsin-ching and Kuan Hsien. The wood costs some 12 cash a catty, and is made into chairs and furniture generally.

27. *Zizyphus vulgaris, Lam.*—The jujube tree is common throughout Szechwan, especially in the north. The wood, which

costs some 14 cash a catty, is made into small tables, and the like.

28. *Albizzia Lebbek, Bth.*—The wood of this tree, which is called the "Yeh-ho Shu," from the fact that its flowers close at night, is made into frames for looking-glasses and into small articles used in the toilet. Ch'êngtu is supplied from Chiung Chou, and the wood costs 10 cash a catty. The central doors of the shrines in Confucian temples are frequently made of this wood, and, as the flowers of the tree close, so these doors have always been closed, even to Emperors, for everyone acquainted with China knows that entrance to a Confucian shrine is gained by the two side doors only.

29. *Juglans regia.*—From Ch'êngtu northwards to the Kansu border the walnut is quite a common tree and the wood, which is here valued at 16 cash a catty, is made into heavy articles of furniture. Where thin boards are required, it is said to be unserviceable. At one time the stocks of the rifles turned out at the Arsenal here were made of "Nan mu," but as they were found to be too light, they are now made of walnut.

30. *Sapindus Mukorossi, Gaertn.*—The wood of this tree, already referred to as one of the soap trees, is manufactured into combs.

The two great centres for the building of native craft in Szechwan are Chungking and Wan Hsien, and three kinds of wood are used in their construction. They are oak planking, some 3 to 4 inches thick, for the bottom, Nan mu boards for the lower part of the hull, and Cunninghamia boards for the upper and for deck-houses, hatches and masts.

When one considers the many thousands of junks and passenger boats, large and small, trading on the upper Yangtsze and its tributaries, it is evident that large quantities of these three woods must be annually consumed in building new craft as well as in repairs rendered necessary by the accidents which are of everyday occurrence on these dangerous waterways.

CHAPTER III.

Animal Products.

1. *Sericulture, Silk, and Silk-Weaving.*

One of the greatest and most important industries of Szechwan is silk, sericulture and silk-weaving. Nearly every part of the province produces silk, but there are certain well-defined areas within which the trees suited to the food supply of the silk-worms are specially cultivated. In the south-east, on the borders of Kweichow, within the districts of Nan-ch'uan Hsien and Ch'i-chiang Hsien, two kinds of oak, *Quercus Bungeana, F. B. Forbes*, and *Quercus Fabri, Hance*, grow, and on their leaves the silk-worms of *Antheraea Pernyi*, introduced many years ago by a Chinese official from the province of Shantung, feed and spin their cocoons. The Province of Kweichow is a considerable producer of this wild silk, and I think M. Rondot, in his book "L'Art de Soie," vol. 2 (Les Soies), p. 132, very much over-estimates the production of Szechwan. He gives 4,620,000 kilog. of cocoons, equal to about 4,444 piculs of raw wild silk, as the yield of this province; but much of the Kweichow silk enters Szechwan, and is laid on the market at the city of Nan-ch'uan, while the pongees made from it are known to the Szechwanese as Kweichow pongees. In fact, it is difficult to get the Chinese here to admit that this wild silk is a product of Szechwan at all, but having passed through the district of Ch'i-chiang Hsien twenty-one years ago on my way to Kweichow and Yünnan, and seen the silk-worms feeding on the oak, I can speak with some confidence of the existence of this local industry. The output, however, even with two crops a year, for *Antheraea Pernyi* is bivoltini, must be small—too small to be reckoned as a factor in the great silk industry of the province.

The great spinner of Szechwan is the silk-worm of *Bombyx mori*. It is a domesticated worm, its chief food being the leaves of *Morus alba, L.;* but I wish to emphasize here what I stated as the result of inquiries in this province many years ago. In the neighbourhood of Chia-ting I then came across the "Cha Shu"—*Cudrania triloba, Hance*—and I stated that silk-worms in their in-

fancy were fed on its leaves. Some doubt was cast upon this fact at the time, and I was questioned very narrowly on the subject by numerous correspondents, to whom I could only repeat what I had heard from the natives engaged in the silk industry. My return to Szechwan has enabled me to corroborate my previous statement. Early this year on the road from Chia-ting to Ch'êngtu, I passed through copses and hedges of *Cudrania* and *Morus*, and I set myself to try and verify my previous statement. The result is the same with a few more details.

The leaves of the *Cudrania* are chopped up fine, and are used to feed the silk-worms as soon as they emerge from the eggs. They are their only food for twenty-two out of the forty-eight days on which they require to be fed, and on the balance of twenty-six days only mulberry leaves are used. I was also assured that worms thus fed produce a better silk than if they had been reared on mulberry leaves alone. Not, however, content with my own inquiries, I requested a gentleman of my acquaintance at Chia-ting to go into the question and favour me with the result. The following is an extract from his letter :—

"The reasons given to me for feeding silk-worms on "Cha Shu" leaves are (*a*) these leaves come out sooner than the mulberry ; (*b*) the silk is toughened by the worms feeding first on these leaves ; (*c*) the worms also give more silk in consequence of these methods."

The words I used during my first residence in Szechwan were :—

"I was informed that these leaves (*Cudrania*) are particularly suited to the infant palate, and that the silk produced from this diet is superior in quantity and quality."

These testimonies will, I hope, remove any doubt that may still be lingering in the minds of these interested in the subject. But it must not be supposed that the silk-worms of Szechwan are all fed on the leaves of both trees, for, while the mulberry is found well distributed throughout the province, the *Cudrania* is particularly abundant, so far as I know, only within the Prefecture of Chiating Fu, one of the chief centres of sericulture in Western China.

In spite of the great economic value of silk to Szechwan, little attention is paid to the food supply of the worms. It is rare to meet with plantations of young mulberry trees, and as rare to see pruned trees. I have explained elsewhere the clever way in which the Szechwanese obtain a well-grown tree from an old trunk by coating a branch with mud, covering the latter with straw, and casing the whole with strips of bamboo fixed with ropes. When the rootlets have sufficiently developed in the mud, the branch is cut off and planted, and a young tree is at once available ; but they

seem to let their mulberries run to wood, with a consequent inferiority of the leaves for feeding purposes. The present number of trees could be quadrupled without injury to the usual crops, and the silk production correspondingly increased.

Early in March the sheets of paper on which the female moths laid their eggs after emerging from the cocoons the previous summer are taken from the places where they have been stowed away, and, if the year is forward and the trees putting forth their leaves, usually worn in the breasts of the women of the family for a few days to accelerate the hatching of the worms. The latter are then placed in shallow bamboo baskets, and carefully fed with the cut-up leaves of the *Cudrania* or mulberry, as the case may be, care being taken to remove all dirt from the leaves before supplying them as food. During the process of feeding the baskets are kept scrupulously clean, the women and children of the family paying far more attention to the health and well-being of the worms than to their own. When the worms have ceased feeding and are ready to spin their cocoons they are transferred from the baskets to the silkworm "hills," or loose sheaves of straw or rape stalks, where they at once begin to weave rough envelopes within which the cocoons are completed in from four to six days. Well-formed cocoons, distinguishable as male and female by their shape, are selected and laid aside for propagation purposes, and the rest, if not at once reeled, are either steamed or baked to destroy the chrysalides and prevent the moths emerging and rendering the cocoons valueless from a reeling point of view. Cocoons from which the moths have emerged are called pierced cocoons, and I shall have occasion later to point out the purpose for which they are most ingeniously utilized. As a rule, the worms have completed spinning by the beginning of May, and on the 18th of that month yellow cocoons were priced by me in the Ch'êngtu P ain, and cost 240 cash a catty, that is about T. 20 a picul.

In Szechwan various kinds of machines are used for reeling silk from the cocoons, the difference in construction depending chiefly on the methods of applying the motive power. One of the simplest machines is that used in Ch'êngtu. An open framework of wooden bars, 4 ft. 4 in. long, 1 ft. 10 in. wide in front and 1 ft. 11 in. behind, 2 ft. 9½ in. high at the narrower end, and rising to 3 ft. 9 in. in the rear, has two flat pieces of wood let upright into the two long horizontal top bars at a distance of 1 ft. 9½ in. from the higher end, which has no upper cross-bar. These flat pieces of wood are notched, and in the notches rest the short iron axles of a wooden roller 5 inches in diameter. The roller, which is 19¼ inches long, is bound at both ends with narrow bands of iron. On the right hand, looking to the rear of the framework, the iron axle is continued to form an elbow, with a knot at the end.

Into this roller are inserted at equal distances in its circumference six pairs of wooden spokes, 21 inches long, each pair closed at the top by a bar $15\frac{1}{2}$ inches long. Four of these pairs, which are opposite, fit square into the roller, the pieces of wood forming each pair being $8\frac{1}{2}$ inches apart; but the fifth and sixth pairs, which are also opposite, are different. The spokes of the former are 11 inches apart, and the sixth pair slope inwards as they near the roller and enter it only $4\frac{1}{2}$ inches apart. But for the accommodation of the sixth pair an opening $5\frac{3}{4}$ inches long and 1 inch wide is drilled through the centre of the roller, and the two spokes, whose heads, where they enter the top bar, are semicircular, and therefore movable, are kept apart by a wooden wedge driven between them through the opening in the roller. By driving out this wedge the sixth pair of spokes can be pushed further into the roller, and thereby slacken anything wound tight on the cross-bars of the six pairs of spokes which form the reel for the silk after it leaves the cocoons. But I am anticipating. In the left-hand corner, and in the upper bar of the framework in front, a round thin spindle of wood 8 inches long is firmly inserted, and over it a wheel consisting of two round thin pieces of wood, $3\frac{1}{2}$ inches in diameter, with central holes, and joined together along the edges by eight pieces of narrow split bamboo to form a hollow drum $7\frac{1}{2}$ inches long, is placed upright so that the drum has to revolve horizontally round the spindle which projects $\frac{1}{2}$ inch above it. On the wooden top of the drum a narrow flat piece of bamboo, having one of its ends projecting $\frac{1}{2}$ inch beyond the edge, is nailed, and the projection has a round hole drilled in it. Into this hole a wooden peg is fitted, and the other end of the peg, which is long and pointed, passes through a hole drilled in the end of a flat strip of bamboo with two upright lengths of thin bamboo 6 inches apart near its centre attached to it. The other end of the bamboo strip passes loosely through a hole 1 inch square $1\frac{1}{2}$ inches under the top of a wooden projection, $5\frac{1}{2}$ inches long, at the right-hand corner of the framework opposite the bamboo drum. The peg joining the strip of bamboo to the drum is sufficiently long to allow the former to clear the projecting spindle when the latter revolves round it, and the only purpose served by the drum when in motion is to push the strip of bamboo with its two upright pieces backwards and forwards. As the silk yarn on its way to the reel presses on the right of and against these upright pieces of bamboo, the side motion imparted to them is simply intended to effect an even distribution of the yarn on the reel. But how is the drum itself set in motion? On the left-hand side of the roller—that is, on the same side as the drum—there is a shallow groove $\frac{3}{4}$ inch broad close to the iron band forming the edge of the roller. Into this groove and round the drum a band of cotton braid is fixed, so that

when the roller—that is, the reel—revolves the drum and its attachments are set in motion. On the iron elbow or crank of the roller on the right, a crook or fork of wood, with a short length of rope attached to a projecting end, is placed, and the tail of the rope is tied to a bamboo so as to raise the latter about 18 inches from the ground. The bamboo runs forward parallel to the framework and a short distance beyond, where its end is nailed to a piece of wood fixed in the ground. From the ground it slopes upwards towards the crook, and a man standing in front of the framework with his back to the bamboo presses the latter up and down with his right foot, causing the reel to revolve and setting the whole machinery in motion. The reel revolves, the drum goes round, and the silk-distributing bamboo bar slides backwards and forwards.

It is now necessary to explain how the silk yarn reaches the reel. A bar of wood $2\frac{1}{2}$ feet long, 2 inches broad, and $1\frac{1}{2}$ inches deep has two pieces of wood 11 inches long let into its $1\frac{1}{2}$-inch side at right angles, 9 inches and 8 inches from its two ends respectively. These two pieces of wood are $9\frac{1}{2}$ inches apart, and are simply intended for the reception of stones for weighting and steadying the mechanism about to be described. From the broad side of the bar, and $9\frac{1}{2}$ inches apart, rise vertically two pieces of wood $13\frac{1}{2}$ and $11\frac{1}{2}$ inches high and three-quarters of an inch broad, the longest piece being on the right-hand side, looking from the steadying side. These two upright pieces of wood are distant from the ends of the bar, the higher almost 7 and the lower $11\frac{1}{2}$ inches. They are joined by a cross-piece 6 inches above the bar, and $3\frac{1}{2}$ inches above the latter a thin iron elbow pierces each upright piece, runs backwards 3 inches at right angles to the bar, and then turns for $2\frac{1}{2}$ inches parallel to it, each elbow ending in what may be described as the two top whorls of a corkscrew, points upwards and outwards from the elbow; 1 and $1\frac{1}{2}$ inches from the tops of the higher and lower uprights respectively a piece of wood 6 inches long projects at right angles. Each of these 6-inch cross-pieces has an opening in the centre running downwards from the left to the right side, and admitting a round piece of bamboo 6 inches long, about the thickness of a chopstick, and, from the formation of the orifice which it fills, slanting upwards. Higher up on the left side of the cross-piece attached to the higher vertical, and an inch on each side of the slanting bamboo, two other holes are drilled, but, as they come out near the bottom of the cross-piece on the right-hand side, the flat pieces of bamboo $4\frac{1}{2}$ inches long which they contain are less slanting than the piece of bamboo above which they project. The flat sides of the bamboo face each other. The cross-piece on the lower vertical is also pierced on each side of the slanting piece of bamboo; but the holes in this case are practically vertical, and so, therefore, are the flat

pieces of bamboo, also $4\frac{1}{2}$ inches long, which fill them. The flat pieces of bamboo on the wooden cross-pieces are 3 inches apart, and round holes are drilled near their tops, through which a round piece of bamboo, projecting about three-quarters of an inch on each side is passed. The greater part of each bamboo between the flat pieces is coated all round with wheat straw to about three times its own thickness, not only to prevent its slipping out, but to facilitate the passage of the silk yarn over it. Rice straw, being softer, is unsuitable for this purpose.

This smaller machine which I have endeavoured to describe is altogether unconnected with the reel.

When reeling is about to begin, a charcoal stove, fitted with an iron pan full of water on the top, is placed in front of the framework containing the reel, and the smaller machine is placed above the pot, its left-hand side being near the drum, and the right-hand side drawn away from the framework at an angle to bring the axis of the straw-covered spindles parallel to the axis of the reel. Everything is now ready for reeling, and when the water is hot, cocoons are tossed into the pot and stirred about with a comb or pair of chopsticks till the silk is loosened. If, now, the filaments of five cocoons are to be reeled into one strand of silk yarn, they are deftly seized, drawn up from the pot, twisted into the corkscrew tip of the iron elbow or bracket—no difficult threading of an eye being required—up the right side of the slanting bamboo, under and over, from right to left, the straw-covered spindle, down the left side of the slanting bamboo, under the latter and passing to the right of the yarn rising from the pot, backwards to the right of the vertical bamboo on the bamboo slide, and on to the cross-bars of the reel. The workman (for one individual—man or woman—attends to the whole process) presses the bamboo lever with his right foot, the reel goes round, the bamboo drum revolves, the slide moves from side to side, and the yarn rising from the cocoons is spread over a couple of inches or more on the reel.

The machine I have tried to describe above reels off two sets of skeins, one through each of the corkscrew openings.

It will be observed that each group of filaments crosses itself on the way down between the straw-covered spindle and the slanting bamboo, and here it is that some of them most frequently give way and have to be renewed. A reeler admitted to me that this crossing is the weakest point, but asserted that it tightens and makes the yarn more compact.

This breaking of the filaments, and rough addition of extra filaments to counter-balance the thinness of the central parts of the threads of cocoons are the cause of the unevenness of Szechwan silk, and it seems to me that foreign reeling plant might be

introduced into the province with advantage to home engineering establishments and the natives engaged in the silk industry.*

An experienced workman will reel 10 catties of cocoons in one day, and, if of good quality, they will yield 14 to 15 Chinese ounces of silk—if inferior, they may give 12 to 13 ounces. The ten catties of cocoons are reeled into four skeins, so that each skein weighs between 3 and 4 ounces. The proportionate weight of reeled silk to cocoons is thus three-fortieths to three-thirty-seconds, or less than one-tenth. When the skeins are completed, the wedge separating the eighth pair of spokes in the roller is driven out, the spokes are pushed inwards, the tension on the skeins is removed, and they can be easily taken off the reel. In damp weather a brazier of glowing charcoal is placed under the reel to dry the silk yarn as it comes over, but in bright sunny weather it is unnecessary.

Some parts of Szechwan, such as Pao-ning, produce what is called Kuo-p'ên Ssŭ, that is silk that has passed through the pan or basin. Various and conflicting accounts are given regarding this silk, but the explanation is perfectly simple. It is that the silk yarn on its way from the cocoons in the hot-water pot is made to pass under a bamboo fixed in a pan or basin of cold water before it reaches the reel. This method, which is said to produce a cleaner yarn, involves more labour, greater risk of breakage, and the silk is consequently somewhat dearer. I have seen it stated that the filaments of two or three cocoons can be thus reeled because they gain strength by passing through the cold water. Realers assure me, however, that this is not the case, and that the least number of filaments required to make silk yarn is four, and in Szechwan they range from that number as high as twelve. The reeler does not reel to the very end of the filament on the cocoon, and a thin envelope still remains inclosing the chrysalis, which has been cooked by the hot water. These chrysalides are either eaten just as they come from the pot, or more usually seasoned with sauces, while the envelopes are laid aside to be treated in the same way as pierced cocoons. I should have stated that when the skeins are taken off the reel they are knotted with a loop at one end to prevent the yarn getting mixed and ravelled. The skeins are then twisted tight and made up into "pa" or books ranging in weight from 84 to 200 Chinese ozs., according to the place of production. The usual books weigh 84, 100, 160, and 200 ozs.

The following Table gives the approximate annual production and value of raw silk throughout the province :—

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*Great improvement has taken place in this industry of late years by the introduction of foreign reeling machines, and a finer quality of silk has resulted.

Approximate Production and Value of Raw Silk in the Province of Szechwan.

Area of Production.	Kind of Silk.	Number of Books.	Weight per Book.	Value per Book.	Total Value
			Ch. ounces.	Taels.	Taels.
T'zŭ Chou	Thin yellow	8,000	200	57	456,000
	Stout yellow	4,000	200	46	184,000
	Stout white	1,000	200	47	47,000
Mien Chou	Thin yellow	10,000	100	27	270,000
	Stout yellow	4,000	160	35	140,000
	Stout white	5,000	160	36	180,000
Chia-ting Fu.. ..	Thin yellow	5,000	200	57	285,000
	Stout yellow	30,000	200	46	1,380,000
	Stout white	10,000	200	47	470,000
Mei Chou	Stout yellow	7,000	200	45	315,000
	Stout white	3,000	200	46	138,000
Ch'êng-tu Fu.. ..	Stout yellow	60,000	200	46	2,760,000
	Thin yellow	6,000	200	57	342,000
	Stout white	10,000	200	47	470,000
T'ung-ch'uan Fu ..	Thin yellow	20,000	84	21·5	430,000
	Stout yellow	40,000	84	17	680,000
	Stout white	10,000	84	17·5	175,000
Pao-ning Fu	Thin yellow	30,000	100	27	810,000
	Stout yellow	30,000	100	21	630,000
	Stout white	8,000	100	21·5	172,000
Shun-ch'ing Fu ..	Thin yellow	10,000	100	27	270,000
	Stout yellow	20,000	100	21	420,000
	Stout white	5,000	100	21·5	107,500
Hsü-chou Fu.. ..	Stout yellow	10,000	200	43	430,000
	Stout white	10,000	200	44	440,000
Ya-chou Fu	Stout yellow	10,000	200	41	410,000
	Stout white	10,000	200	42	420,000
Ning-yüan Fu ..	Stout yellow	9,000	200	42	378,000
	Stout white	600	200	43	25,800
Ch'ung-ch'ing Fu ..	Stout yellow	6,000	200	42	252,000
	Stout white	4,000	200	43	172,000
Total ..	.. ..	.. ..	..	..	13,659,300

Summary of Quantity and Value of Raw Silk Produced in Szechwan.

Kind of Silk.	Weight in Ch. ounces.	Piculs.	Lbs.	Value in Taels.
Thin yellow	10,480,000	6,550	873,333⅓	2,863,000
Stout yellow	36,200,000	22,625	3,016,666⅔	7,979,000
Stout white	12,660,000	7,912·5	1,055,000	2,817,300
	59,340,000	37,087·5	4,945,000	13,659,300
10 per cent. for extras and omissions	5,934,000	3,708·7	494,500	1,365,930
Total	65,274,000	40,796	5,439,500	15,025,230

The figures set down against each area represent the minimum output. In each case there is an excess, but the exact amount thereof is unattainable. I have thought it advisable, therefore, to add 10 per cent. for this excess as well as for trifling omissions, and the total may be taken to be as near the actual output as it is possible to make it. My inquiries on the subject have extended over several months, and the information received has been carefully sifted. In round numbers, Szechwan produces raw silk to the amount of 40,000 piculs, of the value T. 15,000,000. The above prices represent the November values of the silk at the great silk mart of Tso Ch'iao, 20 *li* from Ch'êngtu, whither silk from all parts of the province is brought for sale. The June prices would be slightly lower, for the values rise as the season advances. These prices are, perhaps, unusually high, owing, it is said, to a large export and to a shortage caused by unfavourable weather during the feeding season at the time of my investigations.

The best silk in the province is produced in the district of Jên-shou, to the east of the Min River, between Ch'êngtu and Chia-ting. It comes to Ch'êngtu for the warps of satins and the higher grades of silk. The bulk of the export to foreign countries by way of Shanghai comes from the country lying between Mien Chou and Shun-ch'ing, whence it finds its way to Chungking for shipment.

This raw reeled silk is the form in which the product is put upon the market for export; but Szechwan is a great manufacturer of silk piece goods, and I propose now to describe the weaving of satins, silks, crapes, velvets, and plush, gauze, ribbons, and the manufacture of braid and silk thread. Ch'êngtu is the greatest centre for silk weaving in the province, as well as for embroidering the silks and satins which it manufactures. It is necessary, however, to follow the reeled silk through the various stages of preparation it has to undergo before it is ready for the loom. A skein of reeled silk is spread so as to encircle a shallow oblong wicker basket, from the sides of which rise three lengths of bamboo about 2 feet long and several inches apart. From the roof of the house and over the basket, some 8 or 10 feet above it, a small ring is suspended by a string, whose other end is tied to a peg in the wall, and is used for raising or lowering the ring at pleasure. A small boy (this part of the work is done by children) seizes an end of the silk yarn in the skein, passes it through the ring, and winds the yarn round the upper end of a bamboo reel. This reel consists of two stars of split bamboo $3\frac{1}{4}$ inches apart, each star being made up of three pieces, and ending in six points, with a round hole nearly $\frac{3}{4}$ inch in diameter in the centre of the star. The points of the stars fit into six flat pieces of pointed bamboo, $7\frac{1}{8}$ inches long, the ends of which are

equidistant—$1\frac{3}{4}$ inches—from the stars at either end of the reel, so that the reel, whose diameter is $5\frac{3}{4}$ inches, is exactly the same at both ends. A round, wooden rod, 25 inches long, is passed up through the centre holes in the stars of the reel till it projects $\frac{1}{2}$ inch above the upper star, where it is stopped by a slight bulging in the rod below the lower star. From this point downwards the rod tapers gradually to a diameter of a little over $\frac{1}{4}$ inch at the end remote from the reel. The bulging on the rod holds the reel quite firm at the other end. Holding the thin end of the reel under his right arm, the boy twirls the rod with his right hand, and the silk yarn passing between the thumb and forefinger of his left hand as it descends from the suspended ring is carefully wound on the upper part of the reel. As the yarn presses against the face of the thumb of the left hand on its way to the reel, the thumb is bound with a piece of cotton cloth to prevent cutting. As soon as a sufficient quantity of yarn is wound on the reel the rod is withdrawn and the reel is submerged in a tub of clear cold water until the silk is thoroughly saturated. I noticed that during the winding the yarn frequently snapped and was rejoined by a twist of thumb and forefinger moistened with saliva.

A reel of wet silk is now wound on a spindle in the following manner: The reels, four or five in number, are removed from the water and set upright on their ends, the silk being on the upper part of the reels. Near by is a wheel 2 ft. 3 in. in diameter, with a tyre or rim $4\frac{1}{2}$ inches broad. The tyre consists of two circles of split bamboo joined together underneath by ten cross-pieces of bamboo, from the centre of each of which a spoke enters the wooden axle of the wheel. One end of the axle ends in a driving iron crank having the handle covered with bamboo. The axle is supported by wooden posts fixed in wooden planks forming a bed all round the base of the wheel. To the plank in front a board about a foot wide is fixed. This board slopes from the side of the plank slightly inwards towards the wheel, rising a little above it and approaching it within an inch or two above the height of the axle. The flat side of the board faces the tyre of the wheel, and in its centre, where board and tyre approach, a rack, like a pipe rack, is fixed. Between the six pairs of pegs forming the rack a long narrow slit, slightly longer than the rack, is cut through the board. To complete the machine five or six pieces of stout twine are separately tied tightly round the tyre of the wheel. Into one end of a hollow bamboo spindle $5\frac{2}{5}$ inches long and $\frac{3}{8}$ inch in diameter a round bamboo spike, which passes through a bamboo roller $2\frac{1}{8}$ inches long and $\frac{1}{2}$ inch in diameter, and projects for $1\frac{3}{8}$ inches at the other end, is firmly fixed, leaving a space of $\frac{1}{2}$ inch between spindle and roller. The spindle with its roller attachment measures $9\frac{3}{4}$ inches long. The workman draws

one of the pieces of twine on the tyre of the wheel through the slit in the board, pushes the roller end of the spindle through between twine and board, fits the projecting bamboo end of the roller into a hole in the opposite side of the rack while the nearer side occupies a part of the hollow space between roller and spindle, and lets the twine drop into the remainder of the space nearest to the spindle. Other spindles are filled on the rack in exactly the same way one below the other, their number depending on the number of layers of twine on the tyre of the wheel, for each spindle has a layer to itself. When everything has been adjusted the workman seizes the end of the wet yarn on the reel, gives it a twist round the spindle, and having thus connected each reel with its own spindle sits down in a line with the edge of the flat board, holding the yarns on the top of a short length of round bamboo in his left hand to prevent it being cut, and, loosely covering them with his thumb and fingers, sets the machine in motion by turning the crank of the wheel with his right hand. The wheel revolves, the spindles driven by the twine whizz round, and the silk passes over from reels to spindles.

From the spindles the yarn is now reeled off on to a winding drum in the following manner: A wooden framework resembling a builder's horse, with longitudinal and cross bars but no top bar, it fitted with a wooden bottom, down the centre of which runs lengthwise a double row of short bars and wooden projections. These rows are 3½ inches apart and the projections are alternately high and low, the shorter having round holes drilled through them, while the longer have slits cut in them horizontally from side to centre and curving downwards to vertical. The rows are so arranged that each high projection faces a low one in the opposite row. By placing the free end of each roller attached to the spindle in the hole in the short projection, and fitting the space between roller and spindle into the opposite high projection, a double row of spindles, twenty-eight on each side, is so arranged that the rollers of one row lie above and close to those of the other, leaving just sufficient room for a driving belt to pass between them. By this arrangement the fifty-six spindles project outwards on both sides of the horse. The longitudinal base bars on each side are fitted with numerous wooden pegs about a foot high, and outside the pegs a length of bamboo is fixed horizontally on either side on a level with the bars. A couple of feet from the base there is a stout wooden longitudinal bar on either side, and when the machine now being described is in motion a narrow strip of wet felt lies loosely along each bar. Its use will be referred to later. A foot above these side-bars, and running horizontally through the centre of the horse, is a single bamboo, fixed to a cross-piece of wood at each end of the horse. This bamboo has fifty-six very

narrow side-slits, twenty-eight on each side, and about 2 inches apart. The slits are alternate, not opposite. Over this bamboo, in the centre of the horse, a raised arch of a single piece of split bamboo is nailed to the inside of the two horizontal side-bars, and on the top of the arch is fixed a piece of wood about 2 inches broad, with fifty-six slits on one side only, attached to a bamboo underneath, and projecting a few inches beyond the cross-pieces of wood at both ends of the horse. The bamboo arch, when moved, imparts its motion to the notched wooden bar on the top of it. The apices of the two triangles formed by the uprights of the horse at either end are grooved, and in the grooves rest the ends of an iron rod or axle, which can be removed at pleasure. The winding drum, which consists of two drums fitting endways into each other, is 5 feet long and 26 inches in diameter. A drum is made up of a stout piece of wood at either end, which a central hole and two cross-pieces of wood passing through it at right angles, so that the six ends of the spokes are equidistant. The ends of the six spokes of the two wheels thus formed are joined by horizontal bars, forming what may be called a hollow wooden wheel. They are strung on the iron axle through the central holes, and joined together to form the winding drum. At one end of the horse, and in a line with it, is a large skeleton wheel, consisting of two narrow pieces of bamboo joined together underneath by cross-pieces of split bamboo, and from the centre of each cross-piece a bamboo spoke joins the wooden axle. The spokes, ten in number, are equidistant; the wheel is 6 ft. 4 in. in diameter; and the tyre or rim is 8 inches broad. On one side the axle ends in a crank, and the driving handle (which is of wood) is placed at an angle of over 90 degrees. An endless belt of stout hemp thread, slightly over an inch in width, passes over the rim of the wheel, between the two sets of rollers attached to the spindles arranged on the floor of the horse, over a small bamboo wheel revolving on a cross-piece of wood at the rear of the other end of the horse and on a level with the spindles, back over the top layer of spindle rollers, and on to the upper part of the wheel. Two pieces of upright bamboo, fixed at either end of the horse a few inches apart, keep the belt from straying from the desired course. If the crank is now turned, the belt, rushing between the spindle rollers, drives the lower set in the direction in which it is itself going and the upper set in the opposite direction, the latter helped by the belt, which passes over the top layer of rollers on its return to the wheel. The winding drum does not, however, move, and I shall proceed to describe the manner in which it works. Fixed near the floor on the upright at the end of the horse nearest to the driving wheel, but on the side opposite to the crank, is a wooden wheel $5\frac{3}{4}$ inches in diameter, with a

grooved rim, revolving in the same direction as the driving wheel —that is, from right to left. I shall call this wheel (A). Two feet higher up on the same beam, but revolving from left to right, is another wheel (B), $2\frac{3}{4}$ inches in diameter, with a grooved rim. A few inches higher up is a small bamboo wheel (C), 1 inch in diameter, revolving round a short axle fixed at right angles to the beam to which (A) and (B) are attached; and a foot higher is a fourth rim-grooved wheel (D), $3\frac{3}{4}$ inches in diameter, also fixed on an axle projecting at right angles from the vertical beam and revolving in the same direction as (C)—that is, at right angles to (A) and (B). The projecting end of the axle of the driving wheel opposite to the crank is enlarged by cloth padding, and has a groove over which an endless stout hemp rope is passed. The rope on the upper part of the axle passes down under a pulley, fixed by a separate rope a short distance from the ground, under (B), over (C) and (D), from (D) under and over the edge of the winding drum, and descends to (A), under which it passes to the under side of the padded axle-end. From one side of the wheel (B) projects a peg, which passes through a hole in the end of a length of split bamboo whose other end is tied to the side of the arch above referred to as supporting the horizontal notched slide.

We will suppose now that everything is in position and that the spindles are covered with silk yarn. The end of the yarn on each spindle is drawn out parallel to the spindle through the pegs standing on the longitudinal base-bar, under and over the outside horizontal bamboo, up over the central longitudinal wooden bar, through its slit in the central horizontal bamboo and the notch in the slide, and on to the winding drum. The workman turns the crank, the driving belt causes the spindles to revolve, the yarn passes up to the winding drum, on which it is spread by the action of the slide on the arch, which is moved backwards and forwards by the lever attached to the wheel (B), driven, like (A), (C), and (D), by the endless rope encircling the padded axle-end. But as soon as the silk yarns pass over the central longitudinal wooden bars, strips of wet felt are spread horizontally over them, and they pass up between the felt and the bars. It seemed to me that the felt was intended to clean the silk as it passed upwards, but I was assured by the workmen that its only use is to tighten the yarn on its way to the winding drum. In this way fifty-eight skeins of silk yarn are separately wound on the drum, leaving a blank space of a few inches where the two drums unite to form the winding drum. When the winding is completed axle and winding drum are removed from the horse, and the winding drum is drawn asunder into two pieces, which are set on their ends with the blank parts nearest the ground. Each of these drums has twenty-eight skeins upon it, and the yarn of each skein has

now to be doubled and thrown. The machine used for doubling is exactly the same as that employed for reeling the wet silk from the reels on to the spindles, as described above. The drums with the skeins are, as I have said, placed on their ends on the floor, and, 7 feet overhead, are loosely and separately suspended a number of rings by twine attached to the beams of the roof. The rings I saw in use were the large smooth mouths of broken earthenware wine-jars. The ends of the two top skeins on each drum are passed through one of the rings, carried down to the machine, and reeled on to one spindle to form a single strand. From the five drums the workman was reeling five spindles at the same time. When the two top skeins were reeled he proceeded to the next two, and so on to the end. When fifty-six spindles have been thus reeled they are placed in the machine above described and wound on to the winding drum, and it will be seen that as the spindles revolve rapidly the yarn is twisted—that is, thrown—on the first part of its way up to the drum. When this operation is completed the skeins are again reeled on to spindles to tighten and strengthen the double strand, and they are finally put into a machine in which the winding drum is one single piece, but with a much thicker axle, into which, by the removal of a few wooden pins, one of the six longitudinal frames forming the drum can be pushed in for a short distance and thereby allow the skeins to be readily removed. The silk is now ready for the "Lien-fang"—that is, the establishment where it has to undergo the treatment described by me under the head of "Dyeing." All silk required for warps, with the exceptions already stated, has to undergo this final treatment, which softens and renders it very pliable. In the very highest grades of silks both warps and woofs are thus treated, and the material is very much softer, for if the woof is hard the silk after a time—especially if folded away year after year, as Chinese clothes generally are—is liable to crack.

On the final winding drum it is particularly desirable that all the skeins should be of the same size and weight, and the following device has been hit upon to attain this result. A copper tube, like an empty brass cartridge, is fitted on the end of the axis of the winding drum nearest the driving wheel, and a little below on the upright beam fixed on the crank side, and at an upward angle, are a number of round wooden pegs. On the pegs are loosely-fitting tubes similar in every respect to that on the end of the axis. These have each 665 turns of silk thread wound round them, while the one placed on the axis is bare. The machine is started, the thread on one of the tubes below is joined to the tube on the axis, and when eight of the covered tubes have been wound off—the tube on the axis being replaced when covered—sufficient silk has passed to the drum to bring the skeins up to the proper size and weight.

I have described above how the silk, yellow or white, is reeled, doubled, thrown, and wound into skeins of the necessary size and weight, and I now propose to follow the yarn to the manufactured silk goods. In weaving the best silks, such as Ning Ch'ou and satins, where the original white colour is to be produced in the material, the yarn of the warp is first prepared and bleached, while that of the woof, unless specially ordered, is unprepared, but bleached; for, unlike crapes (Hu Chou) and Ta Ch'ou, these higher-class goods cannot be bleached in the piece. Needless to say, no bleaching takes place when the yarn has been dyed.

The bleaching is done in the following manner: A piece of sulphur weighing about $1\frac{1}{2}$ ozs. is placed in an ordinary bowl, which, in turn, is deposited in the bottom of a large chinaware jar. The sulphur is ignited, and on the top of the bowl an earthenware tile, convex side up, is fitted so as to allow the fumes of the sulphur to escape at the two sides. A grating of open-work bamboo is arranged on the top inside the jar, the silk yarn or crape in the piece is loosely spread above it, and the whole is enveloped with a piece of cloth or other covering material. Here the silk remains for about six hours, when it is removed, washed in clean water, and hung up to dry. This is repeated three times; and in the case of crapes each piece is afterwards wound on a wooden roller, stretched lengthways and sideways by hand, and then placed in a press weighted with stones.

Whether the yarn is prepared, dyed, bleached, or raw, it undergoes the following treatment before it is spread between the cloth and yarn-beams of the loom to form the warp. A skein of yarn is spread over so as to encircle six upright pieces of thin bamboo, each 3 ft. $6\frac{1}{2}$ in. long, four of which are fixed at equal intervals in a piece of wood 2 ft. 2 in. long, $1\frac{1}{2}$ inches wide, and 2 inches deep, while the remaining two rise from a similar piece of wood, which, however, is only a foot in length. A thin bar of wood fixed in the centre of the deep side of the latter passes loosely through a hole in the centre of the deep side of the former, so that the piece of wood with the two upright bamboos can be pushed out or drawn in. This is intended for tightening or slackening the skein as necessity may require. These three pieces of wood with the six upright bamboos can be moved about at pleasure, and are simply a device for spreading the skein of silk yarn, which has now to be wound on to reels similar in every respect to those already described as in use by boys in reeling off the skeins of raw silk. In the latter case the work was entirely done by hand and arm, but a machine now comes into play for winding the yarn. A stout bamboo 5 ft. 9 in. long has at a distance of 4 inches from one end, a slit drilled in it. This slit is $3\frac{1}{2}$ inches by $\frac{1}{2}$ inch. In the centre of the slit is a cross iron wire threaded through what

looks like the tip of a bamboo fishing-rod 2 ft. 9 in. long. The wire passes through at 6 inches from the butt, and from the butt end a string 2 feet long hangs, and is held down either by a stone wrapped in a piece of cloth weighing some 11 ozs., or more frequently a pair of old straw sandals. The tip of the rod has a fixed iron ring attached to it exactly the same, but larger than in the case of a fishing rod. From 1 inch behind the ring a string passes down and joins the 5 ft. 9 in.-bamboo at a point 3 ft. 2 in. from its upper end, where the slit is. Here, lashed to the side of the 5 ft. 9 in.-bamboo, is a block of wood $21\frac{1}{2}$ inches long, 2 inches deep, and $1\frac{3}{16}$ in. broad, which ends 9 inches from the foot of the bamboo. Two cross-bars, $13\frac{5}{16}$ inches long and $2\frac{1}{4}$ inches apart, leave this block at right angles, the lower one 1 inch from its lower end, and enter a block similar to the other, but only $11\frac{3}{8}$ inches long. A piece of wood with a semicircular notch in its upper end is nailed against the inner face of the shorter block, its lower end resting on the upper bar. The centre of the notch is $1\frac{7}{8}$ inches from the top of the shorter block, and in the centre of this block itself a circular hollow is cut half-way into the wood, and, as the circle is $\frac{3}{4}$ inch in diameter, its top is $1\frac{1}{8}$ inches from the upper end of the block. Facing this circular hole and notched piece of wood is a slit 7 inches long by $\frac{3}{4}$ inch broad, commencing $2\frac{1}{2}$ inches from the upper end and arched at top and bottom. A rod—or, rather, a club—of hard wood 23 inches long, measuring near the club end 1 inch in diameter, tapering to $\frac{1}{2}$ inch in diameter at the thin end, is passed—the thin end through the slit in the longer block, and the club end, which is globular and bluntly pointed, is placed in the circular hole in the opposite block. The latter is kept there by the piece of wood with the semi-circular notch. The rod, whose thin end rests in the bottom of the slit and projects $6\frac{1}{2}$ inches beyond it, slopes downwards towards the shorter block in which its club end rests. A short piece of rope or leather is fixed by a noose to the 5-ft. 9-in. bamboo just above the longer block, and the free end is drawn over, round, under, and again over the projecting thin end of the rod in such a way that the tag end, only 2 or 3 inches long and weighted with an iron ring or a few cash for a handle, falls inside between the rope or piece of leather and the longer block. By pulling the tag upwards with the right hand, letting it drop, and pulling upwards again, it will be seen that the rod revolves towards the person pulling, and when a reel, such as already described, is strung on the rod where it is kept in position by the swelling of the club end, rod and reel revolve with considerable rapidity. If, then, a skein of silk yarn is spread round the six upright bamboos placed under the point of the little fishing-rod and the end of the strand of yarn forming the skein is drawn through the

ring and down to the reel by pulling and dropping the tag alternately, the operator, usually a woman or girl, causes the reel to revolve rapidly, and the yarn is drawn round it. One end of a Chinese stool is usually fixed in the space between the two crossbars so that the person can sit while at work; and it will now be seen why the fishing-rod is lightly weighted, not fixed. Were it fixed, the yarn would snap at weak places, whereas, being lightly weighted, the point is simply drawn down and facilitates the passage of the yarn, and when the yarn snaps or sticks all the operator has to do, without getting up, is to push up the light weight and bring down the point of the rod with its ring. I am given to understand that a skilled worker will in this way reel as much as 10 Chinese ounces of yarn a day.

The number of strands in a warp depends on the breath of the material to be manufactured as well as on the weight and quality desired, and I cannot do better than describe the arrangement of a warp of black satin of which I was an eye-witness. Fifty-eight reels of silk yarn, which had undergone all the processes above described, including dyeing, were placed in line on the ground an inch or two apart, and, as far as possible, in rows three deep —and to be strictly accurate, there were eighteen rows of three, and two rows of two reels. Fixed 5 feet overhead, and parallel to the line of reels, was a wooden bar from the bottom of which, and attached to it by iron eyes, hung fifty-eight iron rings, each about 1 inch in diameter. The eyes were big enough to allow a free movement of the rings. On the ground 2 feet in front of the row of reels lay a heavy stone from which projected a bamboo supporting a frame about 1 foot square slightly below the height of the rings. This frame was filled with narrow vertical strips of split bamboo, in each of which a round hole was drilled nearer the top than the bottom of the frame, and about 4 feet behind the frame and resting against the wall of the room was a stout oblong framework of four planks of wood measuring 10 by 6 Chinese feet. This framework was placed lengthways along the wall and from the two end planks projected a number of wooden pegs about 6 inches in length. One or two pegs also projected from near the centre of the two long horizontal planks of the framework. On the right-hand end of the framework was lashed a row of round horizontal pegs about 2 inches long fitted in a wooden bar. These pegs were about half an inch apart, and I counted seventy-eight of them. The end of the strand of yarn on each reel was now seized, passed through its respective ring, and down through one of the holes in the frame of bamboo strips. The ends of the fifty-eight strands were then drawn out by hand and knotted to a peg in the lower horizontal bar of the framework behind. As soon as this had been arranged, two men alternately drew a hand round

the strands where they issue from the frame and coiled them backwards and forwards on the pegs of the framework, the man on the right finishing up by twining his handful of fifty-eight strands round a peg on the upper bar, then under the uppermost 2-inch peg in the bar lashed at the end of the framework, and down to the peg over which the ends of the strands were first knotted. Here the bunch of strands was loosely tied. A second coiling took place, and the bunch of strands was also drawn under the uppermost peg and tied at the bottom of the framework. That is to say, there were 116 strands of silk between the first or uppermost and second pegs. This process was continued between the second and third, and downwards until the whole of the seventy-seven interstices between the seventy-eight pegs were filled with the total of 8,932 strands of silk. The number of reels is usually fifty-six, but there being only one black colour, two had been added from some yarn that had been left over from a previous winding.

The largest number of strands in the warp of the widest and best satin ranges from 11,000 to 13,000, so that the horizonal short pegs lashed to the framework frequently number more than seventy-eight and many exceed 100. When the required length of warp has been wound on the framework a wooden bar fitted with sockets corresponding to the number of short horizontal pegs is fitted on the top and lashed at the two ends. The bunches of strands are now cut at the point where the first coil at the bottom of the framework began. The ends are drawn up towards the closed peg-frame, and two bunches of strands are tied together, a peg always separating the two. The other ends of the coils are tied separately, and the warp is complete. It has now to be stretched on the loom.

The Ch'êngtu loom differs very little from the ordinary hand loom which survives in parts of Great Britain to-day. There is the usual heavy framework with the yarn-beams and cloth-beams at either end, and I propose to describe here the parts of a loom for weaving figured satin, the most complicated of all the looms for silk piece goods. In addition to the yarn and cloth-beams, the axle of the former ending in two toothed wooden wheels for winding and releasing the yarn, this loom has eight pairs of healds fitted with thin silk vertical cords furnished with the necessary loops and a reed of fine strips of bamboo. Under the loom there is a pit, in the front part of which eight whole bamboo treadles spread fan-shape backwards, and under eight horizontal bamboos which project from 9 inches to 1 foot on the right of the loom. These horizontal bamboos lie beneath the position occupied by the healds and, of course, under the loom. The eight treadles are each joined by ropes to one of the horizontal bamboos which, in turn, are each attached to the lower bar of one of the eight front healds by a rope join-

ing another descending from the ends of the bar. Several feet above the place occupied by the healds, in the centre of, and running parallel to, the loom a wooden bar is fixed. On the top of the front part of this bar eight flat pieces of bamboo projecting about 2 feet on each side, are nailed. To the ends of each of these the ends of another piece of flat bamboo, bent into the shape of a bow, are tied so that each of the flat pieces nailed on the bar forms the string of the bow. Each of the eight front healds is suspended by ropes leaving the two ends of its upper bar and joining a short rope attached to the centre of the bamboo bow. I shall explain the object of this arrangement immediately. The overhead bar behind the bamboos forming the strings of the bows passes through eight wooden levers whose right arms project beyond under the loom the same distance as the horizontal bamboos under the loom, and the ends of the levers and bamboos are joined by ropes or strips of bamboo.

The ends of the short left arms of the levers lie over the centre of the loom; that is, over the centres of the eight rear healds the ends of whose two top bars are joined to the levers by strips of bamboo fitting into double iron hooks suspended from the levers by iron eyes. Each rear heald has, of course, its own lever. If a treadle is now pressed, it will be seen that one of the eight front healds is lowered, and one of the rear healds raised. If the treadle is released the rear heald falls by force of gravity, while the front heald, in the act of being depressed, draws down the bamboo bow, which acts as a spring, and draws up its heald again as the treadle is released.

The reed is suspended behind the cloth beam and in front of the healds by a couple of ropes attached to an overhead cross-batten. Two bars of wood fitting one into each side of the reed run backwards towards the rear of the loom and are jointed into the stout upper ends of pivots working on metal-shod beams underneath. The reed of a full-sized satin loom contains as many as 1,500, or even more, teeth of fine vertical slips of bamboo, and, as the strands of such a warp may number 13,000 it is evident that some eight strands must pass between each two teeth.

The shuttle, which weighs $7\frac{1}{2}$ ozs., is 17 inches long, 1 inch wide at the centre and $\frac{11}{16}$ inch deep. The wooden central part, which is cut through and through for a length of $5\frac{7}{8}$ inches, is $8\frac{5}{8}$ inches long and the ends are cased with iron curving slightly inwards and blunt at the points. The iron casing is fixed by being drawn along the sides of the wooden centre and driven through them, entering the wood at the back and front $3\frac{1}{8}$ and $2\frac{1}{2}$ inches apart respectively. In the centre of the front side there is an eye lined with chinaware for the passage of the woof yarn. Low down on the opposite side two little brushes of coir-palm

fibre, $1\frac{1}{4}$ inches apart, are let in to the wood so that the faces of the brushes, which are slightly longer than the width of the shuttle, press against the opposite side. These brushes afford a resting place for the bobbin and, as there is no bottom to the shuttle, prevent it from falling out. The bobbin, which is a hollow bamboo $3\frac{3}{8}$ inches long and $\frac{1}{8}$ inch in diameter, revolves on a round thin piece of bamboo whose pointed ends rest in little holes pierced below the centres of the two flat ends of the hollow centre of the shuttle. There is a notch on the outer side of the right-hand flat end to enable the end of the axis of the bobbin to slip down to its little hole after the other end has been placed in position.

The above are the essential parts of a loom for weaving plain satin; but, as I have undertaken to describe a loom for the manufacture of figured satin, it is necessary to give details as to how the figures and flowers are produced in the material. As the machinery for the purpose has to be affixed to the loom before the warp is stretched it must be described first, and, as it applies to satins and the best silk goods, but not to ribbons and some other silk materials which will be noticed in their proper place, one description will suffice.

Looking from the cloth-beam towards the back of the loom one notices just behind the healds several (usually three or four) bunches of silk cords separately suspended from a cross-beam high above the loom. About a foot below their point of attachment to the beam they are brought together again loosely by two arms of cross cords whose ends are stretched by two vertical pieces of bamboo. The cross-cords pass through and through the vertical cords, and in this interlacing lies the secret of the figure or pattern in the material to be manufactured. Below the cross the vertical cords pass down, over, and to the right of several stout bamboos suspended at righ angles to the loom and below them each cord is joined by three or four cords, the number depending on the number of bunches attached to the beam overhead. The vertical cords with their additions now pass down, over, and between several finer bamboos suspended diagonally to the healds so as to cover the whole breadth of the loom and thereby distribute the figure or pattern.

When they arrive at the place where the warp is stretched each cord is provided with a loop, and they then pass down through a large bamboo grating under which each cord is attached through a small hole in the tip of a slip of bamboo wood about 18 inches long. The lower ends of the slips hang a few inches above the bottom of the pit under the loom. On a staging erected on the left side of the loom, opposite the suspended cords, a man sits aloft on a bar parallel to the loom in such a position that the cords of the cross-arms are within easy reach of, but above, his

hands. As I have said, the figure or pattern to be woven lies in this tangled mass of cords. On pulling down the first cross-cord the workman finds that the vertical cords are divided by it, and he seizes the number so divided and nearest to him, pulls them outwards and upwards, drops the cross-cord, seizes the next cross-cord (it may be on the other arm), pulls the number of vertical cords which it in turn separates from the bunch, and so on.

The pulling of these vertical cords means the raising of the strands of the warp which pass through their loops. It may be one or it may be many, dependent on the figure; but he is concerned only with the vertical cords nearest to him which each cross-cord opens and places within his reach. By the addition of three or four cords to each original cord the raising of the strands of the warp, which is the essential element in the production of the figure, is simultaneously carried out across the whole breadth of the warp.

In the process of pulling, the operator keeps time with the movements of the reed, and when there is a break between the figures in the length of the material he takes his cue to stop and recommence by the weaver tapping on the reed, for he cannot follow from his perch aloft the progress of the work. When the cross-strings are all exhausted they are drawn upwards again and the figure once more buried in the bunch of cords. The vertical cords are well rubbed with white and yellow wax to prevent their sticking together and to facilitate their separation by the cross-cords. The manufacture of these cord figures for the weaving establishments is in the hands of a few experts who supply the patterns. From the patterns the weavers make up the bunches of cords for the looms. I have asked many weavers why, once they have got a pattern from the expert, they do not purchase it outright or simply make a copy for future use, but all the answer I could get was that it was cheaper to employ the expert each time than to buy the quantity of silk cord which would be required for a number of patterns. I have beside me the pattern of a figure made up of a combination of bamboo leaf, peach-blossom, and the flower of *Paeonia moutan, Sims*, in which the vertical silk cords number 360 and the cross-cords 515. It weighs 5 ozs. These, of course, represent merely the upper half of the figure, for the vertical cords have to be trebled or quadrupled above and below the warp by the weaving establishments.

To stretch the warp on the loom, the ends of the bunches of yarn held by the frame with short pegs are drawn under the yard-beam, a thin narrow strip of bamboo is passed through the tied ends of the bunches, and adjusted over a line of short wooden pins projecting from the beam, the pegged frame is pushed forward to spread out the warp, the toothed wooden wheels at the

ends of the beam are turned towards the front of the loom, and while the warp is being drawn under the beam a workman spreads on the warp-strands sheets of paper, which are also dragged under the yarn-beam, and, separating the layers of the warp yarn, prevent it from slipping too fast as the weaving progresses. The other end of the warp which has been passed over the healds, is held tightly by another workman in front of the cloth-beam, where four smooth, stout horizontal bamboos have been rigged up, and between, under, and over which the warp is made to pass on its way to the yarn-beam. This is simply a device to procure an even pressure on the warp. When the yarn has been wound on the beam until the cloth-beam ends of the warp are behind the card-figure (I am still speaking of figured satin), these ends are passed by hand through the loops in the card-figure, in the eight pairs of healds between the teeth of the reed, and fixed on the cloth-beam exactly like the other end of the warp. In all satins the strands have each a separate loop in the healds, and in the heaviest class of goods they pass in groups of eight between the teeth of the reed. In lighter satins they pass in groups of five. In the former the strands are so arranged in the healds that on pressing a treadle the fall of a front and the rise of a back heald give a shed in which the proportion of strands below to those above is seven to one, while in the latter it is four to one. This, of course, gives the face of satin, which is underneath, its glossy appearance. The stretching of a warp, as I have above described it, occupies several days, the great difficulty being the threading of the loops of card-figure and healds and the reed; but once a loom has been used the labour is very much reduced by joining each of the strands of the new to the ends of an old warp, and pulling them through card-figure, healds, and reed. This I have seen time after time, and the work was done with marvellous dexterity and speed, considering that several thousand knots had to be tied. It should be noted that in satins, silks, crapes, velvet, and even silk ribbons, the strands of silk which go to make up the edges of the material are stouter than the central part of the warp. They are not wound on the yarn-beam, but on emerging from the rear healds they pass backwards through a perforated piece of flat bamboo to keep the strands separate, then under a cross bamboo affixed to the under-sides of the two long sides of the loom, whence they are carried over a smooth wood or bamboo cross-bar, placed in position above the yarn-beam, and finally hang down wound on a reel or weighted by a stone on the other side. In crape weaving I have seen the edge yarn carried right over the loom and dangling by reels on either side of the weaver at the cloth-beam, and well within reach of his hands. In the heavier looms a pulley with ropes running along the side of the loom to

the weaver's left lies on the top of, and is affixed to the wheel on, the left end of the yarn-beam, so that by pulling on the rope he can release the yarn as required. In the light loom used for weaving ribbons, the same purpose is effected by means of a rope carried round the wheel at the right side of the yarn-beam, and brought forward within reach of the weaver's feet, which manipulate the supply of yarn.

The yarn for the woof in satin and silk, unless specially ordered, is raw silk—that is, silk as reeled from the cocoons; but several strands are required to make up one strand of the woof. Whether of the original white or yellow colours (bleached or unbleached) or dyed, the strands of raw reeled silk are first beaten on a stone slab with a wooden mallet to soften them. They are then wound on to reels by hand in the manner already described in the treatment of warp yarn. From the reels they are transferred to the bobbins in the following manner. The bobbin-winder is a small oblong wooden machine, on one side of which an octagonal openwork bamboo wheel, 16 inches in diameter, with a rim 4 inches wide, is fitted so that the axle rests in two uprights, one rising out of the machine, the other nailed to its side. The angles of the wheel are joined by cross-pieces of wood slightly under the apices, and covered with short lengths of bamboo, which revolve round them. A foot in front of the wheel and in a line with it, an iron wire about the stoutness of a knitting needle is driven through the bar of wood forming the upper bar of the machine, and projects some 10 inches above and 2 inches below it. Six inches in front of the vertical wire, and at right angles to it, a similar iron wire protrudes some 4 inches from the end of the front cross-bar of the machine. Where it protrudes a shallow, round hollow is scooped in the wood sufficiently large to take loosely the end of a bobbin. A string of silk or cotton is placed on the rim of the wheel at the back, drawn forward over the top and under, so that it passes on the inner sides of the vertical wire above and below the side bar respectively, given one twist, and run round the horizontal wire in front. It is then securely tied, but sufficiently loose to allow a bobbin placed on the horizontal front wire to pass through it and fit into the hollow of the front bar. Rising forward from the front of the machine is a thin bamboo rod, about 3 feet long, with a fixed iron ring at the tip. The reels of silk yarn or thread, as the case may be, are placed upright on the ground under the tip of the rod, and the ends of the yarn fixed to the bobbin. A wooden handle, not forming part of the wheel, is inserted in the interstices between the spokes, pushed round, driving the wheel, which acts on the string and causes the bobbin to revolve with great speed. In this way the strands of yarn, which may number from two to twelve, according to the

quality of satin or silk, are reeled on the bobbin, which, placed in the shuttle, is thrown through the shed of the warp, driven home by the reed and forms the woof.

In plain and figured satins, as soon as 18 inches or a couple of feet have been woven, the weaver takes a short length of a large bamboo which has been cut horizontally through its centre, and holding the arched side in both hands, rubs the material heavily with the two ends forming the bottom of the arch. These ends have been carefully smoothed, and the rubbing, which takes place on the upper or wrong side of the satin, is intended to effect an even distribution of the predominating strands of the warp on the right side and thus complete the gloss on the face of the material. In inferior satins a little batter, consisting of a mixture of wheat flour and cold water, is spread on the wrong side with a piece of cotton cloth, after the rubbing or scraping with the bamboo, to make the material seem thicker and delude the purchaser. This is applied in all colours except red, which is declared to be sensitive to wheat flour and is treated with rice flour. In the hot months of summer a little alum is added to the batter, some say to prevent it and the satin from mildewing, others to make the material proof against moths, but I think the former is the more reasonable explanation. In the case of the silk manufactured at Chia-ting, and known as "Fên Ta Ch'ou," the batter or sizing consists of pea flour.

In all satins, whether plain or figured, broad or narrow, the loom has eight pairs of healds and the strands of the warp pass singly through each loop in the healds, but in the heavier silks, such as "Ning Ch'ou," it has only six pairs of healds, and sometimes six front and three back healds. The material manufactured by the latter, however, is somewhat inferior. There is this further distinction that in silk the strands of yarn pass in pairs through the heald loops and in groups of six through the teeth of the reel. In the best "Ning Ch'ou" the strands of the warp number from 9,000 to 10,000. The card-figure is the same in figured satins, silks, and crapes, and is manipulated in the same manner; but in figured gauzes and ribbons, of which I shall speak later, a different method is employed.

In figured satins three men are usually employed at each loom: one weaving, one at the card-figure, and the third attending to the warp, whose strands, owing to their great number, require constant attention.

Crape, both warp and woof, is manufactured from raw silk of a white or yellow colour, for, as I have pointed out elsewhere, preparation, bleaching, and dyeing, if dyeing is desired, are carried out in the material, not in the yarn or thread. What particularly distinguishes crape from satin and other silk is the fact that the

woof is made of twisted thread not yarn. The crape loom has four pairs of healds, but the four rear healds are bound together and moved in couples, while the four in front work separately. There are, of course, four treadles. The reed has 2,440 teeth, and, as the strands of the warp number 5,760 (reduced to 2,880 by running each two strands through a paste or batter), they pass through the teeth in pairs of double strands. Each double strand, however, has its own separate loop in the healds. The edge strands, which number twenty on each side, are stouter than the strands of the warp and are not wound on the yarn-beam. On leaving the rear healds they pass backwards through twenty small holes in a flat piece of bamboo, under a cross bamboo beneath the level of the warp joined to the under-sides of the long beams of the loom in front of the yarn-beam, and are carried up and over the loom, their ends being tied to a reel or other piece of wood which dangles down on either side of the weaver and is under his control.

I have already described the process by which small boys transfer the raw reeled skeins of silk to reels. Two, three, or four of these reels are taken, placed upright on the ground, the ends of the yarn seized and wound on to a single reel. The number of reels depends on the thickness of the desired thread: they are never less than two nor more than four. When the new reels are full they are forthwith steeped until the silk is thoroughly saturated in cold water. Each reel is then fitted upright on a hollow axle moving freely round a peg on the top bar of a T-shaped wooden frame, which a man can readily carry about in one hand by the pole forming the down stroke of the T. The ends of the united strands on each reel (there is accommodation for ten reels on the top bar of the T) are fastened in a notch near the upper end of a 3-inch iron wire, somewhat stouter than a knitting wire, while the lower end of the wire passes through a copper ball about the size of a marble. The wire and ball, which together weigh $\frac{3}{4}$ oz., form part of the plant for twisting the thread, and at the same time serve the purpose of keeping the strands of yarn tight during the process.

On a bamboo tripod about 6 feet high, a cross-bar of wood, on the top of which are fastened at equal distances twenty bamboo half-hoops, is fixed; 20 or 30 yards beyond a bamboo with a cross bamboo top bar is embedded in the ground, and a like distance beyond a single bamboo is erected. Taking in one hand the T-shaped frame with the reels, he deftly places the copper balls between the hoops on the right side of the tripod bar, so that the balls drop some $2\frac{1}{2}$ feet below it, carries the revolving reels along, draws the yarn over the bamboo bar ahead, round the erect bamboo, back over the cross bamboo, and between the ten

remaining loops on the left tripod bar. Severing the strands of yarn, he attaches to each set its iron wire and copper ball in a line with the other ten already in position. Commencing on the left, the workman takes up a couple of pieces of wood resembling a pair of diminutive boot-trees soled with a band of leather, and seizing the iron wire above the first copper ball between the soles, twists it rapidly in one direction. He does the same with the next four. The next five are twisted in the opposite direction. He treats the next ten in a similar manner, five in one direction and five in the other, making what the Chinese call right and left-twisted threads. He repeats the twisting a second time. By the contraction of the yarn the balls ascend towards the hoops on the tripod bar; but he lowers them by advancing the tripod, and again twists the whole twenty. When the balls again reach the hoops the twisting is sufficient and the thread for the woof of crape is complete. The wooden twisters have hollows near the heels to allow the hands to have a firm grasp. Throwing these aside he breaks off the ten balls and wire on the right, attaches each thread through its narrow channel, with a tiny revolving bamboo for an arch, leading to an openwork wooden winder, the ends of whose axis fit into the wooden sides of a machine resembling a small barrow without legs, in which the ten channels take the place of the wheel. The winder has a handle on the right, and he trots along turning the handle as he goes and bringing over the thread on to the winder in ten separate skeins. Returning to the tripod he breaks off the ten remaining balls and wires and fixes the ends of the threads on the winder so as to be able to catch them up and join them on to the ends of the next lot of threads. When the skeins on the winder are complete, the whole is steeped in cold water to prevent the untwisting of the thread. It is afterwards removed and placed in the open to dry. The thread is then wound on to bobbins by means of the octagonal bamboo wheel, care being taken that the thread with the left and right twist respectively is wound on separate bobbins.

The shuttle used for crape weaving weighs $7\frac{3}{4}$ ozs. It is shorter than that used for satin and "Ning Ch'ou," and measures 13 inches by $\frac{11}{16}$ inch. The length of the wooden centre is 7 inches and of the central hollow 4 inches. It is, of course, provided with the two palm-coir brushes. Two shuttles, one with thread twisted to the right, the other with thread twisted in the opposite direction, are used. The weaver makes the shed, passes the former through from right to left, presses the next treadle, repasses the same shuttle from left to right, depresses the next treadle, seizes the other shuttle, passes it through and back to the right like the previous one, and goes on weaving, taking each shuttle in turn. It is this alternation of thread twisted in opposite

directions that gives crape its peculiar wrinkled appearance. Unlike satin and "Ning Ch'ou," the face of the crape is uppermost. A weaver will accomplish 16 to 17 feet a day, the width of the material varying from 1 ft. 4 in. to 1 ft. 6 in. in Chinese measurement. The usual breadth is 19 English inches. Crape loses considerable weight when prepared and dyed, or simply bleached. A piece 50 Chinese feet long may weigh 26 Chinese ounces at the time of manufacture, but when placed on the market it will weigh only 17 Chinese ounces.

There is a material manufactured called "Hsien Chou"—that is, thread crape. It is woven both plain and figured. It differs from crape in that the thread of the woof is prepared silk twisted in one direction only, so that only one shuttle is used in weaving. The loom used has eight front healds, with two additional healds for depressing the strands of the warp in the manufacture of the pattern, and four rear healds. The two figure healds are in addition to the card-figure. The breadth of "Hsien Chou" is 1 ft. 8 in. (Chinese measurements), and the strands of the warp number 3,200. The presence of two figure healds is due to the fact that the figure as now manufactured is always round in shape, and to effect this in a warp in which the strands are less numerous than in heavier silks other aid beyond the card-figure is necessary.

Another material included in crapes is "P'ing Chou," but it is really a silk. It is 2 ft. 2 in. (Chinese measurement) in breadth. The strands of the warp number about 3,000, and the woof is of raw silk. The loom has eight front and four rear healds. The material is almost entirely figured; but only the card-figure is required for the pattern. In crape, "Hsien Chou," and "P'ing Chou" the face of the material is always uppermost, and it is probable that the inclusion of the two last in crapes is due to this.

Crape weaving takes place outside Ch'êngtu. Little, if any, is done inside the city, and the reasons given are that labour is cheaper in the country, and that there is much more space available for manufacturing the thread. Both are true, for food is much cheaper outside, and the city is well packed with buildings.

The weaving of silk velvet is somewhat peculiar, and seems to me to deserve a detailed description. The loom has two yarn-beams some distance apart and placed one under the other. The upper and lower have warps of about 3,000 and 2,000 strands of raw and prepared silk yarn respectively. The two warps meet before entering the healds, of which there are eight; but the four in front, through whose loops only the prepared silk yarn passes, are arranged to move together by means of a single lever connected with the outermost right-hand treadle, while the four behind move separately. There are, therefore, five treadles. The reed is made up of some 700 fine vertical strips of bamboo, and through the

interstices the strands pass in groups of six or seven. On pressing the right-hand treadle the four front healds, with the whole of the warp of prepared silk, rise together, while one of the back healds moves slightly downwards with its proportion of raw yarn, and a shed is formed. That is to say, the top of the shed is prepared and the bottom raw silk. Through the shed a narrow flat strip of bamboo, long enough to project about a quarter of an inch on each side of the warp, and about the stoutness of an ordinary straw, is passed by hand and driven home by the reed. The second treadle is pressed and makes a shed of a combination of prepared and raw silk. Two shuttles are now used, one with a bobbin of fine cotton yarn, the other with raw silk. The former is thrown through the shed by the weaver's left hand, the next treadle is pressed, and the same shuttle thrown back from right to left. The cotton is driven home by reed, the next treadle pressed, the shuttle with raw silk thrown through the shed from right to left, the next treadle pressed, and the silk shuttle returned from left to right. The silk, like the cotton, is now driven home by reed; the next treadle—that is the treadle on the right operating the front four healds with the supply of prepared silk—is depressed, and another strip of bamboo inserted, cotton and silk yarn following as before, and the shed with prepared silk only above, and raw silk below is again formed. The weaver now stops, takes a thin piece of iron or steel some 3 inches long and half an inch broad, sharpened at one end like a lance and curving inwards almost forming a semicircle, with two projecting points, and draws the latter deftly along from left to right on the top of the first strip of bamboo severing the warp of prepared silk yarn covering it. The severed yarn forms the pile of the velvet, the strip of bamboo is lifted out, thrust into the new shed forward, and the work of weaving is continued, the yarn covering each strip of bamboo being severed by the weaver as he proceeds. An edge about a quarter of an inch wide is left unserved on each side. The velvet is 1 ft. 8 in. wide (Chinese measurement), and as Szechwan produces no bamboos with such a length between the joints, the bamboo strips are annually imported from the east of China. They are yielded by the bamboo called "Nan Chu"—southern bamboo—much used in Southern China for making chop-sticks and for the carving of antithetical aphorisms. As the weaving of the velvet proceeds, stretchers with iron points piercing the centres of the two edges are placed beneath the material to keep it taut. Velvet weaving is a slow process: 2 feet are considered a good day's work, and the manufactured article costs about half a tael a foot (Chinese mensurement).

Plush is manufactured in exactly the same way as velvet. The loom is alike, the only difference being that the strips of bamboo

inserted in the shed are stouter, so that when the yarn on the top is cut the pile is longer.

The shuttles are of the same size, shape, and weight as those used for crape.

Plain and figured gauze is manufactured on a loom much smaller than the ordinary silk loom. In the former the loom has five pairs of healds, and the warp and weft are both of raw silk. The ordinary width of the material is 1 ft. 2 in. and the length 19 feet, Chinese measurement. A whole piece can be woven by one man in a day. The warp contains 3,000 strands, with stouter strands for the two edges, arranged in the usual way apart from the yarn-beam. Ten strands pass together through the teeth of the reed. This gauze, which is prepared and dyed in all colours, is used for lining wearing apparel.

In figured gauze there are, in addition to the five pairs of healds, twenty healds for the figure. They are placed immediately behind the ten ordinary healds and are worked by twenty wooden treadles, from which project twenty props, arranged in four rows of five each. Ropes connect these treadles with overhead levers, which in turn raise the figure healds. There is no card-figure. The closeness of the figure-treadles necessitates the attachment of the props. The ordinary five pairs of healds are worked by the usual five treadles, which, however, lie alongside and to the right of the loom. These are depressed by the right, while the left foot plays over the twenty props of the figure healds. As in plain gauze, the warp and weft of the figured are both of raw silk. It is difficult to distinguish any pattern until the material has been prepared and dyed. The warp of this gauze, which is woven in pieces 18 feet by 1 ft. 2 in. Chinese measurement, contains 2,500 strands, passing in groups of five through the teeth of the reed. Figured gauze, which, like the preceding, is always dyed, is used almost exclusively for mounting scrolls, pictures, and the like. A wider (1 ft. 7 in.) figured material is manufactured principally at the city of Shun-ch'ing Fu for the same purpose, and in small quantities in Ch'êngtu. It is called "Ta Hua Ling" (large figured gauze) to distinguish it from "Hua Ling" and "Pan Ling" (figured and plain gauze respectively).

There is an inferior kind of gauze manufactured in Ch'êngtu called Ming-ch'i Ch'ou. It is dried and used for linings, but it is more generally waterproofed by a coating of prepared boiled wood-oil and made into hat covers, rain-coats, and sheeting, and the like.

The shuttle used in weaving gauze weighs $5\frac{1}{4}$ ozs., and measures $11\frac{1}{8}$ inches by $1\frac{1}{4}$ inches by $\frac{3}{4}$ inch, the open part being $3\frac{7}{8}$ inches long.

Satin and silk ribbons of every imaginable colour and pattern are manufactured by loom in Ch'êngtu. The lengths vary, with a maximum width of $3\frac{3}{16}$ English inches. I have already described in great detail the weaving of silks, and, to enter fully into the ribbon industry would make this section, already too protracted, of an interminable length. I shall, therefore, confine myself to a description of the process of weaving a satin ribbon $2\frac{1}{16}$ inches wide, of which I was a witness.

The loom was small but complicated, on account of the large number of healds with which it was fitted. They numbered eighty, worked by seventy-eight treadles, eight being on the right side of the loom for the ordinary healds, which numbered ten. Of these ten, the two front healds really represented eight, for by two cross-lengths of bamboo fixed underneath the loom and forward of the cloth-beam they were attached by ropes alternately to each of the eight side treadles. That is to say, on pressing a treadle, one of the two front healds was lowered and one of the eight healds behind raised to make the shed in the warp. Owing to the closeness of the seventy treadles underneath the loom, and the consequent difficulty of working each separately by foot, they were provided with 3-inch wooden props arranged—not side by side, which would have presented the same difficulty—in rows of five running backward, each prop in the row representing every alternate treadle, and thus leaving sufficient space between them and enabling the weaver to press the correct treadle. The treadles under the loom were worked by the left foot, the eight to the right of the loom by the right. The satin ribbon of which I speak had two central figures appearing alternately, or at intervals, with two smaller and different figures on each side of them, while on the two edges in the centre of the space between the central figures another small figure or flower was woven. Behind the ten ordinary healds were seventy others, thirty for one of the central figures, ten for the edge figures, and 30 for the other central figure. There being no card-figure as in figured satins and silks, the raising of the warp strands had to be done by these seventy healds, in which they were arranged according to the pattern required. I may say here that the weaver, on being closely questioned, produced his card-figure drawn out on a piece of paper marked with tiny squares dotted where necessary in their centres, the squares representing the loops in the figure healds and the dots the strands of the warp.

The warp, which entered the healds from the yarn-beam, was divided into two parts, the upper layer being of yellow raw silk, which passed through the loops in the two front healds ("Su") only. The lower layer, which was made up of various prepared and coloured yarns, passed through all the necessary loops of the figure healds and the eight healds immediately in front of them.

While each strand of warp had its own separate loop in the healds, they passed in groups of ten through the teeth of the reed—two strands of the upper layer of raw silk and eight strands of the lower. By depressing a treadle the weaver lowered one of the two front healds containing one-half of the strands of the upper layer of the warp and raised by one of the eight healds an eighth part of the strands of the lower layer of the warp, thus leaving seven-eighths on the under side which, as in satins, forms the face of the ribbon. The shuttle thus passes with its bobbin of raw (sometimes prepared) silk between seven strands of prepared silk and three other strands, one of prepared and two of raw silk. The former make the face, the latter the back of the ribbon. Such are the proportions of the strands along its whole breadth. The seventy figure healds were attached by ropes to levers working in a beam above the healds and arranged alternately in groups on both sides of the loom.

The strands of a warp range from 85 to 2,400 in number, according to the width and quality of the ribbon. The satin ribbon above referred to, which I bought while being manufactured, was 23 Chinese feet long, and cost T. 0·7·0.

Silk ribbons are manufactured on a similar loom, but the strands of the warp are less numerous and so arranged in the healds as to be much more evenly distributed between the face and back of the material. They pass in twos or fours through the teeth of the reed. The lengths for silk ribbons run from 38 to 104 Chinese feet, against 23 feet for satins.

The shuttle is made entirely of horn ware, weighs about a quarter of an ounce, and measures 5 inches by $\frac{7}{8}$ inch by $\frac{1}{2}$ inch, with a hollow centre $3\frac{1}{4}$ inches long. This is the usual size; but for the narrowest ribbons it is even smaller.

Silk braid is mostly made by women and girls in their leisure moments as well as for a livelihood, and in mild weather they may be seen hard at work outside the doors of their houses. A round basket, about $2\frac{1}{2}$ feet long and a foot in diameter, is placed with its mouth to the ground. A bar of wood, about an inch and a half wide and the length of the diameter of the basket, is fixed on the upturned bottom, with a central groove across its width. The woman or girl sits on a low stool on one side of the basket looking along the groove, on the other side of which are joined together a number of strands of prepared silk. These are drawn together forwards along the groove and terminate each on its own wooden reel; but before its reel is reached each strand passes through a 6-inch length of thin bamboo and a few copper cash which rest on the side of the reel. The reels are arranged in a half-circle about a foot down the side of the basket, and a single turn or knot is made with the reel and its strand to keep the

latter from slipping off. Seizing two reels, one in each hand, the operator throws one over the other, repeats the same with another two, and so on, finally plaiting together the doubled strands till the whole becomes a pieces of braid, which slips over the groove and is kept taut by a weight on the other side of the basket. The latter is itself weighted by a stone hanging in its centre and attached by a string to the lower part of the bar fixed on the upturned bottom. The number of strands and reels depends on the width of the braid being plaited. That which I examined had thirteen strands, three white in the centre and five black on each side. This braid is exceedingly cheap.

To manufacture round silk cord two men are required. The basket and the reels of prepared silk are the same as the above, but instead of a groove on the bar there is a small central hole, in which the end of a thin strip of bamboo some 3 inches long is fitted. The ends of the strands joined together run vertically above the bamboo, and are kept in position by a weight after they have passed over a hook. The two men, facing each other, pass and repass the reels, which hang all round the basket, from side to side of the basket, and the finished article, in the shape of cord, is plaited round the strip of bamboo. The latter is removed as it gets covered, is withdrawn from the cord, replaced in its hole, again covered, and so on. The cord I saw being made had sixteen strands. Any required diameter of cord can be thus woven by simply changing the size of the bamboo. The above refers to hollow cord, but a cord with a cotton centre is also made, and in this case there is no bamboo slip, the cotton itself taking its place is drawn upwards as it is covered.

I have already described the manufacture of thread used for the weft of crapes. Sewing and embroidering thread are made in the same way, the only difference being in the tightness, the latter being much looser than the former. In both, however, prepared silk yarn is used.

One is struck by the amount of embroidering in satin and silk that goes on in Ch'êngtu. In many streets one sees shop after shop in which men and boys, often mere children, are bent intently over the frames whereon the groundwork is stretched. There is no lack of pattern or colour, but the workmanship is decidedly inferior to what is produced at Nanking or Hangchow; and embroideries from down river, as they are called, are much appreciated, and fetch much higher prices than the native product, which, however, is of no mean order.

Products of Pierced and Reeled Cocoons.

Pierced cocoons—that is, cocoons from which the moths have escaped and thus rendered them unfit for reeling—and reeled

cocoons—that is, what remains of the cocoons after the silk has been reeled off—are ingeniously utilized for the manufacture of an excellent silk wadding. Not many years ago a leading Encyclopædia, in its article on silk, contained the following passage: "The raw silk is made up into hanks of various sizes. That from China and Japan is tied up in packages of six hanks each, technically called books, and sometimes the ends of these books are covered with silken caps very curiously formed out of a single cocoon so managed as to form a filmy cap sufficiently large to cover a man's head. The method used by the Chinese to accomplish this is quite unknown in Europe." The method may now be well known in Europe; but, as all the foreign residents I have questioned in Szechwan have expressed their entire ignorance of the process, there can be no harm in describing the manufacture as carried on in Ch'êngtu.

Two Chinese ounces of soda are placed in a boiler with 50 catties of cold water and brought to the boil. Six catties of pierced or reeled cocoons are then added and boiled for an hour. At the end of this time they are scooped out of the boiling water with a bailer having a sieve bottom and poured into cold clean water. A workman then takes each cocoon separately and teases it out with the fingers of both hands, removing the brown dry skin of the chrysalis which the imago has left behind and, in the case of the reeled cocoons, the dead chrysalis, and spreads it over a semicircular wooden hoop rising on a plank in front of him. Twenty pierced cocoons are thus spread one on top of the other, and the cap thus formed is removed. As there is much less silk on the reeled cocoons twenty-five are required to form a small cap. The cap, which measures $7\frac{1}{2}$ by $4\frac{1}{2}$ inches, is shaped like a wall pocket or Turkish bath slipper. Three of these caps are then taken, steeped in cold water, and pressed one after the other over a much larger semicircular hoop, removed and hung up to dry. This larger cap or bag, called "Chang Mien" and made up of three small caps, measures 21 inches across the mouth, narrowing to a foot at the bottom, which is rounded and has a depth of 14 inches. A simple calculation shows that sixty pierced or seventy-five reeled cocoons are required to make one of the larger caps, which, flattened together to any desired thickness, give an excellent light warm wadding for winter clothing. Another use to which this material is put is the manufacture of thin mattresses, which are placed by the richer classes in the bottoms of coffins to form a soft resting place for their dead.

Six catties of pierced cocoons, costing T. 0·7·0 per catty of 16 Chinese ozs., yield 3 catties' weight of caps. Reeled cocoons, on the other hand, cost T. 0·4·5 per catty of 20 Chinese ozs., and yield 2·4 catties' weight of caps. White and yellow cocoons are

both used in the manufacture, and white and yellow caps are worth T. 1·6·0 and T. 1·4·5 respectively per ordinary catty of 1⅓ lbs. If an hour's boiling proves insufficient to soften the cocoons, they are rinsed in soapy water before being teased out.

There are four silk-weaving guilds in Ch'êngtu. They are (1) the Ch'êngtu Guild, with 3,500 looms; (2) the Chungking, or Eastern Szechwan Guild, with 1,400 looms; (3) the Chêkiang Guild, with 600 looms; and (4) the Religion Guild (Roman Catholic converts), with 500 looms—a total of 6,000 looms. These are for the manufacture of silks and satins only. Outside the walls, but in the neighbourhood of Ch'êngtu, there are 3,400 crape looms, with a total of 7,000 for the whole province. There are 500 gauze looms in and around the city. I have found it impossible to arrive at even an approximate estimate of ribbon looms; but they are very numerous, and the Roman Catholic Mission has done much to introduce foreign patterns. The manufacture of silk braid by hand may be seen in every street in Ch'êngtu.

The next important weaving centre in the province is the market town of Su ch'i, 25 *li* from the city of Chiating on the way to Mount O-mei. Here there are some 500 looms for the manufacture of Ta Ch'ou, a plain white silk of very general use. It is dyed all colours, however, and one variety, called Fên Ta Ch'ou, is heavily sized with a mixture of bean flour and sugar. In the city of Chiating itself there are less than 200 looms for the weaving of crape. The city of Jên-shou produces a stout, black crape, generally used for turbans or head bands very generally worn throughout the province. The cities of Pao-ning, Shun-ch'ing, Lu Chou, and Chungking together have some 400 looms, and manufacture more especially gauzes, crapes, and silk and cotton mixtures.

I have gone minutely—perhaps too minutely—into the subject of silk, but my aim has been to show that the unevenness and consequent inferiority of Szechwan silk is due to the primitive, if occasionally ingenious, machinery in use. If the Szechwanese could be induced to club together and introduce steam filatures, like their brethren in Southern China, there is every reason to believe that the product of this province would become as valuable and as much sought after as the best silk now available for export in China. Such a result would be a benefit not only to Szechwan, but also to the foreign manufacturer.

Silk Fabrics Manufactured in Szechwan.

10 Chinese inches = 1 Chinese foot.
1 Chinese foot = 13¾ English inches.

No.	Material.	Size, Length, and Breadth.	Where Woven or Made.	Manufactured in—	Price per Ch. foot. T. m. c.
	Satin.				
1	Plain (Kung Tuan) ..	40′ to 70′ by 2′ 8″	Ch'êngtu	Two colours	0 6 5
2	Ditto	40′ to 70′ by 2′ 4″	Do.	Black only (Yüan ch'ing)	0 5 0
3	Ditto	40′ to 70′ by 2′ 2″	Do.	Various colours	0 4 0
4	Figured (Hua mo pên)	40′ to 70′ by 2′ 2″	Do.	Do.	0 4 7
5	Bedcover (Wu ts'ai mo pên)	10 by 2′ 2″	Do.	Two colours	4 5 0 (per piece)
	Silk.				
6	Plain (Ning Cho'ou) ..	40′ to 70′ by 2′ 8″	Do.	Do.	0 6 5
7	Ditto	40′ to 70′ by 2′ 4″	Do.	Black only	0 5 0
8	Figured (P'ing ch'i Hua Ning Ch'ou)	40′ to 70′ by 2′ 2″	Do.	Various colours	0 4 7
9	Figured (Tuan ch'i Hua Ning Ch'ou)	40′ to 70′ by 2′ 2″	Do.	Do.	0 4 3
10	Figured (Pa Tuan) ..	60′ to 70′ by 2″	Do.	Do.	0 2 8
11	Bedcover figure (Pa Tuan)	10′ by 1′ 9″	Do.	Two colours	2 7 0 (per piece)
12	Kuan Hua..	60′ to 70′ by 1′ 9″	Do.	Various colours	0 3 0
13	P'ing Chou	40′ to 70′ by 2′ 2″	Do.	Do.	0 3 0
14	Hsien Chou	11′ 3″ by 1′ 7″	Do.	Two colours	0 4 0
15	Ch'ing shui Ta Ch'ou ..	46′ to 48′ by 1′ 5″	Chia-ting	Various colours	0 3 6 (per Ch. oz.)
16	Fên Ta Chou	46′ to 48′ by 1′ 5″	Do.	Do.	0 3 1 (per Ch. oz.)
17	Chin yin Ta Ch'ou ..	46′ to 48′ by 1′ 6″	Do.	One colour	0 3 6 (per Ch. oz.)
18	Li Ch'ou	96′ by 1′ 3″	Shun-ch'ing	Various colours	0 0 7
19	Ming ch'i Ch'ou	45′ by 1′ 2½″	Chêngtu	Do.	0 0 6½
20	Shêng Ssŭ Ch'ou.. ..	22′ by 1′ 2″	Do.	Two colours	0 1 0
21	Khata (Thibetan) ..	8′ by 6″	Do.	Do.	40 cash each.
22	Fu Ch'ou (wild silk) ..	50′ by 1′ 3″	Do.	One colour	0 1 2
	Crapes.				
23	Crape, plain and figured (Hu Ch'ou. Fu Tsung in Szechwanese.)	50′ by 1′ 5″	Do.	Various colours	0 1 1 to 0 2 4
24	Figured* (Hua Fu Ch'ou)	50′ by 1′ 5″	Do.	Do.	0 1 3
25	Chin yin Tsung	50′ by 1′ 6″	Do.	One colour	0 2 0
26	Su sha pa	44′ by 1″ / 48′ by 1′ 2″	Jên-shou	Black	0 1 0 / 0 1 3
	Gauzes.				
27	Plain (Pan Ling) ..	19′ by 1′ 2″	Ch'êngtu	Various colours	1 2 0 (per piece)
28	Figured (Hua Ling) ..	17′ by 1′ 2″	Do.	Do.	0 7 0 (per piece)
29	Figured (Ta Hua Ling).	20′ to 28′ by 1′ 7″	Do.	Do.	0 1 0
	Velvet.				
30	Plain	24′ by 1′ 8″	Do.	Black only	0 4 8

* Classed under crape because the weft is thread not yarn. This is a wild silk.

No.	Material.	Size, Length, and Breadth.	Where Woven or Made.	Manufactured in—	Price per Ch. foot.
	Plush.				T. m. c.
31	Plain	24′ by 1′ 8″	Ch'êngtu	Various colours	0 6 5
	Ribbons.				
32	Satin, figured	24′ by various widths	Do.	Do.	0 0 8 to 2 0 0 (per length)
33	Silk	Do.	Do.	Do.	0 0 7 to 0 7 0 (per length)
	Thread.				
34	Sewing and embroidering	Do.	Do.	Do.	0 4 8 (per Ch. oz.)
	Cord.				
35	For tassels	Do.	Do.	Red	0 4 0 (per oz.)
	Ditto	Do.	Do.	Do.	0 3 6 (per oz.)
	Ditto (sized)	Do.	Do.	Do.	0 2 6 (per oz.)
	One tassel	Do.	Do.	Do.	0 3 5 (per piece)
	For queue	Do.	Do.	Black (Tsang ch'ing)	0 2 0 (per set)
36	Silk lining made from pierced and waste cocoons	Do.	Do.	Yellow White	1 4 5 1 6 0 (per catty)

2. *Insect White Wax, Honey, and Beeswax.*

I have discussed elsewhere* the whole subject of insect white wax, and it only remains for me to add a few notes to what I have already written regarding this extraordinary industry.

When I visited the white wax country round the city of Chia-ting in the summer of 1884, I heard much regarding the "Wax Dog," which was declared to be an inveterate enemy of the wax insect (*Coccus pela*), and I have described how the farmer goes the round of his white wax trees (*Fraxinus chinensis, Roxb.*), and belabours their stumps with a club during the heat of the day for the purpose of bringing the deadly foe to the ground. Through the kindness of a friend, I have now succeeded in procuring specimens of the "dog," which turns out to be a full-sized ladybird (*Coccinella*) of a fine red colour, unspotted, but with a narrow, dark rim round the edge of the semi-spherical body. Writing in 1884 I said : "I was unable to obtain a specimen of this insect (the "La Kou," or wax dog), which is developed in the early stage of wax production, but it was described to me as a caterpillar, in size and appearance like a brown bean." Here,

* "Three Years in Western China," chapter xi.

then, we have the larva of the ladybird, and, as both larva and imago are fond of aphides, there is every reason to suppose that they find *Cocci pela* equally palatable. The friend of the florist and the hop-grower is the foe of the white wax farmer.

I have little to add to the uses of white wax. I have stated under the head of "Oil Plants" that a little of the wax is added to the oils used in candle-making, and that the candles themselves are coated with it. In paper shops it is largely employed in imparting a gloss to the higher grades of paper, such as visiting cards and notepaper. It is rubbed on the surface, and then evenly distributed by hand pressure with a smooth, flat stone. In damp, clammy weather a board thinly coated with white wax is drawn along the surface of satin and silk warps in silk-weaving establishments to facilitate the passage of the strands through the heald loops, and, as already stated, the strings of the card-figure are dipped for a moment in a mixture of melted white wax and beeswax to assist their separation by the workman who sits aloft on the figure-weaving loom. I have already described the process by which a lustre is added to cotton cloth by rolling it under a huge stone, and before the rolling begins the foundation stone on which the cloth rests is usually treated with a polish of white wax; but this is more to ease the operation than to give lustre. Sometimes, however, the surface of the cloth itself is lightly rubbed with wax. It is employed as a polish in jade-ware, in the daintier articles of furniture, such as small dressing-cases and cabinets, and it is universally used by the medicine shops for coating pills, and thus preserving the active properties of the drugs of which they are composed. The main uses, however, are candle-making and paper-glazing.

This annual production of insect white wax in Szechwan varies with the climatic conditions. Wind and rain are destructive to the insects, exposed as they are on the branches of the *Fraxinus*. During the year 1903, for example, the rains were exceptionally continuous and heavy, and the output of the Chia-ting Prefecture was estimated at 50,000 piculs; but, as each catty weighs 17—not 16—ounces, the yield would really have amounted to 53,125 piculs. The price of each picul of the heavier weight is T. 45, so that the total value of the Chia-ting production would have been T. 2,250,000. Ch'êngtu is credited with an annual consumption of 1,000 piculs. Other parts of Szechwan yield small quantities of white wax, usually on the *Ligustrum lucidum Ait.*, but they are too insignificant to be of any commercial importance.

So far as my observation has extended, bee culture is not an absorbing hobby nor a favourite industry in China. True, over a farmhouse door one may frequently see one or even a couple of hives made out of parts of the hollowed-out trunks of trees,

with a couple of apertures in the closed ends, but one misses the collections of hives so commonly met with in the old-world gardens of English farmhouses. When rape and fruit trees are in bloom in Szechwan the hum of the honey-bee is heard on all sides, but the fact that honey is not an article of diet, or even a food relish, is sufficient rason for the absence of any serious attempt at bee culture. Confectioners occasionally use it sparingly instead of sugar in sweetmeats, and the very young children of well-to-do parents are treated to a mixture of honey and sesamum oil, but in the latter case it is intended merely as an adjunct to a mild aperient administered to prevent convulsions. Nearly all the honey is bought by the medicine shops and it is in these shops alone that it can be had retail by the foreigner. It is used by the chemist in compounding his nauseous drugs. He buys it wholesale from the farmer at prices ranging from T. 16·4 to T. 18 per picul of 105 catties.

Beeswax, which is valued at T. 42 a picul of 100 catties, has not the numerous uses to which insect white wax is applied. As already mentioned, it is employed with the latter in rubbing the strings of the card-figure in silk-weaving; it is also used to a limited extent in candle-making, and the carpenter finds it a good furniture polish. Another, but minor, use is the polishing of the string of the cord employed in carding raw cotton after ginning. This keeps the wool from adhering to the string.

In Szechwan the honey-bee, like the white wax insect, has a formidable enemy. The moth, called the honey-moth, "Mi O," or hawk-moth, "Ch'ing Ying O," once it finds its way into the hive plays terrible havoc. It is itself accused of devouring the honey and this may be the case, but there can be no doubt that the larvæ which are born of the eggs deposited by the mother in the hive, quickly eat up the store of honey and compel the bees to evacuate their home. The moth is strongly built, the body measuring 2 inches long, thickly covered with downy, yellow hair. The upper pair of wings, which are brown and spotted, are strong and powerful-looking, and the dried specimen now lying beside me looks as if it might have caused considerable damage had it not succumbed to the ire of a native and come into my possession through the hands of a friend.

3. Hides, Leather, and Glue.

At p. 34 of his Report on the "Trade of China for 1901," the British Commercial Attaché for China said :—"The export of hides does not begin to compare with that of India, where conditions governing the supply are almost the same as in China. In both countries cattle are solely bred for agricultural purposes, and it is only when they get sick or die of old age that their hides are

available for commerce. Drought and famine in India have the effect of largely stimulating the export, but even under ordinary circumstances the normal export is over 8,000,000 hides per annum, whereas, calculating eight hides to a picul, China last year only exported some 2,000,000 hides.

"This figure may go on gradually increasing, but it is questionable if an approximation to the Indian export will ever be attained. The areas whence present supplies are drawn are principally those in easy communication with ports of shipment. Cost of transportation must prevent the large number of hides which might be collected for export in Western China from finding a profitable market, Chungking, for instance, in 1899 only exporting some 2,700 hides." This is, no doubt, a printer's error, for 3,464 piculs of hides were passed through the Foreign Customs at Chungking in that year, and these, at eight hides to the picul, would give 27,000—not 2,700—hides.*

There is a very general, but very erroneous impression prevalent among foreigners in China that cattle are killed only when age unfits them for farm or transport labour, but any one acquainted with Western China, where there is a comparatively large Mohammedan population, knows that such is not the case. Among Mohammedans the killing of cattle for food is entrusted to certain individuals and every care is taken by them that nothing unclean or diseased is slain. The explanation of the larger export from India is presumably due to the fact that the Mohammedan population is double that of China, that more cattle are killed for food, and, consequently, more hides available, and that the transport, freight, and financial facilities are much better. But there is another reason : China largely consumes her own hides in the shape of leather, which is much more in demand for boots and shoes than in India. And that is only one of the numerous uses to which, as I shall show later, leather is applied. To dispose of the impression that hides are only available when cattle are sick or die of old age, I may state that I have frequently met in the streets of Ch'êngtu string after string of oxen in prime condition on their way to the abattoirs. The above is more likely to be the true explanation of the small export of hides from Chungking to which the Commercial Attaché referred, and it may be taken for granted that, as there is no waste in China, the hides that remain in the country are utilized to the full. Cattle cannot be killed for the value of their hides even to please the merchant,

*The export of undressed buffalo and cow hides from Szechwan in 1919 through the Maritime Customs amounted to 65,874 piculs of the value of H.T. 1,534,453, while the export from the whole of China to foreign countries in the same year was 383,333 piculs valued at H.T. 10,361,381.

but one thing is certain, and it is this : if the owner finds it more profitable to sell to the exporter than to the glue and leather manufacturer he will not hesitate to do so, and the great demand for hides in Hankow and Shanghai during the year 1902 led to the export from Chungking through the Foreign Customs of 7,468 piculs, which would represent about 60,000 hides—more than double the export of 1899. Moreover, the export through the Foreign Customs at Chungking of Szechwan products, excluding salt, amounts, I believe, to only about 25 per cent. of the total, and no doubt there are hides included in the balance of 75 per cent. of which no reliable information is available.

It is estimated that 20,000 hides of ox or cow, water-buffalo, and yak are annually available in Ch'êngtu, that 12,000 of these are exported, and that the balance of 8,000 are converted into leather. This at first might appear to be a very small quantity of leather for the consumption of a city whose population is estimated to amount to between 400,000 and 500,000 souls ; but it should not be forgotten that, omitting rain boots and shoes, the ordinary everyday shoe of the Chinese male contains, after all, only a small quantity of leather attached to the bottom of the thick sole which is otherwise made up of felt or paper. The uppers are of cloth, or more frequently of silk, of silk and satin combined, or all satin. True there are certain bindings made of leather, but this is quite a different and much more expensive article from the hides of the ass, mule, or horse, and sometimes of the skin of the sheep which is passed off on the buyer as the product of the ass. It should also be borne in mind that the everyday shoe of the Chinese woman contains no leather, and it may surprise many to know that women manufacture their own shoes, and that in this wealthy and populous city of Ch'êngtu there is not a single shop for the sale of women's footgear.

I propose now to describe the manufacture of leather in Ch'êngtu, which is probably the same throughout the whole province of Szechwan, a process which differs widely from European methods, the gelatinous hide being cured by heat and not by tanning. As different methods are used with different kinds of hides, I shall first deal with the pelts of the ox or cow. The raw hides are steeped in a concrete tank of lime and water for fifteen days. The proportion of powdered lime is about 4 lbs. to each hide. They are then removed, thoroughly washed, and stretched on an upright framework of wood. The hair is then scraped off with an instrument resembling a curry-comb but without the central bars, the only and upper bar or rim being well sharpened. The hair is sold to the farmer for fertilizing purposes at about 10 cash a catty. The de-haired hide is then removed from the frame and steeped for a short time in cold water, when it is

removed and in its wet state passed by hand over the top of a large stove in which rice straw is kept constantly burning. It is passed and repassed till every part of the hide has been subjected to the heat; but while still in a semi-moist condition it is placed on a layer of wet rice straw spread on the ground, and covered with another layer of wet straw. The next hide is similarly treated and placed on the top of the other till a huge pile of layers of hides and wet straw has been built up. Each hide is treated in this way twenty-four different times, and afterwards hung up to dry as leather. It is now quite soft and pliable, and ready to be made into rain boots and shoes, the lower part of the sole of men's shoes, scabbards, straps, and similar articles. A raw hide weighs about 45 or 46 catties, and is worth about T. 0·1·0 a catty. As leather it weighs some 18 catties, worth T. 0·3·0 a catty. Its uses are much more varied and numerous than those of the leather made from the hides of the water-buffalo and yak, to which I shall now refer.

The hides of the water-buffalo and yak are usually in the first instance bought by glue manufacturers who, after carefully washing them, remove with a sharp iron scoop as much of the fleshy side of the hide as it will bear. I am told that as much as 20 catties of a hide weighing some 50 catties, and worth T. 0·0·7 a catty, is frequently removed in this way. The scrapings are boiled for a short time, and the resulting fatty liquid is used for waterproofing paper lanterns. The flesh is then removed from the boiler and spread out on a tray in the sun to dry. In this dry, hard form it can be kept for any length of time till required for conversion into glue. It is quite devoid of any objectionable smell. This is important as glue is made only during the cold weather, and the scalded flesh has to be kept through the heat of summer. It is made by boiling the flesh for two or three days, when a basket of fine bamboo work is placed in the centre of the pot. Through its sides the liquor percolates into the centre of the basket, which, acting as a sieve, keeps back all solid matter. The liquor is then baled out into a shallow grated tank and quickly solidifies into a black substance like, but less pliable than, caoutchouc. Before completely solidifying it is cut by knife into strips measuring 22 inches long (the breadth of the tank) and two inches wide, the thickness of half an inch or less representing the depth of the substance in the tank. Such a strip weighs some 10 Chinese ounces, and is worth 15 cash an ounce. In other words, it costs 160 cash a pound, or 5 pounds for a dollar. I am informed that the scraped flesh will yield 60 to 70 per cent. of glue. The latter, called "'Pi chiao," or skin glue, is universally used by carpenters in the manufacture of furniture, and is a common ingredient in paint colours.

When the glue manufacturer has extracted all he wants from the hides, he disposes of them to the leather maker, who now treats them in exactly the same way as ox-hides. The leather produced is, of course, thinner and inferior. It sells for T. 0·2·7 a catty, and while employed to a certain extent in boot shops, its chief use is the making of leather trunks, drums, and saddles. Its use, however, depends entirely on its thickness. If the glue manufacturer has removed too much of the inner lining, the leather, useless to the bootmaker, falls to the trunk maker, to whom its thinness naturally appeals, enabling him to turn out a much neater article than if he had a thicker material to deal with.

The hides of horses, mules, and donkeys, from which a superior leather is produced, are treated in quite a different manner. They are steeped for ten days in a solution of sulphate of soda and water. They are then taken from the wooden vats, stretched on frames, and the hair removed by a double-handled knife as in the case of ox-hides. The inner side of each hide is then scraped to reduce its thickness by means of a knife called from its shape the iron cap knife—"T'ieh mao tao." This, shaped like an ordinary Chinese cap, has its lower edge sharpened all round, and a wooden handle ending in the crown extends downwards through the cap. After the first scraping, the hides are steeped for a couple of hours in cold water thoroughly impregnated with the fatty matter of the pods of the soap tree, *Gleditschia sinensis, Lam.* They are again scraped, washed in clean water, and stretched on a frame to dry. It is now leather, and is coloured black and green by pine soot and foreign green paint respectively—applied with a bristle brush. When dry the coloured side is rubbed heavily with a smooth stone to impart a polish to the leather. The hind quarters of the animal are said to yield the best material. The leather is cut up into narrow strips for binding and decorating Chinese shoes. The manufacture of this leather is entirely in the hands of Shensi men, and so well do they protect their industry that I found it impossible to buy one of the iron-cap knives, which all come from Hsi-an Fu, nor could I induce a local blacksmith to make one for me. The scrapings of the hides and the hair are disposed of for manure.

Before leaving the subject of hides I should mention that stout lashings, 7 feet in length, are made by twisting two strands of raw ox-hide into rope. So firmly are the strands interlocked, that one has great difficulty in separating them at the ends. A length costs 70 cash. A finer lashing, made of a single strip of raw hide, ox or water-buffalo, twisted till it is round in shape, costs 10 cash for a length of 3 ft. 10 in. Three strands of raw mule hide are also twisted into strings almost as fine as fishing lines, and it is only by a slight difference in colour that the joinings

are observable. After the strands have been sufficiently twisted, the string is rubbed smooth by hand, first between two wet and finally between two dry stones. This fine hide rope is used for the strings of the bows employed in carding raw cotton and wool. A length of this hide string, 17 feet long, costs 120 cash.

4. Horn, Hoof, and Bone Ware.

The horns of the water-buffalo, yak, and ox, besides being exported in considerable quantities from the province, are largely utilized in Ch'êngtu for the manufacture of a great variety of articles in everyday household use as well as in various industries. There are whole streets in the city devoted to the making of hornware goods. The horns are bought for T. 0·0·7–8 a catty, those of the water-buffalo being the biggest, and therefore the most serviceable for the larger kinds of goods. When flat pieces, such as brush backs and handles, are required, the horns are sawn in two along their lengths without any previous treatment, and, as the inside of a horn is always smooth, the outside, which is rough and wrinkled, is planed with a long hand-plane, in which not one, but a number of cross iron blades are inserted. When sawn and planed the necessary lengths and thicknesses, the pieces are placed above a charcoal stove, and, after being softened by the heat, arranged between thin heated iron plates in a press into which wooden wedges are driven. By this means they are straightened, and on removal from the press they are steeped in cold water, which hardens them into the shape they have acquired under pressure. They are now ready to be made into combs, a saw being used to form the individual teeth, backs of tooth, boot, and cloth-brushes, and the like. They are polished with moistened oak charcoal laid in a piece of cloth, followed by rubbing the surface with a handful of the dry shavings of the horn. In the case of such articles as powder-flasks and scoops for administering medicine to horses and cattle, where the natural shape of the horn is required, the horns are merely planed and polished. Shoehorns are simply planed in the curve, while shuttles are planed into shape and their centres removed with a saw. But in the manufacture of cups a different treatment, involving the use of a foot-lathe, is employed. The horns of the water-buffalo being naturally more or less flattened, especially towards the base, are sawn into circular lengths and heated over a charcoal stove until they are softened. A stout, round, pestle-shaped piece of wood, tapering very gradually towards one end, but not to a point, is pushed and hammered into each length of horn, which, being softened, assumes the rounded shape of the pestle. Horn and pestle are then steeped in cold water to harden the horn into its new circular shape, and, when ready for further

treatment, the pestle is driven out by hammer. A length of wet round horn is the result.

The lathe used by carpenters and workers in horn, bone, tin, and copper consists of a few stout wooden bars joined together. One end of the mandrel, which bulges towards the centre, and is some 2 feet long, fits into a cross upper bar in front, while the other end runs through a bar behind, and raised about 6 inches above the level of the front bar, so that the mandrel slopes downwards from the workman, who sits behind a small platform fixed at the rear of the higher bar. Attached to the axle of the mandrel running through the latter is a hollow wooden chuck, or cup, which runs half-way along and over the platform, which is really the workman's bench. To the right of the chuck a raised piece of wood is firmly fixed to the bench parallel to the chuck. A band of leather about an inch broad is wound twice round the bulging centre of the mandrel, and its two ends are attached to the extremities of two treadles which run forward from a cross-bar beneath and behind the workman. By depressing the treadle on his right the workman causes the mandrel, with its chuck, to revolve rapidly towards his right, and brings the leather band back again by depressing the other treadle with his left foot. Taking a round block of wood, with a series of terraces cut on its circumference on one side, the turner places the other unterraced or ungrooved side in the chuck and hammers it home. He then threads the length of hollow horn on the grooved end till it reaches a groove that fits it, when it also is hammered home. Taking a long, sharp, iron chisel in his right hand, which he steadies against the bar on the bench to the right of the chuck, he holds the flat point of the chisel against the horn, and, depressing the right-foot treadle, causes the horn to revolve, while with the chisel he reduces it to the necessary thickness. This is done all over the horn—bottom, sides, and top—and with a pointed chisel he runs a groove on the inside of the tube about a quarter of an inch above the bottom of the narrower end of the horn, which lies next to him. This groove is intended for the circular thin horn bottom of what is fast becoming a cup, the bottom being, of course, fitted when softened by heat from the mouth or wider end. At the mouth of the cup, on the outside, a groove a quarter of an inch wide is similarly cut by a chisel for the reception of the lid, which, fitted with a top in the same way as the bottom is inserted in the cup, overlaps the grooved mouth. Every part of the exterior of the cup is then polished, first with oak charcoal moistened and then with dry horn shavings, while revolving with the chuck. Some of the smaller cups are white, being made of ox-horn, but the great majority are fashioned from the horns of the water-buffalo and yak, and are dark-brown, almost black, in colour. These cups are the principal horn ware of Ch'êngtu, and

their sole use is for packing and storing native opium for home consumption. They are of all sizes, from 10½ inches in circumference at the mouth to a small thing little bigger than a lady's thimble.

The soles of the hoofs of the ox, water-buffalo, and yak are frequently planed, squared, and made into combs as in the case of horns, but the most general use of the hoofs is the manufacture of lanterns, which are mostly met with in temples and official residences. They are called "Fêng Têng," or wind lanterns, and the ingenuity displayed in their manufacture deserves a detailed description. The hoofs are first boiled till soft, and, while still warm, they are planed to the necessary thinness with the many-bladed plane above referred to. They are then steeped in a pit of cold water for nearly a couple of months, and I was informed that the water in the pit which I inspected had not been changed for a hundred years. True, the odour that escaped lent some probability to the truth of the statement, but seeing by my manner that I doubted the assertion, the Manager who accompanied me hastened to add that the water had not been changed during the lifetime of the last three Managers, and certainly not in his. Fresh water, he assured me, would be far less effective than the liquid in the stagnant tank. After steeping for a couple of months they are removed, boiled for half an hour in water in a Chinese pot when the hoof divides into two parts—the side and the sole. Close to the pot, and embedded in the floor, was part of the trunk of a tree with an oblong hollow about 18 inches wide and of a similar depth. Into the hollow are placed vertically a number of iron plates about an inch or more thick, and corresponding to the width and depth of the hollow. The spaces on each side of the plates were filled with wooden wedges driven home by hammer. The iron plates weighed about 50 lbs. apiece. Between each pair of plates, which are first heated, are laid four to six pieces of hoof, the wooden wedges are driven home, and as soon as the plates are cool—in about half an hour—the press is opened, disclosing thin, flattened, irregular sheets of what I may call hoof-ware. A press was opened in my presence, but the sheets removed were dark-brown—almost black. The hoofs of the water-buffalo happened to be under treatment in the press. The sheets derived from ox-hoofs are semi-transparent, and they are used for making the bodies of the lanterns, while the sheets made of water-buffalo and yak-hoofs are employed for binding the circular tops and bottoms of the lanterns.

The semi-transparent sheets of hoof are arranged to form the half of a hollow sphere with the edges slightly overlapping, leaving a round hole at the top several inches in diameter. As each sheet is added to its neighbour it is seized where the edges overlap between

the flat claws of a large pair of pincers about a couple of feet long and several pounds in weight. The claws of the pincers have previously been heated, but not red hot, over a charcoal stove, and as they seize and press the overlapping edges the sheets are welded together by the heat and pressure. In the same way a narrow dark-brown band cut from sheets made of water-buffalo or yak hoofs is welded round the edge of the orifice at the top of the half-sphere. A second half-sphere, with a much smaller hole at the bottom, is made up in the same way, and the orifice bound; but a thicker piece of sheet hoof, about an inch wide, is welded to an edge of this band which is left projecting, and the lower edge of the stout circular band forms a steady stand for the lantern when it is placed over a candlestick. The two half-spheres are now held together so that their edges slightly overlap, and, with one claw of the heated pincers passed through the larger orifice and the other outside, the workman welds the two half-spheres into one sphere, in other words the lantern. Before, however, the two are joined together all the rough places where the edges overlap are scraped with a round, sharp-edged, flat piece of iron about 2 inches in diameter, and so cleverly is this done that it is impossible to tell where the sheets have been joined. The places where the edges of the two half-spheres overlap are similarly treated outside and inside. Red characters or designs are now painted on the inside of the lantern through the larger opening at the top, and to complete the article, which, for fashion's sake, has to be lobed like a peeled orange or pumelo, the edge of a heavy, heated, iron wedge fitted with a wooden handle is drawn at equal intervals from top to bottom outside. The heat causes the points of contact to wrinkle. In other words, the lantern is corrugated—a process which, while intended to impart beauty, in reality gives additional strength. In spite of this, however, lanterns are broken, for the horn is brittle; but they can be mended by welding fresh sheets. While in the factory I noticed old lanterns being tinkered in this way.

I may add that, as nothing is wasted in China, the dust and scrapings of the horns and horn-sheets are sold by the factories at from T. 2 to T. 3 a picul. They are in great demand as manure.

The skeleton of an ox, water-buffalo, or yak may be bought wholesale from the butcher at from T. 2 to T. 3. The bones are then retailed for 30 cash a catty. Such as contain marrow have the joints sawn off and the contents extracted for food, fetching 100 cash a catty. Further, all the bones are boiled and the resulting fat sold to the candle shops for 80 cash a catty. The hollow bones are turned and made into opium cups in the same way as horns, but the polishing material in this case is a braid (moistened) woven from the stalks of *Equisetum hiemale*, *L.*, followed by the dry shavings of the bone. Before manipulation all bones are steeped

in cold water. They are, moreover, cut into tube lengths on the lathe, a pointed chisel being placed on the bone and held thereon until the necessary length of cup is severed. Flat bones, useless for cups, are sawn, planed, and polished similarly to horns, always substituting *Equisetum hiemale* and bone shavings for oak charcoal and horn shavings. They are similarly made into brush-backs, dice, chopsticks, buttons and the like, while the shoulder-blades of the animal are utilized as scoops in the salt and sugar shops. Such bones as are useless for manufacturing purposes are hammered into small pieces and dust for manure, which is sold for 30 cash a catty. The Chinese has no bone disintegrator, but he has hit upon an ingenious plan for preventing the fragments of the bones he laboriously hammers on a flat stone from scattering out of reach. The hammer, similar to that used in hammer-throwing competitions, has a number of tags of cotton cloth attached to the iron head, and these prevent the particles from spreading.

5. *Hair, Bristles, and Feathers.*

I have already stated that the hair which is scraped from the hides of animals in the process of leather manufacture is sold for manure, but the hair of the yak, which attains considerable length, is highly prized, although not in this province, for the manufacture of tassels for official hats. That derived from the hind quarters of the animal is preferred in the Province of Kansu, which is the chief producer and exporter of these tassels. The hair is dyed red with *Rubia cordifolia, L.*, and in Ch'êngtu these Kansu tassels are valued at from less than one to as much as 6 taels apiece, according to quality.

Yak-tails, which enter Szechwan through Ta-chien-lu and Sung-p'an, are used for fly brushes. The yaks themselves which enter the province are slaughtered for food, and their tails are thus available, but the demand is much greater than the supply. They are procurable at Sung-p'an for about T. 0·30 each, and occasionally at Ch'êngtu for about 400 cash.

The tails of horses are used for a variety of purposes. The hair is plaited into summer hats, into the uppers of Chinese shoes, and woven into a cloth on a loom smaller but similar to that already described for the manufacture of rush mats. Instead, however, of each hair being inserted separately as a weft thread, a bunch is passed through the shed of the hair warp, and the weaver retains only one by seizing the end of it between the thumb and forefinger of his left hand on the left side of the loom. This hair cloth is used for making strainers. The hair is also cut up into short lengths for tooth-, hat-, shoe-, and cloth-brushes. I may state here that these brushes are all small and of very poor quality, and

that there should be a great opening for cheap foreign brushes; but manufacturers must bear in mind that freights to the west of China are under the present system of transport excessive.

The great majority of pigs reared in Szechwan are black, but in the centre of the province, especially in the districts of Jung-ch'ang and Lung-ch'ang, which lie to the west of Chungking, there is a large sprinkling of the white variety. The price of bristles in Ch'êngtu ranges from T. 0·1·5 to T. 0·5·0 per catty, according to quality. They are there assorted, bundled and packed in cypress boxes by female labour, which is paid at the rate of 10 to 20 cash a catty. Each box contains from 350 to 360 catties. They are sent down river to Chungking and Shanghai for export to foreign countries. The bristle-collecting season extends from November to April, that is throughout the cold season. During the rest of the year no business is done, for the bristles are said to be soft and useless for manufacturing purposes during the hot months. Bristle brushes are made in Ch'êngtu, but in no great quantity. The export of bristles through the Foreign Customs at Chungking in 1902 amounted to 9,148 piculs, of the value of 175,818 Haikuan taels, when the average value of the Haikuan tael for the year was 2*s.* 7$\frac{5}{8}$*d.* Pigs' hair is disposed of for manure.*

Duck feathers are collected during the winter months in Szechwan, and exported down river. In the neighbourhood of Ch'êngtu they cost about T. 0·0·7–8 a catty, but as this includes wing and tail feathers, which are picked out and rejected, there is a loss by their exclusion of 20 per cent. in weight. They are baled with coarse hemp cloth, each bale weighing from 350 to 360 catties.

There is a small but growing export of chicken feathers from the province, but most of them go into local consumption for the manufacture of feather dusters and for manure.†

Wing feathers of the eagle are brought from Tibet, through Ta-chien-lu and Sung-p'an, to Ch'êngtu, where they are made into fans, but the quantity is inconsiderable.

Not many years ago the little egret was common in Szechwan, but the demands of European fashion have gone far to make it extinct, and I am told that the annual export of plumes from the province does not now exceed a very few ounces, which are worth about T. 100 an ounce.

6. Wool and its Products.

A certain amount of sheep's wool is annually collected in Szechwan, but nearly the whole of the export comes from Tibet,

*In 1919 the export of bristles from Szechwan was 11,448 piculs.
†In 1919 the export of feathers from Szechwan was 5,623 piculs.

entering the province by the Ta-chien-lu and Sung-p'an roads. Through the same towns also come droves for provincial consumption. It is estimated, and I think fairly accurately, that about 50,000 piculs, or 3,000 tons, of wool annually enter Szechwan—between 30,000 and 40,000 piculs through Ta-chien-lu, and the balance through Sung-p'an. The price at the latter place per load of 110 catties averages between T. 6 and 7; the freight per load between Sung-p'an and Kuan Hsien amounts to 3,000 cash, or T. 2·5·0; and the price in Ch'êngtu is 14,000 cash, or, roughly speaking, T. 11·6 per picul of 100 catties. Wool for export does not of course come here. From both towns it is carried overland by pack animals and porters to the nearest waterways. The Sung-p'an supply is shipped at Kuan Hsien for Chungking, and from Ta-chien-lu at Chia-ting, after a short water journey by raft down the Ya River. When the wool comes to market it is in a filthy condition, and on arrival at Chungking it is cleaned before export. As it loses about 15 per cent. of its weight in the process, it is not surprising that it is valued on export by the Foreign Customs at 14 Haikuan taels per picul. The average annual export from Chungking through the Foreign Customs during the ten years from 1893–1902 was 16,519 piculs, or close on 1,000 tons; and although hopes are entertained that the wool trade from Szechwan will considerably develop, it must be confessed that, in addition to the natural difficulties of the roads over which it has to pass, there are other obstacles which militate against any rapid expansion. Both at Ta-chien-lu and Sung-p'an the trade is almost entirely a form of barter in which tea is the principal Szechwan asset. There is no native bank, and very little money at either place. At the former it is calculated that there is never more than 10,000 rupees in free circulation, while at the latter it is difficult to change even the smallest quantity of sycee into copper cash. Cash is scarce and dear, and the cost of transport, which is exceedingly limited, is also high, so that, until better financial arrangements are made it is unlikely that any great or rapid expansion of the wool trade will take place.

The wool brought to Ch'êngtu as well as the wool derived from old skins, which are here converted into leather (used for the same purposes as horse, mule, and donkey) is manufactured into felt, which is utilized for making the thick soles of Chinese shoes, and into cloth, which, as I shall describe presently, is ingeniously converted into imitation fur and used for lining winter garments.

The felt is manufactured in the following manner: The wool is first carded like raw cotton and spread lightly by hand on the top of a bamboo screen measuring 4 by 3 Chinese feet. It is freely sprinkled with cold water, the mouth being used as a syringe. The screen and layer of wool is then rolled up tightly by hand and

tied with pieces of string. Taking his place on the top of the roll, the workman keeps turning it round with his feet, and the time which this process occupies may be gauged from the fact that ten to twelve rolls are similarly treated by one man from daylight to 3 o'clock in the afternoon. The screen is opened from time to time to adjust the edges of the wool, and when the latter is sufficiently welded together it is removed and placed on the top of a similar bamboo screen. Boiling water is sprinkled on the top four or five times, and the screen rolled up as before and trampled by foot to remove the dirt and oily smell. When this has been effected, the felt, for the wool has become a piece of felt, is removed, folded, and placed with other pieces in a large bamboo basket. The basket is carried to and placed in running water, and a man stepping into the mouth of the basket tramples the felt until it is clean. The felt is then spread out to dry, but, when half dry, it is first stretched by hand so that each piece shall measure 3 ft. 2 in. by 2 ft., Chinese measurement. After the felt is dry, a batter consisting of ordinary rice ground with water and boiled is applied to both sides, and when this is dry the manufacture is complete. Black felt is similarly made, and the pieces are cut to form the thick soles of Chinese shoes. White felt costs T. 0·3·3 per piece, against T. 0·2·5 for black. In Chungking the white felt is dyed red as well as figured by placing a network of clay and lime where the dye is not required. Coloured and figured it is used for carpeting and bed mats.

Imitation fur is manufactured in the following manner: White wool is teased by hand and spun into yarn. Cotton yarn to the number of some 400 strands is stretched on a plain loom, with two pairs of healds to form the warp. The woollen yarn is wound on to bobbins in the usual way and placed in a large shuttle usually made of part of a water-buffalo's horn, only one side of which is cut open. The woollen yarn constitutes the weft. After this rough cloth has been woven it is washed clean by beating—usually in running water—and then dried. It is afterwards heated over a charcoal stove and, when still warm, one side of the material is brushed vigorously with a hard bristle brush. The hairs then stand out from the cloth, but, as they are uneven, the longer wool is cut off with large scissors. In this form the cloth is steeped, or rather dipped, in a jar containing a batter of rice-flour and water. When the batter is still wet on the cloth, the latter is spread out on a table of wooden planks and the hairy surface treated by rubbing every part of it round and round with the end of a piece of bamboo till the wool becomes a series of little curls. It is then dried and afterwards beaten or tapped with a stick to remove the superfluous dry batter, and the imitation fur is completed. It is manufactured into lengths of from 18 to 36 Chinese feet, with

a width of from 9 to 10 Chinese inches (10 Chinese inches = 1 Chinese foot = $13\frac{3}{4}$ inches English). There are several qualities, dependent on the amount of wool used, and the best costs about T. 0·1·0 a foot ($13\frac{3}{4}$ inches). Black imitation fur is also made in the same way, but the cloth is dyed before it undergoes the above treatment. This imitation fur is used for lining winter clothing.

At the city of Hsü-chou Fu or Sui Fu, situated at the junction of the Min River with the Yangtsze, a carpet or rug industry has recently sprung up. The warp is cotton and the weft woollen yarn. The rugs are of various sizes, but the usual measurement is 6 ft. 5 in. by 4 ft. $4\frac{1}{2}$ in., this being the proper size for wrapping Chinese bedding. Such a rug costs in Ch'êngtu T. 1·3·0. The material is made in various colours and devices to suit individual tastes. I have also learned that similar rugs are now being made on a small scale a couple of miles outside the north gate of Ch'êngtu.

7. *Skins and Furs.*

Although Szechwan is not itself rich in fur-bearing animals, it is a market for the fur-skins of Tibet and the southern provinces of Yünnan and Kweichow, and thus becomes an indirect exporter. Ch'êngtu, moreover, is a great centre for the curing of skins and the preparation of furs for clothing. The province can boast of only an inconsiderable number of goat, sheep, rabbit, otter, monkey, and cat skins as its own special production, but it is supplied by Tibet, through Ta-chien-lu and Sung-p'an, with goat, sheep, fox, lynx, wolf and civet skins, and some indifferent sables, and by Yünnan and Kweichow with a few tiger and leopard skins far inferior to those yielded by Manchuria.

Goat-skins greatly predominate, and the export through the Foreign Customs at Chungking rose from 5,791 in 1894 to 429,888 in 1902; but, as the Native Customs figures are not available for reference, it is impossible to say what supplies are annually placed on the Szechwan market for export. These skins were valued by the Customs in Szechwan in 1904 at about 1 Haikuan tael a pair, while sheepskins, the export of which amounted to only 27,623 were valued at five for one Haikuan tael.* I learn from the fur shops at Ch'êngtu that about 100,000 goat and sheep skins annually come here to be cured, and I shall now describe how they are converted into furs for clothing :—

The skins are first cleaned. They are carried outside the city walls to running water, and packed in large wooden tubs into which is poured a decoction made by boiling in water the pods of *Gledits-*

*In 1919 the export of goat-skins from Szechwan reached a total of 3,745,572 pieces.

chia sinensis. After being well soaked in this soapy infusion river water is added, and they are washed and all grease dirt removed. They are then taken from the tubs and well rinsed in the river. This process is repeated with fresh soapy water. They are then conveyed to the curing-houses, where they are packed in large jars containing a solution of sulphate of soda ("p'i hsiao") and water and the flour of rice ground with water in the ordinary Chinese stone mill. The amount of soda depends upon the weather. In the hot months 50 to 60 catties per 100 skins are required, against 70 catties in winter. The solution of soda and a bushel (40 lbs.) of the wet rice-flour having been mixed in the jar, each skin is taken separately and placed in the liquid compound. There the skins are allowed to steep for six to seven days in hot and twelve days in cold weather, when they are removed and the fleshy sides well scraped and cleaned with a knife. After this they are replaced in the same jars, but another bushel of wet rice-flour is added for each 100 skins. This second steeping occupies some twenty to thirty days, according as the weather is hot or cold. They are then removed and dried. Each skin is afterwards taken separately, damped on the raw side by sprinkling cold water by mouth, again scraped by knife, and hung up to dry. The cure is completed by beating each skin with a whip to remove the rice-flour and sulphate of soda.

Tiger and leopard skins are steeped ten days longer and rabbit (tame) skins, being thin, have the superfluous flesh removed by hand not by knife ; but all other fur skins are cured as above.

The following is an approximate estimate of the number of skins annually brought to Ch'êngtu for treatment, with the places of origin and their values when cured :—

Kind of Skin.	Place of Origin.	Number.	Value of Furs according to quality.
			T. m. c. T. m. c.
Goat and sheep	Tibet, through Ta-chien-lu and Sung-p'an	102,000 to 103,000	0 3 0 to 1 2 0
Fox (brown)	Ditto	3,000	1 0 0 ,, 3 0 0
,, (white breast only)...	Ditto	4,000	1 0 0 ,, 1 8 0
Civet (Ma-lo-tzŭ)	Ditto	300	0 6 0 ,, 1 2 0
Lynx (Chê-li)	Ditto	300	3 0 0 ,, 5 0 0
Wolf	Ditto	100	3 5 0 ,, 6 0 0
Otter (land)	Hsü-chou Fu	200–300	2 0 0 ,, 4 5 0
Rabbit (tame)	Ch'êngtu Plain	10,000	0 0 8 ,, 0 1 8
Tiger	Yünnan and Kweichow...	10–20	15 0 0 ,, 40 0 0
Leopard	Ditto	50	8 0 0 ,, 20 0 0
Cat	Local	500	0 2 0 ,, 0 5 0
Sable (very inferior)	Tibet	100	1 0 0 ,, 2 5 0
Monkey	To-chien-lu, Sung-p'an and Wu-shan Hsien	500	0 7 0 ,, 2 0 0

Monkey-skins are made into leggings and breast-pads, and worn as a specific cure for rheumatism.

The raw skins from Tibet come to Ta-chien-lu and Sung-p'an in June and July, and the prices at the latter place were quoted in August as follows:—Goat and sheep skins T. 55 per bundle of 120; lynx, T. 6–7; wolf, T. 2; fox, T. 1·60; and civet T. 0·3·0 apiece. It will be noticed that in the case of the lynx the raw skin is quoted higher at Sung-p'an than the fur at Ch'êngtu, but the figures given to my friends refer to the very best skins. The breasts of the lynx are favourite furs for jackets and robes, and in making them up the black spots are first plucked out.

8. *Soap.*

I have already mentioned that the fatty pods of *Gymnocladus chinensis* are chopped up fine and mixed with certain perfumes to form a salve or cosmetic; but toilet soap is also made here, not, however, so far as I can gather, to any great extent. There are four large and several smaller shops engaged in the industry.

The following is the method pursued:—Camphor baroos, pig's caul, and barley sugar are ground up in a stone mill, all refuse removed, and the compound thoroughly mixed by hand. Raw white soda imported from Shensi is broken up by hammer and baked to powder in an iron pot, while pig's fat it melted in another. These five ingredients are worked up with pea-flour, musk, and essence of roses for the best soap, placed in small figured moulds, and, when dry, packed in tin boxes. This quality, under the name of "rose-scented soap," sells for 96 cash a box. It is of the consistency of putty. Other and cheaper qualities of the same yellowish colour, or dyed red with cinnabar, but without the musk and rose essence, are as hard as foreign toilet soaps, and are packed in round or oblong cardboard fancy-coloured boxes. A piece of the cheapest quality, measuring $1\frac{1}{2}$ in. by $1\frac{1}{2}$ in. by $\frac{10}{16}$ in., and weighing exactly 1 ounce, may be had for 16 cash, including the box. It is also moulded into little coloured cakes the size of large lozenges and packed in oblong cardboard boxes with glass tops. Such a box, containing ten cakes arranged in two rows—four white, three red, and three black—costs 64 cash.

The essence of roses, which grow well in Szechwan, is obtained by packing alternate layers of petals and white sugar in large jars and placing the jars in the sun. The resulting liquid is baled out and used in the production of the rose-scented variety. The amount of pea-flour, and the proportions of other scenting materials depend, of course, upon the quality of the article required.

9. *Musk.*

Although musk—the secretion in the glandular pouch in the hinder part of the abdomen of the male musk deer (*Moschus moschatus*)—is not a product of Szechwan, it is introduced in large quantities into the province from Tibet through Ta-chien-lu and Sung-p'an, and, forming as it does a valuable article of trade, deserves as much mention as the skins, furs, gold, and rhubarb which come from the same region. At the places of production it is bartered for salt, tea, silks, satins, and cloth, and on arrival at Ta-chien-lu and Sung-p'an it is valued at about T. 10 an ounce, which is increased to T. 18–19 at Ch'êngtu. T. 29–30 are also quoted for the pure article, for musk readily lends itself to adulteration, and it is largely practised in Szechwan. Larger pods are here sold at 500 to 600 cash apiece, and smaller at 300 to 400. Various materials are used for adulterating it, such as dried blood, sand, and the like. The pods are cut open, a quantity of the pure musk extracted, adulterating matter inserted, and the pods closed by needle and thread. A skilled eye is required to detect the fraud. Musk is a thing that can easily be carried on the person and smuggled, so that it is exceedingly difficult to arrive at even an approximate estimate of the total quantity that enters Szechwan. The value of the annual arrivals at Ta-chien-lu has been given as T. 500,000 and at Sung-p'an less. The export from the province through the Foreign Customs at Chungking in 1902 amounted, however, to 49,760 Chinese ounces, of the value of 901,900 Haikuan taels. The average annual export for the ten years from 1893 to 1902 was 47,660 Chinese ounces, so that 1902 was little over an average year. Musk is no doubt powerful, but when the extent to which it is used in the medicine shops, in perfumery, and in the preservation of clothing from moths is considered, it is fairly safe to state that the annual value of the Tibetan export to Szechwan is little, if anything, short of T. 1,000,000 when laid down at Ta-chien-lu and Sung-p'an T'ing. In 1904 I visited Ta-chien-lu where I found that the musk hongs annually trimmed and cleaned from 1,000 to 1,200 catties of pods of the value of about T. 300,000.

CHAPTER IV.

Minerals and Mineral Products.

Szechwan contains a great quantity of minerals, some of which have been developed in a remarkable degree, while others are only in process of exploitation. It is unnecessary in a report like the present, already overburdened with details, to enter into the history of this development, which dates back, as in the case of salt to a period anterior to the Christian era. What I propose to do is to name the various minerals known to exist in the province, state as far as possible their places of production, and add a few words regarding the industries due to their presence, and the uses to which they are applied.

1. Gold.

The traveller who enters Szechwan by the Yangtsze in winter cannot fail to be struck by the rude placer mining which is carried on on the numerous shingle banks exposed in the bed of the river during that season, but, so far as I have been able to ascertain from personal inquiry and observation, the amount of gold annually won from the bed of the Yangtsze does little more than compensate the unemployed peasantry for their labour, and cannot be other than insignificant. There is a mistaken idea that all this gold is washed down from its source in Tibet during the annual rise in the river, but this is disproved by the fact that placer mining is also carried on in the Szechwan tributaries of the main river, and the traveller to Ch'êngtu by the Min River sees the same busy search for gold in its exposed bed. Every prefecture ("Fu") is credited with the precious metal; but careful inquiry goes to show that the important gold-bearing quartz is found only in the west and north-west of the province. The district of An Hsien, in the Department of Mien Chou, to the north of Ch'êngtu, yields small nuggets of gold, reputed to be the finest, and is closely followed in quality by the product of Litang in the far west. There is a large number of quartz mines in the Ta-chien-lu district but the fact that the gold-bearing strata lie principally within the area occupied by the Tibetans and other tribesmen where Chinese are unable to work without protection accounts for the backward condition of the gold-mining industry. There is, however, a Government mine supplied with foreign plant in the district of Mien-ning Hsien, in

the range of mountains between the An-ning River in the Chien-ch'ang Valley and the Ya-lung River. This is the Maha mine, to operate which a grant of T. 100,000 was made by the Provincial Treasury. It had not been worked lately, but another attempt was about to be made to run it. There were others interested in it besides the Government. One native bank contributed T. 20,000 and held 200 Chinese ounces of gold worth about T. 37 an ounce, or a value of T. 7,400, against its contribution. The Provincial Government had, however, forbidden the bank to disposed of these bars—probably the total output up to that time —as it and other investors were interested creditors, and no arrangement for the division of the spoil had yet been arrived at. Most of the gold that finds its way into the province comes from Tibet.

The usual native method of extracting the gold from the ore is as follows : The quartz is crushed, carried to the nearest running water, and washed in a basket lined at the bottom with a mixture of wood-oil and lime. The stone is washed away, and the gold sinking to the bottom is collected and placed in a bowl of quicksilver, which is then squeezed through a piece of cloth. The gold remaining in the cloth is then melted up and cast into ingots, which are sold to the goldsmiths at from T. 27 to T. 31 per Chinese oz., according to quality. It has now to be refined. The crucibles, which are bowl-shaped, are made of clay, coal-ashes, and sand, and are manufactured at Chungking, Lu Chou, and Chiung Chou. The crucible is first made red-hot in a charcoal furnace, described fully under Silver, and the gold placed therein. As soon as the latter melts certain small proportions of saltpetre, borax, and arsenic are added to the molten metal, according to the amount of impurities it is seen by the operator to contain. The saltpetre causes the gold to spread and allow the impurities to rise to the surface ; the borax and arsenic mix with and attract these impurities to the side of the crucible, whence they are removed by means of an iron rod having a tooth-shaped hook at the end. When the impurities have all been eliminated, the crucible is seized by a pair of tongs and the molten metal poured into an iron bar-mould, whence the bar of gold is, on solidifying, removed again by tongs and plunged into cold water. It now appears as a yellow bar weighing about 10 or 12 Chinese ozs., worth some T. 38 an oz. I was told that the price in Shanghai was T. 42 an oz. but as Ch'êngtu T. 95 are equal to Shanghai T. 100, the margin of profit cannot be very great. The gold is brought to the furnace by the owner, and the operator charges 100 cash for casting each bar, and hands over the crucible with its dregs, along with the bar, to the owner. The dregs are, I understand, further treated for any remaining metal. The moulds, as already stated, are of two sizes. The smaller bars measure $3\frac{1}{2}$ by $\frac{9}{10}$ by $\frac{1}{2}$ Chinese inches, and weigh about 10

Chinese ozs. These are stored as treasure or exported. The larger bars measure some 8 Chinese inches long, weigh about 12 Chinese ozs., and are mostly used for the manufacture of gold-leaf. One of these latter bars is beaten out on an iron anvil by hammer, the sheet during the process of hammering being heated from time to time in a charcoal fire to render the metal more ductile. When completed the sheet is cut up by scissors into ninety-six leaves, which are usually known as gold-leaf. These leaves are then placed in a charcoal fire in a stove with a sprinkling of a mixture of ground salt and dust between the leaves, and the whole covered with live charcoal. When the fire has burned itself out the gold leaves, each measuring 3 $\frac{9}{10}$ by 3 $\frac{1}{10}$ to 3$\frac{1}{2}$ Chinese inches, are removed, brushed, and washed clean in cold water. They are now ready to be manufactured into gold ornaments, circular gold leaves, and "Fo Chin," or "Joss Gold."

To manufacture circular gold leaf, known as "Hoyeh Chin," $\frac{8}{10}$ Chinese oz. of gold-leaf is taken and cut up into 1,600 small pieces, each of which is placed between two small sheets of black paper—"Wu Chin Chih"—made in Hang-chou Fu, in the province of Chê-kiang, and the whole packed tightly in many layers of the tough paper called "P'i Chih"—the bark paper of Kweichow, made from the inner fibrous peel of *Broussonetia papyrifera*. The packet is gummed firmly and beaten on a flat smooth stone by one man for two days, when the thin sheets of gold are removed more or less round in shape and about 2$\frac{1}{2}$ Chinese inches in diameter. The sheets are used for gold-plating.

To make "Fo Chin," or "Joss Gold" the circular sheets of the above are placed each between two square (nearly 7$\frac{1}{2}$ inches) sheets of the same black paper, and the whole inclosed as before in many layers of bark paper. The packet is now hammered on a smooth oval stone by two men seated opposite to each other for two days, one of the men holding the packet by one of its corners. The thin sheets are then removed, taken separately and spread on a slightly curved leather (horse) pad with a centre of cotton wool and a wooden handle attached to the centre underneath. Before the gold sheet is laid on the pad, however, the latter has a thin dusting of charcoal ash sprinkled on it to prevent the gold adhering to the leather. The edges to the sheet of gold are then squared by a long knife set in a narrow wooden frame and the parings are utilized for filling any holes or imperfections in the sheet itself, which is then cut up into small squares—$\frac{3}{4}$ Chinese inch—from six to twelve in number. Each of these tiny square sheets of gold is raised by knife, usually with the assistance of the breath, and placed between a fold of fine paper. In this form each sheet is valued at from 2 to 3 cash. They are done up in tiny bundles and used for gilding images, signboards, carved characters, and woodwork generally.

The black paper above referred to is universally used by the medicine shops for dispensing powders. The surface, being smooth and glossy, does not admit of the powder adhering to it—an annoyance to which patients and nurses are frequently subjected in more civilized countries.

I may mention that a primitive blow-pipe is in common use among the gold and silver-smiths in Ch'êngtu.

2. Silver.

Szechwan, so far as I have been able to ascertain, is not particularly rich in silver ores, but the metal is found in the districts situated in the north-west, west, and south-west of the province. They are T'ien-ch'üan Chou, Lu-shan Hsien, and Ta-chien-lu T'ing (in the Ya-chou Prefecture), Sung-p'an T'ing, Li-fan T'ing, Mou-kung T'ing, Mao Chou, Chiung Chou, and Kuan Hsien, and in Hui-li Chou, Yüeh-hsi (sui) T'ing, Yen-yüan Hsien, and Mien-ning Hsien, in the south-western Prefecture of Ning-yüan. The ore is smelted with charcoal in furnaces erected at the mines, and the alloys, such as lead, are removed by means of saltpetre and borax.

Silver is manufactured into personal and decorative ornaments of every description, into dollars, subsidiary coins, and Chinese rupees, for use in Tibet, by the Mint in Ch'êngtu, which derives its supply of silver from the Provincial Treasury. The latter receives the land and other taxes in silver from the local authorities throughout the province. The great bulk of the silver in Szechwan, however, is in the shape of ingots or shoes of sycee, most of which average about 10 taels or Chinese ounces in weight, and the daily casting of these ingots is by a no means inconsiderable industry in Ch'êngtu. The process is carried on at night, for then it is that the cash shops, which have been buying silver for copper cash during the day, send their collections of broken bullion to the furnaces to be melted up and cast into fresh ingots. I may say that the men engaged in this, as in the gold industry, are natives of Shensi. I visited one of these furnaces at night, and the following description of the process may not be devoid of interest: The shop, a small room, abutted on one of the main streets. In one corner, close to the back wall, a bellows, worked by pulling a handle backwards and forwards, connected with a three-sided brick furnace a foot or two above the level of the bellows. The furnace was open in front, and there was a wide projecting ledge of brick in the centre and on both sides on a level with the floor of the fireplace for the accommodation of the workman's tools and materials required in his trade. On the centre of the bench were laid out sets of tongs of different sizes and strengths, and iron rods ending in bent, tooth-shaped wedges; while at the sides were wooden trays

containing, each in its separate hollow compartment, resin, flake lead, powdered arsenic, saltpetre, and borax (P'êng Sha). On the brick roof of the furnace were a number of small crucibles, which, unlike the semicircular cups used in gold refining, were conical, the apex of the cone at the bottom ending in a short protuberance or knob. When I entered the shop, the bottom of the furnace was heaped with half-live chips of charcoal, which were soon brought to a red heat by the boy at the bellows. Taking one of the crucibles in his hand, the workman, after examining it closely, placed it apex downwards among the charcoal at the edge of the fire, and, picking up one or two live chips of charcoal with a pair of tongs, landed them in the crucible. There they remained for a few minutes, and, as nothing seemed to go wrong, he raked out the top of the fire, and put the crucible in the centre, adding another live chip to it. As all seemed to be going well, he removed the crucible for a moment, raked out the charcoal on the top of the fire, and buried the crucible face downwards, heaping the raked-out charcoal on the top. The bellows was then worked vigorously for a few minutes until the crucible was red hot, when it was removed by tongs, and found on close examination to be slightly cracked. It was discarded, another substituted, and the same process repeated. The second crucible, on being taken out, was found to have stood the test. A little saltpetre was thrown into it, and the crucible, held by a pair of tongs, was turned over to remove the ash; 10 taels' weight of broken silver, among which I noticed a small shoe of Shensi sycee, having been duly weighed, was then poured into the crucible, and the latter was at once replaced on the furnace, and the boy at the bellows set to work with all his might, while the workman kept placing live chips of charcoal round the sides and back of the crucible. As soon as the silver melted, the workman flicked with a tiny spade a small quantity of saltpetre into the crucible, which he followed with a flake or two of lead. He had noticed from the appearance of the molten silver that there was an excess of impurities, whose removal, on which he was bent, would cause a slight loss in weight, and the flakes of lead were added to make good the prospective loss. After this a little more saltpetre was added. It appears that the saltpetre causes the silver to open out and release the impurities, which thereupon rise to the surface. A little arsenic was now added, causing the impurities to recede to the side of the crucible. The rod with the toothed end was then inserted and drawn round the inner side of the crucible, the impurities adhering to the tooth. The end of the rod became red hot, and, on being withdrawn, the impurities were scraped off by means of an iron bar. This was repeated several times, and the impurities, which are the perquisite of the workman, and still hold a very small quantity of metal, are afterwards utilized.

Finally, a considerble quantity of borax was placed on the top of the molten silver. It gradually found its way to the side of the crucible, and was removed by adhering to the toothed rod. While this was going on, an iron mould had been taken from its bed in a bucket of sand, and heated on the charcoal in the front part of the fire. It was then dipped in cold water, and replaced in the sand. The crucible was now removed by tongs, and the silver gently poured into the mould. Before the latter had time to solidify, the conical bottom of the crucible was gently pushed down on the surface, causing an edge of the silver to rise all round, and was raised up just as the molten mass was on the point of solidifying in the centre, bringing with its bottom protuberance a little silver, which forms the usual knob in the centre of a shoe of sycee. Tapping the mould with a hammer loosened the ingot or shoe of silver, which was at once seized by tongs and placed on an iron plate or anvil. Placing his iron seal on the top of the ingot, the workman, with a few vigorous strokes of a hammer, impressed the name of his shop or trade-mark upon it, and the sycee was laid aside to cool. No resin was used, and it was explained to me that it is employed only when it is evident to the workman that the silver contains tin, which it has the property of isolating. When the silver is good, small quantities of saltpetre and arsenic are used, but when it contains considerable alloy, more is required, and borax in addition. I saw four ingots cast in less than an hour, and in the two last no borax was required, but saltpetre and arsenic were used throughout. The wage paid to the workman for casting each ingot was 40 cash. I have omitted to state that, while the furnace was in full blast, an iron screen, with a small, square hole in the centre, through which the crucible could be seen, was placed in front of the furnace to prevent live sparks from reaching the workman.

3. *Copper.*

The copper reefs of the Provinces of Kweichow and Yünnan run north-west into Szechwan, where the Yangtsze makes its sweep southwards after its junction with the Ya-lung, and the southern half of the Prefecture of Ning-yüan, including the Department of Hui-li Chou and the two districts of Hsi-ch'ang Hsien and Yen-yüan Hsien, is rich in this metal. Hui-li Chou especially is noted for its copper mines, which mainly supply the wants of the whole province. In that department both red and white copper are found, the latter, which is not artificially produced, being smelted from a combination of ores found *in situ*. The smelting is done by packing layers of ore with alternate layers of charcoal in cone-shaped furnaces. The contents are brought to a red heat by means of a

bellows made of part of the hollowed-out trunk of *Sterculia platanifolia*, in blowing which five or six men are engaged at one time. The smelting occupies a day, and when this has been effected dry rice and rice with the water in which it has been milled are poured into each furnace to bring out the colour in the copper which is afterwards drawn out in round rough layers of the diameter of the furnace, and, therefore, differing in size and weight according to their position in the cone. It is again fused and run into slabs.

The copper reefs are not, however, confined to the south-west of the province. They are found further north in the district of T'ien-ch'üan Chou, Ming-shan Hsien, Lu-shan Hsien, and Jung-ching Hsien in the Prefecture of Ya-chou Fu, in Ma-pien T'ing and Lei-po T'ing and the district of P'ing-shan Hsien, in the Prefecture of Hsü-chou Fu, to the north-east of Hui-li Chou, and the Chien-ch'ang Valley, and in the mountains in the west of the districts of Kuan Hsien and P'êng Hsien, in the Ch'êngtu Prefecture. Copper mines are worked at a place called Pai-shui Ho, in the Mi-chia Shan hills, 90 *li* from the city of P'êng Hsien, and the copper is brought to Ch'êngtu for use in the Arsenal and Mint and for copper and brass ware generally. From the Ning-yüan Valley the copper comes to Ch'êngtu in slabs, weighing from 35 to 40 catties, and is valued here at T. 0·3·8 per catty, while the circular blocks from P'êng Hsien weigh from 40 to 60 catties worth T. 0·2·8 a catty. White copper costs T. 0·7·0 a catty.

Ch'êngtu is a great centre for the manufacture of copper and brass ware. Kitchen utensils of all kinds, such as pots, pans, basins and spoons, tobacco pipes, lamps, candle-sticks, locks, hinges, buttons, images, bells, gongs, musical instruments, weighing scales, and other articles too numerous to mention are here made of copper or a mixture of copper and zinc. Copper mixed with tin is also minted into cash, and it is likewise used as an alloy in the manufacture of silver dollars, Chinese rupees for use in Tibet, and subsidiary silver coins.

In the manufacture of red copper or brass ware, 5 to 6 ounces of zinc are added to every pound of copper, while for yellow brass ware 10 to 11 ounces are required.

Gold, silver, and copper are drawn into wire in the following manner: At one end of a rude wooden bench two uprights, one at each corner, are erected, and between them half-way up is fitted a stout wooden roller. On the centre of the roller there is a metal knob, over which is fixed by an eye the end of a leather band several feet long. The band is wound twice round the roller, and its free end is attached to an ovate iron ring which is passed over the point of a pair of stout pincers, and rests on the shoulders of the two handles. In the centre of the bench rises a stout round pole with a deep groove parallel to the roller. A number of iron

or steel plates some 9 inches long by 6 inches broad, ½ an inch thick at the base, and gradually tapering to a point, were lying about in a basket on the bench. Each plate had twenty-four circular holes drilled in it in four rows of six nearer the point than the base. Each hole was about the size of the end of an ordinary lead pencil on one side and tapered to a narrower round opening on the other. Each plate differed from the other in that the narrow holes were of different sizes. Taking up a plate and placing it base downwards in the groove, he inserted a wooden wedge and drove it home until the wedge was firmly fixed. Seizing a piece of silver 1 foot long, about the stoutness of a lead pencil, and pointed at both ends, he inserted one end in a hole in the plate so that the point projected through the narrower orifice facing the roller. Catching this point with the pincers he turned the roller by a bar rising from its projecting axle. The band on the roller tightened and the oval ring pressed on the shoulders of the handles of the pincers, causing the roughened teeth of the latter to maintain a firm hold of the end of the silver. By straining on and turning the roller the silver was pulled through the plate and was rounded and lengthened in the process. This was repeated several times through holes in the same plate, when new plates with smaller outlets were substituted, the silver lengthening each time—in other words, becoming wire.

In this way an ounce (Chinese) of gold can be drawn into a wire or thread some 600 feet long, while the same weight of silver or copper may be extended another 400 feet. Gold and silver wire are used in the manufacture of ornaments for the hair, ear-rings, rings, etc., whereas copper is utilized for wiring artificial flowers, bristle and hair brushes, and for spacing foot and inch measures and the like.

In addition to the copper yielded by the mines of the province, much of the old copper cash in circulation is melted down and manufactured into articles of all kinds. It is said that a string of 1,000 good cash will produce about 6 catties of copper, which is, of course, much more valuable than the cash value of the coins. The practice is illegal, but is daily carried on in Ch'êngtu.

4. Lead.

Lead is found in Hui-li Chou, Mien-ning Hsien, Yen-yüan Hsien, and Yüeh-hsi T'ing, all in the Prefecture of Ning-yüan Fu; in Kuan Hsien in Ch'êngtu Fu, and in Mao Chou, Sung-p'an T'ing, Li-fan T'ing, and Mou-kung T'ing. The ore is smelted with coal and run into bricks and bars weighing about 50 and 5 catties respectively. The price in Ch'êngtu is T. 0·0·8 a catty. It is mostly used as an alloy in tin for the manufacture of lamps, candlesticks,

head ornaments, wine pots, basins, and every variety of household utensils. Lead is also largely used for conversion into white lead, the manufacture of which I have already described when dealing with paint colours. Tin itself is not a product of Szechwan; it is brought to Ch'êngtu from the Ko-chiu mines in Yünnan.

5. *Zinc or Spelter.*

P'ing-shan Hsien, Ma-pien T'ing, and Lei-po T'ing, in the Prefecture of Hsü-chou Fu; Hui-li Chou, Mien-ning Hsien, Yen-yüan Hsien, and Yüeh-hsi T'ing in Ning yüan Fu; Chia-chiang Hsien in Chia-ting Fu; and T'ien-ch'üan Chou, Lu-shan Hsien, and Ming-shan Hsien in Ya-chou Fu, are all credited with the possession of zinc. The ore is smelted with charcoal and the metal poured into iron moulds and turned out as bricks measuring 12 by 5 by 3 Chinese inches and weighing about 50 catties. The value here is T. 0·0·9 per catty. Its principal use is as an alloy in copper to form brass.

6. *Antimony.*

So far antimony has been discovered in only one district of Szechwan—Hsiu-shan Hsien, in the district of Yu-yang Chou, in the south-east, where it borders on Kweichow and Hunan, and I understand that the whole of the output is by agreement disposed of to the mining department of the latter province at about T. 36 a ton.

7. *Asbestos.*

This mineral, usually called Shih-mien ("Rock Cotton" or "Rock Wool") is found in veins in rocks in several places in the north, west and south of Szechwan. In the north within the prefecture of Lung-an the fibre is short and of little value for textile purposes; in the west in the neighbourhood of Ta-chien-lu it is frequently long but brittle without tensile strength; and in the south in the Chien-chang Valley, it is of very good quality—probably the best in China—long, strong and capable of being woven into cloth. In this valley I found cloths of this mineral in use in Chinese inns. When dirty they were thrown in the fire and extracted clean and again ready for use.

8. *Mica.*

Mica is found in the country lying between Ta-chien-lu and Mou-kung Ting especially in the valleys of the Ta-chin Ho and Hsiao-chin Ho, which go to make up the headwaters of the Tung

or Ta-tu River; and in 1904 on the banks of the latter I passed over ground literally carpeted with mica flakes glittering in the sunlight. I have before me now a sheet of mica from that region measuring some 12 by 8 inches, a quarter of an inch thick and made up of thirty odd lamina or folia. Even in the mass it is remarkably transparent. This is a mineral awaiting development and a foreign market.

9. Iron.

Iron is well distributed throughout Szechwan, but owing to the difficulties of communication, parts of the north are supplied by Shensi. In addition to the usual demand for agricultural implements, artizans' tools, and kitchen utensils, the most important use to which iron is put is the manufacture of large iron pans for the evaporation of salt at the numerous brine wells throughout the province. The fact that these pans, which are from 4 to 5 feet in diameter, weigh often as much as 1,600 lbs., and have constantly to be renewed, will give some indication of the quantity of iron required in their manufacture. True, the old pans are broken up and re-moulded, but the annual consumption of the metal for this purpose alone must be enormous. Many of the evaporating pans used at the great salt wells of Tzŭ-liu-ching and Wu-tung-ch'iao are made at a place called Kan-shui, in the district of Ch'i-chiang Hsien to the south of Chungking, near the Kweichow frontier, where, and in the neighbouring district of Nan-ch'uan Hsien to the east iron is particularly abundant. Indeed, all along the banks of the Ch'i-chiang River, which enters the Yangtsze at Chiang-k'ou, south by east of Chungking, the manufacture of these pans is a most important industry, which has been greatly aided by the fact that the pans can be sent by water almost to the very wells. Laid down, the pans cost from T. 30 to T. 45 each, according to weight. The moulds used in casting them consist of an upper and lower layer of clay mixed with straw and sometimes human hair for binding purposes; the upper layer is pierced with numerous vent-holes. Iron is also carried from the same ironworks to Lu Chou, where and on the banks of the T'o River pan-casting forms an important industry, and Ch'êngtu is supplied from the same source as well as from Jung-ching Hsien, in the Prefecture of Ya-chou Fu to the west, where the metal is abundant. Charcoal is almost universally used in smelting. The ore laid down at Kan-shui costs 5 cash a catty. The iron when smelted is worth T. 1·4 per 100 catties, and pig-iron is sold for T. 2·7 for the same quantity. In Ch'êngtu, pig-iron and bar-iron from Kan-shui costs T. 4 and T. 5·8 per load of 98 catties. Iron is also found and worked within the Prefectures of Chia-t'ing, Kweichow, Ch'êngtu, Hsü-chou, and Ning-yüan.

10. Saltpetre.

Nitre, or saltpetre, is found throughout the province as an efflorescence on the soil and on the walls and foundations of old houses; it is extracted by lixiviation in the usual way. It costs in Ch'êngtu 260 cash a catty, and is used in the manufacture of gun-powder, in medicine, and in the refining of gold and silver.

11. Sulphur.

Sulphur is found at various places—in the north at Kuang-yüan Hsien, where it is combined with coal; in the Nan-ch'uan district in the south, where it borders on Kweichow; in the district of Mao Chou, north by east of Ch'êngtu, and elsewhere. The sulphur from Nan-ch'uan supplies a great part of the province. It is worked under Government surveillance and the retail price is regulated by the provincial authorities. It costs little more than 20 cash to produce a catty, but freight and Government control bring the retail price up to 100 and 120 cash for the two qualities. It is used in the match factories in Chungking, for bleaching purposes in the silk and other textile industries, and in medicines.

12. Sulphate of Soda.

About 7 miles to the west of the district city of P'êng-shan Hsien, which lies on the left bank of the Min River below its junction with its Ch'êngtu branch, are two places called Kung-i-ch'ang and Hsieh-chia-ch'ang. Here there are a number of wells varying from 50 to 80 feet in depth. From these wells the water is pumped into large ponds by means of the ordinary endless chain pump used for irrigation purposes. In these ponds crystals of sulphate of soda are precipitated, and, under the name of P'i Hsiao, are exported in considerable quantity to Chungking for use in a glass factory at that port. The soda is also brought to Ch'êngtu, and, as already stated, employed for curing skins and furs. It costs in Ch'êngtu 16 to 20 cash a catty.

13. Gypsum.

This mineral is found and worked in the district of Mei Chou, lying on both banks of the Min River to the south of the district of P'êng-shan Hsien. Gypsum occurs in seams of from 8 to 9 Chinese inches in thickness. It is dug out and sold at the place of production for about 6 cash a catty. At Ch'êngtu it costs 14 to 15 cash. It is used as an ingredient in beancurd, as a medicine, and, powdered and mixed with water, it is made up into cakes which are utilized instead of soap for washing clothes. Powdered gypsum is, of course, "Plaster of Paris."

14. Potash.

Potash is obtained from the ashes of plants and trees consumed for the purpose in the prefecture of Chia-ting and in the district of Mao Chou and the district of Wên-ch'uan Hsien to the north-west of the Ch'êngtu Plain. The ashes are packed in large wooden vats on the top of sand covering sieves, which form their bottoms. The vats are now filled with warm water, which extracts the potash from the ashes, percolates through the sand, and escapes through the sieves into reservoirs placed underneath. The water is then transferred to pans and evaporated like salt, two days' continuous evaporation being required to produce the marketable commodity. The potash is of various colours, according to the plants and trees whose ashes are used. The bamboo ash, for example, produces a black potash which can only be employed in paper factories, but the lighter colours, such as white and brown, are used for making bread and cakes, while red, green, and darker varieties are more suited for dye-houses. The potash is packed in wooden tubs weighing 128 catties, and is thus carried all over the province. It is also transported in the shape of cones, weighing 11 to 12 catties, packed in bamboo bracts. There is very little difference in price between the six colours produced, the values at Ch'êngtu ranging from T. 6·1·0 to T. 6·6·0 per tub. Potash is also obtained at the various brine wells where it is a by-product of salt evaporation.

15. Sulphate of Iron.

Copper as is found in combination with coal in the district of Chiang-an Hsien, in the Prefecture of Hsü-chou Fu, and in the Prefecture of Chia-ting Fu. It is separated by boiling the coal dust, drawing off the water, and re-boiling the latter till it thickens, when it is poured into wooden moulds. When it solidifies it is packed for market in wooden tubs, each weighing about 300 catties. The cost at the place of production is from 5 to 6 cash a catty, rising to 12 to 13 cash in Ch'êngtu. It is employed in the dye-houses as an ingredient in black-colour dyeing.

16. Coal and Coke.

Coal is widely diffused throughout the province, and differs in quality from lignite in the far west to bituminous in the north and anthracite in the east. Vertical shafts are unknown, horizontal galleries being simply driven into the hillsides. The price at the pit's mouth ranges from 80 to 300 cash per picul of 100 catties; but the average based on prices at nineteen widely-separated places in the province, may be taken as 160 cash, or T. 2·24 a ton. Carriage, however, is an expensive item, and has been calculated

to average 15 cents a ton overland per mile. The best coal as yet discovered in Szechwan comes from the valley of the Chia-ling River, where it flows through the district of Chiang-pei T'ing. This river joins the Yangtsze on its north bank at the port of Chungking, and some of the coal finds its way eastwards into Hupei. The evaporation value of this coal—that is, the number of pounds of water 1 lb. of coal will convert into steam from and at 212° F.—is 14·08, while the evaporation value of the best Welsh coal is 15·55. As, however, mining is little more than superficial, it may be taken for granted that better results have yet to come.

In the cities of Szechwan, and on the thousands of junks plying on its waterways, coke is preferred to coal. It is slightly dearer, but burns less rapidly, retains its heat longer, and requires no provision for the escape of smoke. There are two great centres for the manufacture of coke—the districts of Ch'i-chiang Hsien and Kuan Hsien. I have visited both, and the process is the same. Dust coal is separated by water, precipitated in tanks, removed and kneaded into blocks, which are arranged in rows and tiers, separated by coal ashes, inside a kiln built of stones partly under but mostly above ground. A central air shaft is left, and, with this exception, the top of the kiln is also covered with ashes to prevent excessive combustion. The kiln is fired through a small opening at the bottom, wood being used as fuel. It is allowed to smoulder for about ten days, and, as soon as all the smoke and vapour have disappeared, the kiln is pulled to pieces and the blocks of coke are dragged out and watered to prevent further combustion. Ch'êngtu is supplied by the coke-works on the left bank of the Min, a few miles above the city of Kuan Hsien, and the fuel is floated down by raft on that branch of the river which passes under the walls of the provincial capital. The Ch'i-chiang output finds its way down the Ch'i-chiang River to the Yangtsze.

17. Lime.

Lime is as common in Szechwan as coal, and the two strata are frequently found in juxtaposition where the upheaval of the crust of the province has been particularly extensive. It is dug from the hill sides and limestones are collected from the beds of rivers and streams and burnt in kilns in the usual way. Mixed with clay it is used in building of every description, in white-washing, and in hide-curing. Slaked lime in Ch'êngtu costs 140 cash a bushel of 28 to 29 catties.

18. Jade.

Some 20 miles north of the city of Kuan Hsien, and 8 miles inland from the left bank of the Min, there is a jade mine. The

output amounts to only a few piculs a day, and the stone is coarse in quality. It is worth 80 to 100 cash a catty at the mine. The stone is brought to Ch'êngtu and manufactured into ornaments, such as rings, bracelets, and the like. The cutting of the stone is done by means of a circular metal disc fixed on the bar of the lathe which I have already described as employed in the manufacture of horn and bone ware. Drilling the stone is done by the same machine, sand and water being used in the process.

19. Mineral Oil.

Petroleum is known to exist in the province. In the district of P'eng-ch'i Hsien, in the Prefecture of T'ung-ch'uan Fu, a native company has a monopoly for working the oil, but the results have proved unsatisfactory, as, owing to inability to refine it, the oil will not burn freely. Traces of oil have been found in other districts, and the famous "fire" wells of Tzŭ-liu-chiang, the gas from which is employed in salt evaporation, no doubt owe their usefulness to petroleum deposits. The oil itself has not been reached, at least in any quantity, and it is probable that a rock crust through which the gas has succeeded in forcing its way still separates the province from untold wealth.

20. Salt.

I have left to the last one of the greatest and most valuable industries in Szechwan—the manufacture of salt—with which the province supplies not only its own vast population, but also great parts of Hupei, the whole of Kweichow with the exception of the one Prefecture of Li-p'ing Fu, which draws its requirements from the Two Kwang, and Northern Yünnan, including the Prefectures of Chao-t'ung and T'ung-ch'uan and the Department of Chên-hsiung.

I do not propose to discuss in this place the interesting but somewhat complicated system of salt administration of the province: my aim is simply to describe the method of production and arrive at an approximate estimate of the quantity and value of the annual output.

The great brine deposits of Szechwan are contained in the south-central part of the province, between the T'o and Min Rivers, which enter the Yangtsze at Lu Chou and Hsü-chou Fu respectively. Near the Min, at the Wu-Tung Ch'iao Wells, the brine is found at a depth of about 500 feet, while near the T'o, at Tzŭ-liu-ching, where the most numerous and most productive wells are worked, the depth runs from 1,000 to 3,000 feet. These two great salt areas lie near the centre of the Red Basin, and the brine is found underlying the sandstone crust which covers it; but brine is found and worked at lesser depths throughout the east of

the province, and, even to the east of the Red Basin, such as at the eastern end of the city of K'uei-chou Fu, where, during low water season, pits are dug on both banks of the Yangtsze, brine is struck at a depth of about 30 feet and evaporated on the spot. In the south-west of the province, in the Chien-ch'ang Valley, brine is found and worked at Pai-yen-ching—"White Salt Wells"—within the district of Yen-yüan Hsien, where it lies at a depth of about 50 feet. To give an idea of the process of salt manufacture in Szechwan, I may quote from my diary what I wrote when visiting the K'uei-chou Fu, Tzŭ-liu-ching, and Pai-yen-ching salt works. The K'uei-chou Fu pits I visited on the 20th December, 1902, and I then wrote as follows :—

"Taking advantage of the six hours' delay, I started at 10 A.M. to visit the salt factory, and proceeding eastward below the city (K'uei-chou Fu) wall, I met a large number of men carrying baskets of more or less dust coal citywards. I priced this coal at several points on the road and learned that it cost 150 cash per 100 catties, or, at the exchange here of 720 cash per 1 dollar, 3 dol. 60 c. per ton. The number of carriers led me to think that I was approaching a coal mine, but on reaching a stream (called the Hsiao Ho, or 'Small River,' and described as such on official flags) I discovered a large number of boats discharging coal, which is mined 15 *li*, or 5 miles, higher up the stream. Crossing the stream by a rude wooden bridge, I accompanied a string of coal carriers to the tail of the shingle bank, whence clouds of steam were rising. In the middle of this evidently temporary village I found a wide pit, about 30 feet deep, at the bottom of which brine was bubbling up at two places a yard or two apart, and men busy as ants dipping their buckets in the brine, carrying them up the sides of the pit, and emptying their contents into wooden tubs, whence the brine was led by outlets, covered with bamboo sieves, into shallow wooden troughs connecting with cement-line storage tanks of no great size or capacity. From the tanks the brine was baled into smaller wooden tubs, also provided with sieves and lengths of bamboo, leading to large iron circular evaporating pans, about a yard in diameter and a foot in depth. These pans fitted loosely into circular holes in the ground, beneath which were large open furnaces visible from small openings, through which they were supplied with coal. Under each furnace was a tunnel, about 4 feet high and 3 feet wide, which acted as a draught chamber, and carried the smoke through cinders banked on the opposite side of the evaporating pan. The brine in the pans was boiling and in process of crystallization, and I was informed by the workman that one or two days were required to complete the evaporation, the furnace being kept burning night and day. Pan and granular salt were both being evaporated. The furnaces, which are built of mud and cinders, have to be rebuilt

every ten to twenty days, and the fact that evaporation can be carried on for only four to five months out of the twelve accounts for the temporary character of the works. During the rest of the year the shingle bank is covered by the rise in the river, when work is, of course, impossible, and the same conditions apply to the works on the south bank. The salt on production costs 20 cash a catty; but there is a likin station at the works through which all the salt has to pass, and which, after duly weighing each load, exacts 12 cash a catty, bringing the price up to 32 cash. When the tax has been paid the load is lightly sprinkled with a red powdered substance, which takes the place of a seal, and the salt is then carried to the end of the bridge above referred to, where it is inspected at an examination office and receives a certificate exempting it from further taxation. This salt is not, however, permitted to circulate beyond the Prefecture of K'uei-chou Fu. During the period of salt evaporation the coal from the Hsiao Ho is not allowed to be exported for fear of a failure in supplying the salt works. Carriers of coal from the bridge to the evaporating pans are paid at the rate of 10 cash a load; but boats also descend and discharge in the Yangtsze at a point nearer the works, and carriers have to be employed for the shorter distance. I gathered that the total number of furnaces at work amounted to some 110 on both banks of the river, and I think that the output of both pan and granular salt for the five months cannot exceed 30,000 piculs, or about 2,000 tons. At the city end of the bridge coal briquettes were being manufactured, and cost 3 cash apiece. The coal dust, having been brought to the proper consistency by a mixture of water and clay, is placed in a bottomless wooden mould, measuring some 6 by 4 inches, on the ground which has been carefully sprinkled with coal ashes. The wooden mould is at once removed and the briquettes sun-dried."

It is necessary to explain here what is meant by pan and granular salt. Pan salt is the salt that crystallizes and cakes on the side of the iron pan during the boiling and evaporation of the brine. This is caused by keeping the furnaces well supplied with fuel and developing great heat. In the case of granular salt less heat is applied, and the crystals form and remain separate without caking. At K'uei-chou Fu the brine is as clear as the water of the Yangtsze itself, and no purifying of the granular salt, such as is practised at Tzŭ-liu-ching, is required. Pan salt may be of any thickness from 2 to 6 inches, and being shaped like the pan, and therefore inconvenient for transport purposes, it is broken up usually into four pieces.

The following may be taken as an accurate description of the brine wells of Tzŭ-liu-ching, which I visited in 1884. Some additional information is given at the end of the quotation :—

"I found myself seated—a settle had been procured for me—beside a square stone embedded in the ground, with a central hole a few inches in diameter. From the hole there was issuing a hempen rope about an inch thick, which, ascending, passed over a movable wheel fixed at the top of a staging some 60 feet high, and bearing a striking resemblance to the shears at a dockyard. On leaving the shears the rope descended and passed under another wheel fixed a few feet above ground, whence for the moment it escaped from our range of vision. After the lapse of a quarter of an hour the top of a tube, from 9 to 10 inches in circumference attached to the rope, made its appearance, and was drawn up to within a foot of the wheel. Meantime a workman stationed at the mouth of the well had thrown a rope round the tube, which was composed of the stems of a number of bamboos fixed together, and immediately the lower end appeared he drew it to one side and over a wooden reservoir built into the ground. Embracing the tube with his left arm, he plunged an iron rod which he held in his right hand into the bottom, and, raising a leather valve which was there adjusted, allowed the contents, consisting of black, dirty-looking water, to escape into the reservoir. This was the brine. The tube was again placed over the well, and descended with great rapidity. Whence the motive-power that raised the brine? Following the rope after it left the second wheel I found that it entered a large shed, the floor of which was several feet underground. In the centre of the building was an enormous bamboo wheel or drum, 12 feet in height and 60 feet in circumference, placed on a vertical axis, to which the rope was attached 6 feet from the ground. As I entered four huge water-buffaloes were being harnessed at equal distances to the circumference of the drum; each buffalo had a driver, whose duty it seemed to be to belabour the animal with a short, stout hempen rope to induce it to break into a trot. As the drum revolved the rope coiled round it at a sufficient height not to impede the buffaloes. For a quarter of an hour—that is, until the tube had been again raised—this unmerciful beating went on, when the poor beasts, exhausted and white with froth, were unharnessed and led back to their stable, whence a fresh relay was brought. When the animals were unharnessed and the signal given the drum reversed with great velocity, creating a violent wind all round. Forty animals were employed at this well, and each relay raised the brine about ten times every twenty-four hours. They are specially selected for the work, and cost from T. 40 to T. 50 apiece. The specimens I saw were fat and in excellent condition, but although they are carefully fed and attended to, each costing 300 cash a day, their staying power does not exceed five years. Many even fail within the first year; nor is this to be wondered at, for the make of the animal fits it for a slow, plodding life only.

"Retracing my steps to the large reservoir by the well, I found that the brine was being carried off in bamboo pipes laid down between it and smaller wooden reservoirs in the evaporating sheds, which I next visited. On the floors of the latter rows of brick furnaces, with round openings at the tops, were built. On each furnace rested a round, shallow iron pan, about 4 feet in diameter, filled with brine conducted in open bamboo pipes from the reservoirs, which occupy one side of the shed. Where was the fuel? Under each pan was a flame blazing from a bamboo tube coated with lime and fitted with an iron burner, while all round flames burst from smaller upright tubes and lighted the sheds, for there was no cessation, night or day, in the work of evaporation. I was next conducted to the 'fire well,' whence the fuel is procured. It was quite close to the brine well, and was carefully built over—bamboo tubes covered with lime—to prevent escape ramifying from the cap covering the mouth to the evaporating sheds. There can be little doubt that the 'fire wells'—which are nearly all situated within the town—contain petroleum, from which the vapour or gas arising supplies the natural fuel. They have, however, never been worked for the oil. The stench which permeates the whole town reminds one forcibly of a gasworks, but the gas has not, as in some parts of Ohio, been utilized to light the streets. All the wells, which are worked by private companies, are now under Government control, and there is an office established at Tzŭ-liu-ching through which all salt transactions are carried on. The actual cost price of the salt is 13 or 14 cash a catty, but the Government manages to extract from buyers 22 to 23 cash.

"The salt is of two kinds—pan, or lump, and granular salt. The former is from 2 to 3 inches in thickness, and is of the same shape and size as the evaporating pans. In preparing the latter, bean flour is used to give it a whiter appearance. The work of evaporation occupies from two to five days, according to the strength of the gas flame. As the salt wells number over a thousand, and the 'fire-wells' only about a score, much of the brine is carried into the town for evaporation. Pans are leased by the year, the privileges costing about T. 40 each. A contractor supplies the pans, which weigh 1,600 lbs. apiece, for from T. 30 to T. 40 a year each, the old pans, which are changed about once a fortnight, being the property of the contractor. Brine is found at depths varying from 700 to over 2,000 feet, and from a dirty yellow in the shallower, becomes a deep black in the deepest wells. Twice as much salt is evaporated from the black as from the yellow brine—the deeper the well the stronger the solution. As the region in which the wells are situated is of sandstone formation, the difficulties of boring to these great depths, even with primitive machinery, are not very great. A bamboo lever is erected over the spot where the operations

are to be carried on; an iron jumper, over 100 lbs. in weight, is attached by a bamboo rope to the thin end of the lever; on both sides of the thicker end scaffoldings with plankways are built; several men jump simultaneously from the planking on one side to the planking on the other, using the lever as a stepping-stone; and the jumper is raised, released, and falls, crushing the stone, a rotary motion being imparted to the weight by a man who stands by the mouth of the well, and twists the bamboo rope as the lever is about to drop. The rope is lengthened as required by adding strips of split bamboo. I have heard doubts expressed as to the depths of these wells, but the figures given are unimpeachable. The well which I visited was over 2,000 feet in depth, and I arrived at this result by a very simple calculation. The drum was 60 feet in circumference, and thirty-four coils of rope were wound up before the tube reached the mouth of the well. In boring in the vicinity of the town, at least, it is impossible to predict whether petroleum or brine will be struck, but as both are valuable, the result is always satisfactory."

The diameter of the mouth of the well is usually from 9 to 10 inches, and the diameter of the bamboo tube-bucket 4 inches. The length of the latter depends on the height of the tripod shears, and may run to 80 odd feet. The wells are lined for the first 200 or 300 feet with cypress wood in lengths of about 6 feet. These are first cut in two lengthways and then hollowed out. A bamboo tube-bucket costs about T. 20, and the hemp rope costs another T. 20. Mules, oxen, and water-buffaloes are all used for turning the whim, or drum, which winds up the bucket. The cost of raising the brine runs from 12 to 14 cash a catty, and of evaporation 2 to 4 cash; but the latter is regulated by the price of coal, which is brought into use only when the gas is being employed to its utmost capacity. These prices refer to a brine well in juxtaposition to a hydrogen well; but, as much of the brine has to be carried to the gas evaporating sheds, the cost of carriage has to be added, and it may be taken for granted that 20 cash represent the fair average value of a catty of salt before taxation. The amount of salt evaporated from the brine rises from 7 per cent. in the case of the yellow liquid from the shallower wells to 13 per cent. for the black drawn from the deep wells. In manufacturing granular salt from black brine the following purifying process is adopted:—

Yellow soya beans are ground up with cold water in a stone mill. The liquid with the ground beans is collected, poured into a pan, and warmed. It is then filtered through a strainer on the top of the boiling brine, causing precipitation of the impurities in the latter. The floating impurities are skimmed off, and the salt crystals baled into a bamboo basket, which retains the solid matter. The salt crystals are now fairly white; but if still further purification is

desired, the water in the pan is poured over them and drains away any remaining impurities. The liquid so drained, called "Tan Pa," is used to cause coagulation of the legumine in the manufacture of beancurd, and, for convenience of transport, it is evaporated, resulting in a substance as hard as stone.

In regard to the Pai-yen-ching wells, in the south-west of the province, which I visited in 1884, I made the following notes on the spot :—

"The brine wells of Pai-yen-ching are two in number—one is off a dirty street, the other behind the town. They are both about 50 feet deep. The mouth of the former is some 8 feet long and 2½ feet broad, and the brine is raised in narrow wooden buckets, to the sides of which bamboos tied together are fixed, and serve as raising handles ; the latter has four round mouths lined with wood, and the brine is raised in round wooden tubs with similar bamboo handles. The evaporation pans, which are manufactured from iron obtained in the neighbourhood, are cone-shaped—the apex of the cone forming the bottom—and vary in height from about 1 foot to 2½ feet. They are serviceable from 10 to 20 days. The furnaces are built of mud, with holes for the pans ; and coal (lignite) is the fuel used. The process of evaporation is as follows : A little brine, which is light in colour compared with that at Tzŭ-liu-ching, is poured into the heated pan ; the brine bubbles up to the top of the pan, and deposits a thin layer of salt on the inside ; a little more brine and another layer is the result, and so on until the salt is some 3 or 4 inches thick. Care must be taken to keep the pans supplied with brine, otherwise the salt cones would crack and break up. (They are transported whole on the backs of pack-animals.) Two days and nights are required to evaporate the necessary size. This salt, which is very much inferior to the salt produced at Tzŭ-liu-ching, supplies the south-west of Szechwan, finding its way even north of Ning-yüan Fu. There are seventy-two evaporation houses, the number of pans in each varying from twenty to thirty. The total production is over 2,000 catties a day. The pans vary in price according to size, the larger costing 1,800 cash each. The coal (lignite), which is found west of Pai-yen-ching, is exceeding cheap, about a cash a catty. It is found just under the surface of the ground, and little labour is expended in mining it. About 3,000 catties are daily consumed by a house boiling ten large and ten small pans. The price of salt when it leaves the evaporator's hands is a little over 30 cash a catty ; but there is a local Government tax of 12 cash a catty, so that the actual cost to the consumer (on the spot) is over 40 cash."

The above is a description of the work of salt evaporation in the east, centre, and west of Szechwan ; but, as I have already

said, the greatest centres of the salt industry lie in the centre of the province at Tzŭ-liu-ching, where alone natural gas is utilized, and Wu-tung-ch'iao, near the banks of the T'o and Min Rivers respectively. At the latter place, which ranks second to Tzŭ-liu-ching in output, only pan (or lump) salt is manufactured. It is of a decidedly black colour, and is exported in large quantities to Kweichow and Yünnan. Coal from the hills lying behind the right bank of the Min, and opposite the salt-yielding area, is the fuel used in the evaporation. There are altogether forty districts of Szechwan which produce salt, and withered grass, lignite, wood, coal, and gas are all taken advantage of, each as the others are available, for fuel.

Various and very varied estimates have been made of the annual production of salt in Szechwan. I have made inquiries from to time in China regarding the consumption of salt in family life, and I have found that the amount differs according to the supply of salted fish, vegetables, and food generally procurable in the market. If they are abundant the family consumption is less, and *vice versâ*. In Szechwan there is practically no salted fish, but vegetables are salted and exported from the province, and the result of my inquiries in Szechwan has led me to consider that 10 Chinese ounces per month, or about 8 catties a year, may be taken as a fair estimate of individual consumption. In this estimate I am allowing for a reduced consumption by children. If, then, the population of Szechwan be taken as 45,000,000, the annual consumption of salt would be 360,000,000 catties; but, as stated above, the province supplies Western Hupei, nearly the whole of Kweichow, and North-eastern Yünnan. It has been ascertained that the Salt Office at Ichang annually levies on Szechwan salt entering Hupei a sum approaching T. 2,000,000, and that the tax amounts to 28 cash a catty. Taking the value of the tael to be 1,200 cash, the tax would annually account for an import into Hupei through Ichang of 86,000,000 catties.* I propose to take 80,000,000 catties as the minimum of Szechwan salt passing through Ichang and add 4,000,000 catties for salt carried overland into Hupei as well as for consumption in that province to the west of Ichang. Kweichow and Yünnan remain, and it may be fairly assumed that the population of these two provinces drawing salt from Szechwan does not exceed 5,000,000. At the annual allowance of 8 catties per head Kweichow and Yünnan would require 40,000,000 catties. On this basis I am forced to the conclusion that the annual production of salt in Szechwan amounts to not less than 484,000,000 catties. This,

*This was an underestimate, for according to the Ichang Customs Trade Report for 1906 as much as 96,740,400 catties of Salt arrived at that port from Szechwan in that year.

however, does not include what is used in pickling, salting, and other industries, and I am inclined to put the total output at about 500,000,000 catties, equivalent to some 300,000 tons. It may be asked, how does this compare with other estimates? I take two writers on this subject. One gives 206,181,600 catties as the total production, which would place each individual in this province alone on the altogether inadequate allowance of about 6 Chinese ounces per month, or $4\frac{1}{2}$ catties a year; the other states that he considers the production of the districts for which the T'o River is the outlet to be 600,000 tons, *i.e.*, 1,008,000,000 catties, which would give each inhabitant of Szechwan over 22 catties a year, a manifest superabundance derived from only one, but undoubtedly the richest, salt area in the province. After considerable trouble, I persuaded the Salt Commissioner to furnish me with details of the production, and the following table gives the districts and the approximate output of each :—

THE SALT DISTRICTS OF SZECHWAN AND THEIR ANNUAL PRODUCTION.

District.	Quantity in Catties.	Price of Production at 20 Cash a Catty.
		Cash.
Chien-wei Hsien	83,872,320	1,677,446,400
Lo-shan Hsien	51,200,000	1,024,000,000
Fu-shun Hsien	274,400,000	5,488,000,000
Jung Hsien		
Yün-yang Hsien	25,427,250	508,545,000
Ta-ning Hsien	9,915,750	198,315,000
K'ai Hsien	202,500	4,050,000
Tzŭ Chou	3,000,000	60,000,000
Jên-shou Hsien	300,000	6,000,000
Ching-yen Hsien	6,000,000	120,000,000
Nei-chiang Hsien	140,000	2,800,000
Tzŭ-yang Hsien	30,000	600,000
K'uei-chou Fu	2,700,000	54,000,000
Jung-ch'ang Hsien	50,000	1,000,000
Ta-tsu Hsien	40,000	800,000
Ho Chou	5,400	108,000
Tung-liang Hsien	14,000	280,000
Chung Chou	300,000	6,000,000
P'êng-shui Hsien	2,300,000	46,000,000
Wan Hsien	40,000	800,000
Yen-yüan Hsien	1,300,000	26,000,000
Wei-yüan Hsien	6,000	120,000
Chiang-an Hsien	30,000	600,000
Chien Chou	2,300,000	46,000,000
Nan-ch'ung Hsien	80,000	1,600,000
Hsi-ch'ung Hsien	30,000	600,000
P'êng Chou	12,000	240,000
Ta-chu Hsien	12,000	240,000
Ch'êng-k'ou T'ing	190,000	3,800,000
Lang-chung Hsien	50,000	1,000,000
Nan-pu Hsien	900,000	18,000,000

THE SALT DISTRICTS OF SZECHWAN AND THEIR ANNUAL PRODUCTION—*cont.*

District.	Quantity in Catties.	Price of Production at 20 Cash a Catty.
		Cash.
San-t'ai Hsien	240,000	4,800,000
Shê-hung Hsien	720,000	14,400,000
Yen-t'ing Hsien	320,000	6,400,000
Chung-chiang Hsien	670,000	13,400,000
P'êng-ch'i Hsien	370,000	7,400,000
Sui-ning Hsien	80,000	1,600,000
Lo-chih Hsien	900,000	18,000,000
An-yoh Hsien	750,000	15,000,000
Mien Chou	590,000	11,800,000
	469,487,220 =279,433 tons.	9,389,744,400 =7,824,787 taels.

It will be seen that the Salt Commissioner's figures fall slightly short of my estimate, but they do not cover illicit salt, which is produced in considerable quantities, and eludes official cognizance. Of this illicit salt it is impossible to form any trustworthy estimate. Some would have me believe that it amounts to 50 per cent. of what is controlled by Government, but if even 10 per cent. be added to the Commissioner's figures the result exceeds 500,000,000 catties, or about 300,000 tons*. If, then, 20 cash be taken as the cost price of production of this amount, the total value at the wells is T. 8,607,265.

At the centres of production salt, after payment of the Government tax, is retailed for consumption within limited areas; but salt intended for consumption throughout Szechwan generally is transported under Government certificate, and at destination retailed under licence. The retail price is also fixed by Government, and varies from time to time. The price at Ch'êngtu was 51 cash, or less than 1*d.* a lb.

I regret to say that these notes on minerals are very imperfect. To deal with the subject in a satisfactory manner would necessitate more extensive journeyings throughout the province than I was able to accomplish, and a chemical and practical knowledge which I do not possess. Szechwan, especially the west and north of the province, offers an exceedingly interesting field to the mineralogist, who will in the years to come lay bare much varied wealth. These notes, therefore, should be looked upon as nothing more than finger-posts to the districts where buried wealth awaits scientific exploitation.

*I have been courteously informed by the Chief Inspectorate of Salt Revenue that the total production of Salt in Szechwan in 1918 was 385,597 tons of which 375,505 tons were released for consumption.

CHAPTER V.

Conclusion.

In the forgoing pages I have endeavoured to deal to the best of my ability with the economic products of the richest province of China, and I now propose to say a few concluding words on the great obstacle which, under present conditions, stands in the way of their rapid and profitable disposal. Szechwan lies at the very back of China; but its remoteness would be of less consequence were it readily and easily accessible. Unfortunately, it is not. The casual traveller in Western China points to the magnificent waterways of the province, and calls loudly for steam navigation on its great commercial artery, the Yangtsze and its tributaries. Thirty years ago I myself was an enthusiast on this subject, and could not believe that steam could be beaten by tracking—that a junk could go where a steamer could not follow. A closer study of the conditions of these waterways convinced me that I was wrong, and I was compelled to join the ranks of practical navigators, who declared that from a commercial and paying standpoint through steam navigation of the Upper Yangtsze, from Ichang as far as Wan Hsien, was a dream that could with difficulty be realized. This, however, did not condemn the whole of the Upper Yangtsze, for from 9 miles above Wan Hsien westwards the river might be navigated all the year round by powerful light-draught steamers as far as Hsü-chou Fu at its junction with the Min, which for all practical purposes is its highest navigable point. It is true that by 1903 one, and only one, steam-vessel, His Majesty's ship "Woodlark," had succeeded in steaming without any extraneous aid into Szechwan from the Lower Yangtsze, but she had to await favourable conditions before risking the passage of each rapid. Time was of less moment to her than safety, but to a merchant-vessel laden with cargo delay, even if success ultimately followed, meant serious loss. It may be asked, "What did it really matter if the prospect of steam navigation on the Upper Yangtsze had to be abandoned? Junks would still continue to ply, and trade would go on as before." It mattered much to the Province of Szechwan, which, with its industrious population of 45,000,000, is rich in valuable products, but was unable to get proper value for its money. The Szechwanese are particularly fond of foreign goods of all kinds, but they were debarred from a free indulgence in them by the heavy freights with

which they were, under past conditions, necessarily burdened. When I was in Ichang, in the beginning of December, 1902, the freight per catty from Ichang to Chungking was 23 cash, that is to say, about 4*l*. a ton. Even 5*l*. was not an unusual freight for this stretch of 400 miles, and, if the goods had to be brought to Ch'êngtu, that sum was more than doubled. The result may easily be imagined. The foreign resident in Ch'êngtu had to pay 10 dol. 30 c. for a case of kerosene oil, which in Hankow cost only 3 dol. 40 c., and a 4-lb. tin of Hong Kong cube sugar, worth about 60 cents in Shanghai, could not be had for less than 3 dol. 40 c. In fact, the latter was sold as a sweetmeat for some 6 cash a cube. As with these, so with all foreign goods. They were expensive luxuries, which only the richest classes could procure. To take another simple instance. What delights the heart of a Chinese lady more than anything else is to have her gowns adorned with foreign ribbons, and when I was investigating the subject of silk manufactures I was constantly asked about them and their price. The weavers of native ribbons never ceased to extol the foreign article, but always commented on the high prices that had to be paid for it. Foreign cotton textiles are what the Szechwanese really want, but the heavy freight and the locking up of capital caused by a three months' journey from Ichang to Ch'êngtu by junk militated against their free consumption. It had been suggested that this might to a great extent be obviated by running steamers between Wan Hsien and Hsü-chou Fu, and even as far as Chia-ting, on the Min River; but, although the Yangtsze could no doubt be navigated between these two places all the year round and the Min at high water, I had unhesitatingly to condemn the Min for five months—from November to March. It is then full of rapids, has insufficient breadth of channel at many places for handling a steamer in a very swift current, and is, in my opinion, much more dangerous than the worst parts of the Yangtsze at low water. Steam navigation west of Wan Hsien would be only a partial remedy, and we had to look elsewhere for a complete cure. By "complete cure" I meant the construction of railways from Hupei into Szechwan and, later, railway concessions were granted and work commenced at the port of Ichang; but, as the Government claimed that all trunk lines should be official and only branch lines should be built by private companies, much discontent arose among the Szechwanese who wished that all construction should be unofficial. Progress was thus blocked and it was this discontent in Szechwan which, if not one of the causes of the revolution of 1911, was at least synchronous with its outbreak.

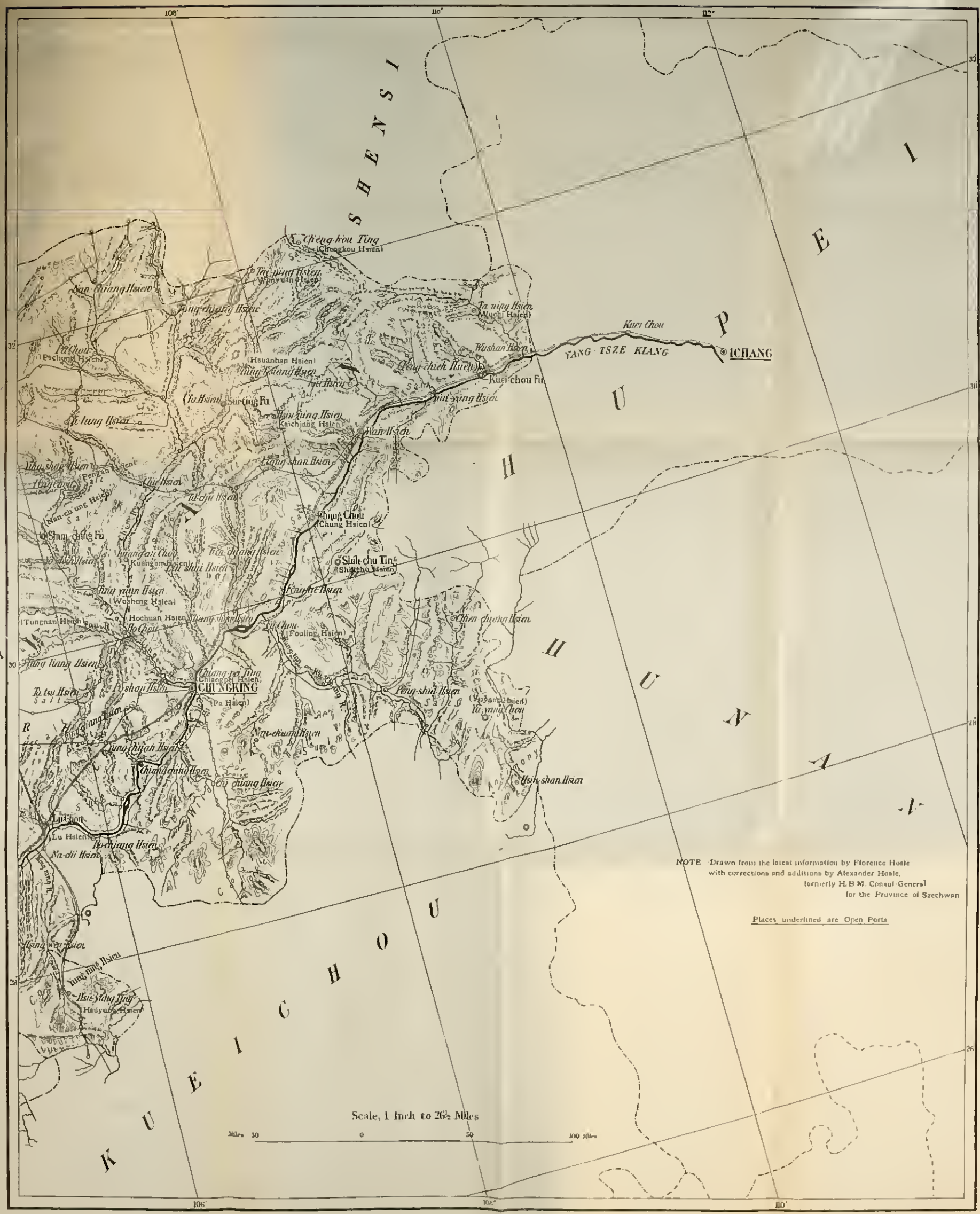
Fortunately, however, Captain Plant, who threw his whole energies into the task of conquering the rapids by steam, was at last able to do what other pioneers had failed to accomplish. He

devised steamers capable of navigating the Upper Yangtsze between Ichang and Chungking on a sound commercial basis. His example was quickly followed and, although there have been wrecks and losses, there are now several lines of steamers plying regularly on the Upper Yangtsze except during the winter months when the river is too low to admit the passage of the worst rapids.

In spite of great risks, steam navigation on the Upper Yangtsze has become an accomplished fact; and when railways have also penetrated into the interior, Szechwan, one of the largest, wealthiest and finest provinces of China, will have her chance of developing that wealth and of taking her proper part in the trade of the Far East.

SKETCH MAP OF

EASTERN SZECHWAN



NOTE Drawn from the latest information by Florence Hosie with corrections and additions by Alexander Hosie, formerly H.B.M. Consul-General for the Province of Szechwan

Places underlined are Open Ports

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SKETCH MAP OF

WESTERN SZECHWAN AND EASTERN TIBET.

NOTE—Drawn from the latest information by Florence Hosie
with corrections and additions by Alexander Hosie,
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for the Province of Szechwan.

Scale

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