

LAC AND ITS DECOLOURIZATION BY ORPIMENT
AS TRACED TO BABYLON

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Lākṣā in Sanskrit is a loan word and to the ordinary man non-connotative. It first occurs in *Atharvaveda* or about 1500 B.C. Pāṇini prefers to call lac *Jatu*, a genuine Sanskrit word signifying an adhesive. Lac applied to an object in turnery would be lacquer and was called *Jatuṣa*. This would be shellac or purified lac. Crude lac contains two pigments. The lac resin, the secretion of the lac insect, contains a yellow pigment erythrolaccin. When only this pigment is allowed to remain the purified lac or shellac is coloured light yellow. But the insect body contains a red dye, laccaic acid, which remains incorporated in insect skins. Granules of crushed lac often show adhering residual skin particles. When such lac granules are melted the red dye passes into the melted lac as contamination and the resultant shellac appears chestnut coloured. But when orpiment is mixed with the lac granules and melted, the red dye is decolourized, and not the yellow erythrolaccin. The shellac then appears yellow. It means shellac is decolourized by orpiment when the contaminated red lac dye is destroyed.

Since some basic facts pertaining to lac may not be generally known these are being offered for understanding how orpiment came to be used as the one substance which can decolourize lac or shellac. Lac is the crude name for the products of an insect, the lac insect, belonging to the genus *Kerria*, among scale-insects or coccids. Of this substance there are several kinds, being yellow to chestnut in colour. The insect has a delicate skin which necessitated it to secrete a protective resinous covering, the lac-cell, into which it is housed. It is rarely found singly, while normally the assembly of lac-cells constitutes an encrustation on a twig of the tree which had supplied the insects with its sap as food. The encrustation still attached to the twig is called stick-lac. The encrustation has been considered as the "hive" of the lac insect. The insects contain within their bodies a red dye the laccaic acid, while the resinous coat outside is impregnated with a yellow pigment erythrolaccin.

Stick-lac is brought to a factory where it is refined into shellac. The raw material is pulverized and the granules are soaked in water and washed to free them from residues of the bodies of lac insect and of the twigs. These granules, washed and dried, are the main secretion product of the insects, but there would also be adhering particles of insect skins which are coloured red. Moreover, there would be within the granules the yellow pigment, erythrolaccin. To the mass of the dried granules

about 5% pine-rosin is added to lower the melting point. Further, orpiment, or trisulphide of arsenic, is added in traces to decolourize the red dye laccaic acid. Special knowledge is required to know that laccaic acid, in the solid state, can best be decolourized by orpiment. Obviously, most chemists would not know this particular fact, but it is implicitly admitted by all organizations of standardization of raw materials. Orpiment, however, has no effect on erythrolaccin, which remains unchanged and imparts a yellow colour to the product. The mass of lac granules, with traces of orpiment, is then filled into a long tube of calico, some three inches in diameter. The tube is brought on one side of a charcoal heated hearth when the resin melts and oozes out. The molten lac is scraped off, stretched into sheets and broken into pieces when it resembles ordinary shells and is called shell-lac or shellac. The colour of this refined shellac should be yellow. If the colour happens to be brownish, it would indicate that the laccaic acid has not been reduced, which in turn would mean that insufficient orpiment had been used. Shellac is dissolved in alcohol or methylated spirit and turned into French polish for wooden furniture. When white varnish is needed shellac is dissolved in alkali, and treated with bleaching powder or better with a solution of sodium hypochlorite. Such bleached lac is stored best under water to prevent dehydration or better still is at once dissolved in spirit and used as white French polish.

There is an excellent report on lac and its industrial treatment by Hautefeuille, which I translated in 1924.¹ There is also the report on lac refining as a special subject by Pindance, also translated by me in 1930.² A summary account of refining shellac was published by me in 1934.³ Yellow coloured shellac, as the trade prefers, can never be produced without traces of arsenic as the undersirable but unavoidable contaminant. This is recognized by the Bureaus of Standards of different countries. The Report "Specification for Shellac"⁴ of the International Standards Organization, printed in Switzerland in 1957, gives on p. 29 the method for "the detection of orpiment"; on pp. 30-31, for "determination of arsenic"; and on pp. 33-36 for "determination of traces of arsenic". These references are clear proof of arsenic being invariably present in shellac.

The one property of lac that is most obvious is its adhesiveness (popularly it is also called *Lākh-kā-gond* in Hindi, or gum-lac). In Sanskrit it is called *Jatu*. To understand the significance of the word *Jatu* we may recall that *Jatu* means both lac and bat. Bat is a creature seen adhering to the tree. Likewise, lac is something adhering to the twig of a tree. Thus came *Jatu* to connote adhesiveness. Besides, we have the name *Śilā-jatu* for a drug, similar to bitumen is texture. *Śilā* means rock and *Jatu*, something adhering; whence *Śilā-jatu* would be what adheres to a rock. Thus, the semantic series would be, lac = *Jatu* = adhesive. Lac, melted and purified, is shellac as explained above. Wooden objects on a turnery can receive a coating of lac as lacquer. This art must have been known even in ancient India,

for Pāṇini (c. 500 B. C.) uses the word *Jatu* = lac (the resin) and *Jatuṣa* = lacquer (lac applied to wooden objects in a turnery). Agrawala⁵ reports both these words as used by Pāṇini.

We are here interested in *lākṣā* as the name of the substance lac. The word occurs in *Atharvaveda* (III, 5) (dated c. 1500 B. C.). It is a drug to join broken or fractured bones as also flesh torn apart, resulting in wounds. Being an adhesive it would be a "wound-binder", and a "wound-healer", the terms used in the hymn on *lākṣā*.⁶ Moreover "he who drinks thee lives", making it a real medicament used externally and internally. It has been considered as a drug of vegetable origin, nothing better than a gum. Plants which produced it best had been six and had also been named. Until Dave⁷ came to interpret the *Atharvan* hymn V. 5 on *lākṣā* no one had understood it as other than a vegetable product. The hymn, however, gives enough indication to identify *lākṣā* as lac, but offers no hint to indicate that it is an insect product.

It was a drug and believed to be a plant product. This fact has been explained earlier⁸ and must be emphasized again. In the absence of any knowledge of lac being of insect origin the word *lākṣā* here could not mean 100,000 and as such a product of countless number of insects as some seem to think. Misra⁹ who made lac a subject of special study nevertheless writes that "the very name *Palāśa* (*Butea frondosa*) as *Lākṣā-taru*, shows that the ancient people of India knew the tree to nourish a *lakṣa*, one hundred thousand, insects". This reference to ancient times may mean *Mahābhārata* but *Atharvaveda* would be much earlier. Strange enough, no commentator of *Atharvaveda* ever interpreted *lākṣā* as an insect product. Dave was the first and his attempt dates as late as 1950. But neither Dave nor Vishva Bandhu⁵ refers to the theory of *lākṣā* meaning 100,000. No Sanskrit scholar hitherto has entertained such a theory.

As the background to *lākṣā* as a drug, there has been the impact of Chinese culture upon Vedic Āryāns. The words *soma* as the plant ephedra, and the drink *surā* as beer or fermented grain-juice¹⁰ are loan-words from Chinese, and so are the words in Sanskrit for rice¹¹ and even for wheat.¹² No wonder then that *lākṣā* is also Chinese in origin. In China there is the insect-wax, *Peh-Lah*, meaning white-wax. According to Read¹³ "it was used for internal injuries", and according to Smith¹⁴ also for dysentery and affections of the lungs. Briefly, it could join flesh to flesh and was styptic. Thus, it was the equivalent of *lākṣā*. Now *Peh-Lah* was the crude substance and when melted and purified it was called *La-Cha*, literally wax-sediment. This was the name of the drug as actually used. This name was transferred to lac since it was an adhesive drug like the Chinese wax. At that time lac as drug was not known. In the Kashmiri language lac is still called *Lā-Ch* or *lāch*, which is almost identical with the Chinese term *La-Cha*. *La-Cha* was Sanskritized as *Lā-Kāṣā*. This would be an adhesive and a drug like the Chinese wax.

The Vedic Āryāns as fast growing people came in contact not only with the Chinese but also with the Balylonians who were very advanced in civilization. Agrawala⁵ among others, has shown that some Sanskrit words can be traced to the languages spoken in ancient Mesopotamia. This brings us to the technique of writing as developed in Babylon. Levy¹⁵ informs that "in the excavations at Nimrud a large number of wooden boards coated with a thin layer of bees-wax have been discovered dating back to c. 715 B.C. The wax was mixed with sulphide of arsenic, or orpiment, to give it a yellow colour". They used a board, gave it a coating of wax and easily inscribed the text they wished to write. That was their paper and pen. Further details are given by Wiseman.¹⁶ He writes about Assyrian writing boards and says "Prof. Mallowan described the discovery of Assyrian writing boards of ivory and wood at Nimrud in 1953. Writing boards were of tamarisk, cypress, cedar and walnut. The boards were covered with a thin wafer like overlay of wax, 1/20 inch thick, of melting point 67°C., containing 25% orpiment as filler. Experiments showed that the addition of orpiment made the bees wax more plastic and enabled the molten wax to flow evenly over the surface. Without orpiment wax did not yield to the stroke of the stylus or allow a clear cut incision". Here, the result of mixing orpiment with wax could be directly seen and this explains how such a technique must have arisen. When the boards were coated with wax and orpiment, the latter to the extent of 25 per cent, it gave a yellow background. Such a surface, when scratched with a metal point or stylus released the darker colour of the wood. Thus the inscribed characters appeared dark against a yellow background. It is to be noted that wood itself was not scratched. If ivory board was used the text appeared white against a yellow background but ivory itself did not get scratched. When the Āryāns first took to writing they also used wooden boards and the text was inscribed on wax-coated surface. The Sanskrit word for script is *lipi* which signifies "smearing" and not scratching. It refers to the earlier stage when the writing board had to be smeared with wax or with lac which later was scratched to produce a writing. Thus *lipi* or writing refers to the earlier stage preparatory to actual writing. Let us here conceive three kinds of writing boards: plain wood, wood smeared with bees-wax and wood smeared with lac. The inscribing material or "pen" would be a metal point. This has been well visualized and shown as Fig. 1 here, as depicted by the Editorial Board of the journal *Science of Ancient Life*, published from Coimbatore. With such a stylus it is difficult to "scratch" characters or letters on a wooden board. Much energy would be required and characters would have to be "engraved" rather than "scratched". Writing on wax coated wooden board would be easy but such boards have to be carefully preserved. Wax is soft and inscribed writing would be easily smeared. Āryāns had been mainly nomads when they adopted writing, and had no palaces, not even temples. Wooden board coated with lac, was conveniently scratched. It had a hard surface which was not easily smeared and it withstood storage better. Lac was unknown in

Mesopotamia but was a natural product in India. Its use had been known and its property, as a harder adhesive than wax was easily recognized. Thus, the Āryāns wrote on a wooden board with lac and orpiment to give it a yellow as also a relatively hard surface. We can now conclude that the Babylonian art of writing was imported

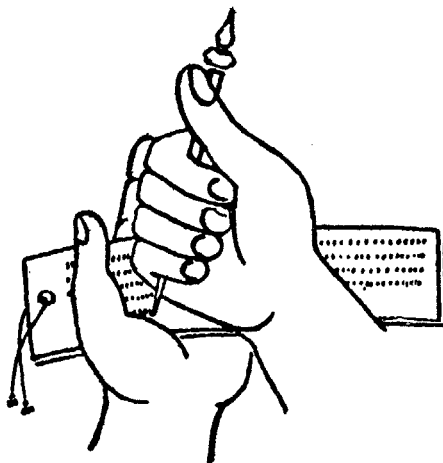


FIG. 1. A scribe writing on lac coated wooden board, as visualized by the Editorial Board of *Ancient Science of Life*, a journal from Coimbatore. It is being gratefully acknowledged.

as such but later, instead of wax lac mixed with orpiment was used, when decolourization of lac was automatically discovered. To say that the ancient Āryāns tried to bleach lac and experimented with different chemicals and finally found orpiment as an answer to the problem, would be a theory which would imply that the lac industry at the time had assumed large dimensions when alone such a problem could have arisen. I feel safe in concluding that the Āryāns first became familiar with the Babylonian art of writing and through it came to discover the decolourization of shellac. In any case this technique must be dated before the time of Pāṇini (500 B.C.), who speaks of *Jatuṣa*, lacquer, as distinct from *Jatu*, lac, the natural product.

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There were some differences in the opinions of the referee and the author.

While accepting the paper for publication the editor considers it desirable to print below the comments of the referee and the reply of the author thereto.

Comments of the referee :

1. By bleaching of shellac, shellac is made colourless by the use of hypochlorites. Orpiment was used in the past—mostly by unscrupulous manufacturers—to make shellac attractively yellow. The mineral has no role in bleaching. The mention of “the present method...red dye” is just a wrong statement.

Further, the red dye mentioned is removed on washing of stick-lac in the manufacturing process. It is the insoluble erythrolaccin that remains, impart colour to shellac. This colour is removed by modern hypochlorite bleaching.

2. Mention of ‘Laksha’ derived from Chinese ‘La-cha’ is perhaps a far cry. The Sanskrit word ‘Laksha’ means a hundred thousand and is suggestive of a large number of insects involved in the production of shellac.

3. Orpiment is As_2S_3 and not As_2S_2 .

4. The thesis of extrapolating Babylonian ‘art of writing’ to subsequent use in the ‘art of bleaching’ by Aryans will not be acceptable for the simple fact Aryans knew the poisonous character of arsenic compounds which would deter them to use the shellac-orpiment combination in medicine. Perhaps the use of orpiment in shellac industry is relatively modern for reasons mentioned already.

Reply of the author :

1. Orpiment is admitted to be the only substance that decolorizes lac. I have been a Chemist and tried this to convince myself. Orpiment is legally admitted. (Refers to first paragraph of comment No. 1).

Washing never removes all the red dye. (Refers to the second paragraph of comment No. 1.)

2. I know of no scholar of Sanskrit who maintained this. (Refers to comment No. 2.)