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Some experiments in reproducing a partially obliterated inscription on an Old Javanese copper-plate in the Royal Library, Copenhagen. (Met 6 afbeeldingen)

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**SOME EXPERIMENTS IN REPRODUCING A PARTIALLY
OBLITERATED INSCRIPTION ON AN OLD JAVANESE
COPPER-PLATE IN THE ROYAL LIBRARY,
COPENHAGEN**

Several ancient Javanese copper-plate inscriptions have found their way to European collections. Some of them have been brought to Europe by expeditions, while others have come with officials returning from service in Indonesia. At the orientalist congress held at Brussels in 1938, Mr. Kurt Wulff, Ph. D., then keeper of Oriental manuscripts and printed books in The Royal Library, Copenhagen, in answer to a question from Mr. F. H. van Naerssen, whether any Javanese inscriptions were found in Danish collections, was able to say that a number of ancient Javanese copper-plate inscriptions were known to be in a private Danish collection. Dr. Wulff was, however, not able to give further particulars. Through Mr. Th. Thomsen, then inspector-in-chief of The Ethnographic Department of The National Museum at Copenhagen, Professor B. J. O. Schrieke ascertained that the plates, 10 in the number, were in the possession of Mrs. L. Nørgaard of Klampenborg, near Copenhagen. As a result of correspondence between Mrs. Nørgaard and Prof. Schrieke arrangements were made for the plates to be lent to The Royal Tropical Institute¹ at Amsterdam, where they were closely scrutinized by van Naerssen. His doctoral thesis, which was submitted to the University of Leiden in 1941², was in part based on the studies of the Klampenborg plates. In 1952 The Royal Library acquired the plates from Mrs. Nørgaard.

For some years a catalogue of Oriental manuscripts in The Royal Library and The National Museum has been under preparation³. In

¹ Koninklijk Instituut voor de Tropen, formerly The Colonial Institute (Het Koloniaal Instituut).

² F. H. van Naerssen: *Oudjavaansche Oorkonden in Duitsche en Deensche Verzamelingen*. Akademisch Proefschrift. Leiden 1941.

³ In 1846—57 a catalogue of Oriental manuscripts was prepared, (*Codices Orientales Bibliothecae Regiae Hauniensis*. edit. Westergaard, Olshausen et Mehren. I—III. Haun. 1846—57.) which, however, has become out of date.

1 2 3 4 5 6 7 8 9 10 cm.

A

B

fig. 1 (SEE TEXT)

fig. 2A

Photograph and diagram showing a detail of the inscription on side A of the plate. The surface has been ground.

fig. 2B

Photograph and diagram showing a detail of the inscription on side B of the plate. The characters of the inscription are fully intact.

fig. 6

THE FINISHED COPY MADE WITH THE CELLULOSE-ACETATE-CASTING METHOD.

the summer foreign orientalisks, who contribute to the catalogue, come to Copenhagen and make descriptions of the manuscripts in their respective fields. Last year it was decided that descriptions of the ancient Javanese copper-plate inscriptions should be prepared, and Dr. van Naerssen was invited to come to Copenhagen to undertake the work.

One of the plates which now bears the signature, *K - Old Javanese - 94*, as stated by van Naerssen shows certain features suggesting that it might be a palimpsest⁵. In the upper part of side A of the plate faint traces are found of a partially obliterated inscription. (see fig. 1 A.) The surface seems to have been ground, probably by a flat stone or the like, so that only those parts of characters which were deeply cut are extant. (see fig. 2.) The traces are so faint that direct reading off the plate is almost impossible. In the upper part of side B an inscription is found which seems to have been engraved while the plate was placed on a curved support, possibly a stone or the trunk of a tree. (see fig. 1 B.) This is indicated by the fact that at both ends of the plate, the copper has reacted to the engraving tool in exactly the way it might be expected to do when not firmly supported. The inscription on side A seems to have been obliterated before the inscription on side B was made. Otherwise more of the inscription on side A would have been preserved between the areas where the engraving on side B has been reproduced in reverse on side A. This fact seems to corroborate van Naerssen's statement that the plate is a palimpsest.

As the descriptions of the copper-plates include transcriptions and translations of the engraved texts, it is desirable that the legibility of the partially obliterated inscription on the palimpsest-plate be improved so that the descriptions can be as complete as possible. At the request of the keeper of The Oriental Department of The Royal Library, Mr. Leo Buschardt, M.A., the present authors made some experiments in order to prove whether it would be possible by application of physical, chemical or photographic methods to improve the legibility of the traces of the inscription still extant. Since the experiments may eventually be of some interest to other workers they are described in detail in the present paper.

Certain fundamental demands must be made of the methods which come into consideration. They must not inflict the slightest damage to the item in question and as far as possible the appearance of the sur-

⁴ Formerly the signature was that put to the plate by van Naerssen. op. cit. p. 112a *X slotplaat*.

⁵ van Naerssen. op. cit. p. 113—114.

face of the plate should be left unaltered (i.e., the patina of the plate should be preserved). To test the physical and chemical working methods, which might be used, an experimental plate was made. It consisted of a piece of brass 50×150 mm, approximately 1 mm thick. On the recto-side of the plate numbers were stamped into the surface by steel stamps. On the verso-side some simple geometrical figures were engraved with an engraver's needle. Next, both surfaces were ground with carborundum paper and iron chips so that the appearance was approximately that of the copper-plate in question.

Among the methods which were at our disposal, some could at once be rejected because they did not answer the fundamental demands stated above. For instance this was the case with a method which is much used in criminal investigation in the reconstruction of obliterated numbers on guns, motor-blocks, bicycles and the like⁶. With this method the metal surface is treated either with strong nitric acid and ethyl alcohol with an admixture of certain organic compounds depending on the character of the surface to be treated, or with a mixture of hydrochloric acid, ethyl alcohol and cupric chloride. The method had to be abandoned because of the highly corrosive properties of the chemicals.

A method of electrolysis designed by the Japanese, Shigeo Arai⁷, was viewed with some scepticism but was nevertheless tested since similar methods are used without reservation in museum laboratories in the cleaning of metal items. The procedure is as follows. An isolated metal clip is connected with the negative pole of a low current supply⁸ and the positive pole is connected with the item to be treated. (see fig.3.) The voltage to be used should be about 6.5 V. The electrolyte is made according to the formula:

distilled water	500 ml.
strong sulphuric acid	15 ml.
sulphate of copper	1 g.
pure gelatine	1 g.

The ingredients are mixed in the order given in the formula. A tuft

⁶ W. Walensky: Die Rekonstruktion ausgefilterter Fabriknummern und sonstiger Prägezeichen. in: Archiv für Kriminologie Bd. 90. pp. 289—92.

⁷ American Journal of Criminal Law, Criminology and Police Science. Vol. 43 pp. 809—11, 1952—53.

⁸ The current supply may be a battery or a transformer with rectifier, connected with the ordinary 110 V or 220 V. a.c. supply.

of absorbent cotton is dipped into the electrolyte and placed into the gap of the metal clip. When the moist cotton is pressed down onto the metal surface the current begins to flow and an electrolytic process

fig. 3

Diagram showing the metal clip used for the electrolytic polishing in the reconstruction of obliterated inscriptions on metal surfaces.

is started. The surface is polished with the cotton for about 3 minutes during which time the electrolytic process continues. Next, the surface is washed in running water for about 1 minute and a last it is dipped into a neutralizing solution. When the surface has completely dried it is photographed. After the electrolytic treatment the parts of the surface into which characters had been stamped or engraved appear somewhat different in shade than the surrounding areas.

When the method was tested on the experimental plate it at once became clear that although rather satisfactory results might be obtained, electrolysis could in no circumstances be used on the copper-plate in question for the surface of the experimental plate had become seriously corroded. However, since the surface corrosion might possibly be ascribed to zinc in the brass plate, a counter-test was made on a copper coin. Part of the stamp was obliterated by grinding and then the surface was treated in the manner described above. This test gave a similar result. The characters of the stamp were developed, but at the same time the surface was found to have corroded, although to a more restricted extent than in the case of the brass plate. The method was therefore abandoned.

1.

2.

3.

4.

fig. 4

Diagram showing four stages in the making of a cellulose-acetate-cast.

Another method tested was a surface casting technique devised specially by the present authors. The method is similar to the so-called "moulage-method"⁹ which is much used in criminal investigation in making of casts of traces left by burglar's tools and the like. A transparent plastic material (cellulose acetate) was used as casting material, whereas in the "moulage-method" the casting is made with an opaque material. When a transparent casting material is used it becomes possible to make photographic prints (enlargements) directly from the casts because of the varying power of light absorption of the cellulose acetate according to thickness. Furthermore this method, when used as described below, does not present any danger of physical or chemical damage to the item in question.

The technique was developed during a series of experiments on the experimental plate. In the introductory experiments the surface of the plate was moistened with acetone and a slip of cellulose acetate film (C/A — blue base) was immediately pressed down on the moistened area. (see fig. 4.) This technique was unsatisfactory for practical use, but the results proved that with proper adjustment of certain technical details the method could be useful and might eventually be expected to give results in the present case. Accordingly another series of experiments was made in order to attain a developed technique, which might be used practically. The experiments at last proved successful after the following technique was used: Cellulose acetate film was cut into small pieces which were placed in a glass container. Pure acetone was next poured into the container, which was stoppered well and set aside for 24 hours. As the swelling of the cellulose acetate advanced, the mass was vigorously stirred every few hours with a metal rod. After a lapse of about 24 hours the mass had become a thick jelly, which was thinned with acetone and stirred until the consistency was that of thick oil. The cellulose acetate was applied to the surface of the experimental plate with a brush. Immediately a square piece of cellulose acetate film was pressed with a rubber roller against the part of the surface which had been covered by the C/A-jelly. It was left for "drying" for about 10 minutes. Then the piece of C/A-film was stripped off the metal plate and mounted between two plates of glass.

A few experimental surface casts were then made on the actual copper-plate. They were submitted to the judgment of Dr. van

⁹ H. Söderman and J. J. O'Connell: *Modern Criminal Investigation*, London, 7th edition 1938, pp. 435—38.

Naerssen, who was in Copenhagen at the time, and on his advice it was decided that the entire surface should be copied in this manner. A system of white guide-lines was drawn with a neutral white photo-pencil on the surface of the plate. The squares of C/A-film on which the copy actually was made measured 40×40 mm and the copy was made in such a way that a 10 mm space along the left and the upper edges overlapped adjacent areas. This was done with a view to mounting of the photographic prints to be made from the casts later. The order in which the casts were made may be indicated in this way:

1	—	3	—	5	—	7	—	9	—	11
	2	—	4	—	6	—	8	—	10	— 12
<hr/>										
13	—	15	—	17	—	19	—	21	—	23
	14	—	16	—	18	—	20	—	22	— 24
<hr/>										
25	—	27	—	29	—	31	—	33	—	35
	26	—	28	—	30	—	32	—	34	— 36
<hr/>										
37	—	39	—	41	—	43	—	45	—	47
	38	—	40	—	42	—	44	—	46	— 48
<hr/>										

(cf. fig. 5)

1	2	3	4	5	6	7	8	9	10	11	12
13	14	15	16	17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45	46	47	48

fig. 5

Diagram showing the plan according to which the cellulose-acetate-casts of the surface of the plate were made.

In using the casts as photographic negatives¹⁰, the scale was increased

¹⁰ The printing was done with an ordinary photographic enlarger, at the smallest lens aperture, and the time of exposure was 48 seconds. The photographic paper used was KODAK Velox (normal).

about $\frac{1}{3}$, whereby the final mounting of the copy was much facilitated. Just before Dr. van Naerssen left Copenhagen, he had occasion to make a rough comparison of the original inscription with the reproduction thereof. (see fig. 6.) He found that he might be able to read more of the inscription in reproduction than from the original plate.

The photographic experiments were made using the actual copper-plate. During the exposures the plate was illuminated by four strong carbon-arc-lamps, which were placed in such positions that the light fell at oblique angles on the surface of the plate. In order to improve the contrasts the surface of the plate was dusted with fine talc-powder, the excess of which was removed by blowing.

The preliminary exposures were made in order to test several types of photographic plates with varying characteristics. The next exposures tested various combinations of photographic plates and filters. Utilizing the information furnished by the introductory experiments the final exposures were made by employing a combined filter technique: During the exposure-time which was 8 minutes at $f/11$, the objective was first covered with an ILFORD Minus-red-filter. After 6 minutes' exposure the Minus-red-filter was replaced by an ILFORD Delta-filter and the exposure was continued for 2 minutes more. Among the photographic plates which were tested, an ortho-chromatic plate (KODAK Commercial Ortho) appeared to be best suited for use in the present case. The photographic plates were developed rather slowly in a very dilute developer of the methol-hydrochinone type. The negatives were printed on ordinary KODAK Bromide paper.

The photographic as well as the cellulose-acetate reproductions, which resulted from the experiments described above, gave fairly satisfactory results insofar as the legibility of the partially obliterated text was considerably improved in both cases. But it must not be concluded that the last word has been spoken about reproduction of partially obliterated inscriptions on metal surfaces. The cellulose-acetate casting method for instance might be improved by an admixture of colorants to the cellulose-acetate jelly so that the light absorption of the C/A-casts in a given area would increase in relation to the thickness of the C/A-layer. The method also might be improved by adding a small amount of a metal salt to the C/A-jelly, and copying the casts with a mercury-vapour lamp in an UVIOLE-glass bulb and therewith making use of the power of metal salts to absorb long wave ultra-violet radiation. Still other methods may be of some use, depending on the problem at hand. Mention should be made of two photographic techniques. One is based

on the fact that ultra-violet radiation makes certain materials fluoresce ¹¹. The other is based on the fact that certain materials are opaque to infra-red radiation ¹². The procedure is the same with either technique. A suspension of a material which improves the contrasts of photographs which are made with ultra-violet or infra-red radiation is worked well into all depressions and scratches of the surface. Next, the surface is wiped in such a way that only the depressions and scratches contain the contrast improving material. When the photographs have been made the surface of the plate is carefully washed with a suitable solvent in order to remove all traces of the contrast improving material.

Considerable research must be done before these methods are developed to such an extent that they may be put into practical use, but it is only a matter of time until the fundamental principles involved are ascertained.

Copenhagen.

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¹¹ F. E. Lamplough: Application of Ultraviolet and Some Aspects of Fluorescence and Phosphorescence *in*: Transactions of the Illumination Engineers' Society, London, Vol. 1 pp. 69—79 1936.

¹² C. P. Shillaber: The Use of Infra-red in Theory and Practice. *in*: Photomicrography in Theory and Practice. (John Wiley and Sons Inc. New York 4th printing) 1949 pp. 594—97.