

# Hidden Text: Imaging and reading an ancient tablet in an envelope

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## Introduction

In 1953, archaeologist Sir Max Mallowan of the British School of Archaeology in Iraq found a collection of forty-seven tablets in a private residence at Nimrud (Biblical Calah). The residence belonged to a moneylender named Šamaš-šarru-ušur who lived during the reign of King Ashurbanipal (668 – 627 BC). The house was destroyed by fire, baking the clay tablets in the process and preserving them in impeccable condition (Wiseman 1953: 135).

One of the inscribed envelopes, IA5.074 (ND 3430) (48 mm x 36 mm x 27 mm), is now in the collection of the Australian Institute of Archaeology, a member of Mallowan's consortium. It arrived in Melbourne on 21 January 1955 as part of the 1954 division of finds (AIA Doc 5403). In November 2018, it was X-rayed at the Australian Synchrotron to produce an image of the enclosed tablet (see right).



Tablet (X-Rays)

1 é 2 anše ina u-šal-li  
2 gab-di<sup>m</sup>sanga-15  
3 é 2 anše ina mu-li  
4 gab-di kaskal<sup>ur</sup>nina  
5 pab! é 4 anše a.šà  
6 ku-um ru-bé-e šà kù.babbar  
7 m<sup>d</sup>šá-maš-man-pab kú  
8 3 me-re-še 3 kar-ap-ḫi  
9 pab 6 mu.an.na kú  
10 ina u<sup>4</sup>-me šà kù.babbar sum-nu  
11 a.šà-šú u-še-ša  
12 nu šī-pi-še nu še nu-sa-ḫi  
13 iti.bár u<sup>4</sup> 28  
14 lim-me<sup>m</sup>en-kaskal-kur-u-a  
15 igi<sup>m</sup>šil-en-dal-<li>  
16 igi<sup>m</sup>sanga-15 igi<sup>m,d</sup>pa-ka-pab!-pab  
17 ina igi<sup>m</sup>qur-d[i-du.g]ur  
18 ina igi<sup>m</sup>gig-ša-dingir  
19 igi<sup>m,d</sup>pa-zu  
20 igi<sup>m,uru</sup>arba-il-a-a

An estate of 2 homers on the river-flats adjoining (that of) Sangī-Issār; an estate of 2 homers on high grounds adjoining the Nineveh Road. A total of 4 homers of fields. Instead of interest on the silver, Šamaš-šarru-ušur will have usufruct. Three (years) cultivated (and) three fallow: a total of six years he will have usufruct. When he pays back the silver he will redeem his field(s). There will be no straw or corn tax. 28th Nisannu, Eponym of Bēl-Ḥarran-šadū'a. Before Šil-Bēl-dalli, before Sangī-Issār, before Nabû-pī-aḫi-ušur; at the disposal of Qurdi-Nergal, at the disposal of Limraš-libbi-ili; before Nabû-lē'i, before Arbailāiu.

## Method

The Imaging and Medical Beamline (IMBL) at the Australian Nuclear Science and Technology Organisation's Australian Synchrotron, Clayton, Victoria (see above left) was used. X-rays were converted to visible photons and detected using 'Ruby', a Gadox/CsI(Tl)/CdWO<sub>4</sub> scintillator screen coupled with a PCO.edge sCMOS camera (16-bit, 2560 × 2160 pixels) and a Nikon Makro Planar 50mm lens. The field-of-view was set to 25mm high x 78mm wide with a pixel size of 30.4 μm, monochromatic beam energy of 60 keV and sample-to-detector distance of 50cm (see above right). A total of 1800 equally-spaced angle shadow-radiographs with an exposure length of 0.05 seconds was obtained as the envelope was rotated through 180°. One hundred dark (closed shutter) and beam profile (open shutter) images were obtained for calibration before initiating shadow-radiograph acquisition. Due to a limited beam height, two successive sets of radiographs were obtained, with a vertical displacement of 25mm between each tomographic dataset. Total time for the scan of 4040 projections (26 GB) was 5.2 min.

The raw 16-bit radiographs were stitched together and normalised relative to the beam calibration files using IMBL Stitch in-house software, and reconstructed using the X-TRACT [ref/CSIRO]. The Gridrec reconstruction method was used to form a 16-bit, three-dimensional volume image of the tablet. Segmentation of the tablet was achieved using VG Studio Max 2.2, employing combinations of thresholding, region-growing and manual segmentation, to overcome the challenge arising from the direct contact between portions of the inner tablet and outer envelope. This may have been complicated when the envelope and tablet were unintentionally baked in antiquity. The segmented inner tablet was then volume-rendered and a clay tone overlay added for aesthetic purposes. Finally, it was enhanced and arranged using Adobe Photoshop.

## Conclusions

The synchrotron X-ray of the envelope acquired the text of the enclosed tablet without causing damage. The two complete texts, shown opposite, afford an opportunity to study the practice of Neo-Assyrian contract law. The tablet was written first and is the contract. The envelope text appears to have had a notarizing function, listing the original witnesses with seals for two of them, as well as additional names, all of whom substantiated the legal validity of the transaction and the authenticity of the document and its signatures.

## References

- Herbordt, S., R. Mattila, B. Parker, J.N. Postgate, and D. J. Wiseman, 2019, *Documents from the Nabû Temple and from Private Houses on the Citadel*, CTN 6, London: British Institute for the Study of Iraq.  
Siddall, Luis R., Carla A. Raymond & Joseph J. Bevitt, 2018 Hidden Text: Imaging and reading an ancient tablet encased in an envelope, *Buried History* 54: 3-10.  
Wiseman, D.J. 1953 *The Nimrud Tablets, Iraq*, 15(2), 135-60.



Envelope (Photos)

1 na<sup>4</sup>kišib m<sup>qur</sup>di-<sup>d</sup>u.gur  
2 na<sup>4</sup>kišib m<sup>gig</sup>ša-dingir  
3 10 gín<sup>meš</sup> kù.babbar luḫ.u  
4 ša<sup>m,d</sup>šá-maš-man-pab ina pa-ni-šú-nu  
5 ku-um ru-bé-e ša kù.babbar  
6 é 2 anše a.šà ina u-šal-li  
7 gab-di<sup>m</sup>sanga-<sup>d</sup>15  
8 é 2 anše ina mu-li-e/gab-di kaskal<sup>ur</sup>nina  
9 pab 4 anše a.šà.ga  
10 ina uru.še ú-sa-a-ni  
11 3 me-re-še 3 kar-ap-ḫi  
12 pab 6 mu.an.na<sup>meš</sup> kú  
13 la še-pi-ši la še nu-sa-ḫi  
14 ina u<sup>4</sup>-me ša kù.babbar ina ugu  
15 ŠE-<sup>r</sup>x<sup>r</sup> i-šak-<kan>-u-ni  
16 a.šà-šú-nu u-še-šu-u  
17 iti.bár u<sup>4</sup> 28.kam  
18 lim-mu<sup>m</sup>en-kaskal-kur-u-a  
19 igi<sup>m</sup>šil-en-dal-li  
20 igi<sup>m,d</sup>pa-zu  
21 igi<sup>m,uru</sup>arba-il-a-a  
22 igi<sup>m,d</sup>pa-ka-pab-pab  
23 igi<sup>m</sup>sanga-15  
24 igi<sup>m</sup>en-bād

Seal of Qurdi-Nergal.  
Seal of Limraš-libbi-ili.  
10 shekels of refined silver  
(Two seal impressions)  
belonging to Šamaš-šarru-ušur, at their disposal, instead of interest on the silver an estate of 2 homers of field adjoining Sangī-Issār; an estate of 2 homers of high ground adjoining the Nineveh Road. A total of 4 homers of field in the village of Usāni. 3 (years) cultivated (and) 3 fallow; a total of 6 years they will have usufruct. There will not be straw nor corn taxes. <sup>14-15</sup> When the silver is deposited on the threshing floor? they will redeem their fields. 28th of Nisan, Eponym of Bēl-Ḥarrān-šadū'a. Before Šil-bēl-dalli, before Nabû-lē'i, before Arbailāiu, before Nabû-pī-aḫi-ušur, before Sangī-Issār, before Bēl-dūri.

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