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Chapter 34

Focus Raqqa: Inventory of Museum Collections and Reconstruction of Missing Tablets

Olivier Nieuwenhuyse†, Khaled Hiatlih, Rasha Hakki, Ayham Al-Fakhri, Jouke Verlinden, Karsten Lambers, Katrina Burch Joosten, Hubert Mara, Dominique Ngan-Tillard

Abstract

The National Museum of Raqqa in Syria has suffered immensely from the ongoing violence since 2011. Much of its valuable collection of movable archaeological heritage (*c.* 6000 items) is considered lost. Starting with 500 of the most precious objects of the museum, stored in the Raqqa Central Bank and stolen from there in 2013, the pilot project *Focus Raqqa* created a concrete and workable database to facilitate their identification and (hopefully) recovery by Syrian and international police and heritage institutions. The project made a pivotal first step towards potential reconstruction of the Raqqa Museum in the future. The Raqqa museum collection included cuneiform tablets. Some of the tablets were cast before the war to allow detailed study in Europe. Today the tablets have vanished. The pilot project *Scanning for Syria* safeguarded information from the lost artefacts by making high-resolution three-dimensional scans of the silicone rubber moulds and subsequently physical replicas of the original objects by 3D printing. The short life expectancy (30 years) of the moulds necessitated measures for long-term preservation. The *Scanning for Syria* team did not only succeed to preserve and share scientific knowledge in the academic circle; it also told the story of Syrian people and their culture to everyone, raising, thus, more voices in the united effort to keep cultural heritage safe in a zone of conflict.

Keywords: Raqqa museum, inventory, cuneiform, digital preservation, 3D-printing

Introduction

We are all aware of the unprecedentedly terrible and still ongoing destruction of the archaeological, historical, and human potential of Syria, not far north from Yarmouk, Jordan. Across the world, individuals and institutions have stood up to safeguard Syrian heritage as much as possible. As we all recognize, this heritage matters to all Syrians regardless of their individual persuasion, but it also matters to all of us. So far, there has been a disparate tendency to focus on the large and monumental, the sites with great historical or artistic value, the places that are well known internationally, for example, the Roman city of Palmyra in the Syrian Desert, or the spectacular Old City of Aleppo.

However, these are not the only cultural remains of importance, neither for a specialist (*e.g.*, an archaeologist), nor for a Syrian father taking care of his children and wishing to teach them something about their cultural heritage... Because the soul of a nation lies in its ancient history, both archaeologists and ordinary people recognize the value of all types of archaeological remains across the country, which, although less visible and spectacular, are equally important, such as ancient *tell* sites scattered over the countryside and small provincial museums where the results of archaeological excavations are presented to a local audience.

The provincial town of Raqqa is the focus of this article. Raqqa, although described as "the Capital of Evil", was also a bristling, lively boomtown and the vibrant headquarters of much Syrian and international archaeological activity. Until the war, Raqqa had a small archaeological museum and a huge collection of archaeological objects. As it looks today, Raqqa seems as a relatively recent creation. At the end of the 19th century, it was a village in the steppe. Well known as the second city in the Abbasid Empire, the ruins of this city laid almost abandoned for centuries, until Ottoman investments and colonial administration began in the 19th century. In fact, Raqqa has a long, distinguished history dating back to the earliest manifestations of our species, in the times of the Neanderthals. Over the past decades, archaeologists have been bringing this distinguished prehistory back to life.

Archaeological investigations in Raqqa Province began already in the early 20th century. However, they expanded enormously in the 1960s and 1970s following rural and economic development. In the 1980s, the Directorate General of Antiquities and Museums (DGAM) opened the archaeological museum in Raqqa. Located in an old Ottoman building, the museum became the coordinating hub for Syrian and international archaeological activity. These excavations resulted in a steady stream of archaeological objects. Top pieces went to the National Museum in the capital, Damascus. But the Raqqa Museum itself put on display a nice representation of all of the major stages in the long history of the region. This attracted tourists, local families, schoolteachers, and ordinary *Raqawi* with an interest in ancient history. Worth noting is that the museum also cared for the study of large archaeological collections from excavations, a project that promised several centuries of future archaeological investigation.

When war eventually reached Raqqa, it resulted in enormous damage to the museum building and its collections. Initially, opposition groups did their best to protect the building in spite of the violence. When Islamic State (IS) arrived, all hell broke loose. The museum building was confiscated and turned into a booby-trapped ruin. The archaeological collections were mostly destroyed. In March 2016, the DGAM approached the Centre for Global Heritage and Development, a consortium of Leiden, Delft and Erasmus Universities in the Netherlands, with a request for assistance in making a documented inventory of the archaeological collections lost from Raqqa. Thus began the project *Focus Raqqa* (Nieuwenhuyse *et al.* 2019). Next to it, the project *Scanning for Syria* started, aiming at preserving cuneiform texts on tablets which were once part of the Raqqa museum collection and have vanished today.

Focus Raqqa

With the financial support of the Dutch Prince Claus Fund, a small team of European and Syrian archaeologists, including two former staff members of the Raqqa Museum was brought together and the international peer network was consulted. The primary goal of the project was to make an inventory of archaeological objects stolen from the Raqqa museum, including as many good-quality photographs as possible. The inventory would be made available to the DGAM and to international policing organizations, to facilitate the future identification of the objects of the Raqqa museum on the international art market. Then, the future recovery of the objects and, hopefully, repatriation to Syria would be prepared. In parallel, *Focus Raqqa* would raise public awareness on the plight of the museum, the city, its people.

Using the information made available by colleagues of the DGAM, international NGOs and reports from local eye witnesses, a provisional damage assessment was made. Much remains uncertain even at the date of the publication of the volume in hand. What is known so far is that the archaeological collections were mostly destroyed. This was done deliberately. Gone are the objects from the public expositions, but also those from the closely guarded store rooms. Gone, too, are the hugely important study collections kept in a separate storage facility, known as Heraqla (indeed, a tragic loss to humanity). Because of the many uncertainties on the collections, the following small pilot-project was initiated. From the start of the war until IS forced them out, the museum staff had worked against the clock to document the collections as best as possible. Anticipating troubles, they had stored a small collection of "precious" objects in the Central Bank of Raqqa. In 2012, the bank was robbed and these objects were stolen. This sub-collection became the pilot-project for *Focus Raqqa*.

The inventories made by museum staff were the starting point of this pilot-project (Figure 1). The DGAM kindly made them available. They had listed all items stored in the Bank of Raqqa. For each item, the list contains the museum registration number and a brief description. It is emphasized that these inventories were made in haste and in difficult, stressful conditions. The *Focus Raqqa* team progressed in a series of five steps: first, making a database, second, translating the descriptions from Arabic into English, third, filling in missing data, and fourth, correcting inconsequent definitions, since these do not help the work of organizations such as the Interpol, whose work relies on descriptions as complete and reliable as possible. The inventory lists were not very detailed, but they contained a crucial piece of information: the official Raqqa Museum registration number. This allowed to trace objects in the Raqqa Museum registration book, of which the DGAM made a copy available. The Raqqa Museum registration book was the "missing link". Once the museum registration number is identified, the book gives additional descriptive information for the artefact in question. Importantly, in many cases the book also lists the excavation project registration number. This number or code then becomes the key to approach the international excavation project archives and ask for high-quality images. This final and crucial step proved to be the most time consuming, and the most challenging. A lesson was learned from this: the search for illustrations of stolen artefacts can only be done successfully in good international cooperation.

القائمة رقم 4

List No. 4

تسلسل Series	الرقم العام General Number	العدد Number	الوصف Description	ملاحظات Notes
29	2376	1	رقيم طيني عليه بعض الأحرف والمقاطع الكتابية طول 2,7سم العرض 4,1سم السماكة 1,9سم. A Clay Tablet with some letters and writing syllables, length: 2,7c.m, width: 4,1c.m, thickness: 1,9c.m.	تل الصبي الأبيض Tell Sabi Abyad
30	2392	1	رقيم طيني طول 3,8سم العرض 3,1سم السماكة 1,8سم. A Clay Tablet, length: 3,8c.m, width: 3,1c.m, thickness: 1,8c.m.	تل الصبي الأبيض Tell Sabi Abyad
31	2431	1	رقيم طيني عليه كتابات A Clay Tablet bears writings	تل الصبي الأبيض Tell Sabi Abyad
32	4887	1	كسرة صغيرة لرقيم طيني عليها كتابة مسمارية، طول 1,5سم، عرض 1سم. A small fragment of a clay tablet bears cuneiform writing, length: 1,5c.m, width: 1c.m.	تل الصبي الأبيض Tell Sabi Abyad
33	2316	1	رقيم طيني عليه كتابة مسمارية، طول 4,4سم، عرض 3,7سم، سماكة 2,1سم. A Clay tablet bears cuneiform writing, length: 4,4c.m, width: 3,7c.m., thickness: 2,1c.m.	تل الصبي الأبيض Tell Sabi Abyad
34	2413	1	رقيم طيني عليه كتابات مسمارية A Clay Tablet bears cuneiform writings	تل الصبي الأبيض Tell Sabi Abyad
38	4876	1	رقيم مسماري Cuneiform Tablet	تل الصبي الأبيض Tell Sabi Abyad

أمين متحف الرقة
curator of raqqa museum
محمد الجاجان Mouhammad Al-Jajan

رئيس دائرة آثار الرقة
President of the Department of Antiquities of Raqqa
محمد سرحان الأحمد Mouhammad Sarhan Al-Ahmad

Figure 1. Raqqa Central Bank Collection. Part of the inventory made of the collection stored in the Raqqa Central Bank (Image: DGAM Damascus).

After completion of the pilot inventory, a better understanding of the collections stored in the Central Bank of Raqqa and stolen from there was gained. 512 objects, sorted by category, were on the inventory made by the museum staff just before the city fell. Prominent categories are coins, jewellery, cylinder seals, and clay tablets carrying cuneiform texts. The vast majority of the Raqqa Central Bank collection – more than 80% – were coins. This is not very surprising as they were made of precious metals (often gold) and they were kept in the bank. The robbers of the bank could not resist the temptation to confiscate the ancient money. Unfortunately, most of these coins have poor documentation, and no stated provenance. This is because many of them came from older, non-academic excavations in Raqqa. From an international policing organization's perspective, these objects must be considered a total loss. Fortunately, the collection that was selected for the Raqqa bank is not representative for the museum as a whole. The Raqqa Museum

contained about 6,000 objects, most were not coins, and many of them have good documentation and provenance. Completing the inventory is valuable, and *Focus Raqqa* proved that it can be done.

The objects identified came from a variety of excavations in the Raqqa Province, carried out by German and Dutch teams. These teams were approached and were asked for photographs and additional information that might contribute to the identification of these objects if and when they appear in the art market. *Focus Raqqa* received tremendous support through the international peer network of academics across Europe, but did face two key challenges. First, the access to European project archives was complicated: excavation archives are scattered across countries, universities, research institutes. Locating them and arranging formal access through project representatives can only be done successfully through international cooperation. Second, the quality of available documentation differs. Older project archives are available only in pre-digital format.

Figure 2 illustrates the types of objects displayed or archived at the Raqqa museum. The artefacts may not be UNESCO World Heritage-level objects, and they might not fetch very large sums of money on the market, but they certainly are valuable from academic, art-historical, aesthetic and symbolic reasons. The left image is a photograph of a prehistoric buckle – something to hold up your pants – more than 8,000 years old, in the form of an animal, made of polished, engraved bone. The right image shows a Late Bronze Age clay tablet with cuneiform text, recording the worries and activities of rural administrators in the Middle-Assyrian Empire, 1200 BC.

Figure 2. Objects stolen from the Raqqa Central Bank collection. Left, bone buckle (Tell Sabi Abyad, c. 6500 BC). Right, clay tablet carrying cuneiform text (Tell Sabi Abyad, 1200 BC). (Images: Focus Raqqa Project).

Scanning for Syria

An offshoot of the *Focus Raqqa* was the project *Scanning for Syria* funded by the Dutch Organization for Scientific Research (NWO) within the framework of its Creative Industry programme. Before the war began, silicone moulds were made of important archaeological objects for detailed study in Europe. The objects included pottery sherds with

textile impressions (Shir, 6400 cal. BC) and clay tablets with cuneiform texts. As ancient textiles are poorly preserved in the Middle East, these sherds are hugely important for prehistorian archaeologists. When the war began, the silicone moulds suddenly gained a new meaning. The original objects were all lost in the fog of war. Carrying the imprints – in negative – of these objects, the moulds are all that is left of the originals. The pilot project *Scanning for Syria* worked with the silicone rubber casts of Tell Sabi Abyad cuneiform tablets (Akkermans and Wiggermann 2015; Klinkenberg 2016) which were once part of the collections of the Raqqa Museum. The tablets record the anxieties of local administrators living in the Assyrian fortress at Tell Sabi Abyad in the 12th century BC. The precious texts have been preserved in the casts until now, but will certainly fade away as silicone rubber degrades in time.

Scanning for Syria explored the potential for both academic research and heritage work for creating virtual reconstructions of the cuneiform texts from the moulds. The moulds were scanned with an X-ray micro-CT-scanner (Nanotom manufactured by General Electrics). X-ray micro-CT uses the same principle as medical CT scanners to see through materials but at a much higher resolution. Resolution depends on the size of the scanned object. Most moulds could be scanned at a voxel size of about 0.025 mm. The penetrating X-rays reached even the tiniest character deeply hidden in the concavities of the moulds, so that the virtual 3D reconstructions show the tablets without any distortion. Defects present in the moulds, like bubbles trapped at the tip of wedges during casting, could be corrected on the digital models. Since the only relevant information contained in the cast is the surface information, alternative digitization methods were searched for. Collaboration was initiated with two strong European centres in the domain of digital Assyriology: the Catholic University of Leuven (Belgium) and Heidelberg University (Germany). Leuven University's light dome proved to be the ideal tool for recording the texts imprinted on convex tablets, when 3D physical replicas are of less importance: it is very fast and very accurate, but distorts curved surfaces. Heidelberg University's close range light scanner provided very high resolution models of the cast surfaces. However, some cuneiform wedges are hidden in the concavities of the moulds so that multiple scans followed by scan stitching were required to capture the whole text. This proved to be time-consuming and with a risk of local text losses. The fact that the silicone rubber moulds deformed when they were manipulated to be scanned under different angles complicated the stitching work. In the end, the X-ray micro-scanner housed at TU Delft turned out to offer a good compromise between time-efficiency, accuracy and text recovery. From the digital models, physical replicas were produced with two types of 3D printers, a material jetting printer and a stereolithography printer. For material jetting, droplets of resin are selectively deposited and cured with UV light (Stratasys Connex 360). For stereolithography, a liquid photopolymer is selectively cured by a laser (Form2). Both techniques were used throughout the project, as they offered similar resolutions (0.016-0.024 mm). Stereolithography supports a wider range of material mixes, such as ceramics, while material jetting could avoid the necessity for support structures. The tiny asperities left on the models at contact points with the support structures were preferred to the thin layering that is inherent to material jetting and was apparent on the side faces of the replicas. The first prints did not come out in the natural clay colour of

the original object. Instead, they came out in bright blue, orange, even pink colours (Figure 3). Initially, this somewhat disturbed the Assyriologists who evaluated the legibility of the 3D prints. After a moment of familiarization, they were delighted to see that the texts were perfectly readable.

Figure 3. Coloured high-resolution prints of Assyrian cuneiform texts from the site of Tell Sabi Abyad, northern Syria (image: National Museum of Antiquities, Netherlands, Scanning for Syria Project).

Scanning for Syria succeeded at preserving the information in the moulds and made them more accessible. Traditional casts are solid, clumsy artefacts that usually disappear in a shelve. Virtual scans are stored in public archives, are easily shared with the world with just an email, and can be studied and reproduced by scientists, museum curators, and educators, wherever they happen to live. The 3D printed tablets may serve as teaching material in Assyriology classes. Museum visitors can manipulate them ("hands on experience") for a better appreciation of the ingenuity of Assyrian cuneiform writing. As a way to engage the Dutch (and international) non-academic audience, an innovative chocolatier was contacted and the world's first-ever cuneiform tablet in chocolate was produced. Museum shops sell the chocolate tablets for the profit of Syrian refugee students in The Netherlands. A QR code on the package of the chocolate tablets links to the digital story of the tablet, from its manufacture in 1200 BC to its recovery by a Dutch team of archaeologists; to its cast, translation, scanning, digital enhancing, 3D printing, and chocolate 3D replica (Ngan-Tillard 2018). The book also answers several questions posed to the *Scanning for Syria* team on how to read a six-faced tablet and what the wedges mean.

Scanning for Syria did not stop at preserving the precious cuneiform text. At the Interdisciplinary Centre for Scientific Computing (IWR) at the University of Heidelberg, a team is teaching smart computers to read the cuneiform. The team of the Forensic Computational Geometry Laboratory (FCGL) at the IWR develops sophisticated algorithms to identify and enhance the cuneiform characters captured in the digital tablets. It successfully extracts even faint, small characters (Mara *et al.* 2010) within 3D models (Bogacz and Mara 2018). The Heidelberg team dramatically decreased the time for decipherment of the Raqqa tablet T98-34 by automatically computing high quality images clearly showing the cuneiform characters (Figure 4), which would have taken an Assyri-

ologist several hours to manually craft a matching drawing! Mara's team is now moving on, teaching his computers to recognize words. Such algorithms are sorely needed; thousands of clay tablets that have survived millennia have yet to be translated. A first large open benchmark dataset to pave the way for artificial intelligence in Digital Assyriology was recently published (Mara and Bogacz 2019).

Figure 4. Automated reconstruction of cuneiform (Raqqa Museum tablet T98-34). Left: digital reconstruction from the scan. Centre: semi-automatic decipherment by Heidelberg University's open source software GIGAMESH. The match between GIGAMESH and the original hand-drawn transcription made by Assyriologist Dr. Frans Wiggermann (right) almost reaches 100 % (images: Hubert Mara, Scanning for Syria Project).

Conclusions

Scientific research communities can and should contribute to safeguarding archaeological heritage from conflict situations in the Middle East. They are able to make very valuable contributions away from the front lines by using their own, unique peer networks and specific inter-disciplinary approaches. Heritage efforts should not exclusively focus on monumental and World Heritage sites. Much is to be gained from including lesser known collections, provincial museums, even landscapes. Raqqa especially, both the city itself and its heritage, deserve much more attention. So far, international attention on this city has been primarily focused on its role as a military target, a "headquarters of evil". But Raqqa is a real city, and the *Raqawi* are real people. As the city today lies in ruins, its inhabitants deserve to be heard. Their heritage is ours as well. It deserves to be protected with the full force of international academic and political power.

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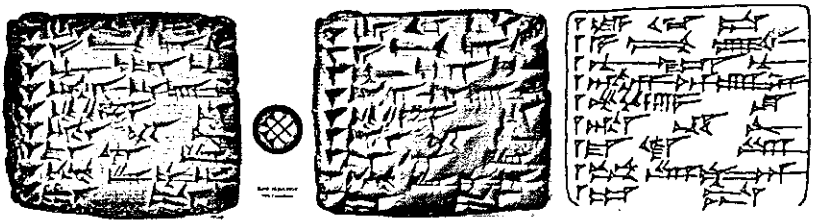

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الملخص

الرَّقَّة في البؤرة: جرد المجموعات المتحفية وإعادة بناء الألواح المفقودة

أُلفِير نويهويزي
مركز دلفت إيرازموس للتراث العالمي والتنمية – لايدن – هولندا

خالد هياذله
مركز دلفت إيرازموس للتراث العالمي والتنمية – لايدن – هولندا

رشا حقي
مركز دلفت إيرازموس للتراث العالمي والتنمية – لايدن – هولندا

أيهم الفخري
مركز بابراكت للاثار – مونت بيوفري – فرنسا

جوك فرلندن
جامعة أنتويربن – أنتويربن – بلجيكا

كارستن لامبيرس
جامعة لايدن – كلية الآثار – العلوم الأثرية – لايدن – هولندا

كاترينا بروخ يوستن
جامعة لايدن – كلية الآثار – العلوم الأثرية – لايدن – هولندا

هيوبرت مارا
جامعة هايدلبرج – مركز الحوسبة العلمية المتعدد التخصصات - هايدلبرج – ألمانيا

دوميرك نجان-تلارد
جامعة دلفت التكنولوجية – كلية الهندسة المدنية وعلوم الأرض – هولندا

عانى متحف الرقة في سوريا كثيراً من العنف القائم منذ 2011. وتعد الكثير من مقدرات المتحف الأثرية المنقولة (قرابة 6000 قطعة) في عداد المفقود. ابتِداءً بخمسمئة قطعة ثمينة من قِ طع المتحف، والمحفوظة ببنك الرقة المركزي، والتي سرقت منه في 2013، قام مشروع الرقة في البؤرة بإعداد قاعدة بيانات موثقة بغرض تمكين الشرطة السورية والدولية، ومؤسسات التراث من التعرف عليها. حقق المشروع خطوة محورية أولى في الطريق نحو إعادة بناء متحف الرقة في المستقبل. احتوت مجموعة متحف الرقة على ألواح مسمارية. أُعِدَّت نسخ لبعض هذه الألواح قبل فترة وجيزة من بداية الحرب، ولم يتسنَّ دراستها بشكل مفصل في أوروبا اليوم، فقدت هذه الألواح. صان المشروع الريادي "المسح الضوئي من أجل سوريا" معلومات أُستقيت من قطع مفقودة، من خلال إعداد نسخ ضوئية ثلاثية الأبعاد ذات جودة عالية للقوالب السيليكونية، والنسخ المنتجة عنها، وهي نسخ عن الأصل أُعدت بالطباعة ثلاثية الأبعاد. إن العمر الافتراضي القصير للقوالب (30 عام تقريباً) يحتّم اتخاذ الإجراءات العملية للحفظ على المدى طويل. لم ينجح فريق "المسح الضوئي من أجل سوريا" في الحفاظ على المعرفة وتبادلها في الدائرة الأكاديمية فقط، بل عرض قصة الثقافة السورية وشعبها على الجميع

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