Focus Raqqa

Inventory of Museum Collections and Reconstruction of Missing Tablets

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

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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 (ca. 6000 items) is considered lost. Starting from 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, workable database to enable identification 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 not only succeeded at the preservation and sharing of knowledge in the academic circle. It also told the story of Syrian culture and its people to everyone for raising 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 unprecedented, and terribly 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 Syrians of whatever persuasion, but it also matters to all of us. So far, there has been a disparate tendency to focus on the big and monumental, the places 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, to an archaeologist, these are not always the most important. To a Syrian father taking care of kids growing up, these are not always the most useful to teach the family something important about their past. Because the soul of a nation lies in its ancient history, both archaeologists and ordinary people recognize the value of the archaeological remains across the country. Of ancient tell sites scattered over the countryside. Of small, provincial museums where the results of archaeological excavations are presented to a local audience. Less visible, less spectacular, but equally important.

The provincial town of Raqqa is the focus of this article. Raqqa: "*the Capital of Evil?*" Yes. But also a bristling, lively boomtown that was 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. Raqqa as it looks today is relatively recent. 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 - 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. Importantly, the museum also cared for huge collections of archaeological study collections from excavations. These promised several centuries of future archaeological study. 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 conference. 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. A tragic loss to humanity. Because of the many uncertainties on the collections, a small pilot 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 for Focus Raqqa.

The inventories made by museum staff were the starting point of the pilot (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 pilot 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 for inconsequent definitions. As organizations such as Interpol do not like inconsequent object definitions, the Focus Raqqa team did its best to make 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 for an object, the book gives additional descriptive information. 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 fifth final 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 museum staff just before the city fell. Prominent categories are coins, jewelry, 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. When the robbers came to rob the bank, they failed to resist the temptation to confiscate the ancient money too. Unfortunately, these coins mostly have poor documentation, and most have no stated provenance. This is because many of them came from older, non-academic excavations in Raqqa city. 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 6000 objects, most were not coins, and many will 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 Raqqa Province, carried out by German and Dutch teams. These teams were approached, asking for photographs and additional information that might contribute to the identification of objects on the 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 are efforts that 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, aesthetical and symbolic perspectives. 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, ca. 6500 BC). Right, clay tablet carrying cuneiform text (Tell Sabi Abyad, 1200 BC). Images Focus Raqqa Project.

Scanning for Syria

An offshoot 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 textiles preserve poorly in the Middle East, for prehistorians these sherds are hugely important. 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 of 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 centers 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 color of the original object. Instead, they came out in bright blue, orange, even pink colors (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.

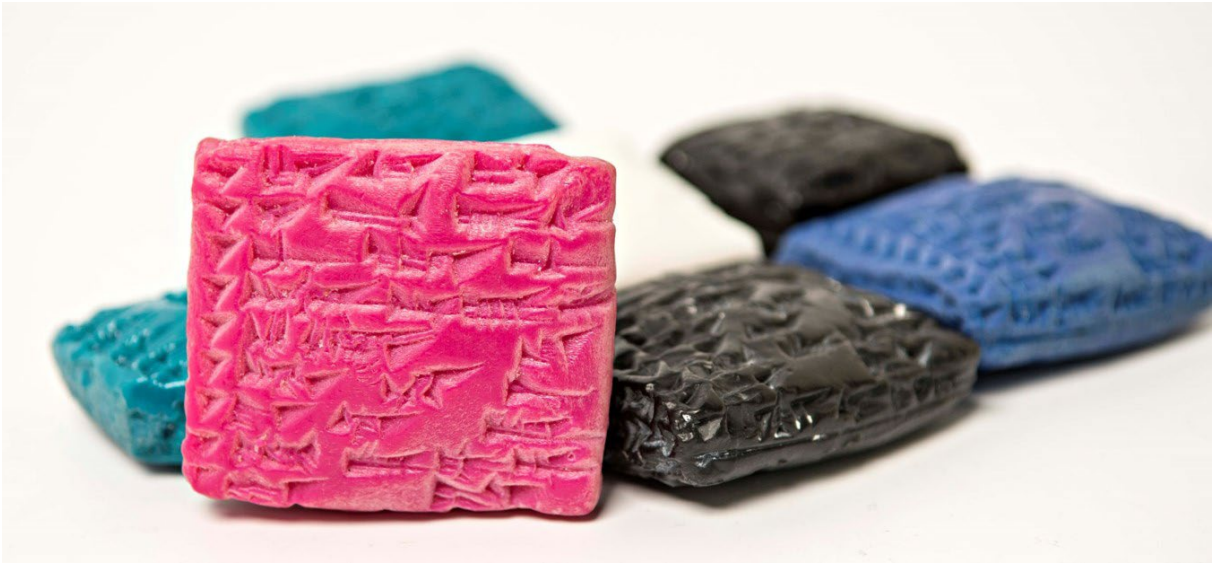

Figure 3. Colored high-resolution prints of Assyrian cuneiform texts from the site of Tell Sabi Abyad, northern Syria (image: National Museum of Antiquities, Netherlands, Scanning for Syria Project).

Scanning for Syria succeeded at preserving the information in the moulds and made the information 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 the many questions posed to the Scanning for Syria team on how to read a 6-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 assyriologist 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).

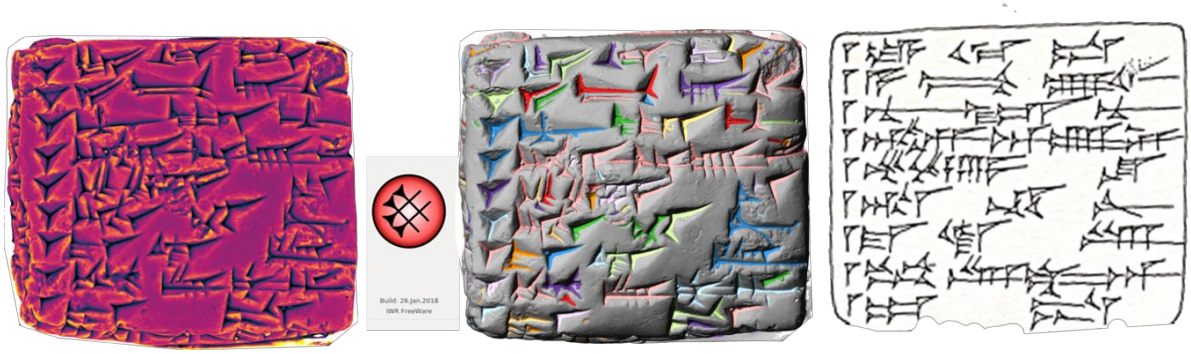

Figure 4. Automated reconstruction of cuneiform (Raqqa Museum tablet T98-34). Left: digital reconstruction from the scan. Centre: semi-automatic decipherment by Heidelberg University's open source software GIGAMESH. The match between GIGAMESH and the original hand-drawn transcription made by Assyriologist 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 deserved much, much more attention. Both the city itself and its heritage. 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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Olivier Nieuwenhuijse was specialized in Near Eastern archaeology. Olivier worked as a researcher in projects across the Middle East, carrying out field research in Syria, Turkey, Lebanon, and Iraq. After completing his PhD at Leiden University his post-doctoral study investigated the social and material repercussions of the so-called 8.2 ka abrupt climate event in the ancient Near East. In 2009 he co-organized the first international conference on the

Late Neolithic archaeology of Upper Mesopotamia. He previously worked as an assistant-curator for the department Near East at the National Museum of Antiquities Leiden, and published regularly for popular-scientific media. Since 2011 Olivier participated in the Sharizor Survey Project, an international co-operation investigating long-term patterns of human settlement and land-use in the Sulaimaniya Province of Northern Iraq. He was a leading specialist on the prehistoric ceramic traditions from the Near East. Olivier taught Near Eastern archaeology and various specific theoretical and thematic topics. Olivier was active for the Centre for Global Heritage and Development since the early days in 2015. He was leading the project Museum Raqqa and initiated the project Scanning for Syria. Olivier worked for the Deutsches Archäologisches Institut and held a Humboldt research position at the Freie Universität Berlin. He was advisor for the World Customs Organization.
Source: https://www.globalheritage.nl/people/olivier-nieuwenhuyse

Ayham Al-Fakhry
Ayham al-Fakhry is a Syrian archaeologist attached to the centre archéologique de Bibracte. Originating from Raqqa, he studied archeology at the University of Damascus where he graduated in 2004. His passion for archaeology led him to work in a very special, demanding environment. In 2013, the General Directorate of Museums (DGAM) appointed him director of antiquities in Raqqa. As the last curator of the archaeological museum of Raqqa before IS took over the city, al-Fakhry made inventories of threatened collections and tried to hide artifacts at secret safe havens. Subsequently, he participated in projects to protect and track the looted artifacts from Raqqa and Syria. He has been vice president of the National Museum of Damascus and vice-president of Archeological Affairs in Syria. Al-Fakhry now lives in Strasbourg, France, working on follow-up projectz to protect the Syrian cultural heritage.
Source: http://www.focusraqqa.com/

Jouke Verlinden
Prof. Jouke Verlinden is design researcher and coordinator of the research group on Product Development at the Faculty of Design Sciences, University of Antwerp. Since his academic career at TU Delft, he has been involved as digitalization and 3D printing expert in a number of Cultural Heritage and Archeology projects. His current research includes digital craftmanship with human-robot interaction, digital fabrication of (historic) textiles, and digital restoration of intricate sculptures.

Karsten Lambers
Karsten Lambers is an archaeologist and the coordinator of the Digital Archaeology teaching and research programme at the Faculty of Archaeology, Leiden University. He has been involved in field projects at World Heritage and other archaeological sites in Europe and Latin America since his undergraduate studies at University of Bonn. Many of these projects involved the 3D recording, modelling and analysis of artefacts, architecture, and landscapes. Having obtained his PhD from University of Zurich in 2005 with a thesis on the Nasca geoglyphs in Peru, he held teaching and/or research positions at the German Archaeological Institute and the universities of Konstanz and Bamberg before joining Leiden University in 2015. His current research focuses on advanced computational methods to extract

archaeological information from large heterogeneous datasets such as remotely sensed images and text corpora.

Katrina Burch Joosten
Katrina Burch Joosten is an archaeologist and an audiovisual/digital artist. She began working for the Scanning for Syria project while studying for an MSc in Digital Archaeology at Leiden University. Her archaeological research concerns the application of novel digital tools to reframing archaeological questions and interpretations of the past. Her audiovisual practice combines visual ethnography with enhanced storytelling using 3D modelling and binaural sound composition to create immersive, educational VR experiences.

Hubert Mara
Hubert Mara is a computer scientist/engineer with long term experience in interdisciplinary projects with archaeology and the Digital Humanities. He studied at the Vienna University of Technology in Austria, where he got his diploma. Afterwards he became a Marie-Curie fellow within the Cultural Heritage Informatics Research Oriented Network (CHIRON) at PIN - University of Florence in Prato, Italy. In his PhD project at the Interdisciplinary Center for Scientific Computing (IWR) of the Heidelberg University the foundation for digital methods for cuneiform tablets was established and implemented in the GigaMesh Software Framework (https://gigamesh.eu). This work is continued within the Forensic Computational Geometry Laboratory (FCGL) founded in 2014 by Hubert Mara and supported by the German Universities Excellence Initiative. The German Federal Ministry of Education and Research (BMBF) awarded the FCGL a project of the 2018 eHeritage II program for Contextualization and analysis of seals and sealings of the Corpus of minoan and mycenaean Seals (ErKon3D) jointly-lead with the Institute for Classical Archaeology in Heidelberg. Furthermore Hubert is involved in the Austrian Corpus Vasorum Antiquorum (CVA) for integration of 3D-metrology and 3D-data analysis for the field of pottery research. He is a member of the advisory committee of the German chapter of the Computer Applications & Quantitative Methods in Archaeology (CAA) association.

Dominique Ngan-Tillard
Dominique Ngan-Tillard is a geoscientist. She studied geophysics at School and Observatory of Earth Sciences in Strasbourg, France. She obtained a diploma from Imperial College, London, UK for her research on borehole stability in anisotropic formations and holds a PhD from Grenoble University on shear band localization in marls. After her studies, she worked as an engineering geologist in construction projects in Hong Kong and the Netherlands. In 1997, she joined Delft University of Technology as assistant professor. She coordinates the Master in Geo-engineering and lectures engineering geology and rock mechanics subjects. Her research focuses on non-destructive ground investigation at multiple scales using multi-physics tomography. She uses her geo-engineering know-how to help reveal and understand the microstructure of archaeological soils and artefacts exposed to various physico-chemical loadings. She developed numerical and laboratory tools to predict the impact of construction works on archaeology buried in wetlands. She was also involved in the digital preservation of

Assyrian heritage lost during the civil war in Syria through the project Scanning for Syria. In a follow-up project, she extracted all sorts of information hidden within encased cuneiform tablets. Currently, she unveils Neolithic diets from the scans of human coprolites with a multi-disciplinary team. Data inter-operability is key in her research.