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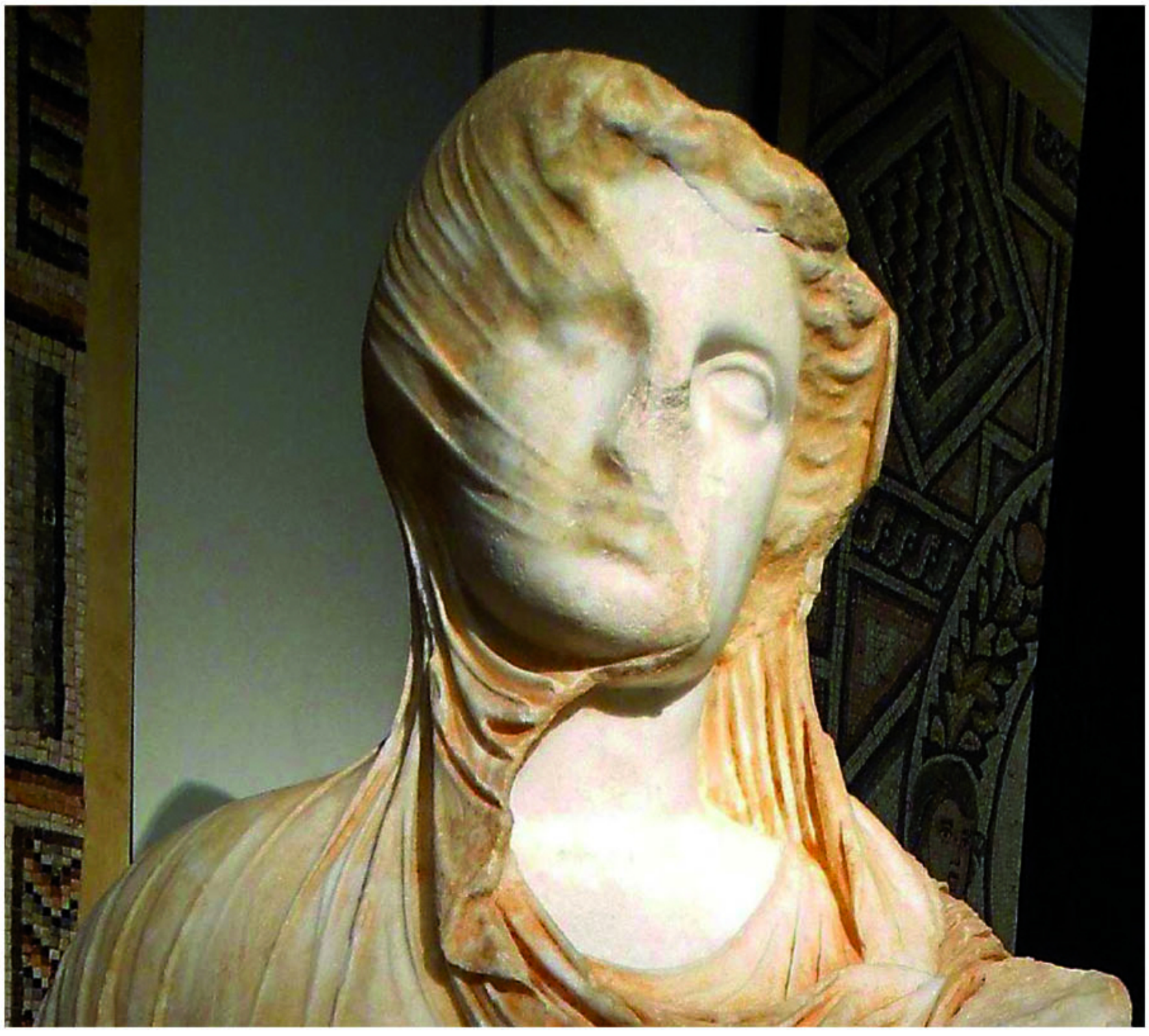

«L'ERMA» di BRETSCHNEIDER

QUADERNI
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22

n.s. II, 2019

«L'ERMA» di BRETSCHNEIDER
Roma - Bristol, CT

Quaderni di Archeologia della Libya
n. 22, n. s. II

Via Marianna Dionigi 57
00193, Roma - Italy
www.lerma.it

70 Enterprise Drive, Suite 2
Bristol, Ct 06010 - USA
lerma@isdistribution.com

con il contributo e la collaborazione di

FONDAZIONE MEDA
MEDITERRANEO ANTICO - ONLUS

Quaderni di archeologia della Libya. - 22, n.s. II - Roma : «L'ERMA» di BRETSCHNEIDER, 2019.
p. 222 + 12 (in arabo): ill. ; 28 cm.
(Periodicità annuale. - Dal n. 1 al n. 13 : Quaderni di archeologia della Libia)

ISSN: 0079-8258
ISBN: 9788891319197 (volume cartaceo)
ISBN: 9788891319180 (volume digitale)

CDD. 21 939.7
1. Archeologia - Africa romana

Norme editoriali scaricabili all'indirizzo: http://www.lerma.it/Downloads/QAL_NormeAutori.pdf

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The EAMENA and MarEA Projects: Notes on Current Training and Research in Libya and Beyond

Julia Nikolaus, Louise Rayne, Nichole Sheldrick

This article provides an update on the work the "Endangered Archaeology in the Middle East and North Africa" (EAMENA) project has conducted in Libya over the last year. It also introduces a new project, the "Maritime Endangered Archaeology" (MarEA) which was established in partnership with EAMENA. Both, EAMENA and MarEA, focus on mapping, recording and monitoring archaeological sites across multiple MENA countries, including Libya. Both projects aim to provide tools for remote mapping, interpreting and recording archaeological sites that will prove useful in capacity building in the MENA region. Between November 2017 and March 2019, three, two-week long EAMENA-Cultural Protection Fund training workshops took place in Tunis (Tunisia), in which 20 Libyan archaeologists and heritage professionals took part.

The "Endangered Archaeology of the Middle East and North Africa" (EAMENA) project

The EAMENA project was established in 2015 to identify, document, and monitor damage and threats to archaeological sites in the MENA region[1]. The project uses a combination of remote sensing techniques, archival research, and field visits to conduct analyses and assessments of the features and condition of sites, which are recorded in the EAMENA database[2]. The database has been customised using the open-source, Arches v.3 heritage management platform, developed by the Getty Conservation Institute and World Monuments Fund, and is an open-access resource[3].

As of March 2020, the EAMENA database currently holds more than 290,000 records overall, from Mauritania to Iran, nearly 10,000 of which record sites in Libya[4]. The EAMENA project is working on a number of on-going projects in different areas of Libya. One such project is the digitisation of the sites of the UNESCO Libyan Valleys Archaeological Survey[5], which, when incorporated into the EAMENA database, will act as an updated GIS for the survey and include recent assessments of the condition of the sites. Also ongoing are projects to digitise and monitor the World Heritage Site of Cyrene and its hinterland[6] and another to document the heritage of the al-Jufra oases in the Sahara.

Between November 2017 and March 2019, three, two-week long EAMENA-Cultural Protection Fund (CPF) training workshops were held in Tunis (Tunisia). Over the course of the first two workshops, 20 Libyan archaeologists and heritage professionals from various parts of the country were trained in

[1] Bewley *et al.* 2016.

[2] http://database.eamena.org.

[3] Users can register for full access at the following link: http://eamena.arch.ox.ac.uk/database-registration-form/. In general see Zerbini 2018.

[4] Rayne, Sheldrick, Nikolaus 2017. See also Nikolaus *et al.* 2018.

[5] Barker *et al.* 1996.

[6] Rayne *et al.* 2017.

introductory GIS (Geographical Information Systems), remote sensing techniques and the EAMENA methodology of identifying and recording sites. Half of these participants, 10, returned for the third and final advanced training workshop[7]. The goal of the workshops was to provide Libyan archaeologists with new skills and resources that will aid them in the conservation and protection of their heritage.

During the basic training workshops, participants learned how to identify archaeological sites and interpret satellite imagery using free platforms such as Google Earth Pro. Detailed instruction on how to input data on the archaeological details and condition of sites into the EAMENA database was a key skill that was developed. Participants were then taught to use QGIS to conduct basic analyses and create maps; instruction on field recording and training in the use of handheld GPS units was also provided during a field trip to a local archaeological site. During the advanced training, participants were given the chance to improve their skills with the database and QGIS, and were instructed in more advanced techniques of analysis, such as the use of Google Earth Engine[8].

EAMENA automated monitoring of damage and destruction

Over the last year, the EAMENA team has started to develop a script using Google Earth Engine that is designed to alert heritage professionals about damage to sites in their region such as agricultural expansion or construction. Google Earth Engine is a platform which supplies regularly updated free satellite imagery and high-performance computing[9]. Machine learning and classification algorithms are applied to freely available and regularly collected satellite images which detect changes in agricultural and urban extents much more rapidly than manual human interpretation alone. Heritage professionals and archaeologists from Libya received basic training in using Google Earth Engine as part of the EAMENA-CPF advanced training workshop mentioned above. For example, our algorithms highlighted the urgency of protecting sites in the al-Jufra oases of Libya, because they are currently threatened by agricultural expansion (*Fig. 1*). Over the past 20 years, 47 of the 90 recorded sites in al-Jufra have been damaged or destroyed by modern agricultural activity.

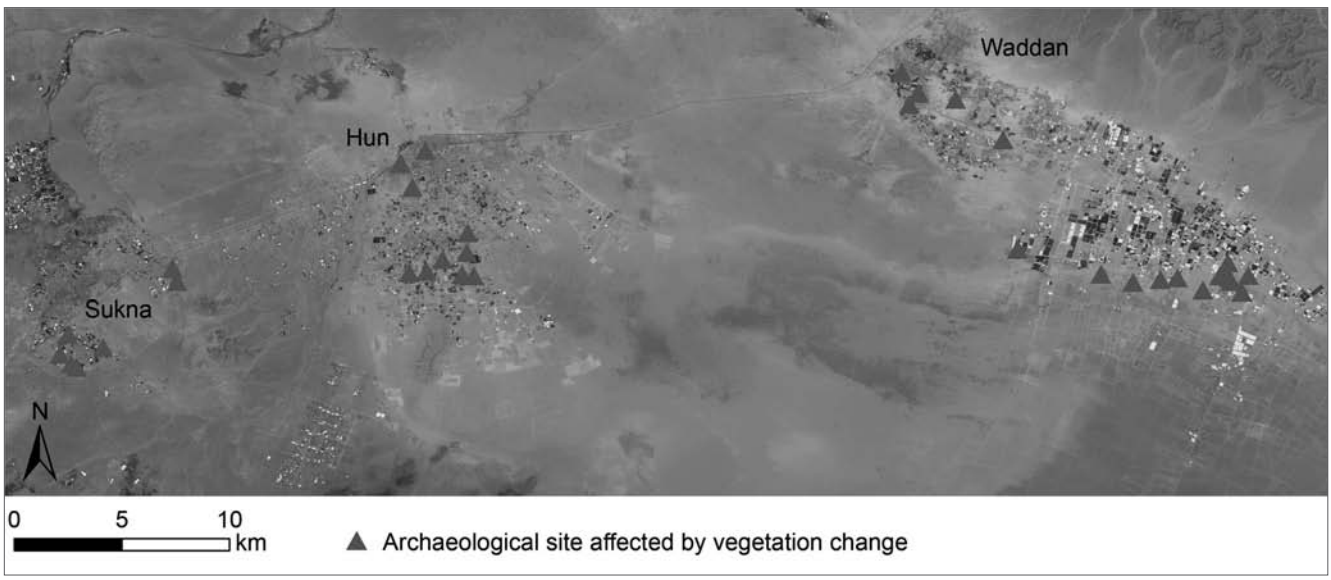

Fig. 1 - Extent of area in which vegetation has changed between 2016 and 2019 overlain on Sentinel-2 composite from 2019. Changed area was derived from the difference between vegetation indices in the al-Jufra oases applied to Sentinel-2 images. Sites encompassed by the changed area are highlighted. Contains modified Copernicus Sentinel data 2016/2019.

[7] Hobson 2019.
[8] See *infra*, p. 205.
[9] Gorelick *et al.* 2017.

The "Maritime Endangered Archaeology" project (MarEA)

In 2019 the MarEA project was established in partnership with the EAMENA project. The coastal zone in the MENA region is under severe threat from natural and human impacts. In Libya, the famous coastal sites of Sabratha, Lepcis Magna and Apollonia are under threat from coastal erosion and sea level changes, which severely threaten and damage the archaeological remains[10]. The expansion of modern coastal cities in Libya also poses serious threats to the cultural heritage in the region. Over 80% of Libya's population lives in the cities and towns situated in the coastal zone[11].

Furthermore, the recent conflict in Libya caused serious damage to historical cities, such as Benghazi, which suffered severe damage to its historical buildings. Consequently, cultural heritage in this zone is being lost at an alarming rate which highlights the critical need to document coastal and near-shore underwater heritage before it is lost.

Through a working partnership with EAMENA, the newly established project MarEA aims to document the coastal zones of the Middle East and North Africa. The main focus is on all coastal, near-shore and underwater sites visible from satellite images and recorded in extant documentation using the EAMENA database. A team of maritime archaeologists based at the University of Southampton (England) and Ulster University (Northern Ireland) specialize in the identification, documentation and interpretation of coastal and near-shore cultural features. The methodology mirrors the EAMENA regional scope but with a sole focus on documenting more comprehensively the dynamic coastal and near-shore underwater zone.

The MarEA project is building on the coastal documentation that has been previously achieved by the EAMENA team. In order to determine the nature and degree of threat, the MarEA team documents the changing nature of maritime archaeological sites. Furthermore, local to regional-scale sea-level change, sedimentary and erosional processes provide a framework within which the team can identify and interpret coastal and underwater sites with respect to their location both past and present. The relationship of maritime sites to the sea is often dynamic and changeable over time and space, owing to the above-mentioned processes. A further component of the project includes targeted coastal and marine survey and ground-checking survey. Priority will be given to areas of imminent threat and/or high archaeological potential. A detailed programme of engagement with our existing networks and projects will be included in the initial stages of the MarEA work while also aiming to create new partnerships in the MENA region.

Acknowledgements

The EAMENA and MarEA projects are funded by the Arcadia Fund. The EAMENA-CPF training workshops are funded by the British Council's Cultural Protection Fund in partnership with the Department for Digital, Culture, Media & Sport. The EAMENA project is a collaboration between the universities of Oxford, Leicester and Durham, under the overall direction of Prof. Andrew Wilson and Dr Robert Bewley (Oxford), with co-investigators Prof. David J. Mattingly (Leicester) and Prof. Graham Philip (Durham). The MarEA project is a collaboration between the universities of Southampton and Ulster and is directed by Dr Lucy Blue (Southampton) and Dr Colin Breen (Ulster).

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Julia Nikolaus, School of Geography and Environmental Sciences - Ulster University, Cromore Road, Coleraine, BT52 1SA, United Kingdom, j.nikolaus@ulster.ac.uk

Louise Rayne, School of Archaeology and Ancient History - University of Leicester, Leicester, LE1 7RH, United Kingdom, ler14@leicester.ac.uk

Nichole Sheldrick, Institute of Archaeology, - University of Oxford, South Parks Road, Oxford, OX1 3TG, United Kingdom, nichole.sheldrick@arch.ox.ac.uk

Finito di stampare nel mese di luglio 2020
da «L'ERMA» di BRETSCHNEIDER,
tipografia CSC Grafica s.r.l. via A. Meucci, 28
00012 - Guidonia - Roma