Focusing on the Elmina Castle (1482, Ghana) the school introduces the principles of structural diagnostics of heritage masonry buildings with the aim to produce a systematic survey (manual, photogrammetric, laser scanning, aerial drone photography) and related digital reconstructions of select areas of the Castle. The school also fosters the understanding of the historical environment, and in particular the pivotal role in the Transatlantic World, of Elmina Castle through study visits to other forts and castles in coastal Ghana. In addition, the school offers a broader view of Ghana’s natural and cultural heritage through guided visits to selected archaeological sites and national parks. There are no pre-requisites. The field school is designed to attract undergraduate and graduate students in the humanities, social sciences, and engineering interested in acquiring skills in a multidisciplinary environment.

Faculty: Prof. Renato Perucchio, Co-director – Mechanical Engineering and Director, Archaeology Technology and Historical Structures, University of Rochester – renato.perucchio@rochester.edu; Prof. Kodzo Gavua, Co-director – Archaeology and Heritage Studies and Dean, School of Arts, College of Humanities, University of Ghana - kgavua@ug.edu.gh; Prof. Michael Jarvis, History and Director, Digital Media Studies, University of Rochester - michael.jarvis@rochester.edu, and Prof. William Gblerkpor, Archaeology and Heritage Studies, University of Ghana - gblerkpor@utexas.edu.

Teaching Assistants: to be selected from UG graduate students in Archaeology and Heritage Studies and from the personnel of the Ghana Museums and Monument Board

Program Dates: 28 May 2017 – 1 July 2017 (35 days)

Academic Credits: Students register for six credits in the UR Archaeology, Technology, and Historical Structures (ATH) summer 2017 ATH 299 Digital Archaeology of Heritage Structures of West Africa (to be approved)

Program Fee: $4,950 – includes tuition plus all room & board and internal travel while in Ghana.
INTRODUCTION

The UR Archaeology Technology and Historical Structures and the UG Department of Archaeology and Heritage Studies intend to initiate a comprehensive multi-year multi-disciplinary study of the Elmina Castle, Cape Coast Castle, Fort Amsterdam, Fort Williams, Fort James and the Christiansborg Castle, all of which are UNESCO World Heritage Sites found along the coast of Ghana. The study shall begin in summer 2017 with a multi-disciplinary field school on digital archeology focused on the Elmina Castle, a monument of extraordinary importance for understanding four centuries of interactions between West Africa, Europe, and the Americas beginning with the late 15th century and extending through the peak of the Atlantic Trade in Enslaved People in the 17th and 18th centuries. The field school is jointly organized by the University of Rochester and the University of Ghana.

Elmina Castle

Built in 1482 by the Portuguese Crown as São Jorge da Mina, Elmina Castle is the oldest permanent structure constructed by Europeans in Sub-Saharan Africa, and the first in a long series of fortified trading bases that various European countries established along the West Coast of Africa. The building is the best-preserved and most complete example of early European masonry construction in Sub-Saharan Africa. The meticulously planned Castle served as an imposing commercial outpost over four centuries, becoming a center of vigorous international trade. During the 15th and 16th centuries, it controlled the sea trade between the Gold Coast and Europe, protecting Portugal's monopoly of the gold trade against Castilians, French and English. In 1637, the Dutch wrested control of Elmina Castle from the Portuguese and made it a major hub of an Atlantic Slave Trade involving Europe, Africa, the Americas, and, indirectly, India.

The economic dimensions and the resultant social effects of the global trade centered at the Elmina Castle were highly significant. By the beginning of the 16th century, the Gold Coast was providing an estimated 10% of the world's known annual gold supply, dispatching nearly 1,000 kg of gold to Lisbon between 1490 and 1560. Between 1500 and 1808, nearly three quarters of a million Africans were shipped from the Gold Coast to the New World as part of the larger Atlantic Transatlantic slave trade. The Castle was also a religious and education center where the first chapels and schools were established to provide European education and coordinate Christian missionary activity.

The process of construction and continuous rebuilding under the Portuguese and the Dutch introduced materials and technologies new to West Africa while also reflecting changes in European military architecture development, making Elmina Castle an ideal location for studying how European military building technology evolved and was adapted to the particular conditions of West Africa. After Ghana became an independent country, the Castle was given over to the Ghana Museums and Monuments Board in 1972 and included by UNESCO in the World Heritage List.
Long Term Project Objectives

The overarching goal is to perform an integrated archaeological, ethnographic, historical, and engineering study of Elmina Castle and subsequently other historic buildings using state-of-the-art methodologies and instrumentation. Our objectives include the creation of a state-of-the-art digital environment for multi-disciplinary study, virtual visualization, and material conservation of the castles and forts. On the ethnographic side of the study, our aim is to identify and define relationships that may have developed between the monuments and local people and their life ways. We expect that our multi-year project will train graduate students and early career researchers from archaeology and engineering and allied fields to operate in a multi-disciplinary research environment and to acquire skills in digital archaeology and monument analysis.

2017 Field School Course Objectives

The objective is to introduce the students to the principles of structural diagnostics of heritage masonry buildings with the aim to produce a systematic survey (manual, photogrammetric, laser scanning, aerial drone photography) of select areas of Elmina Castle and related digital reconstructions. The school will also foster the understanding of the historical environment, and in particular the pivotal role in the Transatlantic World, of Elmina Castle through study visits to other forts and castles in coastal Ghana. In addition, the school will offer a broader view of the country’s natural and cultural heritage through guided visits to selected archaeological sites and national parks. The students will work closely with archaeologists, engineers, and historians with combined specializations on West Africa, historical masonry structures, and digital surveying and reconstruction techniques. They will take part in the following activities:

- **Building structural analysis** – students will acquire a background understanding of why earthen and masonry historical buildings stand up and why they fall down. This includes notions of statics, materials, construction, failure, and conservation with case studies focused on the European forts and castles of coastal Ghana.

- **Historical and cultural context** – students will be guided to understand the historical and cultural context within which the forts and castles were constructed, modified, and used over five hundred years. This will include an overview of the cross-cultural interactions and engagements involving Europe, the Americas, and Africa. Students will visit archeological and historic sites, as well as local settlements and national parks.

- **Surveying** – students will learn and practice manual and digital (photogrammetry, laser scanning and aerial drone photography) surveying techniques as applied to architectural units and entire monumental structures.

- **Recording** – students will participate in systematic recording of multiple data related to the architecture, material characterization, and damage conditions of structural elements such as walls, vaults, roofs, and floors.

- **2D and 3D modeling** – students will learn and practice the construction of 2D and 3D digital models of buildings based on integrating multiple surveying data.

- **Data evaluation and report preparation** – students will participate in the preparation of a comprehensive report which will include a preliminary evaluation of the findings in terms of structural integrity, construction sequence, and the historical and cultural context.
PREREQUISITES

There are no prerequisites. The school is designed to attract undergraduate and graduate students in the humanities, social sciences, and engineering interested in acquiring a multidisciplinary advanced training on surveying, digital modeling and engineering evaluation for the study and conservation of heritage earthen and masonry buildings of West Africa. The material covered is self-contained and integrates lectures with extensive hands-on experiential learning.

PROGRAM SCHEDULE

<table>
<thead>
<tr>
<th>WEEK</th>
<th>DATE</th>
<th>LOCATION</th>
<th>ACTIVITIES - MORNING</th>
<th>ACTIVITIES - AFTERNOON</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>28-May</td>
<td>Legon</td>
<td>orientation to Ghana - historical background (KG)</td>
<td>visit to Museum in Legon and to campus (KG, WG)</td>
</tr>
<tr>
<td></td>
<td>29-May</td>
<td>Legon</td>
<td>lecture (RP - statics)</td>
<td>visit to historical Accra and Museum (KG, RP)</td>
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<tr>
<td></td>
<td>30-May</td>
<td>Legon</td>
<td>lecture (RP - materials)</td>
<td>lecture (KG - survey)</td>
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<tr>
<td></td>
<td>31-May</td>
<td>Legon</td>
<td>lecture (RP - structures)</td>
<td>lecture (KG - survey)</td>
</tr>
<tr>
<td></td>
<td>1-June</td>
<td>Legon</td>
<td>visit Fort Usher, James, and Cristiansborg (KG, RP)</td>
<td>local visits and shopping in Accra</td>
</tr>
<tr>
<td></td>
<td>2-June</td>
<td>Legon</td>
<td>site visit and lecture to Krobo Mountain, Shai National Park, and Akosombo Dam on Volta river (WG, RP)</td>
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<tr>
<td>2</td>
<td>4-June</td>
<td>Legon</td>
<td>lecture (RP - structural failures)</td>
<td>review of assignments (RP, KG)</td>
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<tr>
<td></td>
<td>5-June</td>
<td>Cape Coast</td>
<td>move to Cape Coast - Elmina</td>
<td>reconnais. of Elmina Castle and Fort St. Jago (KG, RP)</td>
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<tr>
<td></td>
<td>6-June</td>
<td>Cape Coast</td>
<td>lecture (RP - visual assessment)</td>
<td>lecture (KG - survey)</td>
</tr>
<tr>
<td></td>
<td>7-June</td>
<td>Cape Coast</td>
<td>manual survey and visual assess. (RP, KG, WG)</td>
<td>data processing and prelim. evaluation (RP, KG, WG)</td>
</tr>
<tr>
<td></td>
<td>8-June</td>
<td>Cape Coast</td>
<td>manual survey and visual assess. (RP, KG, WG)</td>
<td>data processing and prelim. evaluation (RP, KG, WG)</td>
</tr>
<tr>
<td></td>
<td>9-June</td>
<td>Cape Coast</td>
<td>site visits and lecture to Fort Amsterdam and Cape Coast Castle (RP, KG)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10-June</td>
<td>Cape Coast</td>
<td>manual survey and visual assess. (RP, KG, WG)</td>
<td>intermediate revision and global assess. (RP, KG, WG)</td>
</tr>
<tr>
<td>3</td>
<td>11-June</td>
<td>Cape Coast</td>
<td>lecture (Introduction to photogrammetry and laser scanning: data acquisition and processing - MJ)</td>
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<tr>
<td></td>
<td>12-June</td>
<td>Kumasi</td>
<td>travel to Kumasi and lake Bosumtwi</td>
<td></td>
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<tr>
<td></td>
<td>13-June</td>
<td>Kumasi</td>
<td>site visits and lectures to Kumasi (vernacular architecture, museums) (KG, RP)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>14-June</td>
<td>Kumasi</td>
<td>site visits and lectures to Kumasi (vernacular architecture, museums) (KG, RP)</td>
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<tr>
<td></td>
<td>15-June</td>
<td>Kumasi</td>
<td>site visits and lectures to Kumasi (vernacular architecture, museums) (KG, RP)</td>
<td>return to Elmina</td>
</tr>
<tr>
<td></td>
<td>16-June</td>
<td>Cape Coast</td>
<td>rotations between manual survey, photogr. and laser scanning (MJ, KG, WG)</td>
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<tr>
<td></td>
<td>17-June</td>
<td>Cape Coast</td>
<td>rotations between manual survey, photogr. and laser scanning (MJ, KG, WG)</td>
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<tr>
<td></td>
<td>18-June</td>
<td>Cape Coast</td>
<td>data processing lab work (MJ)</td>
<td>intermediate revision and global assess. (MJ, KG, WG)</td>
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<tr>
<td></td>
<td>19-June</td>
<td>Cape Coast</td>
<td>rotations between manual survey, photogr. and laser scanning (MJ, KG, WG)</td>
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<tr>
<td></td>
<td>20-June</td>
<td>Cape Coast</td>
<td>visit to Kakum National Park</td>
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<tr>
<td></td>
<td>21-June</td>
<td>Cape Coast</td>
<td>data processing and preliminary evaluations (lab work - KG, WG)</td>
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<tr>
<td></td>
<td>22-June</td>
<td>Cape Coast</td>
<td>manual survey and visual assessment (KG, WG)</td>
<td>data processing and preliminary evaluation (KG, WG)</td>
</tr>
<tr>
<td></td>
<td>23-June</td>
<td>Cape Coast</td>
<td>manual survey and visual assessment (KG, WG)</td>
<td>data processing and preliminary evaluation (KG, WG)</td>
</tr>
<tr>
<td></td>
<td>24-June</td>
<td>Cape Coast</td>
<td>final revision and global assessment (RP, KG, WG)</td>
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</tr>
<tr>
<td>4</td>
<td>25-June</td>
<td>Cape Coast</td>
<td>site visits and lectures to Fort Patience - Apam (KG, RP)</td>
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<tr>
<td></td>
<td>26-June</td>
<td>Legon</td>
<td>visit to Ada-Foah - swimming in the ocean</td>
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<tr>
<td></td>
<td>27-June</td>
<td>Legon</td>
<td>final report preparation (RP, KG, WG)</td>
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<tr>
<td></td>
<td>28-June</td>
<td>Legon</td>
<td>final report preparation (RP, KG, WG)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>29-June</td>
<td>Legon</td>
<td>presentations and conclusions (RP, KG, WG)</td>
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<tr>
<td></td>
<td>30-June</td>
<td>Legon</td>
<td>local visits and shopping in Accra</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1-July</td>
<td>Legon</td>
<td>DEPARTURES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2-July</td>
<td>Legon</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Requirements**

All students are required to keep individual field notes and to complete a course project. Undergraduates will work in teams to produce a research report. Each graduate student will be responsible for an individual report. The course grade will be based as follows:

- Participation: 30%
- Field notes: 20%
- Preliminary report presentation: 20%
- Final report: oral presentation: 10%, written report: 20%

**Course Material**

Each student must bring:

**Equipment:**

1. Personal laptop
2. Simple scientific calculator (capable of making trigonometric calculations)
3. A drawing set including two triangles, a ruler, goniometer, and a protractor
4. Drawing pencils (automatic) and erasers
5. Flash memory (at least 32Gb)
6. Electric adaptors (compatible with British/Ghanaian electric outlets)

**Textbooks:**

3. A packet with selected articles and book chapters on the archaeology of West Africa, Elmina, the European forts and the Atlantic Trade, plus survey papers on the various techniques used in the course will be provided in PDF format.

The course will provide the following equipment:

1. Desktop server with appropriate application software packages
2. Laser measures and tripods
3. Digital cameras
4. 5 meter tape measure and 1 meter folding ruler
5. Levels
6. Photo scales
7. Compasses
8. Engineering graph paper and drawing boards
9. Field notes books

**Travel Details**

**Arrival**

- Students should arrive at Kotoka International airport (Accra) on Sunday May 28, 2017 where they will be met by a designated driver and will be taken to the residence on UGhana Legon campus. Local cell phone numbers for the program directors and other emergency contact information will be provided at the time of enrollment. If you miss connection flights or your arrival is delayed, please notify (via phone, email, or text) the program directors.

**Visa Requirements**

Travelers to Ghana are required to obtain a Ghanaian visa. To apply for a visa, your passport must be valid for at least six months after the date of entry. You must obtain a visa before arrival in Ghana by applying directly to a Ghanaian consulate or by using an international visa service. We will provide an official letter in support of your application.
Accommodations – During the first and last week students will be hosted at the International Student Hostel in the Legon Campus of the University of Ghana, one or two persons per room with toilet and shower in each room. Sheets and pillows will be provided, but you will have to bring your own towel.

During weeks 2-4 the program will move to Cape Coast/Elmina and students will lodge at a modern guest house within the campus of the University of Cape Coast, one or two persons per room with toilet and shower in each room. Sheets and pillow will be provided. Similar housing will be provided during the three-day visit to Kumasi at mid-program.

Breakfast, lunch and dinner will be provided throughout the duration of the program (from the arrival to the day of departure, included.) Transportation will be provided with a UGhana coastal bus. All transportation expenses and the entry fees to museums and parks are covered by the program.

Mail and Cell Phones – We require that you bring a GSM/unlocked cell phone and purchase a rechargeable SIM card in Ghana. This will allow to maintain phone and internet connection for your local and international communications needs. You can buy Rechargeable SIM cards at the Kotoka airport while waiting for your luggage. The international telephone code for Ghana is 233 (from the US, you must dial +11 233).

Health and Safety – Yellow fever vaccination is required to entry into Ghana. Travelers must show proof of vaccination by carrying the International Certificate of Vaccination (also known as yellow card). The medical office which gives you the vaccination will issue the yellow card specifying the vaccine type and date. We strongly recommend that you consider taking anti-malaria medications since all areas of Ghana visited during the field school carry the risk of mosquito-borne malaria. You should consult with your doctor on the type of anti-malaria treatment appropriate for your case. You should also bring with you an insect repellent. The Center for Disease Control and Prevention (CDC) also recommends vaccination against Hepatitis A and Typhoid for all the visitors to Ghana. Students should carefully review the health information for travelers to Ghana provided by CDC at https://wwwnc.cdc.gov/travel/destinations/traveler/none/Ghana/. Travelers are recommended to stick to safe eating and drinking habits. Drinking water is generally unsafe in Ghana. Use only bottled, boiled, or otherwise purified water for drinking. Do not use ice cubes made from unpurified water sources. Eat only thoroughly cooked food served hot, or fruits and vegetables that you have cleaned and peeled; avoid salads. Consume only pasteurized milk and dairy products, or use powdered or canned milk and cured cheeses. Avoid street vendors and unregulated food establishments. Bring anti-acid and traveler’s diarrhea medications prescribed by your doctor. For a comprehensive review of safe eating and drinking habits we recommend that you carefully read the CDC information at https://wwwnc.cdc.gov/travel/page/food-water-safety.

Participants taking prescriptions should carry all required documents and medications with them.

Ghana has a tropical, constantly humid, climate with very little distinction between seasons. Temperatures during the day will average 30 C (86 F), and can drop to as low as 20 C (68 F). Exposure to the sun can be damaging: loose clothing that covers most of the body and a wide brim hat to protect face and neck should be worn while working in the outdoors. Central and southern regions of Ghana experience a rainy season from April to June and again from September to November. Severe torrential rain falls during the annual monsoon season, which starts in June. This causes floods in low-lying areas, and river banks to burst.

Finally, we require that all participants download and read the iJet Ghana Trip Brief. To do so, open the link https://planner.worldcue.com/portal/auth/portal/planner?username=RochesterPlanner and go to Location Intel, type in the destination (if city is not listed, just select GO on country), download "Trip Brief" under Location Reports on right hand side.
**Program Visits**

In addition to the Elmina Castle, the academic program includes the following visits (see map):

- Historical Accra, including Fort Usher, Fort James, and Christiansborg Castle
- Krobo Mountain Archaeological Site, Shai Hills Reserve, and Akosombo Dam on the Volta River
- Historic Elmina town and Fort St. Jago.
- Cape Coast Castle and Fort Amsterdam
- Historical Kumasi, including museums and vernacular architecture, and Lake Bosumtwi
- Kakum National Park
- Fort Patience in Apam
- Historic Ada-Foah, including Fort Kongenstein and swimming in the ocean.

**Program Costs**

All participants must enroll in **ATH 299 Digital Archaeology of Heritage Structures of West Africa** for six credit hours.

Program fee: **$4950.** The fee includes tuition and all expenses (room, board, all program-related transportation within Ghana, admissions to museum and parks visited as part of the program) for the duration of the program, with the exception of textbooks. **Airfare to Ghana is not included in the fee, and participants are expected to make their own travel arrangements to arrive in Accra.**

University of Rochester students are eligible for a $500 travel stipend.

**Application**

Application deadline is March 31, 2017. Applicants received before March 1 will be accepted on a rolling basis. While the online application system is being set up, prospective applicants are strongly recommended to contact Prof. Renato Perucchio at renato.perucchio@rochester.edu.

**Practical Information**

**Currency** – The Ghanaian currency is the **New Cedi.** In February 2017 the exchange rate was: **1 US$ = 4.30 New Cedi.** Bring your ATM card. To avoid having your card locked when you try to use it outside the US, before you leave inform the bank that you are traveling to Ghana. You may also want to consider acquiring a little amount of New Cedis before you leave.

**Travel** – The Bradt Travel Guide **Ghana** by Philip Briggs (7th edition, just published in Feb 2017) provides a reliable and comprehensive source of travel information. We highly recommended it.

**Attire** – Bring only loose clothing. No formal attire is required. Loose attire to covers most of the body and a wide brim hat (not a baseball cap) to protect face and neck from sun exposure should be worn while working in the outdoors.