


IDI Showcase  
May 7, 2015  
UC San Diego

**Cyber-Archaeology and  
Challenges of Research Data  
Curation:**  
*The Impact of New  
Approaches to Data Capture,  
Curation, Analyses and  
Dissemination*

Thomas Levy  
Distinguished Professor  
Department of Anthropology & Qualcomm Institute/Calit2  
University of California, San Diego



HOME




Research Data Curation Program

Need assistance with  
Data Management?

We can help!



**DMPTool**

Build your Data Management Plan

IDI leads you to digital infrastructure to support your research and instruction.

## What is IDI?

UCSD's Integrated Digital Infrastructure (IDI) service streamlines the delivery of cutting-edge IT services to UCSD faculty, researchers, and students.

Working with all the IT providers on campus (ACMS, ACT, Calit2/QI, the Library, SDSC, and departments/divisions), IDI directs you to:

- [High-speed network connections](#)
  - Push big data swiftly across campus, to SDSC facilities, and to the world
- [High-performance computing](#)
  - Make your cluster dollars go further, or take advantage of as-needed cycles for smaller projects
- [Colocation facilities](#)
  - Find a home for your equipment that's greener, safer, and wastes less lab space
- [Storage/Cloud](#)
  - Get more disk space, better backups, improved uptime/accessibility.
- [Tools & training](#)
  - Learn about electronic lab notebooks for the classroom & lab, and find cutting-edge IT training opportunities at UCSD
- [Research Data Curation](#)
  - Manage, curate, and archive the results of your research work

### [IDI Showcases May 6-7](#)

IDI Showcases on May 6 & 7 offer lightning talks from faculty who have benefited from IDI support, plus info on how to apply for support in 2015/16. Join us to learn more!

### [IDI Call for Proposals 2015/16](#)

The IDI Call for Proposals for funding for 2015/16 Transformational Projects and Digital Research Platforms is now available! Proposals are due on June 15, 2015, so act fast.





*“Inventing a persistent, collaborative research and education environment as a model for the major research university in the 21st Century” –  
Larry Smarr, Mission Statement, Calit2*







Welcome

The National Science Foundation's Integrative Graduate Education and Research Traineeship (IGERT) program is investing \$3.2 million over five years in a University of California, San Diego-based project for Training, Research and Education in Engineering for Cultural Heritage Diagnostics (TEECH). With field sites in Italy, Jordan and Mongolia, the international IGERT-TEECH program is carried out through the UCSD Center of Interdisciplinary Science for Art, Architecture and Archaeology (CISA3), a partnership of the California Institute for Telecommunications and Information Technology (Calit2), Jacobs School of Engineering, and UCSD's Division of Arts & Humanities.



News Releases

- May 20, 2014  
Tut's Tomb: A Replica Fit for a King
- Jan 15, 2014  
UC San Diego Students Look Back on Fall Field Expedition in Florence
- Dec 13, 2013  
Qualcomm Institute Joins World Cultural Leaders at Digital Heritage International Congress
- Nov 07, 2013  
Dispatches from the Field: Interdisciplinary Team Deployed Near Tip of Italys Boot
- Nov 06, 2013  
Final Printed Version of ArchaeoSTOR Research Article
- Oct 25, 2013  
Students As Oracles: In Delphi, UC San Diego Researchers Report Cyber-Archaeology Findings

Media Clips

- May 20, 2014  
Tut's Tomb: A Replica Fit for a King
- Sep 12, 2013  
TopCoder Teams with NASA and National Geographic Emerging Explorer Albert Lin to Create a Powerful Algorithm that Identifies Human-Built Structures in Genghis Khan's Homeland
- Oct 30, 2012  
The scientific quest to find the lost Da Vinci
- Oct 15, 2012  
Maurizio Seracini: The secret lives of paintings

Multimedia

- Sep 13, 2013  
Collective Minds and Machine Learning Exploration Challenge
- Jun 4, 2013  
Ashley Richter - NSF IGERT Video and Poster Competition
- Mar 13, 2013  
IGERT Trainees Demo Technologies for CENIC Annual Meeting

Graduate Student Participation:

NSF Integrative Graduate Education and Research Traineeship (IGERT) grant – 2010 – 2015 - \$3.2 million



Training, Research and Education In Engineering for Cultural Heritage Diagnostics (TEECH)

Falko Kuester, PI  
Thomas Levy, Co-PI  
Maurizio Seracini, Co-PI





UCSD  
LEVANTINE AND  
CYBER-ARCHAEOLOGY LAB  
EXPEDITIONS

GREECE

CYPRUS

JORDAN

ISRAEL

SAUDI ARABIA

TURKEY

SYRIA

LEBANON

ISRAEL

JORDAN

IRAQ

IRAN

KUWAIT

PERSIAN

QATAR

U.A.E.

OMAN

YEMEN

EGYPT

SUDAN

RED SEA

ARABIAN SEA





# TYPES OF PROJECTS

Cyberinfrastructure

Paleomagnetic Dating

Archaeometallurgy / Cultural Heritage

Archaeometallurgy

Cultural Heritage

Cultural Heritage



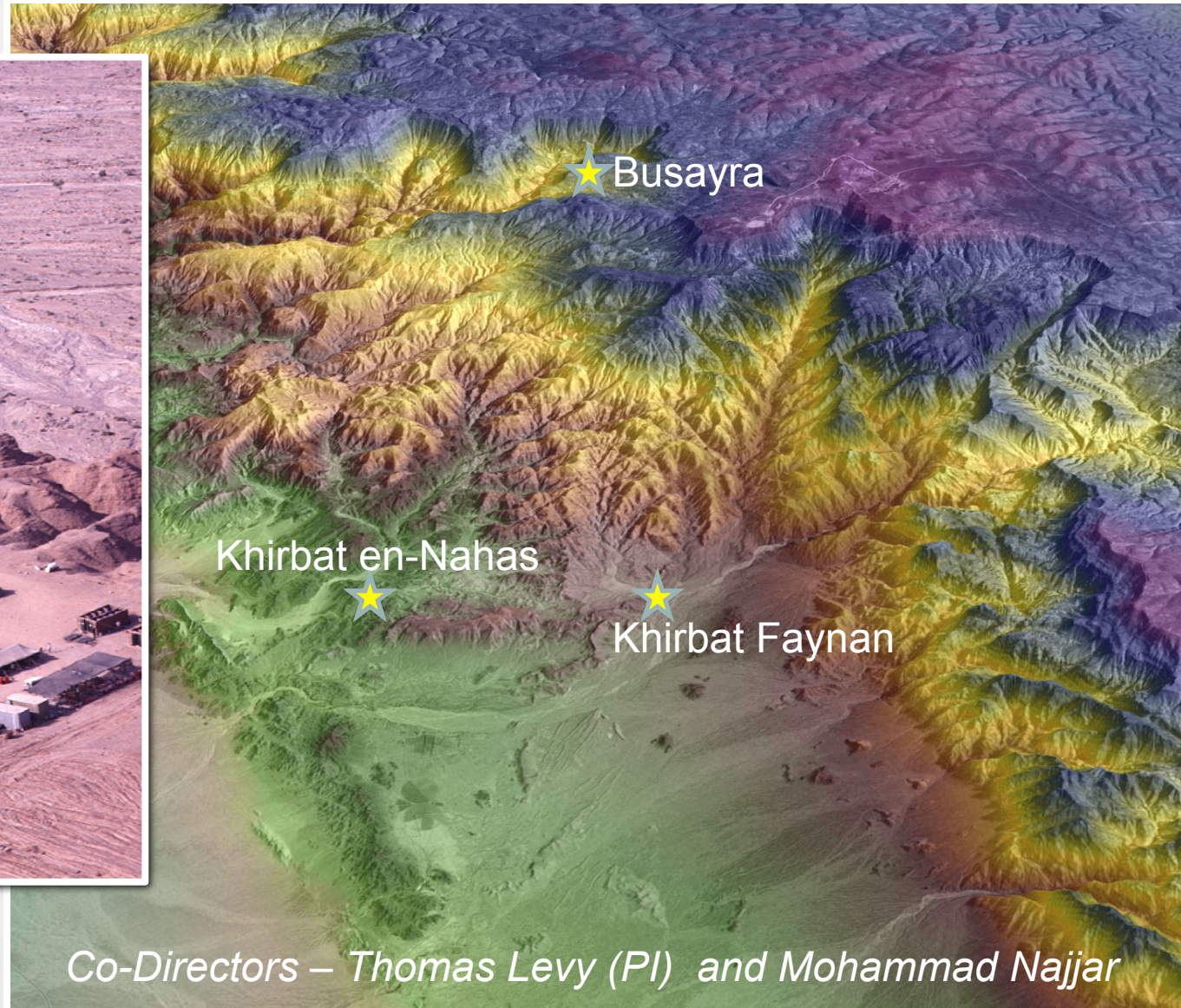
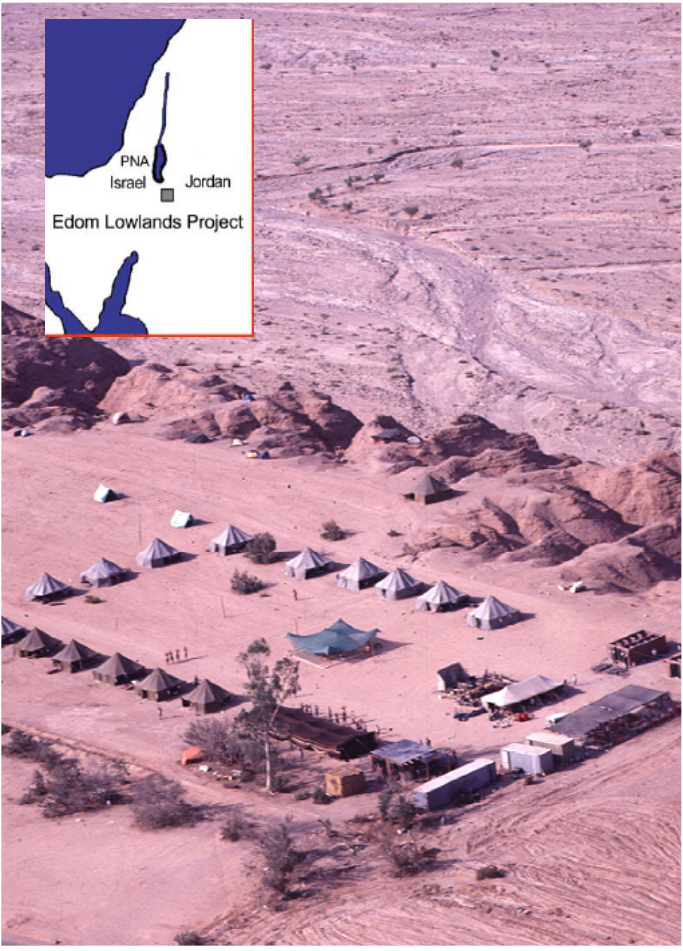
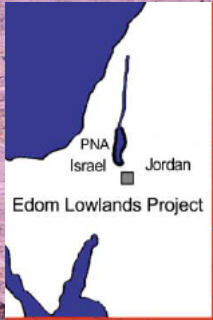


The old way of digging and recording:  
1979 - 1998





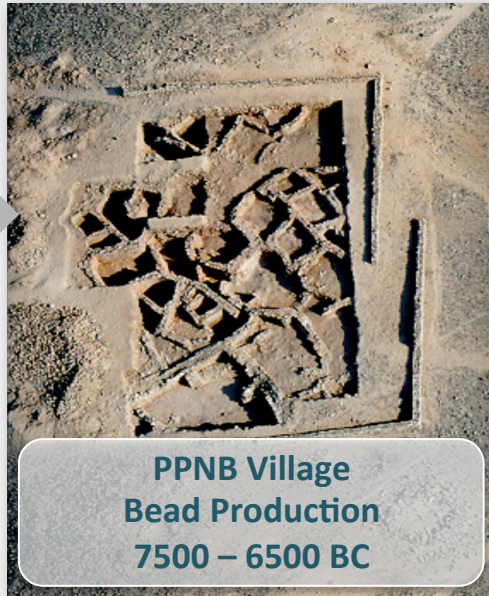
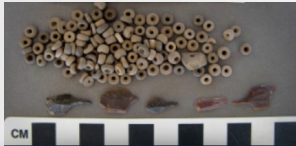
# UCSD ELRAP in Jordan - A 'Deep Time' Study of Technology (metallurgy) & Social Evolution



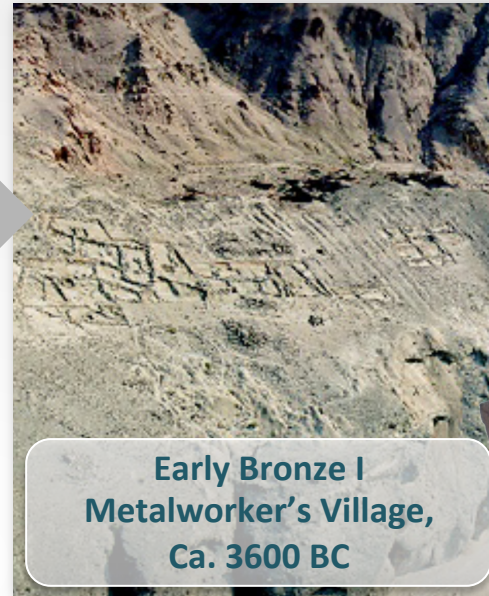
*Co-Directors – Thomas Levy (PI) and Mohammad Najjar*



# UCSD Deep-time Metallurgy Research in Faynan, Jordan

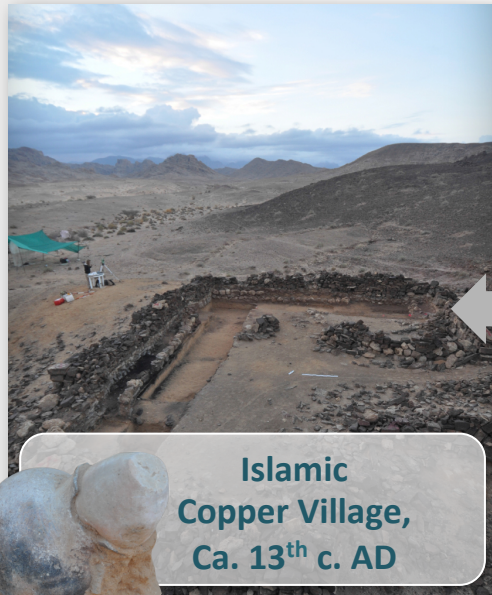


**PPNB Village  
Bead Production  
7500 – 6500 BC**



**Early Bronze I  
Metalworker's Village,  
Ca. 3600 BC**

*with  
Mohammad Najjar*



**Islamic  
Copper Village,  
Ca. 13<sup>th</sup> c. AD**



**Iron Age  
Copper Factory,  
Ca. 1200 – 900 BC**



**Early Bronze III-IV  
Metal Manufactory,  
Ca. 2700 – 2000 BC**







# New Explorations in Iron Age Edom – Anthropological & Historical Approaches

## Organization of Craft Production (after Costin)

- Context – Degree of Elite Sponsorship
- Concentration – Distribution over landscape
- Scale – size of labor force,  
- principles of labor recruitment
- Intensity – full time/part-time

## Trade

## Ethnogenesis – Edom and Israel

## Social Evolution

*Khirbat en-Nahas, Jordan, ca. 10 ha  
Helicopter shot courtesy Queen Noor*







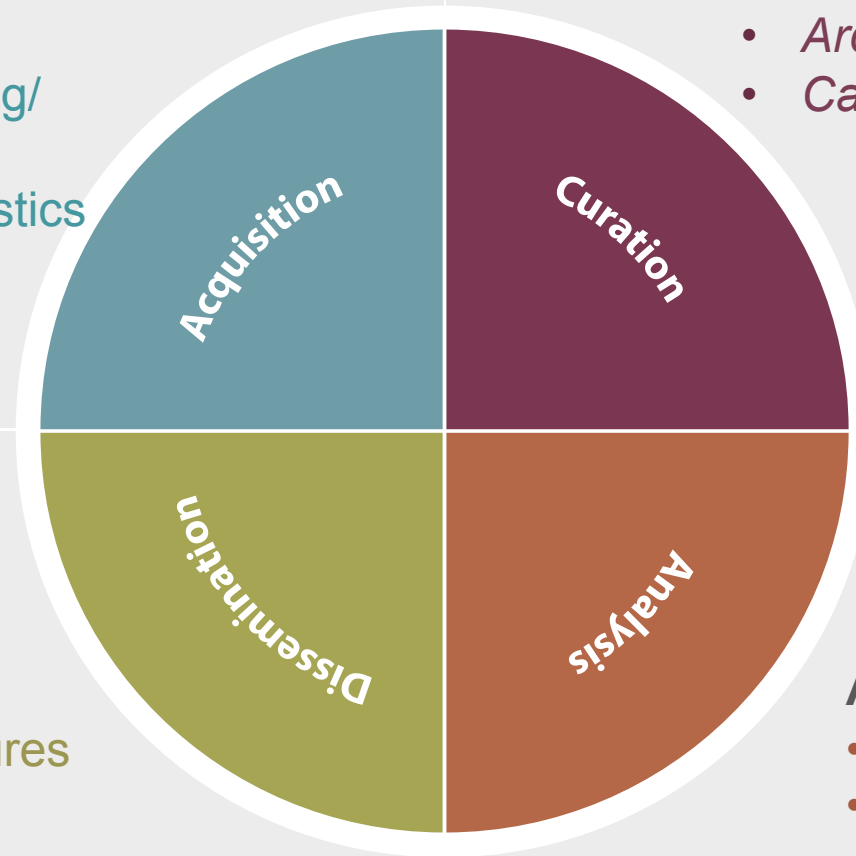


## ACQUISITION

- Archaeology Research Design
- Digital Data Collection Tools
- Diagnostic Imaging/ Geophysics
- Analytical Diagnostics
- *ArchField*
- *OpenDig*

## CURATION

- Data Storage
- Geo-Spatial Mapping
- Augmentation
- *ArchaeoSTOR*
- *California Digital Library*



## DISSEMINATION

- Cyber-Infrastructures
- Open Access
- Citizen Science
- Print Publishing
- CAVES
- Archaeo-Diplomacy

## ANALYSIS

- Modeling & Simulation
- Visual Analytics
- Crowd Sourcing
- 3d Visualization
- Cultural Analytics



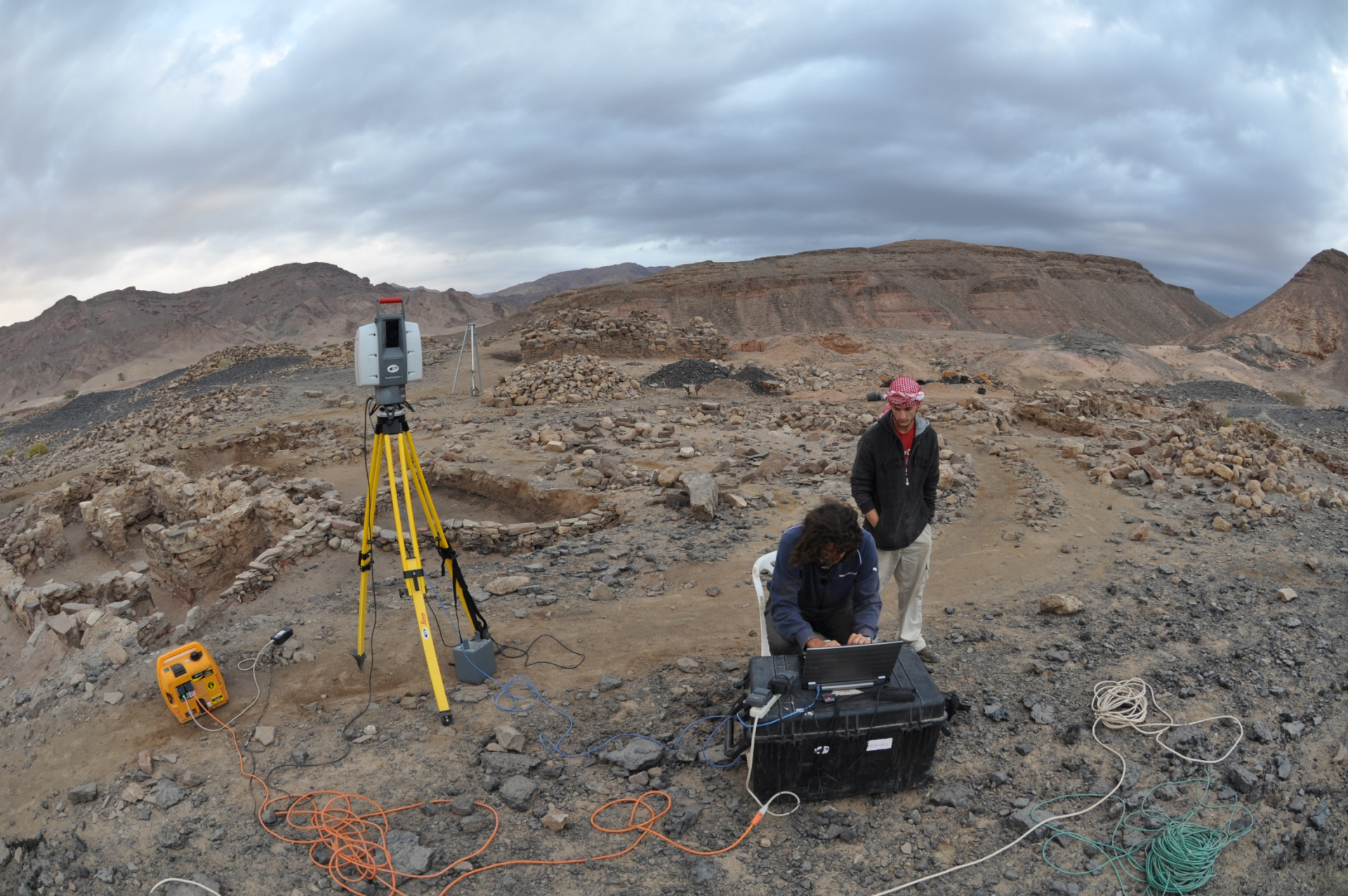
ArchField

OpenDig

ArchaeoSTOR







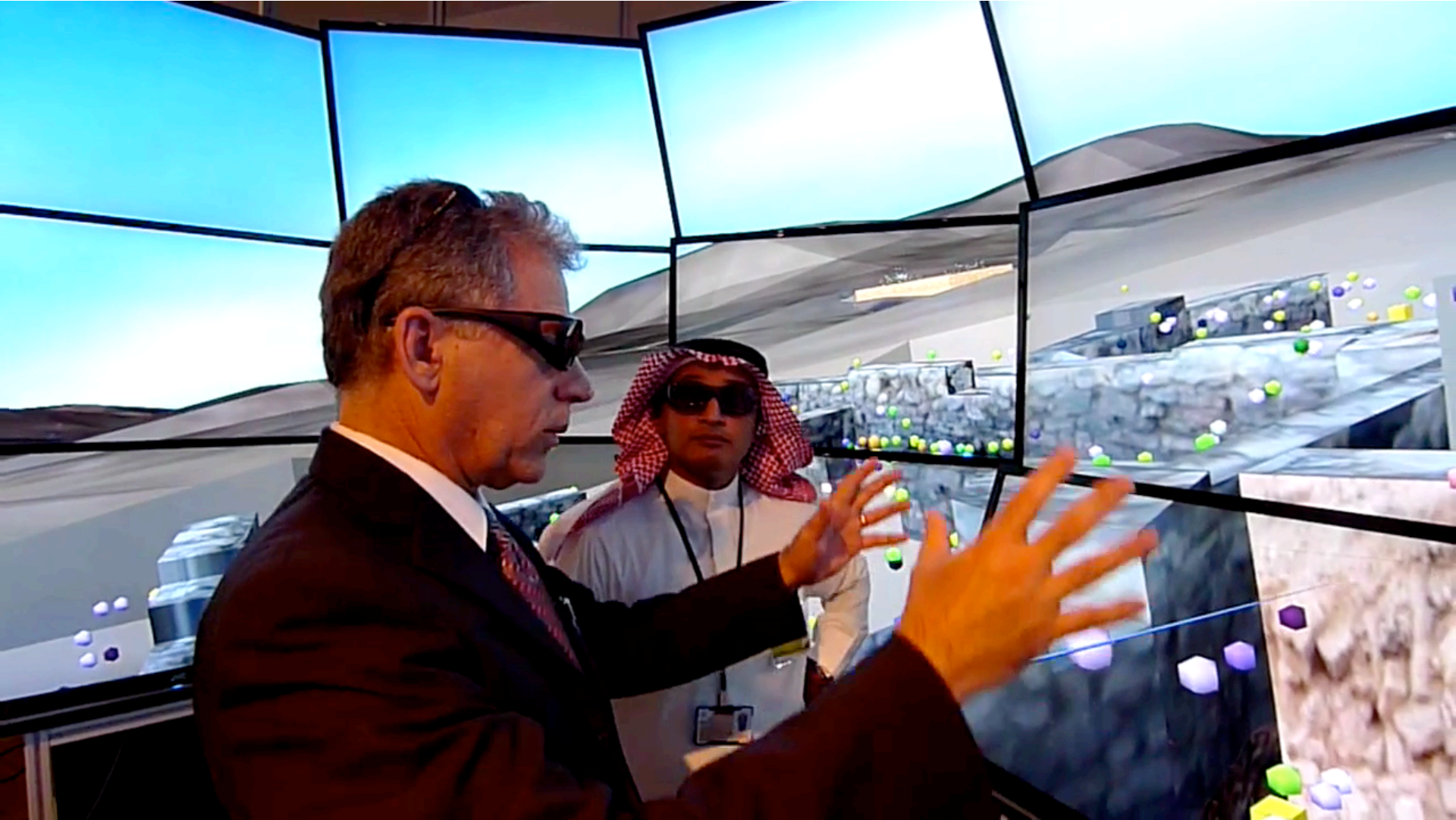
LIDAR (Light Detection And Ranging) - Laser Range Finder Scanner, Khirbat en-Nahas, Jordan, November, 2009 Project: Tom Wypych and Vid Petrovic







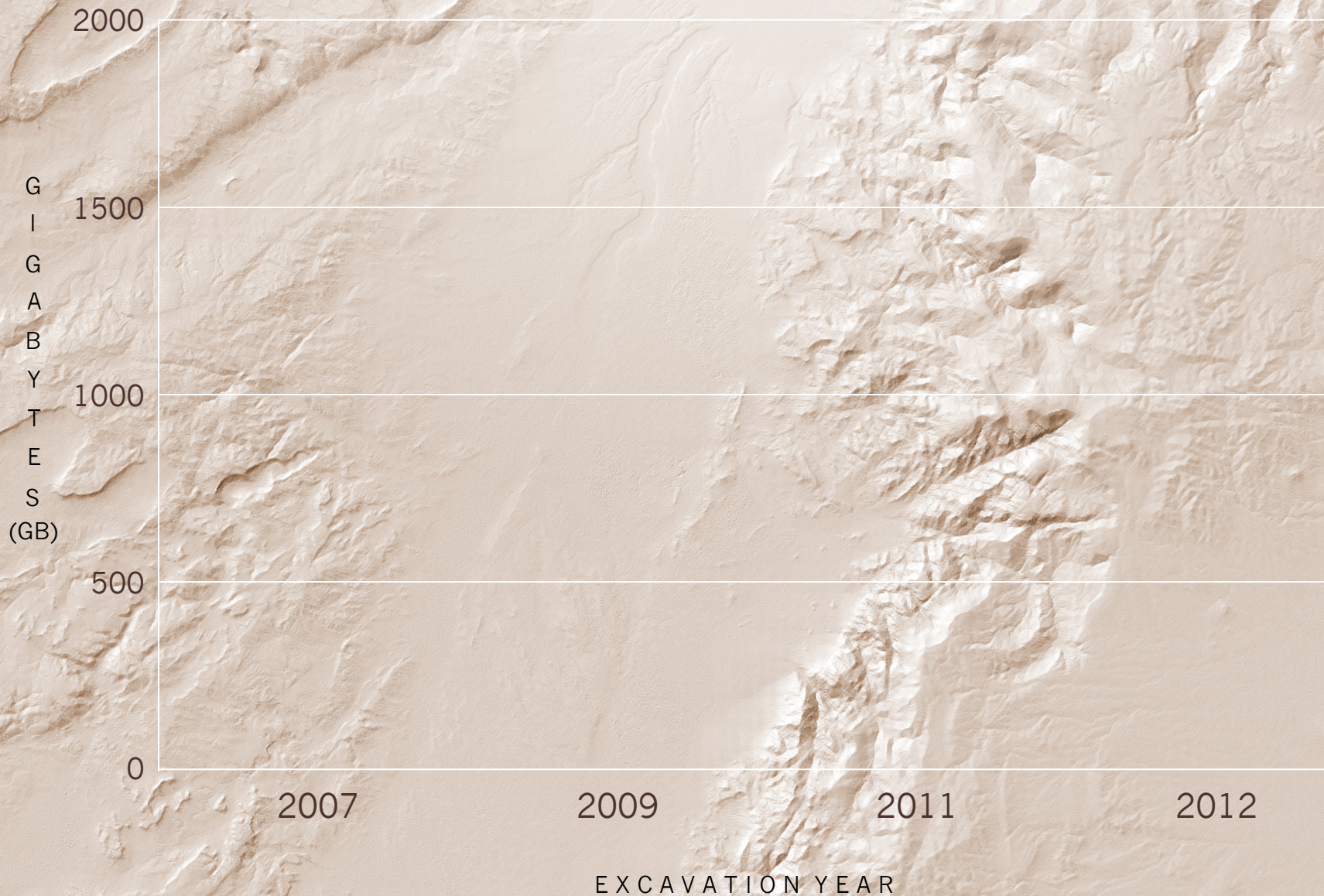
Calit2 - KAUST's *NexCAVE* – International collaboration enables new portable *NexCAVE* & new Cyberinfrastructure



*Jordan archaeology data displayed at KAUST  
Grand opening, PI- Tom DeFanti, Calit2*

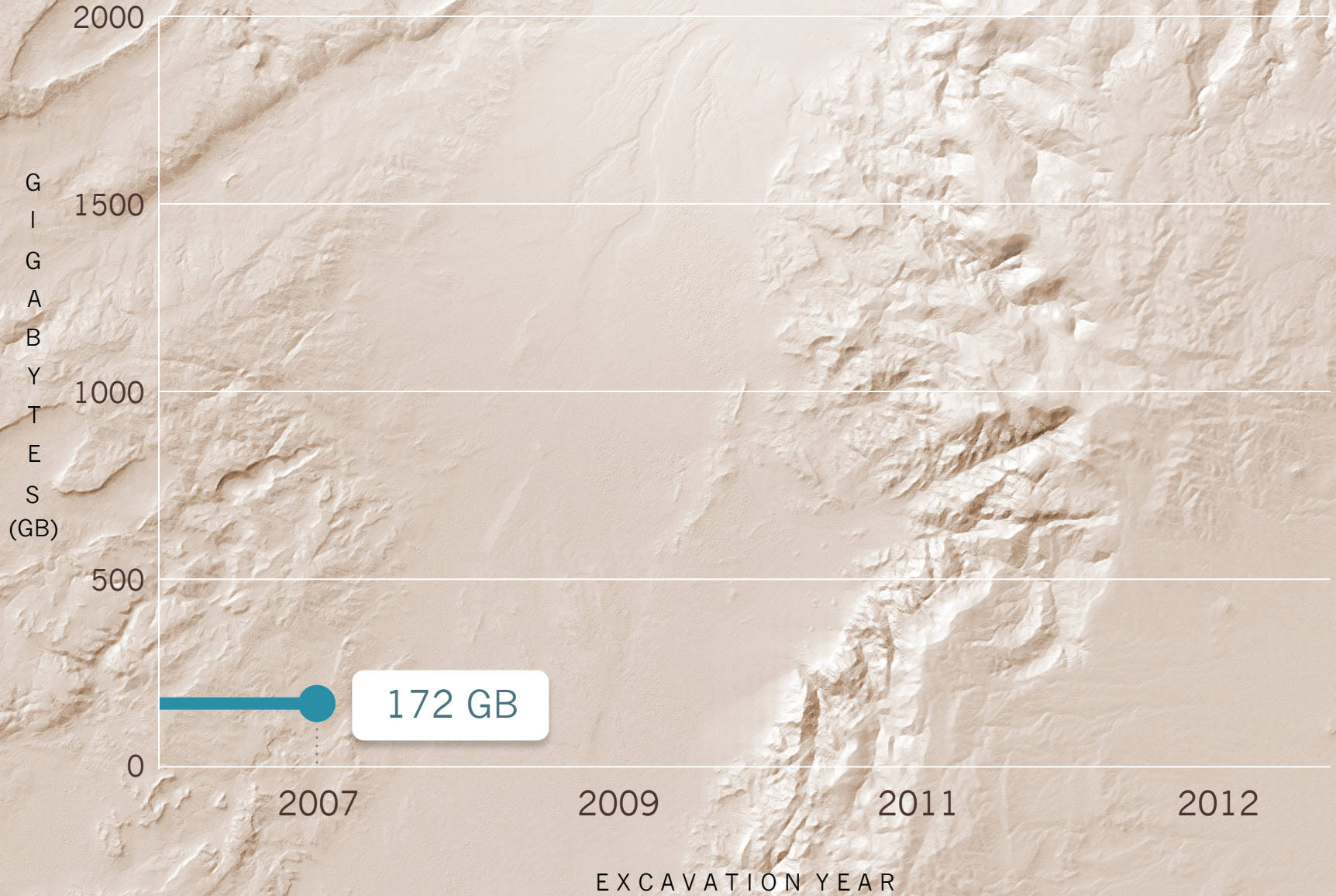


# Cyber-Archaeology Digital Data Avalanche in Jordan



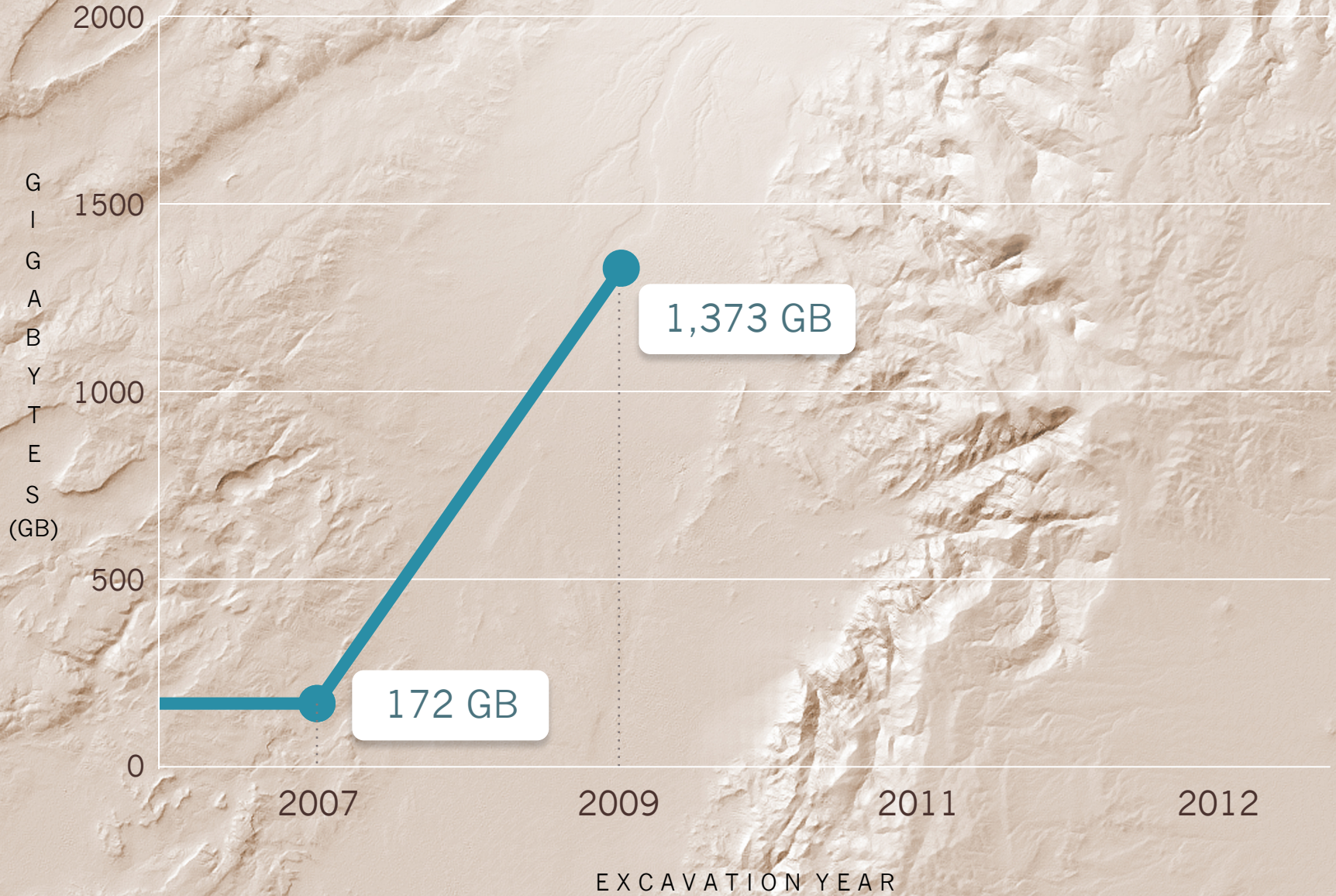


# Cyber-Archaeology Digital Data Avalanche in Jordan



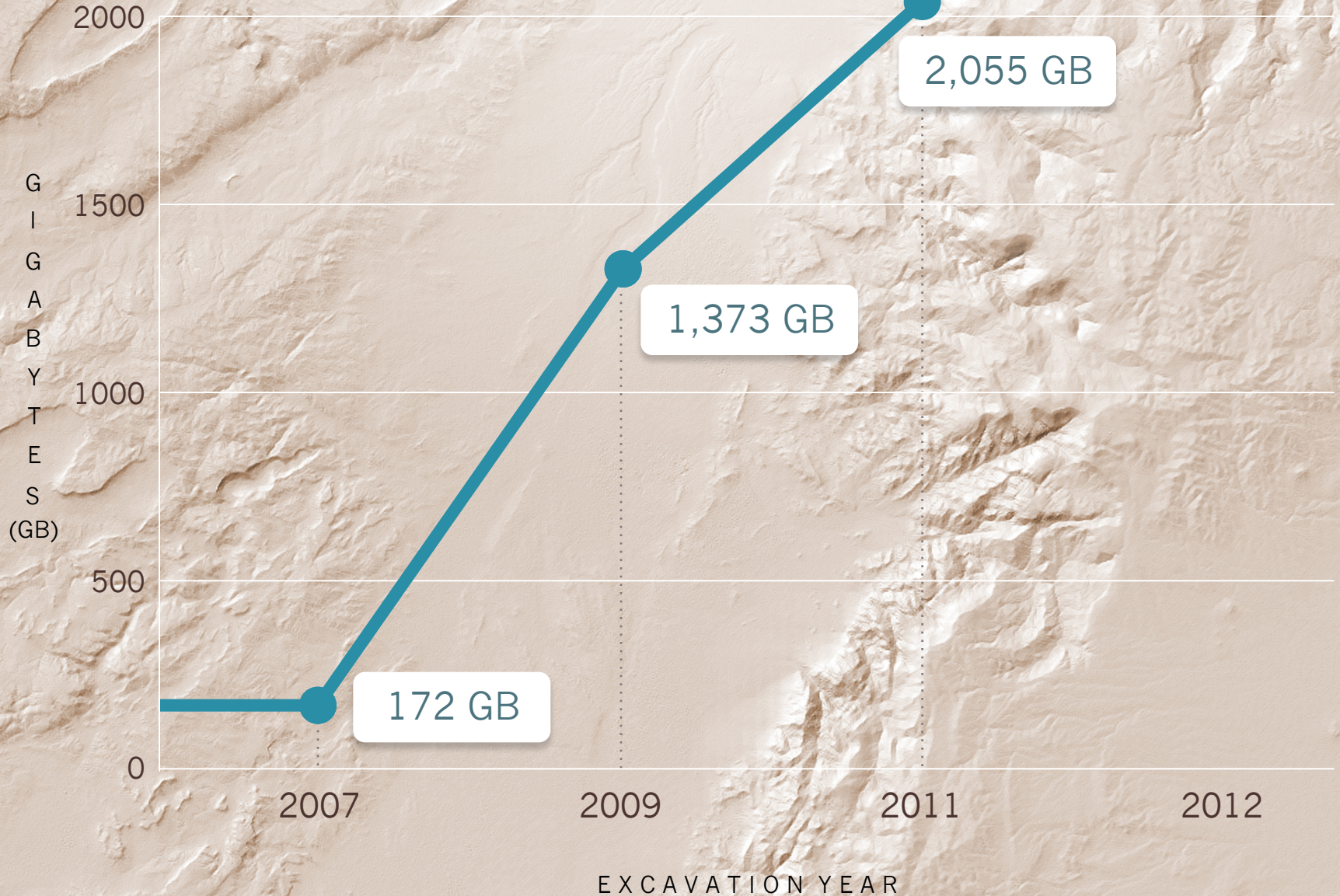


# Cyber-Archaeology Digital Data Avalanche in Jordan



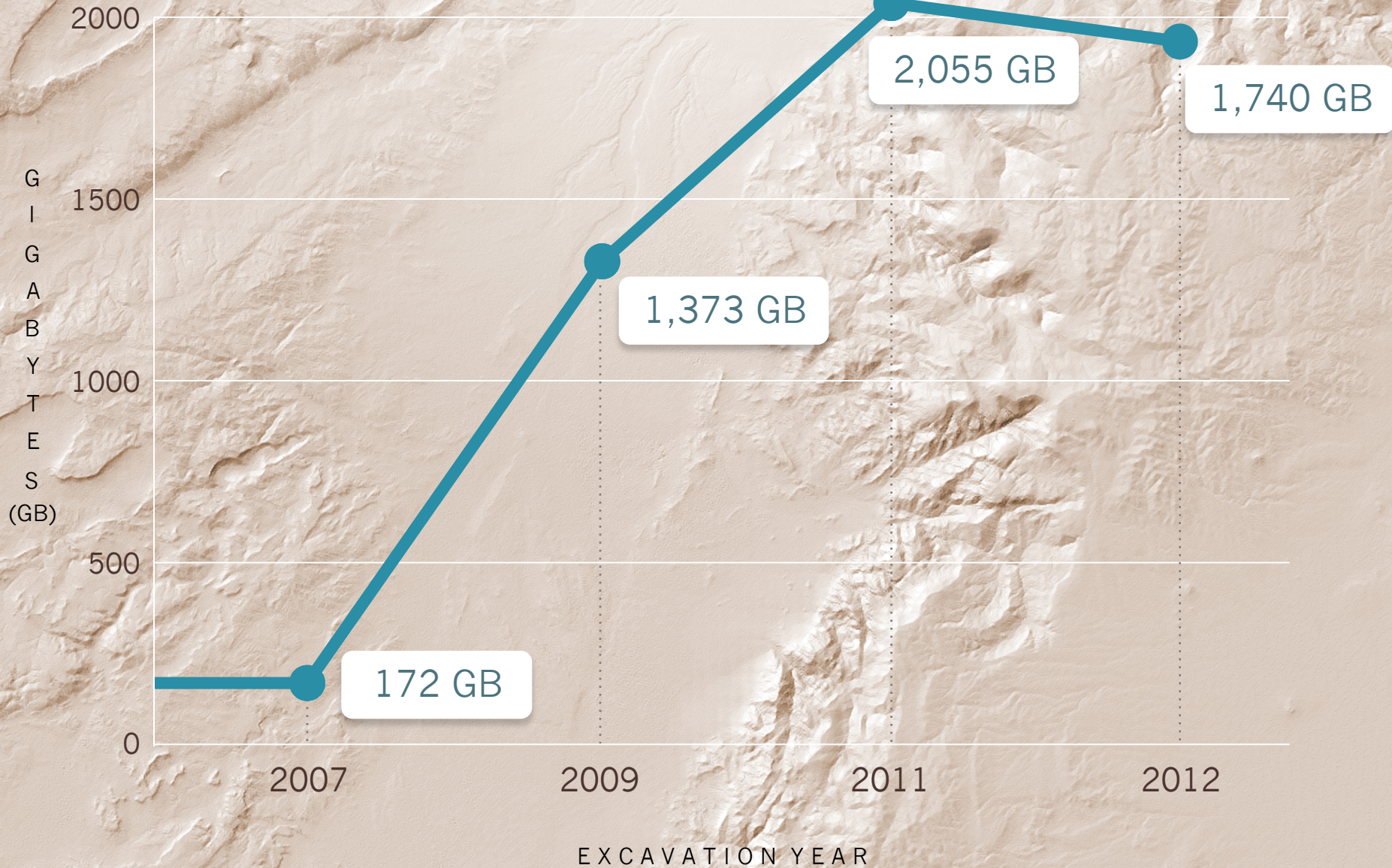


# Cyber-Archaeology Digital Data Avalanche in Jordan



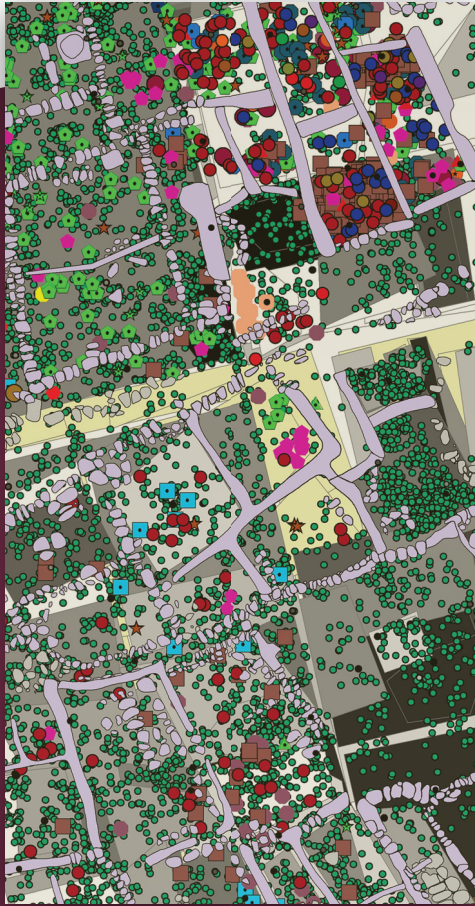


# Cyber-Archaeology Digital Data Avalanche in Jordan

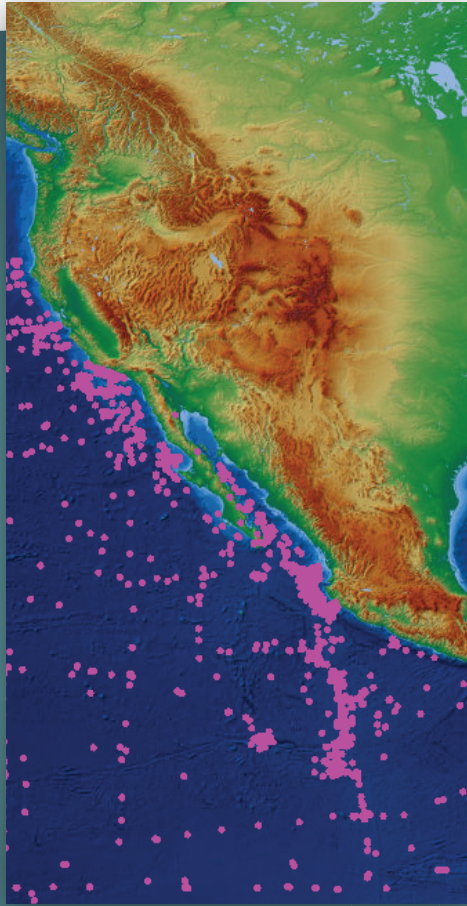




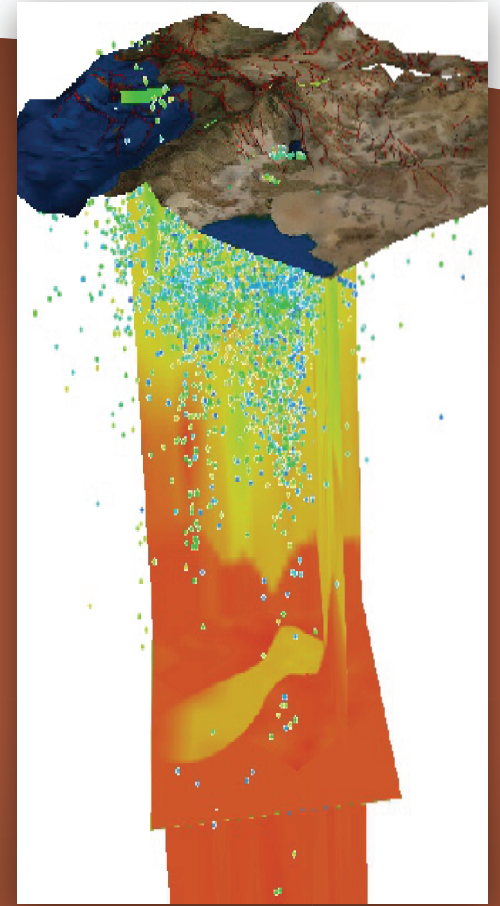
# UCSD RESEARCH CYBER-INFRASTRUCTURE



**UCSD  
Cyber-Archaeology**

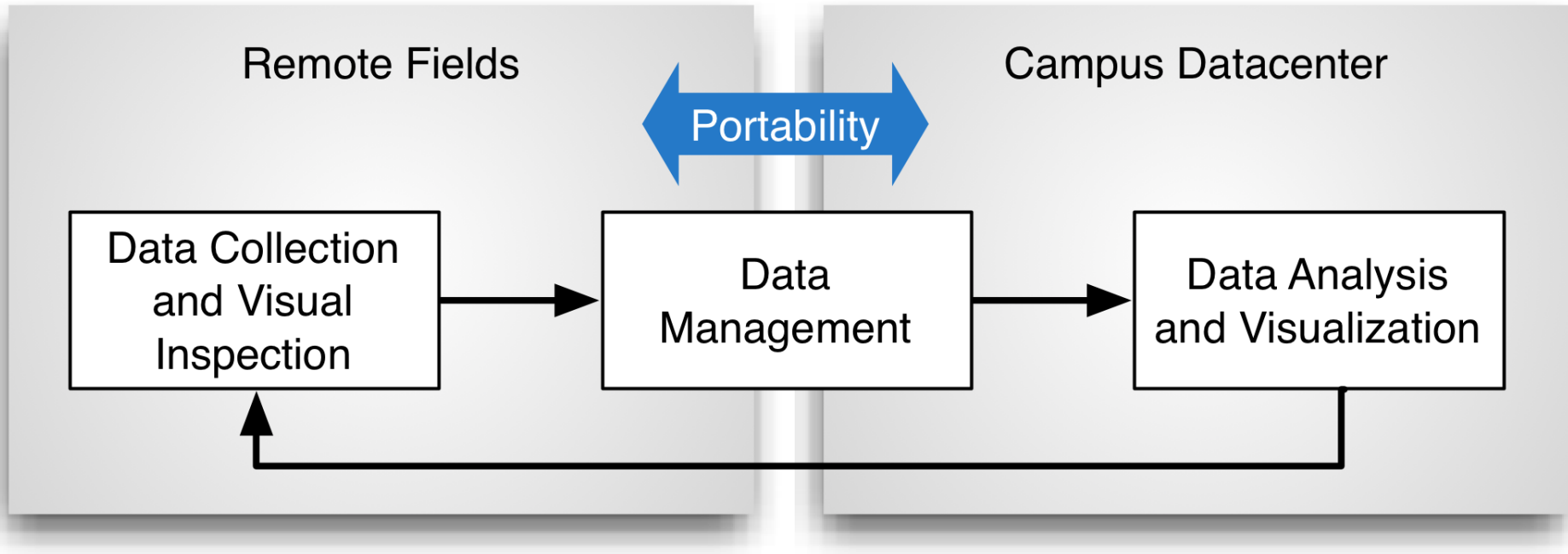


**UCSD  
Oceanography**



**SDSC  
NSF Geology**



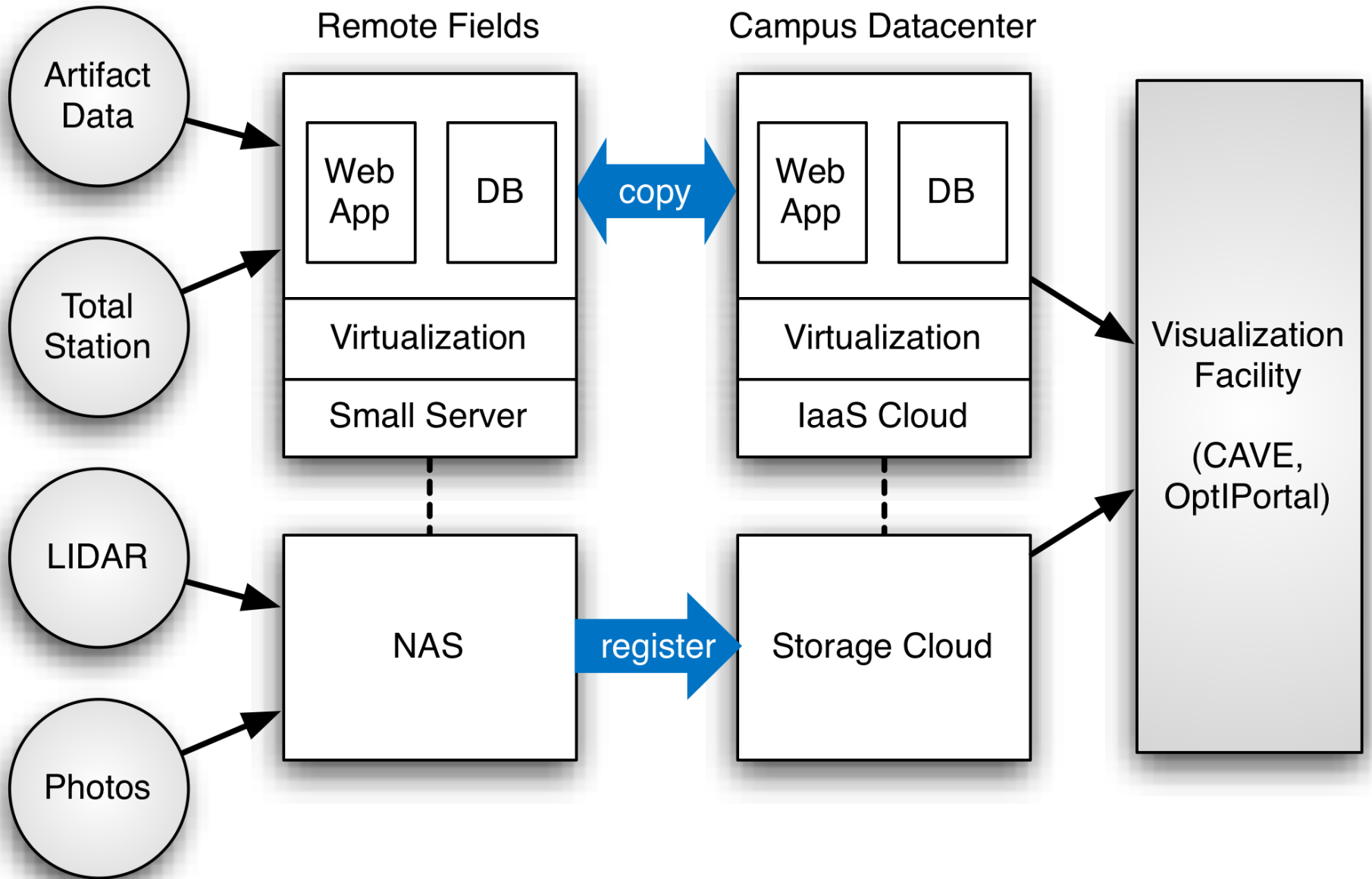




# ArchaeoSTOR

## Remote Fields

## Campus Datacenter





# New Insights into the Iron Age Archaeology of Edom, Southern Jordan

Volume 1



Situated south of the Dead Sea, near the famous Nabataean capital of Petra, the Faynan region in Jordan contains the largest deposits of copper ore in the southern Levant. The Edom Lowlands Regional Archaeology Project (ELRAP) takes an anthropological archaeology approach to the deep-time study of culture change in one of the Old World's most important locales for studying technological development. Using innovative digital tools for data recording, curation, analyses and dissemination, the researchers focused on ancient mining and metallurgy as the subject of surveys and excavations related to the Iron Age (ca. 1200–500 BCE), when the first local, historical state-level societies appeared in this part of the eastern Mediterranean basin. This comprehensive and important volume challenges the current scholarly consensus concerning the emergence and historicity of the Iron Age polity of biblical Edom and some of its neighbors, such as ancient Israel. Excavations and radiometric dating establish a new chronology for Edom, adding almost 500 more years to the Iron Age, including key periods of biblical history when David, Solomon, and the Egyptian pharaoh Shoshenq I are alleged to have interacted with Edom.

## Contents

### CHAPTER 1

The Iron Age Edom Lowlands Regional Archaeology Project

### CHAPTER 2

Excavations at Khirbat en-Nahas 2002–2009

### CHAPTER 3

New Perspectives on the Iron Age Edom Steppe and Highlands

### CHAPTER 4

Iron Age Ceramics from Edom

### CHAPTER 5

The Petrography of Iron Age Edom



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Thomas E. Levy, Mohammad Najjar, and Erez Ben-Yosef

New Insights into the Iron Age Archaeology  
of Edom, Southern Jordan • Volume 1

Levy • Najjar • Ben-Yosef

# New Insights into the Iron Age Archaeology of Edom, Southern Jordan

Volume 1

2014 – Final publication of 10-years of field work and research, 2 volumes, 1,000 pages  
3 PhD dissertations



# Workflows and Tools for Ingest of Research Data into the UC San Diego Library Repository

Arwen Hutt + Matt Critchlow, Juliane Schneider and Ho Jung Yoo, David Minor



The Library  
UC SAN DIEGO



# Browse by Collection: UCSD Research Data Collections

View current collections below. Click an image or link for a full description.

Results 1 - 5 of 5

Sort: title ▼

20 per page ▼

Advanced Search



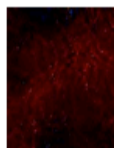
## [Bee Research Methods: Video Demonstrations](#)

This collection shows bee behaviors and methods used to study bee behaviors.



## [Khirbat en-Nahas Project](#)

A collection of archaeological artifacts and data for the excavation of the Khirbat en-Nahas site, and exploration of Iron Age state formation in southern Jordan.



## [Santa Fe Light Cone Simulation research project files](#)

This project was the result of an ongoing effort by the Laboratory for Computational Astrophysics, leading to development of the Enzo simulation software capable of a seven-level adaptive mesh refinement (AMR) cosmology simulation.



## [Scripps Institution of Oceanography, Geological Collections](#)

A growing archive of sea-floor samples and associated data supporting a diverse variety of scientific research.



## [Teaching Bee](#)

This collection of documents provides teaching exercises and information for instructors of students ranging from junior high school through college.





## Collections »

## Khirbat en-Nahas Project

خربة النحاس

### About this collection

#### Description

As a part of the Edom Lowlands Regional Archaeology Project the UCSD Levantine Archaeology Lab under the direction of Prof. Thomas Levy, has excavated three seasons at Khirbat en-Nahas (KEN). This study of Iron Age state formation in southern Jordan is deeply rooted in three conceptual frameworks: a) general anthropological theory concerning processes of secondary state formation and the evolution of social power, b) historical models concerning the Iron Age based on Anthropology, Biblical and extra-Biblical sources, and c) Middle Range theory that aims at linking raw archaeological data with more complex generalizations and conclusions about the past based on the hard archaeological evidence retrieved from the excavations. Fundamentally, the research was a response to the unsolved problem of who controlled metal production at this key Levantine site during the Iron Age, a period that follows the collapse of many of the Late Bronze Age civilizations in the eastern Mediterranean region. Recent field work at KEN and limited AMS radiocarbon dating have pushed back the dates for the Iron Age in Edom some 200 to 400 years earlier than previously thought (Levy et al 2004, 2005; Higham et al 2005). This has opened up new research questions that challenge models that explain the emergence of the Edomite state (i.e. core-civilization (Assyrian) dominance over Edom vs. local peer polity interaction with neighboring statelets such as Israel, Judah, Moab and others).

#### Field Directors

- Levy, Thomas Evan
- Najjar, Mohammad

#### Illustrator

- Hebron, Caroline

#### Research Team Members

- Arbel, Yoav
- Beherec, Marc
- Ben-Yosef, Erez
- Gidding, Aaron
- Krahn, Kyle


[View Collection Items](#)



Collocate collection items (of course!)

Allow for full description of the collection, including controlled names, headings, notes and links to related resources.



University of California

**CDL**  
 California Digital Library



# ArchaeoSTOR

*“The World’s Most Awesome Archaeology Database”  
UCSD undergrad development team*



Gabriela de la Torre, Chad Naylor, Rose Elliot, Carolyn Breeze



# Grails to Rails

The old ArchaeoSTOR was coded in an *ancient* ten-year- old Grails version without a solid testing or maintenance framework. This had a lot of bugs and would need some serious rebuilding to get it into top shape...



```
class BarcodesController < ApplicationController
  before_action :set_barcode, only: [:show, :edit, :update, :destroy]

  require 'barby'
  require 'barby/barcode/code_128'
  require 'barby/outputter/png_outputter'

  # GET /barcodes
  # GET /barcodes.json
  def index
    @barcodes = Barcode.all
  end

  # GET /barcodes/1
  # GET /barcodes/1.json
  def show
  end

  # GET /barcodes/new
  def new
    @barcode = Barcode.new
  end

  # GET /barcodes/1/edit
  def edit
  end

  # POST /barcodes
  # POST /barcodes.json
  def create
    @barcode = Barcode.new

    respond_to do |format|
      if @barcode.save
    end
  end
end
```

```
reese@Roses-MacBook-Pro:~/archeostor$ git checkout HEAD -- Gemfile.lock
reese@Roses-MacBook-Pro:~/archeostor$ bundle install
```

...The new ArchaeoSTOR, however, uses Ruby on Rails- a much more popular programming language that should make the new ArcheoSTOR much easier to build and maintain.

( Some of the really cool code for ArcheoSTOR )



# Plans for ArchaeoSTOR

With Ruby on Rails, we should be able to build a well-functioning web app from the ground up, complete with good security and access control. In the future we hope that ArcheoSTOR can become a tool for the archaeology community as a whole.







Mada'in Salah, Saudi Arabia – October 7, 2013  
Hijaz (Biblical Midian) –



KAUST – UCSD Cyber-Archaeology Expedition in al-Ula Valley  
Falconviz – with Neil Smith



# Mada'in Salah, Saudi Arabia – October 7, 2013

## Hijaz (Biblical Midian) – SfM models



KAUST – UCSD Cyber-Archaeology Expedition in al-Ula Valley