Paleoecological Data from Archaeological Sites: A Rich Resource under Imminent Threat

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Deeply stratified sites with organic preservation:
Not just for archaeologists anymore?
Or:
“distributed observing networks of the past”
Cultural Knowledge: From Black Box to Tool Kit

- Local and traditional knowledge (LTK) as resource.
- How to collect, mobilize, and assess?
- Long term records (archaeology/paleoecology)
- Sustainability of what, for how long, at what cost, and for whom?
- Creating practical tool kits for future sustainability.
Scales of Unpredictability through Time

Millennial = Oral History or A wing and prayer

Centennial = LTK+Oral histories

Decadal = Partnerships

Sub-Annual = local adaptive mechanism

IPCC 2001
Why archaeology?

• Longue durée—deep time
• Multiple (relatively) independent cases
• We know how the story ends
• Implies a long period of success
Socio-ecological systems

(Chapin et al 2006 PNAS)
Socio-ecological systems

(Chapin et al 2006 PNAS)
Some finds

Wooden artifacts

Leather belt fragment

Toy horse

New Runic Inscriptions:
X-070. Cross arm with the inscription '... father and ...'
X-070. Other side of arm '... holy John.'
Jet & Ivory composite labret and fish bones
An Ipiutak egg
Not just culture--

- Basic zooarch data
- Stable isotopes
- aDNA
- Steroids
- Trace elements
- Big data
- Ecosystem reconstruction and change
- Climate/habitat reconstruction
- Extinctions & bottlenecks
- Species response to specific types of change

OVER MILLENIA
Sites as nodes in
Distributed Observing Networks of the Past
(DONOP)

• Today:
  • Researchers collect samples from land & sea
  • Samples are returned to a home base (museum or lab)
  • Samples are curated and remain available for study

• In the past:
  • People hunted and gathered animals and plants from land and sea
  • Items were returned to a home base (archaeological site)
  • Parts of those were discarded and remain available for study

Different goals, similar outcomes
Sites as nodes in a Long-Term Ecological Observing Network

• Differing trajectories of Atlantic cod vs. Pacific Cod under different fishing regimes (CODSTORY & Sanak Biocomplexity Project)

• Eider conservation on a millennial scale and LTK in Iceland (Hicks et al. 2014)

• WALRUS--Walrus Adaptability and Long-term Responses: Using multi-proxy data to project Sustainability (aDNA,C14, stable isotopes, steroids, morphology)

• Pre-contact fish use in the Barrow area
Sanak Island Food Webs

Credit: Jennifer Dunne
Image courtesy Herbert D.G. Maschner
Archaeology and Eggshell Identification

- Massive concentrations of eggshells are found in Mývatn archaeological sites dating to first settlement (c. 875 AD)
- Electron Microscope analysis of excavated bird eggshell proves that most eggs came from ducks
- Kesara Anamthawat Jónsson, Arni Einarsson & Megan Hicks expand the story: large collections and deep stratigraphy, sp. Level ID.

Modern and recent historic sustainable management of waterfowl in Mývatn extends back to first settlement — over 1100 years! Local TEK on the millennial scale, bioscience, archaeology, ethnography, and local ecological knowledge combine synergistically.
Looking Back to Look Forward

- Uses information about past ecosystems for the strategic management of future ecosystems
- Reverse the ‘shifting baseline’ syndrome by broadening the understanding of ecosystem dynamics across time
Our Library is on Fire NOW

YOU KNOW YOU'RE A HISTORY FAN WHEN

YOU STILL GET UPSET THINKING ABOUT THE LIBRARY OF ALEXANDRIA.
Rising sea level and increasing storminess threaten sites from arctic to tropics. Not all sites can be rescued or conserved, but expertise exists in site protection and rapid rescue. Need for international collaboration in priorities and joint action.
Sea Ice extent reduced
Simulated ground temperatures at 1 meter depth for Alaska for the periods 2000-09 (above) and 2090-99 (below)

It is projected that communities of Point Hope and Kivalina will lose their permafrost by 2100
Walakpa--July 2013
Stanford in shown in black, 2013 points in purple; 2014 in red
August 2015

Images courtesy Mark Ahsoak Jr.
Approx. 200+ Dorset/Thule/Inuit winter sites in Labrador, each is a probable source of data regarding local subsistence and ecology in the past. Excellent site record spanning the MWP and LIA

- Relatively few large-scale excavations to date; some sites have yielded huge collections of well preserved animal bone, plant, insect and geoarchaeological data

- Excellent preservation and dating potential with the overlap of treeline and permafrost limits: frozen sites with dendrochronology, 14C

- Most sites are close to sea level and vulnerable to coastal erosion

- The most productive sites are threatened by permafrost melt (accelerated decay, destabilisation of soil column)

Stratified midden at Uivak Point
1 HjCl-09:
An archive of Inuit subsistence during the LIA

Growth ring record of age and season of death in dentine of a ringed seal (winter kill)

Collapse of soil column and shore edge slumping at Oakes Bay 1 HeCg-08 due to permafrost melting and shore erosion
In Greenland sites are endangered by both marine erosion and increased summer temperatures.

“Melting middens” - Rapidly degrading organic preservation.

Bishop’s Manor at Gardar. GHEA target for cooperative rescue by NKA, DK, CUNY, Arch. Inst. Iceland- drawing on IPY NABO experiences and resources.
Melting middens and modern drainage ditches threaten organic preservation in the surviving stratified middens.
Gufuskalar Iceland 15\textsuperscript{th} c Fishing Booths and Winter 2014/15 storm damage

2014 End of season  
2015 Start of season
In Scotland, thousands of sites are threatened by erosion, and the SCAPE Trust has been working with Government Agency, Historic Scotland, to prioritise action at sites and promote collaborative working with communities around the entire coast. The public are encouraged to correct and update data using an interactive website and mobile apps, and they nominate locally-valued sites for projects.

FACEBOOK
Scotland's Coastal Heritage at Risk
October 6 ·
We've had a fantastic weekend surveying the Newshot ship graveyard - thanks so much to everyone who came along. We'll be posting a blog soon to detail what we've discovered about the history of the boats.
What do we do about it?

• We need an **Observing Network** to identify & prioritize archives that are being lost.
  • More “boots on the ground”
  • Clearing house for information

• We need **Support** to address most vulnerable sites in an interdisciplinary way

• We need to **Connect Nodes** in the archaeological network with nodes in modern observing networks
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