

# Paleoenvironmental Change and Urban Abandonment in the Early and Middle Bronze Age Levant

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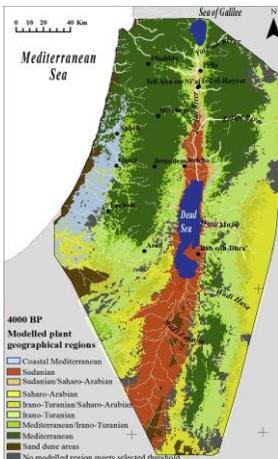
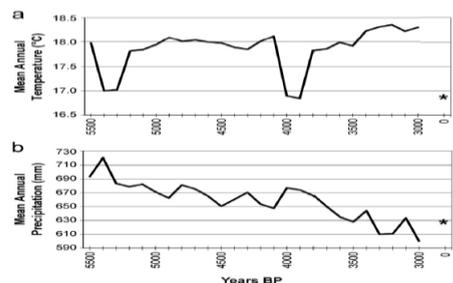


## Investigating Urban Collapse

Research focused on the Early Bronze IV (2550-2000 BC) archaeological site of Tell Abu en-Ni'aj, Jordan during a period of urban collapse. The Early Bronze IV is hypothesized to be a period of severe and rapid aridification throughout the Near East. This hypothesis was tested by analyzing the cultivation patterns at Ni'aj. Seed taxa were identified and counted to analyze trends in specific crop taxa, and carbon isotope ratios for the seeds were used to estimate drought stress. These measurements assess the impact of climate change on the Levantine society in antiquity.

## Past Climate & Vegetation Models

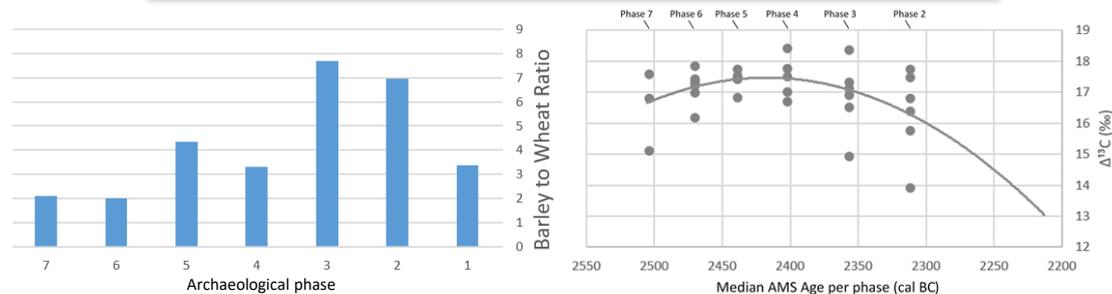
Data were compared to models from Soto-Berelov, Fall, Falconer & Ridder (2015) for Bronze Age temperature and precipitation (left), and vegetation at the Early Bronze/Middle Bronze transition (right).



## Findings

Analysis of seeds from Tell Abu en-Ni'aj shows a shift from wheat to barley reliance during urban abandonment in EB IV. Increased frequency of cultivated crops over wild species suggests intensified agriculture through the occupation of Ni'aj. Values for  $\Delta^{13}\text{C}$  indicate slightly increasing water availability early in EB IV, followed by a decline later in the period. Results show that changes in agricultural practices at Tell Abu en-Ni'aj correlate with the onset of high drought stress and aridity.

## Archaeobotanical and Stable Isotope Results



Barley to wheat ratio from Tell Abu en-Ni'aj (left) and water availability curve based on  $\Delta^{13}\text{C}$  (right).

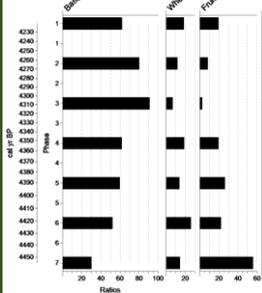
## Expanding Our Research

### Visualization Methods

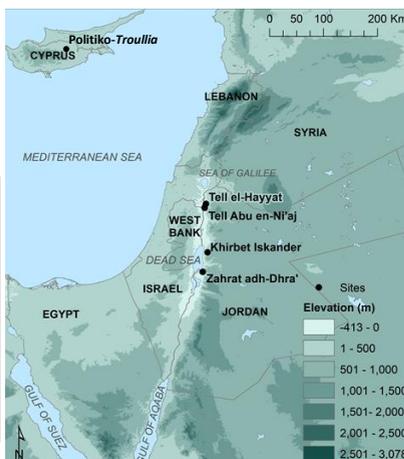
- Biome Models
- Pie Chart Comparisons

Ni'aj Total Cultivated Cereal  
Wheat 0.2 Barley 0.8

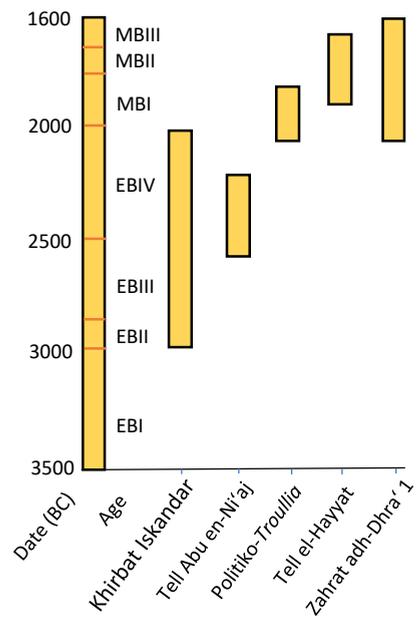
- Tilia Diagram Comparisons



### Five Archaeological Sites Across the Levant



## Active Site Range

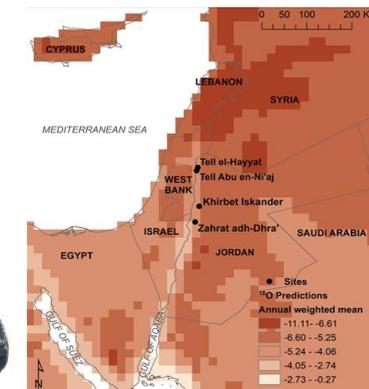


## Ongoing Research

Expanded paleoenvironmental analysis will gather  $\delta^{13}\text{C}$  from carbonized seeds and modern plants, and  $\delta^{18}\text{O}$  from faunal remains and modern water to assess isotope concentrations through the Early and Middle Bronze Ages (3000-1600 cal BC). We will expand our initial isotope curve from Ni'aj, which suggests a gradual (yet relatively rapid) climate shift. We anticipate drought at the onset of the Early Bronze IV followed by higher water availability in mid-EB IV, and a subsequent second aridification at the end of EB IV. We expect climate to improve at the onset of urban redevelopment at the outset of the Middle Bronze Age (2000 cal BC). We will piece together Levantine climatic trends through the Bronze Age, and test the hypothesis of wide-spread, rapid desertification leading to urban abandonment.

## Environmental Isotopic Proxies

Isotopes will be measured for seeds, shells and domesticated animal bones from our archaeological sites. Maps and paleoenvironmental models can illustrate the extent of temperature & precipitation changes in the Levant.



## Acknowledgements

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