

48 Hypermedia and Archaeological Publication: The Wadi Ziqlab Project

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48.1 INTRODUCTION

One of the problems that has plagued archaeology in the last two decades is how to publish an affordable yet useful archaeological report. As archaeologists include more and more types of data that their predecessors would never have conceived of recording, seemingly requiring ever larger manuscripts for their dissemination, the costs of creating the traditional printed publication have also increased markedly. For some archaeologists, the solution has been to put much of the data and large numbers of images on microfiche (e.g., Keene 1981; Miles 1985; Peltenberg 1982), or to bring down the costs of printed monographs by using desktop publishing. One possibility which we have been exploring on the Wadi Ziqlab Project is to combine a relatively inexpensive printed monograph that summarizes our results and presents our principal hypotheses with a set of HyperCard stacks that allows users to browse through our entire archive of survey, excavation and laboratory data. Ultimately, we hope to have this set of stacks and a large collection of images available on optical disk.

One of the principal problems in creating such an archive is how to structure the data and the stacks in such a way as to facilitate their use by archaeologists and to minimize the number of hard links that are required to anticipate most of the users needs. Since the more general issues of using multimedia and optical media in archaeological publication and education have appeared or are appearing elsewhere (e.g., Banning 1991; Banning n.d.; Chen 1986; Martlew 1991; Rahtz *et al.* 1992; Ruggles 1988; Smith 1992), this paper will concentrate on aspects of structuring the Wadi Ziqlab archive.

48.1.1 Background of the project

The current Wadi Ziqlab HyperCard stacks are prototypes for ones we plan to use in publishing the results of fieldwork in northern Jordan. The Wadi Ziqlab Project incorporates archaeological survey of an area of about 115 km² that drains part of the Transjordanian Plateau into the Jordan Valley, as well as excavation of a variety of sites and laboratory analyses of ceramics, lithics, geological, botanical and osteological data. The archaeological material from this project ranges in age from the Lower Palaeolithic to about AD 1900. The focus of research in Wadi Ziqlab was to examine changes in settlement systems and to attempt to relate them to changes in economic strategies and environmental conditions. In particular, agricultural and pastoral strategies were of interest (Banning 1982; 1985; Banning & Fawcett 1983; Banning *et al.* 1987; 1989; n.d.).

48.2 THE STRUCTURE OF THE WADI ZIQLAB PUBLICATION

In designing the prototype of the Wadi Ziqlab hypermedia publication, a number of factors guided us. The types of archaeological data themselves imposed some constraints. It was important that users be able to access all of our archive, including all photographs, all artefacts and all field notes, quickly and easily, even without much knowledge of computers. We hoped that we could provide a framework for the data that was intuitively clear and that allowed users to browse very freely without getting lost in a confusing web of linked information, and that we could make the interface reasonably pleasant and inviting. We wanted to integrate the publication

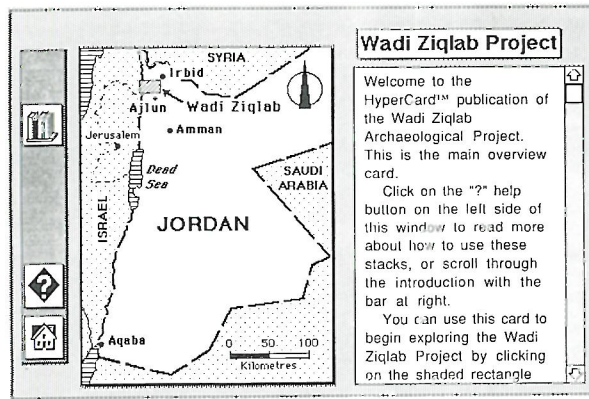


Figure 48.1: One of the introductory cards of the main Wadi Ziqlab stack. Users can click on the shaded rectangle to zoom into Wadi Ziqlab.

with a teaching stack that would draw on the real data in the archive to allow students to carry out simulated surveys and excavations, to write reports on what they found, and to get some feel for what archaeological research was really like. Finally, we hoped to create a framework that was easily adaptable to other archaeological projects, perhaps including an interactive stack-builder stack that helped other archaeologists publish their own archives.

48.2.1 The spatial metaphor

It is important for hypermedia to have a unified organizing concept that helps users avoid the disorientation that can result from being enmeshed in complicated webs of linked data (Daniels & Mara 1988). In selecting the primary skeleton for organizing all the stacks, we opted for a spatial metaphor that encourages users to navigate through most of the data by reference to maps and aerial photographs. This makes it fairly easy to integrate data at several different scales, regional through microscopic, and allows users to keep track of where they are by returning to a familiar frame of reference at the touch of a button. Having zoomed down to some minutiae of particular pottery sherds or botanical material, users can always get their bearings by returning to a map that highlights the localities relevant to the material they have just been viewing before returning to detailed information in the same or another related locality. Furthermore, most archaeologists appear to be very comfortable with maps and stratigraphic sections (which also form an important part of the stacks).

Following title cards and the option to view a Help stack that provides users with some introduction to the use of the publication, the main

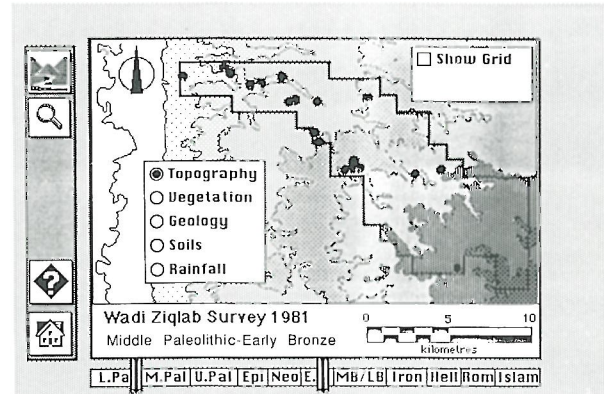


Figure 48.2: One of the topographic maps at the regional scale, with the time bar selecting sites of the range, Middle Paleolithic to Early Bronze Age, which are shown as black dots on the map. Users can click anywhere within the marked boundary of the survey area to zoom in on one square kilometre.

stack begins with a map of Jordan (Figure 48.1), accompanying an introduction, from which users may zoom in on the Wadi Ziqlab survey area itself. This regional map is the main skeleton of the publication to which users may return periodically to reorient themselves. They have the option of formatting this map to show topography, geology, vegetation, soils or precipitation, and whether or not to show a one-kilometre grid. Along the bottom of the map is a time bar; by sliding the two markers along this bar users can select the range of time for which they would like to view archaeological sites on the map or to restrict the range of data searches (Figure 48.2).

Buttons along the left side of the screen provide access to various major functions, such as zooming out of a map, returning to the introductory card, toggling between map and aerial-photo views, getting context-sensitive help or viewing the help tutorial, doing a search, or going "Home".

In addition, the map itself is tiled with transparent buttons that correspond with the survey's one-kilometre sample quadrants. By clicking on any of these, users can zoom in on that portion of the map to examine the routes of any survey transects that were done there, to find the locations of sites in their topographical context, or, by clicking the aeroplane button at left, to view an aerial photograph of the quadrant.

Once a user has zoomed in on a quadrant, whether in aerial-photo or map view, she or he can scroll to neighbouring quadrants simply by clicking on the borders of the current window or, if any sites appear on the map, can click on a site

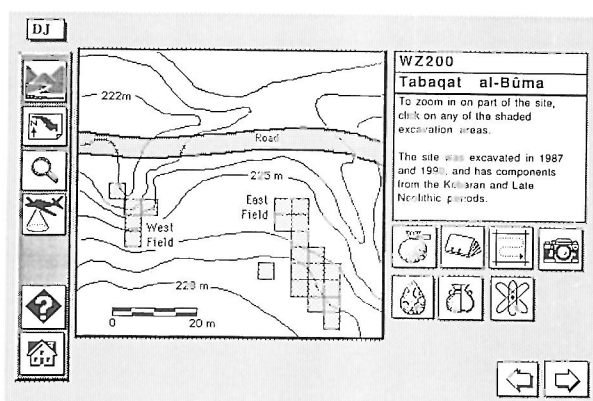


Figure 48.3: One of the head cards at the site level. Users can zoom in on individual excavation areas (shaded) or click on icons to view photos of the site, summaries of pottery, lithics or carbon dates, and other information.

to zoom in on it and reveal a site map and a new palette of buttons (Figure 48.3). It is further possible, in the case of sites that have been excavated, to zoom in on individual excavation areas.

48.2.2 Excavation and survey data

The views of individual sites and excavation areas offer new sets of buttons, this time appearing at right to leave the main buttons unaffected at left, that allow users to gain access to a wide range of information (Figure 48.4). One button allows access to copies of the actual field diaries and field forms of the excavation, where bolded text is itself clickable to link to information about artefacts or samples mentioned in the notes or to definitions of specialized terms. Other buttons permit viewers to browse through pottery, lithics, botanical remains, bones and other types of materials that the excavation recovered. One accesses the results of such laboratory analyses as neutron activation and thin-section analyses of pottery or use-wear analyses of lithics. Another shows the distribution of radiocarbon dates from the site, with the option of viewing the calibration and other relevant information by clicking on an individual date.

When a user has zoomed in on a specific excavation area, it is further possible to click on a trowel icon to peel off deposits and, in effect, simulate a re-excavation of the area. At any stage here users can click on the labels (locus numbers) on the area map to view the locus description form for that particular layer or feature, and can view a Harris matrix or scanned field photographs of the layer in the progress of excavation. Alternatively, she or he can click on one of the edges of the excavation area to view the strati-

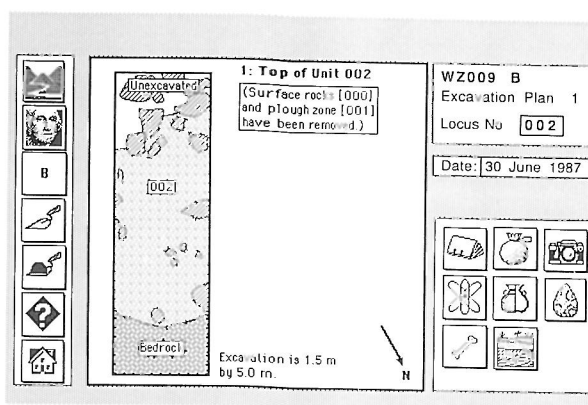


Figure 48.4: One of the cards depicting the top of one layer within a single excavation area. Users can use icons to select information about various kinds of material found in the context, locus 002, can click on the 002 label to access the form that describes this particular soil layer, or can click on the trowel icon to remove the 002 layer from the plan to reveal underlying contexts. In effect this is a simple simulation of the excavation of this area.

graphic section along that edge, again with the option to click on labels to view the locus sheets or to click on an icon to view the Harris diagram or a photograph of the section.

48.2.3 Stack organization

When deciding whether to produce one gigantic stack or to divide data among several different stacks, it is necessary to consider trade-offs in speed as well as users' most likely browsing habits.

In order to make the project more manageable, we have opted for a series of stacks with most of the navigation (and all of the maps) in a main stack, WZ, and specialized information in smaller stacks associated with the main one. Since we expect that many users will plan to spend time browsing through lithics, or pottery, but not both at once, we opted for separating some of the data by material, so that there are stacks called WZLithics and WZPots. Survey data, field notes and carbon dates also have their own stacks. Finally, user help and a tutorial occur on a separate stack linked by the familiar question-mark button.

48.2.4 Card names and data structure

In order to accomplish the many kinds of links that the Wadi Ziqlab stacks make available without having to create each one individually at a great cost in time, we employ what are essentially codes in the card names and some of the fields that make the links context-sensitive. The basic structure is hierarchical, with cards of various

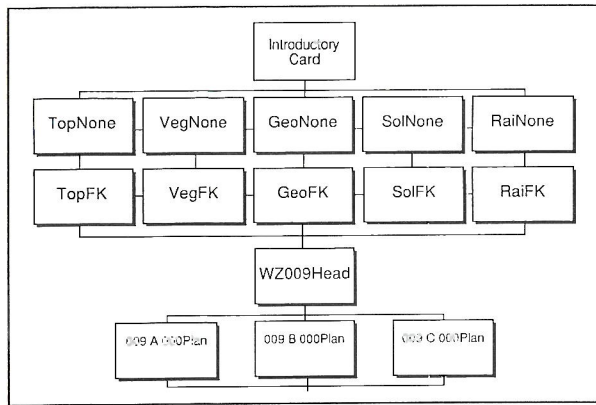


Figure 48.5: A chart showing the main links among cards and substacks in the upper parts of the hierarchy. Near the top are cards that show regional maps of topography, vegetation, geology and so on, with None in the card names to indicate that no archaeological sites are depicted. Other cards in these substacks show the distribution of sites over different chronological ranges. The next lower level shows similar information, but for individual quadrats (quadrat FK is shown on top). Below this are head cards for all sites recorded within Wadi Ziqlab (here showing the card for site WZ 9, which lies within the FK quadrat). Still lower are cards showing each stratigraphic level within each of Areas A, B and C at site WZ 9 (the surface, locus 000, shown on top). Other sites may have more, fewer or no cards at this level, depending on the degree to which they have been excavated.

kinds at the levels of region, quadrant, site, excavation area and locus (Figure 48.5), although some of the cards, such as the field diaries, may carry other types of contextual structure in their card names.

Scripts attached to background buttons become context-sensitive by referring to strings within card names. At the regional level, for example, card names contain the strings Top, Geo, Veg, Sol and Rai to refer to maps showing either topography, geological, botanical, soil or rainfall distributions, with additional strings to describe the time-range of sites to be superimposed on the map (e.g., None for no sites or LPMP for sites of the Lower and Middle Palaeolithic). A final character in the card name, G, when it occurs, indicates that a grid should appear on the map to guide users when they attempt to zoom in on a quadrant; card names without this character omit the grid.

At the level of individual quadrants, card names contain the three characters to indicate the type of map (e.g., Top or Geo) and a two-character string that describes the co-ordinates of the quadrant. Currently, we show all sites at this level, regardless of their date, although it is possi-

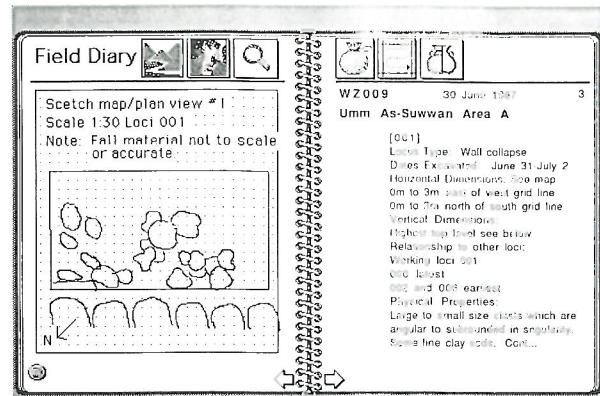


Figure 48.6: A sample diary page with sketch map, fields for site number, date, locus, bag and page number, and a large free field for notes.

ble that a future version of the publication will dim the sites on the map that are not known to contain materials of the time range users specified at the regional level. This could be accomplished by retaining the four-character time range in the card names, a solution that would require enlarging the stack considerably. A better alternative might be to have a script that highlighted or dimmed particular site-buttons on the map by reference to a database of time ranges for each site.

At the site level, card names most importantly contain a string naming the site (sites on the Wadi Ziqlab Project are simply numbered from WZ001 to WZ310), followed by the string Head. At lower levels in the hierarchy, the card names replace the Head term with the Area name and, where relevant, the locus number (a gross stratigraphic context), bag number (a lot or micro-stratigraphic context) and type of material (lithic, ceramic, osteological, etc.). At the level of simulated re-excavation of an area, for example, the card name could be 200F32007Plan for the top view of locus 007 in Area F32 of site 200.

The field-diary cards (Figure 48.6) require a rapid means for accessing the information they contain by site, area, locus and bag, but also by date. Consequently the card names here are quite long. The first page in the diary that refers to bag 22 in locus 007 of Area F32 at site 200, might bear the card name 200F32007221406906, assuming that it is page 6, dated 14 June 1990. Fortunately it is not necessary for those entering data into the computerized field diary to type out these tedious card names, with all the potential for error that would involve, since all the components of this name, including the page number at the end,

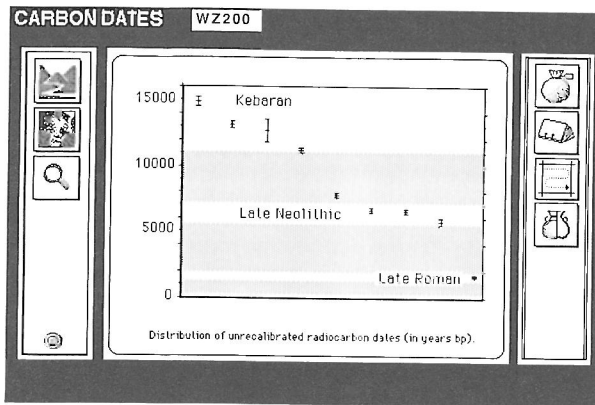


Figure 48.7: A sample card showing the distribution of radiocarbon dates from one site. Users can click on any of the date-bars shown to view detailed information about the particular date selected.

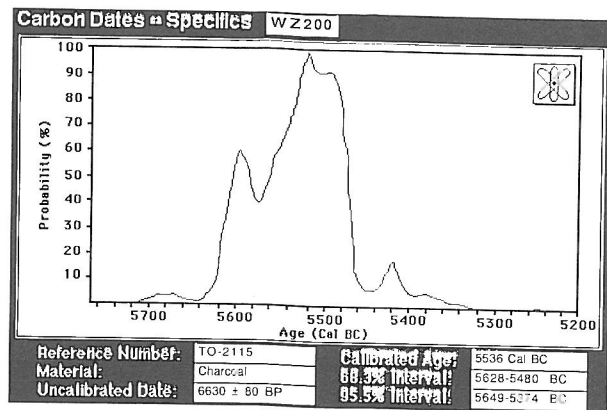


Figure 48.8: The card for a particular radiocarbon date from Wadi Ziqlab, showing the calibration probability curve, material, calibrated and uncalibrated dates, and errors.

can be derived from fields within the diary itself. A card script simply concatenates the contents of the relevant fields and puts the result into the card name. The page number at the end is simply there to avoid confusion in cases where discussion of a particular bag continues for two or more pages.

Cards summarizing information about artefacts and ecofacts similarly require long names. As with the diary cards, they begin with characters for the site number, Area, locus and bag number, followed by three characters for the item number (all items found within a particular bag are arbitrarily numbered from 001 to 999) and a final character to designate pottery (P), lithics (L), worked bone (W), unworked bone (B), metal (M), carbon samples (C) and so on. Carbon samples differ by having their own CarbNo instead of the item number, assigned by the lab that carried out the analysis (here all with the TO- prefix assumed). Again, as with the diary pages, all of the components of the card names can be derived automatically from fields that occur on the cards themselves.

Since many of these items are quite complex, however, and we may wish to display more information than can comfortably appear on a single screen, it seemed useful to show only basic information, including a line drawing, video image, or both, on the card that users typically see when searching for lithics, pottery, or other items. Detailed information, including metrics that only specialized users might want for statistical analyses, occurs instead on a second page that has the same card name as the first, except that it has the additional, final character, 2 (Figure 48.7 and 48.8).

48.2.4 Some example scripts

To get a feel for how card names, button names and fields allow most of the links within the Wadi Ziqlab stacks to work with only background scripts, rather than hard-linked buttons, some readers may find a few examples useful.

The script for scrolling from one quadrant to a neighbouring one to the west, for example, is quite simple. Like the one for toggling between map views and aerial-photo views, it relies on a two-character code in the card name that records the co-ordinates of the current quadrant. Users activate the background button Scroll West by clicking anywhere in the area along the western edge of the current map. The current card name, for example, could be Top DK, with D indicating a location four rows south and K a position in the eleventh column east on the quadrant grid.

```
on mouseUp
  put char 6 of short name of this card into it
  put charToNum(it) into N
  subtract 1 from N
  put numToChar(N) into it
  put "Top " & char 5 of short name of this
  card & it into P
  if there is no card P then
    beep
  else
    visual wipe right
    go card P
  end if
end mouseUp
```

The script for a hypertext button attached to the bolded text, **carbon sample**, in a diary page, or for a radiocarbon background button elsewhere in the stacks, provides one example of how a generic script works to locate specific information within the stacks by reference to contextual information on the current card.

```
on mouseUp
  put chars 3 to 5 of field SiteNo into s
  - must Area information out of long form of
  bag number
  - note that Area designation can be one or
  three characters
  - and is normally separated from short bag
  number by a period
  put chars 1 to 3 of field BagNo into it
  if char 2 of it is .
    put & char 1 of it & into f
    else
    put it into f
  end if
  put field Locus into l
  if char 2 of field BagNo is .
    put char 3 of field BagNo & char 4 of
    field BagNo into b
    else
    put char 5 of field BagNo & char 6 of
    field BagNo into b
  end if
  put field CarbNo into c
  put s & f & l & b & c & C into it
  go card it
end mouseUp
```

The scripting of the sliding buttons along the time bar at the bottom of the regional maps was an interesting problem. The solution we have adopted for providing this time-range function is not especially elegant, as it involves creating a different map for every combination of sequential time periods, a total of 91 maps in each of the topographic, geological, vegetational, soil and rainfall modes. Fortunately, at least, it is relatively easy to generate all these maps simply by overlaying transparent graphics on one another within HyperCard itself, and then to provide the appropriate names. As indicated above, each topographic map, for example, would have a four-character code, such as MPUP for Middle to Upper Palaeolithic, appended to the characters Top in the card name. A more elegant, although probably slower, solution would be to keep site co-ordinates and time ranges in a separate database and create a script that simply highlighted the appropriate pixels to superimpose the locations of relevant sites on a single set of maps. Instead the script for the background button, Left, for example, resets its own horizontal position and then, by reference to its own position and that of the Right button, goes to the card that displays the appropriate combination of sites on the appropriate map.

48.3 OTHER DESIGN CONSIDERATIONS AND FUTURE PLANS

I will end this paper with a few comments on some non-structural aspects of the stacks' design

and discussion of plans for the final implementation of the stacks.

One of the concerns I have had is that the cards in the prototype can become quite cluttered with buttons, since there is a temptation to give users access to as many kinds of links as possible at every step. Possibly one way to avoid this in a future version of the stacks is to make use of windows in which users can adjust settings or preferences to replace some of the radio buttons and check boxes that currently occur on data cards themselves. Another might be to replace buttons that connect users with particular kinds of material, such as pottery or lithics, with pop-up menus. Both these approaches would help save valuable screen real estate.

Another factor that has been a concern is to avoid overuse of special effects. Many stack developers seem to find it very tempting to use just about every visual effect, and some audio ones, that HyperCard makes available. Here I have attempted to use visual effects only in ways that help users visualize what is going on in the stack. When scrolling from one quadrant to a neighbouring one, for example, I think users find it very helpful to see a wipe right or wipe left effect. When turning pages in the field diaries, similarly, I think they will find that a scroll effect helps to emphasize the action that is occurring and is consistent with the notebook metaphor we are using for this particular stack in the archive. And, of course, the zoom effects make it intuitively clear what is happening when a user changes levels among the regional, quadrant, site and area maps within the main stack.

Another part of the design that still awaits implementation is interactive video of artefacts in our archive. I had originally envisaged only line drawings and still photos on the artefact cards, but now I hope to include a QuickTime™ window on each card depicting the artefact in colour, with a sliding button along the bottom of the window to allow users to rotate the artefact through 360°. This should not be very difficult, and the combination of fast compression-decompression software with optical media makes it possible to illustrate literally thousands of artefacts in this way.

Finally, we also hope soon to add two teaching stacks, that draw on the other stacks as source material for tutorials on archaeological survey strategies and the interpretation of excavation data. Students would carry out simulated surveys or excavations, using the real data in the Ziqlab stacks (and, we hope, data from other projects in the near future), and would write excavation re-

ports, using tools within the stacks, with their own interpretations of what they found.

As we continue to refine our prototype stacks, which remain crude in a number of respects, I look forward to readers comments and suggestions for improvements.

Acknowledgements

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