DIYALA PROJECT

Clemens D. Reichel

Over the years I have learned that every type of work is associated with its own set of sounds. As I walk through the Oriental Institute's basement, I have learned to tell them apart even with closed eyes. Over at the window, the humming of two scanners reports the ongoing scanning of field negatives. On the table to the other side the ruffling of paper — old notebook pages, which have turned yellow over time — reflects the indexing of field notes in progress. A faint clicking sound from the photography lab relates that yet another cuneiform tablet — unpublished and mostly unstudied — has been photographed. Perhaps the most indistinguishable sound is the faint scratching of a pen, revealing that objects, laid out carefully on a tray, are being examined and described. These noises occasionally intermingle into a somewhat dissonant symphony. To me, however, it rivals the sound of the sweetest music I can listen to. It is the sound of work in progress.

It is spring 2005 and work at the Diyala Project is indeed going well. Morale is high and both staff members and volunteers are highly motivated. There is good reason — last fall the National Endowment for the Humanities (NEH) announced that the Diyala Project had been awarded a $100,000 grant for 2005–2007 from its "Recovering Iraq's Past" Initiative. For the first time in years, money is not a constraining factor — we can buy the equipment that we need and hire extra staff.

It could not have happened at a better time because the project had been growing substantially over the past few years in its scope and objectives, but its budget had not. As I outlined in last year's report, storage space for the vast amount of digital data that we were producing had become a key issue that needed to be addressed. For quite a while I simply had to ignore demands for faster machines, more disk space, and new software and resort to temporary solutions that often felt like band-aids, a situation all too well-known in academia, especially in the humanities. The world of computers and databases, while substantially increasing efficiency in data management and data storage, is also unforgiving to mistakes. Improper backup procedures can result in substantial if not complete loss of data, which had been assembled so painstakingly over the past ten years. Over the past few years we had a few close calls and dramatic situations but thankfully our "band-aids" held and we never suffered any catastrophic loss of data. It was clear, though, that we were tempting our fortune — the time had come to introduce data storage standards in the Diyala Project that would withstand more much serious challenges. Data storage was only one of the challenges we were facing — virtually all of our equipment needed to be replaced and our software needed to be updated. The NEH grant allowed us to get serious about this.

Before talking about the excitement of the last year, let me briefly recapitulate what the Diyala Project is all about. Visitors to the Oriental Institute Museum who have seen the new Edgar and Deborah Jannotta Mesopotamian Gallery may well be aware that many of the votive statues, stone vessels, votive plaques, cylinder seals, jewelry items, metal vessels, or terra-cotta plaques on display are from the Diyala excavations — unearthed by the Oriental Institute's Diyala expedition between 1930 and 1938 from palaces, temples, and private houses at the sites of Tell Agrab, Tell Asmar, Ishchali, and Khafaje. The Diyala material not only produced many of the highlights in this gallery but also many objects that illustrate aspects of cult, religion, kingship, daily life, raw material procurement, and manufacturing.

RESEARCH

Figure 1. DIGITAL GROUND ZERO: Surrounded by two computers and two scanners at his work station in the museum basement, Robert Wagner examines a large format negative (object photograph taken during the Diyala expedition in the 1930s) for scratches and dust particles. Top right: Robert Wagner and Museum Archivist John Larson discussing a Diyala negative with multiple objects

Many visitors to the gallery would be surprised to hear that only a fraction of this material has been published almost seventy years after the end of the excavations. Between 1938 and 1990 five volumes appeared on the Diyala architecture and four volumes on key artifact classes (sculpture, cylinder seals, pottery), but the bulk of the finds — some 15,000 objects — remained unpublished. According to the excavators' publication plan, most of these items were to be included in a future volume called *Miscellaneous Finds from the Diyala Region*. It is perhaps fortunate that this volume never appeared under that title, for a large number of these finds — which include stone vessels, metal vessels, jewelry, tools, weapons, toys, cosmetic sets, weights, figurines, inlays, cylinder and stamp seals, clay sealings and some 1,200 cuneiform tablets — are now part of our exhibit in the Jannotta Mesopotamian Gallery and hence truly deserve better than to be classified as "miscellaneous."

A major obstacle to publishing these artifacts was presented by the enormous size of this corpus — how does one publish 15,000 objects in one book? How many illustrations could be included for each object? Certain objects (such as sculptured items) required multiple views and close-ups. A richly illustrated volume would have been prohibitively expensive, making compromises on the choice of illustrations inevitable. Such restrictions would have reduced the overall usability of such a volume and raised the question whether it could be considered a comprehensive, "final" publication.

It was the advent of the desktop computer and affordable database applications that finally put such an endeavor into the realm of possibilities. In 1992 McGuire Gibson launched the Diyala Miscellaneous Object Publication Project. Between 1992 and 1996 students entered object descriptions from field registers and catalog cards into a database. At first, data entry was done in "flat," tabular form, but soon we started to appreciate the virtues of a relational database layout, which allowed us to enter multiple value items, such as materials, systematically and in a searchable way, without footnotes or cross references that would have to be looked up manually. We were fortunate that in the year 2000, when the data layout was becoming too complex for our academically trained minds, George Sundell joined us a volunteer. Having recently retired from his job as data architect for a local phone company, George revamped and substantially revised our data structure, which had grown organically and hence somewhat unsystematically over the years, depending on our own knowledge and abilities. In 2002 he started to build a new database layout using Oracle as database backend; since 2003 we have been populating this database with the Diyala Project's data. As reported in previous *Annual Reports*, we often were forced to rethink the logic behind our data layout. As someone who enjoys games involving basic logic I was intrigued by many innovative and unconventional ideas that George came up with. While George had taken classes in archaeology and anthropology at Indiana University and in fact had participated in numerous excavations in the U.S. and England, his professional

background involved the creation of industry standard databases. "Bending" archaeological provenance data, which often had been recorded in great detail but unsystematically by the excavators, into a hierarchical "master layout" — as had originally been our plan (and one that probably would have been shared and accepted by many other colleagues in the field of archaeology), was a no-no for George. As described in more details in our *Annual Reports* from 2002/2003 and 2003/2004, George managed to create a layout that allowed a highly systematic entry of this data. In such situations I frequently had to unlearn what I had learned about data structuring in the past ten years. I had to rid myself of views on the nature, structure, and logical layout of archaeological data, views I had never questioned before but now found impossible to explain in logical flow charts and therefore difficult to maintain.

In short, working with a professional data expert put the on-line publication of the Diyala materials on a solid, well-defined, and sustainable base. As we worked on this material over the years our perception of what we were going to achieve with this publication changed as well. At first we had planned to disseminate the Diyala data on CDs. With the development of the Internet and ever-increasing modem speeds it soon became clear that an on-line, Web-based publication was by far a better way to go. A Web-based publication would be free to the user and, in the absence of printing costs, objects could be illustrated as lavishly as needed. Most importantly, by publishing this data in a backend database we will be able to pass this data on to the user in a dynamic, searchable form, providing not only a publication but also a research tool to query it. Soon we realized the pointlessness of restricting an on-line Diyala publication to the "miscellaneous" objects. A user of the Diyala on-line database will be interested in an integrated view of all Diyala material, irrespective of its publication history. Major items of sculpture, cylinder seals, and pottery had been published previously in book format, but forcing a user to "reunite" the data from print and on-line publications seemed pointless and unhelpful. We therefore included all previously published objects in the database as well.

Our perception of what should be included in this database kept on growing, especially as we kept on working on the objects' archaeological provenance. Following the looting of the Iraq Museum (which sadly also affected the Diyala materials housed in it) in April 2003 and the ongoing wholesale destruction of Iraq's archaeological sites by plundering them for antiquities, the importance (and increased scarcity) of objects from Iraq whose archaeological provenance can be properly established, and which therefore can be meaningfully integrated into Mesopotamia's material and cultural history, has become more than painfully clear. At present the Diyala material remains one of the largest archaeological collections from controlled excavations, justifying the extra attention we paid to its archaeological findspots. Once more, my own understanding of how to structure and enter this data was put to a test. While the physical description of an object can be checked and improved if the object itself is available

Figure 2. EARLIER ATTEMPT AT DIGITIZING Diyala field photographs during the 1990s were limited to the scanning of photographic prints. This photograph, showing a modern impression of a seal with combat between lions, goats, and a bullman as seal scene (from Khafaje, date ca. 2500 B.C.; Iraq Museum, possibly stolen), was scanned from a contact print made of the negative. Though adequate as a 1:1 reproduction, the process of copying from negative to positive has resulted in a severe loss of detail, limiting the allowable scanning resolution and therefore impacting the quality of the digital image

Figure 3. SCANS OF ORIGINAL NEGATIVES are able to capture the grain of the original negative, allowing a much higher scanning resolution and resulting sharper, balanced images. The seal impression shown here is a negative scan of the same image as figure 2, where it is shown as a scan from a print. The increase in quality of print-versus-negative scan is immediately apparent. Below: close-up (location indicated by a white box in the full view of the seal impression) shows the detail captured in negative scans

for verification, the description of its archaeological context would be difficult if not impossible to evaluate or correct. These descriptions are based on an archaeologist's observation in the field, which can never be repeated. Object provenances often were noted in multiple documents, including object catalog cards, field registers, narrative descriptions of an archaeological context in a field notebook, or as a mark in a sketch or plan. The notes could repeat, complement, but occasionally also contradict each other. While contradictions can often be cleared up by identifying a mistake among the available entries, one cannot always come to authoritative conclusions. With the last of the excavators having passed away several years ago we can make informed suggestions based on the material available to us but, needless to say, we can be wrong. The fact that our present day Diyala crew in Chicago may be unable to explain a contradiction in the field notes, however, does not necessarily mean that a user elsewhere in the world cannot. We therefore decided to make all entries for an object's provenance available, especially those that we do not understand ourselves or are unable to reconcile with other entries.

This decision had a much further-reaching impact than we had anticipated. We had to dig much deeper into the Diyala archival material than we ever had planned. In the Diyala recording system, archaeological findspots are mostly described on "locus cards" ("locus" being the basic unit of excavations in the Diyala recording system, mostly synonymous with a room or other architectural spaces). These cards are essentially forerunners to our modern-day locus or context sheets; the data they provide may include narrative locus descriptions (often in dated sequences), lists of features within loci, elevations taken, relative dates (stratigraphic or stylistic) or absolute dates (year formulae on tablets, ruler names on seals or in seal impressions), photograph numbers, object lists, and pottery types. But many detailed descriptions are also found in excavation diaries, letters, sketches, marked up on photographs and even on field plans, all of which are stored in the Oriental Institute's Museum Archives. Some of us, including myself, have had the benefit of working with these original field notes during our dissertation research and therefore could come up with conclusions that often differed considerably from those published by the excavators in their final publication volumes. This situation exposed another crux of book publications — an excavation summary in a book usually represents a tiny fraction of the information originally gath-

Figure 4. DIGGING OLD DAYBOOKS: While scanning original field notes in the background (here a field diary from Tell Asmar), Karen Terras has also begun to transcribe the notebook entries into the text files and to compile an index of keywords for future database searches

ered in the field. Moreover, these summaries represent one interpretation perceived to be the correct one at a certain time after the end of the excavation — they do not reveal thought processes that led to the development of this interpretation and usually do not refer to dissenting viewpoints. As indicated before, a book publication requires tough compromises — every extra page, every extra plan or photo adds to the price of the publication. Items not considered to be relevant to the summary of an excavation will therefore most likely never be mentioned in print. In other words, only a tiny and sometimes unpredictable part of what constitutes an excavation archive will ever be published. In Chicago we have access to the Diyala Archive, but this is an advantage that no one else in the rest of the world shares. Without knowing what is in it an outside scholar would find it hard if not impossible to request access to a particular item even if he came to Chicago. The only way to provide full access to all this material is the creation of an on-line "Virtual Archive" that would be available to everyone.

But just what exactly was "access for everyone" supposed to mean? Initially we considered transcribing all field records for Web publication. But this was easier said than done — just like modern-day field diaries, records from the 1930s consisted of handwritten notes (parts of which may be difficult
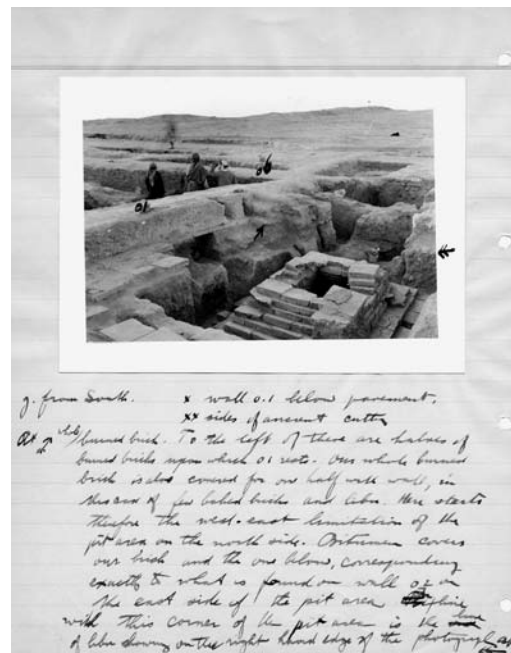

Figure 5. HANDWRITTEN FIELD NOTES provide multiple challenges as shown in this page, taken from Henri Frankfort's field diary for the Palace of the Rulers at Tell Asmar (1930/1931). Handwritten notes often show crossed out or partially overwritten parts, making it difficult to decide what constitute the "authoritative" text. Photographs glued into these notebooks were often annotated to help with the visualization of the narrative; for the Virtual Archive these photographs need to be identified, described, and cross-referenced with field negatives

a) final plan (excerpt)
b) sketch of O30:18 with features from excavator's notebook
c) locus card describing O30:18
d) and e) field photographs showing O30:18 under excavation
f) field photo of object (clay tablet As. 31 T.9) from kiln in O30:18
g) object registration card for tablet As. 31:T.9 with partial transcription of cuneiform
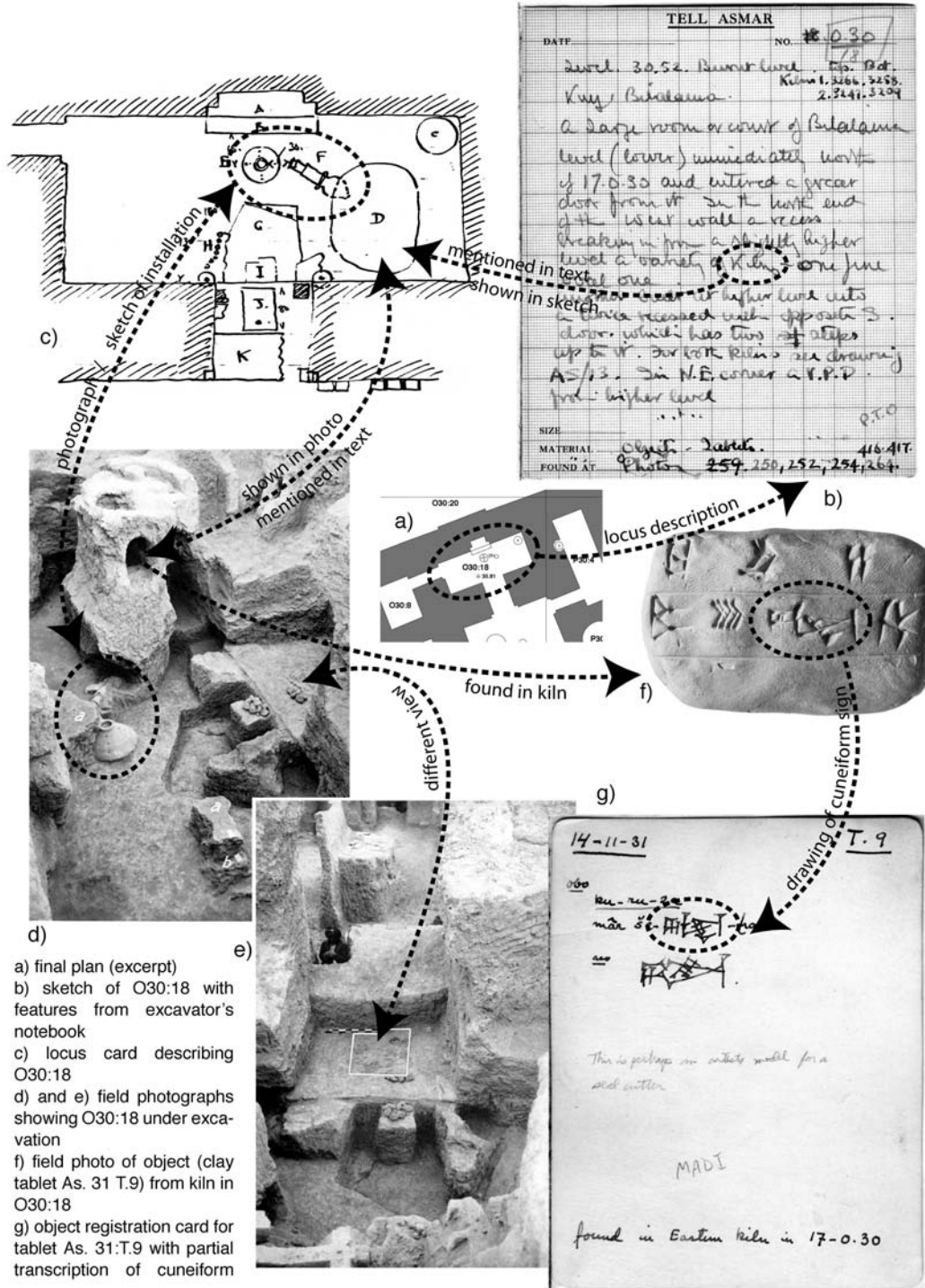
Figure 6. ORIGINAL FIELD RECORDS LINKED AND RELATED. This figure, showing information from notebooks, catalog cards, field and object photographs of O30:18 (the cella of a temple from Tell Asmar), provides an example of how information pertaining to one particular archaeological context can be searched in a relational database

Figure 7. DIGITAL TABLET PHOTOGRAPHY: In the Oriental Institute's Photography Lab, Betsy Kremers examines one of 1,500 unpublished clay tablets from Tell Asmar to determine optimal lighting for the photographs. These tablets are among thousands of previously unpublished archaeological objects that will be made available with the Diyala on-line database

to read or illegible) that often were interjected with sketches and glued in photographs; both sketches and photos could also be annotated. Typing up such notes in a way that faithfully mirrored the originals proved difficult if not impossible. We realized that the only faithful and honest way of reproducing such data is to scan the originals. Such a procedure, however, is time-consuming, labor-intensive, and uses a lot of disk space.

Which brings me back to my walk through the basement mentioned at the beginning of this report. There is one thing I learned during my years at the Oriental Institute: if you cannot afford to pay someone to work for you, ask him (or her) to do it for free. In this respect I have been more than lucky with my volunteer force, which at this point consists of a four-person squad (including George Sundell). So here are the people behind the sounds of work mentioned at the beginning of this report:

Robert Wagner (fig. 1) joined the Diyala Project in spring of 2004. A retired translator (German-to-English) he initially transcribed and translated field registers and notebooks that Conrad Preusser, a German archaeologist who in 1930 headed the excavations at Khafaje, had kept in German (see Diyala Project in *Annual Report* 2003/2004). Once this job was completed, he started scanning cards, field records and, between May and December of 2004, worked himself through some 4,800 object catalog cards and 1,990 locus cards, many of them annotated on both sides. It was largely during this time that we defined what we now consider to be our "digital archival standard" for paper scans — a color scan had to be at a sufficiently high resolution (400–800 dpi) and to be saved in uncompressed format (TIFF). By December of 2004 Robert was ready to tackle the next big challenge: the scanning all original Diyala field negatives. At an earlier time, before negative scanners were more commonly available, we had scanned whatever photographic prints we had of these negatives, but these scans were fairly mediocre in quality (fig. 2). Most of these prints were contact prints from negatives and had a much coarser grain than the negatives. Scanning them at any resolution higher than 300 dpi proved to be pointless — not a satisfying standard when trying to obtain digital facsimiles. Test scans of the negatives, by contrast, which vary in size but average around 5 × 7 inches, indicated that the film grain was not to going to be visible at resolutions below 2,000 dpi. This represented a gigantic increase in

quality (fig. 3) but also in technological requirements and disk storage space. Thankfully, large-format transparency scanners have become much more affordable in the past few years. Registrar Raymond D. Tindel kindly provided a table in the museum's basement area for a computer and a scanner. By early January, Robert had started to scan the first negatives of 1,800 object photographs and over 1,900 archaeological site photographs from the Diyala excavations. Scanning negatives at a high resolution (we settled for 2,400 dpi) takes time, sometimes up to fifteen minutes per scan. Robert found himself making more progress in reading the *Fall of the Roman Empire* than in producing actual scans. We soon decided to have him double-task — we bought another computer and another scanner, turning his basement space into a scanning mission control center. This certainly did speed things up. Robert has so far scanned all available negatives from Tell Agrab, Tell Asmar, and Ishchali and is now working on those from Khafaje. He estimates that he will be done with all of them by the end of this year, which would be a lot faster than I ever expected this to take.

Karen Terras (fig. 4) joined the Diyala Project in May 2004. A veteran of the Iraq Museum Database Project she already had considerable experience in data entry, editing, and scanning. Almost immediately Karen threw herself into scanning excavation diaries and notebooks. Once more, this required some planning, since we decided to scan at a resolution that could be considered as archival quality (at least 400–600 dpi). As in the case of locus and object cards, subsequent color pencil annotations on many pages required these notebooks to be scanned in color to ensure that each of these paper trails could be followed in the digital copy as well (fig. 5). In additions to scanning notebooks, Karen also started to read them for content. It was all well and good to have scans of all the pages, but how was anyone to find anything in them if there was no index for their data? Before creating indices, however, it was necessary to identify indexable items and to compile them in a list — a much trickier order than it may sound at first because how is one to know if in the twentieth notebook an item that was ignored in the first nineteen notebooks will be considered worth indexing? Over the past twelve months Karen not only scanned about 100 notebooks and collected key search items from them, but also successfully transcribed several of them word by word. This will be an added benefit for the user, who will not only have a digital facsimile of the original but also a fully searchable text-based version of these notebooks for which each word, whether indexed by Karen or not, can be found. An example for a possible search is illustrated in figure 6.

Mostly unaffected by Robert and Karen's scanning Olympics, Betsy Kremers has been working steadily since 1998 in the basement as the project's photographer (fig. 7), taking pictures of Diyala objects at the Oriental Institute which either had not been photographed at all or needed better photographs. Originally we used a 35 mm camera with black-and-white film, which was subsequently scanned. In 2003, we switched to a digital SLR, which gives us instant control over the quality of images and also allows us to create color digital images. There is no single program step that could tell me right now how many times exactly in the past seven years Betsy pushed the camera's release button, however the database has logged over 6,000 new scanned black-and-white images between 1998 and 2003 and over 1,000 digital images since 2003.

The intense scanning work of Robert and Karen worsened the project's space crunch that I had lamented earlier on, but thanks to our NEH grant we are now able to face this challenge. Three new one terabyte drives (one terabyte = 1,000 gigabytes) have solved all of our storage problems for now. With prices for storage media coming down more and more there really is no reason any more to compromise on scanning quality. In this context, I am happy to report that I finally have a helping hand in the administration of the project. In late April, Alexandra ("Ali") Witsell joined the Diyala Project as a student assistant. Ali, who is a graduate student of

Mesopotamian archaeology, has taken over all backup routines for scans but soon will also start analytical work on specific artifact classes towards her Ph.D. dissertation on Diyala material. I am hopeful that Ali's future work will continue to highlight the research potential found in the Diyala material.

By June next year, the Diyala Object database should finally go live on-line. But this will not be the end of our work. Over the next few years, we will continue to make additions and corrections, and we are presently seeking funding to finance the creation of the Virtual Diyala Archive on-line that I described earlier on in this report. The worst thing about creating an on-line database as a final publication is also its greatest asset — it will never be finished. This means that the Diyala material will probably haunt me for the rest of my life, but it also makes it possible to post updates and to include new results in the database almost immediately.

This year I wish to express particular thanks to Raymond D. Tindel, who has been and continues to be a more than gracious host to the Diyala volunteers working in the museum basement. Thanks also to John Larson, who kindly made the Diyala material available to us for scanning, and who on countless occasions lent his own expertise. As in previous years, the Diyala Project has received additional financial support from numerous individuals, whose generosity is gratefully acknowledged here. In particular I wish to thank an anonymous supporter for a generous donation that made a substantial refurbishment of my office possible. With new computer tables and bins on the wall, my office now comfortably accommodates three people (George Sundell, Ali Witsell, and myself). Finally, I want give a heartfelt thanks to George, Robert, Karen, and Betsy, the volunteers who have become the heart and soul of this project. Without their selfless input a project of this size would never be possible at the available budget, and their continued enthusiasm remains an inspiration to all of us.

————————————————