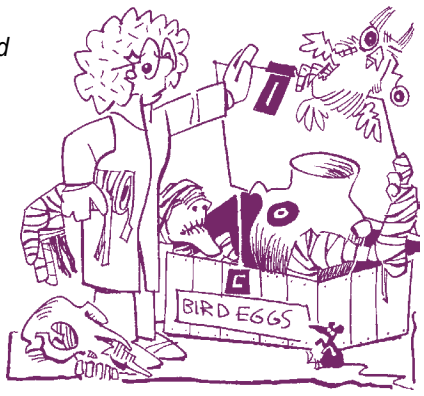
MOVING THE MOUNTAIN:

Science Museum of Minnesota®

GUIDE TO MOVING COLLECTIONS

Everything you've always wanted to know about getting all that stuff from here to there...

AN ANNOTATED TABLE OF CONTENTS FOR MOVING THE MOUNTAIN



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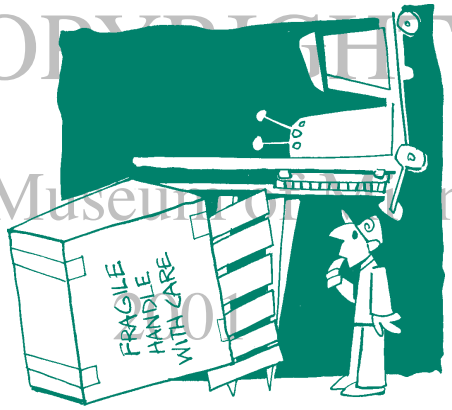

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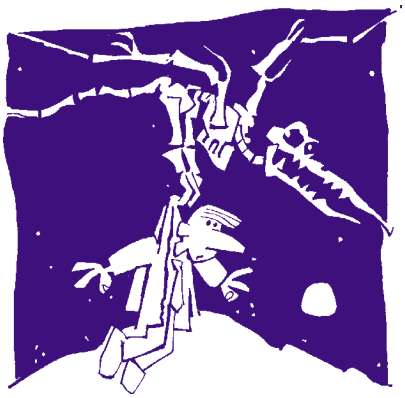

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MOVING THE MOUNTAIN:
THE SCIENCE MUSEUM OF MINNESOTA GUIDE TO MOVING COLLECTIONS

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Editor's Note

Administrative Coordinator Debbie Schoenholz *at her spiffy desk in the break room where she worked for several months after our offices moved.*

When the Collections Management and Conservation Departments at the Science Museum of Minnesota began actually packing our 1.75 million collected objects and specimens in 1997, we planned and undertook a staggering amount of tracking:

for estimating cabinet/drawer requirements,
for sending shipments to the correct destinations,
for locating any item for any Curator at any time,
for indexing against new storage locations,
for ordering needed supplies and materials,
for ensuring efficient and safe transport,
for easiest removal to new cabinets, and
for daily packing schedules.

Data was kept by collection "packing project" for calendar purposes (see the list on pages 33-34), but those projects did not necessarily correlate with curatorial definitions of specific collections. Our purpose in classifying certain types of objects as a single project was to pack them the same way and send them to the same place. Hence a curatorial collection may have been broken into several packing projects that needed different packing methods and/or to be sent to different destinations.

As collections unfolded before us item by item, they were not always in locations or quantities we expected; many times we were surprised at a collection's extent once we had unstacked the overpacked drawers and spread things out. Just as often our space and time parameters, set by the larger world of building construction and institutional policy, were altered so that we had no choice but to accommodate new deadlines or reduced support. I cannot emphasize enough how our planning evolved daily and how often everything we thought we knew was wrong.

In light of these challenges, there were certain kinds of information that we did not seek. We did not track how many volunteer or staff hours were spent on each packing project, nor do we do know what percent of our supplies went to each. In some cases we do not know how many items make up a specific collection. Such information could be estimated from tracking records, sign-in sheets, and calendars, but the information on these daily-use documents often, even usually, changed in progress and was never corrected on paper. Our best estimates gained from such research would be innaccurate.

And so we are offering our experience—as it happened—instead. Where we have useful data we have reported it; where we do not, we hope that our story will give you enough information to help you choose your own packing path. Always you may feel free to call or e-mail any one of us for more detailed discussion of specific issues. And whatever you do,

Keep smiling.

Deborah Schoenholz
February, 2001

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Foreword

This manual is a "how we did it" more than a step-by-step guide to moving collections. It begins with an overview of the planning process and proceeds through the scheduling, staffing, packing, moving, and unpacking of our collections. Each section describes through text, figures, photographs, and a little levity the process we used, with analyses of what we thought went wrong and thoughts on how we would do it differently now. We hope this manual will help you in planning and executing the move of your own institution–or at least to know the pitfalls.

I want to thank all the individuals who have been involved with this project, starting with all the colleagues we pestered; the vendors who worked with us, especially Bruce Danielson of Delta Design, Inc. and his brilliant installation crew; Dave Bettner representing Elecompack; and Mark Kreissler and the boys at Barrett United. Thanks also to Laura Word at the National Endowment for the Humanities; the late James T. "Tom" Callahan at the National Science Foundation; Steve Schwartzman at the Institute for Museum and Library Services; Nigel Yez and Keith Russell of PAST, who made moving dinosaurs a joy; Dave Leak of Blue Rhino for all the early morning fun; John Perry and the "lads" in the SMM Exhibit Shop; Larry Wechsler, grant slinger; the Research and Collections staff; Tom Carlson, Don Hedin, and the Maintenance and Security staff; volunteers; and the doctors who got us all through. I am sorry if I have missed anyone and that there is not space to name you all individually.

One of the most important things we did was to take the time to laugh, be silly, and celebrate our successes as they happened. I hope you are able to do the same; this was a long and exhausting project and the people involved made it better.

Lori Benson
Collections Manager
January, 2001

SMM Collections Move Team, 1998

From left to right:
***Deborah Schoenholz**, Administrative Coordinator*
***Jackie Hoff**, Collections Management Assistant*
***Rebecca Newberry**, Conservation Assistant*
***Lori Benson**, Collections Manager*
***Gretchen Anderson**, Conservator*
***Kristen Parrott**, Curatorial Assistant for Collections*

CHAPTER 1

HISTORY OF THE SMM MOVE PROJECT

Lori Benson
Collections Manager

OVERVIEW

The New Science Museum of Minnesota, St. Paul

In 1992, the Science Museum of Minnesota's board and staff began a long-range program planning process leading to a new vision for the future. An assessment of the museum's facilities showed them to be seriously inadequate to accommodate growing audiences and collections or to allow the institution to fully pursue its mission to meet the informal science education needs of the community and the region into the future. In 1994, following extensive discussions with the city, downtown businesses, adjacent neighborhoods, and long-time supporters, the museum board selected a site in downtown St. Paul on the bluffs overlooking the Mississippi River. The City of St. Paul pledged its full cooperation to integrate the museum's vision into a larger downtown and riverfront recovery program, and the state legislature authorized $1.2 million in planning funds. In 1995, the city pledged contribution of the land and site-related infrastructure improvements with a total value of more than $18 million. Schematic designs of the new facility were completed, and private sector fundraising began. The private sector campaign goal was set at $40 million. In 1996, the state legislature appropriated $30 million in general obligation bonds toward the $99.6 million project. The private sector goal was increased to $41.5 million. By mid-1997, design was completed and a general contractor was in place. Ground was broken in May 1997. In March 1999, the private sector fundraising goal of $41.5 million was reached. The old museum closed September 6, 1999. The new $99.6 million, 400,000-square-foot facility opened to the public on December 11, 1999.

Collections Manager Lori Benson
maintained a good grip on the situation at EVERY level!

RESEARCH AND COLLECTIONS PERSPECTIVE

In 1994, it was clear that the Science Museum of Minnesota would be building a new facility. We had outgrown our old facility and could not accommodate growing audiences, programs, or collections. At the same time, the aging building had deteriorated, degrading the visitor experience and placing col-

lections at serious risk. A conservation survey of storage and exhibition spaces conducted in 1990 had concluded that there were many problems, including the fact that storage was 100 percent overpacked.

In 1995 the site was chosen for the new building. Brainstorming sessions were a continuous part of the early days. Why did we need a new building? What were the problems with the current building that we could correct? Museum staff were extensively involved in all phases of the new building's design, and issue teams were convened before the schematic design was begun to incorporate the staff's expertise into the principles that would guide the design.

The Collections Manager was a member of the team that dealt with issues related to the flow of objects and materials in the course of museum operations, and the needs of moving the collections were considered in that context. Questions about how all kinds of objects, materials, and special exhibits would enter the new building; their patterns of movement once inside; and storage were visualized and mapped.

Museum staff's participation in the building design continued in subsequent phases of the process. One of the responsibilities of the Research and Collections Division was to work with SMM's Facilities Planning Team and building architects to incorporate the needs of collections into the design and layout. In particular, we were keen to address recognized deficiencies in existing collections storage facilities. From holistic, museum-wide, integrated pest management to building security and the environmental specifications of collections storage and work areas, research laboratories, and exhibit areas, every effort was made to consider the needs of the collections.

We addressed all the questions we could think of: for example, How much cabinet and shelf space would we need? We had not done an inventory recently and did not know exactly how much drawer and shelf space would be required as the tightly overpacked objects were mounted and moved into more appropriate storage. How much do the collections weigh and what does the floor load need to be? The current literature was consulted, but when it came down to proving need, a cabinet of invertebrate paleo (some of our heaviest collections) was emptied and each drawer and specimen was weighed on a bathroom scale. Armed with as many such answers as possible, we negotiated our new space.

Once the schematic design was completed, the Collections Manager worked closely with the architect specializing in lab facilities to design the Research and Collections spaces. In addition, the Collections Manager worked with the museum's Maintenance and Building Operations Department to ensure that cost-cutting decisions did not negatively impact the previously defined parameters for collections specifications.

Collections Management and Conservation worked hand-in-glove to get the move project off the ground. During the early planning stages, the Research and Collections Division presented collections issues to other museum departments to raise awareness of the complexity of the move; we could not, like a manufacturing plant, move over a weekend. It seemed necessary to educate these staff members in the realities of collections. The Conservator explained fragility and deterioration issues to show why Research and Collections needed to be involved in the earliest stages of design for the new building and why we had to have specially trained staff and volunteers to handle, pack, and move the collections. It is the Conservator's job to ensure that all artifacts and specimens are packed so that nothing is broken before, during, or after the move. The Collections Manager must ensure that not one of those items is lost.

FUNDING

Finding the money needed to build a new museum and move into it required a phenomenal amount of effort and planning. In the Research and Science Division, the Collections Management Department, in conjunction with the curatorial staff, wrote and shepherded the really big grants from the National Endowment for the Humanities (NEH) and the National Science Foundation (NSF) for moving and for collections storage equipment (shelving, compactors, and cabinetry). The Conservation Department undertook the task of funding the biology collections, which were not covered by NEH (anthropology) or NSF (paleontology) proposals. Institute of Museum and Library Services (IMLS) CP (conservation project) grants were obtained for some of the biology collections (osteology, bird study skins, shells, and wet collections), providing packing supplies and cabinetry for the new vault. The process of applying for and receiving small IMLS CP grants will continue as we fund other parts of the biology collections.

Outside of federal sources, our options for funding collections storage and moving were limited. The capital campaign run by the museum had priority over any projects, therefore most foundations and individuals were already committed until the campaign ended. The division did have access to part of the capital campaign moneys for fixtures, furnishings, and equipment (FF&E) and certain move line items. FF&E was used to fund laboratory benchwork and as equipment match for NEH and NSF grants.

The move project budget for Research and Collections included money for

- benchwork for the laboratories;
- new storage cabinetry, shelving, and compactor system for collections;
- some equipment for the move;
- salaries for extra staff;
- salaries for existing staff;
- hourly staff;
- packing supplies and materials; and
- the moving company.

Final Mix of Moneys for Collections Move

(out of total budget of $99.6 million for entire project)

NEH #PH-20853 Relocation and Rehousing of Anthropology Collections: $700,000
3 staff members, materials, storage cabinets and shelving, and moving company

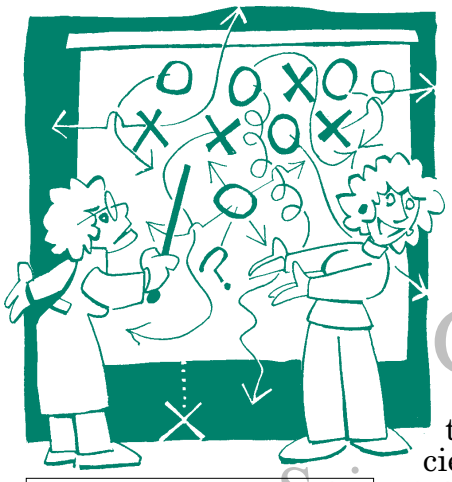
NSF# 9876851 Relocation and Rehousing of Paleontology Collections: $500,000 (rounded)
1 staff member, materials, storage cabinets and shelving, and moving company

IMLS Grants: 3 grants at approximately $50,000 (each)
cabinets and materials for biology collections

Capital Campaign: $843,000
benchwork, compactor system, other equipment for laboratories, some staff match for grants, miscellaneous items, and equipment

General Operating Budget: approximately $800,000
salaries for collections management, curatorial, and conservation staff along with some supplies, equipment, and overhead

MOVING THE COLLECTIONS



STAGE 1: PLANNING

Lori Benson

In terms of actually moving the museum's collections, primary responsibilities fell to the Collections Manager, who is charged with the management and care of all objects, and the Conservator, who is charged with the health and welfare of all objects. Lori Benson, Collections Manager, and Gretchen Anderson, Conservator, began planning for the project in 1995. This included marshaling the necessary estimates for space and equipment in the new facility, forecasting staffing needs, outlining the packing process, estimating materials and supplies, and developing tracking policies, besides finding the money to actually do it all.

WRITING GRANTS

Timing your grant proposals is a primary planning consideration, whether the request is to a federal agency or a private foundation. Anyone who has written grants knows that you must wait, often for several months, before the proposal is reviewed and accepted or rejected. We were fortunate enough to start our funds planning well in advance of the move.

Inhabiting a new facility was the best argument for the purchase of a new storage system. In the end, the Division was allotted less space than initially requested (this was true for every division at the museum), and it became obvious that the only way to have enough space for our current collections and collecting in the future was to build compactor storage into the building. Compactors consist of shelving and/or cabinets that fit on carriages that move easily on rails in the floor; we needed this kind of system to provide as much flexibility as possible. Since it would be difficult and expensive to retrofit these rails after the floor had been poured, the case was finally made for spending the necessary resources, and the rails were scheduled to be installed during building construction even though we had not yet received word about the grants. Since the efficient use of space and the physical integrity of the collections were primary concerns, SMM opted to design storage around a compactor system in a single vault, emphasizing

Matching Funds

"Matching funds" are those moneys provided to "match" the amount requested in a grant. The grantee must document whatever he or she is providing for the project in dollar value.

The granting agency determines what may be considered a match, including

- salary (% of time)
- cost of contractors
- capital (e.g. money spent on infrastructure)
- private money (gifts)
- general fund money
- equipment or supplies
- volunteer time
- operating costs (some times)
- inkind donations

The granting agency also determines the required percent of the match, so that, for example, IMLS CP requires a 1:1 match. That is, if they put up $20,000, we put up $20,000. Other agencies might require 2:1 (for every $2 the agency contributes the grantee contributes $1) or 3:1 and so on.

Suggestions for Writing Successful Grant Proposals

- Work closely with your program officer or other funder.
- Talk to museums that have been funded for a project similar to yours.
- Be clear and specific about your workplan.
- Do your homework so you can justify your choices and your budget.
- Work with your development department.

flexibility in the design and manufacture of storage units and employing a variety of minimizing methods and materials in the packing and storage of objects and specimens.

In 1996, we wrote our first proposal to NEH. With so much still unknown about the new building at this date, our plans were not as well defined as they should have been, and the proposal was not funded. This was also true for our first proposal to NSF. But by working closely with the program officers, we were able to focus our proposals and in both cases we received the requested funding on our second try.

Compactor Carriages Installed in New Vault

One of the major problems with these grants was allocating matching funds (see sidebar on page 14). Many hours were spent with the Development Department and the Finance Department carving out funding from the capital campaign pie to meet these requirements. Then, as the move project got under way and money needs multiplied on every front, it became a challenge to track the moneys allotted to the collections portion of the project.

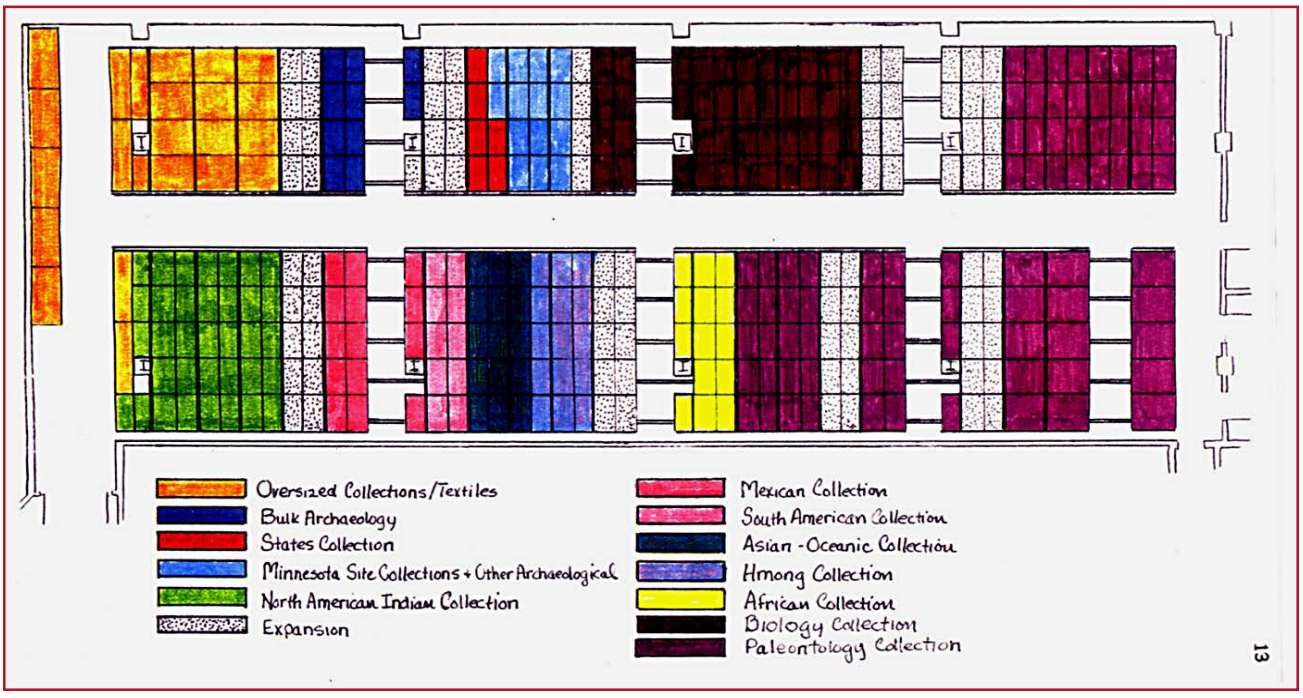
The list of things that can and do go wrong in a large project like this forces planners to build adaptation into their methods. It's called "dancing as fast as you can."

Estimating Storage Requirements

The first step was to complete an inventory of the existing cabintry by 1) cabinet or shelving type, 2) numbers, and 3) locations, since we had such a variety of types and locations including offices, hallways, and every available niche and cranny. In order to get a handle on the number of new Delta cabinets and drawers we would require, we first measured existing Kewaunee cabinet capacities by opening a drawer, measuring the height of the objects in it (to know what depth Delta drawer would be needed), and approximating how many layers of objects it contained. The number of layers was then calculated for each height category

Movers do not successfully come and get things and set them down on the other side without enormous preparation and fastidious time management.

Projected Plan for the New Facility Vault



Move Project Office

This manual *does not address* the major museum move schedule worked out among representatives for all departments within the museum. SMM hired a consultant to run the Move Project Office that worked out the details of scheduling Education; Exhibits; External Relations; Marketing, Communication, and Sales; Museum Programs; Omnitheater and Films; Support Services; the President's Office; and the Research and Collections Division to *all* move from here to there, a process that took an entire year and 1,340 specific line items on its calendar.

The schedule considered here, like all move planning and packing addressed in this manual, is specific to the Research and Collections Division.

(see Chapter 5 for description of Delta cabinets) and converted to area totals, which were divided by the area of a single half- or full-size Delta drawer to get the number of needed drawers of each type and depth. We also added a percentge for growth based on current collecting. Collections Management staff undertook this estimate armed with forms, pencils, and measuring tapes. Where objects were on top of cabinets and/or in boxes, educated guesses were made about their area conversions. Objects to remain on open shelving and oversize objects were directly measured and converted to total necessary area, easily divided by the dimensions of our new shelving. Drawers containing paleontological specimens were counted and translated directly to Delta drawers, doubling that number and adding 25 percent for growth (depths were not taken for this collection as we used only one size (the least deep) drawer for all paleontology.

This method came close enough to a good estimate for bidding purposes, but we were later glad that we did not have to order everything at that time, especially for ethnology. The realities of packing within the drawers as we received them adjusted depths and total numbers as we actually fit objects and particularly mounts into the space.

Scheduling and Staffing

In most cases, the length of time you have available to pack and move will determine your staffing needs as well as your schedule; the two are interdependent.

At SMM, a tentative schedule outlining the gradual packing and moving of collections over five years (from 1998 to 2003) was developed and submitted to NEH. We crossed our fingers and waited. Then, because of circumstances outside our control, it became necessary to vacate our old building in 1999 instead of having collections remain there until 2003. After the first panic, we rethought the project and revised our schedule accordingly.

Considerations in Developing a Schedule

We recommend closing collections for the packing and move. Although we closed collections for research and other use, some exhibit projects were still choosing objects as the packing took place. Items to be used in the new Collections Gallery were sometimes picked only because everything else was packed. In some cases, we were required to unpack something already packed and stored.

Who and how many other groups or individuals will you need to develop consensus for scheduling items?

Making the list of people and organizations with whom you must interface and on whom your plans may depend is an absolutely necessary first step in scheduling your activities. For example, where will you be storing pallets of packed items before transporting them? In our case, we needed to arrange this space with at least two other departments, and our access to those spaces depended upon their schedules. Excellent communication and diplomatic skills are required by all staff involved in these discussions/negotiations, especially in light of the following:

Expect the unexpected; think about contingency plans; be flexible.

- Changes in capital campaign allocations necessitated the revision of our equipment budget several times.
- Competition for scarce resources like storage space and the moving company caused constant readjustments to our daily schedule.

- Packing and moving techniques developed in theory were not always possible in the material world where objects were more fragile, heavier, more numerous, or less accessible than anticipated.
- Shipping dates of suppliers always had to be accommodated.
- Continuing museum activities such as special exhibits, development of new exhibits, or surprise visiting researchers sometimes needed to be accommodated.
- Other divisions and departments occasionally underestimated their needs or abilities, throwing a wrench into our gears.
- New facility construction fell slightly behind, altering our original early-entry plans; while the collections area was ready, the route there, including the freight elevator, was not.

The list of things that can and do go wrong in a large project like this forces planners to build adaptation into their methods. It's called "dancing as fast as you can."

How many staff members will you have and what are their individual strengths and weaknesses?

The speed of your move will be primarily defined by the number of bodies you have. In our case, to pack and move 1.75 million objects, 9 offices, and 6 laboratories over 2 years, we used as many packing volunteers (59) as the Collections Management Assistant and the Conservation Assistant could manage (half-time for each of them), 2 full-time Collections Technicians, 1 full-time Administrative Coordinator, 1 half-time traffic position (Collections Management Assistant), and 1 full-time Curatorial Assistant as well as the Collections Manager, the Conservator, and the remaining half time of the Conservation Assistant. Further help was obtained by individual Curators and their Research Associates as we folded their spaces into the plan, occasional part-time labor, and anyone else we could rope into service as deadlines began to mount (see photo on page 28).

Efficiencies in speed were created by managing the individual strengths and weaknesses of both staff and volunteers. For example, the Conservation Assistant had previously been the person who filled out Condition Reports on ethnographic objects. However, her skills were needed more urgently for other jobs like developing protocols, so the volunteers were trained to do the Condition Reports as they packed to free her for more important tasks. Since these reports were very detailed, a new user-friendly version was developed to enable the volunteers. Your packing plan, which paces your schedule, should optimize the skills of all personnel.

Finally, don't forget to consider the change in workforce allocation that will become necessary as packed objects are moved to your new location. Movers do not successfully come and get things and set them down on the other side without enormous preparation and fastidious time management. You will need at least one person to send and another to receive, showing movers what to pick up on one end and where to set it down on the other end. More staff will be needed in the new location if pallets need to be unloaded to various locations, objects are going to be unpacked, or even if storage there is tight and pallets will need to be rearranged as new deliveries are made. Packing will not continue at the same rate when these activities are taking place.

What Is Clean?

An interesting pre-move issue that affected our schedule was cleaning. We discovered that the contractor and the subcontractors for the new facility had a different definition of "clean" than we had, and when they thought the spaces were ready we did not! This became a large issue before and after the start of the move, and we had to work out a specific definition to which all parties could agree.

Some of the movers brought quite a bit of moving experience with them, which was helpful especially when we had to move large or awkward things. They knew about equipment we could use to make things easier.

At planning time it was assumed that all heavy lifting, pallet wrapping and moving, and so forth would be performed by the moving company. This did not turn out to be the case because of the change in the moving contract and these heavy jobs were performed by the Collections Management Assistant, the Conservation Assistant, and the Administrative Coordinator aided by several able volunteers.

Estimating Costs
Packing Supplies and Materials

Once a tentative schedule and staffing levels have been established, it becomes necessary not only to better estimate the number of objects and specimens to be moved but also to identify all the different *types* of collections to be packed. Approximate inventories of all collections should be made. At SMM, the resulting lists of collections were used by the Conservator to develop packing protocols for each type of collection.

Goals for these protocols included

1. developing permanent mounts so that no further mounting would need to be done after the move,
2. providing maximum protection for all objects through the transport phase of the move,
3. finding and noting all objects and specimens needing attention for conservation/accessioning purposes, and
4. using the minimum volume of packing materials necessary to accomplish 1 and 2 above.

As the shapes and sizes of newly mounted objects were determined, the Conservator made a rough estimate of material needs on the basis of size extrapolation. For example, ceramics were necessarily heavily padded, with wide mounts that included Ethafoam on all sides of the piece. Our estimates for the Ethafoam, Tyvek barrier material, and glue needed for this project would all be high, and the number of such mounts that could be placed in a single box and the size of that box drove estimates of the number of boxes we would need, the number of pallets it would take to stack the boxes, and the space required to store the pallets. This exercise was completed for every type of collection.

Comparative pricing was obtained from companies familiar to the Conservator for all standard materials, and our needs in custom supplies, like specially sized boxes, were put out for bid. We bought appropriately from the best offers, usually sending staff to pick up as necessary. As our pace increased and staff time became even more important, some changes were made to using suppliers who could meet demand faster or from whom pickup was not required.

Detailed Inventories

In some cases, more-detailed inventories were made of a collection as it was packed later in the move as part of our overall goal to include as much information in the packing process as was necessary to make life in the new facility easier. The osteology collection was a case in point, where no good inventory had been maintained. In order to classify bones according to their immediate lab priority, packers wrote a detailed inventory that detailed which specimens needed freezing before relocating, which specimens needed to go directly to the lab, and which specimens could be delivered to permanent osteology storage (see *Osteology Inventory Form*, Appendix A).

We needed safe materials for the packing and safe transportation of a dizzying variety of objects, from fragile textiles and shells to Pleistocene skulls and canoes.

The mounts had to be made of archival materials, whereas the boxes and additional packing were often nonarchival (less expensive) and anticipated to be in contact with the collections only a short time.

Moving Vendors and Equipment

Finding the right moving company is imperative. Companies that handle regular business and home moves are not prepared for the fragility and/or importance of many scientific collections. Assuming that you have input into the hiring decision, you must make it very clear that the protection of valuable collections is more important than speed or price. If these requirements are incorporated into the job request, only movers who are willing to insure their performance should apply. Give a tour to each of these "qualified" companies and describe your expectations, interviewing them to ask questions such as

1. Do they understand handling and security issues?

List of Supplies and Totals Used

(does not include boxes,trays, or purchases for unpacking)

TOTALS

Material	specific	Total Amount
ACID-FREE TISSUE		26,000 square feet
	40"x1000' roll	±20000sq.ft.
	2'x3' sheets; 250sheets/pkg	6000sq.ft.
BACKERCORD		32,874 feet
	1/2"x2500' roll	17500ft.
	3/4"x1100' roll	9900ft.
	1"x550' roll	3850ft.
	1 1/4"x400' roll	1600ft.
	1 1/2"x6' sticks	24ft.
BUBBLE WRAP		2,320 square feet
	1/2"x4'x250'	2000sq.ft.
	1/2"x4'x80'	320sq.ft.
COROPLAST	49"x78"	±10,620 square feet
STOCKINETTE		1075 yards
	2"x25 yards	900yrds
	3"x25 yards	175yrds
ETHAFOAM		50,460 square feet
	1/8"x4'x600' roll	4800sq.ft.
	1/8"x6'x550' roll	19800sq.ft.
	1/4"x4'x300' roll	22800sq.ft.
	1/2"x2'x9' plank	1710sq.ft.
	1"x2'x9' plank	990sq.ft.
	2"x2'x9' plank	180sq.ft.
	3"x2'x9' plank	180sq.ft.
JET MELT	11lb.box	110 pounds
MUSLIN		1,542 yards
	40" wide	1350yrds
	60" wide	21yrds
	108" wide	21yrds
	?	150yrds
PALLET CORNERS		30,250 inches
	29"	5800in.
	34"	13600in.
	69"	3450in.
	74"	7400in.
PEANUTS	14 cubic foot bag	896 cubic feet
POLYBATT		636 yards
	4oz, 48"x40 yards	320yrds
	6oz, 48"x30 yards	120yrds
	8oz, 48"x22 yards	66yrds
	fairfield 45"x75 yards	75yrds
	bulk 10lb box	30yrds
	bulk 25lb box	25yrds
STRETCHWRAP		54,000 feet
	20"x1000'	52000ft.
	17.5"x2000'	2000ft.
TYVEK		18,000 square feet
	60"x100 yards (5'x300')	16500sq.ft.
	5'x300'	1500sq.ft.

2. Have they moved collections before?
3. Do they know what that means for fragility, speed, and so forth?
4. Will they follow your guidelines?
5. Will they follow your timing concerns?
6. Will you have the same moving staff or will it be an ever-changing panoply of faces?
7. How are they planning to move the collections and what kinds of equipment will they use?
8. How will they deal with "unusual" items?

Make sure that all expectations are laid on the table. Define what portion of the work you want them to do. What happens if they don't follow your guidelines and there is an accident? Who is insuring the shipments? Are all expectations clear on both sides?

Other Contractors Used by Collections Move Team

Other moving companies for delivery of old empty cabinets to new owners' supplemental storage

SMM's Exhibit Shop for special construction like extra carts

Wheels supplier for cart construction

Pallet builder for special and regular-sized pallets

Construction specialists to take down complicated shelving

Dinosaur specialists to take down and reassemble large dinosaurs*

Technician to balance scientific instruments

Custom paper cutters and box makers

Rigging company to move very large/heavy objects

*See Chapter 4 on the move of Paleontology Hall. Technically this move was not administered by the Collections Move Team. However, the Collections Manager and especially the Conservator were actively involved with the Director of Paleontology Hall in this part of the move, and our staff and some volunteers were often called upon to get the work done.

Craig Buttons (front) and Craig Poeschel (back) *from Barrett Moving Company transport the large fiberglass reproduction of an Olmec head.*

In one important aspect, this process did not happen at SMM. Early in the process, the Collections Manager had worked with a moving company in order to get bids for the grants. Our specifications and expectations were based on the movers doing the heavy work of lifting, loading pallets, shrink-wrapping, and so forth. Unfortunately, the bid for the entire move project included Research and Collections but was based on the speed and efficiency of an office and equipment move without the labor needs we expected. The final move contract applied to us as well as everyone else, so we were left with our labor needs unmet. This put extreme pressure on our move team in terms of physical labor that we were not expecting, and it incurred unexpected costs where we simply could not move something without additional help or additional equipment such as carts, dollies, and pallet jacks.

Other contractors will be needed as the project progresses, but it is not always possible to specifically plan for them in advance. For example, we expected to be supplied with pallets from our own warehouse. It soon became clear, however, that we would be needing some pallets of nonstandard size that the warehouse did not have and that we would want many more of the standard size than they could supply. As a result, we had to purchase both standard and specialized pallets at additional cost.

The space required to store palleted collections continued to grow beyond our expectations (and our preparations), and as there was no more unallocated space in the museum for us to use, negotiations for small areas of storage space wherever we could find it in the building took a lot of unanticipated time and energy, not to mention the cost of procuring offsite temporary warehousing space.

Analysis: *Although the majority of construction on the Research and Collections spaces was done well ahead of our move (enough for the prerequisite "off-gassing" period), there was more finishing work than anticipated. A great deal of our time was spent making sure that we were not in the contractors' way and that they were doing things safely around equipment and the moved collections; it became the Collections Manager's job for several months to "babysit" contractors and let them into secure spaces. It would have been preferable for the space to be totally complete before starting to move the collections.*

We also had some issues with writing grants and what constitutes a "grant match." Since we had several decision-makers on the project who were not familiar with museums and federal funding projects, we should have spent more time making sure that all individuals understood the terminology (see sidebar on page 14).

Finally, we should have separated the collections from the office moves. Some of the confusion related to moving-company responsibilites and schedules might have been avoided if these types of objects were not mixed. More defined communication at the planning stage might have helped with this as well.

Supplies Were Everywhere...
Jackie Hoff and Rebecca Newberry carefully measure the new Ethafoam planks in the Pallet Room, where as many of our supplies as possible were kept.

STAGE 2: ORGANIZING STAFF

Deborah Schoenholz
Administrative Coordinator

While the museumwide Move Project Office–one individual from each division plus the Move Consultant and his assistant (see sidebar on page 16)–met every week to hash out important issues and construct an overall move plan, the Collections Move Team also met every week to track progress, solve problems, define material needs, and respond to Move Office initiatives. The Research and Collections move was itemized as part of this larger move schedule, but it remained autonomous within those parameters.

Collections Manager Lori Benson represented our Division on the Move Project Office Team. Through her we learned of Move Office developments, returned messages of our own, and in general negotiated our position in the overall move.

Within our own Division, the Research and Collections move was a high-priority agenda item for airing problems and coordinating differences of opinion at every biweekly Division meeting. The Collections Move Team then met with Curators on an as-needed basis; Curatorial responsibilities were managed one-on-one by the Administrative Coordinator.

Overall staffing for moving the collections came from all Research and Collections departments; the curatorial staff had to be available at least to help with the organization and scheduling of their collections. The bulk of activity, however, fell to Collections Management and Conservation staff. Much additional help was necessary even though Collections Management grew from a single-person department to a six-person department and Conservation's part-time assistant became full-time. Volunteers were added when SMM's Volunteer Coordinator asked if we would have projects available for Anthropology Hall volunteers after the early close of the exhibit hall. The Conservation and Collections Management Departments trained all interested volunteers and shared their supervision over the two years of packing.

The Collections Management Department

The level of staffing in the Collections Management Department when this project began was minimal, consisting of our Collections Manager and the part-time temporary Collections Technicians kept on after completion of an NEH-funded cataloging project. When the NEH storage and relocation grant was received, we added two full-time Collections Technicians and one Curatorial Assistant as well as the Collections Management Assistant and the Administrative Coordinator, while the temporary staff were phased out.

The Administrative Coordinator was assigned to

1. manage the entire packing and moving project for collections,

Know your staff and the individuals who will be responsible for decision-making. Individuals don't change during this process, they only become more so.

Karen Harstad
Collections Technician
Grant-funded ethnology packing began in July 1998, when Karen was hired.

Rose Kubiatowicz
Collections Technician
Rose also started in July 1998; she has since organized putting it all away as well (see Chapter 5).

Lynn Ross
Collections Technician
was hired in summer of 1999 to replace departing Karen Harstad.

Curatorial Assistant for Collections Kristin Parrott
hides from the camera behind a tin mask from Queratarо, Mexico.

Some curators and their research staff packed a great many specimens as well, preferring to attend special needs and fragility issues themselves.

Anthropology Research Associate Tim Fiske
puts a ceramic pot away in its new cabinet location.

including regular meeting functions;
2. plan and schedule labor;
3. define and plan packing projects;
4. define and plan tracking mechanisms;
5. develop and produce management and tracking tools;
6. liaise with Curators and their staff;
7. schedule and manage move dates; and
8. provide backup for other staff when needed.

The Collections Management Assistant was assigned to
1. manage volunteer recruitment;
2. manage 50 percent of daily volunteer labor;
3. obtain physical resources;
4. track packed objects;
5. plan storage and traffic;
7. store packed objects;
5. advise scheduling, tracking planning, and project oversight; and
8. provide backup for other staff as needed.

Funding was acquired through NEH grant #PH-20853 for the two new full-time Collections Technicians to pack the ethnology collections and for one full-time position to handle all records-related tasks (the Curatorial Assistant). In addition, money was allocated from the operating budget to allow us to hire part-time temporary help for particular projects as needed.

Contemplating the move of 1.75 million objects creates a lot of headaches. While the Science Museum has always kept careful records of all accessioned material, there were bound to be unlocatable objects, found objects, deteriorated objects, and confused objects in a storage facility that had operated under a succession of Curators since 1959, before which there were no Curator positions. There was no Collections Management Department at the Science Museum until 1994, when the pressing nature of incoming collections, the need for an on-line database and intellectual control of the collections, and the requirements of the Native American Graves and Repatriation Act (NAGPRA) made it obvious that a management function was necessary. As a result, cleaning out the closets was expected to be (and was) a major undertaking in terms of matching and updating records.

Since every single object had to be handled, the move was perceived as an extraordinary opportunity to organize both objects and systems so that after the move, location information could be quickly and easily entered into the database, conservation requirements could be determined and in many cases completed, and object descriptions could be easily updated and improved. To that end, objects were to be conserved and/or updated as time allowed and a system of marking objects for later conservation or updating was devised. This system proved most valuable as, in spite of the best efforts of all involved, most conservation and updating has been done during unpacking.

Analysis: *Staffing for the Collections Management Department as described above proved to be adequate except for the unexpected amount of physical labor involved in the move. At planning time, it was assumed that all heavy lifting, pallet wrapping and moving, and so forth would be performed by the moving company. This did not turn out to be the case because of the change in the moving contract, and these heavy jobs were performed by the Collections Management Assistant, the Conservation Assistant, and the Administrative Coordinator aided by several able volunteers under highly stressed time and budget constraints as move dates approached. It is recommended that weight lifting and physical requirements be formally addressed in all move staffing plans.*

Conservation Department

The premove staff of the Conservation Department consisted of the Conservator and one part-time Conservation Assistant. In addition to their regular duties connected with keeping the museum open, including preparation and cleaning of exhibits, identification and repair of damaged objects, and planning consultation for other museum departments, the Conservation Department was expected to authorize all materials used, develop all packing protocols, and facilitate the safe transport of all accessioned objects. No new staff was hired for this department, but the Conservation Assistant became full-time and was assigned to 50 percent of the direct management of volunteer packers and the ongoing development of packing protocols for them to use (see also Analysis above). The Conservator was available at all times for planning and advice on all packing issues.

Curatorial Departments

Curators were responsible for their own laboratories and offices. They were the primary designers of their new laboratories in the building-planning phase, and their plans for arranging and organizing their work there dictated their roles as primary packers and movers of the myriad equipment, supplies, and records they would individually require. Volunteers were available to them through the Collections Management Assistant on an as-needed basis, for example, to pack libraries or sort lab collections (see *Request for Use of Packing Room Volunteers*, Appendix A). Other needs were met by the Collections Move Team staff through interface with the Administrative Coordinator, as in the case of the osteology inventory previously described.

Curators also advised the Move Team staff on scheduling and storage decisions for their collections and kept us apprised of their research needs up until the time when all collections were closed, not so very long before they were actually moved. Some Curators and their research staff packed a great many specimens as well, preferring to attend special needs and fragility issues themselves (note missing protocols *Paleo 1, 2,* and *7* in Appendix

Research Associates Lee Hallgren (above) and Tom Sawyer (below) *helped pack many fossil collections.*

Preparator and Paleontology Photographer Bob Spading (above) and Preparators Doug Hanks (front below) and Dick Wolszon (back below) *all put in their share of time packing paleontology collections as well.*

Management Tools Survey

Following the move, staff and volunteers were asked to evaluate the management tools used to facilitate our work. Many of these were useful to a only portion of our workers, who you will find key-coded below. These tools, their raw importance scores across the move (out of a possible 10), and their best users are reported here. Individual tools are discussed in the text by function.

Packing Protocols: **10**; all groups
New Office and Lab Maps: **9**; all groups exept V
Move Calendar: **9**; all groups except CuA
Progress Reports: **9**; all groups except V
Workplans: **8**; CoM, Con, Cu
Storage Location Maps: **8**; CoM, Con, Cu, CuA
Written Inventories: **6**; CuA, PT
Pallet Tracking Forms: **6**; CoM, Con, Cu
Hmong House Manual: **6**; CoM, Con
Interdepartmental Planning Mtg: **5**; CoM, Con, Cu
Project Tracking Forms: **4**; CoM
Truck Inventories: **4**; CoM, Con
Dictionary: **4**; CoM, PT, V
Communication Model: **4**; CoM

Collections Management = CoM
Conservation = Con
Curatorial Assistant = CuA
Curators = Cu
Collections Technicians = PT
Volunteers = V

C). Collections Move Team staff enabled this by providing them with packing materials as well as volunteers when requested.

Management

Because of the complicated and nonhierarchical relationships in a matrix organization like the Science Museum and particularly for an undertaking as large as the move project, we felt it was necessary to have a communication plan. The Collections Move Team comprised five department heads and their staffs plus Research Associates and volunteers; the opportunity for miscommunication was enormous. Two documents were prepared to help with this part of the project. First, a data dictionary was developed and expanded as necessary throughout the project (see Appendix B: Data Dictionary). Second, a diagram of the relationships among our separate responsibilities seemed necessary, sometimes just to know who to ask about certain topics. Both were constructed and managed by the Administrative Coordinator, with copies given to all involved.

Tools

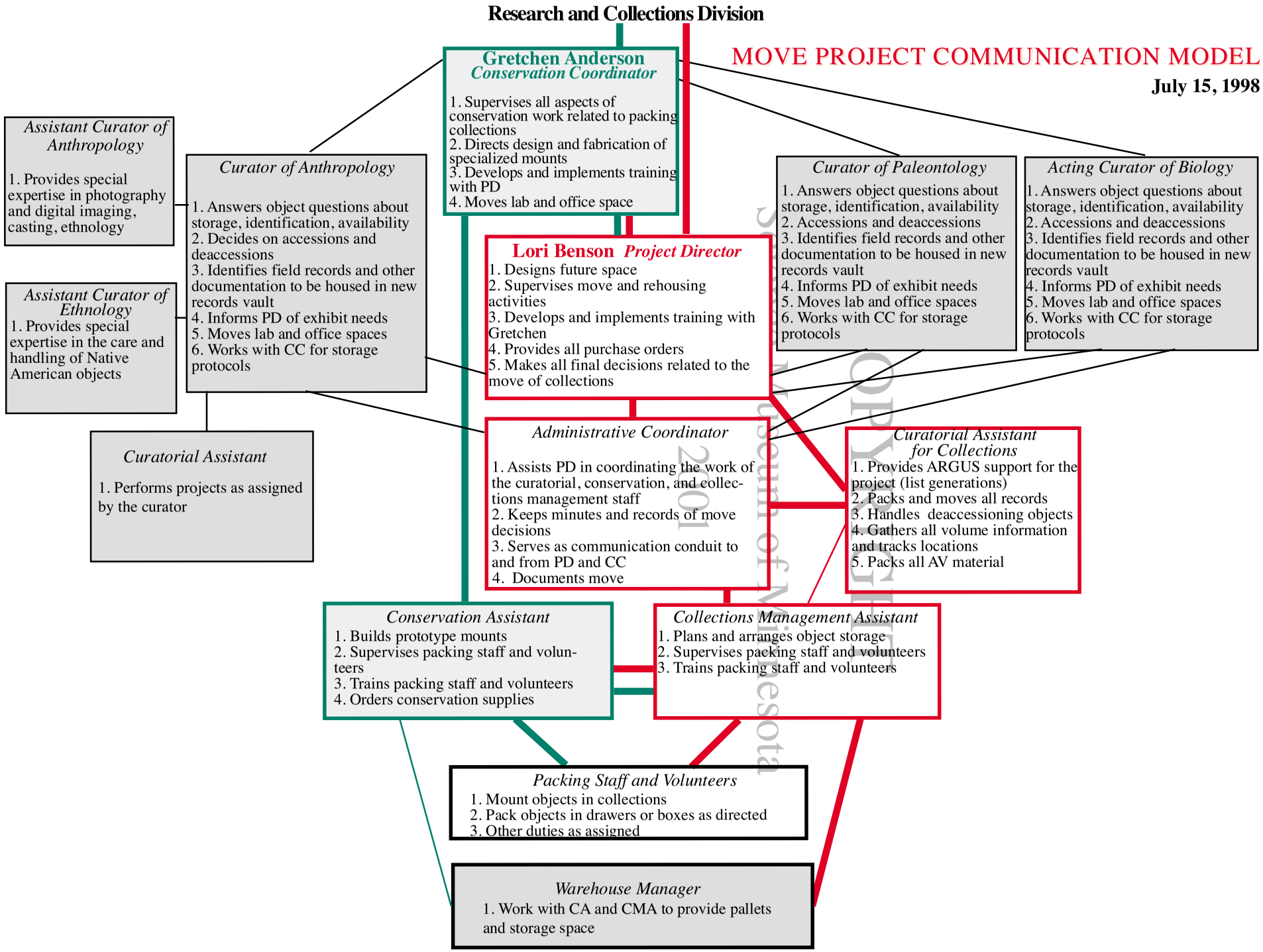
Collections Move Project Data Dictionary (Appendix B)

The data dictionary is a standard tool for project management and consists of all terms with which members of a particular project are likely to come in contact. Most team members did not need to consult the dictionary very often, but it is a tool that is absolutely necessary to the staff person writing the project documentation. It also proved to be very helpful to the volunteers, who could look through it before learning new protocols to understand the materials better.

Collections Move Project Communication Model

The problems associated with mapping two equally involved departments were solved by using colors in the diagram: red for Collections and green for Conservation. Staff from each of those departments were boxed in the appropriate color and the lines of communication were made fat for primary communications and thin for secondary communications. Other players and their interrelationships with the move team were all left in black.

The result is something of a rat's nest, but it is possible to look at this model and see where to go for help with a problem or answers to questions. In reality, especially toward the end of the project, communications did not always work this way. However, the existence of the model eliminated a lot of friction as the tempo of the move increased and conflicts inevitably arose. The model provided a clear arbiter for every case as well as protection for staff who felt overworked and/or used (and we all did at one time or another), as everyone's spot in the flow is clearly defined.


Research and Collections Division
MOVE PROJECT COMMUNICATION MODEL
July 15, 1998
Gretchen Anderson
Conservation Coordinator
1. Supervises all aspects of conservation work related to packing collections
2. Directs design and fabrication of specialized mounts
3. Develops and implements training with PD
4. Moves lab and office space
Assistant Curator of Anthropology
1. Provides special expertise in photography and digital imaging, casting, ethnology
Curator of Anthropology
1. Answers object questions about storage, identification, availability
2. Decides on accessions and deaccessions
3. Identifies field records and other documentation to be housed in new records vault
4. Informs PD of exhibit needs
5. Moves lab and office spaces
6. Works with CC for storage protocols
Assistant Curator of Ethnology
1. Provides special expertise in the care and handling of Native American objects
Curatorial Assistant
1. Performs projects as assigned by the curator
Lori Benson Project Director
1. Designs future space
2. Supervises move and rehousing activities
3. Develops and implements training with Gretchen
4. Provides all purchase orders
5. Makes all final decisions related to the move of collections
Curator of Paleontology
1. Answers object questions about storage, identification, availability
2. Accessions and deaccessions
3. Identifies field records and other documentation to be housed in new records vault
4. Informs PD of exhibit needs
5. Moves lab and office spaces
6. Works with CC for storage protocols
Acting Curator of Biology
1. Answers object questions about storage, identification, availability
2. Accessions and deaccessions
3. Identifies field records and other documentation to be housed in new records vault
4. Informs PD of exhibit needs
5. Moves lab and office spaces
6. Works with CC for storage protocols
Administrative Coordinator
1. Assists PD in coordinating the work of the curatorial, conservation, and collections management staff
2. Keeps minutes and records of move decisions
3. Serves as communication conduit to and from PD and CC
4. Documents move
Curatorial Assistant for Collections
1. Provides ARGUS support for the project (list generations)
2. Packs and moves all records
3. Handles deaccessioning objects
4. Gathers all volume information and tracks locations
5. Packs all AV material
Conservation Assistant
1. Builds prototype mounts
2. Supervises packing staff and volunteers
3. Trains packing staff and volunteers
4. Orders conservation supplies
Collections Management Assistant
1. Plans and arranges object storage
2. Supervises packing staff and volunteers
3. Trains packing staff and volunteers
Packing Staff and Volunteers
1. Mount objects in collections
2. Pack objects in drawers or boxes as directed
3. Other duties as assigned
Warehouse Manager
1. Work with CA and CMA to provide pallets and storage space
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STAGE 3: PACKING

Deborah Schoenholz

Finding Storage Space

Since one of the best reasons to move a museum is that there is no more storage space, finding a place to pack and store valuable objects was a major issue. It was finally agreed that a secure space would have to be created for packing. When the expanding Exhibits Department moved offsite, we were able to use their developers' space, which was next to the Vault where collections were stored. The door to this space was repositioned across a small hallway from the side wall of the Vault into which a new door was installed so that objects could be brought from storage to packing area with minimal inconvenience. The Packing Room was then furnished with tables, mountmaking supplies, and tools and served as the workstation for ethnology packing as well as other volunteer projects.

A 30' x 40' space, the Collections Storage Room was available in our warehouse to store packed collections. In the early 1990s, this large room had been fitted with stacked bays into which pallets of less-fragile collections like archaeology and some fossils could be loaded. These kinds of collections were then scheduled for early packing and removal to the warehouse in order to maximize our storage capacity inside the museum.

Many times we were required to handle pallets two or even three times as we traded and negotiated our way through temporarily available secure space all over the museum.

As the new Packing Room was far too small for storage of any kind, another room of approximately 25' x 50' was located off the same secure corridor. Here old racks were removed and new custom racks were built for our materials storage (boxes, Ethafoam, peanuts, etc.). New Delta drawers were stored here as well as some packed collections, and the space was informally designated the Pallet Room.

Finally, our plan was to empty the Vault of cabinets as soon as their contents had been packed so that pallets of all ethnology collections could be stored in the HVAC (heating-ventilation-air-conditioning)-controlled environment. Other spaces in the museum were negotiated as we outgrew this space during the packing process, including empty exhibit halls, spaces behind special exhibits, and emptied laboratories (see diagrams on pages 44 and 48).

The Pallet Room

was where we stored most supplies and some palleted collections.

Analysis: *As our plan was to mount or otherwise prepare all objects that were overpacked tightly in Kewaunee cabinet drawers and other spaces, we knew that the absolute size of collections would expand a great deal as we moved them into their new permanent Delta cabinet drawers or into boxes for later transfer to Deltas. This made it very difficult to esti-*

mate the space needed for storage of pallets in the old facility, and it became an ongoing issue to find more as the collections grew past our early expectations; we found that our earlier estimate that we were 100 percent overpacked was conservative (see Estimating Storage Requirements, pages 15-16)! Many times we were required to handle pallets two or even three times as we traded and negotiated our way through temporarily available secure spaces all over the museum. We recommend that move planners be careful to locate adequate storage space as early as possible in their moves.

Buying Supplies and Services

As described in the section on planning, our supply list was developed as we moved through different protocols. We needed safe materials for the packing and safe transportation of a dizzying variety of objects, from fragile textiles and shells to Pleistocene skulls and canoes. Sometimes the arrangements for obtaining supplies took a great deal of time, as with the plastic milk cartons that were needed for the wet collections. Finding a provider for these proved very difficult as we could not afford a retail price and producers were unwilling to sell in small lots. In this case, our lack of supplies actually drove the project schedule, and packing the wet collections was put back a number of times until we found success.

Supply purchasing was complicated by the necessity of purchasing through multiple budgets. Original assumptions were that orders and POs (purchase orders) would be handled differentially by the PIs (Principle Investigators) of the grants involved. However, as the pace quickened and PIs were not necessarily available when supplies were needed, the process was assigned to the Administrative Coordinator, who became our purchasing agent and held signed POs. When the Administrative Coordinator could not keep up with the orders, all responsibilities and POs were passed outside the original Move Team to the Division Coordinator, who finally was able to manage the diverse materials needs associated with the packing in a timely way.

Ongoing supply needs were written down as they were perceived by the packers themselves and brought in a "grocery list" to the weekly departmental meetings, after which the list was passed off to the purchasing agent.

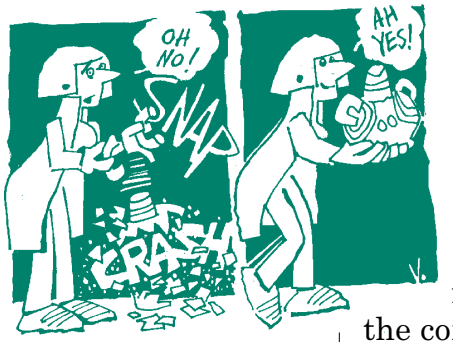
Analysis: *Move planners could save a lot of confusion by setting up a single support person to do all ordering and procurement in the initial stages of the move. We tried several methods before finding the solution; it became apparent that if two or more staff were responsible, some purchases always fell through the cracks, and that a single Move Team member was too busy to do it alone. An associated staff person was the best answer.*

A second problem that continued to plague us was that packers did not always identify their needs before we actually ran out of the material, sometimes causing days or weeks of delay before the item could be replaced. We did not find a solution to this.

Managing Supplies

In the beginning of the move, we ordered a large supply of the materials we were going to use. When and how much we reordered depended on how fast we went through them. One huge headache was "back-ordered" items, which always seemed unavailable when needed most. Remember to check with suppliers well in advance. The second large issue was space–as we quickly ran out of it. Fire codes limited what could be put in hallways so that we put surplus supplies wherever they fit: in offices, behind doors, even under desks. Finally, other departments than ours were ordering the same kinds of supplies for their packing, which made for a lot of confusion on the receiving dock. In the end, we checked for incoming materials (especially packing boxes!) every few hours to avoid someone else taking them and us having to track them down.

Ellen Holt-Werle
Division Coordinator
took charge of ordering all our supplies and materials.



Using Volunteers

The Science Museum could not have moved without its volunteers. Even though early research with other move-experienced museums advised against reliance on volunteer help, the Collections Management Department felt that our past record of successful volunteerism strongly advocated this pathway as a means both of saving money and of creating interest and involvement with the community throughout the ordeal. Volunteers work for fun and often to learn, and we believed that the process of uncovering and then packing our precious collections would delight and entertain them–if we could keep them from being overworked. That meant using more volunteers for shorter periods and investing more staff time into training and management.

Volunteers (including regular Science Division laboratory volunteers as well as those arranged as described above) provided over 9,200 hours of unpaid labor for this move. There is no question that without them we could not have completed on time.

At the request of the museum's Volunteer Coordinator, a description of our project was made available to all Anthropology Hall volunteers. Initially all our volunteers came from this group, who were familiar with our museum and our collections. Those who indicated interest were contacted for a series of packing training workshops developed and provided by the Conservator and the Collections Manager. Each was then asked to commit to a four-hour shift once a week (or more if they desired) to pack collections projects as assigned. This resulted in crews of one to six volunteers both morning and afternoon, five days a week. Management of the volunteers was split between the Collections Management Assistant and the Conservation Assistant, with the Administrative Coordinator and the Curatorial Assistant providing relief and backup.

Science Museum of Minnesota President James Peterson (top) and Director of Research and Collections Ron Lawrenz (bottom) *told us they would help out however they could when a Move Team member was injured and the pace was only picking up. We put them to work retrieving large, heavy objects from the tops of the old cabinets in the Vault.*

The decision to use SMM volunteers to help pack our collections required a great deal of attention to training and management. Beginning in Fall of 1997, required training classes were held for all volunteers who signed up for packing through the museum's Volunteer Department. The Science Museum has had for many years an extremely active volunteer base logging thousands of hours every year in every part of the museum. The Volunteer Department, which is comprised of three staff people, man-

ages and schedules these volunteers. Since closing the old museum involved a long phasing-out process, it was reasoned that many volunteers would become available as their areas were eliminated, so we arranged with the Volunteer Department to redirect as many hours as possible toward packing. The Collections Manager and the Conservator spoke to a gathering of volunteers early in 1997 to explain what we were looking for, and sign-up sheets were made available in their break room.

Training consisted of two sessions, the first a lecture orientation led by the Collections Manager and the second a hands-on workshop for making mounts and working with packing materials led by the Conservator. Both volunteer managers were present at these sessions as well. Lecture sessions covered SMM's accessioning system, safe handling of objects, conservation techniques and Condition Reports, safety issues, Move Team structure and personnel, and projected schedules. Finally, everyone was given a tour of the collections and associated packing spaces. Workshop sessions provided familiarization with cutting tools, materials like Ethafoam and Tyvek, tools like hot-glue guns, and general mounting techniques.

Techniques

We trained volunteers in basic techniques for working with the materials. A poster was constructed to help them identify the most common tools they would need and provide them with a common vocabulary that would be consistent with the protocols that were being produced.

Training included an introduction to materials and methods, handling artifacts, types of damage, and criteria for choosing materials. Instruction on using hot-melt glue and hot air for adhering foams was also given.

Scheduling

Volunteers were asked to sign up for at least one four-hour shift per week, with the explicit understanding that if they could not keep this commitment for any reason they would call ahead and let the managers know they would not be in. It was of paramount importance that these commitments were honored, because in order to actually move our collections, projects needed to be carefully and accurately scheduled into the brief time we had available for packing. This became more critical as the move proceeded.

Tools Poster
was designed to help volunteers find the right tool for the right job.

In practice, as we approached each new packing project, all involved staff and both volunteer managers were consulted to match skills and numbers of volunteers to the needs of specific projects. This required taking into account the physical limitations or talents of each volunteer as well as the social dynamics that developed through the process. For example, the Friday morning packing crew consisted of four (and sometimes five) women who developed a real camaraderie, so that they soon did not like getting split between projects in different places. We learned that this particular crew, while not able to lift heavy objects or perform exacting mounting procedures, when to-

Volunteers (left to right)
Heidi Hoffman, Norma Fischer, and Barbara Theobald,
a.k.a. The Friday Morning Ladies, stuffed stockinette to make hundreds of snakes.

Volunteer Jim Kreche
makes cavity mounts for metal objects.

gether were very capable of repetitious tasks that other volunteers found too boring because they just liked being together and talking–much like an old-fashioned quilting circle. These ladies became extremely valuable for cutting Ethafoam drawer linings and muslin, making stockinet snakes, stuffing bags with foam peanuts, and so forth. In one case where we had to devise a method for cushioning drawers of specimens in glass vials, they were able to assemble a difficult gridlike paper fencing system that many volunteers tried only to quit in frustration (see Small Mammal Skulls, page 85).

Equally unique was a retired but physically adept man who seemed to have no social motivation in working for us at all. He worked quickly and was willing and able to climb into or on top of cabinets, lift heavy fossils, move and stack drawers of objects, or shrink-wrap pallets of packed objects. We assigned him to work with staff on heavier projects and tried to schedule our own activities to use his rare talents to best advantage.

Volunteer Ruth Ladwig
frames textile fragments in a visible mount.

Volunteer managers were responsible for locating and providing all necessary supplies for a particular project, as well as the objects being packed. In most cases, these were all brought to the Packing Room, but sometimes, particularly later in the move, this meant setting up work stations in the Vault or in the research laboratories in the larger museum, in effect taking the packing to the objects. A very large percentage of staff time was spent collecting and moving supplies to the packers so that their time was maximized.

Management Tools

Volunteer Weekly Schedule

Volunteers were required to check into Volunteer Headquarters (VHQ), where their hours were recorded as with any museum assignment. Upon their arrival at the Packing Room, managers noted their arrival in a weekly scheduling notebook where phoned-in and expected absences were recorded as well (see illustration at right).

Volunteer Alex Lowe
cuts drawer liners in his own unique fashion.

Protocol Notebook

As each packing project was developed, a guide to procedure, or *protocol*, was written. Volunteer managers for each shift were responsible for going over each new protocol with the volunteers who would be performing it until it was clearly understood and could be competently executed. Copies of each protocol were left in a three-ring binder in the Packing Room for reference (see Appendix C: Protocols), along with the *Move Data Dictionary*.

Move Data Dictionary

This list of terms and definitions was developed by the Administrative Coordinator for the express purpose of the Science Museum move. Move Project components and building rooms were included along with materials, common museum and conservation terms, and any other terms we thought that volunteers might need to define. This dictionary was kept in the Protocol Notebook

in the Packing Room, available at all times for reference (see Appendix B: Data Dictionary).

Analysis: *Volunteers (including regular Science Division laboratory volunteers as well as those arranged as described above) provided over 9,200 hours of unpaid labor for this move–equal to about five full-time staff for a year. There is no question that without them we could not have completed on time. In addition, relationships that developed during this process both increased our presence in the community and created valuable friendships and involvements among both volunteers and staff. There were, however, a number of attendant issues that move planners should consider before initiating a similar workplan:*

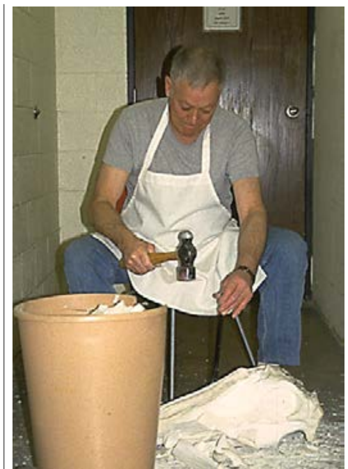
• *Volunteers are often retired people with limited coordination and weight-lifting capabilities. People with arthritis in their hands were not useful for projects where accession cards or inventory lists needed to be written or for intricate mounting or wrapping; most older people were not useful for projects lifting heavy drawers or crawling into small spaces to retrieve objects; some older people need to be seated and cannot stand to work for very long. Matching capabilities to projects is a high priority.*

• *Working closely together on a project for four hours requires a certain degree of cooperation and camaraderie. Occasionally personalities clash, either on first introduction or later in the project after repeated irritations. Restructuring of work crews is constant and difficult because of the limitations of most individual schedules.*

• *Volunteers represent a wide range of both physical and intellectual development, and not everyone is adept at learning new tasks or retaining instruction information. Other people get bored easily and require more complicated projects than may be at hand. Care must be taken to support those both fast and slow in understanding the task and in matching degrees of complication to the individual volunteer.*

• *In a natural sciences museum there are many types of objects, like insects or dirty bones, that may be offensive or even disgusting to some volunteers. Volunteers should be asked their preferences and their dislikes and be accommodated as well as possible in project assignments.*

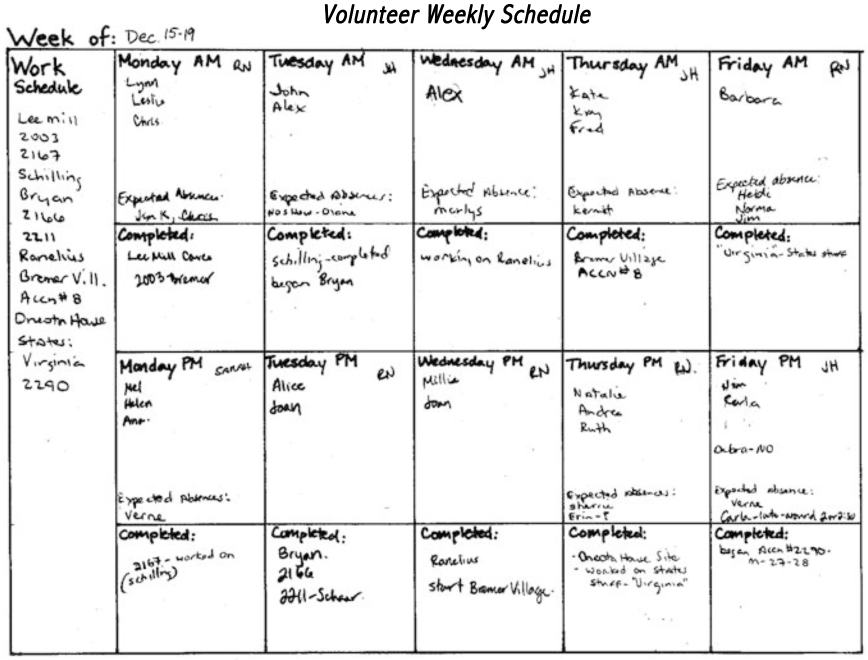
• *Finally, while an effort like this takes a great deal of staff time, it is definitely worth it all.*



Volunteer Verne Anderson
makes a real mess breaking up unwanted casts.

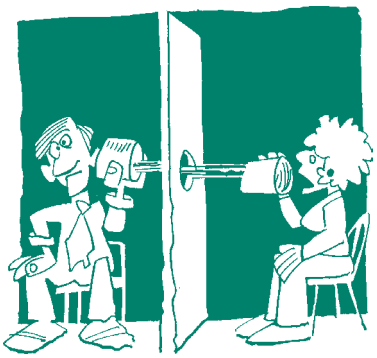
Volunteer Joan Porter
cuts cavity mounts for archaeology.

Volunteer Weekly Schedule



Week of: Dec. 15-19

Work Schedule	Monday	Tuesday	Wednesday	Thursday	Friday
Lee mill 2003 2167 Schilling Bryan 2166 2211 Ranelius Bremer Vill. Accn# 8 Oneota House States: Virginia 2290	Monday AM RN: Lynn, Leslie, Chris. Expected Absences: Jim K, Chris	Tuesday AM JH: John, Alex. Expected Absences: No Show - Diane	Wednesday AM JH: Alex. Expected Absence: Marlys	Thursday AM JH: Kate, Kay, Fred. Expected Absence: Kermit	Friday AM RN: Barbara. Expected absence: Heidi, Norma, Jim
	Completed: Lee Mill Cover, 2003 Bremer	Completed: Schilling-completed, began Bryan	Completed: working on Ranelius	Completed: Bremer Village Accn# 8	Completed: "Virginia"-States shelf
	Monday PM Sarah: Mel, Helen, Ann. Expected Absences: Verne	Tuesday PM RN: Alice, Joan	Wednesday PM RN: Millie, Joan	Thursday PM RN.: Natalie, Andrea, Ruth. Expected absences: Sharrie, Erin-?	Friday PM JH: Jim, Carla. Octra-NO. Expected absence: Verne, Carla-late-arrvd 2or2:30
	Completed: 2167 - worked on (Schilling)	Completed: Bryan. 2166, 2211-Schaar	Completed: Ranelius, start Bremer Village	Completed: - Oneota House Site - worked on States shelf - "Virginia"	Completed: began Accn #2290. M-27-28



Managing Projects

With three curatorial departments (Biology, Paleontology, and Anthropology) to be moved and such a wide array of object types in their collections, we decided that we could only approach the entirety in smaller pieces. To that end, we did a complete inventory (not at the item level) for all departments in all parts of the museum (including labs, storage rooms, and exhibits) and broke the resulting lists down by either type of object (e.g., dinosaur bones, flat skins) or occasionally by required packing method (e.g., wet collections). Very large accessioned objects like articulated dinosaur skeletons, animals in vitrines, and large display birds were either part of the Paleontology Hall move (see Chapter 4) or were classified as Standalone Exhibits along with other large, unaccessioned display pieces for which the Exhibits Department, in conjunction with the Conservator, was responsible (see page 39). Everything else was divided into discrete projects by the Administrative Coordinator.

An inventory of types of objects/specimens was developed for each department in order to get a handle on the size, storage requirements, and packing techniques for each type of collection.

List of Standalone Exhibits *was created by the Administrative Coordinator to keep track of the large-object projects for which the Exhibits Department was responsible (aided by the Collections Manager and the Conservator). While our entire team was not directly involved in these moves, Conservation Department personnel were, and knowing when an object was to move and who was doing it was very helpful in scheduling.* *See page 39 for examples.*

Standalone Exhibits

	ACC#	DEPT.	STRIKE TEAM	PROTOCOLS	MOVE DATE
Iggy					
Bears in the air					
Swans					
Pseudodontorns					
Butterflies					
Gems and minerals					
Triceratops					
Dinosaurs (Jurassic)					
Mosasaurus					
Pterandon					
Whale head					
Tiger in the box					
Sloth bear in the box					
Rumantia in the box					
Olmec head					
Tula					
Jaguar					
Dugout canoe					
Sea Turtle					
Kramer slab					
Douglas fir					
Totem pole					
Map					
Outside sculptures (2)					
Solar panels					
Time capsule					
Sound stairs					
Canteen murals					

Our Administrative Coordinator scheduled numerous trips through collections with each Curator, recording categories and locating their members until we felt the master projects list was complete.

Vacuum Tubes *from the technology collections were carefully packed together in individual cavities and padded tightly to inhibit any vibration during transport.*

List of Collections Move Projects

ANTHROPOLOGY	Protocols
Archaeology	
1. Casts and Casting Supplies	Ethno.1
2. Chert Collection	Anthro.1
3. Current Sites (Cross, Grand Meadow, Bowman)	Anthro.1
4. *Other Sites*	*Finished*
5. *States Collection*	*Finished*
Ethnology	
1. *Anthro Hall Exhibitry*	*Finished*
2. *Cahlander Collection*	*Finished*
3. Ceramics	Ethno.1
4. Collections Exhibit	As needed
5. Cultural Collections	As needed
Africa	
Australia	
Philippines	
Asia	
China	
Japan	
India/Pakistan/Russia/Iran/Afghanistan	
Middle East	
Hmong	
Greece/Italy/Etrusca	
Europe/Scandinavia/British Isles	
SA: Colombia	
SA: General	
SA: Peru	
SA: Upper Amazon	
SA: Ecuador	
CA: Nicaragua	
CA: Guatamala	
CA: Mexico	
CA: Mixed	
CA: Cuba	
Misc. Unknown	
American Indian	
6. Deaccessioned Objects	As needed
7. *Hiller*	*Finished*
8. Library	None
9. NAGPRA	As needed
10. Oversize Objects	?
11. Oversize Textiles	?
12. Photos and Slides	Anthro.5
13. Records	None
14. Rolled Textiles	?

continued on next page

List of Collections Move Projects

This list changed in two ways as we moved through the process. First, collections continued to be discovered well into the move that were not considered in our original planning and needed to be added. Second, we used this list as a status report to all members of the Collections Move Team, so that eventually all projects were declared finished and were displayed in italic type.

Curator of Paleontology Bruce Erickson
puts away small fossils in a half-drawer Delta cabinet.

Paleontology Volunteer Phil Thompson
was kept very busy packing collections.

Dinosaur Longbones
were permanently stored in wheeled carts, but the castors did not work well under so much weight. New carts have been built since moving into the new facility.

Plastered Skull
rests snugly in Ethafoam mount.

Curator of Anthropology Orrin Shane III
displays ceramics from Central America.

Ethnology collections were classified as they had been stored, by geographical source, and were treated [at the macro level] as one long project for which specific funding was obtained.

Archaeology Volunteer Kay Miller
identifies lithic artifacts from a recent excavation.

List of Collections Move Projects continued

BIOLOGY

1.	Bird Study Skins	Bio.3
2.	Blue Circle Bivalves	Bio.1, Bio.2
3.	Bug Colony	None
4.	Collections Exhibit	As needed
5.	Eggs	?
6.	Exhibits	As needed
7.	Freezers	None
8.	Freshwater Bivalves	Bio.2
9.	Hides	Bio.10
10.	Insects	Bio.13
11.	Marine Shells	Bio.1
12.	Metcalf Bones	(Next year)
13.	Mounted Birds	?
14.	Nests	Bio.14
15.	New Mollusk Collection	Bio.1, Bio.2
16.	*NHS Bivalves*	*Finished*
17.	Osteology	Bio.5, Bio.7, Bio.11, Bio.12
18.	Small Mammal Flat Skins	Bio.9
19.	Small Mammal Skulls	Bio.8
20.	Small Mammal Study Skins	Bio.3
21.	Wet Collection	Bio.4

PALEONTOLOGY

1.	Champsosaurus	? with Bruce
2.	Crocodiles	Paleo.3
3.	Dinosaurs: Pallet Room	Paleo.3
4.	Dinosaurs: Paleo Hall	Paleo.8
5.	Dinosaurs: Poison Creek	Paleo.8
6.	Dinosaurs: Racked	?
7.	Dinosaurs: Skulls	Paleo.10
8.	*Fossil Fish*	*Finished*
9.	*Fossil Plants*	*Finished*
10.	Fossil Vertebrates: Mammal	Paleo.5.3
11.	Gar Fish	?
12.	Ichnofossils	Paleo.4
13.	*Invertebrates*	*Finished*
14.	Lab Exhibits	None
15.	Laoporus Trackway	None
16.	Loan Items	Paleo.5.1
17.	Mason Invertebrates	Anthro.1, bulk
18.	Paleo Hall Other	As needed
19.	Paleopathology	Paleo.5.1
20.	*Pleistocene*	*Finished*
21.	Reptiles: Other	Paleo.3
22.	Slab Items and Trackways	?
23.	Torosaurus	Paleo.8, Paleo.10
24.	Trackway in Vault	?
25.	Type and Figured	? with Bruce
26.	Wannagan Creek	? with Bruce

Each packing project was then defined for scope, including necessity for written workplan, staffing and volunteer labor needs, required packing materials, required work space, required storage space, tracking method, and estimated schedule and completion dates; in other words, How will we do this?

Project Definition

The scope of the collections at the Science Museum required a great deal of flexibility in the definition of discrete packing projects for the move. An inventory of types of objects/specimens was developed for each department in order to get a handle on the size, storage requirements, and packing techniques for each type of collection. A close partnership between the Collections Management Department and each of the Curators was necessary to this undertaking, as the Curators were the only source of content knowledge for many items. Our Administrative Coordinator scheduled numerous trips through collections with each Curator, recording categories and locating their members until we felt a master projects list was complete (see Appendix D: Status Reports). As the move continued, still other categories emerged, each to be added as it appeared.

The problems associated with defining these lists largely hung on the fact that there was no single logical basis underwriting them all. For example, sometimes projects were defined by material, as the Pleistocene collection in Paleontology. All members of this group were partially fossilized, accessioned bone from a certain period in history, all were packed using the same protocols, and all were being stored in the same space. In Biology, however, we found that the osteology collection comprised bones from tiny to massive that may or may not have already been cleaned. Furthermore, there were many unaccessioned comparative osteology collections that were used jointly by all curatorial departments that were hard to categorize. Osteology was therefore broken down into discrete projects that were defined either by the packing method or, in the case of dirty bones that needed to be first frozen and then sent immediately to the new laboratory, by destination (see Appendix E: Workplan for Biology).

Many collections, however, were already stored as discrete entities, including most archaeology (in the form of site collections), particular research collections in both Biology and Paleontology, and some exhibit-specific collections like accessioned technology. Ethnology collections were classified as they had been stored, by geographical source, and were treated as one long project .

Analysis: *This approach worked very well for keeping tabs on the entire scope of the project at once. It required, however, a lot of administrative time in creating schedules, inventories, and reports that were constantly under modification after packing*

Volunteer Katherine Kudzy
shows off her mount for a concave basket.

Specific workplans were written where complicated maneuvering was necessary for accessing or completing a project, and tracking forms and instructions were developed to meet the needs of the individual type of object being packed.

Archaeology Volunteer Fred Bollag
sorts lithics from a site being curated in the new lab.

Moving Large Taxidermy
from Vault walls took brute strength and a lot of coordination.

Volunteer John Thompson
builds a reinforced custom box.

The second technique used here that proved to be very valuable was assigning packing staff to consult with individual Curators and their staff and volunteers on packing projects. This liaison became paramount in cases where Curators took care of much of their own packing, as in the Biology and Paleontology departments at SMM.

Mounted Sponge
uses backer cord for support.

Volunteers
Mel and Helen Fischer
sort shells from a Kewaunee drawer.

projects actually began. The move planner should be warned that it is imperative at this point to invest the time necessary to track down the most complete inventories possible, as it is inevitable that there will still be many objects or specimens that are unearthed in unexpected locations over the life of the project. Since after a packing project is finished and stored it may be impossible to incorporate further found like objects, there should be a contingency plan for handling/storing these objects as they are found.

The second technique used here that proved to be very valuable was assigning packing staff to consult with individual Curators and their staff and volunteers on packing projects. This liaison became paramount in cases where Curators took care of much of their own packing, as in the Biology and Paleontology departments at SMM. While they did most of the packing, because they were doing it they needed materials and tools brought to their locations, help with scheduling and deadline logistics, occasional volunteer management, and sometimes extra help from Packing Room volunteers. By using the same staff for the same Curator throughout the move, we were able to develop long-term working relationships built on trust and experience that not only facilitated the move but also helped later in the unpacking phase at the new facility. It also proved valuable to locate a certain type of expertise with each staff member so that questions needing answered during chaotic truck deadlines could be asked of the right people.

Management Tools

Collections Projects Status Reports

Once these lists of packing projects were completed, the Administrative Coordinator transferred them by department to Excel files, with columns for Projected Delivery Date, Packing Crew, Status of Project, and Storage Location. Central copies were kept in color-coded (by department) three-ring binders with other tools for that department, and updated reports were sent to each department head, so that Curators, the Collections Manager, and the Conservator were kept informed as we progressed with the listed projects. In each revised version, screens were dropped into the cells so that finished collections were dark gray, in-progress collections were light gray, and projects yet to be started were left white. This technique provided a quick overview of work left to be done in each department (see Appendix D: Status Reports).

Analysis: *These reports were invaluable in keeping track of the larger momentum of each project. They were kept in a single location and updated in pencil by both the Administrative Coordinator and the Collections Management Assistant (until readability required new output) so that anyone could look in the ap-*

propriate binder to find the status and scheduling of a particular project.

Interdepartmental Planning Meeting

After the first status reports were issued, a date was set for all packing staff to meet simultaneously with the Curators of all three science departments, the Assistant Curator of Anthropology, and the Assistant Curator for North American Indian Collections (in other words, everyone who holds responsibility for our collections). We set aside an entire day to go through all packing projects in such a fashion that special considerations for any project could be noted. Issues included the accommodation of visiting researchers, the addition of new collections, environmental storage requirements for certain collections, field work and other absences, suggestions for packing approaches, loan requirements and parameters, and expectations for departmental help with packing. This meeting resulted in our first working plan for move of all the collections.

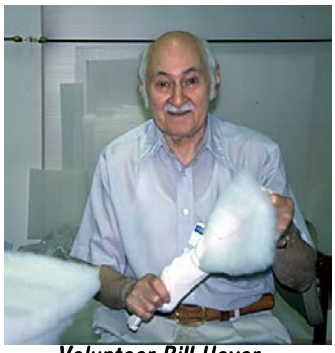
Analysis: *This kind of meeting is an absolute necessity for a move project. Information can be traded with all of these people individually, but in a group setting,*

1. *everyone hears the same thing,*
2. *information only needs to be said once,*
3. *people are stimulated by others to remember more and have more to say about their own interests,*
4. *people are challenged by others so that possible problems are illuminated and often resolved in the same discussion,*
5. *everyone feels they have been treated the same, and*
6. *an underlying sense of group mission is reinforced that translates into more focused work on the part of most members.*

We would suggest that it is very important to schedule this planning meeting when everyone involved can be present. In retrospect, a second meeting at another, later turning point would have been very helpful for SMM's move, but the practicalities of scheduling such a diverse and active group while actually under move conditions would not allow it.

Calendar

The next step in managing the packing projects was to create a projects calendar and schedule volunteers and departmental staff to implement the working plan. Protocols were developed as each new project approached, and packing staff was assigned to consult with particular Curators and departmental staff on the progress of each packing project. Specific workplans were written where complicated maneuvering was necessary for accessing or completing a project (see Appendix E: Workplan for Biology), and tracking forms and instructions were developed to meet the needs of the individual type of object being packed (see Appendix

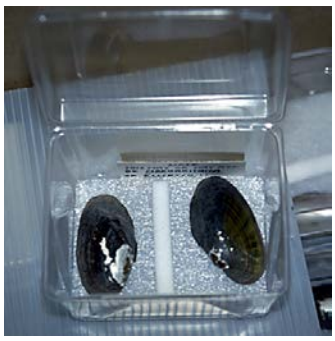


Volunteer Bill Hoyer
stuffs stockinet with polybat to make snakes.

Assistant Curator for Biology Dick Oehlenschlager
logs bird study skins after the move.

Since every single object would have to be handled, the move was perceived as an extraordinary opportunity to organize both objects and systems.

Bivalves
were placed in specially purchased clear plastic containers.



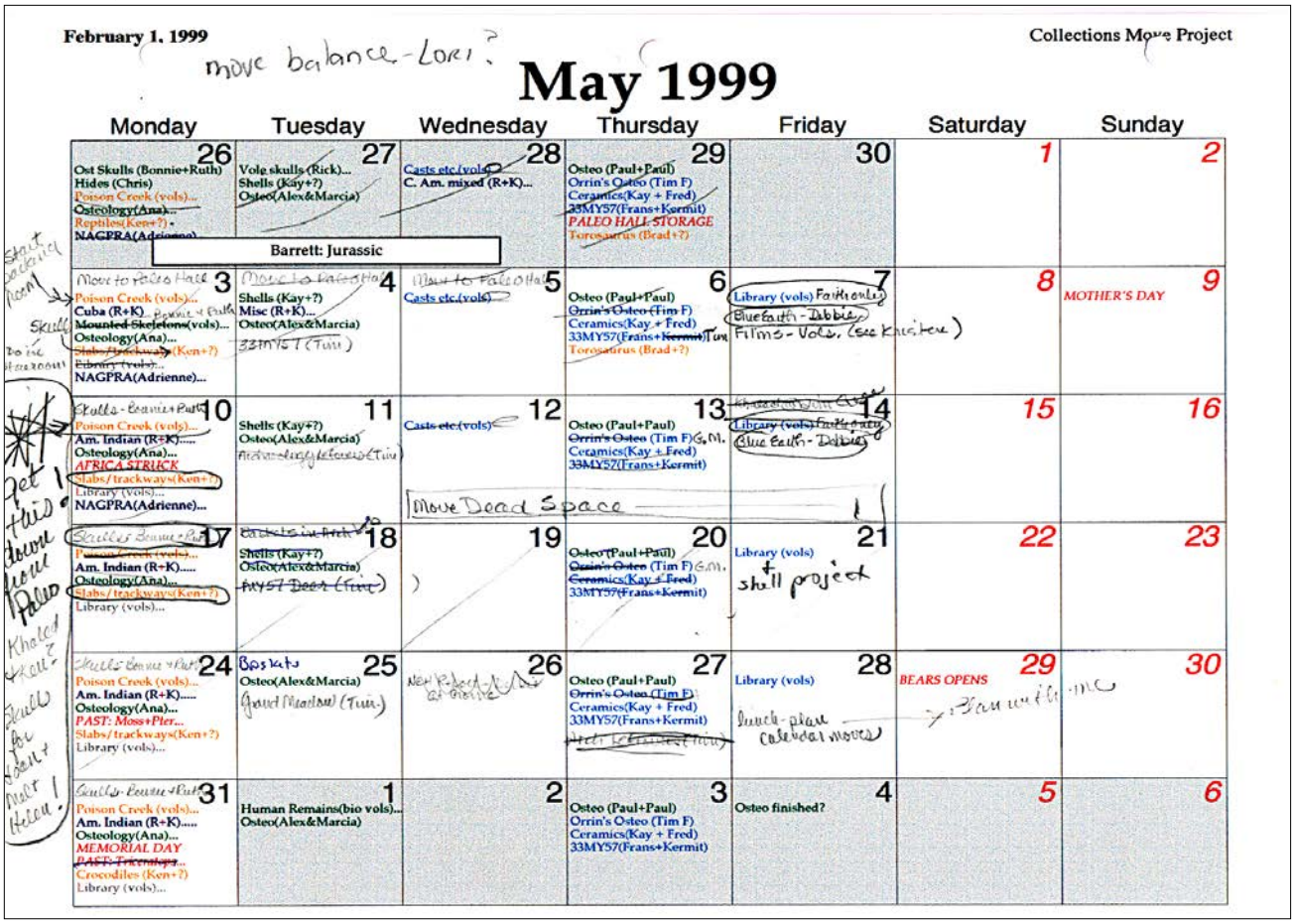
Preparators Kay Blair (above), Gail Rector, and Neva Key (below) helped pack collections while their workstation, the Visible Paleontology Lab (behind glass walls), was in transition.

A: Sample Forms). Calendars specific to a complicated week or a particular staff member or department were sometimes developed from our main calendar as well and distributed where they could do the most good.

Analysis: *A flexible physical calendar is required to keep track of changing plans and schedules in an ongoing way. We used Now! Contact calendar software to specify times and locations for both volunteers and staff, noting projects through color coding the typeface by department (see below). The calendar was kept in a three-ring notebook in an available location and was kept current with handwritten changes that were electronically updated as necessary. This worked well for most of the project, but near the very end it was abandoned in favor of handwritten notes made on a daily basis, since there was no more time to type anything. Keeping the calendar proved to be most challenging. Rescheduling projects, volunteers, and available staff was a constant as we found that, for example, we could not get to the rest of the Poison Creek dinosaur bones until we had negotiated more space for the pallets that were currently being stored in front of them. So the planned bone project was erased from one month and put on*

The Move Calendar

was our Bible throughout the days preceding the actual move dates. Then we could no longer keep up with the changes, but as you can see from the scribbling all over the planned, color-coded (by department) projects, we did our best.



the next. By the end, we were rescheduling down t the hour.

Developing Packing Protocols

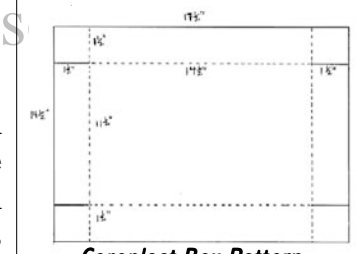
Packing protocols are the instructions developed for packing each type of object in the collections. At SMM, we did not try to develop all of these ahead of time but instead refined each type after we had identified the project, developed a workplan for the project, and tested whatever suggested packing approaches we had devised earlier. The Conservator was invaluable for this part of the project plan and was required to sign off on each method as we finalized it and printed it for use by staff and volunteers. (See Appendix C: Protocols.)

Volunteer Chris Christopherson *writes labels to put in shell boxes.*

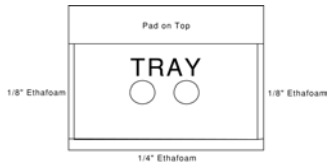
At the end of the move we have sixty-four different protocols describing how to handle or pack objects. Many were transcribed in part from written information provided by the Conservator; all were tested for ease and safety by the Conservation Assistant, and all were fine-tuned in practice by staff and volunteers.

Standalone Exhibits

Certain objects were too large and awkward to be packed and moved along with the rest of the collection. Many of these objects were also displayed or stored separately from the defined areas of collections or exhibits. We grouped all these unique items under the heading of Standalone Exhibits. An object qualified as a Standalone if it was not affiliated with a particular collection or exhibit and if it was awkward enough to require a unique packing protocol. Moving the Standalones became the responsibility of the Conservation Department and the Exhibit Production Shop. Standalones included objects displayed in the lobby such as taxidermy grizzly and polar bears, casts of *Pseudodontorn* (an Oligocene Era relative of today's pelicans), and a flock of taxidermy Trumpeter Swans.



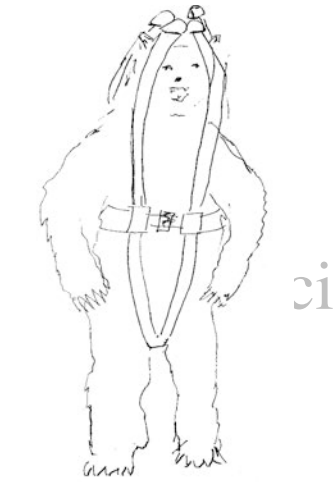
Coroplast Box Pattern *was used to make toppers (see Chapter 3).*



Early Vial Padding Diagram *needed adjustment when planned materials did not fit actual drawers.*

Moving the taxidermy grizzly and polar bears, or "Bears in the Air," serves as a good example of many of the Standalones we moved. In December 1995, the male grizzly bear and a male, female, and infant polar bear were installed on a platform approximately 20 feet above the lobby. The three adult bears are all mounted in standing poses. A Conservation Technician had made a set of nylon webbing harnesses to hoist the bears from

Bears in the Air
Conservation Assistant Rebecca Newberry and Exhibit Shop staffer Mike Lasley prepare to lower Bear # 1.



Bear Harness and Accompanying Directions

the lobby floor to the platform for their original installation. Fortunately, the harnesses and their accompanying directions were saved.

In order to move the bears, the Conservation Assistant collaborated with several members of the Exhibit Production Shop staff. The Shop staff installed a temporary pulley in the ceiling of the lobby. By cutting away the underside of the platform, they were able to unscrew the nuts that held the bears' leg bolts into place. Then the Conservation Assistant put the harness on the bear and the D rings at the end of the harness were hooked to the end of a rope that ran through the pulley. The bear was lifted out of the platform by pulling on the rope. The bear was then lowered onto a scissors lift at the level of the platform and lowered to the lobby floor. One bear came down at a time. At the bottom, the bears were laid on their backs on large pieces of muslin. The muslin worked as a sling that was used to move the bears around while they were being packed and unpacked.

We used large 4' x 8' metal carts to move the bears. The bears, still in their muslin slings, were laid on their backs on the carts and then covered with more muslin. Packing peanut pillows and scrap foam stabilized the bears on the carts. Finally, they were tied down to the cart using wide strips of muslin. Using these ITWCT' carts (see page 87) was incredibly helpful. The bears could be tied down to them very quickly. Unpacking was easy as well. Often the objects were removed from the carts on moving day and the carts were returned to the old facility at the end of the same day. Other Standalones were moved on the large carts as well. In the case of the Trumpeter Swans, which have a 7-foot wingspan and 5-foot-long bodies, we built additional coroplast supports around the parts of the birds that hung over the edges of the carts. It was important to only let things hang off one edge, though, so that one side of the cart could still be tied to the side of the truck.

The Standalone moves worked well since the Conservation Department was familiar with many of the pieces from years of cleaning and exhibit installations. Some of the moves were made even easier by previous planning. For example, the Exhibit Shop had built a new case for the Egyptian mummy in 1995. Since the new building was then in preliminary planning stages, the case was designed to be easy to move: there is a cut-out space in the base that is wide enough to fit a pallet jack. Furthermore, the display case can lift off the base so packing mate-

Bears in the Air

laid on muslin slings filled a large, recently vacated space.

rials can be stored with the mummy. Earlier, the mummy had starred on Newton's Apple, a Public Broadcasting program produced in St. Paul. At the time, a Conservation Technician designed a packing system to secure the mummy into his display case. Once again, we were fortunate to have saved that material. Packing and moving the mummy was one of the easiest jobs we had–owing to the work completed in the past.

Moving the Standalones also went smoothly because there is a good working relationship between the Exhibit Shop and the Conservation Department. Staff from both departments collaborated on ideas for moving these complicated items. We were able to identify when things were too hard to move alone. For example, we hired a rigging company to move the "tree cookie," a large slice of a Douglas fir tree; a huge stone slab filled with fossils; and a 10-foot fossil slab of *Xiphactinus*, since all were too heavy for our equipment.

Former Conservation Technician Nicole Delfino
preparing the mummy for shipment.

Hmong House

The Hmong House is a unique structure built for SMM's Anthropology Hall in 1990. It is a full-scale Hmong traditional wood-frame and pole home built specifically for display by Hmong immigrants to Minnesota. Joined entirely by lashing and pegs, this structure was imbedded in a poured cement platform on the floor of Anthropology Hall. The Administrative Coordinator was charged with devising a plan to help the Exhibit Ship disassemble the hundreds of pieces and then put them all back together in its new location in the Collections Gallery of the new facility.

Consultation with the original construction crew and the SMM Shop crew who would be taking it down resulted in the *Hmong House Planbook*, a detailed set of instructions for labeling the different pieces of the house and then disassembling them into pallets of like components. Scale drawings of all elevations indicating which components went where were included along with numerous photos of joints and specific construction features for reassembly. Copies of the finished planbook were distributed to the crew, the Conservator, and the Assistant Curator of Anthropology who was responsible for this exhibit.

The color-coded construction-paper labels were cut and stapled in place by Collections Technicians and volunteers according to the key shown on page 42.

Assistant Curator of Anthropology Tim Ready
helped design the 1990 exhibit Hmong Oddyssy, for which the Hmong House was built.

The Hmong House
has been a popular exhibit at the Science Museum of Minnesota for over twenty years.

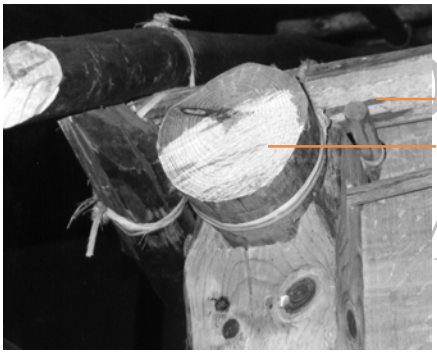
Hmong House Labeling Key (right) and Page from* Planbook *(below)

The legend at the right, reproduced from the Hmong House Planbook, *explains the color coding used to label the Hmong House for disassembly. The page below shows an example of the book's illustrations—elements of the orange category (Structure) of components in the front wall posts.*

COLOR	LOCATION	ELEMENTS
Orange Tags:	S (structure)	for framing, portals, and roof
Green Tags:	F	for front wall, facing from outside
Blue Tags:	L	for left wall, facing from outside
Red Tags:	R	for right wall, facing from inside
Light Blue Tags:	B	for back wall, facing from inside
Yellow Tags:	I	for internal walls, facing from larger interior
Pink Tags:	P	for porch and porch roof

Note: All objects that are on opposite sides of walls as faced will be tagged the same color as the walls of which they are a part; e.g. the cross-braces (small poles) opposite the cross=beams used to lash wallboards into place.

STRUCTURE
Front Wall Posts



Left corner from exterior of house

Left middle from exterior of house

Right middle from exterior of house

Right corner from exterior of house

NAGPRA

Many of our collections fall under the protection of the Native American Graves and Repatriation Act of 1990 as objects of sacred interest to Native Americans. This piece of legislation was designed to give Native Americans the opportunity to reclaim objects in museums and archives that are of cultural significance to the tribes. Museums have been required to inventory their ethnology collections and subsequently offer them to the appropriate cultural group, while those items retained by museums must be kept in accordance with traditional mores. Assistant Curator of Ethnology Faith Bad Bear was responsible for locating these objects so they could be segregated from regular packing projects and dealt with in a manner appropriate to the restrictions for sacred objects.

All such objects were packed under Ms. Bad Bear's direction and were marked in drawers and cabinets and on pallets with swaths of red cloth. The rules for handling sacred objects as interpreted by SMM are shown below.

Assistant Curator of Ethnology Faith Bad Bear
puts baskets into Delta drawers.

All (NAGPRA) objects were packed under Ms. Bad Bear's direction and were marked in drawers and cabinets and on pallets with swaths of red cloth.

Tracking Objects

Objects at the Science Museum were tracked for various reasons. In all cases it was necessary to be able to find a particular accession number at any time during the process. We were a working museum and an active research organization through all but the last few months of the transition to the new building, as we were again as soon as we reopened. Objects needed to be available for projects (especially the new Collections Exhibit that was being developed for the new museum) as long as possible.

A second motivation for tracking many collections was to more accurately analyze the amount of space in cabinets or on shelves that the collection would require after mounting or otherwise spreading from the confines of previous storage space. Drawer after drawer of stacked objects were individually mounted or placed in boxes that would require two or three times their original square footage. As cabinets were purchased for the new facil-

Curatorial Assistant for Anthropology Adrienne Todd-Walden
helped pack NAGPRA and other ethnology after being hired in Winter of 1999.

Handling Indian Objects

There are some basic restrictions for handling all of the Indian collections. They are as follows:

1. Women handling men's objects MUST NOT be near them when on their monthly cycles. This includes pipes, warbonnets, roaches, war shields, war clubs, war shirts, scalp shirts, painted shirts, Ghost Dance shirts, and all sacred and ceremonial objects as defined by NAGPRA.

2. Pregnant women MUST NOT be around the human remains or the men's objects.

3. All Mide'win objects need to be handled only by the NAGPRA coordinator except in emergencies when she cannot be reached. Under such circumstances, non-Indian men should be requisitioned to handle them.

Paleontology Pallet Numbering System

Palettes were labeled "P" and then by subgroup on orange paper:

.1 = Specimens for the Collections Gallery

.2 = Type and Figured Collections

.3 = Discrete study collections

.4 = Invertebrates

.5 = Vertebrates

.6 = Paleobotanical groups

.7 = Trace fossil groups (tracks, trackways, coprolites, pathologies)

.8 = Dinosaur storage

.9 = Casts and restorations

.10 = Geology collection

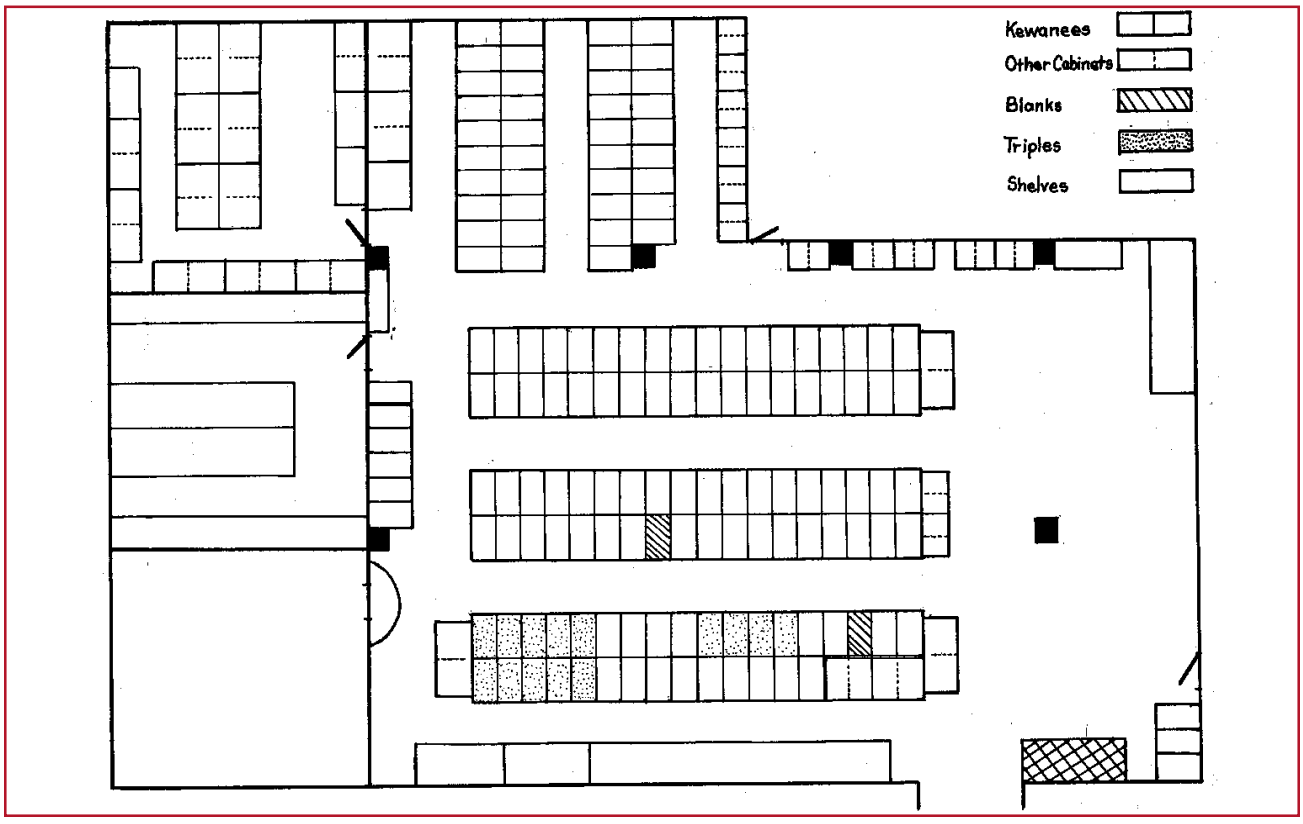
ity, accurate estimates could be obtained by counting the number of mounts/boxes in each standard size used for the project (see Appendix A: Sample Forms).

Some tracking was done simply to document the entirety of a collection for which our records were incomplete. Many archaeology site accessions, just in the door and as yet unrecorded, and some of the biology collections from the last few years, for which time we have had no Curator, fell into this category. Unrecorded site collections were cataloged before being sent to packing with notations about undone pieces (red-tagging) of the collection, and biology specimens were completely inventoried and red-tagged for cataloging after the transition. If later in the process we found unexpected members of any of these earlier-processed collections, we carefully noted their status for disposition later.

Instructions for tracking were included with each protocol so that packers made the necessary notations on boxes, new cabinet drawers, and/or tracking forms. These data were then transcribed to a working notebook in ink color-coded by department as items were stacked and shrink-wrapped onto a pallet or other transportation device so that we knew exactly what was on each pallet. Pallets were then color-coded and numbered on the outside with colored paper for instant locator information. The working notebook was transcribed on a regular basis into notebooks that were kept by department (color-coded binders) for Curators and Exhibit Developers to use to find things.

Plan Used for Storage in Old Vault

As each set of cabinets disappeared, they were erased and pallets stored there were drawn in.



The location of pallets was noted on large blank maps of our storage spaces. Notes were made in pencil so that pallets could be rearranged and kept current as storage issues became more pressing and we moved pallets to accommodate a situation. For example, as we ran out of space for pallet storage in our old Vault, part of the space made available by the closing of Paleontology Hall was utilized. Which pallets were moved depended upon which kinds of objects could be subjected to the HVAC standards in the Hall, so that delicate ethnology collections were left in the Vault and fossilized bone was moved to the Hall. When this transfer was accomplished, the Collections Management Assistant erased fossilized-bone pallet locations from the Vault map and drew them in on the Paleontology Hall map. At any given time we were able to visually find any pallet and estimate remaining space.

Color-Coded Pallet

This pallet of packed Delta drawers has been shrink-wrapped and labeled on all sides with a green piece of paper (for Biology Department) and the type of specimen contained in the drawers. The heavy, molded cardboard corners were absolutely necessary to keep the drawers from sliding, as were the strips of thin foam we placed between them. As a final precaution, pallets were metal-banded before loading.

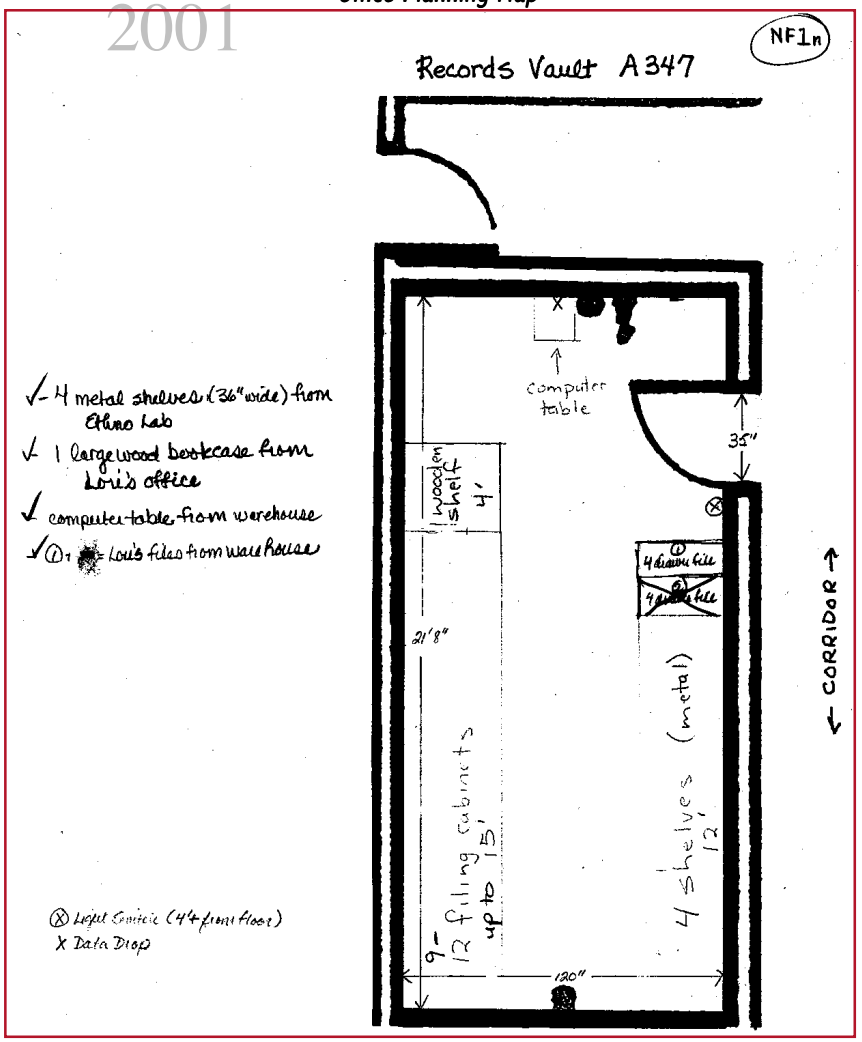
Offices and Laboratories

The Collections Move Team was also responsible for moving all the Research and Collections space to our new accommodations. This involved several steps:

1. sorting "keepers," including equipment, personal office equipment, and furniture;
2. labeling everything that the movers were to take; and
3. mapping placement of all items to be transferred.

Early in the move the Curators were made aware of the necessity of identifying and marking everything they wanted moved. The Collections Manager accompanied each on a tour of their spaces and affixed to each item a sticker provided by the moving company that color-coded all Research and Collections unaccessioned materials so that they would know where in the new building to deposit them and listed the items' destinations by room number. In our case, unlike the rest of the museum (who were getting new modular furniture for their offices), desks and bookcases and the like were chosen from the furniture on hand, some storage cabinets and bookshelves that were to

Office Planning Map



One of the New Offices for Collections Management Staff

Actual loading of the trucks gave us the experience to realize that you don't really get every square inch of the space on the floor of a trailer. You need to account for maneuvering room, room to tie things down, and room for moving equipment like pallet jacks, four-wheel dollies, and packing blankets. We also quickly learned to account for the small size of the freight elevator (8'x 8') and the very low ceiling of the dock area (7').

be abandoned by other departments, and some bookshelves and file cabinets that were stored at our warehouse. All Research and Collections staff were required to go through the same procedure, and all boxed materials like personal books and files were affixed with the same stickers as they were packed, indicating what was in the box and which room was to receive it. Likewise, bookcases and file cabinets kept at our warehouse were inventoried, allocated, and stickered at the warehouse.

The next step was to make sure everything fit. Accurate measurements and maps of each space were made by the Administrative Coordinator, and copies of each map were given to the staff member responsible for that space. It was up to them to then check measurements of the furniture they planned to take and draw each piece onto the map. The Administrative Coordinator worked closely with each person to make sure that stickers were adjusted when planned items would not fit or space was found for something extra. Once all plans were completed, the Administrative Coordinator toured the spaces and listed all items going to a certain space on the map of that space. Copies of the finished maps were kept by both sending and receiving Move Team crews, and the item was checked off by the sending crew as the movers took them to the truck.

Analysis: *This sounds a lot easier than it was in practice. Many people could not decide what they needed most in the earlier stages, so that as the date approached, staffers who had not completed their plans needed micromanagement to get them done. Some plans were very easy to read and reflected good measurements of their items while others did not, so that in the end, the Administrative Coordinator remeasured almost everything to be fit onto the maps. As we might have predicted, everyone wanted more things than would fit, All in all, however, if you have the management staff to keep after individuals and up with the almost daily changes of mind, this method worked very well, with all items moved specifically to their correct places. This avoided storing any noncollection items at the new facility "until later," which was of primary concern to us because of the tight storage space for objects and specimens. We just did not have any to spare.*

Part of the New Conservation Lab

STAGE 4: MOVING

Staging

Deborah Schoenholz and
Jackie Hoff, Collections Management Assistant

There are so many things to think about when planning a large project like this that it is very easy to forget the quantity of detail involved in every element. In this case, "The movers will move it" sounds easy and simple; in fact, it is very far from the truth.

Pallets

Several problems developed over the course of palleting the objects. First, it was difficult (and some days impossible) to keep enough pallets available to stack and wrap the packed materials. Our Collections Management Assistant kept track of what we thought we would need when and arranged to have enough pallets delivered/stored by that time. Originally, the Collections Manager arranged with our warehouse to supply and deliver the 40" x 48" standard pallets, but warehouse resources were strained on every front and we soon outgrew their capacity to keep up with our needs; in the last few months of the move they no longer had the time to deliver anyway. When this first became a problem, we went to our moving company for help; they promised to deliver pallets whenever they were in the neighborhood on the condition that they would be returned to them after the move. This was a big improvement, but the quality of the movers' pallets was such that many could not be used for valuable collections and we again ran up against having nothing to use when we most needed to stack and wrap. Finally, we contacted a commercial supplier to supplement our pallet supply, and we began to save and use odd-size pallets that we could scrounge either from our own deliveries of cabinet drawers or other museum deliveries. Once actual moving began, any pallets emptied at the new facility were also collected and returned to us by the moving company. In this way we were able to cobble together enough pallets to finish the job.

Pallets at the Warehouse *were hoisted into bays until every spot was taken. Floor space in front of the bays was filled as well, so that attention to which pallets were to be delivered first to the new facility was a necessity.*

Science Museum of Minnesota Warehouse *Note the pile of pallets in the main part of the warehouse. The Collections Storage Room is a separated space with its own locked doors off the bottom right of this main room.*

Warehouse Taxidermy

The many bays built for storing large specimens at the warehouse were full long before we were done packing. We were required to keep track of this area carefully, as specimens like these taxidermied animals, which were scheduled for late packing after the close of the museum, were slated for permanent warehouse storage and their bays needed to be kept clear until they could be delivered. We used every inch of available space around them for temporary storage.

We sent notices to any museum departments that could be affected by the move, especially those places where our pallets would need to be temporarily staged before actually loading them onto the truck.

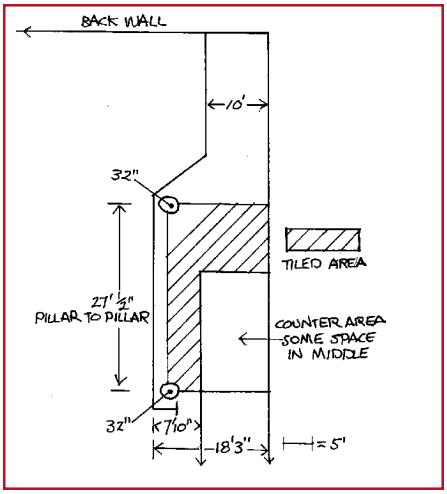
Second, the placement of pallets of particular types of collections required ongoing planning and management. For example, in trying to empty the Vault of as much material that did not need a controlled environment as possible (as defined by the Conservator), we obtained permission from the Curator of Paleontology to store the Pleistocene skull collection in the secured-corridor room, but we could not move it into the less-secure space (locked but in a public area) vacated by Paleontology Hall. Likewise the Curator of Anthropology wanted certain collections available to the Exhibits Department at all times, so that stacked and wrapped pallets of these could not be put anywhere inaccessible–like behind other pallets. The Collections Move Team was required to work within a host of such parameters.

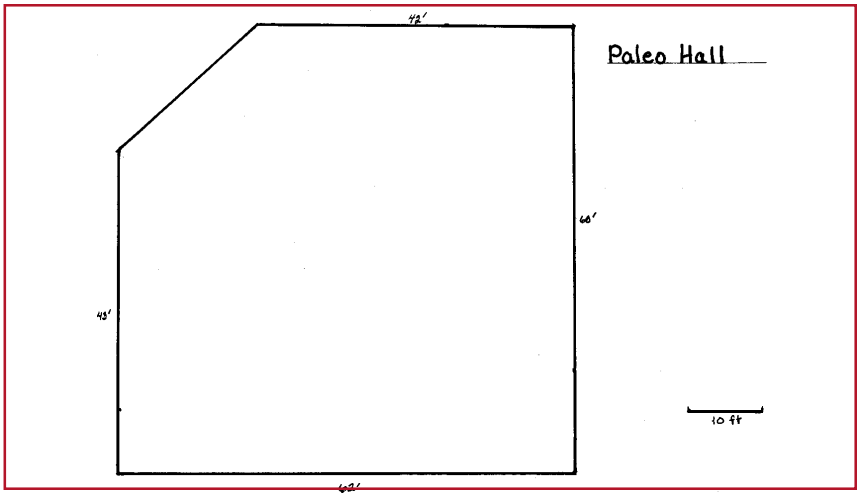
Space

During the early part of the move, our plan was to store as many nonfragile objects as possible in the Collections Storage Room at the warehouse. Packing planning took this into consideration, so that archaeology was mounted, packed, stacked, wrapped, and delivered to the warehouse along with geology and our invertebrate paleontology collection early in the move. These objects, along with those already on site from past storage projects, soon had this room overflowing. The space required to store palleted collections continued to grow beyond our expectations (and our preparations), and as there was no more unallocated space in the museum for us to use, negotiations for small areas of storage space wherever we could find it in the building took a lot of unanticipated time and energy, not to mention the cost of procuring offsite temporary warehousing space. Through the Move Office, arrangements were finally made in nearby office building for space to house as much material as possible that did not need a special environment, like furniture and cabinets, office equipment, and so forth. There were no collections taken to this building.

Scale Diagrams of Pallet Storage Space

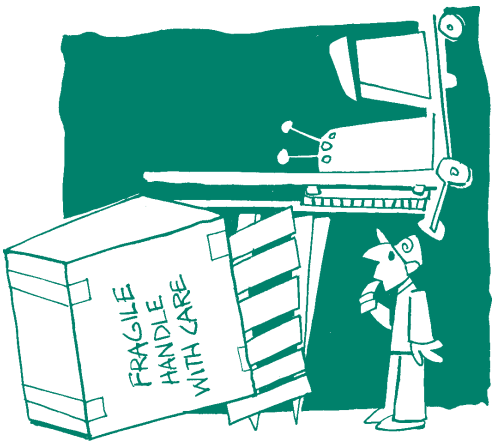
As the storage space in our Vault (see diagram on page 44) and at the warehouse began to fill up, we procured two spaces from the general museum: one odd-shaped piece left behind the walls of a traveling exhibit installed for the last few open months (left), and the other, larger, in the hall vacated by the earlier-moved dinosaurs (right). Once again, we mapped the spaces so we could draw in our pallets as they were parked.





Traffic

Rebecca Newberry
Conservation Assistant



Using the Dock

Obtaining use of the dock for loading collections into transport trucks required several steps. Once a master move schedule had been prepared for the entire museum, the dock was supposedly ours for the days of our scheduled moves. This arrangement was only for other departments in the museum, however, and no such arrangements were made with regular delivery companies, postal deliveries, UPS, or catering companies that were on site for the many events that were still being held during our move. There were also occasions when we did not use our scheduled date but for one reason or another had to choose a different date. On these occasions, we found it wise to confer with any other museum departments that might have had an interest in the same day before actual scheduling.

To cover all these bases, we first confirmed the date and time with the moving company. Three days before the move, we posted a sign on the loading door at the dock so all regular deliveries could see when the dock would be occupied with our materials. Finally, we sent notices to any museum departments that could be affected by the move, especially those places where our pallets would need to be temporarily staged before actually loading them onto the truck.

Even so, there were many conflicts, with delivery trucks required to wait until we were finished and could vacate for them and UPS trucks making several swings through our neighborhood before finally getting to pull in for the short time they required. One staff person was allocated to loading with every move for inventory, oversight, and attention to these details, while another was deployed at the warehouse or new facility to receive. Communications were maintained through the use of cell phones, since loading continued long after the phone systems had been removed from the old building.

Give a tour to each of these "qualified" companies and describe your expectations, interviewing them to ask questions such as

1. Do they understand the handling and security issues?
2. Have they moved collections before?
3. Do they know what that means–fragility, speed, etc.?
4. Will they follow your guidelines?
5. Will they follow your timing concerns?
6. Will you have the same moving staff or will it be an ever-changing panoply of faces?
7. How are they planning to move the collections and what kinds of equipment will they use?
8. How will they deal with "unusual" items?

Loading Trucks

Preparing

Planning and preparing to load the trucks on move days began long before the day ever came. We knew all of the move dates at least a year in advance so we were able to plan packing and staging around those dates. A few weeks before each move, the Administrative Coordinator would start to make of list of things to move. We learned early on that lists were very useful in getting us organized before the move day but that we had to be flexible with them on move days as things inevitably changed at the last minute. Lists also helped us plan how many trucks we would need and how many trips we would need to take during the day. We generally used two trucks with two trips each.

As the list came together in the weeks before the move, we would start grouping pallets and carts together in staging areas. It was important to gather just the things we were planning on

Packed Truck
shows space required at end of truck for moving equipment.

ITWCT Carts
could be fitted two to an elevator.

It was important to load trucks with their unloading in mind.

Decking Bars in Trucks
were often used to tie down high specimens like this fossil bird.

moving in as few places as possible to facilitate the loading. We also considered where the objects were going in the new building in loading the trucks. We tried to group things both by initial location and final destination. We also made sure that all pallets were wrapped and banded or otherwise ready to go when we staged them for their final move. For the beginning of the move, we also had to take into consideration moving items through public areas during our open hours. We tried to move things from our two corridors of offices and labs early in the morning since we had to cross a public walkway with them. Often we would use temporary staging space adjacent to the dock to store these items until we were ready to load them.

Another very important part of planning was measuring. We measured everything at least twice! We generally used 48-foot semi trailers and we quickly learned how many standard 40" x 48" pallets and how many custom 29" x 54" pallets would fit in a trailer. Measuring odd-size pallets helped us plan how many would fit in the trucks and what sorts of things could be arranged around them. Actually loading trucks gave us the experience to realize that you don't really get every square inch of the space on the floor of a trailer. You need to account for maneuvering room, room to tie things down, and room for moving equipment like pallet jacks, four-wheel dollies, and packing blankets. We also quickly learned to account for the small size of the freight elevator (8' x 8') and the very low ceiling of the dock area (7').

We did a walk-through the day before the move to make sure that everything was in place for the next day. This was obviously harder to do when we had consecutive move days, but it generally paid off. It was much easier to fix last-minute glitches beforehand rather than with movers who wanted to move as quickly as possible waiting on you.

In spite of all this preparation, at 5 p.m. there were always pallets to be stacked and wrapped for the next day's move. Shrink-wrapping and banding pallets is a two-person job. We trained two or three volunteers to help with this task to get as much done as possible during daytime hours, but it was usual for two staffers to stay late until the task was done.

Wet Collections in Milk Crates
filled an entire room once they were stacked on pallets. We were allowed use of this room for only one month, so getting the trucks on time was extra important.

Moving Day

Moving days started with a walk-through with the movers. The drivers were responsible for packing the trucks, so they wanted to see exactly what we were planning to move so they could fill their trailers as efficiently as possible. The driver and one SMM staff, usually the Conservation Assistant, would remain on the dock to load things off the freight elevator. Another SMM staff person, usually the Ad-

ministrative Coordinator, would stay with the rest of the movers and direct them to the correct pallets. It was important for the safety of the collections to have staff in both places. Most moving companies never move irreplaceable items and it was good to have someone around to remind them of their precious cargo. The Conservation Assistant would check items off the prepared lists as they went on the truck, keeping an accurate account of what was actually moved. She was also responsible for photo documentation of the moving and loading. By the last few moves, the lists were literally being created as things were going onto the truck. These handwritten lists are the sole documentation for what was loaded into the trucks on which day.

It was important to load trucks with their unloading in mind. The new building has a huge loading dock and freight elevator. A truck could be unloaded in two or three elevator trips. The trucks were loaded, then, in order of how they would be unloaded.

Loading the trucks called for some creativity, and one of the drivers we worked with was good at securing things safely and easily. He used decking bars not only to block rolling carts in place but also to tie down unstable things. This inspired us to use the decking bars to loft long, lightweight items like spears and tipi poles above pallets. The drivers were also very good at tying and strapping things down in the trucks.

Rapport

Building rapport with the movers was a critical element in our successful move. We started by identifying individuals we liked in the first few moves and requesting that they work the rest of our moves. We probably saw fifteen different men during those moves, but we had at least four or five of the same people every time. It was much easier to explain how to handle things delicately once or twice than to start from scratch every time.

We were also able to build good working relationships with them by treating them with respect. The movers brought a lot of moving experience with them, which was helpful especially when we had to move large or awkward things; they knew about equipment we could use to make things easier. We also found it was more effective to explain what it was they were moving and why they should be careful than to just keep telling them to be careful. When they heard, "Be careful with that!" constantly, they would start to joke about it and think we were all crazy. But, if we said, "Be careful with that, it's a rare seventy-million-year-old fossil that can't be replaced if it is broken," they were more careful. Furthermore, they really enjoyed learning about what we had and what they were getting to move.

Rolling Kewaunees
were secured to the sides of the truck at each move.

Another very important part of planning was measuring. We measured everything at least twice!

Collections Management Assistant Jackie Hoff
kept pallets stored for best access at each move, which meant a lot of rearranging in the vault.

A Fragile Canoe
was tied off on both ends of the custom rolling mount that had been built for it.

Stacked Pallets
wait in the new facility's huge dock elevator to be delivered to storage.

Finally, we were generous with free tickets to our museum and complimentary tickets from other cultural institutions. We also made sure they were invited to opening preview events so they could show their families some of the cool things they moved.

It was important to build a good working relationship with the movers since the health and safety of our collections was literally in their hands. We were fortunate in that our movers had previous experience with fine art, but natural science collections are far different and require diverse techniques, so that good communication was of the utmost importance.

Receiving Trucks

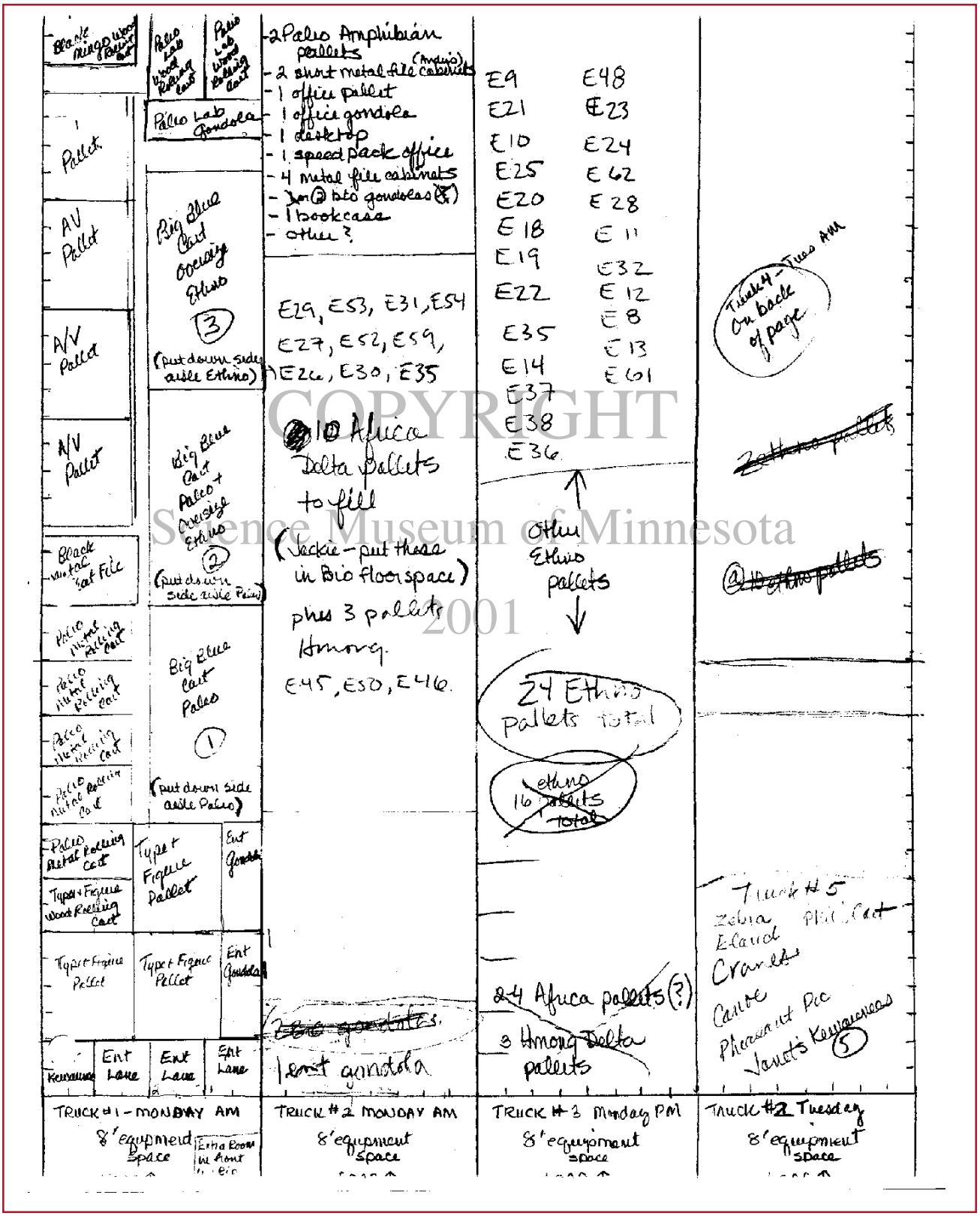
Receiving trucks on moving days was less complicated than loading them, largely owing to the great dock facilities at the new building. In addition to very high ceiling, the dock has an electric dock plate and direct access into a large freight elevator capable of carrying fifteen standard pallets at a time. There is also limited staging space in the dock area, so we were able to unload items and set them aside in order to fill the elevator with pallets for single destinations. We were able to use a secured area in the temporary exhibit hall space located on the fourth floor for staging as well as the collections vault and the Research and Collections Division corridor on the third floor. These were the main destinations for items that were moved.

The largest challenge to receiving the trucks was keeping updated on any changes that had occurred during the loading. It was important to stay in touch with the staff at the old building if changes or issues arose. We used cellular phones to facilitate this and they were indispensable.

We generally had the Collections Manager or the Collections Management Assistant receive the loads. This arrangement worked well; it allowed us to load one truck and send it immediately and then continue loading the second truck while the first truck was being unloaded at the new facility. Loaders would be too tired at the end of their day to finish the unloading of the last trucks anyway. Separate staffs were necessary.

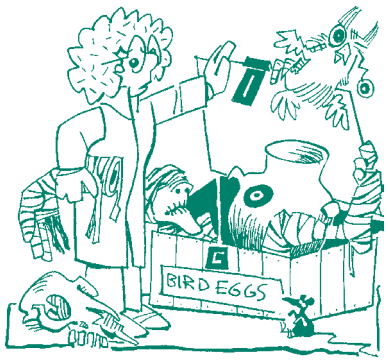
The largest challenge to receiving trucks was keeping updated on any changes that occurred during the loading. It was important to stay in touch with the staff at the old building if changes or issues arose. We used cellular phones to facilitate this and they were indispensable. Unfortunately, the cell phones did not work everywhere in the new building, although they did work from the loading dock. Receiving staff had to be very flexible about what was coming and when. When changes weren't communicated, it was harder for the receiving staff to efficiently store all the moved material. During some moves, it became important to just find a secure space to store something overnight; it could be moved to the proper location the next morning. Staying in close communication helped avoid these sorts of problems and minimized the number of times items had to be moved.

The Staging Area at the New Dock
is large enough to be able to sort pallets so that pallets of the same destination can be moved into the elevator together.



Scale Diagram of Moving Trucks

from one particularly complicated move. Truck 1, on the left, was planned very carefully, since it was carrying some very important collections, but the driver was able to pack even more efficiently when given the leeway to "expand" the plan. The other plans were modified as, in typical fashion, things changed on a minute-by-minute basis. The Administrative Coordinator drew the originals in pencil, and modifications were made on the dock by the Conservation Assistant and the driver as trucks were actually loaded. As major changes were made, they were called in to the Collections Management Assistant, who was receiving on the new facility dock, so that she would know what to expect on each truck.



The Great Hall was so full that moving some pallets out always meant moving others out of the way, much like a Rubik's Cube. This made a constant mess of our organization, which was further confused by the many staff and volunteers who retrieved pallets as they were needed.

Curatorial Assistant for Paleontology Kristi Rogers (above) and Collections Technician Ed Fleming (below) *were hired in fall of 1999 to put away paleontology and archaeology collections, respectively.*

New Building Storage and Unpacking

Deborah Schoenholz

The logistics of unpacking in the new facility were carefully considered and reconsidered until we felt we had a workable plan. There were many issues that needed to be accommodated:

1. Not all cabinets would be installed in the new vault at move date; some cabinets could not be purchased until the next year of NEH funding became available (archaeology) and some could not be purchased until new grants were written to buy them (biology). Other unpacking considerations for the vault included the priorities of each department and the amount of space available between rows to store pallets as they were disassembled.
2. Objects and specimens were to be stored in several different locations besides the vault, including all laboratories, the Paleontology Current Research Room, and the bone room for osteology collections. Pallets scheduled for disassembly needed to be placed in the hallway or inside these separate locations when they were needed.
3. There was nowhere near enough space in the Research and Collections corridor to store all our pallets. As early in the planning as possible we negotiated the use of exhibit space on the fourth floor, the Great Hall, that was not scheduled to contain exhibits until a few months after our move. This space needed to be customized with locked doors to which only the Collections and Conservation Departments were given a key, and there was a hard deadline attached to its use.
4. The Move Team staff included unpackers for the ethnology collections but not for other collections. The same departmental Research Associates and volunteers who had packed needed to be selectively scheduled to help with other collections. This involved absolute coordination with Curators and their schedules, so that often a collection had to wait to be unpacked until the Curator was available to oversee it. The NSF grant also funded a Curatorial Assistant for the Paleontology Department to help with the project.
5. The new cabinets in all locations did not come with their drawers installed. This meant that the same people who put things away first had to screw in the correct dividers for half-cabinets and the runners for all drawers.
6. Certain construction tasks were still under way in the new facility, as even though the building contractor's schedule had fallen slightly behind estimated completions, ours had not. It was often necessary to work around a crew or reschedule our own plans to accommodate theirs.

In order to manage all these limitations and requirements, the Curatorial Assistant for Collections developed a preliminary schedule for unpacking by specific collections that allowed us to target certain collections with certain volunteers who were already familiar with that collection wherever possible. For example, in the case of biology, three volunteers who were associated with this lab before the move were asked to help with the unpacking during their regular half-day shifts. In addition, a part-time staffer was hired for a few hours a week–just for the biology collections. Since there were so few people working to put these collections away, the process took much longer than the unpacking of paleontology collections, whose Curator employed every Research Associate and laboratory volunteer he could find to get the specimens off the pallets and onto shelves or into drawers in the shortest time possible. The Paleontology Department then hired their new Curatorial Assistant to sort and put in order the earlier unloaded fossils.

The preliminary schedule required that all pallets in the Great Hall be emptied in about two months time. We tried to organize them by the dates we would be removing them, but the room was as full as it could possibly be, and in fact we needed to move whole sections to get to others more often than not. Other collections, like archaeology, that had been stored in the warehouse were put off until a later date. The final delivery of collections to the new facility from the old facility took place in October of 1999. Archaeology and paleontology collections previously moved to the warehouse were moved to the new facility in 2000.

Analysis: *The use of the Great Hall, located on another floor of the building, for our primary storage was not without its problems. First, security was compromised. The space had been closed off with temporary walls and doors, but other keys than ours existed so that security, maintenance, and Exhibit Shop personnel had access as well. It was very common to find the doors unlocked or even standing open when we arrived in the morning.*

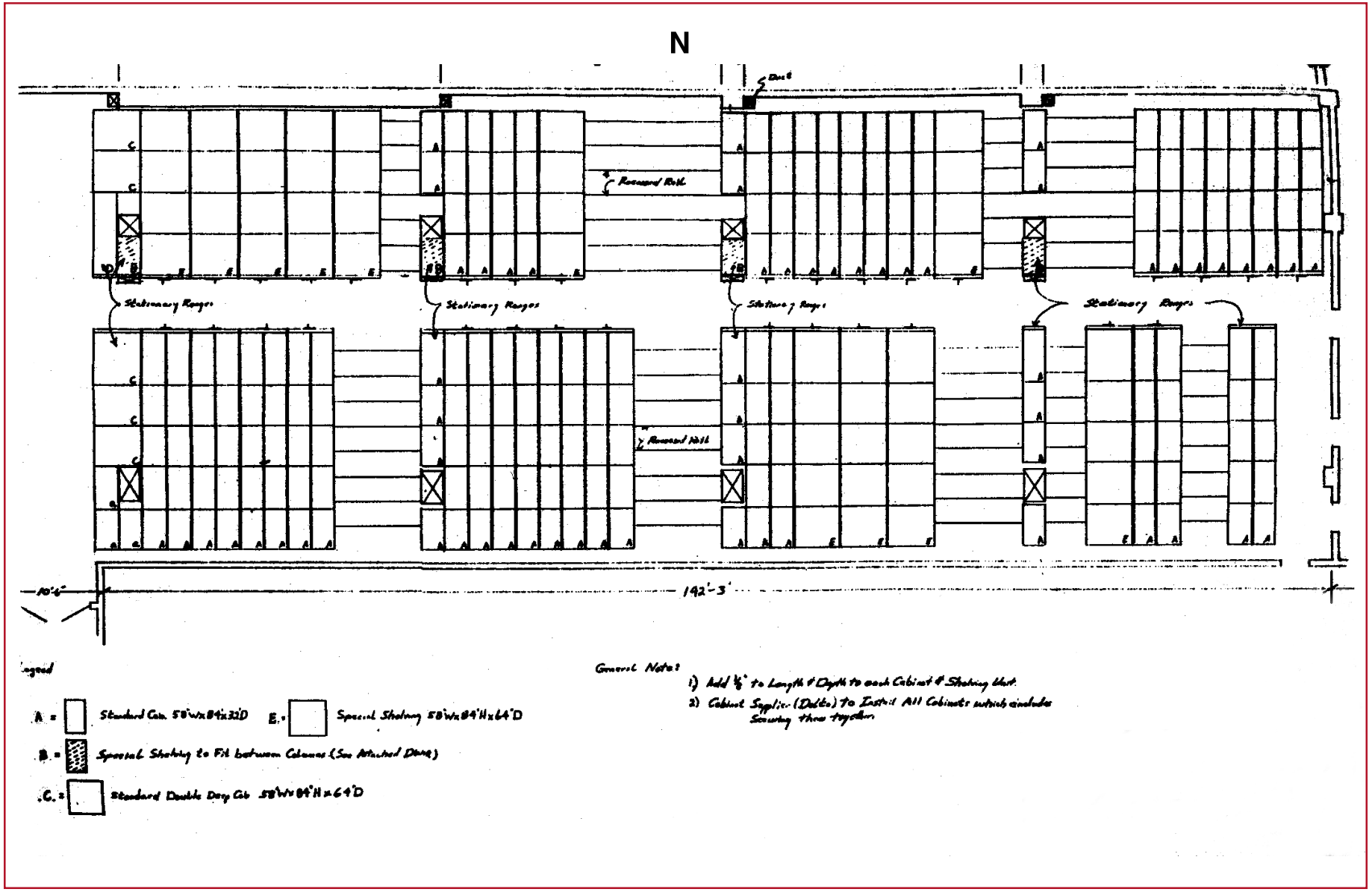
Second, the Great Hall was so full of collections that moving some pallets out always meant moving others out of the way, much like a Rubik's Cube. This made a constant mess of our organization, which was further confused by the many staff and volunteers who retrieved pallets as they were needed.

Last, since the building was still being completed after our move, there were construction issues like water and dust. Water leaked from air conditioning vents on two occasions and dust accumulated at an alarming rate. All pallets were kept covered and checks on their safety were made every morning, so that no actual damage was suffered, but the situation made us very nervous.

Movers' Book Carts (Gondolas) *were perfect for many stackable and smaller items, including these Cornell drawers. Gondolas were all returned to the moving company after the move.*

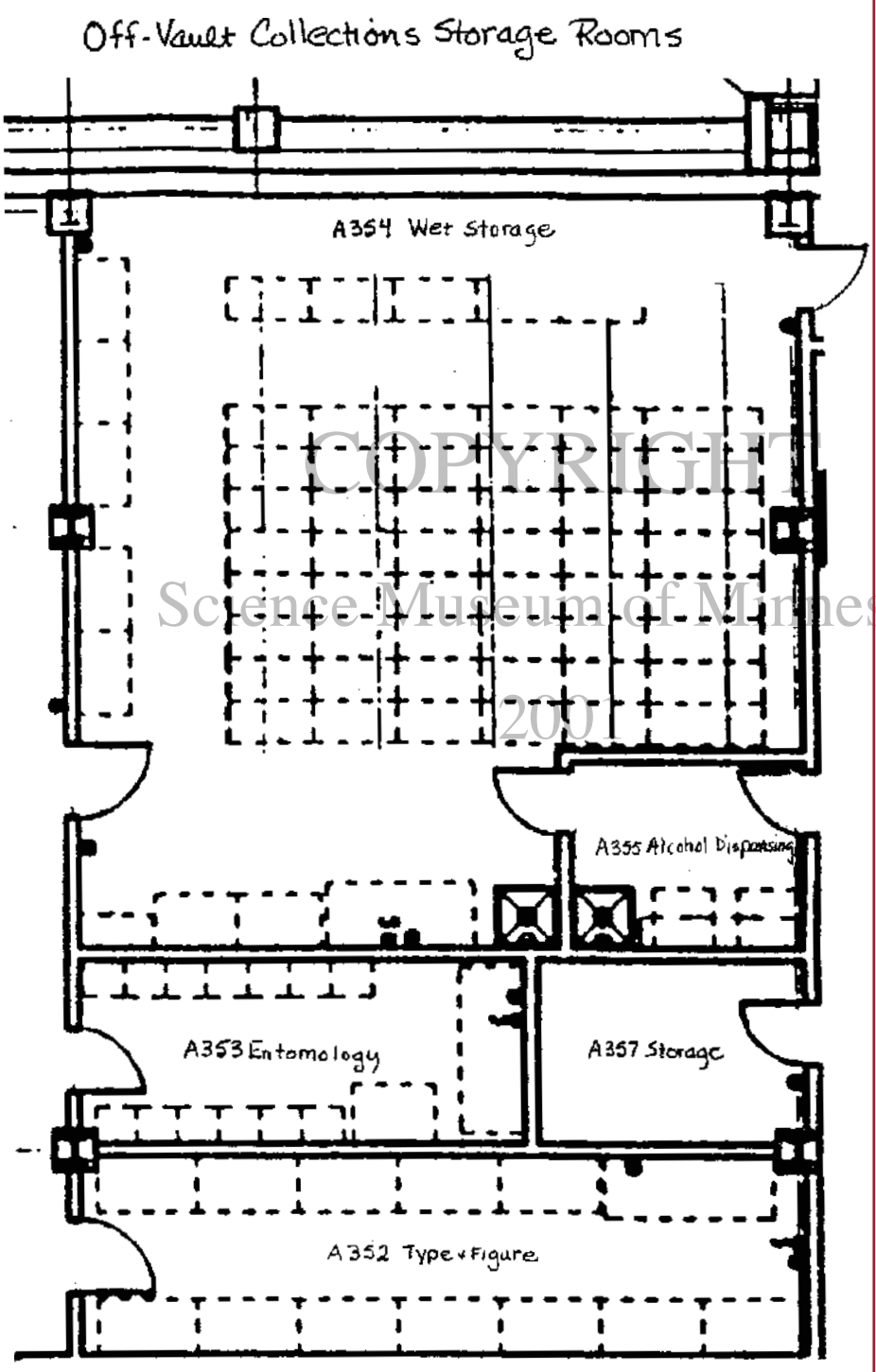
Wooden Rolling Kewaunee Carts *that we had purchased for the labs years ago were so much in demand for a smooth ride that we customized some metal ones to match, putting single Kewaunee cabinets on wheels to expand our capacity (see page 87).*

Biology Volunteer Jim Jacobsen *puts away drawers of birds in the new facility.*



The New Science Museum of Minnesota Vault

is approximately 153 feet long by 55 feet wide and houses ethnology, archaeology, biology, and paleontology specimens.



The Wet Room, the Entomology Room, and the Type and Figured Room
are all located on the east end of the new vault, designed as vault rooms of their own. Cabinets for entomology were not replaced, but new Delta cabinets were obtained for the Type and Figured specimens and compactors and shelving were purchased for the wet room.

Note: This plan was changed after the IMLS CP grant was received owing to changes in rail placement that were made during construction.

Volunteer Bonnie Voelker
liked working in collections so much she continues to help with object inventories and vault organization in the new facility.

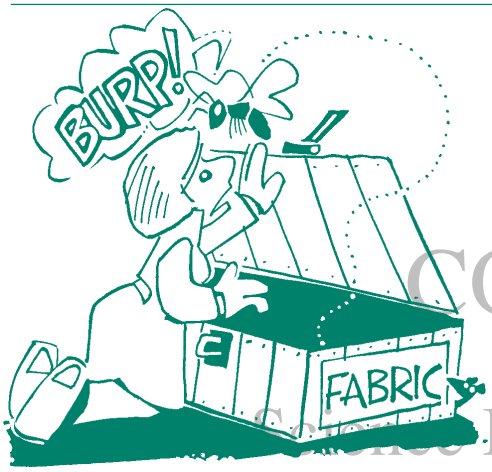
Carolyn Easter and Jesse Richardson,
long-time volunteers for the Biology Department, helped put the wet collections away and organize the new lab.

Ken Mullin
is another long-time volunteer from Paleontology Hall who helped with whatever needed doing for the first few months at the new facility.

Chapter 3

Packing Methodologies

Gretchen Anderson
Conservator



INTRODUCTION

For over ten years I have been working with practical ways to store and ship a wide range of artifacts and natural history specimens. I managed a major storage improvement project in our old facility funded by the Institute of Museum and Library Services (IMLS) as well the packing and crating of objects for many of our touring exhibits. SMM touring exhibitions focus on natural history and often move around the country for ten years or more with objects and specimens that are very fragile (e.g. taxidermy birds). The methods used to pack a dozen raptor eggs or an antique teddy bear could easily be turned to moving the collections.

When it became a reality that the museum was going to move, the Conservation Department began to apply what it had previously learned to safely moving and storing our 1.75 million specimens and objects. We also drew from workshops I had attended presented by the Canadian Conservation Institute (CCI) and the Society for the Preservation of Natural History Collections (SPNHC).

The basic idea was to make things as simple as possible. We initially planned a phased move, moving groups of objects and installing them into the new collections storage facility with as little handling as possible. While the schedule was dramatically shortened early into the project, we were still able to achieve a phased move by spreading out move days and by using SMM's offsite warehouse for interim storage of less sensitive materials. We were able to reuse a fair amount of packing materials as planned, thus reducing the amount we had to purchase and subsequently dispose of. Since we knew we would have more time on the front end of the move than the back end, we also wanted to construct proper, permanent storage mounts and containers (see page 18) that would not need to be replaced after the move. We were able to achieve this as well.

Conservator Gretchen Anderson *in the spooky costume she donned for the Halloween party we held in the EMPTY old Vault!*

Major Challenges for this Move

There was little space to pack or stage collections in the old facility.
Collections were so overcrowded in cabinets that we anticipated they would take up five to ten times as much space when packed to move (including packing materials).
Many dinosaurs had been constructed inside the building and would be a problem to get through doors or into the freight elevator.
We had limited staff, time, and budget.
We would need huge amounts of packing materials.

SPECIAL NEEDS

We began planning packing by looking at ways we could systematize solutions into virtual production lines. All ethnology that would fit was to be packed in the new Delta drawers (which we had delivered to the old museum) so they were ready to install into their waiting cabinets; our old Kewaunee drawers were to be used as often as it suited the project as well (see Drawer into a Padded Tray on page 66). There were still many items that required special attention. The "scary things" were objects that did not fit into any manageable box or cart. Designated staff was devoted to these kind of problems.

Many specimens and ojects are large, awkward, and/or fragile and presented special problems. What do you do with a fully articulated, partially fossilized Pleistocene bison, a specimen that cracked if you looked at it cross-eyed? Since there was no way to take it apart, we constructed a series of braces and lashes to mitigate the vibrations. To do this, an entire cage was constructed around it. The specimen survived without damage. In addition, special condition reports were made that allowed us to track the many cracks that already existed in it.

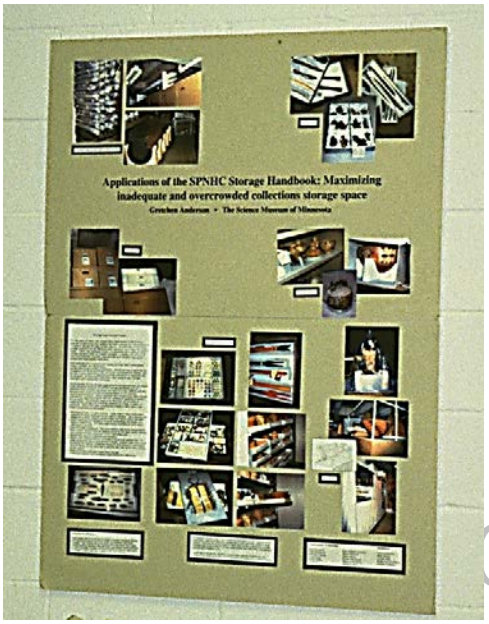
Volunteer Jim Kreche and Part-time Staffer Brad Bredehoft *build a portable corral to move a bison.*

Thescelosaurus *was carefully and completely braced with Ethafoam.*

What do you do with the plaster cast of a *Thescelosaurus* skeleton in a running pose, with one foot (and only one foot) on the ground, when the plaster is so brittle that each time it is jarred it cracks? A single Conservation Technician worked for over a week on this one. Using a combination of braces made out of Ethafoam and twill tape lashing, this former engineer was able to control the vibrations so there was no breakage during the move. It was transported on one of the special 4' x 8' carts describedon page 87. Not to mention the full-scale, mounted *Triceratops* with a skull that weighs a thousand pounds or the 15-foot *Mosasaurus* made of fragile plaster and suspended 18 feet above the lobby floor.

On the other end of the weight scale, what do you do with a huge wicker basket that barely fits on a pallet? This was an interesting problem, different from most in that the object was large and awkward but very light, leaving the pallet too light even to get a pallet jack under it with out major jarring. The problem was how to secure the basket without damaging the fragile structure. This would have been an ideal situation for a pallet with wheels, but by the time we encountered it we were short on time and out of wheels. The Conservation Department came up with a terrific solution: we padded a pallet with 1/4-inch Ethafoam and placed the basket on it, resting it on its rim, and placed a strap of elastic banding around two edges of the pallet. Finally, we took a length of muslin wider than the basket, threaded it through the banding and over the basket, applied enough pressure to keep the basket from moving but not so much as to put pressure on any single part of the basket, and tied it off near the strapping. In addition, some metates were tied in the center of the pallet to add weight. The move went perfectly!

CRITERIA FOR PACKING



Training Poster
was displayed prominently in the Packing Room.

The materials we used for packing were very diverse. Wherever possible and practical, we used archival packing materials, especially for permanent storage mounts. For temporary shipping containers, we used whatever would work in the most efficient manner possible, even if it was not archival. We were looking at a 10-block move and anticipating that collections would not be kept in packing for more than six months.

Price was a factor in purchasing materials. Limiting the number of types of materials that we used in packing and standardizing box sizes as much as possible, we were able to purchase in bulk, thus reducing our cost.

Another reason for limiting the types of materials we used was to make it easier on the volunteers who were doing the actual work. A poster, shown at the left, was made identifying the primary types of archival packing we were using. This was posted in the packing room and available for reference during the entire process.

Criteria for choosing packing materials and methods were based on conservation standards and budget. The primary goal was to get the collections from the old building to the new facility without breaking anything.

Archival vs. nonarchival: We used archival materials whenever possible, but if the specimen was less sensitive to short-term contact with an acidic environment, the requirement was eased. For example, nonarchival boxes were used and reused for collections as needed as temporary shipping containers. Archival materials were used for all long-term storage and containers or if the object was particularly sensitive.

Reuse: The original plan was to move in phases. We wanted to reuse as many materials as possible for reasons of budget, storage, and disposal. Many shipping and storage materials do not degrade and take up huge amounts of room either in a warehouse or a landfill. Even with our compressed move schedule, we were able to reuse many cardboard boxes, pallets, and different kinds of padding, including the peanut pillows (see Definitions, page 62).

Simplicity: Given the range of collections held by the museum and the range of skill levels of the volunteers who worked on the move project, we needed to standardize and simplify the materials and methods that we used as much as possible. In addition, we had limited space to store bulk storage materials, so the fewer materials the better.

Fragility of the object or specimen type: The material that an object or specimen was made of determined what kinds of packing materials could surround it and how much packing there would be. For example, packing would be different for a bird (study skin or taxidermy) than for a mammal (study skin or taxidermy). Feathers are generally more fragile than fur and require a different style of packing.

Standard vs. customized packing: Whenever possible, standard-sized boxes and trays were used. This allowed us to purchase in larger quantity and get a price break on both both acid-free and acidic materials. When necessary, we built custom trays and boxes out of coroplast or other sheet material. We also customized standard acid-free trays.

Once we determined the material needs of a collection and had chosen the packing method, we wrote a protocol. The protocols were designed to describe the methods in a clear manner that could be easily understood by volunteers and non-Conservation staff members. The protocols were also designed to be flexible and adaptive so they could be used across similar types of collections. We supervised the packing process to assess how the protocols worked. This was facilitated by the fact that the Conservation Assistant supervised the volunteers as part of her job and spent most of her time in the Packing Room. The protocols were adapted and amended as necessary, based on the practical experiences of packing.

Important Lessons

We learned some important things about keeping a collection safe during the move:

Keep things simple: By keeping both packing methods and materials simple, we were more efficient and we saved money.

Know your staff (both paid and volunteer): It was important to know what they were capable of doing. Make assignments that make sense. If someone is enthusiastic but has poor manual dexterity skills, find something they can do and praise them for it! One of our most dedicated volunteers was somewhat limited by his age but was very good at making peanut pillows, telling jokes, and keeping up morale. Assign the jobs based on indiviual skills.

Keep things fun: The work is hard and frequently tedious. Volunteers will not keep coming if they are not enjoying themselves. We varied projects and tried to schedule compatible people together. The Packing Room staff played an important role in keeping the volunteers happy.

Know when to let go of an idea: Prototypes often needed to be adjusted and adapted. Sometimes things needed to be simplified. Let those changes happen and listen to your staff and volunteers, as they are the ones doing the majority of the work. Allow others to run with your ideas. Volunteers came up with some great variations on the original designs, and they got the credit for it.

One of my favorite stories about this happened when a mentoring colleague from CCI was visiting. A volunteer had developed a very successful variation for mounting starfish and I had the pleasure of showing my colleague these mounts with the volunteer present. The volunteer received the compliments directly from the person who had taught me to use the materials.

DEFINITIONS

As with any large project, there needs to be a common set of terms used to describe or explain what is to be done. This is like shorthand, so that when the work director says that certain specimens are to be packed with *snakes* or in *cavities*, everyone knows what that means.

Containers Defined

Containers are what the object or specimen is placed in to protect it from damage in the move. We took a broad view of containers–they could be almost anything, from standard cardboard boxes (many sizes, archival, acidic) and old crates to storage drawers or cabinets. Cabinets were put on wheels. Drawers and boxes were stacked on pallets, shrink-wrapped, and banded to keep them from shifting. Some specimens were too large and awkward to be put in a standard box so "open crating" methods were used (see photo of spear box on page 65).

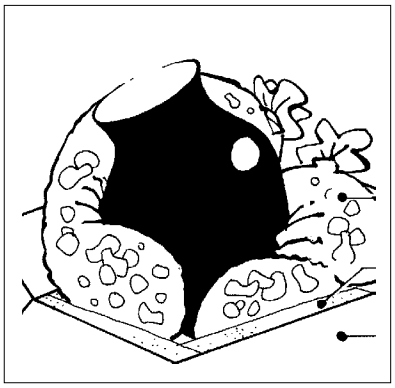
Examples: Smaller items such as shells; study skins; or lesser geology, invertebrate paleontology, and archaeological specimens could be placed in a Kewaunee drawer, padded, then stacked on a pallet. Ceramics, which were too large for the drawers, were placed in padded acidic boxes (acidic cartons were acceptable because they were for transfer only, not long-term storage, and they were less expensive). Large items that did not fit in boxes were placed on large wheeled carts (see Custom Carts on pages 86-87).

Pads, Pillows, and Separators Defined

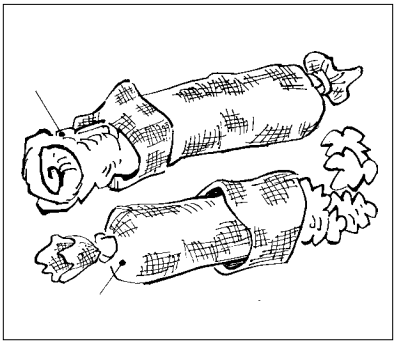
The **type of padding** used in each case was chosen by application of the previously described criteria. These materials provide buffering and anchoring against shifting as well as separation to keep breakables from colliding, abrading, or in other ways becoming damaged.

Peanut Pillows

These were indispensable. They fit all of the criteria–reusable, simple to make, and flexible–and they can be form-fitted around most objects to keep them stable. To make the pillows, we used two sizes of polyethylene garbage bags and various sizes of zip locking plastic bags. The bag was partially filled with styrofoam peanuts, then as much air as possible was squeezed out and the bag was tied shut (a variety of methods were used: twist ties, tying the bag, or a cotton cord). The pillow could be formed around an object with as many pillows added as needed to stabilize it. The big advantage of the peanut pillow was that the peanuts stayed in one place; that is, in the pillow. Also, objects that were nested into the pillows could not settle to the bottom, and it was very easy to remove the peanuts in the bags since static electricity was not a factor. This was a great job for volunteers, especially those who wanted to help but did not have the dexterity to do more-complicated jobs.

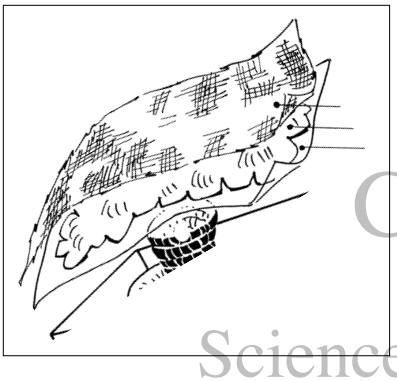


Snakes



Two-inch cotton stockinet was cut to standardized lengths and stuffed with polyester batting. The ends were knotted. Snakes were used to stabilize and support objects. These are very flexible and provide soft and even support.

Tyvek or Muslin Pillows/Layers



Another invaluable method we used to stabilize specimens and objects in bulk was to sandwich sheets of polyester batting between Tyvek and/or muslin. A layer of muslin or Tyvek was laid on the drawer full of specimens. The next layer was a sheet of polyester batting (thickness was determined by the amount of space needing to be filled). A layer of muslin was laid on top of the batting and the next drawer full of items was set on top. We had originally planned to actually sew pillows but found that for a short-term, one-time-only move, the layers were more than sufficient. All pieces were cut according to the standard-size Kewaunee or Delta drawers we were using as shipping containers.

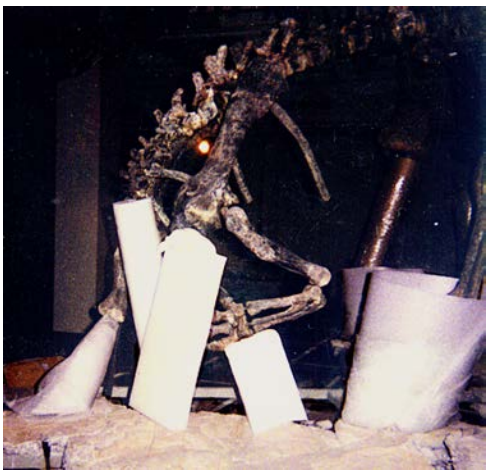
Tyvek was used as the separator when the surface of the specimens or objects were fragile or susceptible to abrasion. The top layer of muslin prevented the batting from catching on the drawer above.

Liners and Separators

In general, these are materials used to line containers, separate objects/specimens from each other, and provide some protection from movement. Materials could include any of the foams (1/8" to 1" thickness, determined by what was needed by the object), tissue, Tyvek, muslin, polyethelene sheeting, mylar, acid-free cardboard, or coroplast. Cardboard separators were often placed between objects to prevent them from colliding. Tissue was used to wrap an object to protect it from contact with its neighbor.

Braces Defined

Braces were made from various materials determined by the needs of the object. For example, a large wooden slit drum was braced with a wooden structure and padded with Ethafoam and Tyvek. Smaller items might have employed a brace made of foam. Braces were used both as internal and external mounts. These help keep the objects stable. The photo at the right shows Ethafoam used as support and bracing for a dinosaur.



Ethafoam Blocks
were used extensively to support standing skeletons. These were cut to fit as a brace and then wrapped into place and secured with 1/4-inch Ethafoam sheeting.

Helpful Hints

To cover Ethafoam with Tyvek, cut slits in the Ethafoam into which you can push the edges of the piece of Tyvek.

To create a ring for a ring mount, cut a piece of backer cord the right size to support the base of the object and join its ends with hot glue to make a circle; glue to cardboard base.

When using hot glue, use an applicator like a wooden craft stick, otherwise the glue may melt the backer cord or Ethafoam.

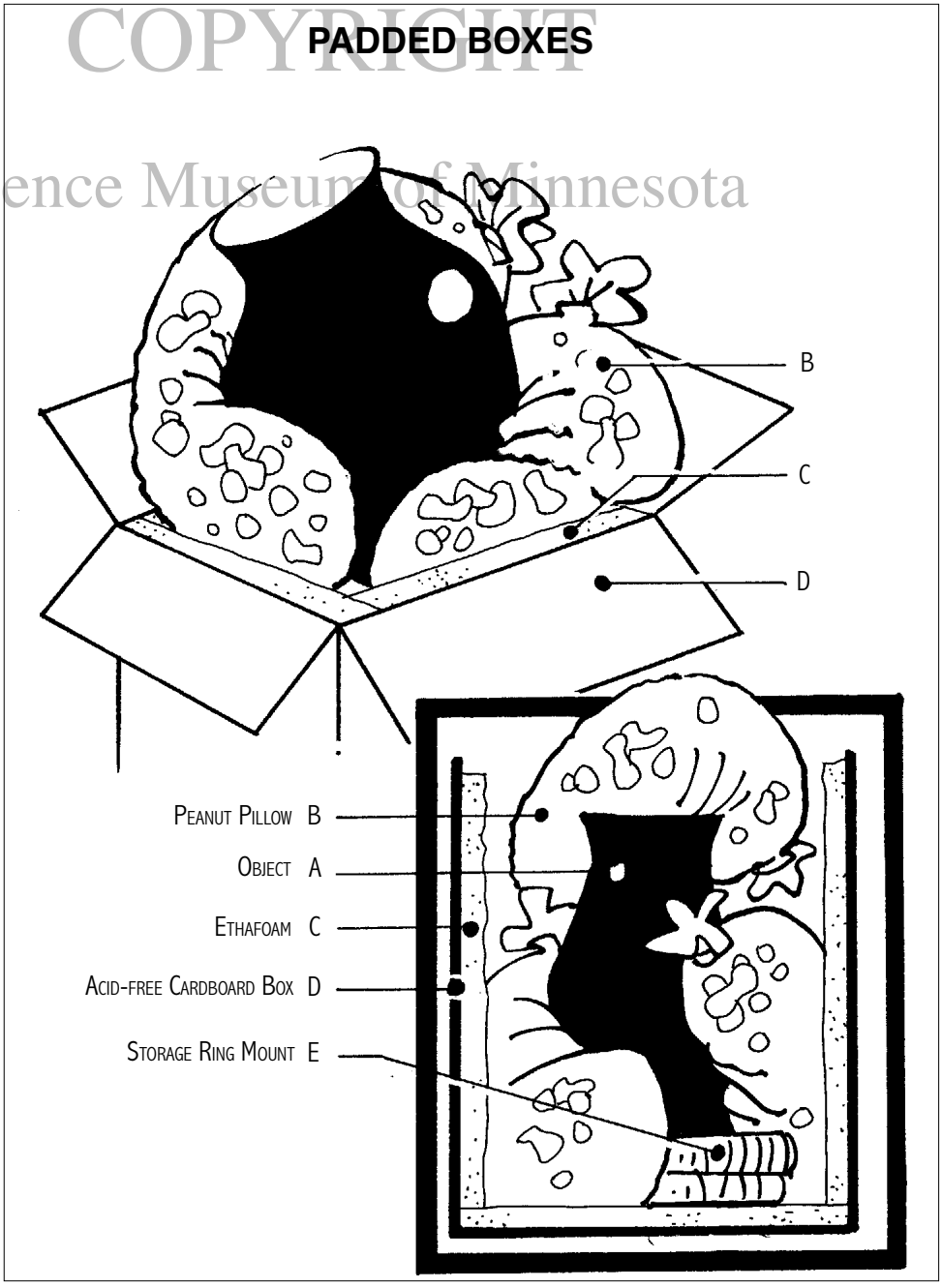
If hot glue drops on your skin, let it cool before removing it and no skin will come with it.

Boxes and Trays

Padded Boxes

Shipping cartons were often the packing boxes. To make this transformation, they were first lined with 1/4-inch or 1/2-inch Ethafoam, depending upon the fragility of the item being packed. The fragile object was placed in the box with its own mount and/or padding and additional lining was added to make it stable.

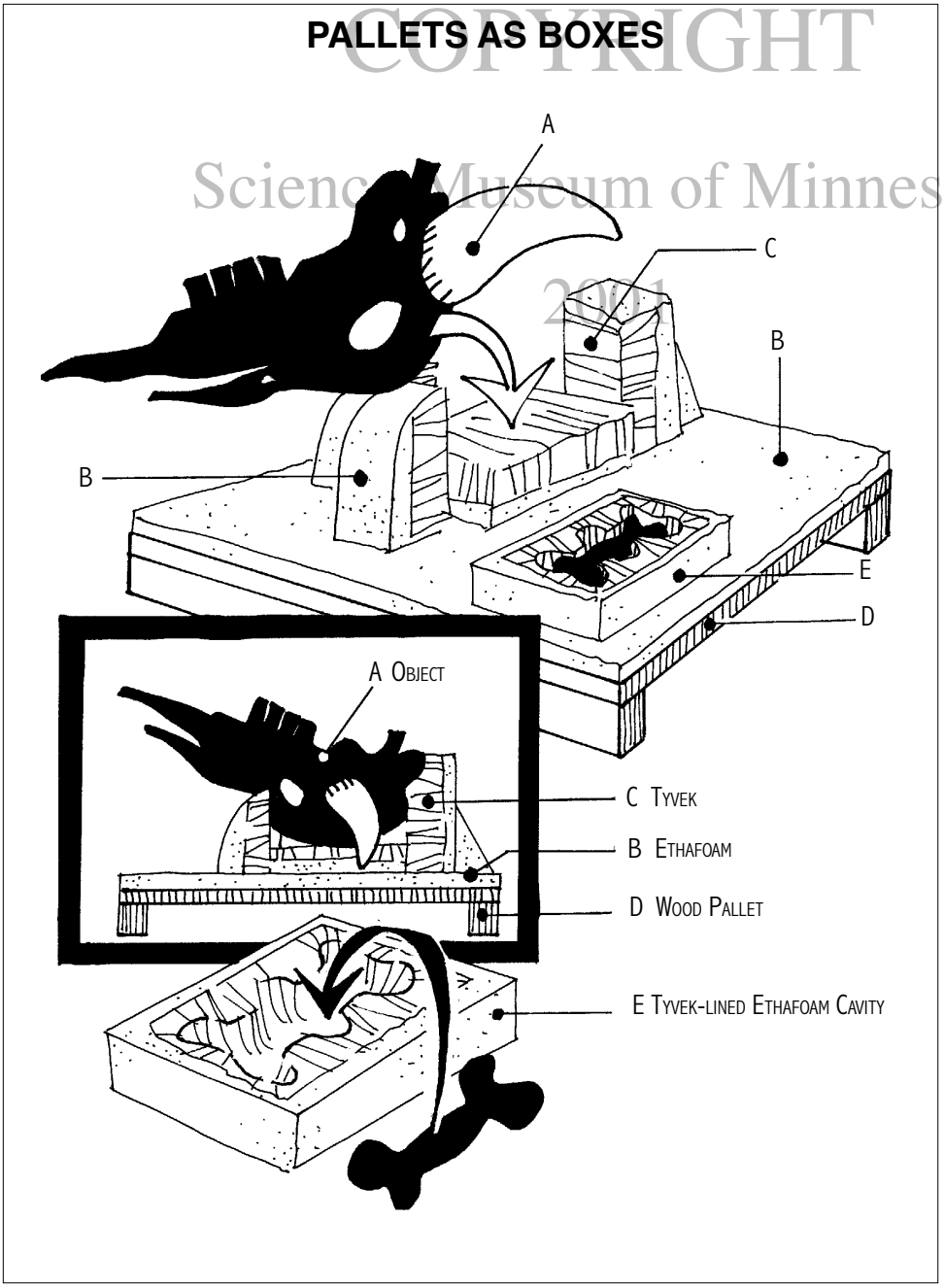
Example: The object to be packed is a large ceramic vessel. It is placed on a ring storage mount designed to fit. The box is prepared with 1/2-inch plank Ethafoam placed on the bottom and the sides. The ceramic on its mount is placed in the box and peanut pillows are formed around it to prevent the object from shifting.



Pallets as Boxes or Trays

For transporting large objects or specimens that did not fit in to any standard carton, pallets were adapted. The base was padded with Ethafoam, its thickness determined by the weight of the target object and how much vibration mitigation was required. If a mount was required it was constructed. The illustration below demonstrates a specialized pallet for a Pleistocene bison skull. The pallet was custom-made to hold a single skull and associated bone. The pallet is solid plywood with an Ethafoam liner. The mount is made of carved Ethafoam blocks covered with Tyvek where the rough foam comes in contact with the fragile surface of the skull. A cavity mount was constructed to hold additional bone from the specimen.

Example: The photo below shows a completed box for spears. Coroplast sheeting was used to deck the pallet and to make the sides, which were simply stapled onto the pallet and taped together. The bottom and sides were lined with 1/2-inch Ethafoam and the spears were layered with 1/4-inch Ethafoam. This box was so big, to accommodate the length of the spears, that we needed to put it on wheels in order to move it around.

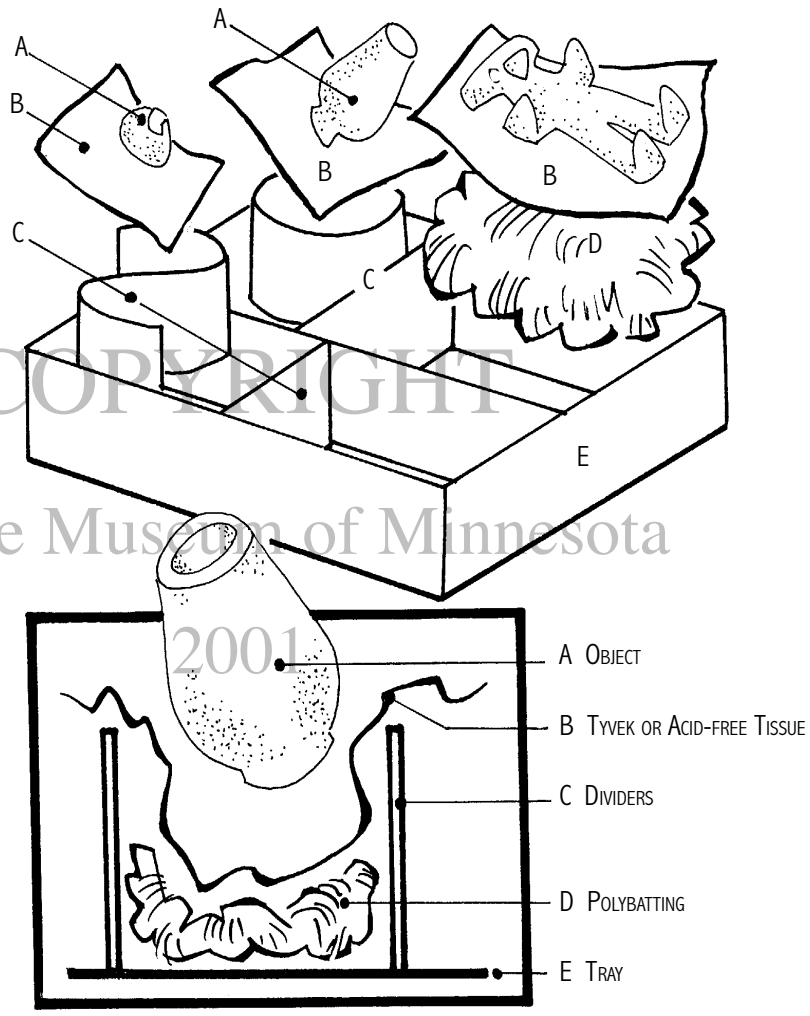


Conservation Assistant Rebecca Newberry *pulls the wheeled spear box into the new vault, where spears will be stored in racks built in the narrow space left between cabinet and wall.*

Subdivided Trays

Acid-free trays with variable subdivisions were purchased for small items in the collection. The trays are designed to stack in a standard-sized banker's box. They come in several configurations of dividers, which we often manually altered to fit objects' shapes. After they were altered (cut and folded), a piece of foam was cut to the dimension of the bottom of the cavity. If needed, polyester batting was laid down to make a nest. Tyvek or muslin acted as a separator between the object and the batting. If additional dividers were required to inhibit movement, they could be made out of a scrap of foam or cardboard.

SUBDIVIDED TRAYS

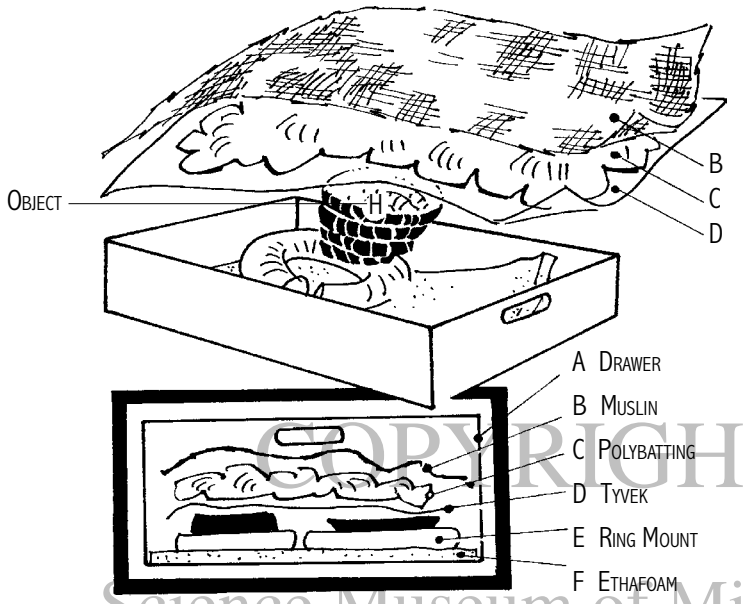


Padded Trays

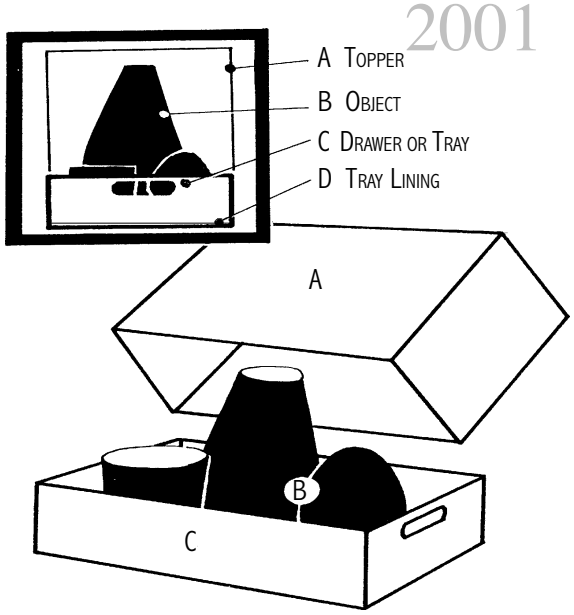
Drawer into a padded tray: To use on-hand, sturdy resources, Kewaunee drawers emptied of collections were often used as moving containers. The drawers were cleaned and lined with Ethafoam, the thickness of which again depended upon the collections being packed. The objects were placed in the drawer mounted on their permanent storage mounts when possible, or in some cases, as in this photo showing osteology specimens in a Kewaunee, just wrapped in 1/8-inch Ethafoam. They were then covered with a layered packet of Tyvek, polyester batting, and muslin, which was tucked lightly around the objects to keep them in place for the short move. The drawers were carefully stacked on pallets, stabilized with heavy cardboard corners, shrink-wrapped to the pallets, and banded with a metal banding machine for good measure (see page 45). Most of our ethnology collection

Osteology Specimens in Kewaunee Drawer

DRAWER AS PADDED TRAY



TOPPERS



and much of the biology collection was moved in the same way, using the new Delta drawers that were to be permanent storage in the new cabinets.

Topper to a padded drawer: Part of the beauty of using Kewaunee drawers as trays was that they stacked so neatly on the pallets, and we tried to use this method for as many types of collections as possible. However, most collections included objects that were too tall to fit under the bottom of a superimposed drawer. To accommodate this, tall objects were put in drawers together and a simple five-sided box or top was made out of coroplast to cover them. These "topper" drawers were then used onthe top of each stack of drawers; hence, the name.

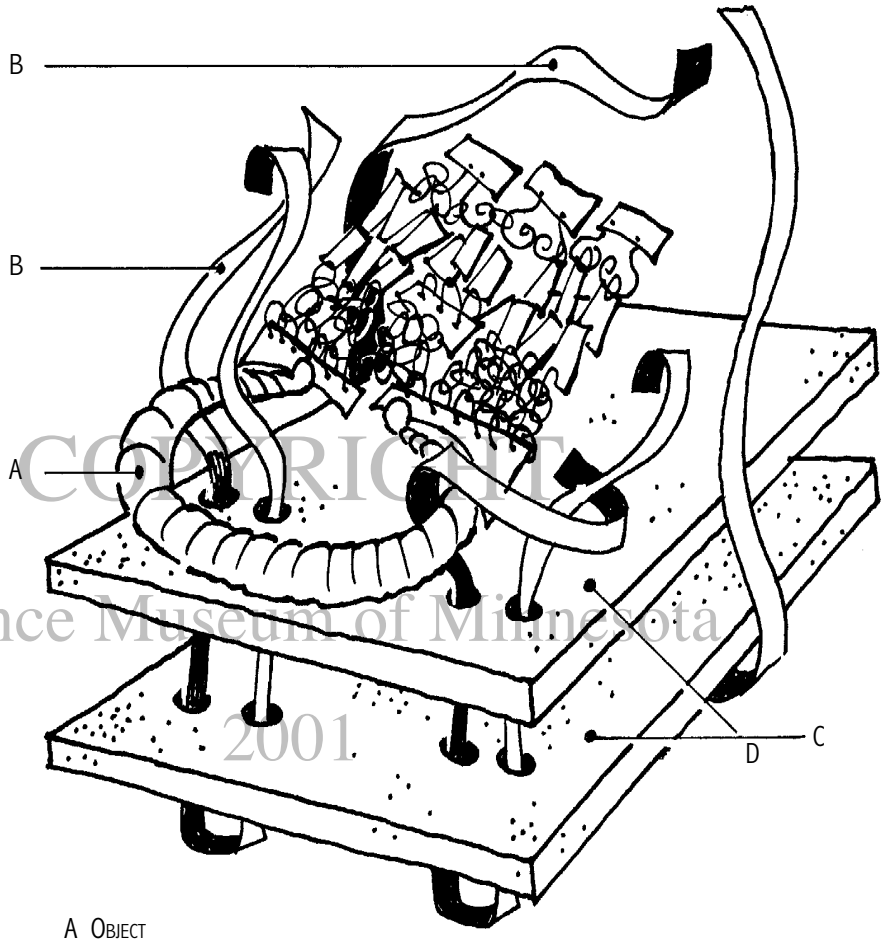
Marine Shells (left) and Bird Study Skins (right) *fill biology Delta drawers used for transport as well as permanent storage. Drawers were prepared for moving as described in the illustrations on these pages.*

Padded Boards

Some objects, even complex ones, require only a simple mount for both storage and shipping, and we tried to use as many of these as possible. We found one of the most useful mounts to be a padded board. A padded board can be easily constructed out of a rigid board (i.e., acid-free cardboard, mat board, or foam core) with a layer of padding material attached (polyethylene, acrylic felt, etc.). An alternative is to use a rigid polyethylene foam for both the board and the padding. The manner of attachment is usually with hot melt adhesive or some other mechanical means.

The diagram to the right shows a complicated silver necklace with a lot of dangling parts. It was determined that for both shipping and for storage, the necklace should be tied to the padded board using cotton twill ties. This prevented the necklace from tangling and/or shifting while providing vibration mitigation and security.

PADDED BOARDS



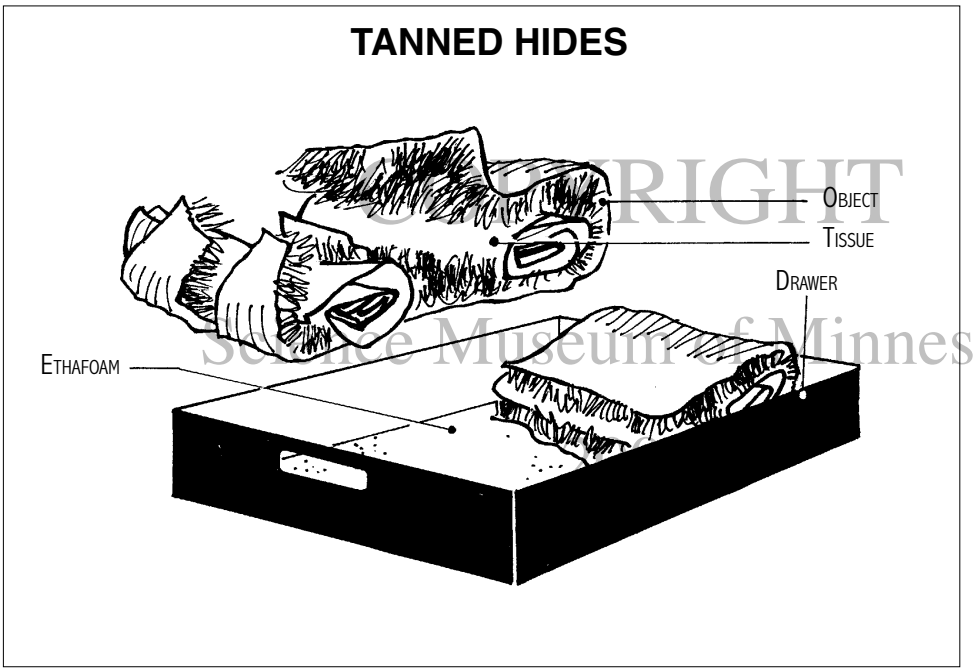
A Object
B Twill Tape
C Foam Core of Acid-free Board
D Ethafoam or Other Padding

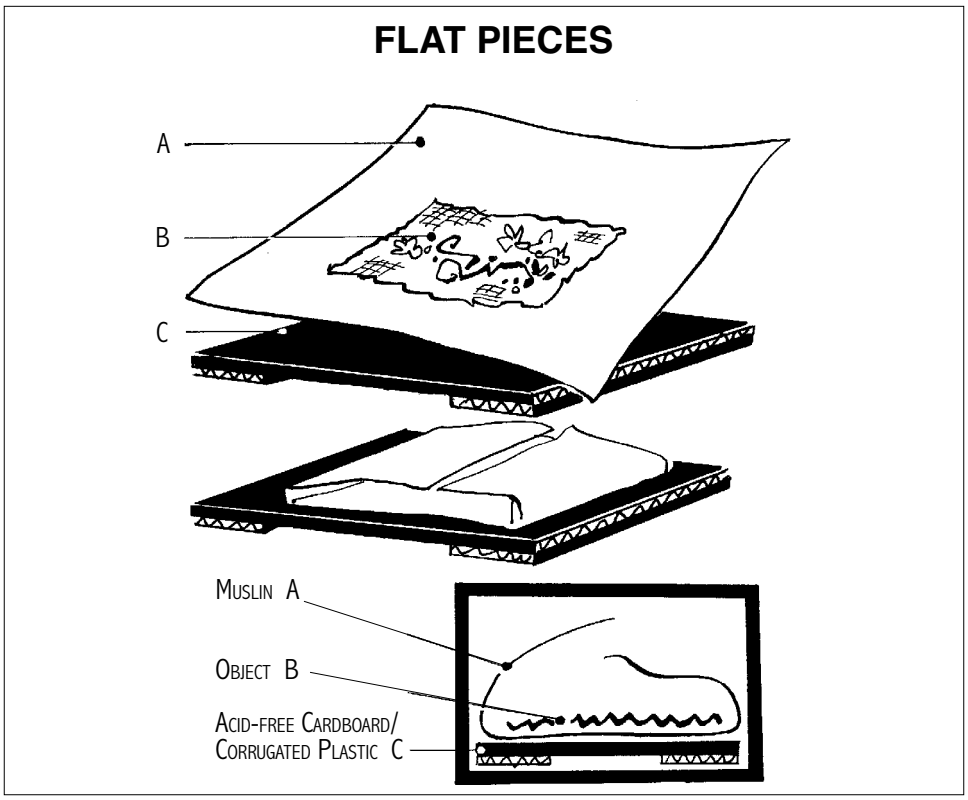
Bead and Shell Necklaces
were attached to padded boards with twill tape ties for both moving and for permanent storage in cabinet drawers.

Liners and Barriers

Under certain circumstances, a textile or tanned hide might be layered or folded on itself, then packed in a box or tray. Flat and flexible archival materials such as acid-free tissue, Tyvek, muslin, and mylar can be used as interleaving sheets between layers of stacked objects or objects folded on themselves. All folds should be padded out with crumpled tissue or snakes. The choice of material depends on the object's composition.

Tanned hides: Hides that need to be rolled should be packed as above. Although it is not ideal, they can be stacked on top of one another. In a perfect world, they would be laid out flat on a screen to allow for airflow, then stored in cabinets to reduce the potential for infestation. As we are short on space, the relative importance of this collection dictated that it should be stacked and folded. The interleaving and padding was unbuffered, acid-free tissue, selected for oils and dirt leached off the hides. Unbuffered tissue should always be used with hide, wool, fur, and feathers.





Small, flat textiles: Textiles and works on paper should be laid flat on a barrier of acid-free tissue or other selected material (e.g., Tyvek, mylar). In addition to being a barrier, this provides support for lifting and as an interleaving barrier if the pieces are stacked. If the object is particularly fragile, then an archival board should be placed under the barrier to provide additional support when handling.

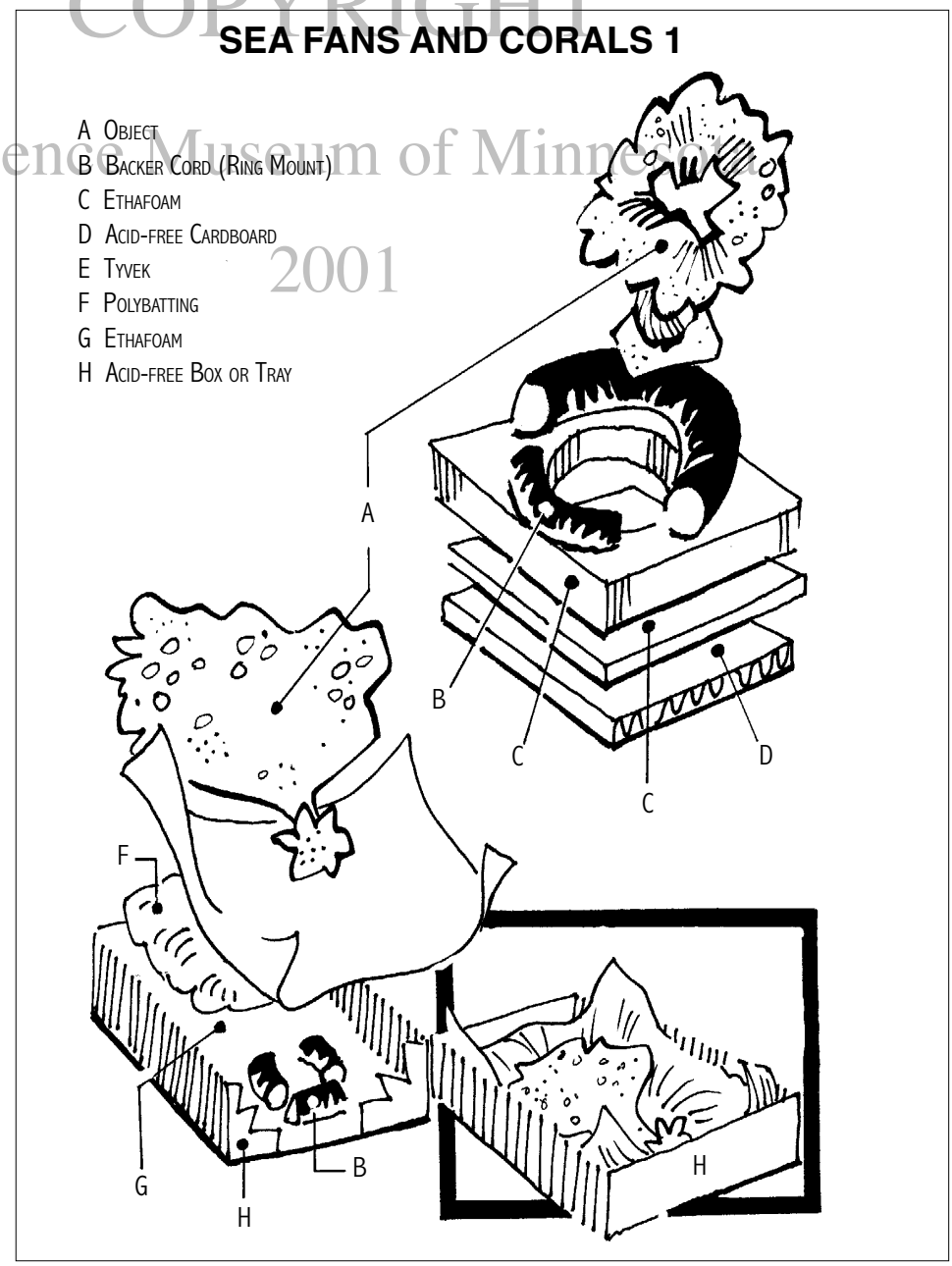
External Supports

Many of the objects in our collections are awkward and difficult to support. These objects come in all sizes and all levels of fragility. All required some kind of additional support to provide stability in order to move them.

Cavity Mounts

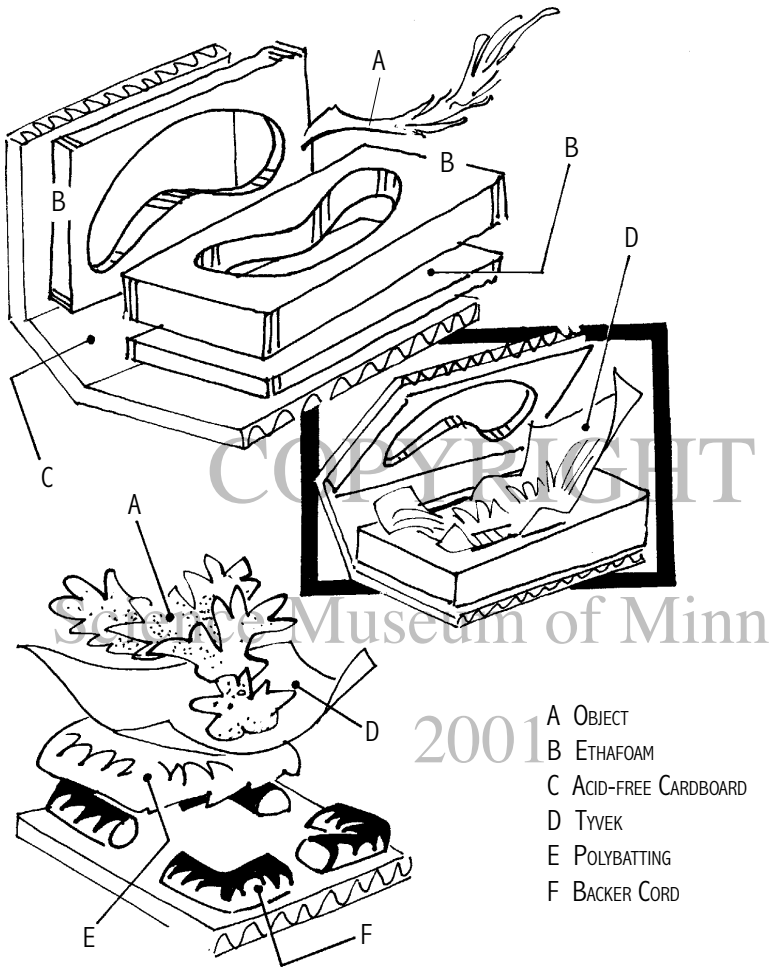
We have long known that cavities are one of the best methods for shipping fragile objects or specimens. They also make excellent long-term storage. The cavity must be shaped to hold the artifact as stationary as possible to mitigate vibration while giving it even support, so that the cavity must follow the contours of the object. Cavities are of two types: those made by cutting away a well in some base material, such as polyethylene foam, and those made by adding materials around the object to give it even support.

Example: These two illustrations (Sea Fans and Corals 1 and 2) each show two ways that we handled very fragile sea fans and corals. These shapes were often extremely awkward and the specimens were very fragile. One of the tricks we used in making some cavities was to use layers of foam. The cavity was cut larger than the specimen through the multiple layers down to the bottom layer, which was left whole. Polyester batting was then placed in the cavity and shaped so it would provide even support for the specimen. Last, a Tyvek separator was placed between the specimen and padding so that the fibers did not get stuck on the specimen.

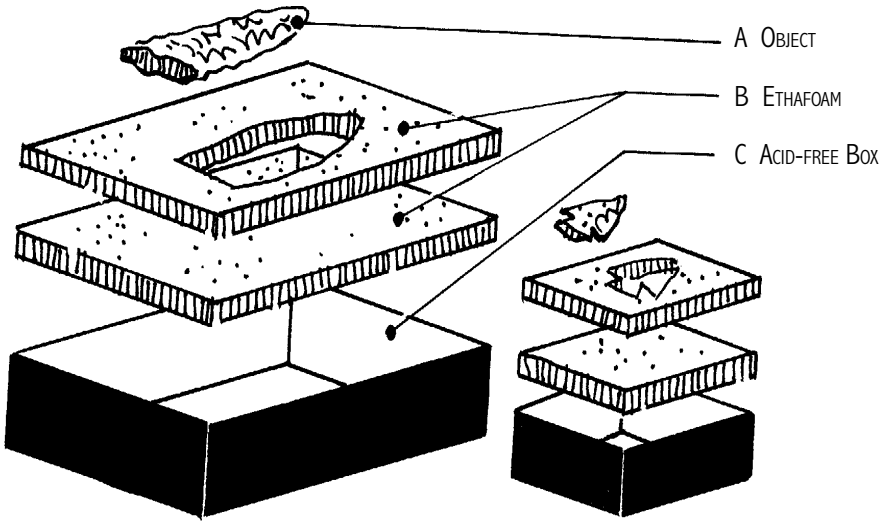


In the upper examples, a cavity was cut through a layer of

SEA FANS AND CORALS 2



LITHIC DIAGNOSTICS

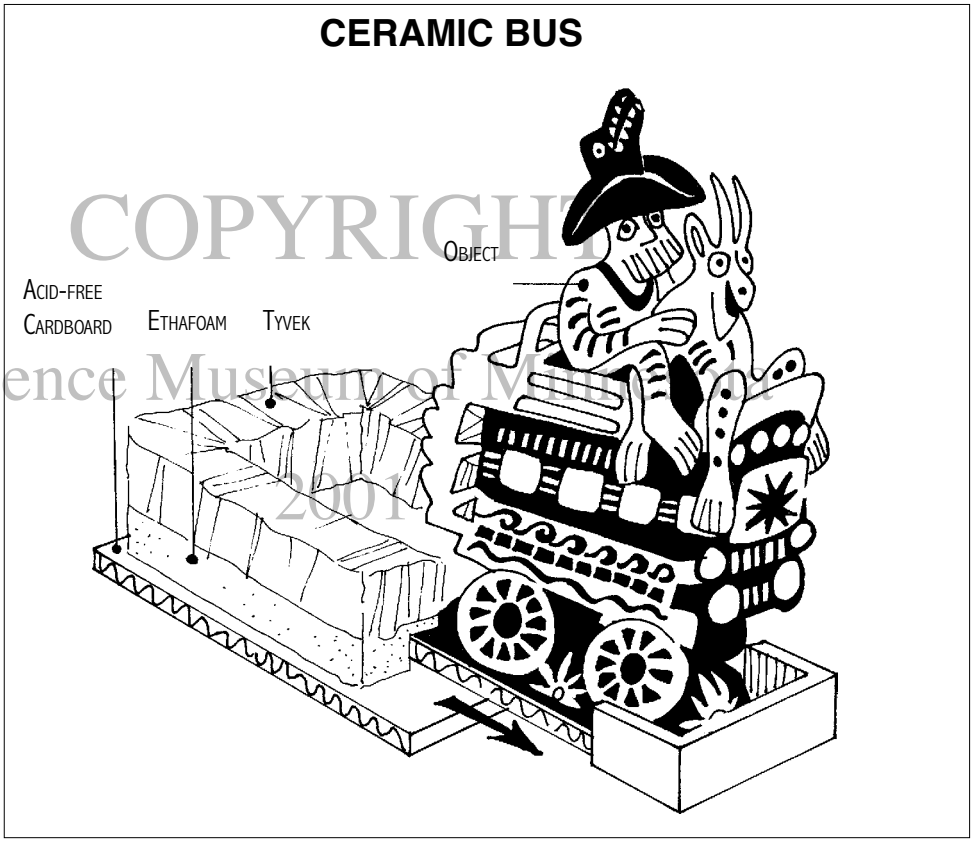


foam. In the first of these, backer cord was added around the cavity to support the coral; in the second, outer acid-free cardboard wrapped above the object to make a cover. Trays such as those shown in the lower illustrations were made of acid-free cardboard padded with foam, with backer cord added to make a cavity and additional padding of polyester batting.

Example: We used similar methods for diagnostic stone tools. A small standard specimen box was lined with polyethylene foam. A cavity was cut through a second layer of foam around the tool, retaining its shape, that was then adhered to the first layer of foam. The cavity was cut to be slightly larger than the specimen. This is an extremely secure method for storing and shipping these artifacts, and even though it uses up a great deal of space in storage drawers, artifacts so displayed can be visually scanned with great ease and are extremely helpful to researchers using these collections.

Braces are very useful to secure an object or specimen when it does not require a full cavity mount or even pressure from all sides. The use of braces limits the point of contact against the object and reduces the amount of material needed to keep the object from shifting. Braces also add additional support for artifacts with fragile parts that need to be kept stable.

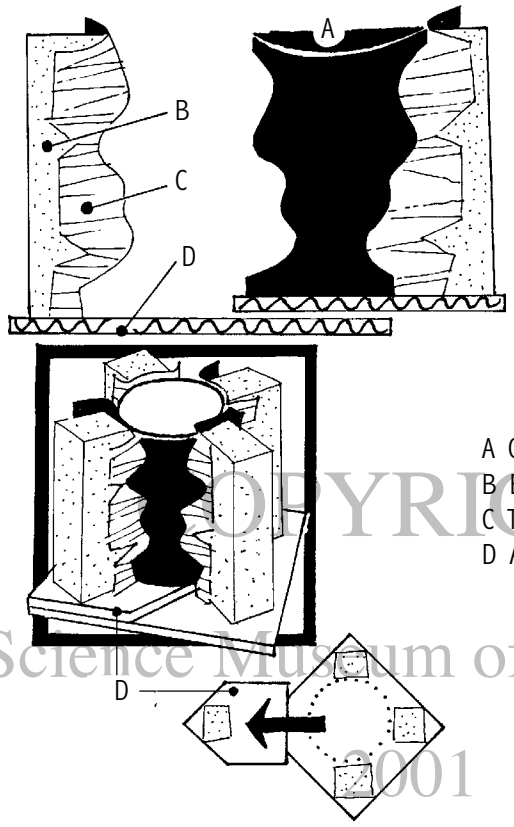
Example: Since all of our ceramics were destined for a somewhat mobile storage situation in a compactor unit, every one of them needed permanent mounts that could keep them from accidentally contacting each other when compactors are being rolled back and forth. This ceramic bus from Mexico is more stable than some ceramics but very fragile. It is a low-fire piece with glazing that will easily chip. It is also extremely complex, with many protrusions. The mount, designed by one of our volunteers, takes the idea of a brace and adapts it so that the object is contained as well as supported. The base is made of double-wall acid-free cardboard, and the object sits on a separate tray made out of the same material. The surrounding brace is built from plank Ethafoam covered with Tyvek to prevent abrasion. The tray that holds the object has a front brace to prevent it from moving laterally, and it and the base of the object slide into a key cut in the supporting brace to keep it from bouncing vertically.



Mexican "Arte Fantasco"
moved in a specially designed mount that braced and stabilized the ceramic at the same time.

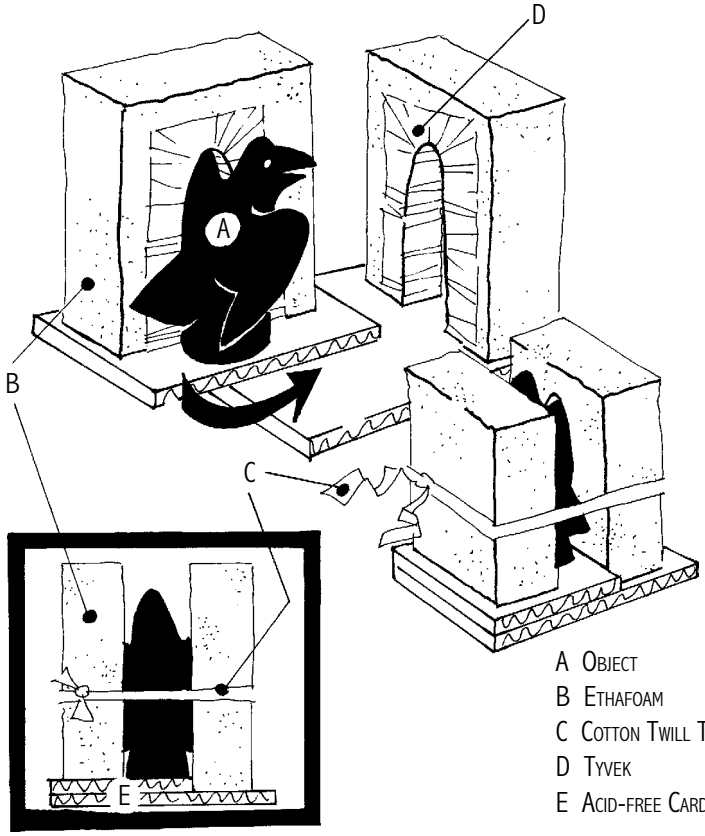
Example: A similar concept was used for the ceramic vase illustrated on the next page (Tall Vase). Acid-free cardboard was again used for the base and for the tray, and this object also stands completely on the tray. First, four Ethafoam braces were carved to

TALL VASE



A Object
B Ethafoam
C Tyvek
D Acid-free Cardboard

CERAMIC BIRD



A Object
B Ethafoam
C Cotton Twill Tape
D Tyvek
E Acid-free Cardboard

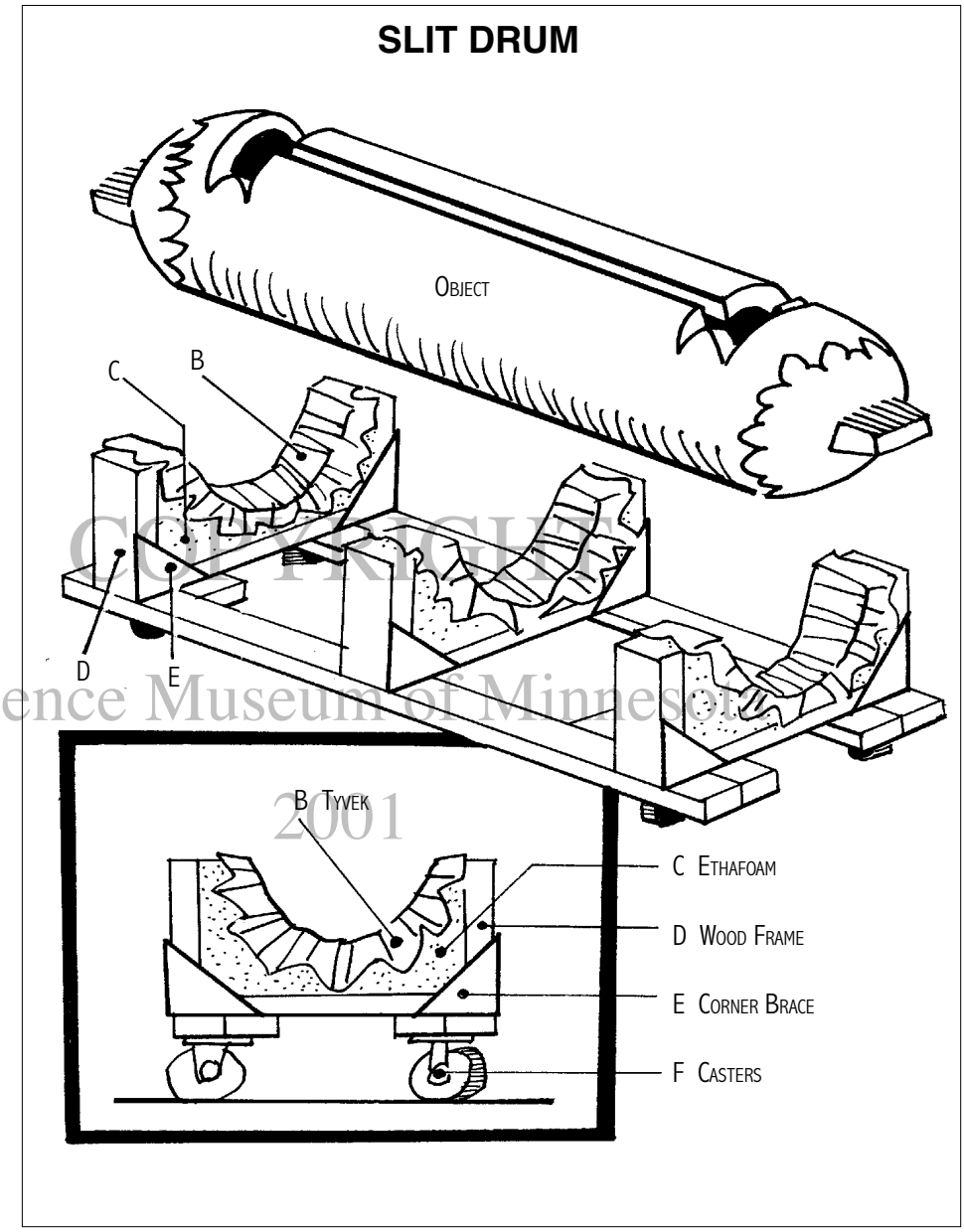
the contour of the vase and covered with Tyvek to prevent any abrasion. Three of the braces were attached to the base with hot-melt glue, forming the corners of a square with the fourth brace, which was attached to the tray. Then the object was placed snugly against the tray brace, and the entire tray was slid into the space in the center of the other three, on top of the base. Cotton twill tape was tied around the mount to prevent it from opening unintentionally. To remove the vase from the mount, twill tape is untied and the tray is pulled out.

Example: The same support-and-contain approach was taken with this ceramic bird figurine, illustrated at the left. A Tyvek-covered well was then cut into two very thick pieces of Ethafoam into which each wing could fit snugly. One support and the object were placed on a tray that slid over the base with the other support, and twill tape was used to hold the two sides together.

Cradles

Cradles are an excellent method for keeping specimens that have both a rigid structure and also a rounded base stable for shipping and for storage. We have used cradles for a variety of artifacts and specimens, including ceramics, canoes, and drums. The cradle can be made of a variety of materials, depending on the object being supported. The material of the object, its size, and its weight all are determining factors.

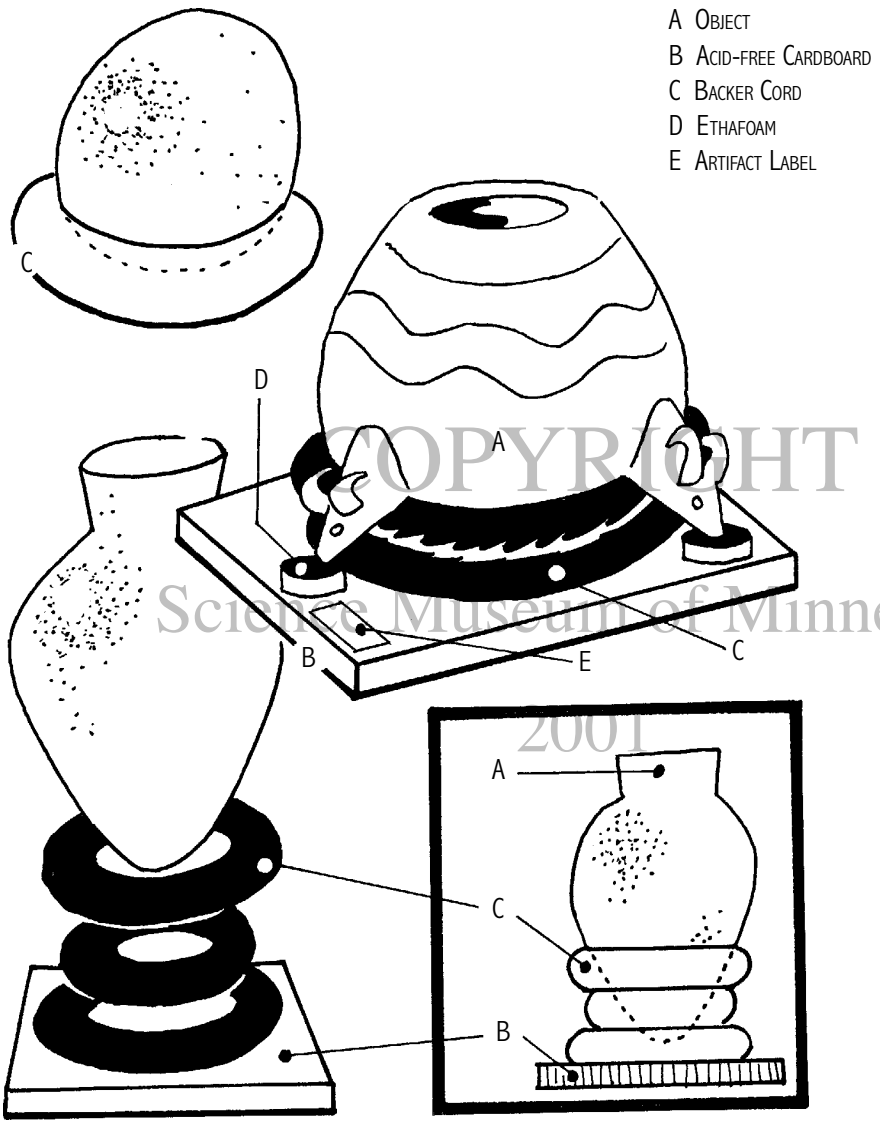
Example: For the slit drum illustrated at the right, which is about 6 feet long and weighs 200 pounds, we made a wooden structure with foam-covered supports to increase overall rigidity. The thich foam is cut out to carefully fit and fully support the curve of the base. In most cases, we lined the foam with Tyvek to prevent abrasion, as we did here. For all large and heavy artifacts, castors were placed on the frame to facilitate moving the object (see Wheeled Carts, page 86). For less-heavy ceramic objects, we used acid-free cardboard as a substrate with Ethafoam cut into wedges and shaped to hold the object, as pictured at the left.



Ceramic Patterned Bowl

is supported on its own base against one of four Ethafoam braces carved to fit the curve of the piece's bottom. When it slides into place it is supported in all four directions.

RING MOUNTS



Objects with Rounded Bases
are ideal candidates for ring mounts, like the ceramic vase on the left and the drum below.

Ring Mounts

Ring mounts are one of the easiest mounts to make as well as the most flexible kind of mounts to adapt, particularly for ceramics and baskets. A ring mount provides even support all around the base of the piece, the simplest consisting of a backer-cord ring attached with hot-melt glue to a tray made of acid-free cardboard. The cardboard can be a flat tray or it can be one with reinforcing sides that increase its strength. Backer cord is made into a ring by using hot-melt glue or hot air (see Handy Hints at the beginning of this section).

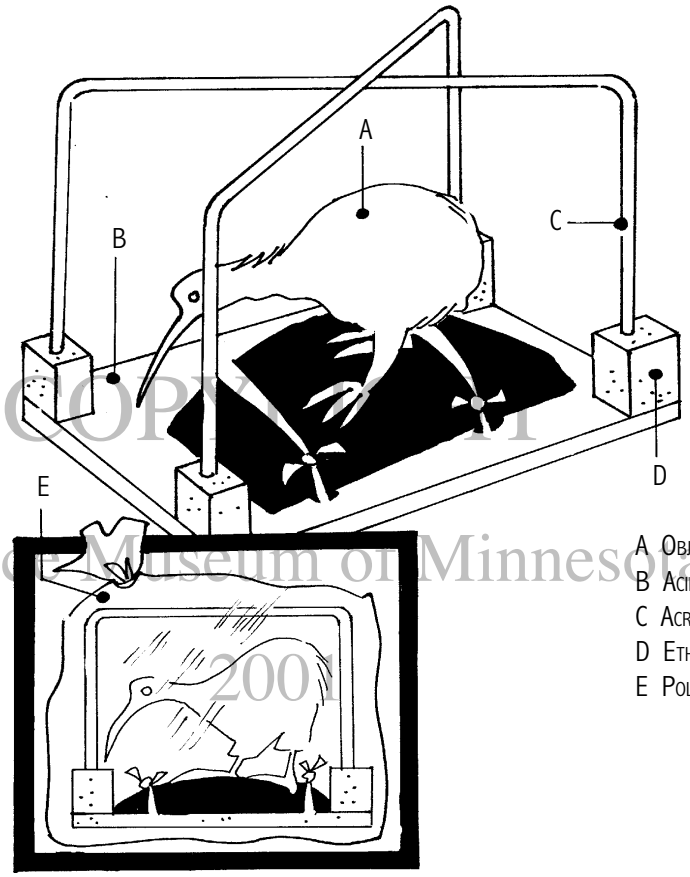
The supporting ring can be made any size, as required by the artifact. It can be stacked and glued as high as necessary to give as much support as needed. It can be formed to the best shape to support the artifact. The conical ceramic in this illustration is an excellent example, as the rings allow the artifact to nest into them without putting any pressure on the pointed base.

Lashing

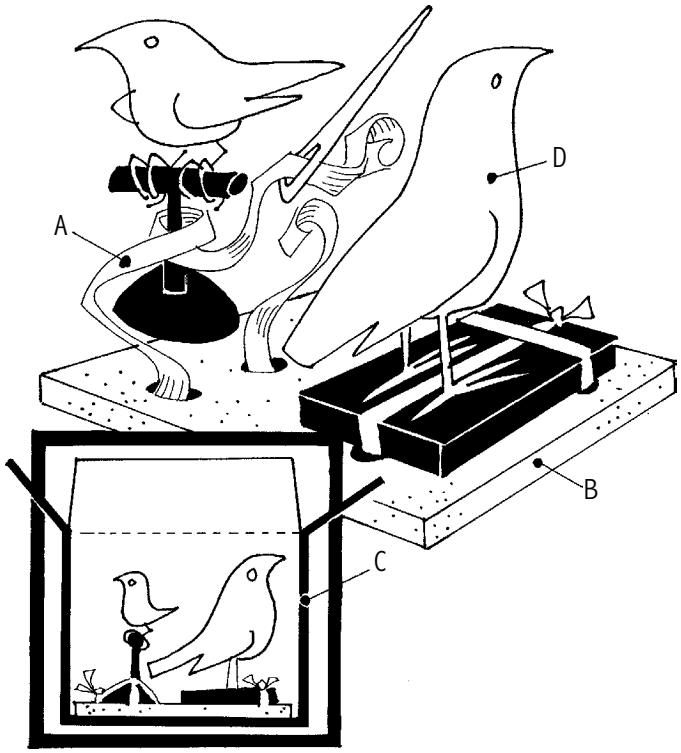
Lashing, or tying down, was used extensively for specimens that could not be boxed or supported easily without damage. We had been experimenting with lashing for six years to find a solution for storing and moving small- to midsized taxidermy pieces for pest control. The kiwi bird in the illustration is an excellent example: feathers on the bird are extremely delicate and break with the slightest pressure. Acid-free cardboard or foam core was used as a base, to which the object's mount was lashed with cotton twill tape. A structure of Ethafoam block and acrylic rod was then constructed to keep the dust cover (a clear polyethylene bag) from touching the object. Much of the taxidermy was moved in this manner, sometimes with many small birds lashed onto a single tray and the trays stacked in boxes for easy handling.

Other candidates for lashing included some of the dinosaur mounted skeletons (see Chapter 4) as well as more modern mounts.

TAXIDERMY BIRDS

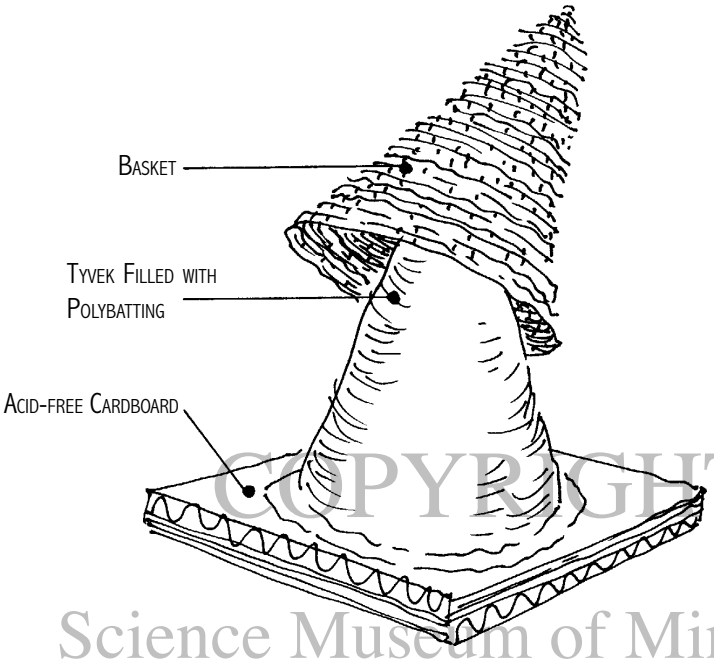


A Object
B Acid-free Cardboard
C Acrylic Rod
D Ethafoam
E Polyethylene Bag

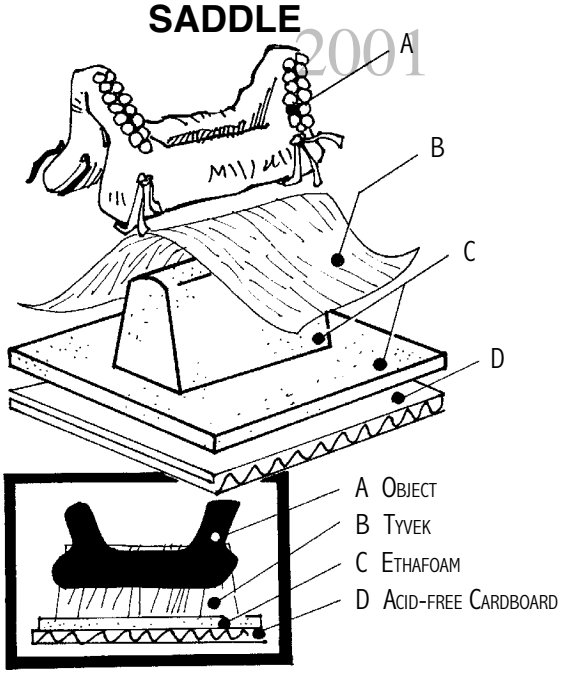


A Cotton Twill Tape
B Plank Ethafoam
C Cardboard Box
D Object

CONICAL BASKET



SADDLE



Example: A padded board was made for the Native American saddle illustrated above and pictured at the right. The base is acid-free cardboard with an Ethafoam pad. Block Ethafoam was carved to match the shape of the inside of the saddle and covered with Tyvek to prevent abrasion. In this way, the dangles on the saddle can dangle and not be torn or crushed.

Native American Saddle

is supported by Ethafoam carved to emulate a "horse" and covered with Tyvek to reduce abrasion potential.

INTERNAL SUPPORTS

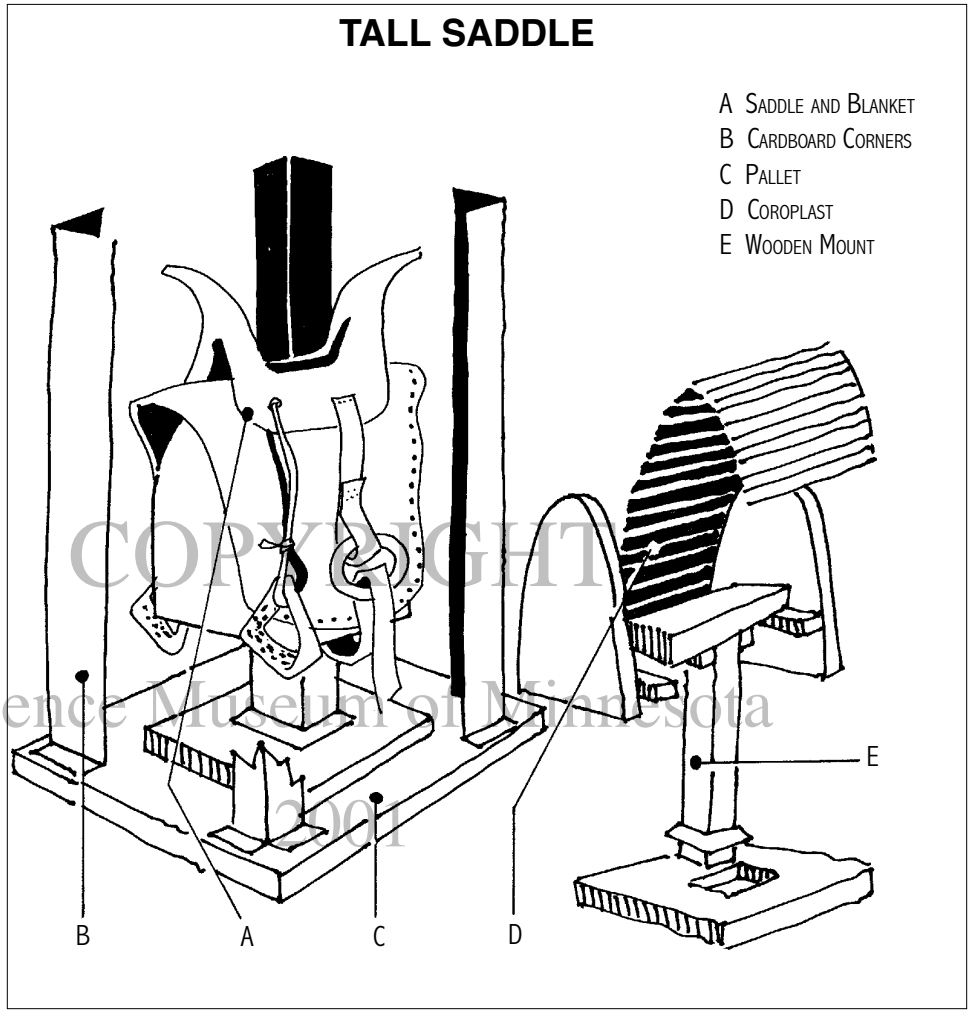
Bracing

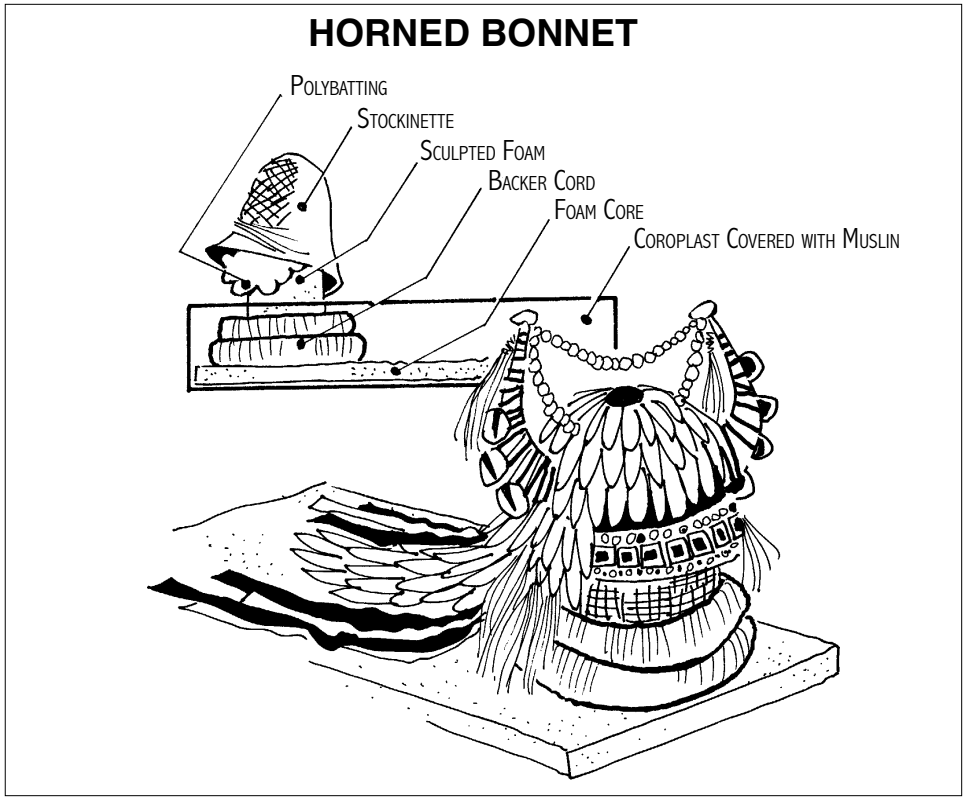
Bracing can be made to support the internal as well as the external structure. Bracing should be made out of whatever kind of material is most appropriate for the particular object.

Example: A base was made for this large conical basket out of two layers of acid-free cardboard. The channels were crossed to make it stronger. The basket had been folded at one time and there were breaks in the side and along the rim so that it was in very fragile condition. An internal support was made of Tyvek stuffed with polyester batting. The support is shaped so that the stress to the basket is taken by the pointed section, which is the strongest area. Pressure from the mount is evenly distributed.

Example: This tall saddle rests upon a mount that was originally designed for exhibition. Wood was used for the base, the support, and the internal brace. For the move, we covered the "horse" with a thin layer of polyester batting and a piece of muslin. Wood was appropriate here in order to provide stable support for the height required to store the saddle without folding the stirrups and the attached blanket, but the following alterations were made to make this into a shipping mount: the cinch and stirrups were tied carefully with cotton twill tape to keep them from swinging; cardboard corners, usually used to keep stacks of boxes or drawers straight on a pallet, were used as additional protection, like an open crate; and the saddle itself was lashed into position with cotton twill tape.

Example: The horned bonnet in the illustration at the right has a multiuse mount, an Ethafoam cylinder carved to support the interior of the bonnet. The cylinder is covered

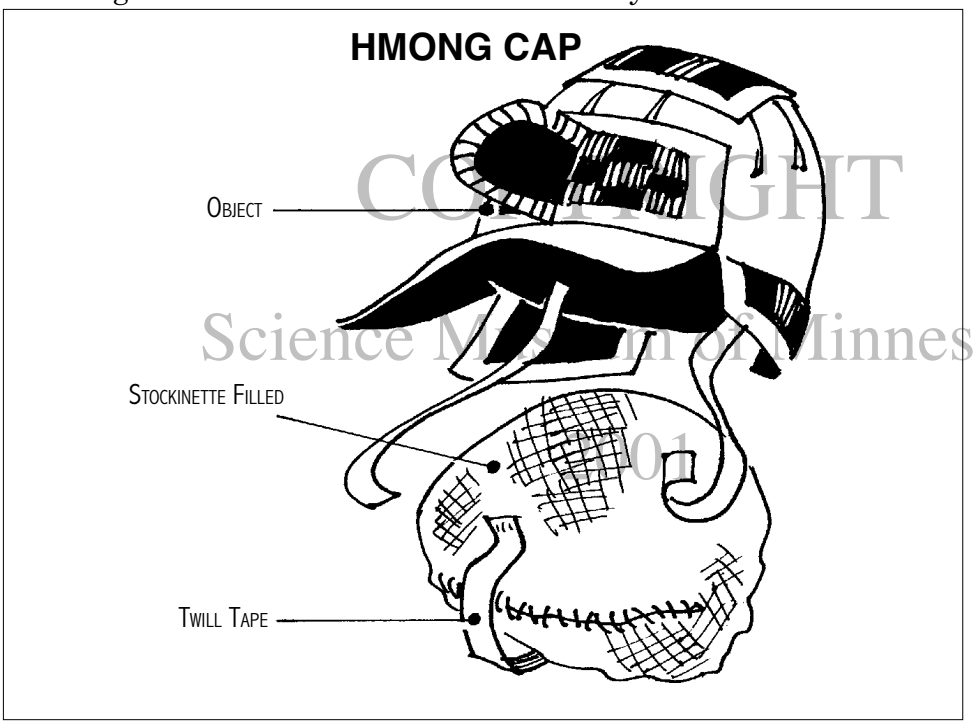


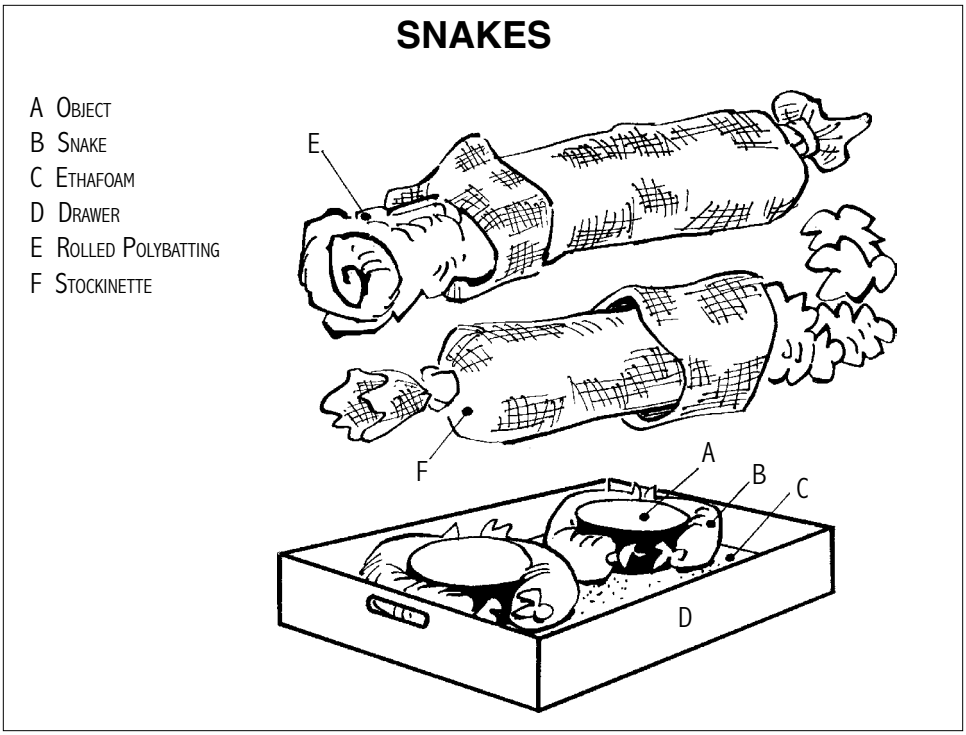


with polyester batting to fill the voids in the bonnet and is covered with cotton stockinette. The base is a plank of Ethafoam with backer-cord rings to hold the bonnet brace. The brace can be removed to display the bonnet. The base provides support to the trailer. A coroplast box was made to ship the bonnet in.

Pillows

Many artifacts, particularly clothing, need to be stuffed out to support their structure. The Hmong baby hat at left is made of layers of fabric and needs to be stuffed to keep it from creasing over time. The more common way to do this is to use a crumpled piece of acid-free tissue to fill the void and create support. However, we wanted to create simple and long-term supports that would stay with the object through the shipping and into storage. By taking cotton stockinette, stuffing it with polyester batting, and stitching the ends, a permanent pillow mount was created. A twill tape tab stitched onto the pillow facilitated its removal from the hat.

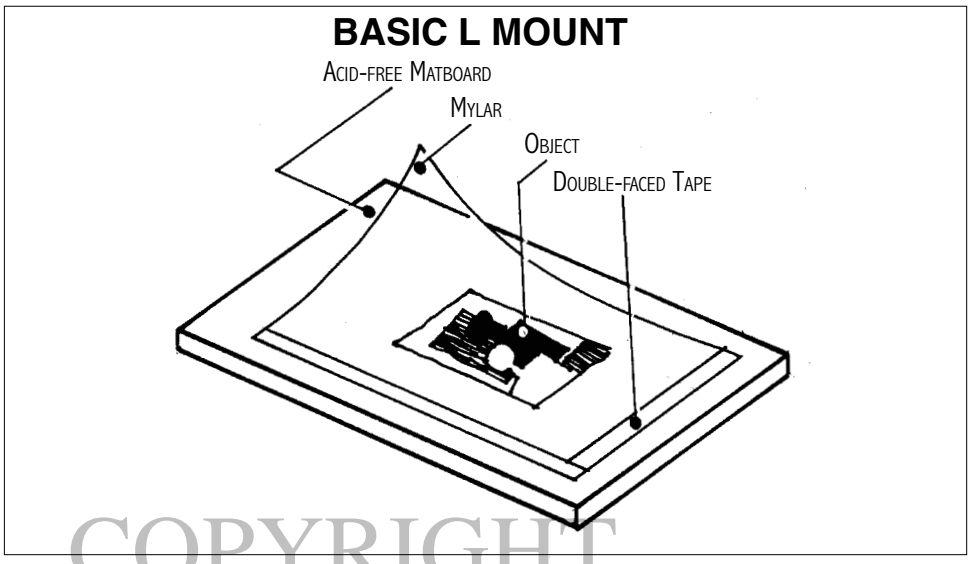




Snakes

Snakes can be used handily for either internal or external supports. The snake was often used to fill gaps in otherwise-braced mounts. They were frequently used as a temporary solution during the move. Also, we crumpled and/or rolled acid-free tissue and then wrapped it around an object or used it as support to keep a textile from folding.

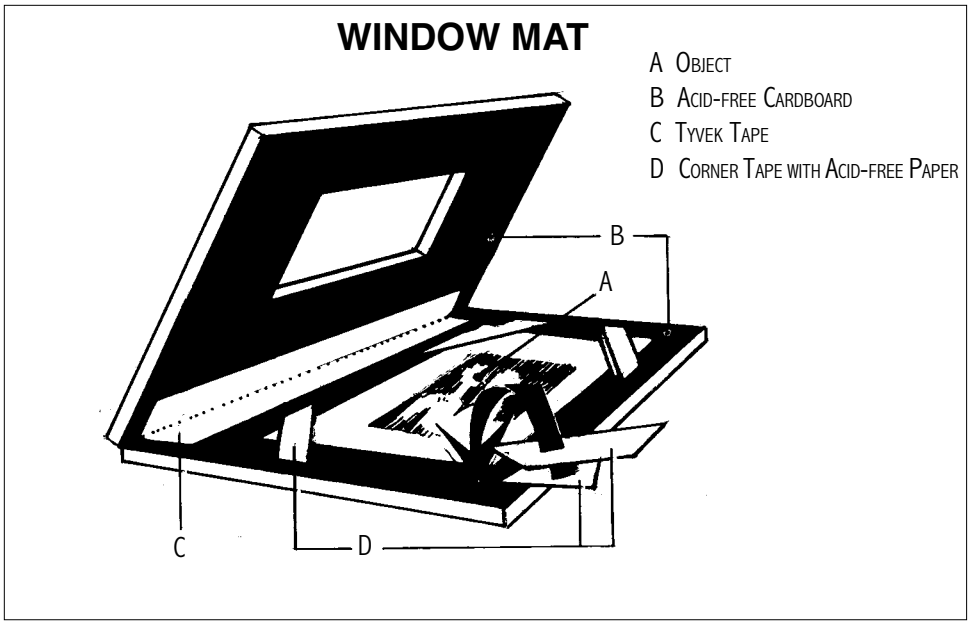
Flat Object Mounts
Boards



L mounts: A variation of a simple board support is the classic L mount commonly used with photographs, various archival materials like letters and newspapers, and small flat textiles. The base of the mount is an acid-free board (foam core, mat board, or cardboard) that is cut to a standard size larger than the object. Mylar, also cut to a standard size, is secured to the board along two edges (bottom and one side) with a double-stick adhesive tape (we used 3M 415, 924, and 969). The flat object is slipped inside the pocket, to be held by pressure. Care must be taken so that the object does not slip into the adhesive.

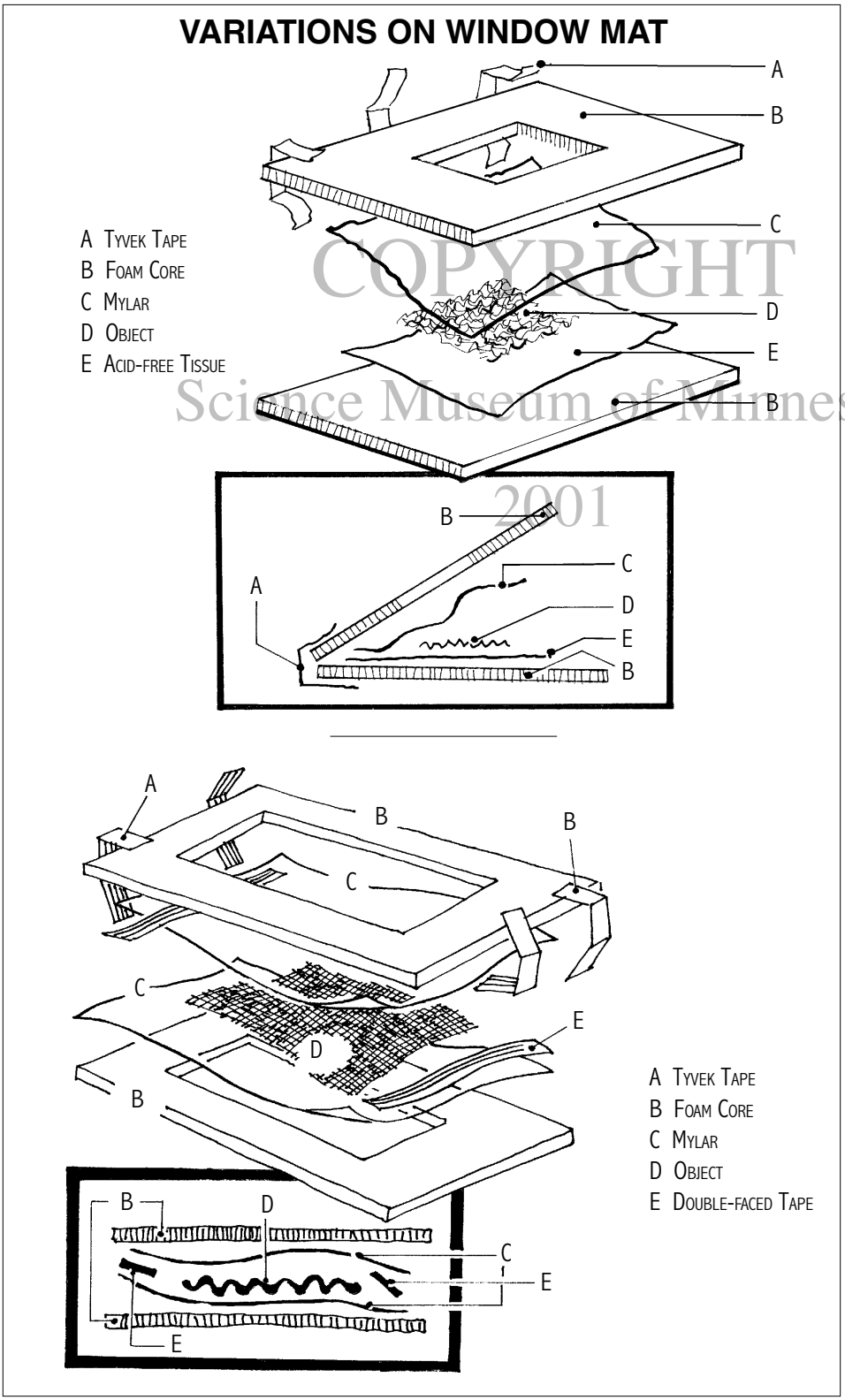
A variation of this is to use mylar as both the back and front of the mount. Two pieces of mylar are cut to the same size, larger than the piece to be encapsulated. Double-sided adhesive tape is laid down along the bottom and one side. The object is slipped into the center, not touching any of the adhesive. The other two edges can be enclosed in the same manner if it is determined that the "L" is not enough to hold the piece. This allows both sides of the object to be examined without handling the fragile item. An alternative to using adhesive is to heat seal the mylar with a soldering iron.

Window mats: A standard window mat provides both stability and security to a flat artifact (work on paper, archaeological textile fragments, etc.). This also allows for the possibility of stacking even the most fragile items. Two pieces of acid-free board (foam core, mat board, cardboard) are cut to the same size. A window is cut into the upper piece. The size of the window is determined by what goes in the mat. The window is attached to the backing board with an acid-free tape or Tyvek tape hinge. The artwork is secured on the backing board using a small piece of acid-free paper under corner tape. The paper



is placed under the tape so that there is no adhesive in contact with the artifact. There are several ways to do this, including using mylar or acid-free paper corners that can be purchased.

We used variations on this method for archaeological textiles from Peru. This is a major study collection used by local weavers and researchers. The fragments are extremely fragile and many do not hold up well to handling. Standard sizes of acid-free foam core were cut. Windows were cut slightly larger than the fragment. Tyvek tape was used to hinge the window to the backing board. Then the fragment was laid on a piece of acid-free tissue in the center of the backing board, a piece of mylar was placed over the fragment, and the window was closed down. If the textile needs additional security, then additional hinges can be placed around the perimeter. This method is particularly good for the more sturdy of the textile fragments.



Another variation was used for extremely fragile pieces. First the piece was encapsulated in a mylar sleeve (as described above). Then the two pieces of board were cut, but this time both were cut with a window. The encapsulated fragment was secured between the two boards with double-stick tape and the boards hinged together. In this way the textile can be shipped, handled and stored without damage. It is fully supported and both sides can be easily studied.

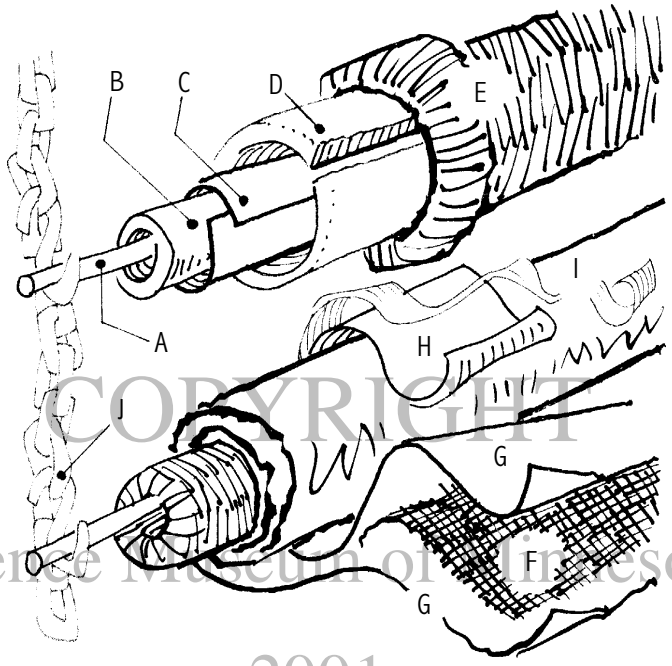
Padded Tubes

This is a basic method for storing and shipping large flat textiles (rugs, tapestry, etc.). There are many variations, but the basic concepts will be understood by the examples below.

Example: For most collections we used a basic-sized tube of acidic cardboard, owing to the high cost of acid-free tubes. To deal with the acidic nature of the tubes we used, the tube itself was wrapped and tucked at the ends with Marvelseal, a metal and plastic laminate developed by the National Aeronautics and Space Administration (NASA) and used by the food industry. Marvelseal is an excellent vapor barrier.

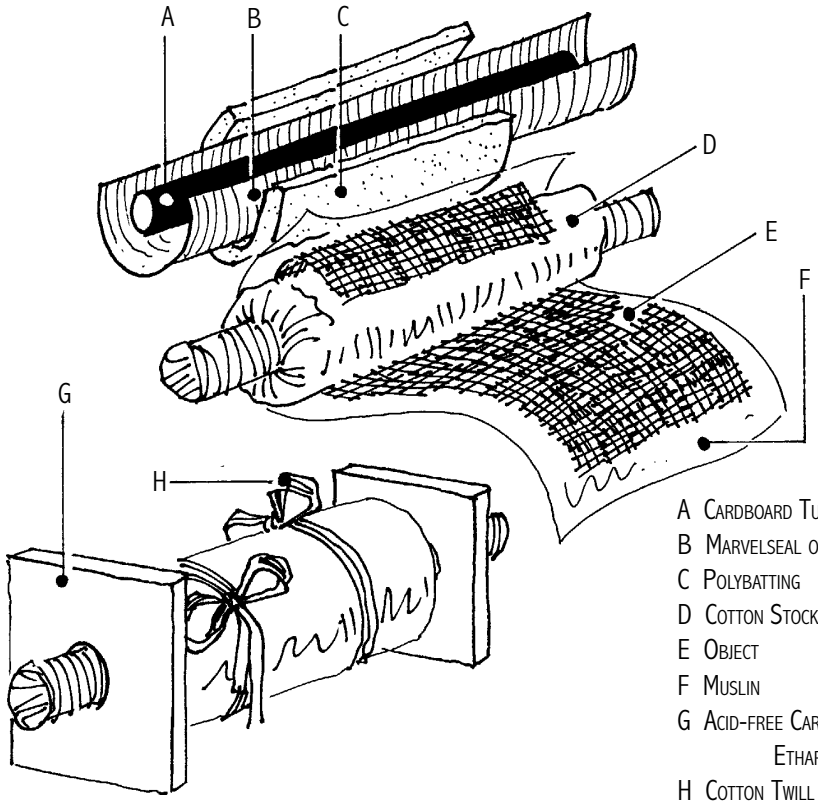
A thin layer of padding (acrylic felt or polyester batting) was placed over this, taking care that the seam was even and not overlapped to make a bump. A precut length of cotton stockinette was then placed over the padding, usually tucked in to the end of the tube. The textile was rolled evenly on to the tube with an interleaving layer of acid-free tissue or muslin (the latter es-

ROLLED TEXTILES HUNG ON RACKS



A Metal Rod (Conduit)
B Acidic Cardboard Tube
C Marvelseal
D Acrylic Felt or Thin Polybatting
E Cotton Stockinette
F Object
G Acid-free Tissue
H Blotter Paper
I Cotton Twill Tape
F Chain and Hook

ROLLED TEXTILES WITH INDIVIDUAL SUPPORTS

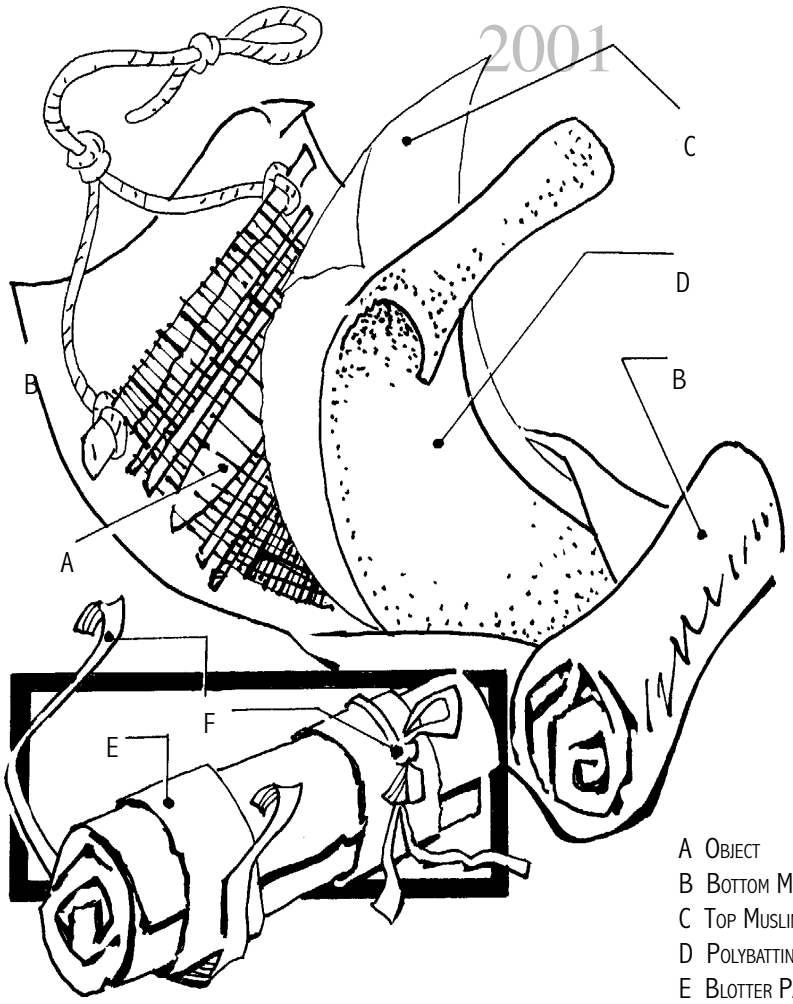


A Cardboard Tube
B Marvelseal of Mylar
C Polybatting
D Cotton Stockinette
E Object
F Muslin
G Acid-free Cardboard or Ethafoam Ends
H Cotton Twill Tape

pecially if the textile is very fragile and requires additional support). Finally, the completed, rolled textile was covered with mylar so that the textile could be viewed. (This method should only be used for textiles that will be stored in cabinets. If they are not protected in this way, they should be completely covered to prevent light damage.) All of the materials were secured with a cotton tie over a strip of acid-free blotter paper, helping to distribute any stress from the tie. Finally, thin rods were inserted through the tubes that were then suspended from metal chains.

Example: Several variations were used. For small, long, flat textiles like Maya belts, end supports were made for the rolled tubes. The padded tube was made the same way except that the ends were not padded or covered with stockinette, so that the Marvelseal-covered tube extended out either end of the rolled textile. A pair of rectangles made of acid-free board or 1-inch Ethafoam are cut with a hole in the center through which the tube is inserted. In this manner, the small textile can be rolled and suspended using a minimum of space.

BACKSTRAP LOOM



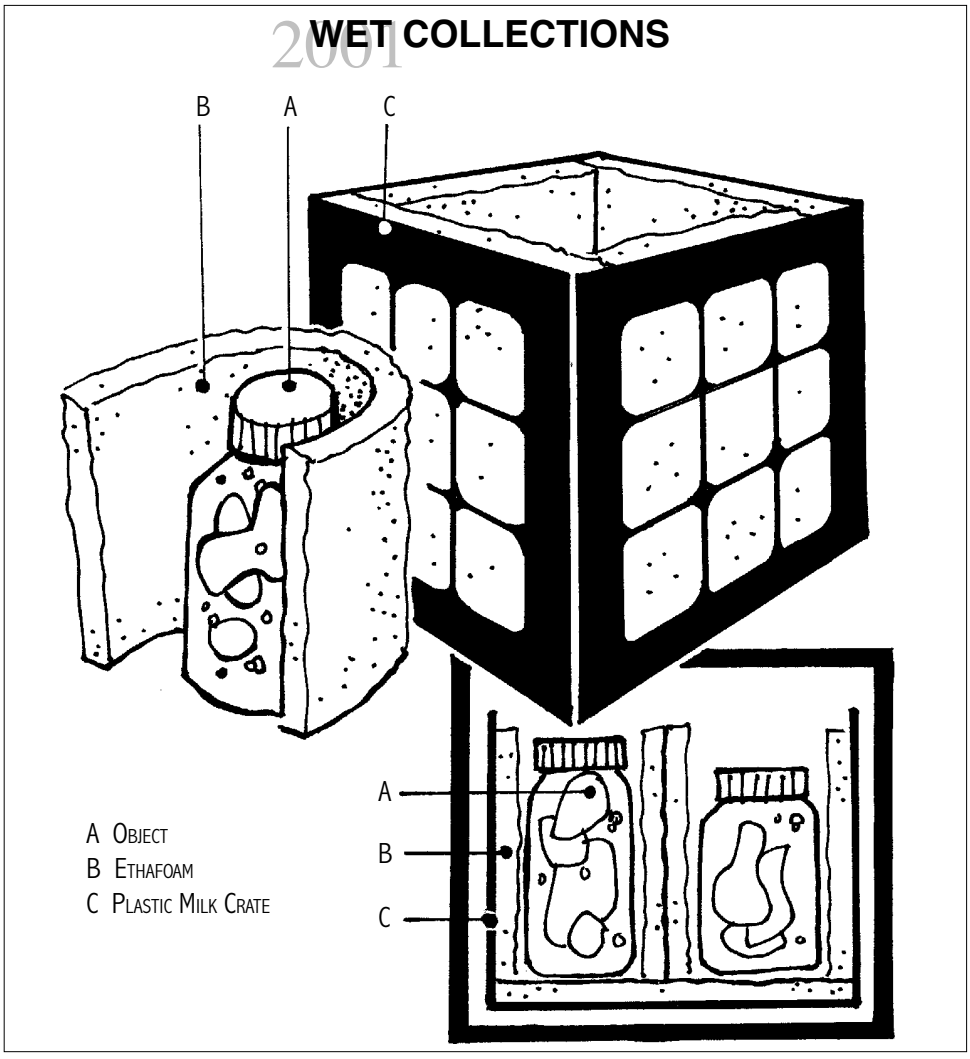
Example: Another interesting variation was used for the series of Maya and Navaho backstrap looms. These are looms with partially woven fabric on them and all of the additional loom parts. They can be large, and they tangle easily. We found that the best way to store them was to roll them, but without the tubes. The loom was laid on a length of muslin. A second piece of muslin was laid on top of the loom as a separator. The final layer was a length of polyester batting. The object was rolled loosely as shown in the illustration and tied into a bundle. This is bulky, but it does keep all of the parts of the loom together and takes the pressure off of the object.

Jars of All Sizes
were packed in milk cartons for transport.

Special Cases
Wet Collections

Wet collections are collections that are preserved in some sort of fluid, usually alcohol, formalin, or glycerine. They are commonly stored in glass jars or plastic bottles, which presents a particularly difficult problem in shipping. Our collection is not large, but it contains jars of all sizes, 5-gallon buckets, and vials. The buckets were easy to move; they were piled two high on a pallet and shrink-wrapped for stability. The jars were another matter. We chose to use plastic file/milk carton crates to put them in. Each crate was lined with 1/2-inch Ethafoam plank. Jars were placed in the crate and separated with Ethafoam strips or plank. If there was enough room, we stacked the jars, again with Ethafoam dividers. This proved to be a good project for some of the volunteers who had trouble with more intricate procedures. We stationed one volunteer who was able to lift moderate weight with two volunteers who packed the jars, and soon the crates were stacked three high on pallets for staff to shrink-wrap. The move was successful and there was no breakage.

The milk crates proved to be a good idea for recycling as well. When we were finished with them, other departments in the museum found a variety of storage uses for them, including housing them to be made available statewide for disaster recovery.



Insects

The pinned insect collection had numerous concerns. The Science Museum uses the traditional method of storing this type of collection by pinning specimens into Cornell drawers, a wooden box with a glass top that slides into a specially designed case.

It is also common for the specimens to be treated with pesticide, usually paradichlorobenzene (PBD) or naphthalene.

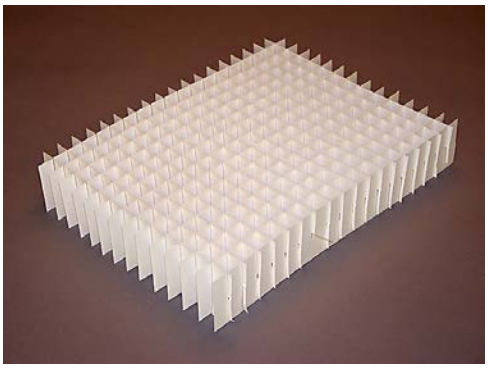
We decided to move the collection inside its cabinets. This meant that we had to pad the cabinets to reduce vibration so that the delicate parts would not be damaged. The Conservation Assistant first removed the loose pesticide from each drawer, then placed padding under and behind the drawer. Finally, when each cabinet was padded, a sheet of Ethafoam was placed on the interior of the door. The movers used a two-wheeled upright dolly to maneuver each cabinet from the old facility to the truck and into the new facility, with special attention to the amount of tilt allowed (see Small Mammal Skulls below).

Entomology Cornell Drawers
were moved inside their herbariums whenever possible.

Small Mammal Skulls

We used a similar method for our collection of 50 thousand small mammal skulls. These are stored one to a vial in wooden trays inside herbarium cases.

Again we decided to move the collection inside of the cabinets. Since the collection was stored in trays of glass vials, we needed to find a way to keep the vials separated. To do this, a biology volunteer and former engineer developed a scheme for creating interlocking cardboard separators that we had specially cut to fit each tray, Cardboard strips about 2 inches high were clipped on one long side 1 inch deep and the width of a single vial apart. Horizontal and vertical strips were then hand-interlocked by our volunteers, making a tray-sized "fence" with a compartment for each vial. These fences could then be flattened by pulling on diagonal corners for easy storage until they were opened and inserted into the trays between the vials. Blocks of Ethafoam were added to stabilize the vials if needed.



Interlocking "Fence" for Glass Vials
(above) was made from slotted strips of cardstock cut exactly to fit the drawers where vials were stored (below).

We then padded the trays and the cabinets to reduce vibration during the move, much as we had for the insect collection, which is housed in taller herbarium cases. The Conservation Assistant first placed 1/2-inch Ethafoam padding under each tray. This was meant to cushion vibration and shock during the move. A coroplast brace was cut for the top of each tray to prevent the vials from bouncing.

The moving company, after much consultation with us, used regular refrigerator dollies to maneuver the cabinets from the old facility to the truck and into the new facility. The herbarium cabinets were too tall to

pass upright through the doors and also too tall to move upright from the dock to the truck; the dollies were used to carefully lower them through these tight spots. We agreed to this only because there seemed no other way and on the condition that we could pick the mover who performed the operation. As in all cases, our staff was on hand every minute to make sure that great care was used. We also found it helpful to explain to the movers what it was that they were moving so they understood the fragility issues, especially when they were handling 50 thousand glass vials. Such explanations were not only effective but had the added advantage of getting our crew interested in science!

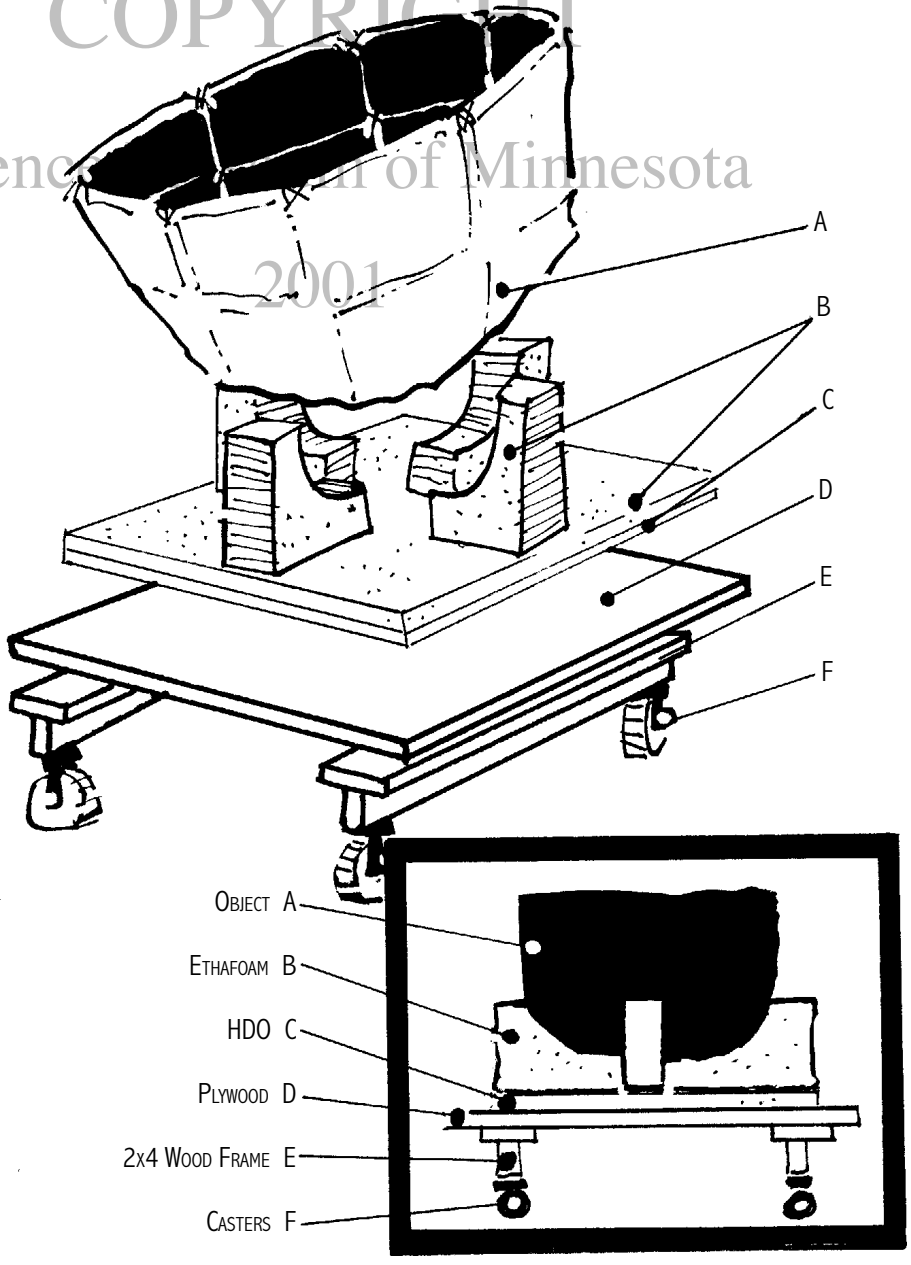
WHEELS

What would we have done without wheels? One thing we have learned over the years is to never skimp on wheels or castors (wheels do not pivot like castors, so most of our needs were for castors). They need to match the requirements of whatever the job is. Not only must they be up to the job (properly rated for the load weight), but they must be able to pivot so that the cart can be maneuvered. We got so we would put wheels on almost anything!

Custom Carts

Custom carts are a perfect solution for many objects and specimens that are not easily moved in any other way. The cart usually consists of a frame with a deck large enough to accommodate the object(s), wheels or castors, sides or a mount to hold the object, and a handle to maneuver it. We moved a birch bark canoe, a bull boat, and two large slit

BULL BOAT



drums on custom carts consisting of wooden frames with wood and Ethafoam cradles. Castors were attached to the four corners so that the objects could be maneuvered in any direction, making it easier to slip them into tight storage spaces. These carts became the permanent storage mounts for each object.

Other Carts

Gondolas: The moving company had a special cart called a gondola. This is often used for moving books, office equipment, and so forth. We found them particularly useful with some collections. There were awkward things that did not fit in standard boxes that worked perfectly on the gondolas. Some of the wet collections moved on them. The part of the insect collection that was not in cabinets moved on them. The shelves were padded if necessary and the specimens were placed on them and padded or wrapped as was appropriate. Then the entire gondola was shrink-wrapped.

Gondolas (Book Carts)
supplied by the moving company were most useful for small boxes, drawers, and miscellaneous collections of all kinds.

Kewaunee Carts: For moving Kewaunee drawers full of high specimens, we customized ten half-size metal Kewaunee cabinets to roll like the seven existing wooden Kewaunees from the labs; we could slide drawers in these slides differentially according to how much head space the objects needed. Our Exhibit Shop was asked to devise a method for attaching castors, which turned out to be a simple wood platform bound to the cabinet with movers' straps. The straps were reinforced with 1"x4" wood lengths to keep the sides from bowing under the weight of sometimes very heavy fossils. Specimens in drawers were packed carefully and padded on top with muslin pillows, and the ride proved to be smooth and problem-free. We used these for most tall fossils, emptying them on the receiving side as soon as they were delivered by the trucks and sending them back to be refilled on the last truck of the day.

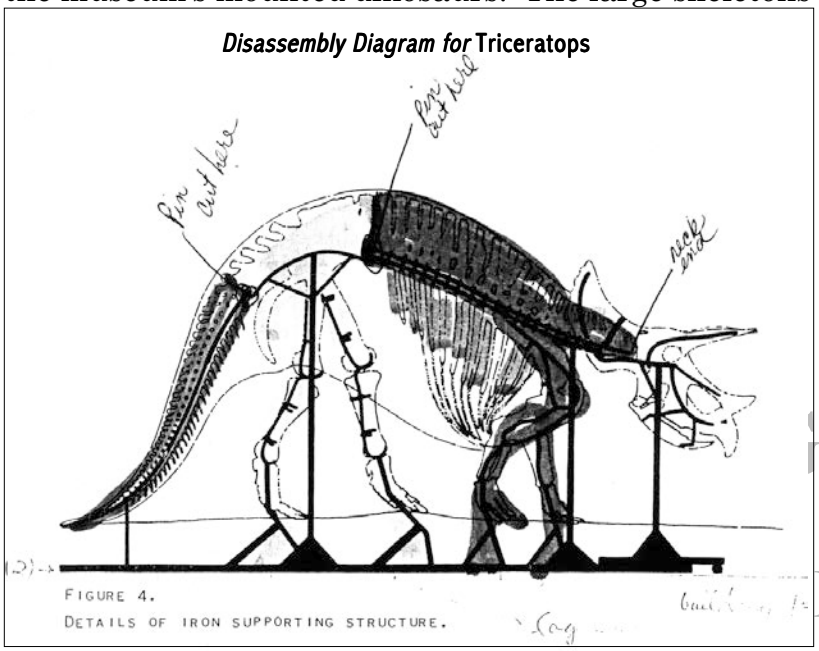
Dockmaster David Allen
helped movers and Move Team staffers get Kewaunee carts to their destinations.

Blue Carts (ITWCTs): The Science Museum had in the past designed a flexible, large cart for a traveling exhibit (called If These Walls Could Talk; hence the acronym) to facilitate the transport of our touring exhibitions. Each cart consisted of a 4'x8' bed on 4-inch high castors. End and side panels could be added by slipping them into slots on the corners. For the move, we had a dozen wooden shelves constructed that keyed into the end panels so each cart could function as a flatbed or a double- or triple-tiered cart.

ITWCT Carts
proved to be most versatile and useful for large objects and specimens.

Perhaps the most stunning use of custom carts, both ITWCTs and those specifically constructed for a specimen, used with a combination of packing method, was the move of the museum's mounted dinosaurs. The large skeletons were to be remounted in the new facility and had to be judiciously disassembled (skulls removed, parts disarticulated, armatures cut) into manageable sections so they could be removed from the old building, moved, and installed in the new one. We tried, whenever possible, to cut the armature in large cohesive units (see Chapter 4). Some of the skeletons were placed almost completely on ITWCTs. In these carts, the castors had actually been welded onto the metal base supporting the skeleton.

***Disassembly Diagram for* Triceratops**



The most dramatic example of this technique was used for the museum's *Triceratops*. The specimen is the largest and most complete *Triceratops* in the United States, and getting it into pieces was a special project all in itself. Large metal frames with heavy-duty castors were welded together. The specimen was disassembled, first the skull and then the rest. Metal supports for the skull were welded onto its cart, while the tail was suspended from the framework of an ITWCT and lashed into place. Each leg was placed on an ITWCT as well, generously supported with peanut pillows. The rib cage and pelvis were separated and individually welded to metal frames on castors. The carts could then be rolled onto the waiting trucks and transferred to the new facility. Carts were tied to the trucks so that they could not shift.

Staffer Brad Bredehoft
contemplates the beauty of Triceratops *while both wait to get on with the move.*

Triceratops
is led off the moving truck by Staffer Dan Miller and unknown helper.

CHAPTER 4

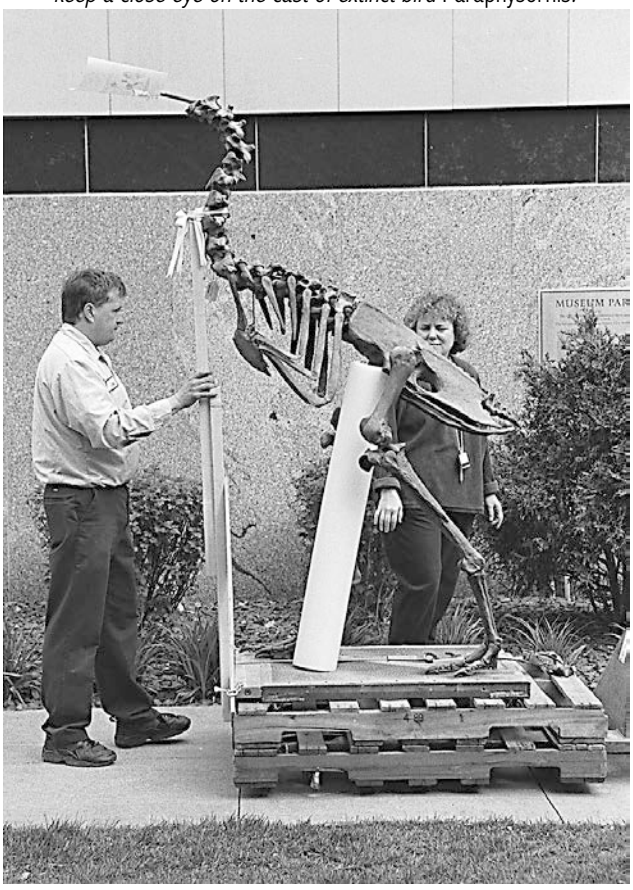
THE SPECIAL CASE OF DINOSAURS

Andrew D. Redline
Director, Paleontology Program
Project Lead, Dinosaurs and Fossils Gallery

BACKGROUND

For over ninety years, the Science Museum of Minnesota has possessed paleontology fossil specimens. Aside from small mounts of individual skeletons and many fragmentary specimens in collections storage, the first large display was that of the horned dinosaur *Triceratops*, excavated and mounted by Bruce Erickson in the early 1960s. The mounted original skeleton was only the third *Triceratops* display in the world at the time and was later joined by a small skeleton of *Allosaurus* and a large marine reptile, *Mosasaurus,* during the early 1970s. Further excavation in the 1980s produced many bones of Jurassic dinosaurs from a new quarry in the Bighorn Basin of Wyoming. The Science Museum began design of a larger, comprehensive display of many dinosaurs and other fossil mounts to be called the Paleontology Science Hall. The *Triceratops* remained in its original position on the east building concourse, but the *Allosaurus* joined a new large *Diplodocus*, a *Camptosaurus*, and an additional cast camptosaur on a large 1,000-square-foot Jurassic "island diorama" that debuted in the then-new Paleontology Science Hall in 1990. This undertaking was the result of a large capital campaign and involved many building modifications, including cutting a hole in the ceiling of the gallery to accommodate the 82-foot-long and 20-foot-tall *Diplodocus* dinosaur. A newly formed company, PAST Inc. of Alberta, Canada, headed by Gilles Danis and Keith Russell, was given the main task of assembling these new dinosaurs. Their experience, speed, and familiarity with the skeletons would lead us to again call on their skills for the disassembly, move, and reassembly of the Science Museum dinosaurs in 1999.

Lori Benson and Barrett Staffer Craig Poeschel
keep a close eye on the cast of extinct bird Paraphysornis.



In many ways, the subsequent move of the fossil skeletons on exhibit was the biggest challenge of all of the collections move issues for the Science Museum of Minnesota. Specimens mounted for exhibit are some of the least protected objects in terms of risk of damage. Many museums have renovated galleries in the past fifty years by removing and remounting skeletons on already-existing premises. The Science Museum's move may have been the first attempt to relocate large mounted dinosaurs from one building to another.

Approximately thirty-five mounted fossil skeletons were on display at the Science Museum of Minnesota's previous facility. Most were composed of original fossil bone, a combination of original bone and plaster, or plaster casts. Fossil bone and plaster, while very heavy and hard, are among the most brittle materials to move as freestanding exhibits. Nevertheless, it would have been impossible to disassemble every bone from every mount, pack each, and re-articulate them at the new Science Museum of Minnesota riverfront facility. Therefore, by 1996, a careful planning process had begun.

CHALLENGE

Thirty-five previously mounted skeletons and approximately ten new skeletons that were to be added to the new building's Dinosaurs and Fossils Gallery display needed to be prepared for the move. These ranged from small reptiles and mammals cast in plastic polymer to the 6-ton *Triceratops* composed of fossil bone and fragile plaster. Each skeleton needed a separate procedure based on its physical composition, shape, and size. Packing procedures and protocols were less important for this aspect of the move and were replaced by years of experience in handling fossil material and an in-depth knowledge of the composition and method of articulation of each individual mount. Knowledge of the degree of fragility of the specimens was arrived at through direct handling by all the staff involved in the move. Staff training erred on the side of caution at all times.

All of the large dinosaurs were mounted on concrete islands that covered their bases. This would make freeing them for the move extremely difficult. The tallest exit from the old building was a pair of 78-inch-high double doors that exited the Paleontology Visible Lab to a small park. All pieces would need to be smaller than these dimensions. Since the days for moving large specimens were limited to two, a considerable amount of space was needed for "staging" skeletons in their disassembled state. While the new building did not have the physical limitations of the old facility, the timing of completion of the spaces that the skeletons would move to was a challenge as well.

***The New Cast of* Stegosaurus**
waits in its plain clear wrapper for delivery to the new museum.

Because the Science Museum of Minnesota is very dependant on its visitor income, the museum board decided that the old facility would remain open until Labor

Day 1999, and the new facility would open only three months later. This was further complicated by the new facility being completed by subcontractors piece-by-piece during this time. Therefore, the new Science Museum of Minnesota would not be entirely constructed as the move was taking place. The move of the dinosaurs was not left until after Labor Day, however. Given the potential for damage, small skeletons were prepared for the move starting in January of 1999. Major work on the large dinosaurs was slated to begin in April as a "work-in-progress" project able to be viewed by the Science Museum's spring visitors.

Team

Keith Russell and assistant Nigel Yez of PAST Inc. were contracted to be the main disassembly and reassembly crew. Russell had experience welding and mounting almost 100 fossil skeletons during the course of his career and was very familiar with the Science Museum dinosaurs, as he had mounted many of them in 1990. Since PAST Inc. is a Canadian company, a considerable number of difficulties were encountered in order to obtain the proper work visas. We had sought Immigration and Naturalization status H-1-B for the team but were denied two days before the contract commencement date. Through the help of the Science Museum's attorneys and Bloomington, Minnesota, Immigration and Naturalization, a much easier I-31 status was finally granted and the major move project began only one week late. It's impossible to emphasize the tensions that emerged during the immigration process or how the move of the Science Museum dinosaurs would have been crippled without their resolution.

In addition to PAST Inc. staff, approximately twenty Science Museum of Minnesota staff members were crucial to the move of the fossil skeletons. These included the paleontology Program Director, the paleontology Curator, the Collections Manager, the Dinosaurs and Fossils Gallery Project Production Manager, and the objects Conservator. This core group began weekly meetings to arrive at schedule and logistics issues and coordinate with trucks and schedules determined by the Science Museum Move Project Office. Staffers from the Exhibits Shop were also critical in the physical move and in welding pieces of skeletons to carts and carriages for transportation. Collections Move and Conservation staff were also a major part of the working team. Staff training was based on two principles. First, one staff member only (approximately seven people had the experience to be that one person) would direct a group in the disassembly and transportation of any skeletal piece. Nothing had the potential to lead to breakage as much as a group of people pulling or lifting in different directions or at different times. Second, each assistant was given instructions on areas of skeletons never to be grabbed, such as vertebral transverse processes or delicate dermal bones of skulls. This training was critical to keeping breakage at a minimum.

The fossil skeleton move portion of the Science Museum collections move did not use much volunteer labor. In most part, this was a matter of a very tight schedule, many hours working in the evening, heavy lifting, and safety issues. About four volunteers were helpful at some times as "extra hands" during the relocation of large skeletal pieces.

Budget

The contract agreement with PAST Inc. was $54,000 for the disassembly and reassembly of the dinosaurs and the mosasaur. Blue Rhino Studios of Bloomington, Minnesota, removed the diorama rocks around the skeletons (and built the new ones in the new

facility) under contract. Other costs were charged to the capital campaign collections move project (some salaries, packing materials) and the capital campaign Dinosaurs and Fossils Gallery exhibit project (Exhibit Shop labor, carts, wheels, steel, lifts, and tools). Moving vans and mover costs were allocated to the capital campaign Science Museum of Minnesota institutional move project through the museumwide Move Project Office. Since costs were absorbed by multiple project budgets as part of their move activities, it's impossible to give an exact budget for the fossil skeleton move. A reasonably accurate number would be in the ballpark of $130,000 to $150,000, excluding movers and vans.

Shop Staffer Dan Miller (left) and Warehouse Manager Ethan Lebovics (right) *check out* Diplodocus *on the scissor lift.*

Tools

In addition to all of the packing materials used for other aspects of the Science Museum collections move, materials such as bracing wood struts and foam planks to dampen vibration and aluminum-coated tape for reinforcing long delicate elements like ribs were employed during the dinosaur move.

Motorized equipment was very important for supporting and lifting the large skeletal elements. In addition to an overhead gantry with chain-equipped pulleys over the Jurassic "island diorama" (a gantry did not exist in the new Science Museum building), a large overhead battery-driven scissors lift was rented for the duration of the move for $1,000 per month. Also critical was a propane-powered high fork with a custom boom attachment. This $5,000-per-month rental piece was used to suspend the vertebral column, sacrum, and skull of *Triceratops* during take-down and setup and *for Diplodocus* as it was set up in the new facility. Hardened steel chain was used with the fork as well.

ITWCTs Full of Dinosaurs
wait packed and ready for transport in the trucks.

A standard array of arc welders, "mig" welders, and acetylene and plasma torches were also on hand for the necessary work of cutting and reattaching the largest of the skeletons. A complete list of tools would be exhausting, but webbed suspension straps, metalworking tools, and adhesives of all types were also important. Paleosculpt, manufactured by Uncommon Conglomerates Inc., was the restoration putty of choice.

Of all the tools responsible for the smooth flow of the skeleton move, none was as important as

quality rubber wheels. These were bolted on custom steel support racks, onto the complete metal bases of some of the smaller skeletons, and were already attached to the custom-move carts. At $30 a piece, they were not inexpensive, but they could be unbolted and reattached again and again during the staged move. Old brass wheels, pallet jacks, and the like would not have dampened the vibration inherent when the fossil material was towed out of the Science Museum east building and might have caused much more in-transit damage.

As part of its traveling exhibits program, the Science Museum also had available double-decked carts for truck loading (ITWCTs; see page 87). By freeing these up for the move, the transition was also considerably simplified. The fabrication of these carts cost about $1,500 each, but this cost was covered by earlier Science Museum initiatives.

Two final tools were a detailed master schedule of the move and an object-by-object list of every specimen to be moved, how it was to be transported, and what its final destination would be in the new Science Museum facility.

Process

Schedule

Work on the schedule of the fossil skeleton move was done in conjunction with the entire collections move, the exhibits move, and the master schedule from the Move Project Office. Each of these projects had representatives "at the table" from September 1998 through the beginning of the move days themselves. The master schedule was deviated from in many details of specific dates of moves but was adhered to in most major respects.

The Paleontology Science Hall was compacted and 50 percent of it was then enclosed by glass walls around the island diorama in mid-March 1999. The large visible lab was expanded and rearranged on an almost weekly basis from then until August 1999. Skeletons were staged, and ongoing work necessary for separately funded, two-year projects was located and relocated frequently during the spring and summer of 1999. Removal of skulls and small mounts began in January. Dino Day, on March 27, 1999, featured the ceremonial removal of the head of *Diplodocus* by Governor Jesse Ventura and the formal commencement of the large-skeleton move. PAST Inc. arrived on April 12 and finished work on June 20 of 1999.

Two separate move days of continuously running semi trucks moved the specimens. The first move day took most of the skeletons except *Triceratops* and *Mosasaurus*. These were taken down from the east building concourse after the island diorama skeletons were already relocated to the new facility. Because these mounts were on a public concourse, they were taken down after the museum closed at night.

All skeletons were in their entirely new locations, repaired and

The Whole Barrett Team Came Out for This One...

From left to right: SMM staffer John Perry (directing), Wade Thur, Jim Holmes, Dan Poythress (back to us), Craig Poeschel, and Ted Ruskowski.

ready for augmenting exhibitry by August 20, 1999. Since the new building was still not complete, they were draped in plastic as a protective measure and some small delicate elements were not attached until mid-November. The December 7, 1999, public opening of the new Science Museum of Minnesota's Dinosaurs and Fossils Gallery featured every previously existing skeleton and more than ten new skeletons or large skulls never seen by our public before.

Early Work/Stabilization

Stabilization commenced with the removal of skulls, tails, and when possible the ribs and arms of the large skeletons. When this was not possible, glues were injected into cracks and bones were reinforced with tape so that even if vibration caused cracking, the elements would not fall and shatter. A take-down plan for each skeleton was arrived at in consultation with PAST Inc. before their visit. All foam, padding, carts, tools, and so forth were on hand well before the serious disassembly began. Many smaller skeletons of reptiles and mammals were simply lifted (base and all) onto the large mobile carts used for the move and then secured with strapping and foam posts to prevent wobbling.

Rock Demolition/Take-down

The environmental treatment surrounding the large dinosaurs was a heavy mix of cement and polyester-reinforced metal mesh that abutted the steel supporting posts of the specimens and an underlying steel tube box frame. The removal of the treatment and the box frame was imperative and was accomplished using hammers, chisels, and reciprocating saws. The vibration this caused to the skeletons was alarming and did result in some damage. Any damage was fixed immediately after the individual skeletons were free. The onerous job of removing the environment fell to Blue Rhino Studios; the disposal of the material (8 individual 30-foot-long dumpsters on the street were required to haul off the tons of debris) was accomplished by Exhibit Shop and Paleontology Program staff; the box frame was removed by Exhibit Shop staff; and the repair of damage was done by Conservation, Paleontology Program, and PAST Inc. staff.

Metal Mesh "Rock" of the Old Museum's Dinosaur Display
is cut away from underlying steel.

The disassembly plan was surprisingly simple. Each skeleton would be "broken" into the largest possible pieces that both would be supportable and would fit out the tallest of the exits in the old Science Museum facility (see diagram on page 88). Internally and externally supported skeletal elements would either be laid on carts or in foam cradles when possible (limbs, vertebrae without lateral delicate projections) or welded to temporary steel mounting hardware with wheels (most vertebrae, sacral bones, the skull of *Triceratops*). Dinosaur-by-dinosaur and

piece-by-piece, each skeleton was broken down. Legs were removed and secured. Then, tails, necks (in the case of *Diplodocus*), and vertebral and sacral elements were handled in the same way. Ground crews would receive every element as it was lowered by chain or rope and pack it to a cart or weld it to temporary wheeled supporting hardware. The allosaur and one camptosaur were within a size range where they would fit out the door and onto trucks just by removing the skull and tail bones. In the case of the largest *Camptosaurus*, however, the prepared skeleton was a mere 3 inches too tall to fit through the large double doors. Rather than incur the considerable cost and time of "breaking" the skeleton down at nonattachment points, the decision was made to spend $2,000 to modify the old Science Museum facility with slightly larger exit doors.

Exhibit Shop Staffer Hugh Jacobson (left) and Nigel Yez of PAST (right) *light a fire under* Diplodocus.

Staging/Truck Loading

Staging the pieces of fossil mounts was made easier by the fact that each was on wheels and so could be rearranged relatively quickly. Even with the large staging space, however, considerable time was devoted to moving each piece multiple times in order to clear necessary exit paths for other elements.

The first move day was supervised by the Collections Manager and proceeded out the large double doors of the visible lab to trucks waiting on the street. The second move day (mostly *Triceratops*) proceeded out the east building loading dock and did not necessitate lifting skeletons to truck-bed level with fork lifts as had been necessary on the street (see photo at right).

Warehouse Manager Ethan Lebovics (fork lift) and Paleontology Program Director Andrew Redline (right) *help Barrett staffer Jim Holmes get the glyptodont into the truck.*

Truck loading on the first day involved the most planning and care. The moving company supplied their most skilled staff (experienced in art museum and rare furniture moves), but the skeletal material still had to be wheeled out a door, through a small park, and then fork-lifted 6 feet into the air to slide into the vehicles. Luckily, the Science Museum of Minnesota produces and loads numerous traveling exhibits every year and so

possesses a skilled fork lift operator on staff. In the case of long carts, the fork lift and the hydraulic lift on the back of the truck had to operate in exact synchronization in order to keep the cart level. Every cart and mounting piece was securely tied to the truck compartment's inside walls for the 5-mile-per-hour trip to the new facility. Six truck loads were delivered on the first move day; four loads were shipped on the second.

Setup

The installation of the large dinosaurs into their new homes was accomplished with remarkable speed by the skilled staff of PAST Inc. Using their superior welding skills and experience, they utilized the same lifting and attachment equipment to reverse the process on each skeleton, one after the other. The reassembly of the dinosaurs was done in two stages, but no one dinosaur took more than four working days to complete (of course, accessory staff were still necessary to aid in lifting, orienting, and logistics). The largest challenge to the setup was actually the ongoing work of the various contractors and subcontractors who were still finishing the construction of the Science Museum of Minnesota's new facility at the same time.

Triceratops *in Its New Home*

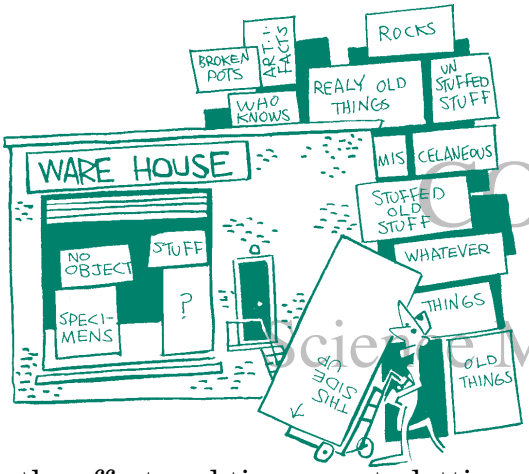
Post Mortem (Assessment of Project)

The move of the large fossil skeletons at the Science Museum of Minnesota was an unparalleled success. Some breakage did occur, but none that kept the project from being ahead of schedule and on budget. The luxury of being able to begin the project some months before the close of the old museum was of great importance, but nothing contributed to this never-before-attempted ambition more than the cheerful cooperation and sometimes "around the clock" work of the Science Museum's staff from many departments as well as their subcontracted partners. While the Science Museum of Minnesota may soon take its new 370,000-square-foot facility for granted, there is a nucleus of staff who know that the move into this building was a major feat of daring and accomplishment. This outline of the dinosaur move supplies only the briefest sketch of the work undertaken. The specifics of all that is described above are logged in the archives of the Exhibits, Paleontology Program, Collections, and Conservation Departments of the Science Museum of Minnesota and are available for the aid of other museums that might wish to attempt a similar project.

Chapter 5

Unpacking Ethnology at the New Museum

Rose Kubiatowicz
Collections Technician



Looking down the center aisle of the empty new vault, we could not help but be impressed by its vast proportions. A compacting system of Delta cabinets installed five deep on either side of the aisle was broken only by interspersed gleaming shelving units. A few open spaces with metal carriages awaited cabinets that had not yet been delivered. According to plan, dedicated sections had been reserved to store the paleontology, ethnology, archaeology, and biology collections.

Was the area large enough? Would everything fit? Had calculations been accurately made? Would the effort and time spent plotting, calculating, and documenting ease the process? Had enough care been taken in the packing process to protect and fully ensure the integrity of each and every object? We had arrived at the moment of truth. During the next months, our questions would all be answered. As the vault stood ready to embrace the palleted, boxed, and carted objects, we eagerly cut the packing bands and shrink-wrap and began to unpack.

Each section of the collection—paleontology, ethnology, archaeology, biology—followed basically the same unpacking process from pallet to drawer or shelf. While some issues varied relevant to the special circumstances and needs of each collection, the basic process remained. Using the unpacking of the ethnology collection as a window to useful methods and procedures, one can effectively understand the entire process.

Delta Cabinets Just Installed in the New Vault
look clean and spacious and ready for the onslaught of collections to come.

ETHNOLOGY

Original Tracking

The daunting task of efficiently unpacking and expeditiously moving objects into permanent locations was dependent upon an organizational plan that would take into account the spatial needs of palleted drawers, boxed oversized objects, single

very large or heavy objects on dedicated wheeled mounts, and racks of rolled textiles. The organizational plan depended heavily, if not entirely, upon the following premove tools, created not only to track and document objects, but also to measure spatial requirements.

Object Log Book

After the objects were mounted by move technicians and placed in drawers for palleting, the following information was recorded on an *Ethnology Collections Tracking Form* in the Object Log Book: object accession number, brief description, number of drawer, size of drawer (half-size Delta or full-size Delta), height of drawer (1 3/4", 2 3/4", 3 3/4", 4 3/4", 5 3/4"), culture area, and special notes or concerns. The Object Log Book also noted whether an object needed curatorial or conservation attention. For example, objects miss-

Heading and Instructions for Ethnology Tracking Forms Used in Packing: Object Log Book

Inventory Tracking Form: Ethnology/Drawers

Culture Group:_____

This form is to be used for inventory of **ethnological** material from SMM's collections *that can be mounted and/or boxed and packed in drawers*. Write the culture group to which the object belongs in the upper right, beginning a new form with every new cultural group. Write the object's catalogue number in the left column (e.g., **A72:6**). The Delta drawers into which the object is being packed should be numbered consecutively, **D1** through **Dxx**. Delta sizes are either full-width (**F**) or half-width (**H**) plus the depth (**1 3/4, 2 3/4, 3 3/4, 4 3/4,** or **5 3/4**), e.g., **H2 3/4**. If you are forced to use a Kewaunee drawer, number in the same fashion (**K1** through **Kxx**) and record the drawer's depth.

Object #	Object Name	Drawer #	Drawer Size	Topper Height	Red Tags #	Red Tags Cons.	Red Tags Other	Notes

ing permanent numbers were red-tagged as they were mounted and packed. The tracking form itself was occasionally refined over the premove packing period to reflect specific needs. For instance, initials of the move technician and the date the technician packed the drawer were noted in the left margin. This was helpful in answering the questions of Curators or for providing clarification of notes. Postmove additions included the notation of new cabinet locations in the far right-hand margin of each page.

Drawer Number Log Book

Drawers were assigned numbers sequentially, as they were completed, beginning with number 1. As each drawer was completed and palleted, a numbered, acid-free card was placed on the drawer and technicians recorded the number, culture area, and date palleted in a separate log.

Initial Plan

Mapping postmove storage locations for the ethnology collection was charged to the Curatorial Assistant for Collections, who followed a general outline developed by the Collections Manager. First, the Curatorial Assistant developed a detailed plan that al-

lowed for a geographic culture flow beginning with an area for objects with unknown origin; proceeding through objects from Europe, Africa, Asia, Oceania, South America, Central America; and ending with North America. Available space within each Delta cabinet was planned for by consulting the Object Log Book and adding up the spatial requirements of the documented drawers. Full-drawer and half-drawer cabinet space was assigned and charts were developed and posted on the end panels of each row of Delta cabinets. The Curatorial Assistant also allowed buffering space for growth as well as space for objects that were not packed in drawers (i.e., objects on exhibit or loan).

After the plan was in place, preparations began for the cabinets to receive the drawers. Volunteers and staff installed the interior framing for the cabinets that would house the half drawers. Supervised by the Curatorial Assistant, actual unpalleting and installation of the Delta drawers was then quickly and efficiently accomplished.

Collections Technicians Rose Kubiatowicz and Lynn Ross *install cabinet dividers in half-drawer Deltas for ethnology.*

As pallets of packed drawers were brought into the storage space from the staging area, volunteers and staff cut the shrink wrap and removed the three protective layers of muslin, polybat, and Tyvek from each drawer. These were then sorted, folded, and stored for future use. Glides were then installed at the appropriate height for each drawer. Finally, the drawer itself was installed in the preassigned area. Zotefoam, used as cushion between the stacked drawers, and other packing materials such as foam peanuts were collected, bagged, and stored. Drawer "toppers" that had been made from coroplast to protect tall objects were cut down and recycled. As the drawers were installed, the objects were inspected for possible move-related breakage or damage.

Analysis: *The initial plan was effective as a means to quickly get drawers off pallets and into assigned cabinet spaces that also fit the desired culture-flow pattern. However, changes in the organizational plan became necessary. When the collections Move Technicians arrived at the new facility they realized the plan's parameters failed to fully include extraneous cultural materials, such as rolled and boxed textiles, boxed baskets, and other miscellaneous objects that arrived packed on various carts. An additional factor was the growing awareness that space was limited regarding future growth. For example, the initial plan allocated a large growth buffer for the Hmong and Mexican collections. However, the buffer proved to be too large and it was quickly apparent that unless the entire space plan was revisited, we would run out of cabinet space for the North American collection. This growing realization necessitated the need to reallocate and redistribute the entire ethnographic collection.*

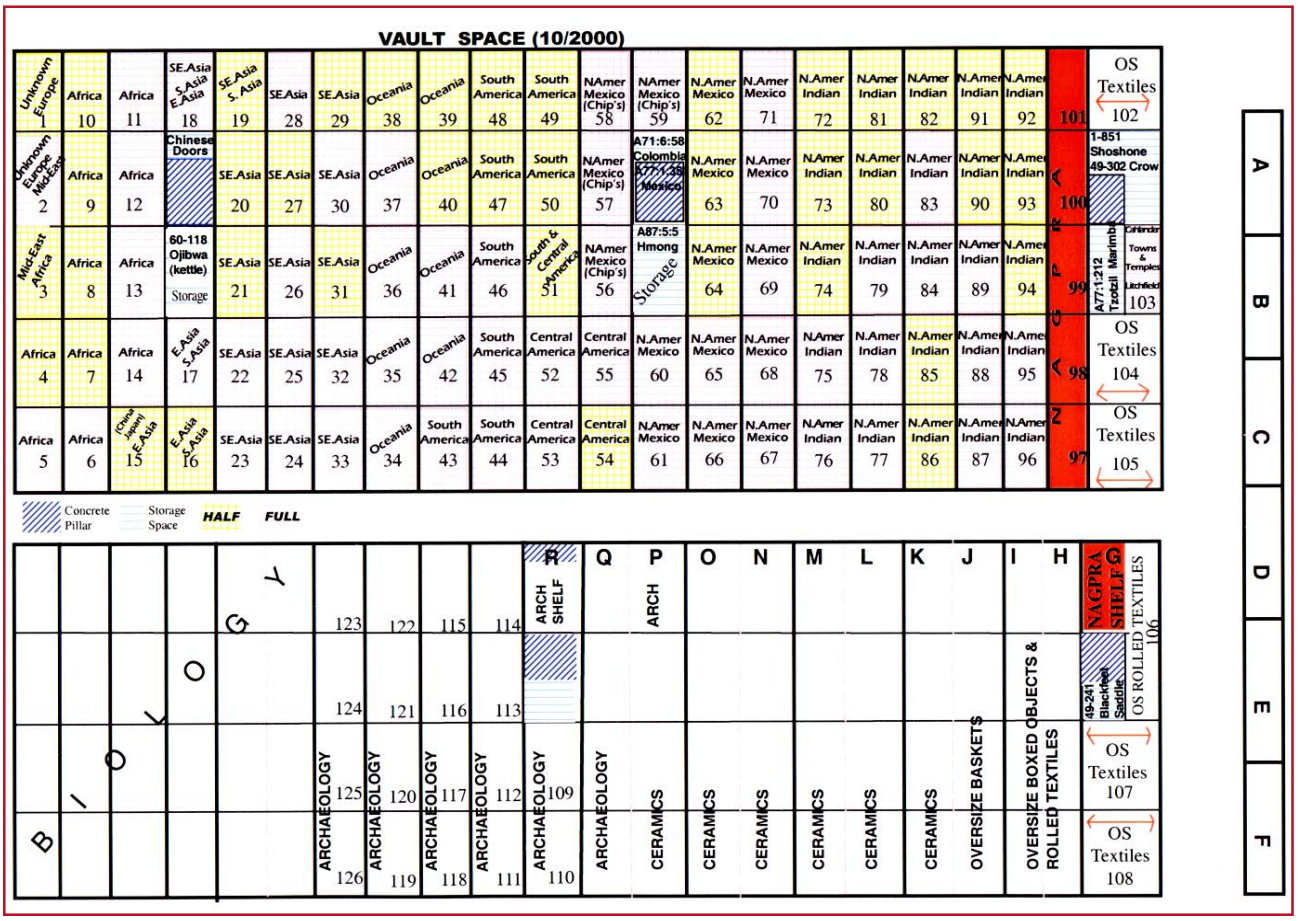
The Revised Plan

A new plan was developed by the Collections Technicians and several visual and tracking tools were designed to facilitate its implementation.

Vault Space Schema

A working chart of the vault space was constructed to provide a clear picture of the reorganization progress and to visually present the following information: the numbering pattern of cabinets, existing half- and full-size-drawer cabinet locations, existing un-

Vault Space Schema



filled spaces, general culture flow pattern, the progress of reorganization, and other miscellaneous planning data, such as projected space needs for various groups of boxed textiles special collections. A formula was arrived at that basically subtracted the existing unaccounted for empty cabinet space from the total available cabinet space. The result was divided by eight major cultural areas and this result indicated the maximum empty space that was available for growth buffer within each area. However, a judgment based upon projected growth for the major areas of collection (Hmong, Mexico, North American) was considered and growth buffer in nonmajor areas of collection was adjusted accordingly. Copies of this chart were periodically given to the Collections Manager and other staff, who were then free to intervene or interact in the process.

Ethnology Collection Tracking Form

The *Ethnology Collection Tracking Form* included the following information: object accession number, brief description, culture area, cabinet number, the assigned drawer number, drawer size, conservation issues, and an area for notes. This form has proven to

be an effective tool to quickly locate objects for retrieval. The information documented becomes especially important because it is the only record that provides an interim accounting of each object and its present location.

ETHNOLOGY COLLECTION TRACKING FORM

RT#-Red Tag (numbering issue)
RTC-Red Tag (conservation issue)
RTO-Red Tag (other issue)

✓	Object #	Object Name	Pre move Drawer #	Drawer size	RT #	RTC	RTO	Culture	Cab #	L / R	Notes

Drawer Location Chart

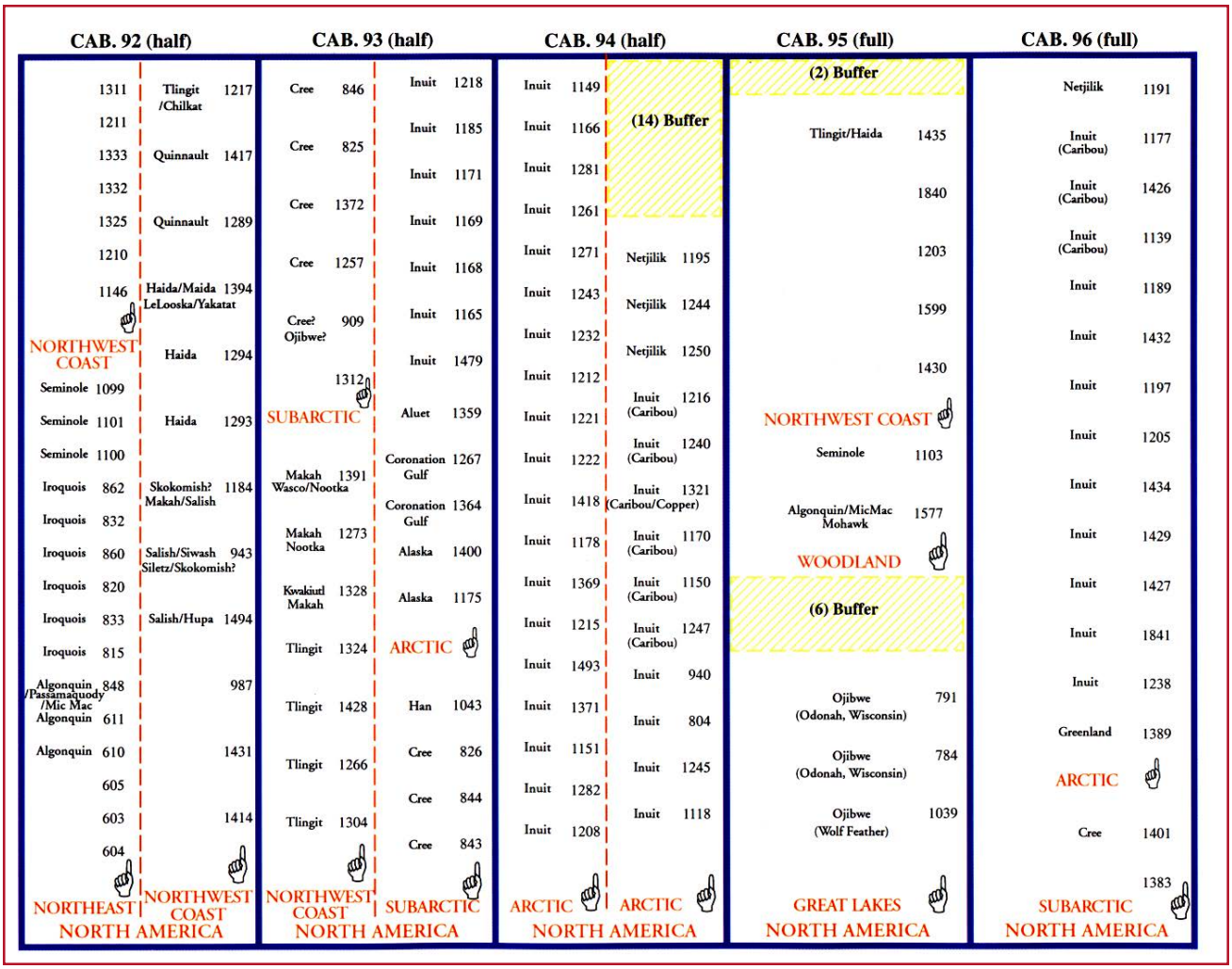
The *Drawer Location Chart* is a visual tracking record of cabinet, drawer, and culture area. It also serves to illustrate buffer zones for future growth. It is posted on the end-cap of each row of cabinets and is designed as an aid to locate objects, cross-referencing drawer locations and culture areas. This chart has been a particularly important aid for curators and other staff who need to quickly locate objects during the interim period when a paper trail is the only means of documenting location.

Drawer Location Chart
posted at the end of each row of cabinets shows technicians where to put away a basket.

Updated Drawer Log Book

An Updated Drawer Log Book containing the current location of drawers and culture areas has also proved to be a useful location and cross-referencing tool.

One benefit of the new plan was that it allowed for the immediate fine-tuning of both the culture-flow pattern and assemblages of objects within the culture, paying particular attention to division of the objects within cultural sub-



Drawer Location Chart

groups (i.e., tribes, specific reservations, etc.) According to the revised plan, each culture area was re-examined and reorganized, if needed, to ensure correct and consistent grouping. For example, Africa is organized geographically north, east, central, west, and south. Within each geographic area, countries were organized alphabetically and were further divided into tribes. New mounts were made when necessary. Each drawer was then documented on the *Ethnology Collection Tracking Form*. The tracking form was used to reliably document the location of objects.

The Collections Technicians divided the organizational work, each taking responsibility for specific cultures. Objects were meticulously cross-referenced for culture group with ARGUS-generated (our database) lists. A general culture group had been previously associated with each object in the Object Log Book during the packing phase. However, the technicians' immediate need was to know exactly and specifically the cultural origin of the object. An or-

Smaller Baskets

fit in cabinet drawers within their culture groups.

Large Flat Textiles
were put in drawers within culture areas wherever possible.

dered list of geographic locations with tribal names and the corresponding drawer numbers with present locations, was generated. In addition, the technicians researched each culture area to enable them to make better and more-informed decisions. Curators were consulted for questions about cultural groups that did not precisely fit into the Western definition of "location" or "tribe."

As the technicians advanced through the ethnology collection, they were followed by two volunteers who cross-checked each drawer's contents with the entries noted in the *Ethnology Collection Tracking Form*. Inconsistencies, additions, or omissions were noted, thus enabling the technicians to recheck their work. The objective in this checks-and-balances operation was to ensure the accuracy of documentation before entry of the new locations into ARGUS.

Analysis: *Several problems arose during the unpacking process that had do with supplies and tools. While these were not major setbacks, they were annoying. For example, we very early ran out of 1 3/4-inch full drawers and left drawer glides. Because of timing constraints and the order process, we waited many months to receive an adequate supply. We periodically ran out of screws and made several trips to the hardware store to purchase more. We found that we lacked good tools, such as Phillips and flathead screwdrivers. This of course was easily solved by purchasing more or by bringing our own from home. The reorganization was also physically challenging and required the presence of both technicians to reorganize, lift, and maneuver the drawers. Interior framing often needed to be added or removed as cabinets that originally housed full drawers now needed to house half drawers. Despite the annoyances, the process moved ahead steadily.*

Oversize Storage

Oversized and boxed objects such as large baskets, shields, spears, masks, drums, canoes, and so forth were initially placed on oversize shelves. As the reorganization progressed, as many of these objects as possible were incorporated into Delta drawers within their proper culture area. For instance, as many baskets as possible were placed in drawers. The remaining oversized objects, such as very large baskets, were placed on two rows of shelving and organized following the identical culture flow as the ethnographic objects within drawers. The decision had been made to store all ethnographic ceramics on shelving, and they were also arranged in a similar manner.

Oversize Cantilevered Shelving
was purchased for very large and very heavy objects like this canoe.

A temporary shelf lettering system was developed and locations were documented, again to facilitate retrieval during the interim. A hanging textile storage system, designed by the Conservator, was built for the thirty to forty large rolled textiles that did not fit in the oversize

rolled-textile cabinet. Similarly, a mounting rack along the 6-inch space between the cabinet ends and the west wall of the vault was constructed for spears, bows, arrows, paddles, and such. Some oversized objects were placed in the "dead" space between the concrete pillars and the cabinets (as noted in the *Vault Space Schema,* page101). Shelving will eventually be installed here to further maximize the space and allow for a second layer of storage. Additionally, space between the cabinet ends and the east wall was utilized to store stone metates and large, flat artwork.

Special Drawers
with tube slots instead of bottoms were purchased for rolled textiles.

Special ethnographic collections were stored separately from the general ethnographic collection in designated cabinets located in close proximity to the general ethnographic collection. For example, the NAGPRA collection was installed in five cabinets at the end of the ethnographic section closest to the North American collection.

Analysis: *At the time of this writing, unpacking is still a very dynamic and ongoing process, but most of our initial questions have been answered. Through determination, creativity, foresight, and good planning, our effort can be judged successful. Yes, the area is large enough to fit everything and allow for future growth. Yes, accurate calculations, the effort and time spent plotting, calculating, and documenting, did ease the process! And yes, most importantly, the care taken in the packing process to protect and ensure the integrity of each object in our collections was warranted and successful. Only one fragile basket arrived with slight rim damage.*

Very Large Baskets
were placed with other oversized objects on shelving.

One year later, looking down the center aisle of the new vault, one notices a half-emptied pallet of ceramics; a stack of empty half Deltas drawers waiting to be filled with presently boxed Mexican textiles; and a pile of bagged, discarded, and no-longer-needed packing materials. Further along the aisle, Collections Technicians interrupt their work to lead an impromptu tour for a group of interested visitors from the University of Minnesota. A Curatorial Assistant, busily unpacking archaeological artifacts, pauses to answer a question about the collection. In the paleontology section, an intern is busy organizing the invertebrate collection, while two volunteers are busy installing newly arrived drawers for biology. As the vault takes a deep breath, it expands to embrace not only objects in the collections, but people and activity. Unpacking the collections has proved to be an exciting, dynamic, rewarding, and ongoing process, in which I am pleased to have played a part.

APPENDIX A: SAMPLE FORMS

Science Museum of Minnesota

2001

Site	**Drawer**	**XS** 11/2 x 2”	**S** 2 x 3”	**M** 3 x 4”	**L** 4 x 6”	**XL** 6 x 8”	**Tan** 81/2 x 111/2”	**Totals**

Demonstration Area _____

Box #_____

Object Name	Object #	Description	Location

Object Type_____

Box #_____

Demo Area	Object Name	Object #	Description	Location

Object Name	Object #	Description	Transferred to:	Signature and Date

Inventory Tracking Form: Biology and Paleontology

Cabinet and	TRAYS						TEMPLATES									Totals
	XS 11/2x	**S**	**M**	**L**	**XL**	**Tan** 81/2x	7x8”	14x8”	21x8”	7x12”	14x12”	21x12”	7x16”	14x16”	21x16”	

Biology: Hides Inventory List

Accession #	Description	Tanned Salted Other	Condition/Cleaning Report	Location

Inventory Tracking Form: Mollusks

Cabinet and Drawer	PET BOXES				
	S 3 1/2x4 1/2"	**M** 4 1/2x7"	**L** 7x9"	Total	**Notes**

Collections Move Project
Osteology Inventory Form
Page #_____

This form is to be used to list all elements of SMM's osteology collection. List by whatever name is found on the specimen. Fill in data columns only for unaccessioned specimens. Use cabinet and drawer number or whatever is descriptive of current location for the last column.

Accession #	Other #s	Name	Notes	Complete Data	Partial Data	No Data	Old Fac. Location

Inventory Tracking Form: Ethno-Archaeology

Culture Group:_____

This form is to be used for inventory of **archaeological** material from SMM's ethnology collections. Write the culture group to which the object belongs in the upper right, beginning a new form with every new cultural group. Write the object's catalogue number in the left column (e.g., **A72:6**). The Delta drawers into which the object is being packed should be numbered consecutively, **D1** through **Dxx**. Delta sizes are either fullwidth (**F**) or halfwidth (**H**) plus the depth (**1 3/4, 2 3/4, 3 3/4, 4 3/4,** or **5 3/4**), e.g., **H2 3/4**. If you are forced to use a Kewaunee drawer, number in the same fashion (**K1** through **Kxx**) and record the drawer's depth.

Object #	Object Name	Drawer #	Drawer Size	Notes

Inventory Tracking Form: Ethnology/Boxes

Culture Group:_____

This form is to be used for inventory of **ethnological** material from SMM's collections *that requires the construction of special boxes not be stored in Delta drawers*. Write the culture group to which the object belongs in the upper right, beginning a new form with every new cultural group. Write the object's catalogue number in the left column (e.g., **A72:6**). The boxes should be numbered consecutively as they are built and filled, **1** through **xx**. Sizes should include **length, width,** and **height**, in that order.

Object #	Object Name	Box #	Box Size			Notes
			L	W	H	

Inventory Tracking Form: Ethnology/Drawers

Culture Group:_____

This form is to be used for inventory of **ethnological** material from SMM's collections *that can be mounted and/or boxed and packed in drawers*. Write the culture group to which the object belongs in the upper right, beginning a new form with every new cultural group. Write the object's catalogue number in the left column (e.g., **A72:6**). The Delta drawers into which the object is being packed should be numbered consecutively, **D1** through **Dxx**. Delta sizes are either fullwidth (**F**) or halfwidth (**H**) plus the depth (**1 3/4, 2 3/4, 3 3/4, 4 3/4,** or **5 3/4**), e.g., **H2 3/4**. If you are forced to use a Kewaunee drawer, number in the same fashion **(K1** through **Kxx**) and record the drawer's depth.

Object #	Object Name	Drawer		Topper Height	Red Tags			Notes
		#	Size		#	Cons.	Other	

Ceramics Inventory and Box List
Collections Move

Box #	Object #	Dimension			Culture/Location
		L	W	H	
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Request for Use of Packing Room Volunteers

Packing Room volunteers are available for packing Research and Collections Division offices and labs WHEN NOT PACKING COLLECTIONS. Please fill in this form and we will try to schedule a crew for your project at the earliest opportunity. As a requestor, you agree to

1. define the project carefully and to the satisfaction of a Packing Room manager;
2. collect the necessary boxes and supplies (tape, scissors, scrap Ethafoam, grey labels, etc. - see packing managers for suggestions to suit your project) that your crew will need on site and replenish as needed;
3. supervise or arrange for supervision of your crew while they pack the project (in most cases, this only means being available for questions);
4. clearly mark the parameters of your project at the site by removing the project from surrounding boxes or confusing contexts, clearly indicating with stickers or other visuals which boxes or shelves etc. are to be packed, or otherwise identifying the exact items to be packed.

Project Name:_____ **Date:**_____

Project Site:_____ **Estimated Packing Time for 2:**_____

Requestor:_____ **Department:**_____ **Phone:**_____

detailed description of project:_____

_____

_____

_____

type of packing boxes:_____**@ number of packing boxes:**_____

packing materials:_____

exact location of items to be packed:_____

_____

labels and/or other information to be written on packed boxes:_____

_____

_____

special instructions:_____

_____

_____

_____

Storage and Other Packing Notes (for Collections use):

December 16, 1998, Move Checklist

Collections Move Project
November 9, 1998

EQUIPMENT/SUPPLIES	Date Ordered	Date Received	Notes
Get pallets from Ethan			
Order strapping machine from warehouse			
Prep pallet corners			
Stock shrink-wrap			
Stock peanuts			

CURRENT PROJECTS TO COMPLETE	Packed	Palleted	Task Complete	Notes
Finish boxing and palleting dinosaurs				
Finish packing and palleting Cahlander				
Finish hi-core paleo fish				
Finish taking grouse to freezer				
Collect taxidermy from Lori's office and vault				
Pack Technology				
Label Hmong House				

MOVE TO DEAD SPACE	Notes	Date
Move all dino pallets into Dead Space		
Retrieve grouse from freezer and stack		
Move Cahlendar pallets into Dead Space		
PREPARATION FOR BARRETT		
Palletize and track all Fossil Fish		
Palletize and track all Fossil Plants		
Palletize and track all Technology		
Pack and track selected taxidermy		

APPENDIX B:
DATA DICTIONARY

Science Museum of Minnesota

2001

Move Data Dictionary

abrade: to wear away by scraping, rubbing, grinding, or friction

abrasion: the wearing away of surface material from a solid by the friction or action of another solid, a liquid, or a gas

absorption: the penetrating of one substance into the structure of another, such as through capillary action or as radiant energy passing into or through a material.

accession: (n) an identification number assigned to a single object or group of objects within a museum's archiving system; (v) **to accession:** 1. to assign a single object or group of object's an archive identification number 2. to mark an object with its assigned identification number

accession number: 1. From 1963 to the present, SMM **accession numbers** have been formed from a letter (referring to the department doing the accessioning), a two-digit number (referring to the year of the accession), a colon (:), and another number (referring to the number of accessions received that year) = letter ## : #. For example, Accession A98:4 means the fourth group of objects (4) accessioned by the Anthropology department (A) in 1998 (98). [Note that occasionally the colon has been replaced by a decimal point; the colon is the standard and should be used for all future accessions.]

2. However, for objects acquired by SMM before 1963, **accession number** refers to two different types of numbers: a) single numbers that were in these earlier years assigned to collections of objects, such as Accession 1, Accession 2513, etc.; after 1962, this numbering system was replaced with the system described above (e.g., A98:4); and b) in other cases a number assigned to an individual object. An example of this type of number is 400/1 (also written 400-1), which means the first object in Accession 400. This second type of accession number was discontinued after 1961. It is not to be confused with the currently used catalogue numbers (see **catalogue number**).

accretions: foreign matter adhered to an object

acetone: dimethyl ketone; a colorless low-boiling volatile liquid soluble in water and many other organic liquids; commonly used as a solvent for adhesives

acid free: a term loosely used for papers and other materials that are often pH neutral or alkaline buffered; specifically, having a pH of 6 to 11, more accurately described as "neutral" or "alkaline buffered"

Aclar sheeting: pe and pp laminated sheeting (or bags) that can be heat sealed; used for vapor barriers, especially archaeological metals

anthropology: the study of humans

Anthropology Department: the SMM Science Division department that is responsible for research in human development and acquisition of related objects; Curator: Orrin Shane III

archaeology: 1. the study of the physical remains of human culture 2. SMM Collections objects that have been dug from the ground or otherwise obtained from archaeological exploration

ARGUS: SMM's collections computer database

artifacts: objects that have been created or manipulated by humans

B-67 and B-72: acrylic resins used un numbering, repairs

backer cord: pe tubes in various diameters used for surrounding and supporting mounted objects

b-box: standard packing unit for smaller items called a banker's box, commonly used for packing files; premade trays fit and stack inside

biology: 1. the study of living organisms, at SMM both in the field and through collected specimens 2. SMM collections specimens that are studied as living organisms

Biology Department: the SMM Science Division department that is responsible for research into living organisms and acquisition of related objects; Assistant Curator Dick Ohlenschlager

black hole: the storage room at the back of either Upper Cedar corridor on the second floor

bubble wrap: pe material used for temporary padding and storage of objects

buffered: see **acid free**

the cage: the storage area located up the stairs in the central area of the Anthropology Hall, adjacent to a theatrical "green room"; used for storage of objects used by the Anthropology Hall and the Education Department

catalogue: (n) the list of accessioned objects in a museum; (v) **to catalogue:** to process an accessioned item into the archive system of a museum by giving the individual object a further identification number

catalogue number: a number assigned to one object from an accession. 1. From 1963 to the present, catalogue numbers at SMM have been formed by adding a number to an accession number. For example, the first object from Accession A98:4 would be assigned the catalogue number A98:4:1, the second object would be assigned A98:4:2, etc.

2. Before 1963, things were done differently. Up until 1934, which would involve Accessions 1 to 500, catalogue numbers looked like this: #-#, where the first number stood for the department and the second number for the specific object. The number assigned to anthropology was 1, so all pre-1934 anthropology catalogue numbers look like this: 1-#. The second number was assigned according to type of object. Anthropology catalogue numbers 1-1 to 1-499 were reserved for household goods such as pottery and basketry, 1-500 to 1-999 for ceremonial objects and weapons, 1-1000 to 1-1499 for personal items such as clothing, 1-1500 to 1-1999 for physical anthropology, and 1-2000 onward for archaeology. So, if SMM received a pot, and the last household item accessioned was 1-300, the new pot would receive the catalogue number 1-301. This type of catalogue number could be assigned only after an object had been identified; before that, the object was referred to by its accession number only, such as "400/1" (see **accession number**).

3. From 1934 to 1962, which would involve Accessions 500 to 2513, catalogue numbers looked like this: ##-#, where the first two numbers referred to the year (34 for 1934), and the number(s) after the hyphen referred to an object from a specific department. [Note: both hyphen and solidus were used interchangeably.] Numbers 1 to 999 were assigned to anthropology, 1000 to 1999 to biology, etc. So, anthropology objects accessioned in 1953 could have catalogue numbers from 53-1 to 53-999. If SMM received a pot partway through 1953, and the last catalogue number assigned to an anthropology object was 53-220, this new pot would be assigned 53-221. [Note that this was the theory; in practice, some anthropology objects were assigned numbers over 1000.] Again, these catalogue numbers were assigned after an object had been officially identified; before that, an object was referred to only by its accession number.

cavity (well) mount: A storage or exhibition mount that provides full support to an object. It can be made by extractive methods or by additive methods. Frequently the profile of an object is transferred to a piece of foam or other support material. The material is cut away to provide a cavity or well for the object. Another form of cavity is to cut out a section of padding material, roughly larger than the object (can be rectangular, round, etc.) and the object is laid inside the cavity. Used to protect a series of objects (usually similar) from hitting each other.

Collection: a nonstandard unit of objects applied to materials for convenient identification; e.g. the Reiff Collection (named after the donor), the Wet Collection (named after member characteristics and requirements), or the Typed and Figured Collection (named after the status of its members)

collections: nonspecific term for all the accessioned objects owned by SMM

Collections Department: the SMM Science Division department that is responsible for the care and handling of all accessioned museum objects; Manager: Lori Benson

comparative collection: a collection of natural history specimens used as references for establishing identifications

Conservation Department: the SMM Science Division department that is responsible for the health and preservation of all accessioned museum objects; Conservator: Gretchen Anderson

coroplast: see corrugated plastic board

corrosion: the loss of metal surface owing to chemical reactions such as rust

corrugated cardboard: acid-free, lignin-free, buffered cardboard used for board, trays, etc. in mounting objects

corrugated plastic board (coroplast): (#1) pp or pe copolymer flexible mounting board; (#2) pc more-rigid clear board; both used for building boxes and trays for objects

cradle mount: a storage or exhibition mount that is used to support and stabilize an object. Areas of the object are identified for support and a piece of foam (or other padding and support material) is carved to support the object.

deaccession: to remove an object or group of objects from the museum archives

Deltas: type of museum storage cabinet (name brand); all collections storage in the new museum will be in Delta cabinets

dermestids: a family of beetles (also called carpet beetles or hide beetles) that are notorious for eating hides, skins, textiles, etc.; used at SMM to remove flesh from skeletal material, they are potentially destructive pests to the collections

diagnostic: in archaeology, an artifact that can be identified as part of a larger whole; e.g., a rimsherd that identifies a pot, a flaked piece of tool large enough to indicate what kind of tool, or a patterned/shaped/manufactured sherd that indicates a certain culture

Discrete Study Collections: suite(s) of specimens from a single horizon or locality

double-stick tape: used for tacking surfaces together in photomounts and textiles; not to be directly used on objects

encapsulation: to support fragile paper or textile between two sheets of polyester film held together by double coated tape, stitched or heat sealed. There are many variations, including using a backing board (neutral mat board) with a polyester cover, with paper behind the object to be supported.

Ethafoam: pe foam used extensively in padding mounts, boxes, and trays; comes in rolls, rounds, and planks of various thicknesses

ethnology: the study of human cultures

fading: loss of color because of exposure to light

field jacket: usually of plaster and burlap, a cast used to encase fossils in the field for transport to the lab

figured: any specimen illustrated in full or part in the scientific literature

flaking: the lifting off and loss of surface material

flat skin: a type of preparation for biological specimens that is used for study but not for exhibition; flat skins are dried on a board and not stuffed; frequently used very large specimens and very small specimens where stuffing is impractical, or when the head is removed (see also **study skin**, **taxidermy**)

foam-core: polystyrene foam inside 2 layers of acid-free paper (Artcor), used for supports, board, mounts, etc.

frass: debris left by an insect, e.g. dirt, eggs, shed larval skins, excrement, casings, webbing; frequently looks like dirt

geology: the study of mineral formations

hi-core: rigid thick polycarbonate copolymer sheet used for mounting large/heavy objects

horizon: in paleontology, a formation, layer, or bed for referring specimens

hot-melt adhesive: clear ethylene/vinyl acetate copolymer adhesive used for building boxes, mounts, and trays; not to be used on objects

hygrothermograph: a mechanical device used to monitor the relative humidity and temperature of a given area; produces a graph that tracks the T and RH over a specified time (day, week, or month). SMM Conservation Department uses drum hygrothermographs, a specific type that produces a clear, easy-to-read chart.

ichnofossils: also called **trace fossils**; any evidence of an animal other than any of its body parts

invertebrates: animals without backbones

IPM (Integrated Pest Management): a holistic method of controlling pest infestation that asks why the infestation is present. IPM entails monitoring to determine what is present and targeting that pest, relying heavily on eliminating the source of the infestation, good housekeeping, and reducing the use of pesticides. Most pests are present for some reason: food, shelter and/or source of water. By eliminating one or two of these factors, by altering the environment (temperature or RH) and keeping the area clean, many problems can be dealt with. IPM also looks at methods of elimination that do not damage the object or the environment.

isolation: the removal of a specimen and/or its container to an established environment where damaging pests or molds can be dealt with

ITWCT: 4' x 8' cart with two or possibly three platforms constructed for an SMM traveling show called **I**f **T**hese **W**alls **C**ould **T**alk

Kewaunee: a type of museum storage cabinet (name brand); most current storage of SMM collections is in Kewaunee cabinets

lignin: fiber in wood that accounts for a wood product's acidity

locality: in paleontology, geographic place for referring specimens

Marvelseal: aluminum laminate barrier sheeting, can be heat-sealed with an iron

mat board: acid-free only, used for supports, board, mounts, etc.

mount: (n) a device constructed to hold/display an object; (v) **to mount:** to construct a device to hold/display an object

MSDS: Material Safety Data Sheets. Information provided by the manufacturer that includes volatility, flammability, toxicity, and health risks; required by law. Staff must be aware of the dangers associated with materials being used.

muslin: cotton (acid-free) unbleached fabric used for wrapping objects, tapes (**twill tape**), ties, and separators (**stockinet**)

object: a single item in SMM collections

object name: the term used for a single item in accessioning it into SMM collections

off-gassing: a chemical process where volatile materials are released, usually slowly (including organic acids), from woods, paints, coatings, polymers, etc. Many of these volatile materials contribute to the deterioration of objects; can usually be smelled.

osteology: the study of bones and skeletons of all animals having them

oxidation: originally used to describe a reaction in which oxygen combined with another substance; the term is now used to describe any reaction in which electrons are transferred. Generally, oxidation will result in deterioration of objects and specimens.

padded tubes: mount consisting of a tube with padding on it to cushion the object; used to roll and store flat textiles on and as a bar to display textiles.

paleontology: the study of fossilized life, both plant and animal

Paleontology Department: the SMM Science Division department that is responsible for research into fossils and acquisition of related objects; Curator: Bruce Erickson

Paleontology Hall: place for exhibiting, relating, and teaching about fossils and past environments

pallet: 1. the wood skids upon which drawers and boxes are being stored 2. the flat wood trays upon which certain large and/or fragile objects are housed

PET boxes: clear polyethylene containers with hinged covers used for permanent shell storage; developed for museum use by the Canadian Museum of Nature

Pleistocene Collection: specimens from the Pleistocene Age

Plexiglass: rigid plastic (acrylic), comes in sheet or rod forms; used for display cases

polycarbonate (pc): a stable and very rigid plastic used for making boxes and trays

polyester: a stable plastic more brittle than polyethylene, comes as film (Mylar D), fabric, or quilt batting; used for trays and boxes

polyethylene (pe): a stable flexible plastic like Ethafoam and backer cord used for mounting and storing objects in a wide variety of ways

polypropylene (pp): a stable plastic used for mounting and storing objects, usually used as a foam; very soft and less abrasive than pe

preparator: person who collects, sorts, pieces, and assembles fossils

protocol: a procedure developed to accomplish any specific task; instructions

quilt batting: polyester fill material used in packing

ring mount: a storage or exhibition mount used to support and stabilize objects, generally used with ceramics, baskets, gourds, and other similarly shaped objects; can function as either a cradle or a cavity

St. Croix Research Station: research facility of SMM located at Marine on the St. Croix, Minnesota, whose focus is primarily related to research into all components of the St. Croix River drainage system

sticky traps: nontoxic insect traps placed in drawers and cabinets to monitor for pests

stockinet: cotton tubes of padding used to separate and/or support objects

stress: force producing, or tending to produce, deformation in a material.

study skin: a type of preparation for biological specimens, used to facilitate study rather than exhibition. These are birds or mammals preserved by removal of all perishable internal parts and reconstructed with cotton, sticks, and wires to resemble a complete animal; good for measurement of variation. (see also **flat skin**, **taxidermy**)

taxidermy: literally, "arrangement of the skin"; a method of stretching an animal skin over a form, using wires and other materials, to simulate a live animal

taxidermy mount: a custom-made stand or support for a skin or hide, usually more or less naturalistic and considered for display purposes. Older mounts frequently contain poisons such as arsenic, mercuric chloride, or cyanide; therefore appropriate precautions should be taken when handling. (see also **study skin**, **flat skin**)

taxonomy: the classification systems of science

telescope-style box: a two-piece box in which the sides of one part fit over those of the other

tissue: only acid-free, lignin-free, unbuffered to use around objects as a protective layer

topper: coroplast boxes of variable height custom constructed to cover artifacts in the topmost drawer on a stacked pallet

trace fossils: see **ichnofossils**

transfer tape: used for tacking together foam surfaces

twill tape: woven ribbon fabric, generally of twill weave (weft threads pass over and under two or more warp threads producing a diagonal design); comes in cotton, linen, and polyester in different widths and densities. The standard used at SMM is unbleached cotton in various widths. Use as ties and tabs in storage mounts.

type: a single specimen upon which a taxonomic species or subspecies is actually based

Tyvek: polyoefin sheeting used as vapor barrier, dust cover, etc. for protection of object from mount or carrier

ultraviolet (UV) light: that part of the electromagnetic spectrum having wavelengths from about 400 NM (long wave lengths) to 4 NM(short wave lengths). These frequencies are extremely damaging to many objects and specimens and should be eliminated from light sources. Sunlight and fluorescent lights are very high in UV.

unbuffered: any material that does not contain alkaline buffering

vapor barrier: a layer of material used to retard or prevent the absorption of moisture in to a construction (wall, floor), a storage area (shelf, cabinet) or an object; e.g. polyethylene sheeting, polyester film, Tyvek, and Marvelseal

vitrine: an acrylic Plexiglas case used to house specimens for display

Wet Collection: specimens stored in bottles, buckets, or jars containing alcohol or Formalin

Zotefoam: a pe closed-cell foam used in packing delicate objects

APPENDIX C: PROTOCOLS

INDEX TO COLLECTIONS MOVE PROJECT PROTOCOLS

The following protocols were written for all packers to use. They were designed and tested by the Conservation Department and then modified as necessary by packers themselves. A few were planned but never written; you will find several missing numbers.

Ethno.11 = Encapsulation
Ethno.12 = Quilts
Ethno.13 = Clothing
Ethno.14 = Rolled Textiles
Ethno.15 = Hats and Shoes
Ethno.16 = Belts
Ethno.17 = Looms

Paleo.3 = Discrete Study Collections
Paleo.4 = Invertebrates
Paleo.5.1 = Vertebrates, Pleistocene
Paleo.5.2 = Vertbrates, Fossil Fish
Paleo.5.3 = Vertebrates, Mammals
Paleo.6 = Paleobotanicals
Paleo.8 = Dinosaurs (does not include Paleontology Hall exhibits)
Paleo.9 = Casts and Restorations
Paleo.10 = Paleo Skulls

West.1 = Protocol and Information for Moving Noncollection Items

Accessioning and Cataloging

1. If objects are organic, freeze or isolate the objects to check for pests. Check with Conservator for procedure.

2. Check the thin Anthropology Accessions Log Notebook to find out what the next A#:# is. Assign this number to your object(s) and *fill out the next line in the notebook*.

3. Get a manila folder, preferably 1/5 cut tab, and write the accession number on the tab. This is the accession file.

4. Put the following forms in the file:
   Accession Record,
   Cataloging Check List,
   Catalogue Worksheet(s).

5. Assign individual catalogue #'s to the object(s). Remember to use a/b/c if a group of objects constitutes a set.

- Use B72 and ink on a hard surface (see Conserv.9 protocol); sew a twill tape tag onto a textile.

6. Fill out the Accession Record and the Catalogue Worksheet(s). Remember to measure the object(s) and record the dimensions on the worksheet.

7. Enter the accession and catalogue information onto the ARGUS **accession** and **object screens**. If this is a first-time collector, you will have to create a new constituent ID from the accession screen.

8. If this is a donation, fill out 2 Deed of Gift forms and write an accompanying thank-you letter. These will then be mailed to the donor with an SASE to expedite the return of one of the forms. The donor keeps the other for his/her records.

9. Write the accession information in the big, **hardbound log book** stored in the records vault.

10. Put the object(s) in the digital imaging lab to be photographed.

11. After the object(s) are photographed, put them in a permanent location in the vault. Enter the location on the ARGUS **object screen**.

12. File the accession file in the records vault.

Ordering Supplies and Petty Cash

The purpose of this protocol is to specify the roles, responsiblities, and procedures for ordering supplies, materials, tools, and equipment related to packing and moving collections.

Roles and responsibilities

1. **Purchase orders (POs):** Lori will provide all purchase orders for the Move Project. She will also be the source of appropriate budget numbers. Please use only POs from Lori so that she will always have a record of the purchase.

- Lori is responsible for managing the budget for Collections Management as well as the Move Project. If an item *other than office supplies* is to be purchased from the Collections Management Department budget, go directly to Lori for the PO.
- Gretchen is responsible for managing the Conservation Department budget and the IMLS CP (osteology) budget. If an item must be purchased from the Conservation Department budget or the IMLS CP budget, get the PO from Gretchen. These are outside the scope of the Move budget.
  Tom Hutchings must sign off on all Move Project POs.

2. Ordering: Ordering responsibilities for the the Move Project will be split up in the following manner:

- Lori will order cabinets. She will depend upon requested reports from packers for her timing.
- Gretchen will order packing room supplies. See the procedure below.
- Ellen will order office supplies. Call her with the items you need after getting Lori's approval. If Lori is gone, requests can still be made but only for really necessary items and under the conditions that Ellen's balance will allow it.

To place an order for supplies and materials

1. Make a request on the **materials grocery list** located on the clipboard hanging on the red shelves in the the packing room. Please indicate priority. If something is really urgent, list the request and contact Gretchen immediately.

2. Rebecca or Jackie will bring the list to Monday's departmental meeting, where Gretchen will query the items. She will place the order on Monday or Tuesday after getting a PO from Lori.

3. In some cases, you may be asked to write up your own order, particularly if it is for something not on the grocery list. Get PO as indicated above. Fill it out as far as you can, including the address of the company, phone number, and "attention to." Do not call the order in until you have a budget number and a signature from the department/project head. (That is, from Lori for Move Project and Collections Department or from Gretchen for Conservation or IMLS.) Give PO copies to the appropriate person:

- White copy: vendor
- Gold copy: department head who signed the PO for you
- Packet: Fran, in the Accounting Department
- Photocopy: Gretchen (put on clipboard in purchase order notebook on desk)

When a shipment of any item(s) arrives

1. Check off shipment against **packing slip**, note any discrepancies.

2. Give packing slip to Gretchen. If she is not available, put it on the clipboard with the PO copy (see above).

3. Gretchen will compare the packing slip with the PO and follow up on discrepancies. If there is anything wrong, she

will inform Lori and Fran.

4. Once the Accounting Department pays the bill, the approriate department head will get the blue copy of the PO for Project or Department records.

Using petty cash

We can spend up to $50 cash at a time to get supplies. If you use your own money to pick something up:

1. Get a receipt — you will not be reimbursed otherwise.

2. Use the **tax exempt number** — you will not be reimbursed for the amount you spend on tax. The number is 21995. Certificates are available from Lori or Gretchen. You should keep one in your billfold.

3. Fill out a **petty cash slip** and give it to Lori (Move Project and Collections Department) or Gretchen (Conservation Department or IMLS) for signing and budget number.

4. Attach your receipt(s) to the slip and make a copy; give the copy as is appropriate to Lori or Gretchen.

5. Take the slip down to Kris in Accounting before noon Monday through Friday. She will reimburse you.

Errands and pick-ups

If you are asked to run errands for the project or the museum, remember the following:

1. If the item is under $50, use the petty cash procedures.

2. If you are using a PO, take the white (top) copy with you. This should go to the vendor. Make sure you get a receipt or packing slip from the vendor and give this to Gretchen.

3. Keep a mileage log in your car (can get one from Lori or Gretchen). Fill it out with begining and ending mileage, destination, etc. Give it to Lori at the end of each month if you have driven for the museum. You will be reimbursed @ 30 cents a mile (approximate).

4. There are several local vendors with whom we have account numbers. Using these vendors will make it easier to use POs. See Gretchen for account numbers.

- Target: account #
- Sir Speedy: Just say that you are with the Science Meusem and give them the PO or project name. We will be billed.
- Wet Paint: use PO or petty cash
- Rubenstein & Ziff: account #

ARGUS: Entering Collections Move Condition Surveys

Conservation condition reports are required for all ethnographic objects. Reports for other types of objects may be requested as needed.

Screen 1

From Main Menu, go to:

B Conservation System Menu, then

A Conservation Request Screen

01	ID	Type # and press Enter. Write the number that appears, i.e. 98.17, on the survey sheet. There is a box in the upper right corner for this.
02	Object ID	Enter the catalogue number.
07	Req Date	Enter 1/1/98.
08	Requester	Enter GEA.
10	Request	Press \ to see menu of options, then Type D, then P, then $MOVE as the name of the scratchpad.
11	Req Prio	Skip this, press Enter.
12	Purpose	Enter MO.
13	Need Date	Skip this, press Enter.

Finish, File, and Quit to Conservation System Menu.

Screen 2

B Conservation Examination Screen

01	ID	Enter the number from the request screen, i.e. 98.17.
09	Condition	Enter the condition from the survey sheet: E, V, G, F, or P
10	Date	Enter from sheet.
12	By	Enter VOL.
15	Con Prio	Skip, press Enter.
16	Purpose	This should carry over from request screen, otherwise enter MO.
17	Remarks	Skip, press Enter.

Part specific

20	Date	Enter from survey.
21	Part	Enter whole.
22	Composition	Skip, press Enter.
23	Condition	Enter from survey sheet, E, V, G, F, or P.
24	Damage	Enter from survey sheet. Place a } between each code, i.e. ACCR}CH}L for an object that has accretions, chips, and losses.
25	Remarks	Press \, then type D, then P, then $REMARKS.

Finish, File, and Quit to Main Menu.

Screen 3

From the Main Menu, go to:

A Collections Management Menu

G Conservation /Condition Screen

01	Object ID	Enter the catalogue number.
05		Enter 2082.
08	Date In	Enter date from survey sheet.
10	Date Out	Enter date from survey sheet.
11	Motive	Enter O.
12	Process	Enter CR.
13	Reference Doc	Enter the number from the request screen, i.e. 98.17.
14	Publication	Skip, press Enter.
16		Press \, then D, P, then type $SURVEY.

Finish, File, and Quit.

Problem Objects and Red-tagging

Any objects that are unnumbered, double-numbered, or questionably identified for any reason need to be researched and correctly labeled, before packing if possible. Problems left unaddressed should be red-tagged for immediate attention at the new facility.

1. Problem objects found by the packers should immediately be called in to Kristen. Follow up the call with a note describing the problem; attach the note to the object.

2. Kristen will look at the object and try to resolve the problem.

3. Any renumbering required for these objects will be done by Karen.

5. When a problem cannot be solved and the culture from which the object came is still accessible, Kristen will red-tag it and write a good description of the problem in the Problems Notebook in the packing room *behind the notebook's red divider*. She will also note the problem on ARGUS and on the catalogue worksheet. Problems behind the divider will be attended as soon as objects are unpacked in the new facility. Packers should red-tag all drawers containing red-tagged objects.

- Some drawers will contain items already marked with a different kind of red tag. These are for conservation purposes and their presence on an object should be noted on a conservation report, but they require no other attention at this time.

6. If the culture from which an object was removed is no longer accessible, tagged and untagged objects should be mounted and put aside in the same location to be packed together after all cultures are stacked and wrapped.

Deaccessioning Objects

1. Fill out a Deaccession Recommendation Form. Be sure to have a curator sign it, note the reason for the deaccession, and recommend a disposition.

2. Fill out a Deaccession Form and have it signed by a curator under "approved by." Once the object has left the building, have the curator sign under "disposal completed."

3. If the object is being given to an institution, fill out an Deaccessioned Object Receipt Form and have it signed by a curator or Collections staff and the recipient at the time the objects leave the building.

- As soon as possible, use the standard Deaccessioning Release Letter and list all the objects taken by number (or description if unnumbered) and send two copies signed by Collections staff here first: request one to be returned with the recipient's signature for our files.
- This letter includes a request that recipient cross out our numbers on the objects.

4. Now mark all records "Deaccessioned."

- Use the red deaccession stamp on the object card and the catalog worksheet.
- If the entire accession was deaccessioned also stamp the accession file and the log book entry.
- If the entire accession was deaccessioned change the accession screen on ARGUS to a deaccession screen.
- The object record on ARGUS should be marked in three places:
- Accession Status Field
- Flag Field
- Location Field.

5. Put all forms in the accession file.

Defining Archaeological Storage
Orrin C. Shane III, Curator of Anthropology, SMM

Research collections

Archaeological research collections include materials collected as part of problem-oriented research projects. As such, these collections are part of the world archaeological record and must be immediately accessible to scholars. Immediately accessible means available in a user-friendly storage system in which individual specimens can be viewed directly and can be easily selected for transport to a laboratory area for study and analysis.

Although what constitutes problem-oriented research has changed through time since T. H. Lewis collected pottery and other artifacts from sites in northeast Arkansas in the 1880s, specimens in our older collections are no less important to research than items collected from the Cross Site in 1996. Research collections should be housed in groupings according to site or component within a site. The important concept here is the assemblage (see Deetz, 1967; Renfrew and Bahn, 1995). An assemblage includes all of the artifacts from a single site or some meaningful component within a site. This can be where the storage process gets a bit tricky, because assemblages are usually defined by the researcher, project director, or curator. There is an important distinction to be made between **artifacts** (*things made and used by humans*) and **ecofacts** (*plant and animal remains used by humans*). Artifacts, with the possible exceptions of stone flakes and pottery fragments, generally occur and are recovered in far fewer numbers that ecofacts. The process of water flotation can recover thousands of fragments of plants used by people at a site. Although it would be ridiculous to house each fragment separately and bulk storage would certainly be appropriate, it would also be appropriate to make processed and identified sub-samples as accessible as stone tools. Therefore, it is important that diagnostic artifacts and perhaps samples of diagnostic ecofacts in assemblages be made accessible. By **diagnostic artifacts,** I mean *any artifact that can be used to distinguish one cultural group from another, either in time or in space*. What constitutes a diagnostic artifact includes but is not limited to

- all formal stone tools or recognizable fragments of stone tools, shaped by flaking, grinding, or polishing
- all artifacts made of metal
- all formal tools of bone, shell, wood or other organic material
- all objects that are part of a process of making a stone, metal, bone, shell, wood, etc. tool. This could include core preparation flakes, bone from which a bone tool is cut or shaped, or spilled bronze from a casting.
- all complete ceramic artifacts or parts of ceramic artifacts (sherds) showing point of juncture between vessel sections or elements of decoration,
- all beads, ornaments, or assemblages of items of adornment

What constitutes a diagnostic artifact can be difficult to define, but for our collections it is fairly self-evident.

Cultural resource management (CRM) collections

CRM collections are a special category of research collections. They are collections that document CRM work, and since much CRM work is mandated by governmental agencies, most CRM collections come under municipal, state, and federal mandates that require by law curation and accessibility for study. At the same time, many CRM collections are reported only in the grey literature (limited-distribution technical reports to agencies) and include many items of limited scientific value. Therefore, while these must be treated as research collections and must be stored as assemblages, only a few items of special interest (as defined by curatorial staff) need be housed as immediately accessible. Most CRM collections would be housed as bulk storage.

Sites to be included in SMM research collections

- Spring Lake Archaeology
- Crites
- St. Croix Valley
- Bryan

- Pedersen
- Mountain Lake
- Vosburg
- Blue Earth Valley (survey collections)
- Willow Creek sites
- Cross
- appropriate CRM materials

The States' Collection

The States' Collection is a valuable reference collection that contains a small amount of site material in specific documented assemblages. However, most of the States' Collection is comprised of surface-collected artifacts. These are usually complete specimens (a plus) but with minimal documentation beyond state or county provenience (a minus). Because of the great level of effort of American archaeology, most local cultural sequences are known. Most objects within the States' Collection have been or can be identified and assigned to a cultural unit. Therefore, the Collection has great value as a reference tool and for defining regional and sub-regional "style zones" for some artifact classes. For this reason, the States' Collection should be treated as a research collection and housed accordingly.

Storage containers

Each **diagnostic artifact** should be stored in its own customized padded container, with at least one side visible and the catalogue number clearly in view. Containers should form one layer in a drawer and no specimen is to be covered by another. See protocol Conserv.8 for cavity mounts.

- Use small black boxes and brown boxes in appropriate sizes; build larger tray only when necessary for a large object like a maul.
- Pack into Kewaunee drawers and stack layers until full; boxes will be removed into Delta drawers in the new facility.

- Track the numbers of small boxes by site or collection.

All **bulk storage** will be done by sorting sites or collections by catalogue number into the blue or grey trays with the most appropriate number of dividers and packing the trays into b-boxes. All boxes should be marked with site of collection name(s) and all accession numbers included.

Hmong House Deconstruction

The Hmong House currently located in Anthropology Hall at the Science Museum of Minnesota is the product of a unique partnership between the museum and local Hmong carpenters who 10 years ago built a traditional Hmong dwelling for display and interaction with the public. Tools and methods used were entirely traditional except for the cement-floor anchor deemed necessary to raise the building inside another building.

The Hmong House will be reassembled as a permanent component of the Collections Exhibit in the new museum. It will be our task to prepare it for deconstruction in a manner that will facilitate the best transfer and most accurate reassembly possible.

1. After consultation with the moving crew and interested parties, Debbie will draw a set of construction drawings that will number and color code each piece of the house and provide visual representation of the entire project. Final version will be bound in 8 1/2 x 11 spiral format and will include

- 11" x 17" foldouts of the floor plan and post designations
- 11" x 17" foldouts of 4 outer wall elevations
- 2 inner wall elevations
- detail drawings and photos of difficult joins
- bundling instructions

2. When the drawings are complete, Collections personnel will be assigned to attach colored numbers to boards and posts with a stapler according to the plan.

3. Work crew will begin to disassemble the structure on or about the 7th of December, 1998.

4. Disassembled and bundled structure will be transported to the warehouse on the Barrett Moving date in mid-December.

Anthropology Hall Exhibitry

This protocol is for packing and storing the many objects from various sources that are not accessioned in the Collections but are or have been part of displays in Anthropology Hall. These objects will be stored and made accessible for future displays in one of two ways: either the objects are part of a diplay, demonstration, or project and will be packed together under the culture name and project area, or they will be classed with other similar objects by culture.

1. Determine the nature of the object and whether or not it is part of a single project.

2. If part of a project, gather all elements of that project together. Use the form **Anthropology Hall: Projects** to list each item as it is placed into the box or boxes. Mark the box with the number of that box in the sequence of project boxes **AP1** - **Apxxx** (**A**nthropology **P**rojects 1 etc.). Start a new form for each project.

3. If there is more than one box in a single project, subnumber the boxes **Box 1 of x** (**x =** total number in project). Record subnumbers on the form as well as main box numbers.

3. If the object is not part of a project, start and number a box for that culture and type of object using the form **Anthropology Hall: Objects**. Number these boxes in sequence **AO1** - **Aoxxx** (**A**nthropology **O**bjects 1 etc.). Start a new box with each culture and type of object. (This category strategy is subject to change by the Anthro Hall supervisor if not convenient.)

4. Wrap each object, support or mount as requested by your supervisor.

5. Objects or groups of objects that will not be kept in Anthro Hall storage should be listed on the third form **Anthropology Hall: Transfers.** These can then be assigned final destinations and transferred to the appropriate department, institution, or person. Release of the objects requires the signature of the person taking them and the date they were delivered. This includes any objects that are to be disposed of. Final responsibility for such disposal will be determined at a later date.

Hmong House Labeling

1. The labeling system for the Hmong House is as follows:

COLOR	LOCATION	ELEMENTS
Orange Tags:	**S** (structure)	for framing, portals, and roof shingles
Green Tags:	**F**	for front wall, facing it from outside
Blue Tags:	**L**	for left wall, facing it from outside
Red Tags:	**R**	for right wall, facing it from inside
Light Blue Tags:	**B**	for back wall, facing it from inside
Yellow Tags:	**I**	for internal walls **A** and **B**, facing them from the larger interior, and furniture
Pink Tags:	**P**	for porch and porch shingles

2. Construction paper will be cut into 2" x 4" labels and marked each with the following information:
- location
- element member (e.g., wall board, portal sill, lashing brace, post, etc.); these designations will be explained on the planbook from which staff making the tags will be working
- number of the piece in that element (e.g., wall board 3, portal facing 2, portal door 2, etc.)

3. Roofing crosspieces, shingles, and furniture will not be individually tagged but must be bundled by the deconstruction crew into like pieces; the planbook will specify the number and description of the pieces to be bundled, but completed bundles must be tagged for location and content. These tags should be written from the planbook and then given to Jake for eventual attachment.

4. When all tags are completed, staff will be assigned to attach them to the appropriate pieces of the Hmong House.

Marine Shells

1. Look over the drawer of shells in boxes and organize groups of like shells together. Remove any boxes or containers marked *type species* and set aside for your supervisor. Leave any empty boxes with others, but point them out to your supervisor.

2. Add Ethafoam and polybatting to the boxes as follows:

- shells only = Put piece of Ethafoam between box and/or paperwork and shell. *NOTE: A large shell might require a mount. See supervisor.*
- capsules = Place 1 piece of Ethafoam plus 1 piece of poly batting under capsules. *NOTE: If capsule is broken or in bad shape, replace shells into new capsule.*
- vials = Same as capsules (1 of each). *NOTE: If the end is plugged with cork that no longer looks good or with any kind of "cotton," change it to a piece of poly batting - we have lots of supplies.*
- enclosed containers = No need to put anything under the container. Change the "cotton" material inside the container to new poly batting. *NOTE: If the contents of the container are very small, cut a piece of Tyvek to fit the container and put that between the shell and the poly bat.*

3. When a drawer is completed, move the contents of the drawer, including any paper that might be in there, to the new white Delta drawers (we will get these for you). Keep them in the shell groups that you established.

4. Put dividers around the groups and secure with scrap Ethafoam.

5. Make sure the number of the original drawer is also put on the new white one(s). See supervisor for method.

Freshwater Mollusks

Mollusks are located in the vault in Kewaunee cabinets. They have been stored mostly as bivalve individuals, with both valves necessary to a single individual. Some have also been stored as right or left valves only. All will be mounted as below and packed in boxes for stacking on palettes and eventual removal into Delta drawers at the new facility.

1. Determine correct size of PET box to use; try to get the smallest possible. Although there are exceptions, you will usually pack one complete mollusk per PET box. You will find them, however, often in *groups* of bivalve individuals; the number of individuals in a box as you find it will be listed on the upper right corner of the information card for that box.

2. Line the bottom of the PET box with 1/4 inch Ethafoam.

3. Put both halves of an individual mollusk into the box with the hinge sides toward the middle.

4. Glue a Zotefoam separator between them.

5. Make sure a card is put into the box with the following information, copied from the "mother card" that was found with the specimen. *Use a pencil* for writing information.

- accession # of the individual being packed (found on the specimen itself; this number should either be the same as the number listed on the mother card or one of the numbers in the series listed on the mother card if more than one individual)
- scientific name

- the number of specimens in the box this one came from (found on the mother card and written on the new card in the upper right corner)
- the cabinet/drawer number found on the drawer from which the specimen was taken (written on the bottom left corner)

6. Place the mother card in the final PET box for those specimens; *a new card is not necessary for this only if the mother card lists only one individual.*

7. Put the box in drawers or boxes as instructed by the supervisor. Each repository is to be marked on the outside with the letter and number of the drawer from which the specimen was taken.

Exceptions

Mislabeled material: keep as you found it and have your supervisor put a note explaining the issue inside the PET box.

Unmatched elements: all left or all right valves are a "specialty" item and you should group them together in one PET box as they were found in the original box.

Questionable anything: see your supervisor.

Study Skins

This method is to be used for both bird and mammal study skins. The measeurements for materials given here are for the Kewaunee drawers that house the bird study skins; they should be converted to the size of the Lane drawers in which the mammal study skins will be packed for the mammal study skin project.

1. Remove a Kewaunee drawer; leave the birds in the drawer and handle them as little as possible.

2. Check to see that there is 1/4 inch Ethafoam lining the drawer; line if necessary, leaving the foam under the paper.

3. Check to see how shifty the birds are. If they move around very much, push them carefully to the back of the drawer, keeping them in their groupings.

4. Lay a piece of Tyvek 20" x 36" over the entire drawer.
- to cut Tyvek, cut 36-inch strips, then cut three 20-inch strips from each.

5. Top with a 19" x 34" pieces of polybatting from the brown bags.
- to cut batting, cut off a 34-inch wide strip, then cut two 19-inch wide strips from that (the extra bit will be about 10 inches). Two 19-inch strips will pad a drawer.

6. Top poly batting with another piece of 20" x 36" Tyvek.

7. Return the drawer to its place in the cabinet.

8. Write the total number of birds of each kind, with their Latin names, on a piece of green paper (ask supervisor for paper) and leave in the drawer.

Osteology Inventory

Osteology collections intended for this protocol are located in Upper Wabasha corridor. Other osteology from around the museum has been inventoried in a more general manner and also may require cleaning.

1. Go through all cabinets and locate all skeletal materials in Upper Wabasha cabinets and rear storage room.

2. Separate bird, mammal, and herpitological materials (indicate on cabinet doors).

3. Within each of these groups, examine, inventory, and separate the following categories in the drawers:
   a. speciments having any number
      - accession numbers = Z# or old biological #
      - collectors' numbers = RJO, NJU, FJ

   b. specimens with complete data but no numbers

   c. specimens identified for species with
      - no data
      - partial data

   d. specimens with no identification for species and no numbers

4. Cull material with no data or identification.

5. Use Osteology Tracking Form for all inventory.

Preparation of Skeletal Specimens

1. Remove skeletal remains from dermestid frass (beetle remains and excrement, being careful to remove all bones and to be vigilant for especially small ones. Although tedious, this process is facilitated by determining if

a. the skeleton should be complete by inspecting the written data accompanying the remains

b.. the skeleton is from a study specimen, in which case only a trunk skeleton is normally represented; there will normally be no skull, outer wing, foot, or toe bones in a bird and no skull, foot, or toe bones in a mammal.

2. After removing all bones from the frass, determine if additional cleaning is necessary. If considerable membranous and/or connective tissue is still attached, refeed the skeletal material to the beetles; if only dusty frass is present, remove it with the appropriate tools (brush, forceps, etc.).

3. After hand-cleaning skeletal materal, place it in an appropriate container and secure a label with identifying data to the outside. Completely immerse the skeletal material in ammonia solution (1-5%). Drill long bones of large animals on both ends to permit the solution to percolate into the bone and loosen the marrow.

4. Specimens should remain in the ammonia solution overnight (for small specimens) to several days (3-5 days for large specimens). Remove from container and dry on paper towels. Long bones should have fluids inside blown out with an air hose at both ends before drying. When dry, place bones in an appropriately sized acid-free storage box (use prepared PET boxes for Delta drawer material). Ensure that all written data is also placed in the box and that the accession # and species are written conspicuously on the outside.

Packing and Moving Mounted Articulated Skeletons

Most articulated skeletons are mounted on a platform, pallet, or structural support that can be used to transport them. Smaller specimens will stay on their platforms, which will be placed on a pallet to be transported. Some (the large crocodile, for example) come apart in sections and each section will be palleted for transport. Many can be transported easily in this fashion, without being enclosed.

1. Examine the specimen for stability, considering the amount of possible vibration and weight. Factors to consider include
    - % of real fossil or subfossil, as opposed to cast, material (fossils, and especially subfossils, are both more valuable and more subject to vibrations and changes in temperature or humidity)
    - weight without the head

2. Remove and pack the skull. Most skulls are slipped on at the back of the neck and held in place with a set screw. Remove the screw and the head and proceed according to protocol **Paleo.10**. If you have questions, contact your supervisor, the Curator of Paleontology, or the Conservator.

3. Check on the amount of vibration in the specimen once the head is removed. If you think further permanent supports are required to keep the specimen from becoming damaged during the move, contact your supervisor and move to the next specimen. Supports will be built by Conservator or Curators.

4. If you think your specimen is stable, add temporary supports as below. These supports are primarily for limiting movement and mitigating vibration. Extreme care must be used where they come in contact with the specimen.

    - For smaller specimens, block Ethafoam can be used for the primary support, with a Volara foam or Zotefoam in closer contact with the specimen. Acrylic felt can also be used against a surface to prevent abrasion (e.g., protect a painted surface or plexiglass from rough Ethafoam).
    - Cut blocks and pieces to fit and hot glue together. Do not glue to the platform or the specimen.
    - For larger specimens, the supports and braces can be a combination of wood and foam, but the same governing principles apply.

5. Label the specimen with name and/or accession # on a small plastic bag in which you have enclosed any attendant paper information. Tape the bag to an Ethafoam or wood support.

6. Finished specimens will be placed on a pallet and enclosed according to their individual needs.

Small Mammal Skulls

The goal of this project is to efficiently pack the vials of skulls so that they can be moved without excessive vibration to the new facility, eliminating any damage to the fragile skulls. Skulls are located in Kewaunee cabinets and a Delta cabinet in Rick Jannet's office off Upper Wabasha corridor. They will be packed at that location.

*We do not currently have either the time or the money to remove each skull and pad it individually (see protocol **Bio.15**) or to create the template for drilling the vial holders that are needed. Funds for proper, long-term storage for the skulls will be sought as part of the series of IMLS CP proposals that we have undertaken to complete our Biology storage requirements in the new facility.*

1. Precut all foam liners. Liners will be cut for the bottom and back of the cubby hole that is created when a tray of vials is removed.
   - The bottom will be 1/2-inch Ethafoam, cut to fit.
   - The back one strip of 1/4-inch Ethafoam, cut to fit.

2. Remove a tray from the cabinet.

3. Line the bottom of the cubby hole.

4. Check the vials. If they are loose and rattle, stuff padding between vials until they are stationary. Use Ethafoam scrap, polybat scrap, or tissue paper. The jars will not be removed from the tray or reordered. (Some vials may have already been separated with thin cardboard. In this case, skip this step.)

5. Replace the stabilized tray.

6. Place a piece of tissue or white butcher paper on top of the vials. This is a separation layer to protect the coding on the corks; cut tissue to fit.

7. Layer first with polybat (1/2") and then with Ethafoam (1/2") cut to fit.

8. Top with coroplast scrap cut according to the diagram below. The coroplast will be positioned so that it holds the rest in place.

9. After all trays have been treated, pad the front of the cabinet with Ethafoam (fit into doors) to ensure that the trays will not shift forward. Move in the current cabinets.

Small Mammal Flat Skins

1. Place each skin in an appropriately sized acid-free envelope. The envelope should be large enough to hold the entire animal, including tail and feet. *

2. Label envelope with specimen number and information per supervisor.

3. Place envelopes in a the boxes provided and then in drawers. These are series, so make sure that they are in numerical order.

* Contact Conservator if there are animals that do not fit in current envelopes. She will order a larger size, or, alternatively, create an L mount with a-f mat board and a mylar front or a custom-folded envelope.

Tanned Hides

Tanned hides are currently stored in Lane cabinets in the vault.

1. Line drawer with Ethafoam (1/4").

2. Lay hide in, flesh side down.

3. If the hide is too long for the drawer, fold it using crumpled acid-free tissue to pad the fold. Crumple the tissue as you roll it for better loft.

4. If it is necessary to stack hides, place a smaller hide on top of a larger hide with Tyvek in between. Avoid this if possible.

5. Watch for infestation. Contact supervisor immediately if you notice any frass or damage.

Trays for Osteology Collections

Padded and subdivided tray for skeletal parts

(Based on mount developed and described by C. Hawks in Storage of Natural History Collections: Ideas and Practical Solutions, ed. C. Rose, A. R. Torres.)

Purpose: This system can be used to cushion skulls and disarticulated skeletal parts in trays or boxes. It is designed to reduce vibration and prevent separate parts of the skeleton from abrading or damaging each other.

Description: A tray or box is lined on the bottom with a piece of Ethafoam or Zotefoam (crosslinked expanded foam). A second piece is placed in the box to pad around the specimen.

Used for	**Materials**	**Tools**
skulls	Ethafoam™	knife
(small to medium)	Zotefoam™	scissors
	tray or box	olfa knife
	Tyvek™	templates

1. Choose the appropriate size box for the specimen. The sides of the box should be as tall as the maximum height of the specimen. If such a box is not available, add a scrap of acid-free board to the sides.

2. Cut one piece of foam for lining the bottom (use scissors or an olfa knife to cut foam)

3. Cut the second piece of foam in a strip as wide as the skull is tall, and long enough to make a single uninterrupted band that winds around the skull and around the box.

4. Place the cranium and mandible in the cushioned container, keeping the teeth of both sections of the skull facing upwards. If the crania is unstable in this position, additional padding or braces (foam) can be added. Some skulls may have to be placed with the teeth down.

Trays for long bones

Purpose: The padded tray should provide the specimen with protection from vibration and from handling.

Description: The tray can consist of an acid-free box that is large enough to accommodate the specimen or a storage drawer. The tray is padded with foam and additional foam (backer cord or foam strips or blocks) are added to contain skeletal elements. The foam will be smoothed out or covered to prevent abrasion.

Used for	**Materials**	**Tools**
medium skeletons	specimen trays/ storage drawers	knife
long bones	Ethafoam™	straight edge
ribs	backer cord	hot glue gun
	Tyvek™	hot glue

1. Choose tray that accommodates the skeleton as it is laid out.

2. Cut a layers of 1/4 inch Ethafoam to fit in the tray. Place the foam liner on the bottom of the tray.

3. Lay out the specimen and mark locations with a pencil, taking care not to mark the specimen. *Move the specimen away from the tray* while you finish the packing.

4. Adhere backer cord or strips of Ethafoam to the liner. You can use a hot glue gun or a hot air gun to secure the foam. Create a series of "stops" and supports to hold the disparate parts of the skeleton in place. Line the rough foam with Tyvek or use a hot air gun to smooth out the surface.

5. Place the long bones back into the space and make adjustments. Add additional padding if needed.

Trays for small and medium skeletons (disarticulated)

Purpose: The padded tray should provide the specimen with protection from vibration and from handling.

Description: The tray can consist of an acid-free box that is large enough to accommodate the specimen or a storage drawer. The tray is padded with foam. Polyfill is used to create cavities for the skeleton. The polyfill may need to be lined with Tyvek to prevent fibers from snagging on the specimen.

Used for	**Materials**	**Tools**
medium skeletons	specimen trays/ storage drawers	scissors
long bones	Ethafoam™	straight edge
ribs	Tyvek™	hot glue gun
	muslin	hot glue

1. Choose tray that accommodates the skeleton as it is laid out.

2. Cut a layers of 1/4-inch Ethafoam to fit in the tray. Place the foam liner on the bottom of the tray.

3. Place a single layer of polyfill in the tray; cover with a sheet of Tyvek or muslin.

4. Lay the specimen out in the tray, making indentations and "valleys" where the bone is.

5. If deeper or stronger cavities are needed, mark the places and move the bone. Cut the cavity and line it with Tyvek or muslin. If rigid padding is needed add Ethafoam or Zotefoam. Return bones to cavities.

Cradles for Osteology Collections

Purpose: To provide support for large specimens.

Description: These for are specimens that are too large and complicated to fit in a cabinet. They will be stored on open cantilevered shelving. They can be properly supported by making Ethafoam cradles and braces. The cradles must be lined with Tyvek to prevent abrasion.

Used for	**Materials**	**Tools**
large specimens	Ethafoam™ sheet & plank	knife
long bones	Tyvek™	straight edge
large skulls	muslin	hot glue gun
		profile gauge
		scissors

1. Examine object and determine where the most advantageous place to put the support is. Most skulls should be placed on the cranium, with teeth up.

2. Using a profile gauge, determine the contour of the area that will be cradled. The gauge will provide you with the contour that can be transferred to the foam block. Transfer the profile of the object at the points where the cradle will contact it. Do this very carefully. The cradle should follow the profile of the object closely so that there will be even pressure on the object. Cut the foam.

3. Make a base (if needed) out of appropriate rigid materials.

4. Attach the cradle to the base. The method of attachment will depend on the materials involved.

5. Pad the cradle and other supports as needed. Use a barrier (Tyvek) as needed. Remember that Ethafoam can be very abrasive.

<u>Cradle for very large objects</u>

1. Build a wooden pallet that is larger than the object. Attach castors to the bottom of the structure. The pallet should be wide enough to provide at least 2 inches of padding on the outside.

2. Attach uprights and add braces for strength.

3. Cut Ethafoam to fit between uprights. Use 2-inch or 3-inch thick as needed.

4. Use plastic profile gage to create the correct profile for the cradle. The gauge can be pressed against the object *IF* the surface is stable and the object can take the stress. *DO NOT USE METAL* gauge.

5. Reproduce the profile on the Ethafoam and cut foam.

6. Attach the Ethafoam to the wood structure with hot melt glue.

7. Line the rough surface of the Ethafoam with Tyvek or with muslin.

8. Secure the lining by making small slits in the Ethafoam and tucking the lining into the slit.

Insects

The Insect Collection will be moved inside its current cabinets in the Entymology Room. A secondary Insect Collection is located in a Kewaunee cabinet in Upper Cedar corridor, to be removed and packed in boxes for transfer.

Upper Cedar insects

1. Pack all boxed insects in b-boxes so that they do not shift. Use scrap packing materials to stabilize.

2. If there are insects that are not enclosed in a box, see supervisor.

Upper Wabasha insects

PDB is present and is hazardous to your health. Only people who have been fitted with respirators will work on this project.

1. Unbolt cabinets if needed.

2. Add Ethafoam padding to the inside of the doors to prevent shifting.

3. Skid cabinet out from the wall and insert two-wheeled dolly under it.

4. Each cabinet will be wheeled onto the truck and taken as is to the new facility, where it will be reinstalled in the Entomology Room in the vault.

To remove PDB

1. Read Material Safety Data Sheets on PDB, wear protective clothing and half-face respirator with organic filter. Precautions are laid out in the MSDS.

2. Remove box from cabinet and then PDB from each case.

3. Dispose of PDB in the proper manner, according to MSDS and SMM rules.

4. Seal box with clear 3M packing tape.

6. Replace each box in its proper slot.

Nests

Nests are often made of loosley woven twigs and fibers. Some are sturdier than others. Always handle with great care as there are a lot of protruding and loose parts that can be come entangled with storage materials. Nests are located in the vault with the eggs; some have already been mounted.

1. Choose or make a tray that is larger and deeper than the nest. Use acid-free materials (coroplast, a-f cardboard, mat board or foam core).

2. To create a "nest" out of polyester batting, line the tray (bottom and sides) with polybat.

3. Make a cavity in the polybat that is slightly larger than the nest. Follow the contours of the nest.

4. Cover the polybat with Tyvek and secure.

5. To make a lifter, cut a rigid board (a-f cardboard, mat board, or foam core) to match the size and shape of the bottom silouhette of the nest.

- Make two slits and insert two cotton tie straps. If possible, use two pieces of 1/2-inch or 1-inch twill tape crossing at the bottom. Be generous with the twill tape.

6. Place the lifter at the bottom of the cavity with the straps accessible.

7. Place the nest on the lifter in the cavity.

8. Put the mounted nests back into Kewaunee drawers.

Permanent Storage for Small Mammal Skulls

IMPORTANT: These skulls are a series. Their order must be retained at all costs.

Padding skulls in vials

1. Cut lots of ____backercord, ____ inches long.
2. Prepare work space. Specimens are small and very fragile. Work over a nalgene pad.
3. Prepare a new tray. Line it with Ethafoam (1/8") or with Zotefoam.
4. Remove vial from tray. Remember to keep in sequence.
5. Open vial and remove specimen with tweezers. Make sure that all of the specimen is out.
6. Place backer cord in bottom of vial.
7. Replace specimen in vial and cap it using the same cork.*
8. Place the vial in the padded tray, keeping it in sequence.

*The cork may be changed to a polyethelene stopper.

Long-range plan for containers

IMLS funding should support the development and use of a template to drill place-holders for individual vials of small mammal skulls in rigid foam trays. Questions still to be answered are

- What kind cabinets are we going to use for these collections?
- Can we use existing trays for the base size?
- Can IMLS funding be used to purchase cabinets as well?

Sorting and Packing Unaccessioned Comparative Osteology

Science Museum osteology collections have been used in other departments throughout the museum for identification and comparison. Many of these accessioned specimens have become mixed with unaccessioned materials from diverse sites and contributors and will require sorting before returning to the collections. Much of the unaccessioned material will eventually be accessioned into the collection as well, but this will be a future project.

1. Osteology from other departments in the museum will be collected by Collections staff in the Packing Room.

2. Conservation staff will check for infestation, and infested boxes will be frozen here and returned to the Packing Room before being sorted into accessioned and unaccessioned material.

3. Remove all material with numbers or information referring to z or other numbers and place in the provided container.
   - If bones are in a tab or black box together, leave them in the box to place in the container.
   - If any accessioned material looks very fragile, wrap in tissue and then 1/8-inch Ethafoam.
   - Accessioned materials will be taken to the Biology lab to be packed according to the appropriate protocol.
   - These materials will be stored in the Collections office next to to the Delta pallets until the Assistant Curator is ready to process and pack them.

4. Pack remaining unaccessioned materials in white b-boxes lined with 1/4-inch Ethafoam with a minimum of padding so that they will be stable enough for the move.

   - Place bones or groups (keep together) in plastic bags.
   - If any material looks very fragile, wrap with tissue first then 1/8-inch Ethafoam.

5. Red-tag the box, mark with the number of bones in the box, and write clearly on the top and end of the box:

Unaccessioned Comparative Osteology

6. Use a grey sticker marked for delivery to the new Biology lab A325 and send to warehouse for palleting.

Osteology in Hollinger Boxes

Some of SMM's osteological specimens are currently stored in acid-free Hollinger boxes. These collections will remain in their current storage with a few modifications. Bones that are very dirty with remaining membranous material will be removed and refed to the dermestids. Bones that are a little dirty or greasy will be packed for short-term storage and red-tagged for further processing after the move. Bones that are clean will be packed for long-term storage and remain housed in the Hollinger boxes in the new facility.

Short-term Storage

1. Remove bones and line bottom of the box with 1/4-inch Ethafoam.

2. Line the padded box with a piece of Tyvek.
   - To make a liner, cut Tyvek large enough to cover the bottom and sides of the box. Make cuts to the corners and fold them up. This will make the liner less bulky.

3. If there are many bones, layer them starting with the biggest in the bottom and inserting a piece of 1/8-inch Ethafoam between each layer. If bones are very fragile, consider using polybat pillows (protocol **Conserv.6**) instead of the Ethafoam inserts.

4. Red-tag each modified Hollinger box and pack in white b-box.

5. Red-tag the b-box, write how many of each size Hollinger is in the b-box, and mark clearly on top and end with the name of the project:

Red-tagged for Cleaning

6. Use a grey sticker and mark for delivery to Biology lab A325.

Long-term Storage

1. Remove bones and line bottom of the box with 1/4" Ethafoam.

2. If there are many bones, layer them starting with the biggest in the bottom and inserting a piece of 1/8-inch Ethafoam between each layer. If bones are very fragile, consider using polybat pillows (protocol **Conserv.6**) instead of the Ethafoam inserts.

3. Pack the modified Hollinger boxes in ceramic cartons, write how many of each size Hollinger is in the carton, and mark clearly on top and end with the name of the project:

Long-term Hollinger Storage

4. Use a grey sticker and mark for delivery to Bone Room A322.

Keep track of the number of packed boxes of each size on the provided forms. Put all b-boxes and cartons in plastic garbage bags and send to the warehouse freezer.

Packing Mounted and Counted Shells

Regarding packing, there are two types of shells awaiting boxing in Kewaunee cabinets in the vault: shells that have been mounted and shells that are in black boxes and trays. These shells have all been previously prepared for transport and we are now ready to have them packed into cartons. The challenge for these shells is to stabilize them as well as possible in their cartons so they will not bang around and become damaged.

Notes: Shells found already mounted will use their **storage mounts** as their **traveling mounts**.

Orientation: Use the most stable position for storage or transport, generally on base. Supplement the mount with padding as described below.

Box: The box must provide at least 1 inch around all dimensions of the shell. If the box is used for more than one shell, additional padding must be placed between them.

Padding, wrapping materials:

1. Padding consists of

- plank or sheet Ethafoam or Zotefoam
- styrofoam peanuts and shredded Ethafoam in polyethylene bags (various sizes)
- polyester batting, covered with muslin or Tyvek

2. Wrapping includes a variety of barrier materials including

- Tyvek,
- acid-free tissue
- Nomex

MOUNTED SHELLS

1. Use at least 1/2-inch Ethafoam in the bottom of the box.

2. Wrap the shell in the appropriate barrier material. Use the softer materials for the more fragile shells. *Please be particularly conscious of protruding parts. Wrap these so that they will not be stressed or grabbed during the unpacking process.*

3. Place shell with mount on the foam liner. Use large bags of styrofoam peanuts or shredded Ethafoam to pad around it. Use smaller bags to fill gaps. When appropriate, fill the center cavity with pads or crumpled tissue paper.

4. Include as many mounted shells as will fit in one box, being careful to use Ethafoam barriers between them so they cannot touch.

5. If shells are short enough for another layer to be put into the box, pad above them as described below for unmounted shells and place a second/third layer on the coroplast separator. Pad shells of differing heights individually to create a relatively level coroplast surface.

6. Place peanut pillow above the shells and close and tape the box.

7. Label the box (on the end) with the word **Shells**, the number of shells, and the Kewaunee drawer(s) from which they were taken.

UNMOUNTED SHELLS IN BOXES AND TRAYS

1. Use at least 1/2-inch Ethafoam in the bottom of the box.

2. Lay boxes or trays to fit on lining; block any empty space between so they will not shift. Try to match the boxes for height (of the shells inside them) as well as you can.

3. Place a layer of tissue, cut to fit the box, over the entire layer.

4. Place a layer of polybat, cut to fit the box, over the Tyvek.

5. Place a separator of coroplast, cut to fit the box, over the polybat.

6. Continue to layer in this fashion until the box is full.

7. Pad the top with a peanut pillow or otherwise appropriate pad and close and tape the box.

8. Label box as above. Write the numbers of all Kewaunee drawers from which you have taken boxed shells for each carton on the end of that carton.

Packing Osteology Collections in PET Boxes

Osteology currently located in Upper Wabasha Corridor is to be rehoused into clear plastic PET boxes and displayed in new Delta drawers and cabinets in the Bone Room of the New Facility. After these skeletons have been inventoried, follow the instructions below to pack.

1. Determine correct size of PET box to use for the specimen you are rehousing; try to get the smallest possible.

2. Line the bottom of the PET box with 1/4-inch Ethafoam if it has not already been prepared.

3. Remove the skeleton gently from the cardboard box it is currently in and place it in the PET.

4. Drop the information slip (there should be one with each specimen) on top of the skeleton and close the top.
   - If there is no information slip, see the Assistant Curator immediately and do not pack without his approval.

5. Place the PET in a Delta drawer lined with 1/8-inch Ethafoam, retrieved from the pallet room for this purpose.
   - Osteology drawers are located in the pallet room and come in depths of 2 1/4 inches, 3 1/4 inches, 4 1/4 inches, and 5 1/4 inches. Choose the depth you will need for the size specimen you are packing and take as many drawers as you think you will fill back up to Upper Wabasha corridor either by carrying or on a hand truck.
   - Your supervisor or someone with a key to the pallet room must take you there. Hand trucks should be available on the East dock.
   - You will be packing these in the hallway and then stacking them on a pallet especially designed for them in the Collections office (or other location as indicated). Ask your supervisor to show you where and how to stack.
   - Ethafoam cut to fit the bottom of the drawers should be provided to you at the packing location, along with scrap Ethafoam and other materials for blocking.

6. Try to fill the drawer with as many uniformly sized PETs as possible; the goal is to use no more depth than is necessary and to use as few 5 1/4-inch drawers as possible.

7. Animals placed in a drawer together should all be either mammals or birds; do not mix the two.

8. If the boxes do not fit neatly enough to avoid sliding, block with scrap Ethafoam, etc.

9. Number the drawers consecutively from 1 through XX and write down on the Inventory next to that specimen the number of the drawer into which each accession # has been placed.
   - Drawers should have pieces of paper cut to fit the label holder that is on the front of each. These papers should be provided to you and if you do not see them at the beginning of the project, remind your supervisor to get you some. Hand write the drawer number on the paper before you slide it in place.

10. Place the Delta drawer on the pallet in the Collections office (or other location as indicated) and put all discarded boxes into Barrett boxes, which are available in the Biology office to be made up by taping the bottoms. Do not tape shut, but make sure your supervisor knows where you have left them when you are finished for the day.

Coroplast Trays for Banker's Boxes

Tools Needed: Utility knife, ruler, triangle, pen, awl, tapestry needle, cotton twill tape, scissors

1. Coroplast should measure 14 1/2" (vertical) x 17 1/2" (horizontal).

2. Use a ruler to draw lines 1 1/2 inches from all edges.

3. Score along each of your vertical lines and on the horizontal lines BETWEEN the vertical lines with the utility knife. To make scoring easier, extend the knife blade less than 1/8 inch. This way it will be very difficult to cut through both layers of the material.

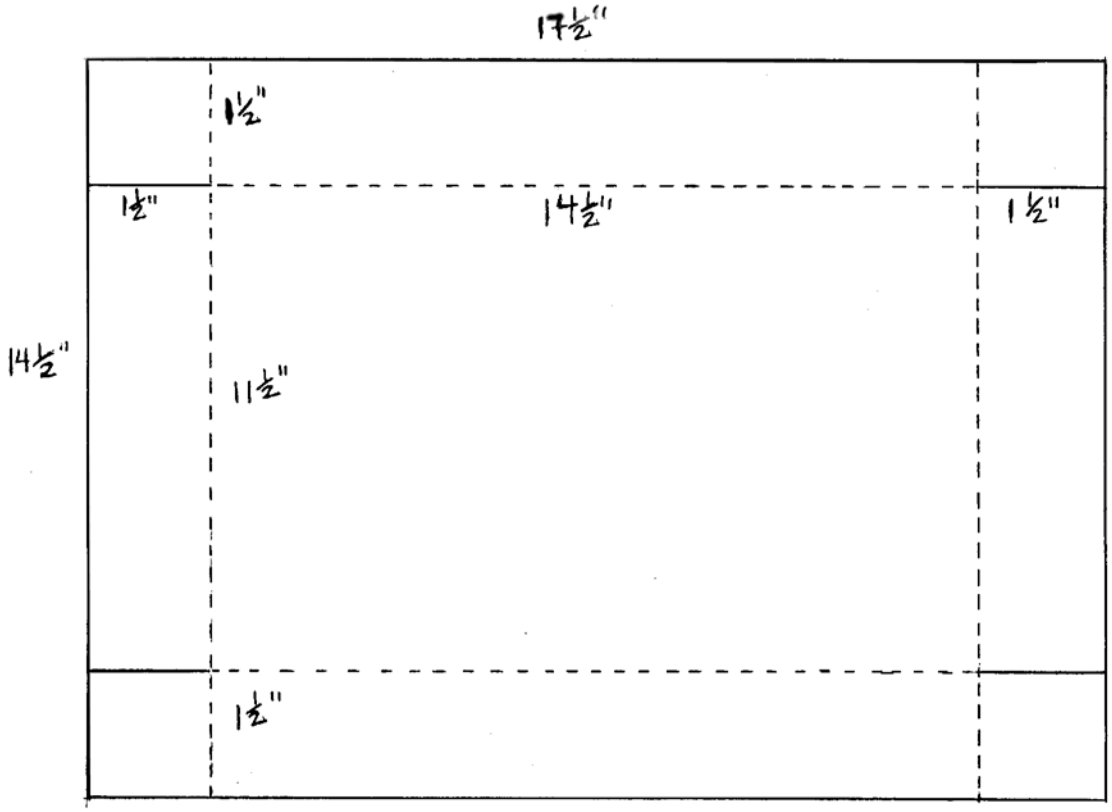
4. Cut on the horizontal lines from the vertical lines through the edge of the coroplast (4 cuts).

5. Fold edges up and fold the cut flaps over the ends. Use a binder clip or pony clamp to hold the flaps in place if necessary.

6. Punch two holes through each overlapped flap and tie down with twill tape. Needles and crochet hooks may be used to pull the twill tape through the holes.

7. Punch two evenly spaced holes in each short end to make handles; make sure they are far enough apart to balance the contents.

8. Run twill tape through the holes and tie off in loops for handles.



Collections Move Condition Surveys

Conservation report surveys are required for all ethnographic material as well as other types of material as requested.

1. Before the ethnographic or other object has been mounted or stabilized, answer the questions on the Collections Move Condition Surveys that you will find available in the packing room. If you do not see them, ask a packing manager.

2. Leave the survey with the object or in the pile on the end of the table, depending on instructions.

3. The following list of terms is available to help describe the condition of the object:

CONDITION REPORTING GLOSSARY

The following are some of the many terms used to describe conditions.

GENERAL TERMS

Abrasion: A wearing away of the surface caused by scraping, rubbing, grinding, or friction; often superficial.

Accretion: Any external material deposited on a surface, most often from burial conditions on objects or accidental deposits on paintings (splashes, drips, flyspecks, etc.) (cf. **inclusion**).

Adhesive residue: May be from glue, paste, pressure-sensitive tapes.

Bleeding: The suffusion of a color into adjacent materials, often caused by water or other solvents.

Bubbly areas: A type of deterioration found in cellulose nitrate and acetate.

Chip: A defect in the surface caused by material that has been broken away.

Corrosion: The chemical alteration of a metal surface caused by agents in the environment or by reagents applied purposely. Corrosion may affect an object's color and texture without altering the form (bronze disease) or it may add to the form, producing hard nodules or crusts (rust). **Bimetallic (or galvanic) corrosion** results from incompatible metal contact.

Crack: A surface fracture or fissure across or through a material, either straight-line or branching in form; no loss is implied. A crack may be described as **blind** when it stops part way; as **hairline** when it is a tiny fissure; and as **open** when it is a large fissure.

Crease: A line of crushed or broken fibers, generally made by folding. A **dog-ear** is a diagonal crease across the corner of a paper, parchment, etc.

Crocking: Rubbing off of color, resulting in the loss of dyestuff but not loss of fiber.

Delamination: A separation of layers; **splitting**.

Dent: A defect in the surface caused by a blow; a simple concavity.

Discoloration: A partial or overall change in color caused by aging, light, and/or chemical agents. **Yellowing** and **darkening** can occur, along with **bleaching** (the lightening of color) and **fading** (a loss of color and/or a change in hue).

Disjoin: A partial or complete separation of a join between two members of an object, as distinguished from a **crack**, **tear**, **check**, or **split**.

Distortion: A warping or misshaping of the original shape; **shrinkage** may occur.

Dry rot: Decay of seasoned timber caused by fungi that consume the cellulose of wood, leaving a soft skeleton that is readily reduced to powder.

Efflorescence: Powdery or crystalline crusts on the surface of stone, plaster, ceramics, etc., formed when transmigrating water reacts with an object's chemical makeup or extraneous deposits from burial.

Embrittlement: A loss of flexibility causing the material (eg., paper, parchment, leather) to break or disintegrate when bent or curled.

Gouge: A defect in the surface where material has been scooped out.

Fraying: Raveled or worn spot indicated by the separation of threads, especially on the edge of a fabric.

Inclusion: Particle accidentally bonded to the surface of an object during manufacture (eg., ceramic, plastic, cast metal, paper).

Iridescence: Color effect in glass due to the partial decomposition of the surface and the formation of innumerable thin scales, resulting in an uneven, flaky surface.

Loss: Missing area or hole.

Mildew: See mold

Missing element: Loss of an integral component of, or an addition to, the material or appendage (eg., handle, tassel).

Mold: Biological in nature, mold or mildew can be in the form of **foxing**; of colored, furry, or web-like surface excrescences; and/or of musty odor.

Odor: Smell of sulfur, camphor, vinegar, etc.; produced by the degradation of cellulose nitrate or acetate products. Strong odor indicates severe degradation.

Oozing: See sweating

Patina: A colored surface layer, either applied or naturally occurring.

Pest damage: Surface loss, tunneling, holes, fly specks, etc., obviously caused by insects or other pests.

Pitting: Small, irregular, shallow pinhole-size losses scattered over the surface of metal caused by acid conditions or resulting from the casting process.

Powdering: Stone surface that is crumbling or pulverized.

Red rot: Powdery red substance found upon vegetable-tanned objects resulting from a chemical reaction with pollutants in the air.

Scratch: Linear surface loss due to abrasion with a sharp point.

Sheen: A polish produced by handling, often occurring on frequently touched locations.

Silvering: Shiny or mirror-like discoloration in the shadow areas of a photographic image caused by the aging of excessive residual sliver compounds.

Spalling: Shallow losses or flaking from the surface of stone or ceramic.

Soil: A general term denoting any material that dirties, sullies, or smirches an object. **Dust** is loose soil generally distributed on surfaces; **grime** is soil tenaciously held on surfaces; a **smear** and a **fingerprint** are types of local grime. A **spatter** or **run** is the result of dried droplets or splashes of foreign material.

Stain: A color change as a result of soiling, adhesives, pest residue, food, oils, etc. A **diffuse** stain is without a distinct boundary; a **discrete** stain has a distinct boundary; a **liquid** stain has a discrete boundary or **tide-line** that is darker than the general area of the stain; a **centered** stain has a darker or more intensely colored center within its general area. In **metallic** staining, adjacent materials are discolored as a result of metal corrosion.

Sugaring: Erosion of the surface of marble creating a very granulated or "sugary" surface appearance.

Sweating: A clear or yellow oily liquid found on the surface of a deteriorated cellulose nitrate or acetate object.

Tarnish: A dullness or blackening of a bright metal surface.

Tear: A break in fabric, paper, or other sheet material as a result of tension or torsion.

Wear: Surface erosion, usually at edges, due to repeated handling.

Weeping: On glass, a reaction between water and formic acid.

Measuring Objects for Volume

The purpose of volume measurement in the context of the Move Project is to determine how much space each object will occupy in the new cabinetry. The volume that is needed is the amount of space a specific object will occupy in the new storage facility. This includes the mount if it will remain with the object.

NOTE: These measurements are not for use in ARGUS — accurate measurements for catalog cards will be done at a future date, as time allows. Catalogue protocols for measuring objects are located in another document.

Please use the following standards for measuring objects:

- Take measurements in **inches.**
- Record the measurements in the following order: **Length (L)**, **Width/Depth (W)**, **Height (H).**
- Use tools that will not scratch or damage the object that you are measuring.
- Measure to the quarter (1/4) inch; always round up.

How to measure

- Measure the base as a rectangle (L, W). If the base is irregular, extrapolate.
- Measure the height (H) of the object when it is on its mount. Include the base.
- Degree of accuracy: measure to 1/4 inch. Always round up; example:10 3/16 inches = 10 1/4 inches.

Tricks for measuring the height

- Put the object on the mount in the correct orientation.
- Place a wooden or plastic stick on the top of the object. Balance it on the rim or keep it parallel to the ground. *DO NOT USE METAL — it will scratch the object.*
- Place a ruler on the table, perpendicular to the table so that it intersects the stick or rod. Read the point of intersection and record that number as the height. Make certain that the numbers on the ruler begin with "1" near the table. Include the height of the mount base in the measurement.

Tools

- **Ruler**: Please use a wood or plastic ruler to prevent damage to the object. The first inch should begin near the end of the ruler. Do not worry if the tool is not perfectly accurate — this is a ball park measurement. (preferred method)
- **Rod or stick**: Please use a wood or plastic stick or other straight edge to prevent damage to the object. The one requirement is that the tool be rigid. (preferred method)
- **Dial caliper**: For smaller objects, a dial caliper can be used to measure all 3 dimensions. Ask your supervisor for one. Use a plastic one to protect the object.
- **Wood caliper**: Use this to measure each dimension, compare opening to a ruler.

Handling Museum Objects
Gretchen Anderson, Conservator, SMM

The museum is responsible for preserving collections. Collections care staff are responsible for preventing damage whenever possible. Research has shown that the biggest threat to museum collections comes from handling! This is also the easiest threat to control. By following the handling procedures laid out below, each of us can significantly reduce the threat to the collections.

Please remember that any sort of damage, no matter how seemingly minor and inadvertently caused will result in irreversible changes to the object. By following the procedures and precautions discussed below, you will be protecting the object for future study, exhibition, and use. Compliance with these procedures will eliminate many of the situations that cause damage.

In case of accident: Should any object be damaged while you are hanlding it, or should you notice unreported damage, contact the Collections or Conservation staff immediately. Keep all broken pieces and documentation together. Document the damage, including how the accident happened. Never undo or remove tape or glue, stitching, or alterations from an object unless directed by Collections or Conservation staff.

The basics rules for handling are common sense. Think and prepare before you pick anything up.

- *minimize the amount of handling*
- *think before doing*
- *use common sense* (you do not pick up a delicate roman glass vial in the same way as you do a stone tool)

Preparing yourself and the work space

1. Dress

- Wear a smock or lab coat that is provided. This will protect the object from buttons and belt buckles and will also protect your clothing from the materials and tools we will use in the project.
- Remove any jewelry or other dangling item that could scratch or catch on the object.
- Wear gloves. Both cotton and latex gloves will be provided. This will protect the object from the natural oils on your hands. These oils can stain the object, and if it is metal, actually etch into the surface. Gloves also protect you from any harmful substances on the object.
- Wash hands thoroughly with soap and water before *and* after handling an object.

2. Space

- Please do not eat or drink in proximity to the object. Spills will stain and alter the piece and will provide food for pests.
- Keep space clean and uncluttered. Clean up the space often as you work.
- Use only pencil (no ink) when working near an object.
- The work bench should be padded. Please do not cut directly on the padded tables. Cutting pads will be provided.
- Use supports to keep the object stationary.

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Strategies for picking up objects

- Think before you pick an object up.

- Examine the object *before* picking it up to determine its stability. Look for breaks, cracks, old repairs and other potentially unstable areas.
- Avoid handling applied decoration and areas that appear fragile. Do not lift by the rim or handle. These areas are usually weak.
- Gauge the weight and fragility of the object.
- Plan where and how you are going to place the object before you pick it up.
- Use both hands to lift the object. Cradle it; keep the weight as even as possible.
- Carry one object at a time.
- Plan your move before you make it. Know where you are moving the object and how you are getting there.
- Determine how you are going to set it down before you pick it up. The object should be set down in the most stable position.
- Always put the object down in the most stable position. You will be making a storage mount for it that should stabilize it in the most stable position. Use pads and snakes to stabilize the object.

Special situations

1. Delicate artifacts: *objects with feathers, brittle fibers or powdery areas require special attention.*

- Avoid touching surfaces that appear to be unstable.
- Use latex glove (cotton may snag and smudge) and set the object on a smooth surface.

2. Insect or mold: *if you suspect insect or mold activity contact the Conservation staff immediately.*

3. Textiles
- Use gloves.
- Support the textile on a board, handle the board, not the textile.
- Carry a rolled textile by the ends of the tube, not the textile.

4. Metals
- Always wear gloves when handling metal.
- Archaeological metal is often fragile due to corrosion.

Make sure that different metal objects do not touch each other.

5. Baskets
- Always support the basket from underneath, using both hands.
- Never lift a basket by the rim or any projecting part. This will be the weakest area and will tear.

When the object can harm you

The above handling procedures are designed to protect both the object and the handler. Some museum artifacts may be hazardous to the handler by the inherent nature of the material, the cultural use of the object, or as result of treatment or preparation methods. You will be informed if there is any question of risk and the museum Collections staff will provide the appropriate protective safety equipment.

The following lists are a selection of potential hazards at SMM.

Wear vinyl or latex surgical gloves and lab clothing with the following. These objects contain toxins that may be absorbed though the skin:

- poisoned arrows or darts
- mercury from the backs of deteriorated mirrors
- beads made of poisonous seeds or other plant material

The following types of objects may be associated with a particle irritant. Wear gloves and a particle mask if toxic particles that can be ingested or inhaled are suspected.

- biocidal treatments on skins, taxidermy, fur, feathers, buckskin, textiles (includes arsenic, DDT, borax, white lead, strychnine)
- fungicide treatments (mercuric chloride)
- iron objects treated with vapor corrosion inhibitors
- silver and copper objects treated with corrosion inhibitors such as benzotriazole (BTA)
- papier mache objects made with asbestos fibers
- any objects treated with PDB or naphthalene repellent
- fumigated objects (ethylene oxide)
- mummified objects that may be infectious

Soft Pads and Pillows

Styrofoam peanut pillows

1. These pillows can be filled according to the requirements of the specimen (size, weight, fragility). For large heavier specimens, use more peanuts and larger bags. Do not fill bags too full.
- Remove as much air as possible from the bag.
- Place bag under object and carefully nestle specimen into a stable position.
- Place additional bags around and over specimen carefully to hold it in place.

Pillows and snakes with polyester* batting

The batting must always be separated from the object or specimen to prevent fibers from being stuck onto the specimen. Do not use cotton batting — it is hygroscopic.

1. Pillow
- Batting is stuffed into a bag (cotton, stockinete, Tyvek). This can be made to size of cavity or tray.
- Stitch or tie the bag closed.
- Place pillow below, above, or around specimen for delicate cushioning.

2. Pillow-pad
- Placed batting directly on the bottom of a padded cavity or tray to the thickness required to support the specimen.
- Tear or mold the batting to provide a cavity if needed by specimen.
- Cover the batting with a separating layer (e.g., Tyvek, muslin, mylar). Secure the the separating layer (tuck, adhere with hot melt).
- Lay object on pillow.

3. Snakes
- Cut stockinette. The length will vary according to what is needed.
- Stuff batting into a 2-inch or 3-inch (or whatever necessary length) cotton stockinete tube. Amount is determined by what the snake is being used for. Try to keep the batting smooth. Longer snakes should not be filled to capacity to allow for flexibility. An easy way to fill a snake is to cut a long strip of batting, turn snake inside out, and fill.
- Tie off the ends with cotton twill tape. (Alternatives: stitch closed, tuck ends of stockinette back into snake, knot ends of snake.)
- Snakes can be used as pads, separators to divide one object from another, soft rings for baskets or ceramics, etc.

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How to Make a Pallet into a Box

1. Acquire a pallet that is the correct size for the oversized object concerned.

2. Ensure that the deck is strong enough to hold the object. Add a sheet of plywood if necessary. Screw down in corners and on sides.

3. Pad the plywood with Ethafoam (1/4" - 1"); thickness will depend on the needs of the object. Generally 1/4 inch will be okay.

4. Create appropriate mount, i.e. cradle, cavity, or pad (see Conservator for guidance).

5. Place object on pallet.

6. Screw sides onto pallet. Sides can be regular (acidic) cardboard or plywood. The sides should be at least 2 inches higher than the specimen.

If a wood frame is required

1. Use 1"x 2" wood.

2. Cut 4 lengths for the uprights.

3. Screw these onto the pallet sides at the corners with the cardboard between the pallet and upright.

4. Add cross-bracing as necessary.

Packing Ceramics for Transport to New Facility (Archaeology and Ethnology)
Gretchen Anderson, Conservator, SMM

MOUNTED CERAMICS

The **storage mount** for the ceramic object should be used as its **traveling mount**.

Orientation: Use the most stable position for storage or transport, generally on base or rim. Supplement the mount with padding as described below.

Box: The box must provide at least 1" around all dimensions of the ceramic. If the box is used for more than one ceramic piece, additional padding must be placed between them.

Padding, wrapping materials:

1. Padding consists of:
- plank or sheet Ethafoam or Zotefoam;
- styrofoam peanuts and shredded Ethafoam in polyethylene bags (various sizes); or
- polyester batting, covered with muslin or Tyvek

2. Wrapping includes a variety of barrier materials:

- Tyvek,
- acid-free tissue, and
- Nomex.
- These materials are to be used if the ceramic surface is friable or unstable. Choice of material is determined by the condition of the ceramic.

Packing

1. Use at least 1-inch Ethafoam in the bottom of the box.

2. Measure ceramic according to protocol (Conserv.3).

3. Examine ceramic for condition. Pay particular attention to any old breaks or repairs, surface condition, and protruding parts. Write condition on the Collections Move Condition Survey (see Conserv.2) and collect them as instructed.

4. Wrap the ceramic in the appropriate barrier material. Use the softer materials for the more fragile ceramics. *Please be particularly conscious of protruding parts. Wrap these so that they will not be stressed or grabbed during the unpacking process.*

5. Place ceramic with mount on the foam liner. Use large bags of styrofoam peanuts or shredded Ethafoam to pad around the ceramic. Use smaller bags to fill gaps. When appropriate, fill the center cavity with pads or crumpled tissue paper.

6. Place bagged padding above the ceramic and close box. *Do not stack ceramics in the box without sufficient padding between them, even if they appear to nest comfortably.*

7. Label the box in the following manner:
- box number = **C** (for ceramics) plus box number; example: **C25**

- culture or geographic area; example: **Mexico, Etruscan, Peru**
- designation: **A** for Archaeology, **E** for Ethnology; example: **A**
- An example of a labeled box will have the following information: **C15 Peru A** , or **C25 Mexico E**

Recording

1. Write the following information on the Ceramic Inventory and Box List
- box number
- object number of each piece in that box
- dimensions (L, W, H) in inches of each piece
- culture or geographic area or each piece

Unpacking

1. Remove lid and upper padding.

2. Examine ceramic to note any damage.

3. Remove padding from around ceramic and examine.

4. Lift ceramic, using support if possible. *Do not lift by the rim or any protruding parts*.

5. Examine and note any additional damage.

MOUNTED CERAMICS IN TRAYS

Many small ceramics will be mounted in premade trays. These may be temporary or permanent mounts. The sides of the tray you choose should be higher than the object.

Box: Use a b-box. The premade trays are designed to fit a b-box.

Padding, wrapping materials: Same as above.

Packing

1. Use at least 1/2-inch Ethafoam in the bottom of the box.

2. Check tray to ensure that the ceramics are not taller than the tray sides.

3. Place the tray with padded and supported ceramics in the box.

4. Pad the ceramics with small bags filled with peanuts or shredded foam. Use a separating layer of tissue or Tyvek if it is needed.

5. Repeat with the a second tray. Generally there will be no more than 2 to 3 trays per box.

6. Pad the top with a bagged styrofoam or otherwise appropriate pad.

7. Label box as above.

Recording

1. Write the following information on the Ceramic Inventory and Box List

- box number
- object number of each piece in that box
- dimensions (L, W, H) in inches of each piece
- culture or geographic area or each piece

Unpacking

1. Remove lid and upper padding.

2. Examine objects in tray as above, note damage for future treatment.

3. Remove tray.

4. Repeat until you have reached the bottom of the box.

CERAMICS WITHOUT MOUNTS

You may come across some ceramics that are not mounted. Please contact supervisor to have mount made. Once an object is mounted, proceed from the appropriate instructions above.

Determining Archaeology in Ethnographic Collections

Objects that have been found under or on the ground by archaeological expeditions form a subset of ethnographic materials that will be kept in separate storage in the new facility.

1. As each new ethnological or ceramic cultural group is approached for packing, the packers will give a list of all the objects known to be part of that project to the Curator of Anthropology. These lists will be generated by Kristen and passed to ethno packers or ceramic packers at least a week before the culture is scheduled to be packed.

2. The Curator will clearly mark all objects that he considers to be part of the archaeological collections on the lists. This may take a few days as he may have to visit certain objects. When he is satisfied, he will return the list to the packers.

3. Once the marked ethnology list is returned, packing will begin and the items will be appropriately sorted, marked, and tracked according to established protocols for their A or E status. See instructions on tracking forms for Ethno-Archaeology and Ethnology/Drawers or Ethnology/Boxes.

4. Once the marked ceramic list is returned, packers will box and mark all ceramics from that culture accordingly (see protocol Ethno.1). Boxes of ceramics will be marked **C** (for ceramics), numbered consecutively, and denoted either **A** (archaeology) or **E** (ethnology).

Ring Mounts

Used for	Materials	Tools
ceramics	backer cord	knife
baskets	Ethafoam™	scissors
ground stone	hot melt glue	glue gun
	acid-free board	tape measure

1. Measure the circumference of the object. Use a cloth measuring tape or a length of twill tape for an accurate measurement.

2. Decide on the diameter of the backer cord. For large objects use a thick diameter. For smaller objects use thinner diameters.

3. Measure the correct length and cut the material with a knife or scissors. An angle cut provides the best tensile strength. The ring should be sized to provide the maximum support for the object.

4. Join the two ends using one of the following methods:

   - **hot melt glue**: Smear a bead of hot melt glue onto a tongue depressor. Smear the hot glue onto one end and immediately put the ends together. It will take less than a minute for the adhesive to cool. *DO NOT PUT THE BEAD DIRECTLY ON THE FOAM — it will melt into the foam, leaving a hole.*

   - **hot air**: Heat both ends of the foam cord at the simultaneously. At the point when the foam begins to deform (melt), roll the ends together. The foam ends will bond instantly. This weld is stronger than using glue. It takes some practice to make this work.

5. The ring should be sized so that it provides continuous support to the object. It can be adjusted by cutting small sections away in the interior.

6. Mark the ring with the catalogue number of the object. Use a permanent ink pen at the front of the ring.

Variations

Several rings: Some objects will require several rings to fully support them. Use several rings, as constructed above, to create a stable support.

Tray: Some objects will require a tray. If a flat tray is called for, make 1/2 inch to 1 inch larger than the object on all dimensions. This will protect the object from accidental bumping when placed in the mobile storage unit. A flat tray can be made of any archival rigid material that is strong enough to support the weight of the object (i.e. a stone object will require a heavier board than a ceramic or a basket).

- Acceptable boards = acid-free cardboard, coroplast, acid-free foam core, mat board. Attach the ring or series of rings to the board with hot melt glue. A tray with sides might be required.

Extra stability: Some objects (i.e. tripod ceramic pots) need additional stability. Be creative in the use of backer cord and Ethafoam padding to add supports as required.

Cavity Mounts

Purpose: Cavity mounts provide support to a three dimensional object. This is can be either a subtractive or an additive method. In the simplest form a hole is made in the base material and then the hole is form- fitted for the object to be stored there.

Used for	Materials	Tools
ceramics	Ethafoam™	knife
baskets	hot melt glue	scissors
ground stone tools	Tyvek™	glue gun
		tape measure
		profile gauge

1. Examine the object and determine the appropriate type of material to use and where support is required.

2. Measure the circumference of the object. Use a cloth measuring tape or a length of twill tape for an accurate measurement. A profile gauge can be used if the object is sturdy enough.

3. Decide on the thickness of foam needed to support the object. *Hint*: Sometimes it is easier to use several pieces of foam to create the cavity. You do not have to cut the entire mount out of one piece — use one for the base and one for the sides and weld the two together.

4. Determine the correct profile and cut or scoop out the shape in the foam. Use a knife or a curved knife to excavate the material.

5. Work the cavity until it fully supports the object.

6. Line the cavity with a barrier material like Tyvek as needed.

7. If you have used more than one layer of foam you will need to attach the two (or more) layers together. Use hot melt glue or hot air for this.

Padded Tubes for Textiles

1. Determine the size tube to use. The diameter of the tube is determined by the size of the object being rolled. For small textiles, use a smaller tube. Use a carpet tube for large textiles.

2. Cut tube 2 inches to 6 inches longer than the width of the object to be rolled.*

3. Remove all debris from tube (vacuum it out).

3. Cut Marvelseal so that it extends 1 inch over each end of the tube. Roll the tube in the laminant and fold ends over edge of tube.

4. Heat seal the laminant to the tube with an iron.

5. Cut and wrap a layer of polyester batting (low loft) around the tube. Padding should be long enough to fold over each end of the tube and wrap around once. Seam should be difficult to detect.

6. Whip stitch batting along seam.

7. Cover with cotton stockinette. Stockinette should be long enough to tuck ends into the center hole of tube.

8. Cover tube with Marvelseal.

*If the textile is over _____inches wide, cut the tube 12 inches longer than the maximum width. It will be placed in a cradle.

L Mounts

This mount style is designed especially for photographs. It can also be used with some documents. Small textiles that are structurally strong and in excellent shape can also be stored this way.

3. Cut a piece of archival board to a standard size, larger than the object.

4. Cut a piece of mylar the same size as the board.

5. Lay double sided tape along two adjacent edges.

6. Position the mylar.

7. Remove the release paper and secure the mylar.

8. Slip the textile into the mount.

Textile Mounts: Overview

Textiles will be rehoused in two phases over the next two years.

Categories of textiles

Most of the SMM textile collection falls into one of these categories:

1. Flat textiles that are strong enough to be rolled on padded tubes

2. Textiles that are fragile, inflexible, have embroidery, surface relief, or seams, and cannot be safely rolled

3. Three-dimensional clothing

4. Woven fiber mats and tapa

Assumptions for textile storage

- All flat textiles will be either stored flat or rolled on tubes.
- Tubes will be stored in Delta Design Cabinets.
- Large textiles will be stored, rolled, in the large cabinet (110" wide).
- Small textiles will be stored in regular cabinets, integrated into their culture groups.
- All flat textiles that can be safely rolled will be stored on rolled racks, including flexible basketry mats.
- Fragile textiles and textiles with heavy decoration will be stored flat in cabinets.
- Rolling is generally better for flat textiles than folding.
- If a textile must be folded, all folds will be padded.
- Textiles stored flat in storage will not be stacked (exception: encapsulated and matted textiles).

Choosing the proper mount

It is important to use care in handling textiles while preparing mounts. Textiles should always be fully supported by a padded board when being handled.

1. Before making a textile mount it is important to consider the following factors:
- The category of textile
- The material
- The construction
- The condition or the structure and the surface

2. The mount style should be chosen based on a careful consideration of all the aspects of the object.
- Structurally strong textiles can be easily rolled on padded tubes (**Ethno.5**). Especially large or long textiles may also be rolled; some may have to be rolled with more care than others (**Ethno.14**).
- More fragile textiles or textiles with surface relief should be stored flat (**Ethno.11**).
- Clothing should always be stored flat with creases and folds gently padded (**Ethno.13**). Large textiles may have to be folded to fit in drawers; the folds must be well padded with acid-free tissue.
- Small or inflexible mats and tapa can be stored flat. Large very flexible mats or tapa can be rolled with care (**Ethno.5; Ethno.14**). Some mats or tapa have been folded in the past and have become very brittle. Please contact the Conservator before unfolding these objects.

3. Please refer to the following protocols when selecting and creating textile mounts:
Ethno.5: Padded Tubes for Textiles
Ethno.6: L Mounts
Ethno.7: Textile Mounts: Overview
Ethno.8: Simple Flat Mounts
Ethno.9: Flat Window Mounts
Ethno.10: Flat Mounts for Fiber Mats
Ethno.11: Encapsulation
Ethno.12: Quilts
Ethno.13: Clothing
Ethno.14: Rolled Textiles
Ethno.15: Hats and Shoes
Ethno.16: Belts

Special cases

If there are questions concerning the packing for Native American collections, check with Faith Bad Bear.

1. Native American clothing (hide or wool shirts, dresses, leggings)
- Shirts and dresses: lay out flat in padded Delta Drawers. Pad sleeves and shoulders with acid-free tissue. Some shirts or dresses will have to fit drawers, then only fold on non-beaded or -quilled surfaces. Pad folds.

- Leggings: lay flat in a padded drawer. Do not stack. Pad folds with acid-free tissue carefully.

2. Native American moccasins (check with Faith Bad Bear)
- Moccasins are currently padded out too much; this needs to reduced. Use acid-free tissue.

3. Native American headdresses
- Faith will be designing and executing this protocol.

4. Huiples
- Flat in a drawer with padding at the shoulders and any other folded sections.

- Use acid-free tissue.

5. Inuit rain gear
- Keep current mount for child's coat.

- Adult coat: Lay flat in a padded drawer. Fold only if aboslutely necessary and pad folds. Use acid-free tissue to pad.

6. Hmong skirts
- Skirts will be stitched to hold their pleats and rolled in the traditional manner. The work is being done by Hmong women and documented by Tim Ready.

7. Japaneses (?) rain coat
- Maintain current mount—no work required.

Simple Flat Mounts

Use for strong, stable, and small textiles such as lace samples.

1. The textile can simply be spread out and placed on a piece of acid-free tissue.

2. Move the object on a board and slide the tissue right into the drawer.

3. Place each textile on a separate piece of tissue.

Window Mounts

For more fragile textiles, use a window mount.

1. Cut two pieces of archival board to a size at least 1 inch larger than the textile. If you are mounting a series of similar pieces, choose some standard sizes so the mounts can be stacked. Types of archival board:
- Acid-free cardboard (buffered)*
- Acid-free foam core (unbuffered)
- Acid-free mat board (unbuffered)
- Coroplast

2. Cut a window slightly larger than the textile out of the upper mat. Cut a second board to make 3 layers if additional height is needed to accommodate the textile.

3. Cover the outside of the window with mylar. Stitch or use double stick tape to attach the mylar to the board. If a mild pressure fit is desired, cover the inside of the window with the mylar instead.

4. The bottom mat can be lined or unlined. Use a lining for unstable pieces that have loose fibers or for pieces that are very slippery. Types of liners:

- Unbleached cotton muslin can be used for items that need some tooth to prevent slippage.
- Tyvek can be used for pieces with loose fibers.
- Reemay can also be used in place of Tyvek.
- Acrylic felt can be used to add additional padding for very fragile textiles. Cover the felt with muslin or Tyvek. Quilt the base for more support if necessary.

5. Tack the liner to the backing board with thread or double stick tape. Make sure tape is well away from the textile.

6. Hinge the two pieces of board with Tyvek tape or gummed linen tape.

7. Make a coroplast folder to group a small series of objects mounted like this.

* Never use buffered (grey board) in direct contact with hides, wool, silk, or fur - add a separating layer.

Encapsulation

Definition: Process used to support fragile paper or textile between two sheets of polyester film, usually held together with double coated tape, sewn or heat sealed. The preservation method does not alter the object in any way and is easily reversible. This provides a mount in which the object can be seen on both sides and one that fully protects the object.

This style is particularly good for fragile textiles and for documents. Degraded labels can be encapsulated.

Fragile Textiles, Paper Documents

(Peruvian textiles, shattered silk)

- Cut two piece of mylar film (3 or 4 mil) to 2 inches to 3 inches larger than the object.
- Place double stick mylar tape along all edges of one piece of mylar.
- Place the textile or document in the center of the mylar, well away from the adhesive.

- Begin exposing the adhesive in one corner. Pull back silicone release paper about 1/3 -1/2 of the way along adjacent sides.

- Position second piece of mylar at the corner, making sure that it is aligned properly.
- Press down in the corner and secure the mylar.
- Remove the release paper and continue to lay down the mylar. Watch to see that the object remains stationary.
- Finish encapsulating the object.

VARIATIONS

Encapsulation with a Mat

- Encapsulate as described above.
- Cut two archival boards for additional support.
- Cut a window in one board that is slightly larger than the object.
- Place the encapsulated piece on the solid board and hinge it at the top using tyvek tape.
- Hinge the boards at the side with Tyvek tape with the encapsulated object between them.
- Write the number of the object on the top board.

This variation is particularly good for textiles that are fragile, but are part of a study collection. The mount allows for handling with little or no danger to the object. It can be done with one or two windows.

Quilts

Quilts are a special problem. They are large, too large for most cabinets or shelves. Their construction is such that it is difficult to roll them. They are bulky and it is difficult to fold them. SMM's collection contains at least two quilts that size. Both are modern and in good condition.

At this time they will be rolled.

Instructions:

- Prepare a large padded tube to size.
- Prepare a full liner of muslin.
- Cut a length of thin polybat and a second of muslin.
- Postition the quilt on the liner with the pattern facing up.
- Place the second piece of muslin and batting on top of the quilt.
- Roll loosely as described in rolling textiles.
- Tie as described in Rolled Textiles.

Clothing

The following is a basic protocol for clothing. There will be many variations depending on the type and condition of the clothing. Please use common sense when working with clothing. Do not get too complicated. If an object requires special packing, contact Gretchen or Rebecca. We may stay with a simple method now and upgrade at the other end as needed.

Faith will be consulted on all Native American clothing. She will directly work on the more complicated pieces (e.g., headdresses).

Clothing will not be stacked or piled.

Clothing will not be folded unless there is no other way to do it.

Basic Packing and Storage for Clothing

Prepare drawer.

Pad with Ethafoam or Zotefoam liner (1/4" or 1/8" will be used most commonly).

Figure out the best (most efficient) orientation for the object.

Pad all folded areas (e.g., shoulders, sleeves, folds for leggings). Use crumpled and rolled acid-free tissue (unbuffered). Keep the pad as smooth as possible. This will prevent the fold from creasing.

- Do not pad seams—this causes stress on the fabric.

If there is fringe, make sure that it is laying flat and straight in the drawer.

Consider the drawer to be the tray, particularly for larger objects.

Do not fold beaded or quilled items unless there is no other way to store them.

Check the SPNCH book for additional ideas if you need them.

Rolled Textiles
- Always roll in the direction of the warp.
- Fully support all fringe.

Protocol
- Measure the dimensions of the textile to be rolled.
- Prepare a padded tube. (large diameter tubes are 4"-8", small diameter tubes are 1"-3"; Cut the length of the tube according to the selvage width of the textile. (see protocol).
- Lay out the textile on a clean padded surface.
- Prepare a "leader." This is a piece of muslin, Tyvek or acid-free tissue (material depends on the size and weight of the textile). The leader should be the width of the tube and long enough so that it will wrap around the tube at least three times. Some textiles will be supported for the entire length and width.
- Lay the leader out with about 1/3 of it under one end of the textile. Position the textile so that end with the label (should be in one corner on the back) will be rolled last. Make sure that the fringe (if present) is laying straight in line with the warp on the leader.
- Begin rolling the leader. Watch carefully as the textile begins to be incorporated into the roll. Keep the warp even and straight. Adjust the tube as needed.
- Interleave with unbuffered acid-free tissue. Place a single sheet of tissue the width of the textile.
- If there is fringe then repeat the leader (muslin).
- When the roll is complete, tie it off with a wide piece of twill tape. Place a collar of acid-free paper or card stock between the tie and the textile. This will spread out the pressure from the tie and knot. (An option would be to stitch Velcro on the ends of the strip so that there is no knot.)

There is no need to put cloth covers on the rolls that are going in cabinets.

VARIATIONS

Large Flexible Mats
- Use a large diameter tube prepared with steps 1-4. (Cut the tube, seal with barrier. Do not pad.)
- Use a piece of muslin the entire length of the mat, including fringe (add length for at least 3 turns around the tube). Muslin and tube must be long enough to support fringe on the sides of the object.
- Roll very loosely. Use a thin layer of polybat, separated from mat with muslin if additional support is needed.
- Tie off as described above.

To Roll Large Fragile Textiles
- Follow the above procedure, except use a sheet of muslin that is as wide as the textile and longer. The muslin will provide better support for the textile. There is no need for interleaving paper when muslin is used in this manner.

Tapa
- Use a midsized tube, with Marvelseal, but not padded. Cover tube with stockinet.
- Interleave with tissue.
- Tie off as above

Rolled Peruvian Textiles: Very fragile objects, but much too long to be stored flat.
- Prepare a small (no more than 2") tube out of 7 mil. Mylar. Mylar is used to reduce weight.
    - Cut rectangle of Mylar.
    - Make tube, securing it with double-sided tape.
- Use a single sheet Mylar (2mil or 3 mil) to support the textile and provide a leader.
- Roll as above.
- Tie off.

Hats, Moccasins, and Shoes

These are objects that require padding on the interior and may or may not need a tray (padded, not padded). All depends on the object and the fragility of that object.

Hats:

- The cap should be padded out. Use either acid-free tissue or a cotton stockinet pillow filled to the right density with polybat.

- If the hat is fragile or requires a tray, make one using a flat, acid-free board that is rigid enough to support. Some hats might be supported better on a padded board. Most do not need more than this.

- If the cap is soft, pad out with tissue, or make a form out of a polybat pillow.

Shoes and moccasins

- If there is a pair of shoes, consider making a small tray for support (usually flat, without sides). Provide a way to tie the pair of shoes on, using twill tape.
- Provide exterior support if needed.
- Pad the interior of the shoe with a wad of acid-free tissue. DO NOT OVER-STUFF — this can cause great damage.
- Carefully tie the shoes onto the tray. Use wide twill tape and blotter paper or another barrier to spread out the pressure and prevent deformation.

Woven Belts

There are many woven belts or strips in the collection. The most efficient way store them is flat for the shorter ones, or rolled. These are up to 4 inches in width.

To Roll A Belt

- Make a small padded tube OR make a twist of tissue as the center of the roll.
- Lay the belt out flat.
- Place a piece of acid-free tissue under the end of the belt so that there are several inches sticking out the end. The tissue should be wide enough to fold over the belt in thirds. If there is fringe the entire length of fringe should be "lined" with the tissue.
- Begin rolling the tissue around the padding. Roll evenly. Do not interleave.
- When the entire piece is rolled, Tie it off with a cotton tie. If there is fringe, line the fringe described above.
- It can be stored on the selvage edge.

To Pad A Belt

If the belt cannot be rolled, then it must be stored flat. Often these will be too long for a drawer. Therefore must be folded.

- Lay the belt out in the padded drawer.
- Estimate where the fold needs to be.
- Place a pad made of either acid-free tissue or fabric pad where the fabric will be folded.
- Fold.
- Repeat as necessary

The pad is there to prevent creases. There does not have to be much in the way of padding..

Looms

This class of object can be very complicated. Many looms in SMM's collection have woven fabric ** on them. There are also additional loom parts that might need to be dealt with. All parts should be stored together in a tray or other wise clearly marked. Most should be rolled unless otherwise noted. ++ Do not ever take the loom apart.

** The following description includes textile looms and mat looms.
++ Small looms can be laid flat. Follow the protocol for flat textiles on a tray.

Backstrap Loom with Fabric or Mat

- Lay the textile out on a very clean surface, preferably padded.
- Cut or tear a piece of muslin at least 6 inches longer and about the maximum width of the loom.
- Place the loom on the muslin so that there is extra fabric on the top and the bottom. Any decoration on the fabric should face up, so that it is seen when unrolled.
- Cut or tear two more pieces of muslin the length and width of the woven sections of the loom. (Alternative materials: acid-free tissue, Tyvek—as determined by needs of the object)
- Cut a piece of polybat less than the length and width of the woven section. Use very low -oft polybat. Split it down the middle if necessary. If you think it still too thick, use acrylic felt.
- Layer the materials: muslin - polybat - muslin.
- Fold one end of the base muslin over the loom to begin rolling. Roll loosely.
- Tie the muslin cover with a wide tie and a strip of 1/8-inch Ethafoam or a-f blotter paper to prevent squishing.

The width of the polybat bat will be determined by the width of support required.

Alternative materials are determined by the strength, fragility and weight of the material.

Do not put the batting directly on the textile. The fibers will catch on the weave.

Discrete Study Collections

Discrete paleontogical study collections are currently housed in Kewaunee cabinets in Wabasha corridor hallway and labs, in the vault, and in the packing room. They mostly comprise mammals but may entail members of other packing categories as well. The Curator has indicated that all of these specimens will be examined and sorted before permanently locating them in Delta drawers once in the new facility and that all of them may be packed without individual mounting or other preparation.

1. These collections will move on special wheeled palettes that will securely hold two single Kewaunee cabinets. After the Curator has indicated which collections are to move in these, packers will need to take the Kewaunee cart to the collection to transfer materials.

2. Transfer drawers from the stationary to the cart Kewaunee one for one; that is, put the drawer into the same cabinet location from which it was taken.

3. Check the drawer for specimens that might roll around and stabilize any with small styrofoam pillows.

4. Leave cart Kewaunee locations empty if that location was empty in the corresponding stationary Kewaunee.

5. Pack spaces between drawers tight enough with styrofoam pillows that materials will not fall out if cabinets were upended.

6. Transfer the cabinet label from the stationary to the the cart Kewaunee.

7. Fill both cart Kewaunees in the same manner.

8. Roll the cart to the loading dock to be trucked to the new facility.

Invertebrates

Invertebrates are located in Kewaunee cabinets in the vault. These need very little packing as they will not be mounted but only stabilized for stacking on palettes. They will first be moved to the warehouse where they will be rehoused in the same cabinets once they have been reassembled there. At the final move to the new facility they will be handled in the same fashion as the Discrete Study Collections (Paleo.3). See also Paleo Workplan 3: Steps to Duration Storage of Paleontology Fossil Invertebrate Collection.

1. Drawers for be packed for removal to the warehouse should be checked for unstable specimens and reinforced with small styrofoam pillows so nothing will roll or move.

2. Each drawer should then get larger styrofoam pillows to fill.

3. Labels remain on drawers as they are stacked on palettes in the order which they were removed.

Vertebrates, Pleistocene

Pleistocene materials are being packed in one of two ways: banker's boxes for smaller specimens and individualized wood pallets for larger specimens such as crania.

Banker's boxes (long or standard as necessary)

1. Wrap individual bones in 1/8-inch Ethafoam and tie with twill tape. This process is similar to wrapping an odd-shaped Christmas gift, folding end pieces in first to be caught under the central and final fold. Tie in a bow. Write accession number, if there is one, on the finished package and place into the appropriately-sized and lined banker's box.

2. When bones seem too small for the above treatment (most bones the size of smaller ribs or less), lay as many as you can lay flat (from a single drawer only) into a coroplast tray, a gray acid-free tray, or a brown 8 1/2" x 11" box and cover with appropriately sized pillow of styrofoam peanuts. Place the whole box into the banker's box. Bones packed in this manner should not stick up higher than the sides of the smaller box.

3. Put the contents of a single cabinet only in as many boxes as necessary, but do not mix cabinets in any single box. Line the bottom of the box with 1/2-inch Ethafoam and put a pillow on top of the packed specimens. Count the number of bones in the box and write how many there are on the outside of the box along with the number of the cabinet from which they were taken and any accession numbers found on the objects.

Custom wood pallets

1. Line pallet with 1/2 inch Ethafoam.

2. Position cranium upside down and prop up with blocks of 2-inch or 3-inch Ethafoam toward the back where the bone is thickest. The horns should rest about 1 or 2 inches above the palette. You may need to stack two or more blocks of Ethafoam to achieve this.

3. Slightly tilt the cranium up so that the thick, strong bones at the rear of the skull bear most of the weight. Place Ethafoam supports near the cheek bones to maintain the tilt. Be careful not to place the support under the fragile nasal bones.

4. Carve a well in the main block of Ethafoam to cradle the top and back of the cranium. Carve cheek supports so they fit snugly against the bone. Make a third carved support that fits against the back of the skull so it will not slide out of the mount.

5. Smooth the carved out wells with a tacking iron or hot air gun.

6. Line all with Tyvek.

7. Glue all the supports down with hot glue. Add additional supports as needed.

8. If other parts of the skull (e.g., jawbones) are found with the cranium, mount them on the pallet as well. Simple well mounts should suffice for this associated material. The wells should also be lined with Tyvek.

Vertebrates, Fossil Fish

The fossil fish collection basically follows the same procedure as Marine Shells (Bio.1).

1. Pack fossil fish individually in standard black boxes to fit unless they are too big. Larger specimens should have blue corrugated cardboard cut to fit. Please use a standard template size if not too awkward; cut rectangle just to fit if standard sizes seem inappropriate.

2. Line boxes (but not boards) with 1/8-inch Ethafoam. There is no need for well mounts unless specimen will roll out or off.

3. Glue scrap 1/2-inch Ethafoam to make border on corrugated cardboard. Edging should be snug to specimen (so it will not move very much) and flush with cardboard edges.

4. If there are any associated paper documentation or notes, place these under the Ethafoam and clip a corner to indicate there are notes underneath.

5. Slide papers listing accession numbers of specimens between the foam and the box end. Slide them under the specimen on board mounts.

6. Place finished mount wherever indicated by packing manager.

Vertebrates, Mammals

Vertebrate mammal collections are currently housed in Kewaunee cabinets in the vault. They comprise mammals not included in Discrete Study Collections (Paleo.3). The Curator has indicated that all of these specimens will be examined and sorted before permanently locating them in Delta drawers once in the new facility and that all of them may be packed without individual mounting or other preparation.

1. These collections will move on special wheeled palettes that will securely hold two single Kewaunee cabinets. After the Curator has indicated which collections are to move in these, packers will need to take the Kewaunee cart to the collection to transfer materials.

2. Transfer drawers from the stationary to the cart Kewaunee one for one; that is, put the drawer into the same cabinet location from which it was taken.

3. Check the drawer for specimens that might roll around and stabilize any with small styrofoam pillows.

4. Leave cart Kewaunee locations empty if that location was empty in the corresponding stationary Kewaunee.

5. Pack spaces between drawers tight enough with styrofoam pillows that materials will not fall out if cabinets were upended.

6. Transfer the cabinet label from the stationary to the the cart Kewaunee.

7. Fill both cart Kewaunees in the same manner

8. Roll the cart to the loading dock to be trucked to the new facility.

Paleobotanicals

The fossil plant collection basically follows the same procedure as Marine Shells (Bio.1).

1. Pack fossil plants individually in standard black boxes to fit unless they are too big. Larger specimens should have blue corrugated cardboard cut to fit. Please use a standard template size if not too awkward; cut rectangle just to fit if standard sizes seem inappropriate.

2. Line boxes (but not boards) with 1/8-inch Ethafoam. There is no need for well mounts unless specimen will roll out or off.

3. Glue scrap 1/2-inch Ethafoam to make border on corrugated cardboard. Edging should be snug to specimen (so it will not move very much) and flush with cardboard edges.

4. If there are any associated paper documentation or notes, place these under the ethafoam and clip a corner to indicate there are notes underneath.

5. Slide papers listing accession numbers of specimens between the foam and the box end. Slide them under the specimen on board mounts.

6. Place finished mount wherever indicated by packing manager.

Dinosaurs

Unjacketed dinosaurs not on display or being prepared in the lab are stored in Kewaunee cabinets in Wabasha corridor or labs, in the vault on shelves, and in the pallet room in Kewaunee cabinets. Jacketed specimens are located in the vault and in the paleontology lab on trucks and shelves.

Unjacketed dinosaur bones small enough to fit in boxes

1. Dinosaur bones located on shelves in the vault will be moved from the vault to duration storage elsewhere in the museum. These bones have been prepared and mostly comprise two individuals, one of which is to be mounted for exhibit in the new facility. It will not be necessary for us to worry about the complete individual, but great care should be taken to box and track accession numbers together.

2. All bones with accession numbers (any number beginning with P) will be packed. Bones without accession numbers, regardless of what other numbers we may find on them, should be left on the shelves until all accessioned bones are packed.

3. Wrap individual bones in 1/8-inch Ethafoam and tie with twill tape or string. The process is similar to wrapping an odd-shaped Christmas gift, folding end pieces in first to be caught under the central and final fold. Tie in a bow. Write accession number on the finished package.

4. Put like accession numbers together in the appropriately sized b-box. Count the number of bones in the box and write how many there are on the outside of the box along with the accession number. Then label the box D1, D2, and so forth. Find all like numbers first and leave until last those that do not have enough components to fill one box. Make sure that multiple accession numbers are all recorded on the outside of the box.

5. Exceptions to the above rule are the several obviously laid-out sections of vertebral column that you will find on the shelf. *Some components of these sections may not have accession numbers; they are to be packed with the rest of the section*. Wrap and mark them exactly as described above but *include on each bone their order in the whole section*; for example, 1 of 23, 2 of 23, 3 of 23 and so forth (for a section with 23 total pieces).

- Place these in order in appropriately sized b-box(es).
- Write the total number of bones in the box on the outside with the accession number.
- Label the box Dx through Dxx as part of the overall sequence of boxes.
- And finally, mark each box for its number in the packed section; for example, 1 of 3, 2 of 3, and 3 of 3 (for a section that filled three boxes). *Do not put any other bones than the bones from one section in any of the section boxes*. Fill with scrap if necessary.

Jacketed dinosaurs and large unjacketed specimens

1. All large and jacketed dinosaurs with a P accession number will be placed on move pallets and simply stacked. These are very heavy and should be stacked to be as stable as possible.

2. Write all accession numbers from a single pallet on a sheet of paper and tape to the top of the stack.

3. Full pallets will be shrink-wrapped on the spot and moved to a designated staging area to await transport to duration storage elsewhere in the museum.

Unaccessioned specimens

1. When the above procedures are complete, there will remain on the shelves a number of unaccessioned specimens, both jacketed and unjacketed. These will be moved by museum staff to the top of the Kewaunee cabinets in Wabasha corridor to be cataloged by the Curator before further processing.

2. After cataloging, these bones will be packed according to the same procedures described above.

Casts and Restorations

Casts and restorations will be moved first to the warehouse and then finally to the new facility on the same palettes. They are located in all parts of Paleontology and will be marked for retrieval by the Curator.

1. Once all casts and reproductions have been retrieved and taken to the packing room, they should be sorted roughly by size.

2. Smaller objects can be put into banker's boxes together with enough scrap Ethafoam padding to keep them from rubbing or moving around too much.

3. Boxes need only to be marked on front and back as "Paleo Casts".

4. Larger objects should be stacked as securely as possible on pallets.

5. Where packers are aware of certain objects (some will have labels) all cast from a single kind of animal, those objects should be stacked both boxes and larger pieces together on a single pallet.

Protocol and Information for Moving Non-Collections Objects

Use this protocol for packing all Research and Collections objects moved to the warehouse, the West Building, or to the new facility that are not considered part of Science Museum Collections; i.e., those ***office/lab/exhibitry items that are not currently accessioned or expected to be accessioned in the future****. Other divisions should see their move coordinators for instructions.*

1. All objects (e.g. typewriters, lab supplies, books, paperwork, etc.) should be packed into Barrett Moving Company cartons if they will fit. For items too large, use whatever is at hand or ask your supervisor to bring something appropriate.

- boxes should be taped on the bottom; use three strips if you think the box will weigh a lot
- tape the top shut also
- write a general description of the material in the box on the end of the box where indicated; if you are not using Barrett Boxes, just write on an end or side where it will fit
- place a grey moving sticker in the upper left corner of the end on which you have written the contents and fill in the department from which the material comes and the destination of the box (Work Station)
- see New Facility Laboratories and Office Number list for destination codes
- if you are not sure which department and/or destination you should use, ask your supervisor

2. Any furniture of other large objects that do not fit in boxes at all should also be marked with a grey sticker and the same information. Place the sticker somewhere prominently on the object.

- NOTE: the West Building elevator is 67 3/4" X 88 5/8"; make sure your object is not too big if your intention is to send it to West.

3. Each time any of these boxed items or furniture are removed to one of the storage areas listed above, a staff person should make an inventory of the boxes, pallets, and items that were moved including the date and the movers (usually Barrett). If you are taking boxes in a truck or car, treat it as a move and record in the same fashion. List department and destination and give to Debbie for typing and inclusion in the grey notebook. Identify all Barrett Boxes as such; use the term "box" or "carton" for other boxes.

- If you are making up a pallet, check the notebook (grey paper binder) for the next consecutive pallet # (look in Pallet Inventories) and use it to mark a grey paper (available in the notebook, packing room, or from Debbie) for each of the four sides of the pallet with the department and the pallet # (W3, W4, etc), to be wrapped in and visible from all sides.
- Make an inventory list of everything on that pallet and include a copy of your handwritten list wrapped on top of the pallet. Give the original to Debbie for typing and inclusion in the grey notebook.
- Remember that all items on a pallet will go to one destination. Use a grey sticker on top of the pallet to indicate that destination.

APPENDIX D:
STATUS REPORTS

2001

Department	Delivery	Status	Packers	Storage Location
Archaeology				
1. Bowman (Army Corps)	July 19-21 *A356 (vault)*	Finished	X	Paleo Hall
2. Casts (unaccessioned)	July 19-21 *A356 (vault)*	Waiting for 1 pot to be cast	Tim Fiske	Paleo Hall
3. Casting Supplies (unaccessioned)	30-Jun *A334 (a.lab)*	Waiting for 1 pot to be cast	Tim Fiske	Imaging Lab
4. Chert Collection (unaccessioned)	June 14-15 *A334 (a. lab)*	Finished	X	West
5. Collections Exhibit	? *exh. hall*	Not started	volunteers	Paleo Hall
6. Collections Exhibit Leftovers	Oct. 11 *A356 (vault)*	Not started	volunteers	Vault
7. Cross (St. Croix)	30-Jun *A334 (a.lab)*	Finished	X	Imaging Lab
8. Grand Meadow	30-Jun *A334 (a.lab)*	Waiting for Orrin	Tim Fiske	Imaging Lab
9. Ohio Sites (loans)	See Orrin Shane			
Incinerator Site	Mailed to Ohio	9/10ths	Frans, Kermit, Tim	Arch Lab
Heckelman (9 boxes)	Mailed to Ohio?	Finished	X	Arch Lab
33ER75 (4 boxes)	Mailed to Ohio?	Finished	X	Arch Lab
33ER85 (unsorted)	Mailed to Ohio?	Not started	Frans, Kermit	Arch Lab
10. Library, Arch Lab (unaccessioned)	June 14-15 *A334 (a. lab)*	Finished	X	West
11. Library, Ethno Lab (unaccessioned) *note: all A.Indian to *A339* (Faith)	30-Jun *A337 (e. lab)*	Not started	Friday a.m. ladies	Ethno Lab
12. Misc. Lab Red-tags and Deaccessioned	30-Jun *A334 (a. lab)*	1/2 finished	Tim Fiske	Imaging Lab

13. Other Sites Warehouse	Jun-00	Finished *A356 (vault)*	X
14. States Collection Warehouse	Jun-00	Finished *A356 (vault)*	X

Department	Delivery	Status	Packers	Storage Location
Biology				
1. Bird Study Skins (IMLS)	20-Oct *A356 (vault)*	Finished	X	Paleo Hall
3. Bug Colony (unaccessioned)	June 21-23 *A321 (derm.)*	Ready	Dick	Biology Lab
4. Collections Exhibit	? exh. hall	Not started	volunteers	Paleo Hall
5. Collections Exhibit Leftovers	Oct. 11 *A356 (vault)*	Not Started	volunteers	Vault
6. Eggs and Nests (moved to Coll. Exh.)	? *A356 (vault)*	Finished	X	Paleo Hall
7. Freezers	23-Jun *A325 (b. lab)*	Ready	Dick	Biology Lab
8. Mollusks (IMLS)	Oct.20 *A356 (vault)*	Finished	X	Paleo Hall
9. Grouse	12-Oct *A356 (vault)*	Finished	X	Dead Space
10. Hides (Lanes)	21-Jul *A356 (vault)*	Begun	volunteers	Vault, Wab.H
11. Insects	30-Jun *A353 (ent.)*	Not started	Rebecca	Wab. Insect
12. Sponges, Fans, Etc.	Oct. 12 *A356 (vault)*	1/3 done	Paleo volunteers	Vault
13. Metcalf Bones (out in the woods)	next year	None	X	X
14. Mounted Birds *note: some from exhibits to Paleo Hall?	2000 April *A356 (vault)*	Begun	Verne	Warehouse
15. NHS Bivalves (IMLS)	20-Oct *A356 (vault)*	Finished	X	Vault
16. Osteology				
1) Very large Skeletons (horses, etc.)	2000 April *A332 (bone)*	2/3 done	volunteers	Warehouse
2) Red-Tagged	2000 April *A325 (b. lab)*	2/3 done	volunteers	Warehouse
3) PETs in Delta Drawers	Aug. 3 *A332 (bone)*	2/3 done	Anna, Paul, Paul	Coll. Office
4) Long-Term Hollingers	2000 April	Finished	X	Warehouse

	A332 (bone)			
5) Small Mammals in Boxes (voles)	Oct. 14 *A356 (vault)*	Finished	X	Coll. Office
6) Medium-sized skulls	2000 April *A332 (bone)*	Finished 5/17	X	Warehouse
7) Large Skulls	July 19-21 *A332 (bone)*	Not started	volunteers	Paleo Hall
8) Unaccessioned Comparative	30-June, Apr-00 *A325 (b. lab)*	1/2 done	volunteers	Coll. Ofice Warehouse
9) Human Remains(Deltas and boxes)	Aug. 3 *A325 (bone)*	Not started	Gretchen/Rebecca	Coll. Office
10) Mounted Articulated Skeletons	July 19-21 *A325 (bone)*	Not started	Bonnie	Paleo Hall
11) Rosy	July 19-21 *A325 (bone)*	Finished	X	Paleo Hall
17. Plants	Oct. 20 *A356 (vault)*	3/4 done	Jim	Paleo Hall
18. Small Mammal Flat Skins	2000 April *A356 (vault)*	Near finished	Tim G.	Warehouse
19. Small Mammal Skulls (voles)	Oct.14 *A356 (vault)*	Not started	volunteers	Coll. Office
20. Small Mammal Study Skins (Lanes)	2000 April *A356 (vault)*	Finished	X	Warehouse
21. Taxidermy Heads and Mammals *note: many will remain at warehouse	2000 June *to be specified*	Begun	Jim and volunteers	Warehouse
22. Wet Collection	30-Jun *A354 (wet)*	Not started	volunteers	Wet Room

Department	Delivery	Status	Packers	Storage Location
Ethnology				
1. Cahlender Collection	12-Oct	Finished	X	Dead Space
2. Ceramics (Vault)	?	Finished	X	Warehouse
3. Ceramics (Ethno Lab)	30-Jun	Ethno.1	Fred and Kay	Imaging Lab
4. Collections Exhibit	?	As needed		Cedar Hall
5. Collections Exhibit Leftovers	30-Jun	As needed		Imaging Lab
5. Cultural Collections		As needed	Rose and Karen	Vault
Africa	19-Jul			
American Indian	8/16,10/11			
	10/13,10/20			
Asia	20-Jul			
Australia	21-Jul			
CA: Cuba	9-Aug			
CA: Guatamala	9-Aug			
CA: Mixed	9-Aug			
CA: Nicaragua	9-Aug			
China	20-Jul			
Europe/Scandinavia/British Isles	2-Aug			
Greece/Italy/Etrusca	21-Jul			
Hmong	20-Jul			
India/PakistanRussia/Iran/Afghanistan	7/20.7/21			
Japan	20-Jul			
Mexico	10-Aug			
Middle East	21-Jul			
Misc. Unknown	20-Oct			

New Guinea	19-Jul			
Oversize Objects	10/11,10/12			
	10/13, 10/20			
Philippines	19-Jul			
Rolled Textiles	20-Oct			
SA: Colombia	2-Aug			
SA: Ecuador	3-Aug			
SA: General	2-Aug			
SA: Peru	2-Aug			
SA: Upper Amazon	2-Aug			
6. Deaccessioned Objects	30-Jun			
7. Hiller	12-Oct	Finished	X	Imaging Lab
8. Human Remains (NAGPRA)	30-Jun	Finished	X	Dead Space
9. Library (Ethno Lab)	30-Jun		Faith/volunteers	Cedar Hall
10. Litchfield Loan (Inuit)	12-Oct	None	volunteers	Ethno Lab
11. NAGPRA	17-Aug	As needed	Adrienne	Vault
12. Oversize Objects (from Halls)	12-Oct	Finished	X	Dead Space
13. Photos and Slides	30-Jun	As needed	Kristen	Imaging Lab
14. Records	30-Jun	Anthro.5	Kristen	Rec. Vault
15. Rolled Mats	12-Oct	None		Dead Space, Ethno Lab

Department	Delivery	Status	Packers	Storage Location
Geology	2000 June	Finished	Lori	Warehouse
Paleontology				
1. Black Mingo Fauna *note: green	Aug.17 *A342 (p. lab)*	Finished	X	Paleo Lab 1
2. Carolinochelys *note: tangerine	30-Jun *A327 (r&c)*	Finished	X	Paleo Lab 1
3. Champsosaurus (2 skeletons+10 boxes) *note: purple	30-Jun *A327 (p. lab)*	Near done	Jerry	Paleo Lab 1
4. Collections Exhibit	? *exh. hall*	Not started		Paleo Hall
5. Collections Exhibit Leftovers	Oct. 11 *A356 (vault)*	Not started		Vault
6. Crocodiles (carts+pallets)	July 19,21 *A356 (vault)*	Not started	Ken + 1	Paleo Lab 2, Paleo Hall
7. Dinosaurs: Pallet Room (carts+pallets)	7/19/;8/10,17 *A356 (vault)*	Padded	Ken + 1	Pallet Room, Paleo Hall
8. Dinosaurs: Poison Creek Boxed	7/19,10/12 *A356 (vault)*	Near done	volunteers	Dead Space, Paleo Hall
9. Dinosaurs: Racked	July 19-21 *A356 (vault)*	Not started	volunteers	Paleo Hall
10. Dinosaurs: Skulls (3 left in lab) *note: most have already been delivered	30-Jun *exh. hall*	Finished	X	Paleo Lab 1
11. Fossil Fish	2000 April *A356 (vault)*	Finished	X	Warehouse
12. Fossil Plants	2000 April *A356 (vault)*	Finished	X	Warehouse
13. Fossil Mammals (carts+pallets)	7/19/;10/11,13 *A356 (vault)*	Padded	volunteers	Vault, Paleo Hall
14. Gar Fish (transfer on wheeled table)	3-Aug *A356 (vault)*	Ready	Gretchen	Vault
15. Ichnofossils (carts+pallets)	7/19/,7/21 *A356 (vault)*	Padded	Ken + 1	Wabasha Hall, Paleo Hall

16. Invertebrates	2000 April *A356 (vault)*	Finished	X	Warehouse
17. Lab Exhibits (mounted, in labs) *note: pink (May 24) & blue (June 30)	May 24, June 30 *A327 (p. lab)*	Finished	X	Paleo Lab 1
18. Laoporus Trackway (for Coll. Exh.)	? *exh. hall*	Ready	X	Paleo Lab 2
19. Loan Items (1 cabinet)	Aug. 10 *A352 (t&f)*	Not started	Neva	Paleo Lab 1
20. Mason Invertebrates	July 19-21 *A356 (vault)*	Finished	X	Paleo Hall
21. Paleopathology *note: red	Aug.10 *A356 (vault)*	Not started	Tom Sawyer + vols	Paleo Lab 1
22. Pleistocene	7/20, Apr-00 *A356 (vault)*	Finished	X	PaleoHall Warehouse
23. Slabs & Trackways (carts+pallets)	7/19/, 7/21 *A356 (vault)*	Not started	Ken + 1	Paleo Lab 2, Paleo Hall
24. *Torosaurus* *note: yellow	30-Jun *A327 (p. lab)*	Finished	X	Paleo Lab 1
25. Trackway in Vault (wheeled table) *note: *Climacticnites*	Aug. 3 *A356 (vault)*	Ready	Gretchen	Vault
26. Tree trunk *note: chartreuse	30-Jun *A327 (p. lab)*	Finished	X	Paleo Lab 1
27. Turtles, Champs & Lizards (carts+pallets)	July19,21 *A356 (vault)*	Not started	Ken + 1	Paleo Lab 2, Paleo Hall
28. Type and Figured *note: ready to pack any time	Aug. 17 *A352 (t&f)*	Not started	Neva	Paleo Lab 1
29. Wannagan Creek Turtles(pack to move) *note: orange	Aug. 17 *A342 (r&c)*	Not started	Paleo staff	Paleo Lab1,2

APPENDIX E:
WORKPLAN FOR BIOLOGY

Steps to Preparation and Move of SMM Osteology Collections

Osteology Workplan Summary

Step 1. *Project 1: Very Large Skeletons* (FEBRUARY 15 - MAY 28)
- Packing Room volunteers
- Retrieve and pack in Packing Room other very large skeletons from throughout the museum, continuing...
  - horse
  - musk-ox
  - ?

Step 2. *Project 8: Unaccessioned Comparative Osteology* (FEBRUARY 15 - MAY 28)
- Packing Room volunteers
- Retrieve and pack in Packing Room, continuing...

Step 3. Inventory (FEBRUARY 22 - MARCH 5)
- Cleaning stops while biology volunteers and Assistant Curator complete full inventory of osteology

Project 5: Small Mammals in Boxes (WEDNESDAY, MARCH 3)
- Wednesday Biology lab volunteers

Step 4. *Project 3: PET Boxes in Delta Drawers* (MARCH 8 - MAY 28)
- Biology lab volunteers pack any PETs destined for freezer from back room
- Biology lab volunteers pack all others, continuing...
- Assistant Curator removes bird study skins from storage room to vault
- Assistant Curator and Loan Officer sort loan material

Project 4: Long-Term Hollinger Storage (MARCH 8 - 13)
- Packing Room volunteers

Project 7: Large Skulls (MARCH 8 - APRIL 1)
- Packing Room volunteers
- Retrieve and mount in Packing Room

Step 5. *Project 2: Red-Tagged for Cleaning* (MARCH 15 - 19)
- Packing Room volunteers
- Pack on site

Step 6. *Project 6: Medium Sized Skulls* (MARCH 22 - 26)
- Packing Room volunteers
- Pack on site

Step 7. *Project 10: Mounted Articulated Skeletons* (MAY 3 - MAY 28)
- Packing Room volunteers
- Retrieve and mount in Packing Room from locations throughout the museum

Step 8. *Project 9: Human Remains* (MAY 31 - JUNE 4)
- Biology volunteers

Detailed Osteology Workplan

1. Rosy the elephant will be removed from Upper Wabasha corridor to the Vault, where all bones that will fit in cartons (long white boxes) will be packed by packing room volunteers (see protocol **Paleo.5.1**) and stored in the canoe space. Skull and pelvis will be laid directly onto the shelves to be palleted at move date.

- Project Name: *Osteo Project 1: Very Large Skeletons*
- all very large skeletons follow this protocol, larger bones to be palleted for move and then cradled at the new facility
- mark boxes with accession # and number of bones in the box
- write project name prominently on top and ends
- store in Vault

2. The Assistant Curator and Collections staff will go through all the boxed osteology in the back storeroom and sort into **four categories** for packing:

a) skeletons that must be refed to the dermestids
- these boxes will be taken directly to the lab

b) skeletons that are dirty but will be cleaned after the move
- Project Name: *Osteo Project 2: Red-Tagged for Cleaning*
- these boxes will be marked with green sticky notes for protocol **Bio.18** (Short-term Storage)
- chickens fall into this category and should be included in this project
- pack according to the above protocol
- red-tag each box and pack into larger cartons (white b-boxes)
- red-tag cartons, mark with project name prominently on top and ends, grey sticker for delivery to new Biology lab A325
- bag and send to warehouse freezer
- track for volume*
- cartons will be palleted at warehouse

c) clean skeletons that will be rehoused into PET boxes and put into Delta drawers (This category is for special individuals that for one reason or another the Assistant Curator would like rehoused in clear boxes; we expect very few, as most individuals will remain in Hollingers.)
- Project Name: *Osteo Project 3: PET Boxes in Delta Drawers*
- these boxes will be marked with yellow sticky notes for protocol **Bio.11**
- pack boxes into cartons (white b-boxes), bag, and send to on-site freezer
- after freezing, store in Collections office next to Delta pallets until Assistant Curator is ready to process and pack

d) clean skeletons that will remain in Hollinger boxes for storage on shelves in the new Bone Room
- Project Name: *Osteo Project 4: Long-term Hollinger Storage*
- these boxes will be marked with chartreuse stickers for protocol **Bio.18** (Long-term Storage)
- pack according to the above protocol
- pack Hollingers into ceramic cartons, mark accession #s and number of boxes on one end, and write name of project prominently on top and ends
- grey sticker cartons for delivery to Bone Room A322, bag, and send to warehouse freezer
- track for volume*
- cartons will be palleted at warehouse

3. Biology staff and volunteers will make an inventory of all osteology for the Assistant Curator (see protocol **Bio.5**).
- this can be combined with the general inventory completed by Collections staff and should be detailed to the satisfaction of the Assistant Curator
- a major purpose of this exercise is to identify unaccessioned specimens to be red-tagged for accessioning at the new facility

4. Biology staff and volunteers will clean (see protocol **Bio.6)** and rehouse into PET boxes (see protocol **Bio.11**) all osteology currently in the Biology lab, in the back storeroom (see **2c** above), and in the Lane or Kewaunee cabinets in Upper Wabasha corridor, beginning with the Lane material.
- Project Name: *Osteo Project 3: PET Boxes in Delta Drawers*
- pack according to above protocol **Bio.11**
- place PET boxes in Delta drawers of the appropriate height (retrieve as needed from basement storage area)
- stack full drawers on pallets located in Upper Wabasha corridor
    - drawers should have strips of cardboard placed between them as they are stacked so they will not

slide
- first pallet is located in the southwest corner of the Collections office across from the Biology lab
- drawers are to be stacked as high as possible, to be repalleted more securely at move date

- track by drawer height**
- **EXCEPTION**: **the voles in small boxes, currently uncatalogued, located in the Lane cabinets in Upper Wabasha corridor and those already in PET boxes in the lab**
  - Project Name: *Osteo Project 5: Small Mammals in Boxes*

a) Part 1: *Red-tagged*
- keep in the same boxes, no padding necessary
- pack boxes into cartons (white b-boxes) and red-tag
- mark cartons with project name prominently on top and ends
- grey sticker for delivery to Biology lab A325, bag, and send to warehouse freezer
- track for volume*
- cartons will be palleted at the warehouse

b) Part 2: *Finished*
- keep in PET boxes
- pack boxes into cartons (white b-boxes)
- Mark cartons with project name and *Finished* prominently on top and ends
- grey sticker for delivery to Biology lab A325 and send to warehouse
- track for volume*
- cartons will be palleted at warehouse

5. Biology staff and volunteers will also be assigned to pack the Hollingers remaining in the store room.
- see **2d** above

6. Biology staff and volunteers will also be assigned to pack medium-to-large skulls on shelves in the store room (see protocol **Paleo.10**). Boxes will be sent to the freezer only if deemed necessary by Conservator.
- Project Name: *Osteo Project 6: Medium Sized Skulls*
- pack according to above protocol
- mark b-boxes with accession #s and write project name prominenly on top and ends
- grey sticker for delivery to the Bone Room A322 and send to warehouse
- bag any boxes indicated by Conservator and send to warehouse freezer
- boxes will be palleted at warehouse

7. Biology staff and volunteers will also mount large skulls (most with horns) on permanent pallets, to be stored wherever possible on site until move date (see protocol (**Paleo.10**).
- Project Name: *Osteo Project 7: Large Skulls*
- mark pallets with accession # and grey sticker for delivery to Bone Room A322

8. Osteology from other departments in the museum will be collected in the packing room, checked for infestation (infested boxes will be frozen here before being taken downstairs), and sorted into accessioned and unaccessioned material (protocol **Bio.17**).

a) accessioned materials will be taken to the Biology lab to be packed according to the appropriate protocol
- these materials will be stored in Collections office next to to the Delta pallets until the Assistant Curator is ready to process and pack them

b) unaccessioned materials will be packed in white b-boxes with a minimum of padding so that they will be stable enough for the move
- Project Name: *Osteo Project 8: Unaccessioned Comparative Osteology*
- pack according to above protocol **Bio.17**
- red-tag and mark with the number of bones inside
- grey sticker for delivery to the new Biology lab A325, bag, and send to warehouse freezer
- boxes will be palleted at warehouse

9. All human skeletons will be laid out in Delta drawers, covered with muslin, and stored with other osteology Delta drawers (see Conservator for protocol).
- Project Name: *Osteo Project 9: Human Remains*

- track by drawer height**

10. Mounted articulated skeletons will be prepared and packed according to protocol **Bio.7** and stored wherever possible on site.
    - Project Name: *Osteo Project 10: Mounted Articulated Skeletons*
    - mark mount with accesssion # and grey sticker for Bone Room A322

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* record the number of boxes of each size; e.g., 12 3x4x3 (LxWxH)
**record the number of Delta drawers used of differing heights; e.g., 15 5 1/2

MEET OUR ARTIST: VERNE ANDERSON

Long-time Minneapolis resident Verne Anderson has volunteered at the Science Museum of Minnesota since he retired from teaching art at a local high school several years ago. He has been a professional artist his entire life and has produced canvases, wooduts, toys, and books for exhibition and sale for many years. The father of Conservator Gretchen Anderson, Verne has given both his time and his considerable talent toward a plethora of projects for the museum, including packing anything we asked him to pack during the move. Having finished the excellent cartoons around which the layout for this book was built, he is now busy at work covering the double doors to the Conservation Laboratory with a roomful of partying mice (right), a mural he designed as the first to brighten the cement-block walls of the new Research and Collections Corridor.

"When my daughter was a child she introduced me to Elsa the lioness of Born Free. *There was a song from the movie sound track that said, 'Beauty surrounds you and the world still astounds you.' After many years the line continues to appeal to my romantic nature. I refuse to let UTOCs (Ugly Things Out of Control) prevent me from viewing the natural world with wonder and celebrating life with zest."*

The Collections and Conservation Departments of The Science Museum of Minnesota dedicate this book to the persistence and creativity of its staff and volunteers, who accomplished the minor miracle of moving the collections of this musem. With gratitude to all, we thank you.

Packing Volunteers, 1997-1999

Alice Aamodt
Ken Allen
Verne Anderson
Diane Arndt
Olivia Bad Bear
Kay Blair
Lois Bohon
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Research Associates and Other SMM Packing/Moving Staff
(Research and Collections Division Staff in Bold)

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