The MICRO (Microfossils In Collections for Research and Outreach) Project at La Brea Tar Pits, Los Angeles, California: Gaining Mega Information from Micro Collections

Christine M. Mazzello*, Connie A. Clarke, Regan E. Dunn, Elizabeth R. Ellwood, Aisling B. Farrell, Emily L. Lindsey, Stevie L. Morley, Stephany Potze, Karin A. Rice, Gary T. Takeuchi
La Brea Tar Pits, 5801 Wilshire Blvd., Los Angeles, California, United States
*Corresponding author: cmazzel1@alumni.jh.edu; ORCID: 0000-0001-5417-7053

Introduction

Microfossils at the La Brea Tar Pits (LBTP) in Los Angeles, California, United States, are small fossil remains of hundreds of species of Late Pleistocene and modern-day plants and animals. These specimens are found within the hundreds of tons of matrix surrounding the charismatic, and better-studied, megafauna of our asphaltic fossil deposits that have been excavated for over a century. Even after decades of sorting microfossils from the matrix, we have only a cursory understanding of the relative quantity and quality of these smaller fossils. Plans for extensive redesign of LBTP have provided us the opportunity to consider our long-term requirements for collections space, research needs, lab workflows and opportunities for educational outreach. With renovations in mind, we developed MICRO -- Microfossils In Collections for Research and Outreach -- to take a deeper look at our fossil-rich matrix and potentially inform on-site infrastructure planning. Here, we focus on the collections management aspects of MICRO.

Specimen safety during storage is highly important. Single-height drawers can be used to house hundreds of microfossils, while maintaining even weight distribution, and storing up to sixteen drawers in a single steel cabinet. Depending on the length, width, and fragility of the microfossils, they can either be housed individually or in bulk, in a plastic or glass vial or dram utilizing acid-free, archival materials to ensure long-term preservation. It is likely that research use of microfossils will continue to increase. It is therefore necessary to have a solid understanding of our microfossil resources, the time and materials it takes to prepare them for curation and research, the physical space they require, and the financial investment necessary to make it all possible. Through MICRO, we are gaining insights into the requirements of microfossils that are broadly applicable to other types of natural history collections.

Fig. 1. The LBTP "Can Room", which houses hundreds of cans of fossil-rich matrix from on-site excavations.

Methods

Sorting microfossils has long been a tradition in the Fossil Lab at the La Brea Tar Pits, and new techniques are consistently evolving to maintain safety of the fossils and continue staff and volunteer education which graciously extends to the community scientists. The workflow used for the MICRO project has been theoretically laid out in phases. The first phase includes a slight, yet effective twist on the existing microfossil sorting workflow. Utilizing a new to LBTP botanical float technique allows for more efficient sorting once the microfossils reach the Fossil Lab, after they have been cleaned at Excavations.

Excavations/Floating Botanicals

To begin Phase 1, processed matrix from a subset of cans representing different excavations was weighed and poured into a bucket filled with clean water. With a gloved hand the matrix at the bottom of the bucket was gently massaged, to release the plant material so it could float to the surface of the water (Fig. 2). The water with the floated material was poured through a sieve, and the process was repeated a few times, until no material floated to the surface. The floated material commonly includes seeds, stems, insects, wood, and leaf fragments. Floating can be a beneficial way to concentrate and reduce the amount of material that will proceed to further phases. The floated material was wrapped into a paper towel, labeled, and hung with plastic clips to dry. The remainder of the matrix that did not float to the surface was laid out to dry on screens.

Fig. 2. An excavations volunteer massaging the matrix to float lighter materials to the surface.

Methods cont.

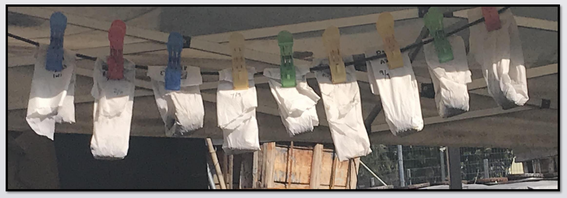

Fig. 3. Floated material drying on a line.

In this workflow, matrix was first processed by excavations to clean the material, prior to floating, and from there, matrix cans were brought into the lab for further sorting. This sorting is a course sort, as part of Phase 1 for this project, and a more refined sorting for a finer scale of identifiable material is planned for Phase 2.

Fossil Lab Sorting

In the next steps, a lab volunteer will extract a scoop of matrix and commence sorting out osteological, botanical, arthropod, Mollusca, and other material, onto a sheet of cardstock on a closed-off tray, using size 1-6 Royal Brush Round Golden Taklon synthetic paint brushes. To aid in proper identification between the microfossil categories, the Lab is equipped with AmScope 7X-45X Stereo Zoom Microscopes with a 4-Zone 144-LED ring light.

Fig. 4. Can of processed matrix to be sorted by volunteers (left). Volunteer scooping 30mg of matrix onto a cardstock-lined tray (right).

Collections

Throughout this project, observations are expected to be made to answer past, present and future research questions, while continuing with ease of accessibility for both staff and incoming researchers. The future of collections storage will greatly benefit from each phase as they are carried out, by providing a clearer vision of how much space is required for the fossils, and what materials will be needed, whilst, following museum best practices.

Results

Due to the current coronavirus pandemic, the MICRO project has come to a temporary halt, and it is unknown when the volunteer program in the Fossil Lab and Excavations will be able to resume. In future phases of this project, we will be sorting for material in more refined categories, based on closer examination of material sorted in this first phase. Likewise, we may develop additional processes to further refine the categories. Despite not being able to physically work in the museum, the future of the collections needs remains a priority for the Research and Collections staff.

Fig. 5. Typical matrix material, (a) osteological (reptile lower jaw bone with teeth), (b) arthropod (beetle elytron), (c) mollusca (valve of a freshwater bivalve shell), (d) mollusca (freshwater snail shell), (e) botanical (leaf), (f) arthropod (insect leg), (g) fragment of arthropod material, (h) botanical (juniper seed pod), (i) osteological (mammal bone), (j) osteological (small mammal claw). Not shown. Inorganic material (oxidized asphalt, rocks, and all geological material) is separated from the fossil material.

Conclusions

The La Brea Tar Pits MICRO project inclusion of Fossil Lab and Excavation volunteers as Community Scientists can be viewed as internal outreach, as well as providing insight for ideas for off-site Community Science activities, including microfossil sorting kits that have been loaned out to schools in the local Los Angeles Unified School District. Future phases of this project will focus on refining sorting techniques to allow for maximum efficiency for museum staff and visiting researchers.

Acknowledgments

We would like to thank the volunteers and museum staff for all of their assistance with this project.