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Curation Techniques of Small-sized Natural History Specimens: A Collection of Microfossils.

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Curation techniques of small-sized Natural History specimens: a collection of microfossils.

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Objective

- Museum quality curation and of a microfossil curation of Cretaceous microfossil focused on mammals.

Problems to address

1) Small size of the specimens
2) Safety
3) Ease of Handling
4) Reversible mounting
5) Storage and record keeping

Collection, Record keeping and storage

Collection: Specimens are collected in bulk in the field by manually excavating high concentration lenses or surface prospecting. Most specimens of interest are small sized and based on previous experience different mesh sizes are used for screen-washing and concentrate generation. A variety of soaking times, flocculants and water exposure are used to generate a specimen-rich "concentrate". The resulting concentrate is inspected under stereo microscope, or binocular dissecting scope to identify and separate mammalian specimens either in the field or in the lab. Most of the specimens are unusually smaller 1mm in length or less, making standard curation impractical.

- **Electronic record keeping:** Specimen were recorded in an excel sheet that listed the number assigned to each fossil, an estimated taxon ID, a brief description of the specimen, the specimen originating locality and Geological Formation, the specimen estimated age, and the excavator/expedition that recovered the material. This is standard practice in the field.
- **Labeling of displays:** Specimen were labeled on the external surfaces of their displays in ways that would not obscure the observation of the specimen while still contained inside the carrying case or vials, reducing handling and risks to the specimens. Labels were both painted using white paint and handwritten using technical pens, as well as printed using a labeling machine. After testing holding power and size printing, Brother PT-D210 Portable Label Maker with Labelife 12mm laminated white label tape was chosen to print our labels. Both printed and handwritten labels include collection number and the systematic and geological precedence and at least one is materially fixed to the specimen carrying element.

  Display boxes, due to their larger size, may also have a QR code attached, used for additional compact labelling, but the curved surface and small size of the vials does not make this viable for them.
- **Color-coding:** Color-coding was used to add distinct visual aids facilitating provenance ID. Specimen were color-coded based on individual locality information

- **Grouping of specimen:** Specimen, once fully labelled, were categorized based on :
  - Locality
  - Taxon
  - Anatomical structure (i.e., P1, jaw, indeterminate)

- Intuitive separation of specimens based on systematic, anatomy, locality and provenance, facilitates use of the material to address different research questions.

Storage modalities: a variety of products were tested for ease of handling, sturdiness, holding power of adhesives, etc. The following products were identified as providing optimal performance:

Transparent display boxes

- Transparent display boxes (pictured right) were used to mount larger specimens (2-5 mm). The specimen are mounted to the lid of the inverted clear display boxes via dental wax. The information for the specimen is duplicated in the lid carrying the specimen and the rest of the box cover. The boxes used were Alpha Rho Small Square Friction Fit Plastic Craft Boxes and Lid – Item No. 1A.

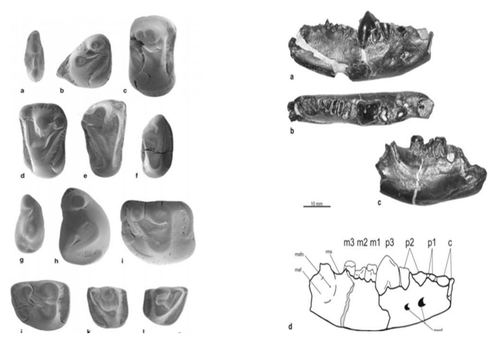
Clear glass vials

- Clear glass vials (pictured right) measuring ¼ dram vials (9x30mm) were used to mount diminutive fossils specimen. Specimen were mounted inside the vial on a cork via a shaped pin head and attached with to the pin using dental wax. The utilization of dental wax instead of glue allows for a firm mounting of specimen, while still maintaining the ability to manipulate and remove the fossil from the display, if needed. The glass vials used were Acme Vial & Glass Co, Inc. clear 1/4-dram 9x30mm glass vial shells (1586 tray/ 9516 cs) with size 0 corks.

Mounting wax

- The specimens are mounted in regular map pins sanded flat providing a platform to attach the wax and the specimen. The dental wax used was Modern Materials Utility Wax Strips – Large White.

Field work, sediment collecting. (Middle left) two members of the field team screen-washing sediments. (Middle right) Reduction of rocks to small pieces while searching for small bones. In (bottom left) and (bottom right) Leandro Canessa screen-washing sediments in a barrel with gentle movements and drying the processed sediments in the same mesh to reduce the breakage of fossil material. See Pascual et al., 2000; Kielan-Jaworowska et al., 2007; Rougier et al., 2009, 2021; Harper et al., 2019 for further data on small fossil mammals from the Cretaceous



Various views of *Coloniatherium cilinskii* upper and lower dentition from Mirasol Chico Canyon, Chubut, Argentina; La Colonia Formation, Maastrichtian, Upper Cretaceous. (Right) *Coloniatherium cilinskii* right dentary from Mirasol Chico Canyon, Chubut, Argentina; La Colonia Formation, Maastrichtian, Upper Cretaceous. This right dentary retains a complete p3, root fragments of p2, m1–m3, and alveoli for p1 and double rooted canine in labial (a) and occlusal (b) views. Materials like these pose a variety of problems we addressed in this project.

(Above) Examples of immediate post collection storage and transport of specimens. Loose, unassorted fossils, along with those stored in small pill and capped capsules filled with cotton, were among the methods used to provisionally house specimen. These methods are appropriate for field storage until the specimens can be properly curated in a research institution and prepared for museum collections.

A typical array of fossil teeth, including incisors, premolars, and molars. Some specimen still retain their partial or complete root. The larger are about 1mm in length .

(Top left) Cardboard cryopreservative boxes (freezer boxes) have been used to store specimen. Freezer boxes can store as many as 81 specimen vials. (Top right) Grouped specimen are further categorized and stored in filing cabinets, with each drawer being organized by taxon ID. Both (bottom left) and (bottom right) show views of a fully-mounted microfossil tooth to a carrying pin.

Conclusions

- The combined use of materials from dental health care, display and cosmetic industries in addition to standard curation practices resulted in a system compact and versatile. Transparent receptacles (plastic or glass) ensure a reduced direct handling of exposed specimens increasing safety. Redundant labelling and use of QR codes opens opportunities to have highly condense information attached to the specimens.

References

- Pascual, R., Gonzales P, Ardolino A, Puerta PF. (2000). "A Highly Derived Docodont from the Patagonian Late Cretaceous: Evolutionary Implications for Gondwanan Mammals." Geodiversitas 22(3): 195-214.
- Kielan-Jaworowska Z, Ortiz-Jaureguizar E, Vieytes C, Pascual R, Goin FJ (2007) First ?cimolodontan multituberculate mammal from South America. Acta Palaeontol Pol 52:257–262
- Rougier G.W., Forasiepi AM, Hill RV, Novacek MJ (2009b) New mammalian remains from the Late Cretaceous La Colonia Formation, Patagonia, Argentina. Acta Palaeontol Pol 54:195–212
- Harper T, Parras A, Rougier GW (2019) *Reigitherium* (Meridiolestida, Mesungulatoidea) an enigmatic Late Cretaceous mammal from Patagonia, Argentina: morphology, affinities, and dental evolution. J Mammal Evol 26:447–478
- Rougier G.W., Martinelli AG, Forasiepi AM (2021) Mesozoic Mammals from South America and Their Forerunners, Springer 1-388pp.

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