Stegomastodon Excavation – Introduction

The subject of our excavation is a *Stegomastodon* that was found by Jude Sparks in December 2016. Both the mandible and a tusk were exposed on the surface. Fossil bones from the same animal are rarely found together in our area. Thus, the unusual association of the mandible and tusk raises the exciting possibility that even more of the skeleton is concealed underground.

The Pliocene-Pleistocene deposits of the Lower Rio Grande Valley belong to the Camp Rice Formation. These are deposits of the Ancient Rio Grande Valley and axial alluvial fans fed by surrounding mountains. The Camp Rice Formation preserves a rich megafauna of proboscideans (elephants), horses, camels, ground sloths, glyptodonts (giant armadillos), tapirs, sabertooth cats, and others. Although the Camp Rice spans a longer interval of time, our *Stegomastodon* is probably about 1.2 million years old based on other occurrences of this species.

Stegomastodon is one of three species of proboscideans that co-inhabited the ancient Rio Grande Valley during the Pleistocene. Among these, *Stegomastodon* and *Cuvieronius* belong to the primitive group of proboscideans termed gomphotheres. While they closely resemble modern elephants, some gomphotheres possessed tusks in their lower jaws either instead of or in addition to upper tusks. *Stegomastodon* and *Cuvieronius* did not. *Stegomastodon* has curved upper tusks while those of *Cuvieronius* are spiraled. Gomphotheres are referred to as mastodonts because, like the American mastodon with which they are often confused and which is very rare in New Mexico, their molars have few cusps or "lophs." This reflects their browsing diet. In contrast, the mammoths, which are much closer to modern elephants and were more common in our area more recently as it desertified, have massive molars with dozens of lophs that are ideally adapted for a lifetime of abrasive grazing.

Proboscideans are behemoths and their bones are massive. Although the long bones and jaw are dense and very heavy, the cranium is not so much. The skull is by no means lightweight, but the vast space between the external contour of the skull and the much smaller braincase within it is packed with honeycomb-like air-filled sinuses. The surface layer of bone of the skull is quite thin - ¼" to ⅛" or even much less. This airy skull lightens the load and probably plays a role in the animal's subsonic hearing. The thin air-filled skull is very fragile and rarely preserved intact in fossils. It requires very careful treatment.

Fossilization refers to the permineralization of tissues, but there are more differences between fossil and modern bone. Roughly half of the substance of living bone is composed of the protein collagen. It is a long structural polymer that gives bone its tensile strength, whereas the mineral apatite (mostly calcium phosphate) provides bone its compressive or loading strength. The collagen in bone decomposes over long periods of geological time. Fossil bones consequently lack tensile strength and are prone to fracture and crumbling. Large specimens like proboscideans can easily disintegrate under their own weight before your very eyes as soon as the sediments that cradle and support them are cleaned away. Thus, a hardener must be applied to the fossil as soon as possible as it is exposed to re-establish at least some of the bone's original tensile strength.

Hardeners are typically glues or plastics dissolved in a volatile solvent that penetrates the fossil and dries. We will use one or two hardeners. "Butvar" (polyvinyl butyral) has the advantage of being easily re-dissolved and removed but the disadvantage of penetrating poorly. It can be used to harden the fossil, but it may be more useful to temporarily consolidate loose sediment to help keep the fossil intact until it can be fully prepared in the lab. Paraloid (also known as Acryloid, ethyl methacrylate) penetrates better and is more durable, but it is not as easily re-dissolved and removed. Paraloid is the preferred hardener for the fossil itself. Both Butvar and Paraloid are dissolved in a solution of acetone, chosen among many possible solvents primarily because of its extreme volatility (rapid evaporation) and low toxicity. All of these exhibit very low or non-existent health risks and are used in a wide variety of everyday household products. However, acetone (the primary ingredient in nail polish remover) is highly flammable and reacts with oxidants such as acids. It can severely dry skin. Avoid breathing concentrated vapors and direct eye contact.

There is a surprising amount of subterranean moisture even in the dry desert. It is important to allow the fossil to dry before applying hardeners or they will not penetrate. This is a very vulnerable time for the fossil. It should be exposed and treated little by little, and the hardener itself must be allowed to fully dry before more of the fossil is exposed. *Never undermine sediment from any part of the fossil*. Even removing sediment from the sides of the fossil may cause it to break up and collapse. Fossil bones will be wrapped in a burlap-reinforced plaster jacket that may be further reinforced in a wooden frame for removal and transportation to the lab.