10th NORTH AMERICAN PALEONTOLOGICAL CONVENTION

FLORIDA MUSEUM OF NATURAL HISTORY

Hilton University of Florida Conference Center

1714 SW 34th Street

Gainesville, Florida

February 15th – 18th, 2014

Abstract Book

The Paleontological Society Special Publications

Volume 13

scan of USNM 550146 would facilitate efficient comparison of morphology and 3D morphometric analysis. After comparing all available technologies, it was determined that the VIALUX OEM 3D scanner best suited our needs for the project. This is a low-powered, structured light scanner that has available software integration for custom software. The unit can run on a 12-volt power source, making it highly mobile. We present here our methods for 3D surface scans. Multiple scan families were generated by repositioning the VIALUX scanner relative to a target plate that the unit was calibrated to. On-site merging of the scan families was done using Meshlab, a freely available, open-source software. Scanning was completed within two days. Final assembly of the meshes was completed at the laboratory at SMU using Rapidform. This methodology resulted in high-resolution, archival 3D surface scans of USNM 550146, available at the National Museum of Natural History at the Smithsonian Institute. The methods discussed here make it possible for quick mobile scanning of large and rare specimens. Scans produced from these methods will make it possible to study large and delicate specimens outside of the institutions that they are held in.

Session 38-6: Tuesday, 9:15 AM

Presenter: Theodorou Georgios

A STUDY CASE FOR A 3D SKELETAL RECONSTRUCTION OF *ELEPHAS TILIENSIS* BASED ON CT AND LASER SCANS; MORPHOLOGY, POPULATION DATA, AND TAPHONOMY.

Theodorou, Georgios E., National Kapodistrian University of Athens, Faculty of Geology and Geoenvironment, Zografou Campus, PO 15784, Athens, Greece; **Mitsopoulou, Vasiliki,** National Kapodistrian University of Athens, Faculty of Geology and Geoenvironment, Zografou Campus, PO 15784, Athens, Greece; **Isidorou, Stellios K.,** National Technical University of Athens, School of Mechanical Engineering, Mechanical Design and Control Systems Section, Zografou Campus, PO 15780, Athens, Greece; **Vasilopoulos, Thedoros K.,** National Technical University of Athens, School of Mechanical Engineering, Mechanical Design and Control Systems Section, Zografou Campus, PO 15780, Athens, Greece; **Roussiakis, Socratis J.,** National Kapodistrian University of Athens, Faculty of Geology and Geoenvironment, Zografou Campus, PO 15784, Athens, Greece; **Theodorou, Evangelos G.,** National Technical University of Athens, School of Mechanical Engineering, Mechanical Design and Control Systems Section, Zografou Campus, PO 15780, Athens, Greece; **Michailidis, Dimitrios G.,** National Kapodistrian University of Athens, Faculty of Geology and Geoenvironment, Zografou Campus, PO 15784, Athens, Greece; **Kaisarlis, Georgios J.,** National Technical University of Athens, School of Mechanical Engineering, Mechanical Design and Control Systems Section, Zografou Campus, PO 15780, Athens, Greece; **Provatidis, Christoforos G.,** National Technical University of Athens, School of Mechanical Engineering, Mechanical Design and Control Systems Section, Zografou Campus, PO 15784, Athens, Greece

Rapid Prototyping technologies based on skeletal remains from a complete original skeleton can easily be used to reconstruct reliable 3D life-sized skeleton replicas. *Elephas tiliensis* fossil bones have been excavated from Charkadio Cave on Tilos Island since 1971, bringing to light more than 15,000 complete or fragmented skeletal remains. This material represents the last Mediterranean elephant, which migrated to Tilos Island from the mainland about 45,000 years ago and became extinct during the Holocene. Complete skeletons in anatomical association and complete skulls or complete vertebral columns have yet to be unearthed, making selection of bones that could belong to a single animal or even to an average skeleton with correct proportions very difficult. In addition, bones such as scapula, pelvis, and ribs are mostly found fragmented. An interdisciplinary team has been put together under the auspices of THALIS MIS380135 project in order to build up and present to the general public a complete three-dimensional skeleton of *E. tiliensis* using Rapid Prototyping technologies. The objective of this research is to combine vertebrate paleontology methods and state-of-the-art Rapid Prototyping technologies for the first time in any Greek endemic form. Methods used include: 1) CT Scans of *Elephas tiliensis* bones of different ontogenetic status; 2) laser scans of selected *Elephas tiliensis* bones; 3) CT scans and laser scans of selected comparative material of *Palaeoloxodon antiquus* and recent elephant bones; 4) taphonomic information from skeletal of *Elephas tiliensis* parts found in anatomical association; 5) classical paleontological methodologies of descriptive and comparative morphology; 6) digital methods for comparative morphology; 7) statistical analysis for calculating allometric proportions of extremities; and 8) statistical analysis for calculating allometric proportions of skulls and vertebral columns with respect to extremities. The 3D skeleton slowly becomes a reality, the different methods are examined and compared, and their results evaluated. The study clearly shows that solely the combination of the above methods will allow the creation of an anatomically correct 3D skeletal reconstruction using Rapid Prototyping technologies. The final 3D mechanical reconstruction will be housed in the new building of the permanent exhibition on the island of Tilos.

Session 38-7: Tuesday, 9:30 AM

Presenter: Gregory P. Wilson

ON THE CUSP: GIS APPROACHES TO INFERRING DIET IN FOSSIL MAMMALS

Wilson, Gregory P., Department of Biology, University of Washington, Box 351800, Seattle, WA 98195

The fossil record of mammals is predominated by isolated teeth and dentulous jaw fragments. Although these elements represent only a fraction of mammalian skeletal parts, they provide substantial insight into taxonomy, body size, and feeding ecology of extinct forms. The link between mammalian tooth shape and diet, in particular, has long been known, but has been challenging to extract from the fossil record. Paleobiologists have applied various methods to this problem, from qualitative characterization of gross tooth shape analogized with modern forms to more quantitative approaches using two-dimensional (2D) linear measurements, geometric morphometrics, functional metrics, such as wear facet area and shearing crest lengths, analysis of tooth enamel microwear, and many others. These approaches have advanced our understanding of mammalian paleoecology, however, they have critical limitations. In