

## **A novel application of the white light/fringe projection duo: recovering high precision three-dimensional images from fossils for the digital preservation of morphology**

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### **Abstract**

There has been long historical interest in digital preservation of morphological features of biological materials, especially because often the preservation of sensitive molecules is critical for evolutionary studies. To this end, we successfully applied the recent advances of the fringe projection profilometry technique, in conjunction with white light and a new phase algorithm, to digitalize the shape of a fossil rodent hemimandible. We were able to generate a cloud of points in an array of data that allowed us to plot a three-dimensional (3-D) digital restoration of the entire fossil sample. The maximum resolution of this system is given by the diffraction limit (in the order of microns), and we show that this enhanced system can be used with objects in a range of 1-30 mm, minimizing the systematic errors induced by small vibrations or light fluctuations and, consequently, improving the signal-to-noise ratio of the recovered cloud data. This is a useful tool to preserve 3-D images of fossils and other biological objects for which rather detailed morphological information is required, like in research studies for biologists and paleontologists or, as in the present case, when researchers need a morphological replica because the sample will be destroyed for ancient DNA extraction.