Modelling Fossils

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Figure 1: Dickensonia Fossil, on display in the South Australian Museum

Background

Dickensonia are one of the first multicellular organisms which lived in the Ediacaran period, approximately 550 million years ago. It is believed that these `cushion like' organisms lived at the bottom of the sea floor, which was covered in organic ooze.[1]

The aim of this project is to use (or adapt) currently available technologies to develop a system that can scan fossils and produce 3D models. However, this method must be simple, easily repeatable and relatively inexpensive (under $1000).

Digitisation of Fossils

FujiFilm FinePix 3D Camera

- Use depth information from the Multi picture object (.mpo) files
- Used AgiSoft's 3D modelling package to view photos

Structure from Motion

- Used Autodesk's 123D Catch to stitch images and estimate the location of points

Laser Scanning

- Used MakerBot's open source MakerScanner system
- System requires a laser line pointer, a PS3 Eye USB camera and distance from the reference wall to generate point clouds
- MakerScanner was adapted to use both a Logitech and a microscope camera
- Point clouds were cleaned using Blender and meshed with Meshlab

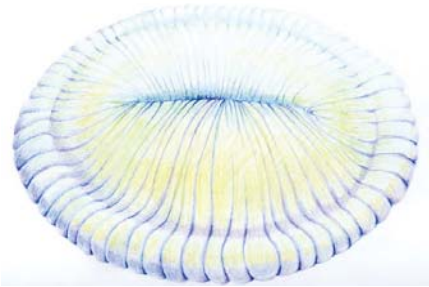

Figure 2: Artist interpretation of possible shape of a Dickensonia [2]

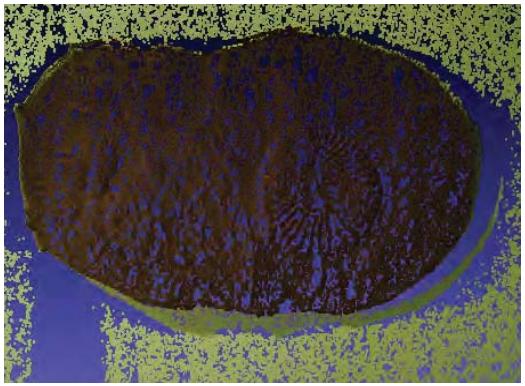

Figure 3: MakerScanner point cloud of latex fossil cast, captured with a PS3 Eye USB camera

Results of Digitisation

FujiFilm FinePix 3D Camera

- Automatic alignment of stereo images at the moment of capture limited the cameras ability to focus when in close proximity to the fossils, even set in macro mode

Structure from Motion

- Underlying grid structure defined by the 123D Catch, constrained the programs ability to model the small variations in the fossils

Laser Scanning

- Even with the higher resolution cameras, it was not possible to capture enough depth information so that Meshlab could reconstruct the fossils

Future Work

One possible extension of this work would be to consider more expensive solutions. One such solution is to scan the fossils with a FastSCAN hand held laser scanning `wand', produced by Polhemus. This product is capable of scanning small non-metallic objects at high resolution. It may also be possible to investigate modelling these fossils from CAT scans. These can also capture small objects at a very high resolution. However, both these solutions were not considered in this study as they are costly and we were attempting to make an inexpensive system due to cost restraints.

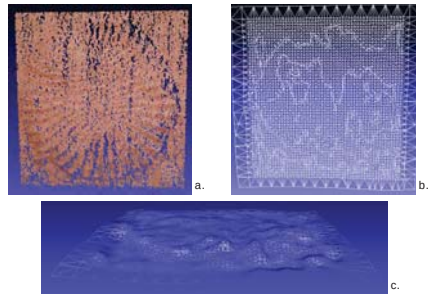

Figure 4a: MakerScanner point cloud of latex fossil cast, captured with microscope camera
Figure 4b: Meshlab Possion Surface Reconstruction of 4a - front view
Figure 4c: Meshlab Possion Surface Reconstruction of 4a - side view

References

[1] David Attenborough's First Life, episode 1 Arrival, 2010. Available at <http://www.youtube.com/watch?v=xR-yMiyquG4>

[2] Meg Bernstein 2012, *Dickensonia*, viewed 17/10/13, <http://megbernstein.com/prehistoric_imwages>