Geophysical Research Abstracts
Vol. 13, EGU2011-4452, 2011
EGU General Assembly 2011

Tomographic reconstruction in palaeontology

Russell Garwood (1) and Mark Sutton (2)

(1) Department of Earth Science & Engineering, Imperial College, London, United Kingdom (russell.garwood03@imperial.ac.uk), (2) Department of Earth Science & Engineering, Imperial College, London, United Kingdom (m.sutton@imperial.ac.uk)

For many fossils – those compressed onto a single bedding plane – the traditional palaeontological approach of splitting a rock open and investigating the revealed surface is highly successful. Occasionally fossils are preserved relatively uncrushed; organisms are three-dimensional, and deposits that preserve them as such can provide a better understanding of extinct species' palaeobiology. However the study of such fossils using traditional techniques is often problematic, as morphology not visible on any split surfaces in the rock remains unrecovered. Tomographic (slice-based) reconstruction can overcome such limitations. We provide an overview of the technique's application to fossils; in addition to resolving morphology in full, tomographic reconstruction can help reveal species' origins, relationships, and mode of life, providing key insights into past ecosystems. Two different approaches to data acquisition, and the process of creating a reconstruction, will be outlined. Physical-optical tomography involves the physical exposure of sections and optical imaging of surfaces. Fossils from the Herefordshire Lagerstätte will be used to illustrate the technique. This Silurian deposit preserves a fauna of small invertebrates in three-dimensions, including soft parts, but both the fossils and host rock are composed of calcium carbonate. This hinders the application of non-destructive scanning, but the fossils can be digitally reconstructed with the aid of high-resolution serial grinding. The approach has revealed a wide range of organisms in previously unattainable detail, including crustaceans, brachiopods, relatives of the horseshoe crabs, and enigmatic forms such as the marellamorphs. X-ray microtomography (XMT/μCT) is a more widely used approach to tomographic data-capture. This non-destructive scanning technology allows datasets to be created by mapping the X-ray attenuation within a sample. Examples will be drawn from its application to Carboniferous siderite-hosted fossils, which represent the earliest widespread records of terrestrial ecosystems. The majority of the era's biodiversity was in the form of invertebrates, and a number of different groups will be presented, including insects, arachnids, and enigmatic taxa. Both techniques, together with the computing power and software techniques required to interpret tomographic datasets, are becoming ever more widely accessible. Used in conjunction with traditional methods, tomographic reconstruction has the potential to revolutionise the study of three-dimensionally preserved fossils.