Ichnofossils as a tool for understanding Contourite deposits

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Contourite deposits have been a major focus of research since their identification just over 40 years ago (Heezen and Hollister, 1964; Heezen et al., 1966). They have considerable economic value owing to their association with petroleum deposits. Ichnofossils in contourite deposits are generally considered a hindrance, obscuring or in extreme cases destroying all primary sedimentary structures in core sections. In recent years the use of ichnofossils as environmental indicators has become increasing popular (e.g. Virtasalo et al., 2006; Wetzel et al., 2008). As the burrows are produced by environmentally sensitive organisms a considerable amount of information may be gained from their study.

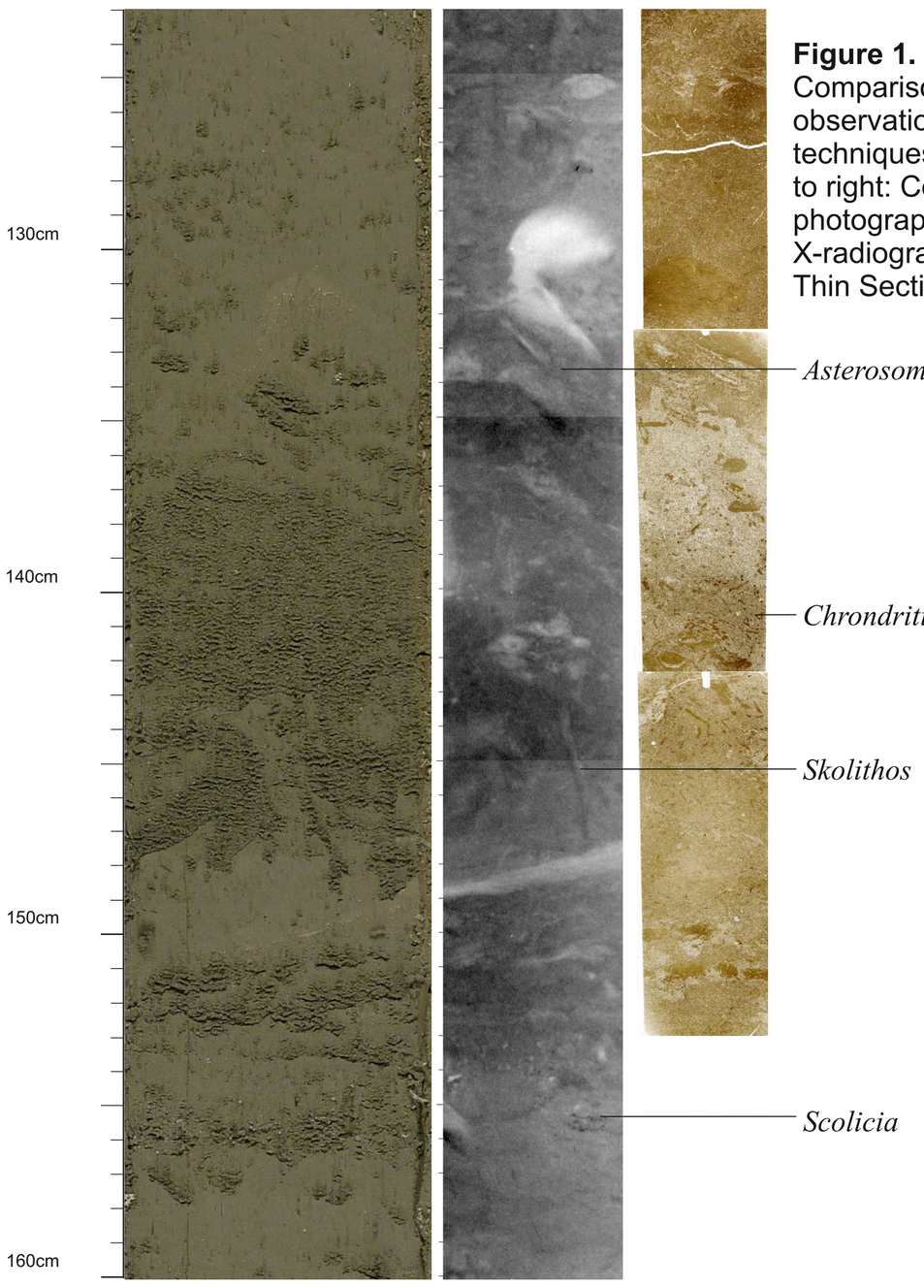

Figure 1. Comparison of observational techniques, left to right: Core photography, X-radiography, Thin Section.

Current Techniques

The observation of trace fossils on the surface of a sediment core is notoriously difficult. A number of techniques can be employed to assist in their identification.

X-radiography may be used to gain a detailed view of the internal structure of sediment cores (Fig. 1). Systems such as SCOPIX (Migeon et al., 1999) are used to scan the length of a core to allow the study of the changing ichnofossil assemblages. One of the biggest problems with the use of X-radiography in trace fossil analysis are the inherent difficulties that arise from the study of a 2D image. The investigator is only viewing a slice of the core - a burrow can look very different depending upon the angle at which it is cut.

Thin sections display very fine detail of grain distributions and allow high resolution study of features. However they are still only a 2D view and are costly and time consuming to produce.

X-ray Computed Tomography

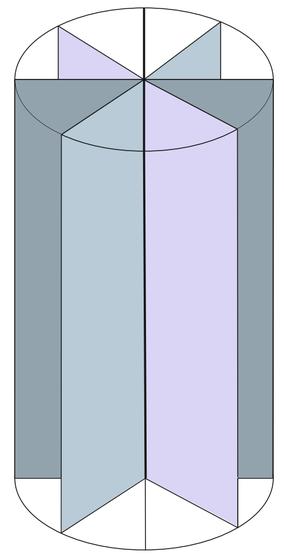

Figure 2. Schematic displaying how CT scans slices of a core at multiple angles to produce a composite image.

X-ray computed tomography (CT) has been used to take the study of trace fossils one step further. CT provides all of the benefits of X-radiography and adds a 3D element to the data (Fig. 2). With image processing software, detailed 3D reconstructions of burrows may be produced. Current research using pilot data obtained at the μ-VIS centre at the University of Southampton has allowed a critical assessment of the technique and confirmed its viability as a method for studying ichnofossils in contourites.

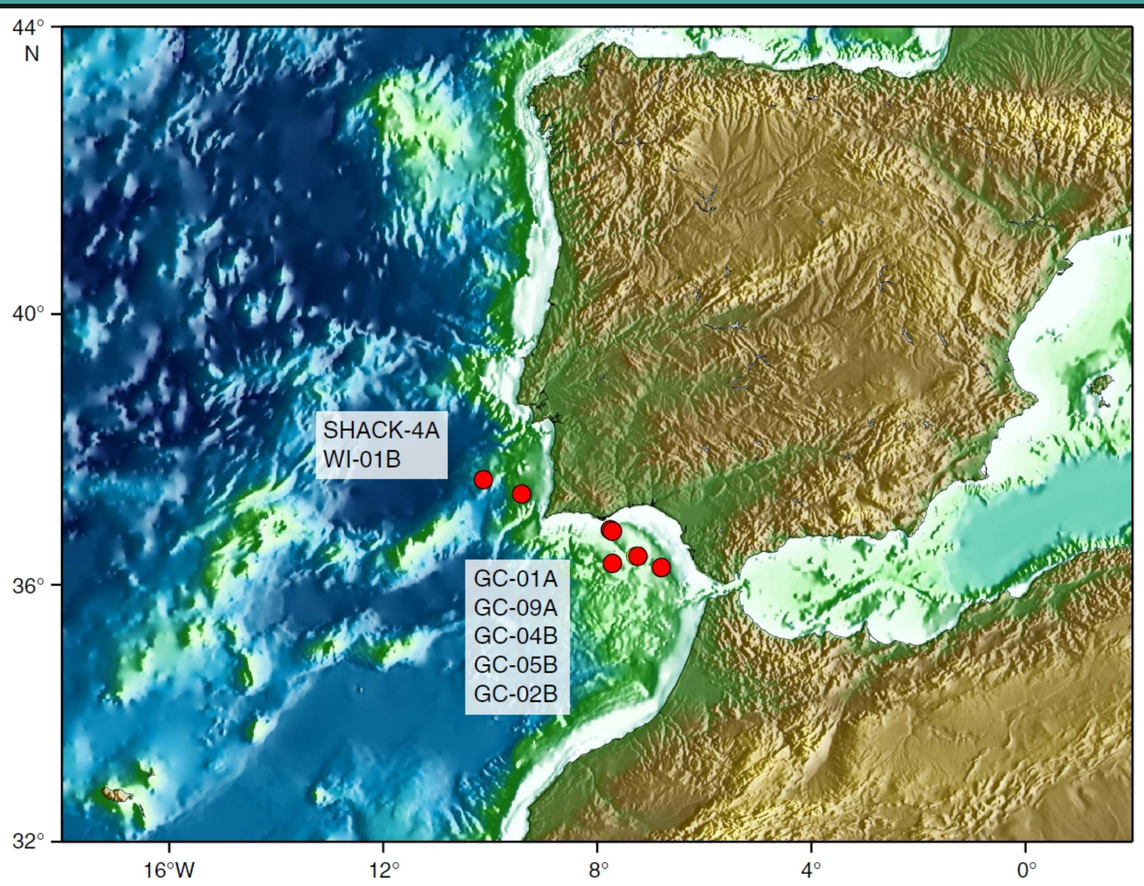

Figure 3. IODP 339 drill sites (Stow et al. 2011)

Conclusions and Future Work

Studies concerning ichnofossils in contourites are rare - there is a need for ichnofacies to be established to assist in the identification of contourites in the future. CT and X-radiography should be used together, along with thin sections to gain the best possible data set.

The contourite drift complex at the Gulf of Cadiz is the focus of IODP cruise 339. Fig. 3 (left) shows the Gulf of Cadiz region and the locations of the sites cored during the expedition. The cores recovered will form the basis of an in depth research project in to the ichnofacies of contourite deposits. CT facilities at the IODP repository at Bremen will be used to obtain the data.

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