Lloyd Milner **Expedition Fund Report 2015 - 2016**

Title of Project: *A Palaeotemperature Reconstruction of a Marine Isotope Stage 11 site at Marks Tey, Essex.*

Abstract / Context

By reconstructing ancient climates we can understand how organisms responded to previous climatic changes, which facilitates assessment of future anthropogenic or natural environment and climate. The Pleistocene Marine Isotope Stage (MIS) 11 (c. 400 kyrs ago) is considered a good climate analogue for the current (Holocene) warm period. This study is focused at Marks Tey clay pit in Essex, England, where lake sediments of MIS11 age representing the Hoxnian Interglacial period and a succeeding cold interval are exposed, offering the potential to study in detail a climatic transition from a warm (interglacial) climate to a cold (glacial) one. Fossilised organisms with modern day analogues can be used to gauge palaeotemperatures. In this study, small bi-valved crustaceans called ostracods were used as proxies. Rich ostracod assemblages have been obtained from samples of the lake sediments, in which the co-existence of juveniles and adults indicates that they are in situ and not sorted or mixed by post-mortem transport. The morphological features on the calcified shells were used to identify the species, subsequently facilitating accurate palaeotemperature reconstruction of freshwater lake conditions using the Mutual Ostracod Temperature Range method. Preliminary results suggest colder winter temperatures than present day due to the occurrence of the extinct Limnocythere falcata in 3 assemblages. This species is considered indicative of a cold climate, its youngest record from the Late Holocene, being from the Siberian Arctic. The relative abundance of taxa from the highest sample also suggests that the Pleistocene lake may have been larger than originally thought.

Research Objectives

(1) Identify non-marine ostracod microfossil assemblages present in previously unstudied sediment column at Marks Tey
(2) Reconstruct the Palaeoenvironment from the sediment column through the identification of ostracod species.
(3) Compare and contrast ostracod based reconstructions with previous pollen analytical studies conducted at Marks Tey.
(4) Compare ostracod-based Palaeoenvironmental reconstructions at Marks Tey with other key MIS 11 sites across Europe.

Fieldwork

The research has consisted upon collecting sediment samples from exposures at Marks Tey thought to contain ostracod assemblages. The samples collected were from different beds in order to identify similarities and differences from different locations and stratigraphic layers. The locations of the sediment samples were measured and each had a detailed sediment log describing the colour of sediment, texture of sediment and depth of each stratigraphic layer. Photographic images were also taken at each of the sites. Once the samples were collected they were taken to the lab and were individually soaked over a twenty-four hour period. This was to disaggregate the sediment and make sieving more effective without damaging any

microfossils contained within the sediment. Once soaked, the samples were each wet sieved they were then heated overnight at 105 dgrees Celsius. This was to evaporate any moisture within the sediment. Water based adhesive was applied in a light layer on a faunal slide to allow the mocrofossils to stick to the surface. The paint brush was dampened to allow the natural adhesive water to pick up micro fossils easily. A small amount of sediment no more than a few particles thick was scattered onto a picking tray under a light microscope, the ostracods were then extracted and placed on the faunal slide. Once 300 ostracods were picked from each bed they were arranged into geomorphological features of the carapaces. The features on the carapaces being critical to identifying the species.

Results

Figure 1 shows the Mutual Ostracod Temperature range method applied to one of my exposures at the MIS 11 clay pit. It shows all the calibrated taxa identified in the assemblage alongside temperature tolerances for January sand July. These are the coldest and hottest months we can therefore identify a rough temperature range based on this assemblage for 400,000 years ago. These results can be combined with other proxy studies for example in Turner 1970 where pollen was a main focus. We can then make predictions for climatic transitions.

Figure 1 - shows some of the outputs of the MOTR method for January and July. Taxa found in the assemblage are listed alongside their calibrated temperature ranges. January is shown to have a -8 to +3 temperature range which is slightly colder than present day. July has a +13 to +23 temperature range with is similar to present day.

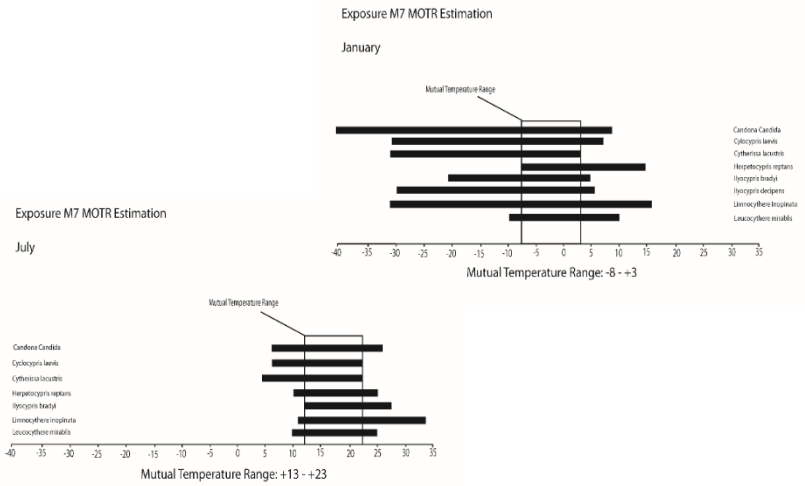

Figure 2 displays some of the species found within the assemblages. These images have been taken by a Scanning Electron Micrograph to provide highly accurate geomorphological detail of the ostracod shells.

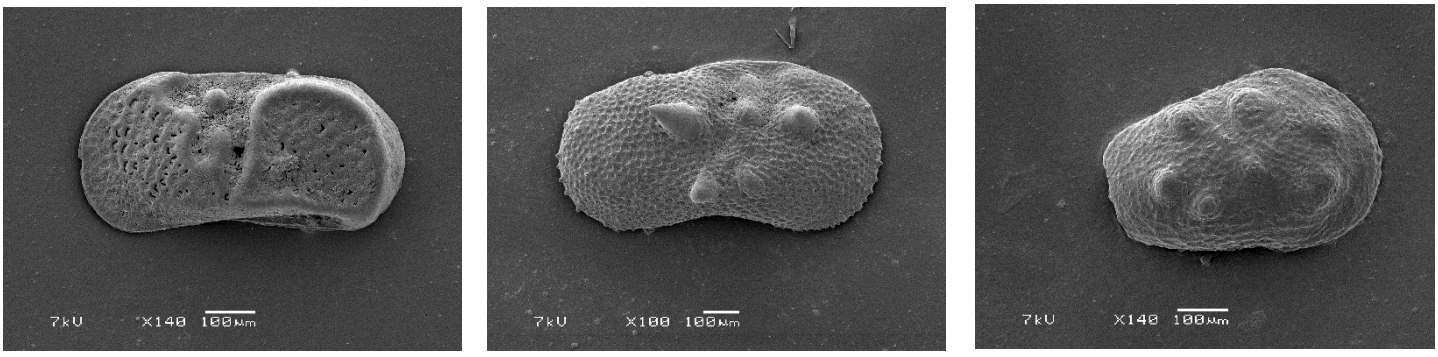

Figure 2 – shows (from left to right) Limnocythere falcata, Ilyocypris bradyi and Cyprideis torosa.

How the funding assisted my research

The funding I received has allowed me to spend more time at the extraction site in Essex as I could afford to travel there multiple days. A total of 3 days were taken which allowed me to take a wide variety of samples. This sampling would not have been possible under a limited time frame. Due to this I have been able to get some very effective results and have been shortlisted by Queen Mary to present at the British Conference for Undergraduate Research. Many thanks to the expedition fund whose funding allowed me to fulfil my potential in my dissertation research, I appreciate it greatly.