

My Laws Prize talk, entitled 'Sediment I have known' opened with a photograph showing a group of glacial geologists enthusiastically inspecting a sequence of glacial sediments in Anglesey, deposited when the last British Ice Sheet overrode this area some 20,000 years ago. Obviously the glacial imprint of Antarctica is more obvious than an exposed section of muddy gravel viewed, on this occasion, on a cold and wet afternoon in Wales, but it's these types of sediments that have told us a lot about the processes occurring at the base of modern glaciers and ice sheets. Not only can they inform us about glacier flow, but they also allow us to reconstruct their former limits, information that can be used to constrain computer models which aim to predict future changes.

My talk focussed on how I've used marine sediments, geomorphology and rock samples from formerly glaciated terrain to reconstruct the glacial history of the West Antarctic Ice Sheet (WAIS) and its fringing ice shelves. I focussed on two main projects; the work I did during my PhD at Durham University and BAS looking at the Holocene (past ~11,500 years) history of George VI Ice Shelf, Antarctic Peninsula and more recent work I've done since joining the survey in 2005, which has focussed on reconstructing the history of the WAIS throughout the Quaternary. Before talking about these two interesting projects, I thanked the many people who have shaped my ideas; especially my PhD supervisors and current work colleagues and collaborators.

I explained how my PhD built on the pioneering work of Chalmers Clapperton and David Sugden, who long before the well-publicised collapses of several Antarctic Peninsula ice shelves, speculated that George VI Ice Shelf might have disappeared during previous warm intervals. To test their hypothesis and put the recent changes we were seeing on the Peninsula into longer-term perspective we collected sediment cores from two lakes within the Ablation Point Massif. These (epishelf) lakes, also studied by former BAS Director and biologist Dr. Barry Heywood in the 1970's, are impounded by George VI Ice Shelf as it flows against the western coast of Alexander Island. The lakes are currently stratified with freshwater overlying marine water and it was this unique setting that led us to speculate that any previous collapse of the ice shelf would leave a distinct signature in the lake sediments, changing from a mixed freshwater-marine environment to an exclusively marine one. Alongside this, we also expected to see the influx of different rock types from Palmer Land as icebergs floated freely across the Sound. This was indeed the case, and our results showed that the ice shelf collapsed between ~9500-8000 years ago. We also showed that this early Holocene collapse followed a period of climate warming that also coincided with an influx of warmer ocean water onto the western Antarctic Peninsula (AP) shelf and concluded that early Holocene climate variability was greater than that observed in recent years.

The second part of my talk focussed on reconstructing glacial limits and deglacial history of the WAIS in the Amundsen Sea. Like my previous studies, the underlying rationale of this work is to provide a much needed long-term context to recent changes in this critical sector of WAIS. Over the past few decades, glaciers draining into the Amundsen Sea have shown accelerated ice flow, rapid thinning and grounding-line retreat. However, because the long-term context of these changes is poorly constrained, our ability to accurately predict their future behaviour is limited. This has considerable socio-economic implication, because collapse of this sector of the ice sheet would raise global sea-level by up to ~1.5m.

I presented work I have been doing in this area, specifically focussing on a new glacial reconstruction from the western part of the embayment as well as new marine and geological data from Pine Island Bay and its catchment. I showed how new result suggest that the grounding-line position in the Amundsen Sea has been largely stable throughout the last c. 10,000 years, with the implication that current changes in ice loss are likely to originate in recent changes in regional climate, ocean circulation or ice-sheet dynamics rather than a long-term response to changes instigated at the last glacial.

I concluded by reiterating that sediments, and particularly glacial sediments can tell us an awful lot about the Antarctic environment, and not just something that obsessive geologist look at on their weekends away on Anglesey. They are helping us build a detailed picture of the behaviour of WAIS through the Quaternary, as well as the processes that control ice sheet dynamics, which will help us produce robust predictions of future ice-sheet change and its contribution to sea-level rise.