Geophysical Research Abstracts, Vol. 9, 10297, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-10297

Numerical modelling of glacimarine sedimentation from tidewater glaciers: iceberg-rafted vs meltwater plume deposition

R. I. Mugford , J.A. Dowdeswell

Scott Polar Research Institute, University of Cambridge, Lensfield Road, Cambridge, CB2 1ER, England (rm423@cam.ac.uk / Fax: +44(0)1223336549 / Phone: +44(0)1223336574)

The processes of glacimarine sedimentation are investigated with a stratigraphic simulation model for two contrasting tidewater glaciers, one in Greenland and the other in Alaska. The three dominant sedimentation processes under consideration by the model are: icebergs, forced meltwater plumes and glacial frontal melt. The advance and retreat of the glacier is simulated by a simple mass balance model, which utilises equilibrium-line forcing. Turbid meltwater emerges from beneath the glacier into the fjord, and rises as a positively buoyant forced plume due to salinity and temperature contrasts with the ambient fjord water. A two-dimensional integral model is formulated for the conservation of mass, momentum, buoyancy and sediment flux along the path of the turbulent, entraining plume, injected into stably stratified ambient fluid. When the plume reaches the surface, it is treated as a radially spreading surface gravity current. The iceberg routine models the formation, transport and melt of a population of icebergs, using a method similar to Bigg et al, 1997, with inclusion of basal and englacial sediment in the icebergs. Subaqueous and subaerial melt of the icebergs result in a continuous rainout of sediment with occasional sediment dumping from overturning events. The model is used to compare sedimentation from tidewater glaciers with varying relative dominance of meltwater and iceberg-related sedimentation processes. Kangerdlugssuaq Fjord in South East Greenland is chosen as an iceberg-dominated glacimarine depositional environment. Sedimentary data (swath bathymetry, sub-bottom profiling and gravity cores), and oceanographic data (from Autosub and shipboard CTDs) were collected during a research cruise on R.R.S. James Clark Ross in 2004. Further sedimentological data were collected by Andrews, Dowdeswell and Syvitski from M/V Barni Seadmundssen in 1991 and C.S.S. Hudson

in 1993 (Syvitski et al., 1996). Using field data to constrain model inputs, the output of the numerical model is compared with the observed sedimentary record. McBride Glacier in Alaska is chosen as an example of a meltwater-dominated glacimarine depositional environment. Model input data and ice-proximal sedimentation rates are taken from published data collected by Cowan and Powell between 1984 and 1987. The application of the glacimarine sedimentation model to these two glaciers links the environmental and climatic conditions in these contrasting glaciological settings to the formation of distinctive glacimarine deposits, such as grounding-line fans and morainal banks.