Geophysical Research Abstracts
Vol. 12, EGU2010-12341, 2010
EGU General Assembly 2010

Complexities within distal sheet turbidite deposits: case study 160,000ka Icod Turbidite, Moroccan Turbidite System

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The Icod landslide from the northern flank of Tenerife not only generated a debris avalanche phase (Watts & Masson, 1995; Masson et al. 2002), but produced a volcaniclastic turbidite that spans three interconnected basins. The Icod turbidite (160,000ka) was reported and correlated during work in the Madeira Abyssal Plain (Pearce & Jarvis, 1992; Rothwell, Pearce & Weaver, 1992). Here it forms a series of vertically stacked sand bodies accumulating into a single event bed. However, the Madeira Abyssal Plain is fed from the Agadir Basin by a series of channels, thus invoking a level of complexity to the deposit with the flow exiting channels at different times. The Icod turbidite can be found deposited more proximally to source in the Agadir Basin as a 0.3-0.6m stacked sand with accompanying 0.2-1.5m mudcap. With this stacked sand facies present here a number of other mechanisms can still be viable: (1) multistage retrogressive landslide failure, (2) flow reflection and (3) internal waves. Geochemical methodologies including ICP-AES, ICP-MS, XRF, ITRAX micro-XRF, SEM EDS and laser-diffraction grain-size analysis have been employed here to investigate the potential of a retrogressive failure at source being the driver of this facies. Evidence suggests that this stacked sand facies in this case is derived from the failure mechanism at source.

Five vertical sand packages have been identified and correlated through the Agadir Basin, with the initial basal package representing the thickest. However, this amalgamated sand displays degrees of complexity with correlated internal erosional surfaces marked by sand-sand grain-size breaks. There are also sand-sand grain-size breaks found at the transition between facies associated with flow properties i.e. Bouma Tb parallel laminations and Bouma Tc ripple laminations. Each of the stacked sand intervals also has a sand-mud grain-size break present at the top of the package. This sand-mud break could possibly indicate (1) bypass of coarse silt or (2) removal of previously deposited silt by erosion of a post-depositional mudflow associated with mudcap remobilisation.

Further to the stacked subunit facies and grain-size breaks, there are additional complexities to the deposit. An omission of a typical Bouma Ta facies is observed, replaced with a thick well-developed banded Bouma Tb, representing density sorting and flow fractionation of dense basaltic clasts and >100μm foraminifera. Above developing ripple laminations associated with Bouma Tc development is a 0.2-0.5m thick convolute laminated sand. This convoluted sand represents increasing shear stress across developing ripples.

Grain-size analysis and ITRAX x-radiographs highlighted an additional process within the mudcaps of the Icod turbidite within the Agadir Basin. The mudcap thickens towards the base of incline from the Agadir Basin to the Selvage Islands. Within the cores with an over-thickened mudcap, the mudcap contained silt contortions. X-radiographs using ITRAX further displayed these contorted silts in the mudcaps. Grain-size analysis was used to confirm the presence of silt and poor sorting through the regions of contortions. These contorted muds have a debritic fabric, and could represent post-depositional remobilisation of the accumulative suspended clay fraction as a mudflow, as it was settling on a gradient and destabilising.

This presentation will show the complexities present in even distal sheet turbidites, and that detailed multi-disciplinary studies are required to unravel the mechanisms at work during their deposition.

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