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Insight in hydrodynamic properties of submarine flows by the mineral liberation analysis system

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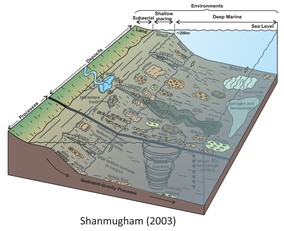
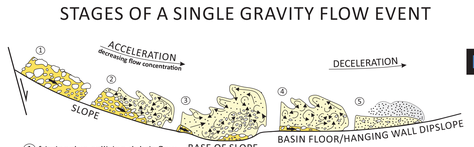
Session SSP1.8. Automated image recognition in microscopic analysis for stratigraphical investigations

INTRODUCTION

Submarine gravity flows transport volumetrically the most extensive sediments on Earth and thereby constitute there the most significant process for moving sediment. So, understanding of these flows is crucial in order to gather how sediments are redistributed across our planet. Submarine flows can undergo transformation during their depositional events and incorporate different types of flows, from dilute turbidity currents, via intermediate stages to dense debris flows. The directly monitoring of these complexities is extremely difficult, expensive or even impossible due to (i) a flow-occurring in relatively inaccessible location and (ii) an unpredictability of such phenomena. The depositional record of submarine gravity flows appears very useful in capturing data, including textural characteristics of these deposits, as important indicators for flow hydrodynamics.



Shanmugham (2003)

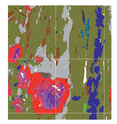


Henstra et al. (2016)

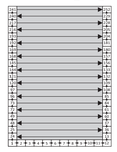
METHODOLOGY


Prof. Bernhard Schulc

1. Scanning electron microscope FEI Quanta 600 FEG
2. Bruker Quantax Dual X-Flash Detector 5010
3. Mineral Liberation Analyser software Suite 3.1.4

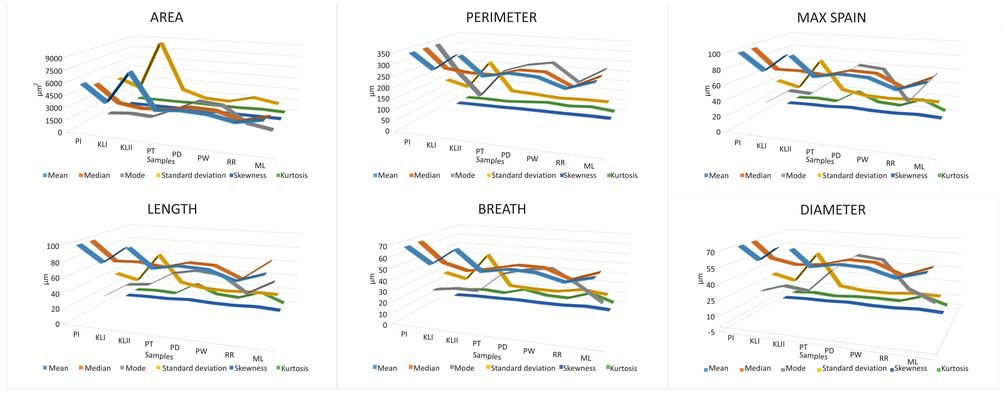

Each X-ray analysis was made for 8 msec with step size of 10 pixels on 1.5 x 15 mm frame with resolution of 500 x 500. Narrow grid of EDX analyses only on grains with defined grey colors. Finds growth zones and resolves complex intergrowths.

The imaging was carried out in the backscattered electron (BSE) accelerating voltage 25keV, working distance 12mm, electron beam current 10µA. Typical analytical traverse of frames analyzed by the Mineral Liberation Analyser for rectangular petrographic thin sections.

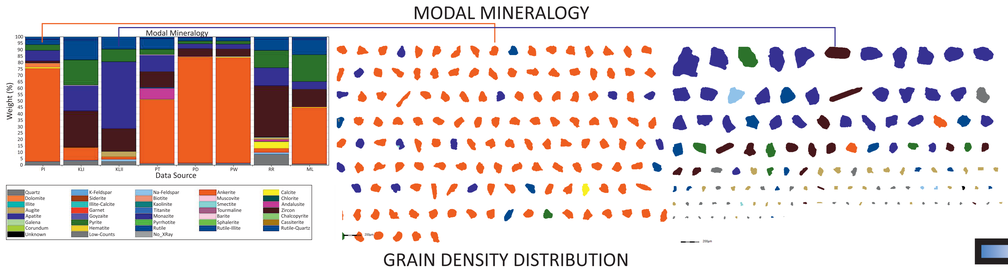

Sylvester (2012)

RESULTS

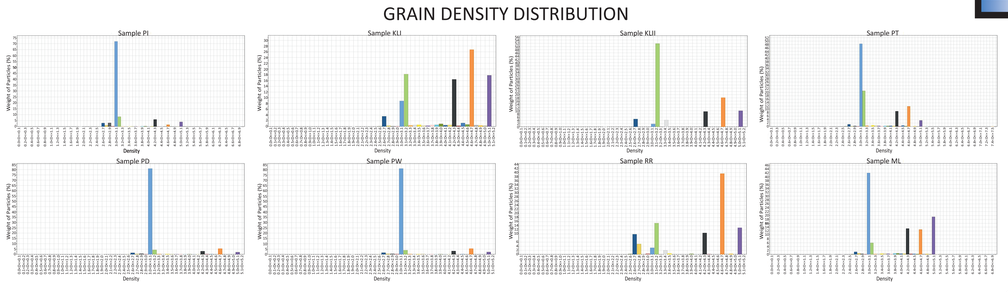
GRAIN PROPERTIES AND THEIR STATISTICS



MODAL MINERALOGY

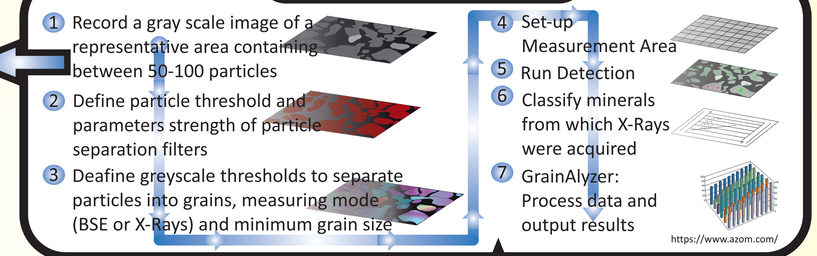


GRAIN DENSITY DISTRIBUTION



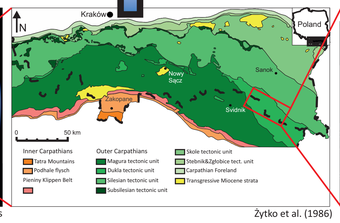
HOW IT WORKS:

1. Record a gray scale image of a representative area containing between 50-100 particles
2. Define particle threshold and parameters strength of particle separation filters
3. Deafine greyscale thresholds to separate particles into grains, measuring mode (BSE or X-Rays) and minimum grain size
4. Set-up Measurement Area
5. Run Detection
6. Classify minerals from which X-Rays were acquired
7. GrainAlyzer: Process data and output results

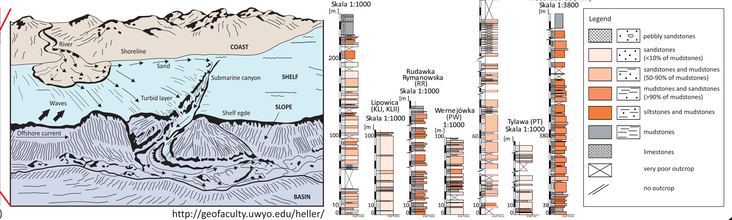


MATERIAL


Google Maps

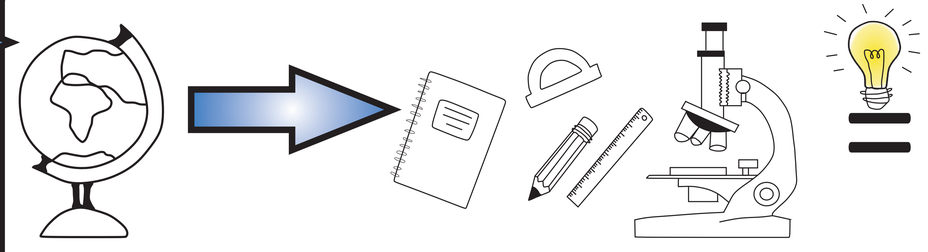


Żytko et al. (1986)

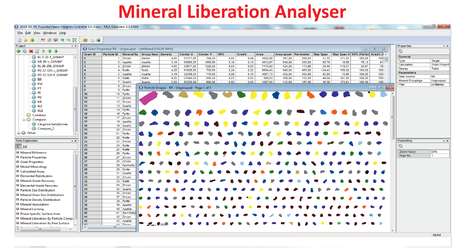


http://geofaculty.uwyo.edu/heller/

CONCLUSIONS



Mineral Liberation Analyser



The Mineral Liberation Analyser (MLA) provided quantitative analysis regarding textural parameters of submarine sediments, necessary to determine depositional flow types and their transformations. The MLA seems to be one of the most suitable methods to extract data set for textural analysis in a large amount and relatively quick time, so it has great potential to detect and suggest some solving in uncertainty and complexity of the difficult to monitor submarine gravity flows phenomenon.