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Large Diameter Piston Coring: Pitfalls and Solutions

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Problems associated with under-sampling and over-sampling in piston-coring are known to exist and can lead to mis-interpretation of mass flux or sedimentation rates and core-to-seismic correlations can appear incorrect. Here, a combined approach using empirical and modelling techniques is used to identify, quantify and hence correct such mis-sampling events.

The coring device used in this study was the "CALYPSO" modified Kullenberg-type piston-corer, which routinely acquires 35m samples in deep water. It has the advantage over similar corers of ease and speed of operation and has found extensive use within the palaeoceanographic community.

Two cores were retrieved from a deep water site on the Goban Spur, off the southern Eire coast. A 0.1 m diameter, 34.75 m long CALYPSO core was retrieved together with a 10.04 m long, 0.25m width/breadth square-section CASQ gravity core. A Geotek Multi-Sensor-Core-Logger (MSCL) was used to log magnetic susceptibility and light reflectance in terms of relative RGB levels of split sections for both cores. Sound velocity and density was measured for the piston-core. Seismic reflection data was also acquired using the vessel's 3.5 kHz. 'pinger'.

To quantify the stretch of the piston-core in *absolute* terms, the Skinner and McCave soil mechanics model was used to correct the CASQ data for friction-induced under-sampling. This resulted in the core being effectively de-compressed to a 'true' depth of 10.96m. By correlating across 19 features within the MSCL datasets between the corrected CASQ and piston-core data, it was evident that the latter had over-sampled down the entire length of the inter-comparable dataset e.g. 19.5m in the piston-core was 11m true depth. For much of the shallowest 13m of piston-core, the incremental over-sampling between correlation points was 150% to 350%. Beyond this, and to a

maximum depth available from the data of 19.5 m, the values ranged between 100% and 150%. By using the acoustic velocity and density MSCL data, it was possible to construct a synthetic seismic reflection series which could be compared to the on-site seismic data. Thus, the degree of stretch could be estimated to greater depth than the CASQ data allowed. These results showed agreement with the MSCL data correlations but, furthermore, suggested that the over-sampling effect was greatly reduced beyond 11 m true depth.

The soil mechanics model can also be applied to predict the over-sampling, provided that certain parameters are known or can be estimated. Excellent agreement can be found between model and field data, but only if a piston recoil pressure of 2250kPa is invoked. This appears to be unfeasibly high, suggesting that the model may not be entirely suitable in its present form to realistically model over-sampling.

This study has shown that over-sampling can have a marked effect on apparent depths in Kullenberg-type piston cores. It is an affect that researchers using such material to predict horizon depth intervals or sedimentation rates need to be aware of. A combination of correlation with model-corrected large diameter gravity core data and seismic data can provide a means of quantifying the mis-sampling so that corrections can be applied.